





16.ª EDIÇÃO ENCONTRO DE INVESTIGAÇÃO JOVEM UNIVERSIDADE DO PORTO

10.11.12 MAIO 2023

REITORIA DA UNIVERSIDADE DO PORTO





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PROGRAMA PROGRAM

16.ª EDIÇÃO

	10 TH MAY	11 TH MAY	12 TH MAY
08:00 > 18:30	Opening of the secretariat for all participants		
00.00 - 40.00	PARALLEL ORAL SESSIONS I	PARALLEL ORAL SESSIONS V	PARALLEL ORAL SESSIONS IX
	A1 - Economics and Management	A1 - Biological Sciences III	A1 - Health Sciences XII
	A2 - Environment I	A2 - Engineering III	A2 - Biological Sciences VII
09.00 > 10.30	A3 - AgroFood I	A3 - Arts I	A3 - Maths & Astronomy
	A4- Architecture I	A4- Chemistry II	A4- Heritage Studies I
	A5 - Health Sciences I	A5 - Health Sciences V	A5 - Health Sciences IX
10:30 > 11:30		POSTER VIEWING & Coffe Break*	
	PARALLEL ORAL SESSIONS II	PARALLEL ORAL SESSIONS VI	PARALLEL ORAL SESSIONS X
	A1 - Criminology and Law I	A1 - Biological Sciences M	A1 - Health Sciences XIII
11:30 > 13:00	A2 - AgroFood II	A2 - Engineering N	A2 - Biological Sciences VIII
	A3 - Environment II	A3 - Arts II	A3 - Astronomy
	A4 - Architecture II	A4- Chemistry III	A4- Heritage Studies II
	A5 - Health Sciences II	A5 - Health Sciences VI	A5 - Health Sciences X
42-00 > 44-20		Lunch Decel	
13:00 > 14:30		Lunch Break	
	PARALLEL ORAL SESSIONS III	PARALLEL ORAL SESSIONS VII	PARALLEL ORAL SESSIONS XI
14:30 > 16:00	A1 - Biological Sciences I	A1 - Biological Sciences V	A1 - Biological Sciences IX
	A2 - Criminology and Law II	A2 - Engineering V	A2 - Sport Sciences III
	A3 - Psychology and Education Sciences I	A3 - Chemistry N	A3 - Physics I
	A4- Engineering I	A4- Sport Sciences I	A4- History, Political and Social Sciences I
	A5 - Health Sciences III	A5 - Health Sciences VII	A5 - Health Sciences XI
16:00 > 17:00		POSTER VIEWING & Coffe Break*	
	PARALLEL ORAL SESSIONS IV	PARALLEL ORAL SESSIONS VIII	PARALLEL ORAL SESSIONS XII
	A1 - Chemistry I	A1 - Biological Sciences VI	A1 - Literary, Cultural and Language Studies II
17:00 > 18:30	A2 - Biological Sciences II	A2 - Literary, Cultural and Language Studies I	A2 - Sport Sciences M
	A3 - Engineering II	A3 - Psychology and Education Sciences III	A3 - Physics II
	A4- Psychology and Education Sciences II	A4- Sport Sciences II	A4- History, Political and Social Sciences II
	A5 - Health Sciences N	A5 - Health Sciences VIII	A5 - Psychology and Education Sciences N

*Evaluation of posters in the morning block occurs between 10:30 and 12:30 and in the afternoon block from 16:00 to 18:00



APRESENTAÇÃO | *FOREWARD*

Para que o mundo pule e avance, conforme escreveu o poeta e investigador António Gedeão, é necessário que o sonho comande a vida de todos aqueles que compõem a comunidade académica e científica, aos quais cabe investigar e inventar o futuro que teremos. Abarcando as mais diversas áreas do conhecimento, o IJUP – Encontro de Investigação Jovem da Universidade do Porto volta este ano, na sua 16ª edição, a permitir que também os nossos estudantes se somem ao esforço para definir aquilo que o amanhã há de ser.

O IJUP constitui, com efeito, uma iniciativa pioneira da Universidade do Porto, assumindo-se como um momento de afirmação da decisiva aposta numa formação académica capaz de promover, acolher, valorizar e estimular a estreita ligação dos estudos universitários com a investigação. Num ambiente em tudo semelhante ao de um congresso científico, os estudantes da Universidade do Porto são convocados a apresentar os resultados da investigação realizada em contexto académico, assim adquirindo competências que serão decisivas para o seu futuro.

Nesta edição, o encontro conta com um novo número recorde de participantes e de apresentações de estudantes — 779 no total —, permitindo dar a conhecer o trabalho desenvolvido em áreas tão diversas como a Química, a Matemática, a Astronomia, as Ciências do Desporto, a Psicologia, a Arte e a História. Se aos mais novos é geralmente reconhecida uma particular aptidão para o arrojo e para a inventividade, os resultados apresentados ¬— devidamente enquadrados por uma cultura científica de excelência, por rigorosos critérios éticos e deontológicos, e pelos cientistas que orientam e supervisionam este trabalho — não deixarão de constituir importantes pontos de partida para a investigação que os agora estudantes hão de desenvolver no futuro.

Assegurando a efetiva transição entre a sala de aulas e o laboratório, entre a teoria e a experiência, a Universidade do Porto vê consolidada a sua vocação para a produção de conhecimento técnico e científico, nutrindo-a entre os seus mais jovens talentos, os quais, em muitos casos pela primeira vez, têm neste encontro uma oportunidade de se afirmarem enquanto cientistas, investigadores e criadores de saber, acrescentando entendimento sobre o mundo que nos rodeia e não cessa de nos surpreender e espantar, instigando-nos a querer levar mais e mais longe a compreensão dos seus mistérios.

António de Sousa Pereira

Reitor da Universidade do Porto

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AGROFOOD



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21080 | Novel ingredients authentication: a step towards sustainable aquaculture

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Abstract

Currently, feeds used in aquaculture are produced based on fish meal and oil, wheat, corn and soy, which raises sustainability issues due to their finitude. In order to promote feed production with a lower carbon footprint and environmental impact, feed producers have been explored alternative ingredients to make the aquaculture sector more sustainable [1,2]. Some of those new ingredients correspond to by-products derived from the agri-food industry, such as microbial, insect and algae-based proteins and animal protein hydrolysates, from by-products, shifting towards a circular economy and blue bioeconomy model [3,4,5]. However, the high demand for novel ingredients for aquaculture carries the risk of fraud, jeopardizing food safety and consumer confidence. As such, authenticity is an EU priority, for which feed producers are looking for to follow in order to rise their economic value, through the certification of their feeds. Currently, there is a lack of standardised methodology to evaluate the authenticity of new ingredients as a food and feed products. In this sense, this innovative project focuses on filling this gap by using molecular tools to assess the authenticity of ingredients. Therefore, the main goal is to provide a DNA-based method to authenticate new ingredients for food and feed. With the authenticity of food and feed items under the spotlight, the industry is working towards product certification, by strictly controlling its ingredients through the use of state-of-the-art technologies. The outcome is the development of an authentication strategy to successfully discriminate and detect new ingredients in different matrices, ensuring the transparency and security of the final product. Several DNA extraction protocols have been optimized on the complex matrices, followed by determination of yield and purity of DNA samples, as well as amplifiability. So far, the optimised extraction method produces DNA suitable for conventional PCR amplification for the target DNA sequence from highly processed food matrices.

Keywords: Aquaculture, Novel ingredients, Authenticity, Bluebioeconomy.

Acknowledgments

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References

Thomas Jensen. "New protein sources for aquaculture feed" *Eurofish*, 3 June 2022, pp. 44-47;
FAOSTAT. Edible insects. Future prospects for food and feed security. In Future prospects for food and feed security. 2013. doi.org/10.1017/CBO9781107415324.004;

[3] Paul et al., 2018, Agricultural Reviews, 2018. 39(4): 282-291;

[4] Gomez et al., 2019, Adv Food Nutr Res, 2019. 89:259-295;

[5] Bandara et al., 2018, Journal of Entomology and Zoology Studies, 2018. 6:3087.

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20748 | Polysaccharides from orange peels: from waste to possible astringency modulators

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Abstract

Astringency is defined as dryness, tightening, and puckering sensations perceived in the oral cavity during the intake of astringent compounds, such as polyphenols.¹

Polyphenols are bioactive compounds essentially found in plant-based products, contributing to their organoleptic properties, namely colour and taste (astringency and bitterness).² One of the main characteristics of polyphenols is their ability to interact with proteins, namely salivary proteins (SP), a phenomenon that is at the origin of the astringency sensation. Astringency is one of the most important sensory properties for consumers acceptance. Indeed, for some polyphenol-rich products, such as red wines, a balanced level of astringency is desirable for their quality providing body and fullness.¹

Currently, polysaccharides (PS) have been described as able to modulate astringency, as they may reduce or inhibit the interactions between SP and polyphenols.^{3,4,5,6} Vegetable and fruits, which generates a large amount of wastes during processing (e.g., peels and seeds), could be a valuable source of bioactive compounds, such as PS.

The main aim of this work was to evaluate the inhibitory effect of PS, extracted from orange peels, on the interaction between SP and polyphenols.

So, the work was divided into: 1) Isolation and characterization of different fractions of pectic PS from orange peels by sequentially extraction with several solvents (water, imidazole and sodium carbonate solutions); 2) Characterization of the SP profile before and after interaction of different polyphenol classes by HPCL and SDS-PAGE; 3) Characterization of the SP profile of the previously interactions in the presence of the PS fractions by SDS-PAGE.

The results showed that most of the PS fractions were effective in inhibiting polyphenol-protein aggregation and precipitation, mainly the ones extracted with imidazole and sodium carbonate. Considering the SP families, PRPs and cystatins were those in which it was observed less precipitation in the presence of PS.

Keywords: Astringency modulation; Food waste; Polyphenols; Polysaccharides (PS), Salivary proteins (PS).

Acknowledgments

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References

[1] S. Soares, E. Brandão, C. Guerreiro, S. Soares, N. Mateus & V. De Freitas, Molecules, 25 (11), (2020), 2590

[2] M. Naczk & F. Shahidi, In Journal of Pharmaceutical and Biomedical Analysis, 41 (5), (2006), 1523-1542

[3] N. Mateus, E. Carvalho, C. Luís & V. De Freitas, Analytica Chimica Acta, 513 (1), (2004), 135–140

[4] E. Carvalho, N. Mateus, B. Plet, I. Pianet, E. Dufourc & V. De Freitas, Journal of Agricultural and Food Chemistry, 54 (23), (2006), 8936–8944

[5] E. Brandão, A. Fernandes, C. Guerreiro, M. A Coimbra, N. Mateus, V. de Freitas & S. Soares, Carbohydr. Polym, 236, (2020), 116044

[6] M. A Pires, L. M Pastrana, P. Fucinõs, C. S Abreu & S. M Oliveira, Foods, 9(8), (2020)

20543 | Edible flowers rich in anthocyanins: Stability and bioaccessibility of an emerging, healthier and sustainable diet

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Abstract

There has been a significant shift in food habits worldwide due to increased awareness and knowledge of the impact of diet on health and wellness. This has led to a growing demand for healthier functional foods that provide additional health benefits beyond basic nutrition. Edible flowers have been traditionally used for centuries because of their medicinal properties and are now experiencing a comeback. In addition to their aesthetic appeal, many edible flowers (EFs) also offer nutritional benefits [1]. EFs are rich in natural phytochemicals, some of which with a high level of anthocyanins that give flowers their red, purple, and blue colors. Due to their structural characteristics, these compounds have been implied in several health benefits [2].

The aim of this work was to explore the anthocyanin content in some EFs (Viola tricolor, Cosmos bipinnatus, Centaurea cyanus and Clitoria ternatea), as well as their bioaccessibility through a range of different approaches.

All the species presented polyglycosylated anthocyanins with different degrees of complexity and substitution patterns. The stability assays were performed by varying factors such as temperature, pH, and time. The results showed that depending on the species, different factors have a specific impact, prompting for the effects of different cooking techniques on the content of such bioactives. Considering the effects of food matrices, including proteins and starch, the presence of both affected the anthocyanin content of the EFs in distinct ways for all the pH values tested. Finally, simulated digestions were performed according to INFOGEST and revealed that overall, a pronounced decrease in the anthocyanin content was observed after the intestinal phase.

These preliminary results suggest that the structural differences in the anthocyanins present in different EFs, may have a great impact on their stability and behaviour towards the cooking and gastrointestinal processes prior to their absorption as bioactive compounds.

Keywords: Edible Flowers; Anthocyanins; Food processing; Bioaccessibility; Gastrointestinal tract.

Acknowledgments

The authors acknowledge the national funds provided to the development of this work, by Fundação para a Ciência e Tecnologia (FCT) under the scope of the project "AnthoE.Flos" (2022.01014.PTDC).

References

[1] Rivas-García, L., et al., Edible flowers as a health promoter: An evidence-based review. Trends in Food Science & Technology, 2021. 117: p. 46-59.

[2] He, J., et al., Dietary polyglycosylated anthocyanins, the smart option? A comprehensive review on their health benefits and technological applications. Compr Rev Food Sci Food Saf, 2022. 21(4): p. 3096-3128.

21116 Characterization of honey from Natural Park of Montesinho and its comparison with honey produced in unprotected areas.

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Abstract

The Natural Park of Montesinho (NPM) is one of the largest natural parks of the 12 existing in Portugal. It is located in the region of Trás-os-Montes covering the northern part of the municipalities of Bragança and Vinhais, encompassing the mountains of Montesinho and Coroa. Honey production is one of the principal activities for the socio-economic development of this region.

Honey is a natural substance derived from nectar that bees collect from plants or from secretions of the living parts of plants, in the surrounding area of their hives. During its foraging activity, bees are exposed to different types of pollutants such as polycyclic aromatic hydrocarbons (PAHs), antibiotics, heavy metals, and others [1,2]. Thus, carrying them inside honeycomb and contaminating honey, compromising its quality and security. The aim of this work consisted in the evaluation of the quality of honeys produced in the NPM and compare them with other commercial and producer honeys from other regions.

In this research, the parameters: moisture, color, ash, pH, free acidity, and diastase activity of honeys samples were determined according to the methodology described in honey related legislation [3]. Additionally, protein content was assessed through Kjeldahl method [4]. The attained data showed that results of quality parameters are, in general, in accordance with the legislation for all samples tested. The content of total proteins, ranged between 1.53 and 8.75 mg protein/g honey, with honey samples from NPM showing slightly higher results than the remaining samples.

In sum, although the high quality of all honey samples, the analysis of the parameters analysed in this work are not sufficient to attribute a relationship between the production of honey in a natural park and the production of honey in an unprotected area. A more detailed study is suggested, with the analysis of PAHs in these honeys for the subsequent evaluation of their relationship with the quality of the honey.

Keywords: Honey; quality parameters; total protein content; NPM.

Acknowledgments

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References

[1] Villalba A, Maggi M, Ondarza PM, Szawarski N, Miglioranza KSB. Influence of land use on chlorpyrifos and persistent organic pollutant levels in honey bees, bee bread and honey: Beehive exposure assessment. Sci Total Environ, 2020, 713:136554.

[2] Badiou-Bénéteau, A., et al. Honeybee biomarkers as promising tools to monitor environmental quality. Environ Int, 2013, 60, 31-41.

[3] Codex Alimentarius. STANDARD FOR HONEY, CXS 12-19811, Adopted in 1981. Revised in 1987, 2001. Amended in 2019, available at: https://www.fao.org/fao-who-codexalimentarius/codex-texts/list-standards/en/ (Accessed March 16, 2023).

[4] Ibe A., Onuoha G., Adeyemi A., Madukwe D. and Udobi J. Quantitative analysis of honey samples from four different sources in Abia State, Nigeria. Int. J. Appl. Nat, 2013, 9, 107-116.

20533 | Climate change-induced effects on *Castanea sativa* Miller – can mycorrhization be an effective mitigation strategy?

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Abstract

Castanea sativa Miller, a high-value crop in Portugal, is currently facing more frequent and longer periods of heat waves and drought, which largely impact chestnut production. Thus, efficient tools to prevent heat and drought-induced damage are urgently needed. Knowing that mycorrhization can improve plant performance under stress, this work explores how mycorrhization can increase young chestnut plants' tolerance to climate change. For this, mycorrhizal (MR) and non-mycorrhizal (NMR) chestnuts were exposed to the single and combined action of heat (42 °C; 4 h/d) and drought (no irrigation). After 21 d, all plants showed their foliar area reduced. Moreover, although drought (single or combined) affected the production of new leaves and lowered the relative water content in both sets of plants (MR and NMR), greater inhibition values were found in NMR ones. Regarding the photosynthetic performance, and following the previous pattern, drought (single or combined) effects were more evident in NMR plants, with the MR plants showing less inhibitory responses for stomatal conductance, transpiration rate, and carbon assimilation. This was also complemented with oxidative stress markers. No differences were detected for the hydrogen peroxide among stress treatments and plant sets. Contrarily, in MR plants, while superoxide anion (O2-) was increased upon single stresses, lipid peroxidation (LP) was only enhanced in response to drought. In contrast, NMR plants exhibited lower O_2^- levels, but increased LP in drought and combined treatments, pointing to higher oxidative damage. Regarding glutathione, a significant rise was found upon heat exposure in MR and NMR plants, with the latter also showing an increase of this metabolite under the co-exposure. Overall, results suggest that mycorrhization appears to improve chestnut plant performance under heat and drought combination, though further data must be collected to draw an integrative vision of the main mechanisms involved.

Keywords: Global warning; Chestnut plants; Mycorrhiza; Drought; Heat; Oxidative stress.

20866 | Foliar application of aspirin increases nitrogen use efficiency in wine culture

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Abstract

Reports on the effect of SA on grapevines are mostly focused on how to improve vine quality, but detailed investigations are still necessary to characterize its impact in the primary and secondary metabolisms, and hence how the quality of grapes and wine can be affected by it. Therefore, the objective of the present work was to understand how the pretreatment of vines at different growth phenological stages with Aspirin®, which is composed of ascorbate (ASA) and acetylsalicylic acid (ACA), will improve the quality of grapes by studying how the primary nitrogen metabolism is affected in leaves and how this reflects in the amino acid (a.a.) content, as a.a. are the precursors of mostly all secondary compounds. Four sets of experimental groups were assembled: I – Control – no treatment; II – Asp – plants sprayed with a solution containing "Aspirina C[®]" at the concentrations of 62 μ M mM ASA and 0,01 mM ACA; III – SA – plants sprayed with 0,01 mM SA; IV – Asc – because "Aspirina C[®]" also contains ASA, plants were sprayed with 62 μM mM ASA. Leaf samples were collected before treatments were (re)applied until grapes were ready to be harvested (total of 4 harvests), being proceeded by total a.a. and Glutamine Synthetase (GS) activity quantifications. Results indicate a 31% increase in GS activity only in SA in the first collection, and in the Asc in the second collection, by 104%. The last collection revealed increases by 240%, 100% and 236% in Asc, SA and Asp, respectively. Total a.a. quantification revealed a significant increase only in the last collection (leaf senescing stage), in the Asp treatment by 91%. It was possible to determine that all treatments, and especially that of Asp, increased nitrogen assimilation, and that it had a positive effect on the total soluble a.a. when grapes were maturing and senescing leaves were actively exporting a.a. to the fruits. This means that Asp pretreatment can contribute to the organoleptic quality of the resulting wine.

Keywords: Acetylsalicylic acid; Ascorbate; Glutamine Synthetase; secondary metabolisms.

20952 | Foliar application of Aspirin affects nitrogen metabolism in wine culture

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Abstract

As climate changes, plants become more susceptible to stressors. A protection strategy may be inducing natural resistance using naturally derived or synthetic molecules that stimulate the plant immune system, triggering defense strategies like the accumulation of secondary metabolites (SM). Molecules that have been shown to induce resistance are salicylic acid (SA) and acetylsalicylic acid (ACA). Information about the effect of SA on grapevines is still necessary to characterize the impact of such treatments in the primary and secondary metabolisms. This work aims to understand how the pretreatment of vines at different growth stages with Aspirin[®], which is composed of ACA and ascorbate (Asc), will improve the quality of grapes, by studying how the primary nitrogen metabolism is affected in leaves and how this reflects in the amino acid (a.a.) profile, as a.a. are the precursors of mostly all SM. Four sets of experimental groups were assembled: I – Control – no treatment; II – Asp – plants were sprayed with a solution containing "Aspirina C[®]" with final concentrations of 0.01 mM ACA and 62 μ M Asc; III – SA – plants were sprayed with 0,01 mM SA; IV – AsA – because "Aspirina C[®]" also contains ascorbate, plants were sprayed with 62 μ M Asc. Three replicates of three vines for each treatment were set up (n \geq 3). Before each spraying (total of 3) leaves from each vine were collected. The results relative to Nitrate Reductase activity in the first collection showed a 235% and 502% increase in AsA and Asp treatments, respectively. The second sample collection revealed an increase by 717%, 234% and 339% in AsA, SA and Asp, respectively. Nitrate quantification revealed a decrease in the AsA by 21% in the first sampling, and a 59% increase in the second. The third collection showed a decrease by 24% and 20% in SA and Asp treatments, respectively. Data suggests that pretreatment of vines with Aspirin can prove to be a sustainable strategy to increase vine yield.

21126 | Unveiling the role of proline in plants exposed to glyphosate

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Abstract

Glyphosate (GLY) is the most extensively applied herbicide worldwide, and its constant and cumulative use resulted in the contamination of agricultural soils, possibly imposing detrimental effects on non-target crops. Although oxidative bursts are not directly related to GLY's herbicidal action, previous studies suggest that a disbalance in redox homeostasis is often an indirect consequence of GLY exposure. Thereby, plants must orchestrate a fine regulation of their antioxidant mechanisms to prevent GLY-induced oxidative stress. One of the responses of the antioxidant system to different types of stresses is the accumulation of proline. Upon plant exposure to GLY, a substantial proline overaccumulation occurs, though this is not accompanied by a tolerance response. This intriguing finding is based on the main question of this research: is the overaccumulation of proline against GLY toxicity a tolerance mechanism or a stress symptom? To answer this, Arabidopsis thaliana T-DNA insertional mutant lines for genes involved in the proline pathway (P5CS1 and ProDH) were used to study plants with contrasting proline accumulation patterns. After 14 days of plant exposure to GLY (0.75 mg/L), a general decrease in fresh biomass was observed in all genotypes, particularly in the prodh mutant, the genotype where proline was most accumulated. Regarding oxidative status, both lipid peroxidation and H2O2 levels increased in wt and prodh mutants, with no apparent changes in mutants with low proline levels. Additionally, these genotypes (p5cs1-1 and p5cs1-4) also evidenced a stronger activation of the antioxidant system, either by accumulating non-enzymatic metabolites (AsA and GSH) or by increasing the activity of key enzymes (CAT and APX). Overall, the gathered data suggested that the plant's ability to survive is unrelated to the excessive proline synthesis caused by GLY exposure, being perceived as a stress signal rather than a defence mechanism.

20840 | IgE-binding capacity of shellfish allergens as affected by food processing and digestibility

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Abstract

Shellfish include a diversified range of seafood species, namely mollusks and crustaceans, which are known to elicit severe/life-threatening allergic reactions in sensitized individuals. Shellfish allergens encompass different proteins families, like tropomyosins (panallergens), arginine kinases, paramyosins, among others. Accordingly, this work intended to assess the effect of food processing and digestibility on the IgE-binding capacity of shellfish allergens. For this purpose, distinct shellfish species (e.g., octopus, shrimp) were submitted to different thermal treatments, namely boiling, oven-cooking and frying. Protein was further extracted, quantified by BCA, and analysed by non-denaturing SDS-PAGE and immunoblotting with sera from shellfish-allergic patients. Some shellfish species were also digested following the INFOGEST 2.0 protocol.

SDS-PAGE results showed a higher number of bands in processed than in the corresponding raw samples, suggesting protein fragmentation caused by thermal processing. Immunoblotting indicated that, in most cases, the IgE-binding capacity of different allergens (tropomyosins, paramyosins, arginine kinase) is stronger in processed (boiled, oven-cooked) shellfish species. During gastric digestion, most allergens preserved their IgE-binding capacity, though it was greatly decreased after intestinal digestion. These findings suggest that thermal processing might contribute to increase the allergenicity of mollusks/crustaceans, while gastrointestinal digestion can mitigate it. This is the first report on the evaluation of multiple shellfish species and the effect of food processing strategies on shellfish allergenicity.

Keywords: shellfish allergy, protein allergenicity, immunoblotting, sera food-allergic individuals.

Acknowledgments

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21170 | Insecticidal activity and toxicity of two spider venom peptides for the control of *Drosophila suzukii*

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Abstract

Drosophila suzukii (Diptera: Drosophilidae) is a worldwide distributed polyphagous pest that infests healthy soft-skinned fruits, having blueberries, raspberries, and strawberries as preferred hosts for their development. This quarantine pest accounts for elevated production losses, as larvae scour the fruit, consuming it and making it unsuitable for sale. Current control methods for this pest are based on large-spectrum insecticides, whose erroneous and repeated application has promoted the development of resistant insects, and unwanted and dangerous toxicity to non-target arthropods and mammals. Culture-based control methods are also employed. However, they are inefficient and labor-intensive, which is neither practical nor sustainable.

Thus, a high demand arises to explore new and sustainable tools to control *D. suzukii*. Spider venom peptides (SVPs) are naturally-occurring molecules that have been receiving special attention as promising insecticides, not only because it is believed they act with specificity on insect neuronal receptors and ion channels, but also due to their complex chemical structure conferring resistance to high temperatures, low pHs and proteases.

Although there is enormous potential in SVPs for pest control, only one study explored the activity of one SVP against *D. suzukii*. To fill this gap, this study explores the efficacy of two orally delivered SVPs, J-Atracotoxin-Hv1c and μ -Theraphotoxin-Hhn2b, against *D. suzukii*, by tracing survival curves and assessing the transcription levels of the most representative detoxification-related pathways, through real-time quantitative PCR. Flies' survival and longevity were monitored for concentrations of SVPs up to 223 μ M for different periods (2 to 48 h). Gene expression results suggest that responses to xenobiotic and oxidative stress, namely expression of P450 proteins and signaling of apoptotic stimuli, are being triggered by cells following ingestion of SVPs.

Keywords: gene expression; J-Atracotoxin-Hv1c; neurotoxic peptides; spotted-wing drosophila; μ -Theraphotoxin-Hhn2b.

Acknowledgments

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20565 | An effective and safe approach to specific bio-pesticides: bacteria-mediated RNAi by feeding on invasive insect red palm weevil (*Rhynchophorus ferrugineus*)

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Abstract

Control methods to manage insect pests are often ineffective. Double-stranded RNA (dsRNA)based RNA interference (RNAi) holds promise as a novel strategy to control these pests, including the red palm weevil (RPW; Rhynchophorus ferrugineus), an invasive insect that affects palm trees. Our research focuses on a potential new control method for this invasive pest, using bacteriamediated RNAi to target essential RPW larvae genes. 1st stage development RPW larvae were fed recombinant E. coli bacterium, which expressed short (s) and long (I) dsRNA fragments from α actin and β -tubulin RPW housekeeping genes. We documented larval weight, and death rate, and finally measured the expression of dsRNA using RT-qPCR.

Our research confirmed that bacteria-expressing dsRNA targeting either α -actin or β -tubulin genes successfully reduced gene expression and caused RPW larval death. α -actin was more successful than β -tubulin in reducing weight gain and inducing mortality. In addition, β -tubulin impaired the expression of α -tubulin, from the tubulin gene family, with which it shares about 50.5% similarity, suggesting that dsRNA derived from a different part of the sequence may have a specific silencing effect. No off-target effects were observed in insects due to the dsRNA uptake. Our results agree with previous studies on the efficacy of RNAi against weevils.

Finally, feeding dsRNA-expressing bacteria to RPW larvae has demonstrated promising results in increasing mortality without any off-target effects. More research is necessary to enhance RNAi delivery and find new target genes for RPW control. Our findings set the foundation for further research into safe and environmentally friendly RNAi-biopesticides technology for not only RPW, but other insects.

Keywords: double-stranded RNA; ecosystem health; gene expression; insects; invasive species; molecular biology; pest control; recombinant bacteria; RNAi technology; weevils.

Acknowledgments

National funds supported this research through FCT- Foundation for Science and Technology within the scope of UIDB/04423/2020 and UIDP/04423/2020, grant 2022_065_BII_9_VeraoComCiencia, the Project PTDC/ASP-PLA/6228/2020, the FCT employment contract CEECIND/03501/2017, and the CIIMAR BYT program.

References

[1] Abe, F., Hata, K., & Sone, K. (2009). Life history of the red palm weevil, Rhynchophorus ferrugineus (Coleoptera: Dryophtoridae), in Southern Japan. Florida Entomologist, 92(3), 421-425.

[2] Ali, N., Datta, S. K., & Datta, K. (2010). RNA interference in designing transgenic crops. GM crops, 1(4), 207-213.

[3] Ayra-Pardo, C., Raymond, B., Gulzar, A., Rodríguez-Cabrera, L., Morán-Bertot, I., Crickmore, N., & Wright, D. J. (2015). Novel genetic factors involved in resistance to Bacillus thuringiensis in Plutella xylostella. Insect molecular biology, 24(6), 589-600.

[4] Ferry, M. (2019). Review Paper (Control: Insects) The world situation and the main lessons of 30 years of fight against the red palm weevil.

[5] Rabiey, M., Hailey, L. E., Roy, S. R., Grenz, K., Al-Zadjali, M. A., Barrett, G. A., & Jackson, R. W. (2019). Endophytes vs tree pathogens and pests: can they be used as biological control agents to improve tree health? European Journal of Plant Pathology, 155(3), 711-729.

[6] Rodrigues, T. B., Mishra, S. K., Sridharan, K., Barnes, E. R., Alyokhin, A., Tuttle, R., Kokulapalan, W., Garby, D., Skizim, N. J., & Tang, Y.-w. (2021). First Sprayable double-stranded rNA-based biopesticide product targets proteasome subunit beta type-5 in Colorado potato beetle (Leptinotarsa decemlineata). Frontiers in plant science, 12.

[7] Santos, A. I., & Calafate, L. (2018). Espécies invasoras. Revista de Ciência Elementar, 6(1).

[8] Seebens, H., Blackburn, T. M., Dyer, E. E., Genovesi, P., Hulme, P. E., Jeschke, J. M., Pagad, S., Pyšek, P., Winter, M., & Arianoutsou, M. (2017). No saturation in the accumulation of alien species worldwide. Nature communications, 8(1), 1-9.

[9] Silva, D. Bacteria-mediated RNA interference in Rhynchophorus ferrugineus (Olivier, 1790). Thesis (Master's Degree in Cellular and Molecular Biology)– Department of Biology, Faculty of Sciences of University of Porto (FCUP).

[10] Zhu, K. Y., & Palli, S. R. (2020). Mechanisms, applications, and challenges of insect RNA interference. Annual review of entomology, 65(1).



ARCHITECTURE



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20428 | Living on Douro's riverside. A collective housing project for Trem do Ouro Fernandes, Rita Ramalhosa, Faculdade de Arquitectura, Portugal

Abstract

Split by land but bound by the river, Porto and Gaia owe much of their development to the river Douro. Both city's proximity to this watercourse, the main means of transportation until the construction of the railway, attracted many people, who settled their businesses and homes on its margins. Despite the huge inflow of people and goods on the river and its borders, the Douro had always imposed great challenges to navigation and docking. So, when at the end of the 19th century, a new port was created (Port of Leixões), many moved to the new location, leaving behind a trace of empty public spaces and abandoned buildings.

In an attempt to renew the life of the riverside, in the 1990s, after more than a century of progressive decline, some initiatives arose, promoting the restructuring, revitalisation and requalification of both the public space and the existing buildings. Those initiatives, together with the dynamization of the area, made people settle in large collective housing facilities. While many were built from scratch, some, on the other hand, reused existing structures, transforming and rehabilitating them, as is the case of the codfish cold storage building (Porto) and an alcohol distillery (Gaia), for example.

My research focuses on documenting the unwritten story of the rebuilding of Douro's riverside (from the city centres to the mouth of Douro), focusing on the progressive appearance of sizeable collective residential buildings. It aims to map newly-built (as well as under-construction) and reused buildings alongside abandoned existing structures that have yet to be repurposed.

The study's ultimate goal is to contribute to the ongoing re-qualification of Douro's riverside, by proposing a collective housing project on one of its obsolete structures: the former Military Maintenance complex, Trem do Ouro.

This research is a part of a Master's Thesis in development, carried out under the supervision of Professor Marta Rocha.

Keywords: Rio Douro; requalificação; conversão; habitação; Trem do Ouro; complexo militar.

20713 | Rehabilitating "anonymous" buildings, architecture in consolidating urban centre's identity

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Abstract

It is acknowledged that monuments and other buildings of exceptional value (recognised as heritage) are remarkable and should therefore be preserved. However, and although it is possible to recognise a city (only) from these emblematic buildings and ensembles, they are not enough to provide a consistent account of the identity of an urban space as they are mainly public buildings with special functions. Regarding safeguarding a city's heritage and the program that makes up for most of its urban tissue – housing - the authors argue that even buildings without any significant spatial or aesthetic conditions) should also be carefully rehabilitated, such actions being understood as a key strategy for maintaining the character of sites. Threatened by the lack of space in consolidated cities that developed from medieval (or earlier) patterns, these "anonymous architectures" face, nowadays, the risk of being demolished in the name of "progress".

In this research we question Architecture's role (and responsibility) in its contribution to the attractiveness that keeps populations inhabiting urban centres, maintaining its socio-spatial and cultural identity, highlighting the environmental advantages of rehabilitating instead of building a new, promoting a sustainable positioning and optimising resources. Against this background, the role of the architect is questioned on the approach to the (excessive) media coverage of designer work and, above all, on the pedagogic contribution to raise society's awareness on the importance of widening the sense of social heritage. We focus on the analysis of case studies in Porto where through rehabilitation the city's immaterial heritage is preserved.

The presented summary is part of the development of an integrated master's dissertation (MIArq) oriented by Professor Doctor André Santos as well as a participation in the conference 'Heritages: Past and Present – Built and Social'.

20890 | (Re)Interpreting Fonte da Moura: approaches between Density and Tabula Plena Oliveira, Ana Catarina, Faculdade de Arquitetura da Universidade do Porto, Portugal

Abstract

In the context of housing and its importance in the city, concepts like Tabula Plena and Density emerge, which seem appropriate to develop in a reality like the city of Porto.

Tabula Plena, the opposite approach of Tabula Rasa (the idea of starting over) represents all the existing buildings we see nowadays and the need to change the architectural practice to explore transformation policies and move forward with rehabilitation, reuse and preservation projects. Through the analysis of publications around the theme Density, we realize that densification can be a tool to explore in the field of public social housing in the city of Porto. To address these two themes, it was chosen the Fonte da Moura Neighborhood built under the Plano de Melhoramentos of the city of Porto (1956-1966) in 1963 and redeveloped in 2013. This neighborhood, besides its topographic irregularities and homogeneous character, which causes segregation from the surroundings, contains several aspects that favor the lack of a sense of community and relationship with the rest of the city, being inserted in a very diverse housing context.

Rethinking this housing complex is to develop new schemes to ensure the coexistence of different perspectives and renewed ways of living and inhabiting the space, which allow for the provision of basic needs. The urgency to dignify housing ends up being limited by the typological uniformity and resistance to variation that characterizes most social housing projects.

Through the exploration of the themes listed above, we try to find a set of tools and strategies that allow the manipulation of the existing housing, in this case, the Fonte da Moura Neighborhood, trying to restructure and densify it. This research integrates an on-going master thesis on Master's Degree in Architecture at FAUP, carried out on the supervision of Professor Marta Rocha.

Keywords: density; city; social housing; community.

20818 | A Reflection for the future: Essay for the Polo III of UP

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Abstract

The present investigation is based on a reflection about a real need, motivated by the visit and daily use of the *Pólo III* of the University of Porto (*UP*) as a student at the Faculty of Architecture of the University of Porto (*FAUP*), the experience lived during the pandemic period, and with the opportunity of Erasmus in Paris.

Living *Pólo III* allows to perceive its virtues, but also its needs, which as a student and future architect concerns me. The opportunity to meet students from *FAUP* and other faculties within Pólo III and other University campuses allowed me to understand how people see and use these places, with a great diversity of opinions and considerations about what Pólo III was, is, and what it could be. This made evident the need to (re)think the *Pólo III*.

The research presented here is sensitive to contemporary debates, urgency, and concerns, to the understanding of the public and urban circumstances of the territory of *Pólo III*, and to the capacity of its potential physical, social, and environmental requalification. When pointing out these possible levels of contextualization, the aim is not to disapprove or condemn the idea or projects that are part of Pólo III, but rather to note its existing conditions and future potentialities. This justifies the pertinence of this investigation, which aims to be a process of research and critical reflection that responds to the contingencies of the city of today, facing it as an opportunity for renewal and adaptation to the needs of the city, people and education.

Keywords: Adaptivity, Flexibility, University campus, University of Porto, Pólo III.

20959 | Cape Verde, "10 graozinho di terra": memory, identity and strategies of the house in Ribeira Brava

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Abstract

This dissertation started from the need for intervention in a house on the island of São Nicolau in Cape Verde. Being Cape Verdean, the desire to do something that would contribute to the development of the archipelago has always existed.

The house in question is in the heart of the city of Ribeira Brava, the home where my grandparents and my mother were born, and which is very present in my childhood memories due to the holidays I spent there. Entering the village always felt like a trip back in time due to its narrow streets and buildings from the colonial era. These characteristics have always been its hallmark and the people have always been its essence. The choice of the house as an object of study is also since it is in a pioneering historic center in Cape Verde decreed by the Institute of Cultural Heritage of Cape Verde.

Cape Verde's urban development is recent and heavily influenced by the Portuguese ways of making cities and living. These influences from Portugal persisted over time, however, as much as the architectural forms remain, the spaces were subverted according to the experience of the Cape Verdean people. This fusion resulted in the embryo of "Cape Verdean architecture", despite not yet being titled as such.

The preservation of this historical heritage has moved slowly, in view of the lack of specificity, architectural intervention in these material heritages depends on the sensitivity of the developers and their ability to "negotiate" the approval with the local public authorities. There are cases of disruption of the urban fabric in the historic center of the village influenced by the existing economic and political power. The clash between these two forces can call into question the urban identity of the place and its link with cultural and social memory.

One of the objectives of this work is to develop a manual for reading and understanding the different urban and constructive practices developed by Portugal in Ribeira Brava.

Keywords: Colonial Architecture, Patrimony, Cape Verde.

21105 | Imagine your perfect park: how would it be? A qualitative study on the preferences, barriers and facilitators of green spaces' use by adolescents in a southern European urban context

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Abstract

Green spaces are an essential element in cities. They can significantly contribute to adolescents' health and wellbeing in the urban setting, being at the same time a cost-effective intervention to reduce health inequities and contributing to climate-resilient cities. Adolescents needs and desires regarding the planning and design of urban green spaces tend to be neglected.

We aimed to identify facilitators, barriers and promoters of use of urban green spaces by adolescents in the Porto Metropolitan Area. A focus group design was used. Participants were selected from the Generation XXI cohort (G21) and were stratified according to their socioeconomic status. Data were analysed thematically using a deductive-inductive approach.

Proximity and multifunctionality of urban green spaces were the most cited facilitators of use, by adolescents; whilst high visitors' pressure, lack of vegetation and lack of maintenance were identified as important barriers. Adolescents enhance the need to increase the number and size of urban green spaces in the Porto Metropolitan Aera, while potentiating their multifunctionality by means of equipment provision.

Keywords: Green Space; Adolescent Health; Urban Health; Urban Planning; Health Policy; Qualitative Research.

References

[1] Europe, W.H.O.R.O.f. Urban green spaces and health. 2016, 16 march 2023]; Available from: https://apps.who.int/iris/handle/10665/345751.

[2] Askew, J., Shaping urbanization for children: a handbook on child-responsive urban planning. Cities & Health, 2018. 3: p. 85 - 85.

[3] Knöll, M. and J. Roe, Ten questions concerning a new adolescent health urbanism. Building and Environment, 2017. 126: p. 496-506. 65.

[4] Patton, G.C., et al., Our future: a Lancet commission on adolescent health and wellbeing. Lancet, 2016. 387(10036): p. 2423-78.

[5] Lyons, R., et al., Urban greenspace use among adolescents and young adults: An integrative review. Public Health Nurs, 2022. 39(3): p. 700-718.

20833 | Cost-effective housing: forms of collective living

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Abstract

The critical reflection to be developed is focused on a research on the theme of collective housing, whose focus is on new and different ways of living, that is, multifamily housing buildings that stand out for the originality of the dwellings or for the diversity. Thus, the main theme is the recent cost-effective housing competitions promoted by the IHRU (Institute for Housing and Urban Rehabilitation) which have already reached a total of 25 tenders for the total design of 2,656 homes.

The objective is then to discuss the assumptions and limitations imposed by these competitions (such as the orientation and ventilation of the apartments, type of accesses, forms of sizing) that limit the design solutions for buildings, but above all, the design of the family unit. These principles, which must be long, make thinking about what residential architecture is somewhat limiting, leading to fires that are little tried, explored and less interesting solutions.

Thus, we propose to discuss the housing models, based on the terms of reference of the recent Castêlo da Maia Competition promoted by the IHRU. According to the IHRU, this ensemble should function as a structuring element that reinforces the quality of the public space, as well as integrating harmoniously into the existing urban fabric, unifying all the adjacent surroundings. The competition consists of the design of 224 dwellings divided into several collective buildings. It should also include the design of an Urban Park, support areas for the housing condominium and an area for commerce and services.

This critical review is enhanced by a comparative reading with a careful selection of economic collective housing references designed, between the 70s and 90s, in the north of Portugal in order to observe the different approaches.

This study is part of an ongoing dissertation in FAUP's MIArq Course 2022/23 with the supervision of Prof. Helder Casal Ribeiro.

Keywords: Inhabit; family cell; Access; Urban Mesh; Orientation.

References

[1] PORTAS, Nuno; "Habitação para o maior número: Portugal, os anos de 1950 1980"; IHRU, 2013, Lisboa

[2] COELHO, Pedro Baptista, PEREIRA, Nuno Teotónio; FERREIRA, Raúl Hestnes; "Habitação de interesse social em Portugal, 1988-2005"; Livros Horizonte, 2009, Lisboa

[3] X COELHO, António Baptista; RICON, José Clemente; "20 anos a promover a construção de habitação social: 1984-2004"; Instituto Nacional de Habitação, 2006, Lisboa

20783 | Utopia built body to body. Dance pavilion in Leça da Palmeira

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Abstract

As an alarm clock, capable to wake my body and mind, I can still remember to hear, from the silence of my room, "that" specific classical music record echoing from the living room. Flying downstairs, those musical notes turned into multiple movements, making me capable of communicating not only with the space but also with my inner me. I've always known myself as a dancer, learning from different schools the technique that allowed me to free and expand the limits of my body.

Later, I found in architecture what I was looking for in dance - the path to an embodied feeling. As stated by William Forsythe, in Público, "Architecture wanted to be a dance, (...) a utopia built body to body". Perhaps, for me, it has always been like this - dancing and raising, simultaneously and unconsciously, the "stage" of my life.

I discovered that the experience promoted by the architecture of each dance school was different. Today, as an (almost) architect, and also a ballet teacher, I'm capable of pointing out the space characteristics that promote an environment that is suitable for working in the studio, socializing in the stretching and changing rooms, engaging both privacy and familiarity, but also be open to the community.

This study proposes an analysis (using memory and photographic records) of my formative path as a dancer and as an architect, making it possible to design a dance pavilion that responds to the occasional needs of a Dance Academy in Leça da Palmeira - rehearsals for shows with many students, partnering classes (high ceilings), open classes for everyone, a stage for performances, a meeting point for students, friends, and workers from different artistic areas and beyond. I believe in the catalyzing power of space and also being capable of promoting an education that is increasingly oriented toward happiness.

This investigation is part of an ongoing Master's Dissertation in Architecture, at FAUP, under the guidance of professor Helder Casal Ribeiro.

Keywords: architecture; dance; education.

20891 | The architecture of psychiatric institutions seen through cinema

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Abstract

Nowadays, the care for mental health is becoming a frequent topic, and as a student I wonder what the role of architects in this matter is. Architecture is a qualitative measure adapted to its users, and since, in this case, its users may have an additional sensibility to what surrounds them, how carefully designed are the institutions destined to help/cure these types of patients? When mentioning these psychiatric rehabilitation establishments, there's a general apprehension. If only a minority of people have been institutionalized, why do we feel terrified of talking about it? Perhaps the closest contact to these establishments were through mass media, movies and shows that instill exaggerating performances and sensations, made to shock us. They give us fiction fables with insane characters acting erratically, living in alienated worlds, and make it so believable that we can't help but be influenced by it. Therefore, they sell the idea that being mentally ill is something expandable and meaningless, like being "crazy", when it's an issue worth being tackled.

Thereby, through a selection of 6 films, my investigation aims to study the quality of space of these sorts of institutions, understanding how cinema makes us perceive architecture, and misrepresent (or not) reality.

This research is part of my Master's Dissertation for the conclusion of the Integrated Master in Architecture by the FAUP carried out under the supervision of Professor Marta Rocha.

Keywords: Architecture, Psychiatry, Cinema.

20839 | The duality of the stairs in multifamily housing buildings in Portugal, 1951-2020 Costa, Ana Francisca Freitas, Faculdade de Arquitetura, Portugal

Abstract

The stair is defined as an element of architectonic composition consisting of a series of steps, which function is to make the vertical circulation between two floors possible. However, the stair can have different designs and even symbolize different things, so in reality it shouldn't just connect floors but adapt to its function, physic and symbolic, and more important adapt to whoever may use it. Thus, there are a set of laws meant to regulate the design of the stair granting it is functional, comfortable, and salubrious.

In Portugal the first legislation concerning stairs is presented in the "RGEU"¹ dating from 1951, and the latest one is presented in the "SCIE"² from 2020, having seven updates and shifts in between. The goal of this research is to study the evolution of the legislation and consequently the evolution of the stair in Portugal, identifying and analyzing a group of housing buildings from the different periods of the multiple legislations made on the matter.

The present research proposes to study the stair in multifamily housing. To analyse said stair the investigation focuses on housing buildings with vertical access or galleries that have duplex apartments, to have more than one type of stair, common and private, to study.

The analysis of the constructed stair is always connected to the analysis of the legislation, in order to understand if this has been respected, and ultimately to understand the positive and negative points and changes in the law.

This investigation is part of the master's dissertation being developed under the supervision of Professor Marta Rocha.

Keywords: Stairs; Multifamily; Legislation.

References

[1] Regulamento Geral das Edificações Urbanas. Decreto Lei nº 38382 de 7 de Agosto de 1951, p.
720, 721. Diário da República nº 166 - I Série. Ministério das Obras Públicas, Lisboa.

[2] Regulamento Técnico de Segurança contra Incêndio em Edifícios. Portaria nº 135/2020 de 2 de Junho 2020. Diário da República n.º 107/2020 - Série I. Secretária de Estado da Administração Interna, Lisboa.

20530 | Architecture *in Conflict*. Dichotomies on contemporary challenges in statesubsidized housing

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Abstract

Conflict situations are inherent to architectural creation processes and appear in the complex equation encompassing many actors involved. Although this management of forces depends on a complex context that goes beyond the disciplinary scope of architecture, this discipline can serve as a tool to mediate, accentuate, or resolve these conflicts.

The research proposes reflecting on the contemporary housing challenges by analysing dichotomies and the confrontation between two opposites observed in concrete case studies in Porto. Thus, the following conflicts are confronted: location, between the city and the periphery across the neighbourhoods of Carvalhido and S. Roque da Lameira; intervention, between rehabilitation and new construction through the neighbourhoods of Rainha D. Leonor, 2nd phase, and Cerco do Porto; and participation, among the perspectives of the various actors in the intervention projects of the "ilhas" N172 of S. Victor and Bela Vista.

The methodology follows the review of bibliographic references, historical cartography, and iconography; the creation of an inventory supported by visits to case studies and exhibitions, among others; and a personal reflection, interpretation, and comparison of the collected data.

The comparative analysis of the dichotomies demonstrates a lack of a specific answer to each conflict. The case studies support clarifying some solutions that have been found for each problem, although each has advantages and disadvantages.

A convergence and balance of several factors – such as profit or public support – is required for the right to decent housing and the city to be effectively fulfilled. Also, the actors with greater decision-making power are frequently not in line with the most vulnerable populations or the middle class, which is currently also affected by these problems.

Keywords: Architecture; Contemporary Housing; Conflict; Location; Intervention; Participation.
20671 | Adapting school spaces to contemporary pedagogy: An interdisciplinary approach

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Abstract

This research proposes a reflection on learning spaces in secondary education and aims to understand how existing spaces can be adapted to the evolution of contemporary pedagogical innovation.

With the rapid evolution of technology, society has undergone significant changes, having a significant impact on the skills and abilities required of students upon completion of mandatory schooling. The education system is thus challenged to adapt and prepare students for the new demands of society. Despite these rapid and constant changes in society, teaching methods and the spaces that accommodate them have remained almost unchanged in recent decades, with the classroom being the space that shows the greatest resistance to changes. Contemporary pedagogy studies show that a change is necessary to meet new ways of teaching and learning and understanding the importance of space in learning and teaching reveals the opportunity to rethink the architecture of the school space.

This study adopts an interdisciplinary approach between architecture and pedagogy in order to interpret the needs of new pedagogical methods from which a reflection on the spatial requirements of these methodologies can be based. The analysis of these spatial demands will allow the design of more stimulating and functional spaces, capable of enhancing the development of the necessary skills for the contemporary world. The PMEES¹ will be used as a case study to explore the current situation of secondary schools in Portugal and understand the existing spaces and their limitations. The objective is the formulation of guidelines for ideal learning spaces that more easily accommodate new learning methodologies. These guidelines will be developed based on the assimilated theoretical framework and their practical application will be demonstrated in learning spaces among the selected case studies. This study is part of an ongoing master's dissertation².

Keywords: School Architecture; Learning Spaces; Architecture and Pedagogy

References

[1] PMEES - "Programa de Modernização do Parque Escolar destinado ao Ensino Secundário" – launched in 2007 by Parque Escolar.

[2] The master thesis is integrated in the research project ESCOLAS: Complexidade e Interpretação, both coordinated by Professor Doctor André Santos.



ARTS



20397 | The decorative arts in the dowry of Beatrice of Portugal: Reconstruction of the 1521 voyage to the Duchy of Savoy

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Abstract

This project aimed to identify and study the objects that travelled on the ship of Santa Catarina do Monte Sinai, and vessels that accompanied it, during the voyage of Beatrice of Portugal (1504-1538), at the time of her marriage to Charles III of Savoy, through the analysis of chronicles of her marriage and departure, as well as the study of the princess's dowry inventories. Given the nature and description of the works of art reported in the sources, we proceeded to research contemporary objects and iconographies in Portuguese and international museums, which could correspond to the description present in the dowry in terms of typologies, techniques and materials. The pieces that we studied did not survive, which imposed this correlation with functionally and morphologically similar contemporary objects.

The methodology is also based on the concept of Crypto-History of Art, a historiographic field that seeks to reflect on lost works through solid research. This helps to vivify the objects that have disappeared, but also understand the living pieces and their contexts. The applied arts that we set out to study were goldsmithery, jewellery, tapestry, textiles, horse armor, books and chests. They were analysed from the point of view of materials, techniques, symbologies, iconographies and uses. The way in which they were transported on the ship of Santa Catarina do Monte Sinai was also the subject of research, as well as the understanding of the fate of the objects from the dowry during the life of Beatrice of Portugal, as Duchess of Savoy, and after her death.

Keywords: Beatrice of Portugal (1504-1538); voyage; Savoy; Santa Catarina do Monte Sinai ship; Decorative arts.

References

[1] SOUSA, António Caetano de (1948). Provas de História Genealógica da Casa Real Portuguesa, nova edição revista por Manuel Lopes de Almeida e César Pegado, Tomo II, II Parte. Coimbra: Atlântida.

[2] Archivio di Stato di Torino, Sezione Corte - Materie politiche per rapporto all'interno, Matrimoni, mazzo 2 d'addizione, fascicolo 9. 20549 | Through pain and moral resistance: A look into the restlessness in Paulo César's art

Barbosa, Pedro, Faculdade de Belas Artes da Universidade do Porto, Portugal

"Don't build a wall around your own suffering it can eat you up from the inside."

Frida Kahlo

Abstract

Art History exists, objectively, to allow the attempt to understand art through time. In this scope, as much as it goes through different points, it works as a moderator of the present, revealing characteristics that, according to each period, were distinct and influential. In light of this, some of the most revered artists have based and base their art on intimate restlessness: such as Beethoven with his troubled childhood and his deafness, Spielberg with the anti-Semitism experienced by his family and himself, and Frida Kahlo with her never-walled suffering exposed in vivid paints. Without the intimate, therefore, there might not have been a Symphony No. 9 evoking joy, a Schindler's List underlining empathy as a colossus, and what are perhaps the most visceral self-portraits possible. It is through this perspective that, throughout this text, we will seek to detail this materialization of the intimate. To do so, we will consider the work of the contemporary artist Paulo César — still unknown to the art system — who has all his work centered on the structures of lighthouses. In the light of Proust's conception about the appropriation of life by art, the work of the mentioned artist will be conducted in parallel to Schopenhauer's The World as Will and Representation, attesting to the role of art as the privileged way to know and overcome suffering. Finally, by including a detailed interview with Paulo César himself according to Schiller and the possibility of exercising freedom through pain and moral resistance, we intend to value the look at human complexity through what is most human in a work: the human being who created it.

Keywords: Artistic creation; Lighthouse; Materialization of the intimate; Restlessness; Suffering.

Acknowledgments

A Paulo César

References

[1] BAENA, Jeff (Diretor). (2020). Horse Girl. In Jeff Baena, Alison Brie, Alana Carithers (Produtores). EUA: Duplass Brothers Productions.

[2] COPPOLA, Francis Ford (Diretor). (1974). The Conversation. In Francis Ford Coppola (Produtor). EUA: Paramount Pictures.

[3] PAULO CÉSAR. (2022, dezembro). Entrevista sobre os faróis [Entrevista realizada por Pedro Henrique Felix Barbosa (Sihan Felix)].

[4] PROUST, Marcel. (2013). Em busca do tempo perdido 7: o tempo redescoberto (Lúcia Miguel Pereira, Trad.). São Paulo, SP, Brasil: Editora Globo.

[5] ROSENFELD, Anatol. (1996) O mito e o herói no moderno teatro brasileiro. São Paulo, SP, Brasil: Editora Perspectiva.

[6] SCHILLER, Friedrich. (2011). Do sublime ao trágico. (Pedro Süsseking e Vladimir Vieira, Trad.). Belo Horizonte, MG, Brasil: Autêntica Editora. [7] SCHOPENHAUER, Arthur. (2001). O mundo como vontade e representação (M. F. Sá Correia, Trad.). Lisboa, Portugal: Editora Contraponto.













Figure 1: Photographs of some of Paulo César's works [photographs taken by the artist himself].

20788 | Louis Galliac- The Artist's Model, 1934

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Abstract

For this following oral presentation, the 1934 painting from Louis Galliac, entitled by *The Artist's Model*, will be decoded.

Louis Galliac (1849-1934) was a French painter born in Dijon, France. He worked on themes related to the Orientalism of 19th century European art and exclusively painted Genre and Portrait art. Galliac attended the École des Beaux Arts in Paris and was a pupil of references such as Alexandre Cabanel, Adolphe Yvon and Léon Borrat.

Through the lens of the art historian Erwin Panofsky and his analysis methods, details and possible references will be discussed. Using the infinite imagination and creativity of an art history student, even music references were supplemented to strengthen the purpose of this work, which leads to the use of theory and an instinctive baggage of visual culture.

Considerations about the relationship with the artistic and cultural context of the time it was created, will be made, such as the techniques and visual elements used in the painting. The analysis involved in the identification and exploration of the artist's choices in terms of symbolisms will also be clear aspects throughout the elaboration of the present work. Furthermore, the role of the model figure in art history is examined, especially in the context of figurative painting and the representation of the female body in art.

The Artist's Model offers valuable insights into the understanding of representations of symbolisms with the power dynamics that exist in artist-model relationships.

Keywords: Louis Galliac; The Artist's Model; oil painting; Orientalism.

Acknowledgments

Work done in the scope of the subject: *Imagem e Contexto I* - first semester of the first year of the Master's degree of History of Art, Heritage and Visual Culture

References

https://www.artrenewal.org/artworks/the-artists-model/louis-galliac/89288



Figure 1: Louis Galliac, The Artist's Model, 1934

21124 | Falsification of importances: The Image-Word opposition in relation to Jaques Rancière's "The Emancipated Spectator"

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Abstract

The present investigation takes as its starting point the relations between the opposition "word" and "image", as well as the notions of authorship and the limits of translation between artistic forms.

To this end, the work of Jaques Ranciére's The Emancipated Spectator is analysed, focusing in particular the essay "The Intolerable Image".

The vertiginous reproducibility of the image is then explored, as well as its pamphlet status in our century. In the face of growing disbelief in the written word, the struggle between these binomials becomes an incoherent conflict.

The deconstruction of the binomial and the search to revive the making of images and consequently the visual arts start from two logical games: the first one comes from the short story by the Argentinean writer Jorge Luis Borges "The Book of Sand", which describes an infinite book. The hypothesis raised in this essay is based on the discovery of said book and the consequent discrediting of the written word.

Once discovered, this utopian book will inevitably contain all the books to come and all verbal and written discourse ever created. All that will remain is the search for an image that, in opposition, will be infinitely small.

On a second level, the notion of authorship and legitimation of a work of art that claims to be visual but needs to rely on words to be explained is addressed.

Returning to Rancière, the spectator who is emancipated declares himself to understand a work of art that is visual, but which is only understandable through the written word.

All this deconstruction culminates in the rehabilitation of that which is understood by necessary images. By "necessary images" one means those that arise from artistic practices, through the most varied means, addressing a multitude of different formal and conceptual concerns, but conceived as ends in themselves.

To illustrate this intention with a phrase by Rancière: "The photograph was titled simply Untitled, which in that context, seemed to mean: no title is necessary; the image alone says enough." (Rancière, 2010, p.40-42).

Keywords: Word-image; Institutional Critic; Reproductibility; Authorship

References

[1] Borges, J. L. (2012). Livro de Areia. Lisboa: Quetzal Editores.

[2] Rancière, J. (2010). O Espetador Emancipado. Lisboa: Orfeu Negro.

20636 | After the sea: the pewter collection in Esposende

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Abstract

This presentation introduces the work developed during the second year of the *Master's in Art History, Heritage, and Visual Culture* in the school year 2022/2023 and a curricular internship at the Centro Interpretativo de São Lourenço, in Esposende. It aims to study the metal collection of the future exhibition «Patrimónios Emersos e Submersos - Do Local ao Global», which came from a finding of a shipwreck. It is now in deposit in the Centro Interpretativo de São Lourenço. Upon understanding the objects in study through inventorying them, it was then possible to develop the analysis of typologies, forms, materials and techniques used, marks, inscriptions and iconography and the functionalities of the objects in study, focusing on the experience and contexts of their uses.

Special emphasis was given to the pewter core of the collection in order to demonstrate the scarce study associated with pewter objects in Portugal and to document the dissimilarity of information of various sources and different academic contexts. Aware of these problems, we seek to develop towards the recognition and dissemination of this Heritage. Therefore, it is intended, with this investigation, to demonstrate the potential of a contribution of our scientific area to the study of pewter objects and to validate the values of the practical component of our course. Additionally, this study expects to dissect the methodologies employed internationally in the study of pewter objects and to open a space for speculative reflection which will allow to produce a better knowledge of these pieces and the historical period that produced them. It is also a main purpose to reflect on communication strategies and tools to better promulgate information about pewter modern objects in today's society.

Keywords: Art History; Shipwreck; Metal objects; Pewter; Modern Period; Esposende.

21192 | Beauty destroyed: Viewing art in face of (its) destruction

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Abstract

Art thinking hardly associates with the idea of destruction. These are two concepts that oppose each other. Artistic production bases itself on construction through the addiction of elements, materials, and ideas that result in a final work, which, to be rightly appreciated, must obey specific patterns of taste that destruction generally cannot convey. Destruction alludes to war, loss, to an eventual end. While destruction brings a feeling of unpleasantness, art transmits one of pleasure. It does not mean one cannot find beauty in the sight of destruction. Although disparate, art and destruction do not find themselves completely separated. This essay will search for beauty in destruction by gathering various examples in the History of Art that used destruction as its motive, through a systematic literature review with focus on specific artists whose works apply to this concept. For this effect, this academic paper will be structured in three key points: firstly, Destruction in Art, that is, the visual representation of destruction. Thus, various artists will be presented who, in diverse ways, resorted to destruction as an aesthetic motive in their works, as in the paintings of ruins in the romantic period, but also in more recent works such as Picasso's Guernica; Second is the Destruction of Art, the intentional destruction of an artistic object, which in turn questions if destroying an artistic object equals to destroying art itself. This essay will focus solely on the destruction provoked by the artist who produced the work, in the likes of John Baldessari's Cremation Project, Banksy's Girl With Balloon, and Rauschenberg's Erased de Kooning Drawing; lastly, Destruction as Art, the production of artistic work through means of destruction itself. More contemporary artists will be presented, such as Anselm Kiefer and Cai Guo-Qiang, whose artistic work focuses on the material possibilities of destruction and the concepts with it associated.

Keywords: aesthetics; art history; destruction.

21286 | EUROPALIA 1991 PORTUGAL National identity and cultural diplomacy - a case study of the Museu Nacional Machado de Castro collection

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Abstract

30 years ago, one of the cultural events with the greatest projection and magnitude in Portuguese culture, held until then, took place in Belgium. During three years they gathered, in a herculean work that had never been carried out in Portugal, the best that national culture and arts had to show to Europe and the World. For more than four months the country presented its most unknown facet in the eyes of a Europe that it wanted to "conquer", after its definitive entry into the European Community (1986) and the subsequent commitment of the Presidency of the Council of the European Union and the European Council in 1992. In this context, Europalia would mean a masterful act of introducing the country, of celebrating Europeanism, but, above all, of affirming a historical and cultural past fully committed and fundamental in the construction of the territory that is today known as Europe.

The studies developed so far and the contributions made to the investigation of this topic are scarce and practically non-existent. The cultural, patrimonial and historical importance of this event deserves the contribution of our investigation to its perpetuation and recognition, and to the knowledge in the fields of Art History.

Starting from the specific case of Europalia 1991, we seek to dissect, during five chapters, the performance of heritage, through movable cultural assets and their dissemination throughout the territory, as a device for promoting national identity and a mechanism for political and cultural affirmation. It is intended to stimulate the discussion of the patrimonial and identifying relevance of Europalia in the definition of a common cultural conscience and as an instrument of soft power. We therefore intend to value this event and enhance its investigation, thus enriching the discussion of the exhibition tradition in Portugal, the role of heritage in cultural diplomacy and external cultural policies, and its role as a definer of a common national identity.

Keywords: Universal Expositions; Europalia; cultural diplomacy; soft power; national identity.

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21214 | A practical case study of zincography in the Portuguese context

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Abstract

Zincography is a broad term that can be used to describe a certain number of printmaking processes that use zinc plates to transfer and reproduce images. The focus of this research is on zincography in relation with the typographic processes, in which an etched photomechanical matrix is attached to a wooden block forming a letterpress block, to be used in a typographic press.

This research began back in 2015 with the Project Lazarus, a collaboration between the Faculty of Fine Arts and the archive of the late Photoengraving Atelier of Marques de Abreu, one of the most important photomechanical printmaking studios in Portugal. It had the objective of identifying and reconstructing the ways in which the technological heritage of commercial origins can be replicated in an artistic printmaking workshop in the present. At this point, the first examples of zincographies were produced based on complex formulas of 20th century European manuals, and stopped there.

At the present moment, the research has been resumed, but now based on the personal notes of Marques Abreu, present in the archive of Centro Português de Fotografia. These notes serve as a primary source on how this process was used between the 19th and 20th centuries in Portugal, and show a path to its reconstruction. This documentation is analysed on the basis of the "technological archaeology" methodology that is being employed in the research conducted at FBAUP's printmaking workshop. This method proposes to recover obsolete reproduction techniques, looking for local and traditional resources to give us a technological foundation on the process while taking it one step further. The end goal is not the simple reproduction of the technique, but the adaptation of its processes to image making in contemporary printmaking. This research is, then, at the same time, both historical and contemporary, finding ways in which zincography can be recovered and transformed to be used in an artistic practice, developing new tacit knowledge.

Keywords: printmaking; zincography; Marques Abreu; technological archeology.



ASTRONOMY & MATHS



21147 | Estimation of the dispersion parameter in generalized linear mixed count models

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Abstract

The theory of Generalized Linear Models (GLM) [1] states that the response variable conditional on the explanatory variables, Y|x, follows a distribution belonging to the exponential family, with parameters (θ, ϕ) for location and dispersion, respectively. For Y|x with the Poisson distribution, $P(\mu(x))$, we have $\theta = \log (\mu(x))$ and $\phi = 1$, due to the equality between mean and variance. The parameters in θ are estimated by maximum likelihood, while ϕ is estimated by the Mean Deviance, $\hat{\phi}_D$, or, more often, by the ratio of the Pearson X²-statistic to its degrees of freedom $(df), \hat{\phi}_P$, which is known to have a X²(df) asymptotic distribution.

This estimator is advertised to keep its properties when applied to either GLM or Generalized Linear Mixed Models (GLMM), and its use is widely advocated [2]. However, the dispersion included by the random effects may interfere with the dispersion of the conditional response variable. In this work, we address the estimation of the dispersion parameter in GLMM.

We proved that $\widehat{\Phi}_P$ is asymptotically unbiased and consistent, and studied its behaviour in small sample sizes. More precisely, we generated data coming from the mixed Poisson regression model, with $j \in \{1,2,3,4\}$ repeated measurements per experimental unit, given by:

- $Y_{ij}|b_{0i} \sim P(\exp{(\beta_0 + b_{0i})})$
- $Y_{i1}|b_{0i}, ..., Y_{i4}|b_{0i}$ are independent, i = 1, ..., 50
- $Y_i | b_{0i}$ independent from $Y_{i'} | b_{0i'}$, $i \neq i'$
- $b_{0i} \sim N(0, \sigma_0^2)$ are independent, i = 1, ..., 50

with $\beta_0 \in \{0.1, 0.5, 1\}$ and $\sigma_0^2 \in \{0.1, 0.5, 1\}$. Subsequently, a model was fitted to the generated data, and the estimates for β_0 , b_0 and ϕ were obtained. The procedure was repeated 1000 times. The estimators for ϕ were sensitive to the presence of random effects. In particular, the greater the variance of the random effect, the greater the deviation from the true value of ϕ . The same estimator behaved as expected in models without random effects.

Keywords: Poisson Regression; Generalized Linear Models; Dispersion Parameter; Pearson Estimator; Mean Deviance Estimator.

References

[1] Peter K. Dunn and Gordon K. Smyth. Generalized Linear Models With Examples in R. Springer Texts in Statistics. Springer, New York, 2018

[2] Alain F. Zuur. Mixed effects models and extensions in ecology with R. Springer, 2009.

[3] Elizabeth H. Payne et al. An empirical approach to determine a threshold for assessing overdispersion in poisson and negative binomial models for count data. Communications in Statistics - Simulation and Computation, 47(6):1722–1738, 2018

21206 | Modeling the length of stay in the Pediatrics Department in CHUSJ

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Abstract

Centro Hospitalar Universitário de São João (CHUSJ), located in Porto, moved its Pediatrics Department to a new building in November 2021. A year after this opening, the local management team and the Hospital Epidemiology Centre intend to analyse the process of patient care with the aim of improving it.

This study evaluated 2786 admissions from 2312 children (2-18 years-old), corresponding to 3772 observations between December 1, 2021 and November 30, 2022. We modelled the length of stay in each of the seven wards using patient characteristics (age group: <13 y.o./otherwise; sex: female/male; residence: Porto/otherwise), admission season (Autumn+Winter/Spring+Summer), main diagnosis at admission (18 different groups), and admission mode (internal/urgent/scheduled).

We used a general linear model, with estimates obtained by generalized least squares – language R, package *nlme*, *gls()*. The response consisted of all Lengths Of Stay (LOS) and the wards were included as an explanatory variable. To address the left-skewness in the response variable, a logarithmic transformation was applied. A residuals analysis identified different variances according to the diagnostic category, which were therefore included. The choice of the final model was based on the Akaike Information Criterion; it included "Ward", "Admission Season", "Admission Mode" and "Diagnosis" as statistically significant explanatory variables.

Results show significantly (p<0.001) lower LOS were associated with scheduled admissions (vs internal referral), admissions during Spring/Summer, and in diseases related with male genitals (vs "others"); significantly (p<0.001) greater LOS occurred at the oncology and medical pediatrics wards (vs observation area in the emergency department) and for the main diagnosis "burns" (vs "others").

The findings suggest that considering the reason for admission and time of year can help hospital staff estimate the expected length of stay, enabling better resource allocation and discharge planning.

Keywords: Length of Stay; Trajectory; GLS; Pediatrics Department.

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21031 | Agreement between imputed values obtained by multiple imputation

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Abstract

Missing values in datasets arise from a missing or incorrect value for a particular variable in an observation. Several imputation methods may lead to different imputed values. This study evaluates the agreement between these values after Multiple Imputation with Chained Equations (MICE) using Linear Models (LM), Random Forests (RF) and Predictive Mean Matching (PMM). We use data from the GENERATION XXI cohort, with variables collected at birth regarding the mother and the newborn. The dataset has 3.6% missings and its complete version comprises 3139 rows and 18 variables. To understand the variability among the imputed values and its relation with the corresponding methods, we randomly deleted 3.6% observations from the complete (original) dataset and used MICE to obtain 10 complete imputed datasets. The concordance between the imputed values used the Fleiss' kappa for categorical variables, and the Intra-Class Correlation Coefficient (ICC) for continuous variables. The imputed values were then compared with the original collected value. For each categorical variable, we counted the proportion of imputed classes matching exactly the original class. For each continuous variable, we standardized each variable and computed the deviations of the imputed value from the original value.

Table 1 shows the results for the best, worst, and median value of the agreement measures for each imputed method. The best results were obtained for the linear model.

Regarding the comparison between original and imputed values: the percentage of matching was 73% (39%;98%) for the LM, 76% (42%;99%) for the RF, and 71% (39%;99%) for the PMM, using median (min; max). The results for the continuous variables are shown in table 2. The table shows that the method with lowest values depends on the variable under analysis.

Our simulation study suggests the LM as the procedure to follow in MICE if the goal is to obtain imputed datasets similar to each other and no preferred method for the agreement between original and imputed values.

Keywords: missing values, multiple imputation, mice, simulation, agreement measures.

Acknowledgments

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Method	ICC		Median	Fleiss'kappa		Median
Linear	N. Weight	Age		Delivery mode	N. Sex	
Model	0.999	0.982	0.996	0.930	0.026	0.229
Random	N. Weight	BMI		Delivery mode	Smoking	
Forest	0.488	0.110	0.406	0.982	0.014	0.251
Predictive	N. Weight	BMI		Delivery mode	N. Sex	
M. Matching	0.701	0.227	0.579	0.955	0.014	0.231

Table 1: Best, worst, and median agreement measures and corresponding variables, for each method

Method	Age	BMI	Gestational	Newborn's	Newborn's
			Weeks	Weight	Length
Linear	-0.074	0.017	0.120	-0.002	0.135
Model	-1.945; 2.852	-1.410; 3.714	-3.777;2.872	-1.142; 1.353	-2.058; 1.592
Random	0.001	0.067	-0.001	-0.055	0.216
Forest	-4.289; 4.285	-5.150; 4.727	-4.835; 4.823	-4.801; 2.638	-4.505; 5.396
Predictive	-0.001	0.162	0.002	-0.004	0.002
M. Matching	-4.080; 4.086	-5.175; 4.653	-3.347; 4.241	-3.592; 3.519	-2.707; 4.503

Table 2: Median (min;max) of the deviations for the continuous variables, for each method

20933 | Can Deep Learning help us to unveil LAEs through broadband filters?

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Abstract

Detecting Lyman-alpha emitters (LAEs) requires specialized survey techniques that do not scale easily if one wishes to increase current population samples which amount to several thousand sources [1]. And with many current and upcoming large-scale surveys lacking narrow and intermediate bands [2,3,4], it will not be possible using current techniques to search for new candidates. We aim to use a well-calibrated sample of LAEs (SC4K [5]), to develop deep learning models using Convolutional Neural Networks which have proved to be efficient already in astronomical surveys [6]. To train our models, we created balanced datasets with 50% LAEs and 50% non-LAEs sampled from 2 < z < 6 and 22 < i-band magnitude < 27 and used only three broadband filters (g-, r-, and i-bands) as an input. It is noteworthy, that using simple broad band imaging data, one can reach good accuracies of 82% for training and 75% for validation. We will show that the developed models do not neeed to be too complex, which makes them easier to train and compare our results with state-of-the-art image classification models. We will finish by highlighting promising strategies to pursue in the near future, which include using astronomyspecific architectures without constraints from using three-filter image data as inputs.

Keywords: galaxies: high redshift; galaxies: photometry; galaxies surveys; deep learning; supervised learning from labeled data; convolutional neural networks.

Acknowledgments

This work was supported by Fundação para a Ciência e a Tecnologia (FCT) through the research grants UIDB/04434/2020 and UIDP/04434/2020. All authors acknowledge the financial support provided by FCT through the project EXPL/FIS-AST/1085/2021. JF acknowledges support from FCT through the Investigator FCT Contract No. 2020.02633.CEECIND/CP1631/CT0002 and APA from FCT through the Investigator FCT Contract No. 2020.03846.CEECIND.

References

[1] Ono, Y. et al., "SILVERRUSH X: Machine Learning-aided Selection of 9318 LAEs at z = 2.2, 3.3, 4.9, 5.7, 6.6, and 7.0 from the HSC SSP and CHORUS Survey Data", The Astrophysical Journal, vol. 911, no. 2, 2021

[2] Sánchez, E. and Des Collaboration, "The Dark Energy Survey", Journal of Physics Conference Series, 2010, vol. 259, no. 1

[3] Euclid Collaboration, "Euclid preparation. I. The Euclid Wide Survey", Astronomy and Astrophysics, vol. 662, 2022

[4] Ivezić, Ž. Et al., "LSST: From Science Drivers to Reference Design and Anticipated Data Products", The Astrophysical Journal, vol. 873, no. 2, 2019

[5] Sobral, D. et al., "Slicing COSMOS with SC4K: the evolution of typical Ly α emitters and the Ly α escape fraction from z~2 to 6", Monthly Notices of the Royal Astronomical Society, vol. 476, no. 4, pp. 4725–4752, 2018

[6] Huertas-Company, M. and Lanusse, F., "The Dawes Review 10: The impact of deep learning for the analysis of galaxy surveys", Publications of the Astronomical Society of Australia, vol. 40, 2023



Figure 1: Training and validation accuracy and loss for 2 convolutional layers.

20967 | Boosting LAEs identification and characterization

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Abstract

Finding Lyman emitting galaxies (LAEs) in large numbers usually entails dedicated surveys using custom narrow-band filters [1]. In this talk, we propose to use gradient-boosting algorithms trained using data from the COSMOS2020 catalogue [2] and SC4K [3]. We create balanced datasets with similar redshift and i-band distributions to train the model to better separate similar generic populations. We test several combinations of optical and near-infrared photometric data to find the best possible model for LAE identification and we achieve an accuracy of ~80-90%. Aside from selecting new potential candidates (almost doubling the number in the training LAE sample [3]), we also train regression models to get a first approximation on the overall sample properties (Lya redshift, line luminosity and equivalent width [4]). We finally discuss the potential of this kind of models to pre-select potential LAEs of future large-scale surveys.

Keywords: galaxies: high redshift; galaxies: photometry; galaxies surveys and catalogs; machine learning; supervised learning from labeled data

Acknowledgments

This work was supported by Fundação para a Ciência e a Tecnologia (FCT) through the research grants UIDB/04434/2020 and UIDP/04434/2020. All authors acknowledge the financial support provided by FCT through the project EXPL/FIS-AST/1085/2021. JF acknowledges support from FCT through the Investigator FCT Contract No. 2020.02633.CEECIND/CP1631/CT0002 and APA from FCT through the Investigator FCT Contract No. 2020.03846.CEECIND.

References

[1] Cowie, L. L. and Hu, E. M., "High-z Ly α Emitters. I. A Blank-Field Search for Objects near Redshift z=3.4 in and around the Hubble Deep Field and the Hawaii Deep Field SSA 22", The Astronomical Journal, vol. 115, no. 4, pp. 1319–1328, 1998

[2] Weaver, J. R. et al., "COSMOS2020: A Panchromatic View of the Universe to z~10 from Two Complementary Catalogs", The Astrophysical Journal Supplement Series, vol. 258, no. 1, 2022 [3] Sobral, D. et al., "Slicing COSMOS with SC4K: the evolution of typical Ly α emitters and the Ly α escape fraction from z~2 to 6", Monthly Notices of the Royal Astronomical Society, vol. 476, no. 4, pp. 4725–4752, 2018

[4] Santos, S. et al., "The evolution of rest-frame UV properties, Ly α EWs, and the SFR-stellar mass relation at z~2-6 for SC4K LAEs", Monthly Notices of the Royal Astronomical Society, vol. 493, no. 1, pp. 141–160, 2020

20561 | Quantitative constraints on modified gravity paradigms

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Abstract

We use low-redshift background cosmology data to place quantitative constraints on three separate modified gravity models, each of which aims to explain the low-redshift acceleration through a different physical mechanism. The Lifshitz cosmology is effectively a parametric extension of the canonical ACDM model, where a time-dependent cosmological constant originates from vacuum energy. The Infinite Statistics model is also a parametric extension of ACDM, where the dark energy is dynamic and originates from the curvature of a dual space-time. We show that the data restricts the additional parameters in these models to be consistent with their ACDM values, and in particular it implies that the theoretically predicted value for a dimensionless coupling parameter in the Lifshitz model is ruled out at more than six standard deviations. In the Regge-Teitelboim model, gravity is described by embedding the usual spacetime manifold in a fixed higher-dimensional background, and there is no parametric ACDM limit. We study several separate realizations of the model, respectively introduced by Davidson, by Fabi et al., and by Stern & Xu, and show that the first two are ruled out by the low-redshift data we use, while the latter is consistent with this data but requires a non-standard value of the matter density. Overall, our analysis highlights the tight constraints on the allowed low-redshift deviations from the standard ACDM background evolution.

Keywords: Low-redshift acceleration; Lifshitz cosmology; Infinite Statistics model; Regge-Teitelboim model.

Acknowledgments

This work was financed by Portuguese funds through FCT - Fundação para a Ciência e a Tecnologia in the framework of the project 2022.04048.PTDC. CJM also acknowledges FCT and POCH/FSE (EC) support through Investigador FCT Contract 2021.01214.CEECIND/CP1658/CT0001.

References

[1] D. Berechya and U. Leonhardt, Mon. Not. Roy. Astron. Soc. 507, 3473 (2021), arXiv:2008.04789 [gr-qc].

[2] V. Jejjala, M. J. Kavic, D. Minic, and T. Takeuchi, Int. J. Mod. Phys. A 37, 2242001 (2022), arXiv:2011.08852 [hep-th].

[3] V. Jejjala, M. Kavic, D. Minic, and T. Takeuchi, (2022), arXiv:2202.05266 [gr-qc].

[4] A. Davidson, Class. Quant. Grav. 16, 653 (1999), arXiv:gr-qc/9710005.

[5] S. Fabi, A. Stern, and C. Xu, Class. Quant. Grav. 39, 175002 (2022), arXiv:2202.09453 [gr-qc].

[6] A. Stern and C. Xu, Phys. Rev. D 107, 024001 (2023), arXiv:2206.14300 [gr-qc].

[7] A. G. Riess et al., Astrophys. J. 853, 126 (2018), arXiv:1710.00844 [astro-ph.CO].

[8] D. M. Scolnic et al. (Pan-STARRS1), Astrophys. J. 859, 101 (2018), arXiv:1710.00845 [astro-ph.CO].

[9] O. Farooq, F. R. Madiyar, S. Crandall, and B. Ratra, Astrophys. J. 835, 26 (2017), arXiv:1607.03537 [astro-ph.CO].

[10] F. K. Anagnostopoulos and S. Basilakos, Phys. Rev. D 97, 063503 (2018), arXiv:1709.02356 [astro-ph.CO].

[11] U. Leonhardt, Annals Phys. 411, 167973 (2019), arXiv:1910.02441 [gr-qc].

[12] E. M. Lifshitz, J. Exper. Theor. Phys. USSR 29, 94 (1954).

[13] A. Strominger, Phys. Rev. Lett. 71, 3397 (1993), arXiv:hep-th/9307059.

[14] R. Gopakumar and D. J. Gross, Nucl. Phys. B 451, 379 (1995), arXiv:hep-th/9411021.

[15] T. Regge and C. Teitelboim, in Marcel Grossmann Meeting on the Recent Progress of the Fundamentals of General Relativity (1975) arXiv:1612.05256 [hep-th].

[16] S. Deser, F. A. E. Pirani, and D. C. Robinson, Phys. Rev. D 14, 3301 (1976).

[17] C. B. D. Fernandes, C. J. A. P. Martins, and B. A. R. Rocha, Phys. Dark Univ. 31, 100761 (2021), arXiv:2012.10513 [astro-ph.CO].

20490 | The impact of stellar activity on the planetary habitability

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Abstract

The constant rise of known exoplanets has been leading to several studies that intend to generalize the scenario known in the Solar System, such as planet formation, planetary systems dynamics or star-planet interaction. In this last topic, a combination of observations and 3D simulations of magneto-hydrodynamics allows the study of space-weather effects on exoplanets such as for the stars TRAPPIST-1 [1] and Proxima Centauri [2]. In this context, the study of the habitable zone takes a major role. The habitable zone is defined as the orbital area around a star where a rocky planet can maintain liquid water at its surface [3]. However, the traditional definition of habitable zone does not consider the impact of rotation and magnetic activity of the stars on the habitability of the planets. Naturally, the impact of the stellar activity in the habitability, increases with decreasing mass, which arouses interest in particular, in K and M stars [4]. In this context, the knowledge of the rotation and stellar activity has an important role [5]. In this way, this work will have two components: observational and theoretical. In the observational component, the light curves obtained by the Kepler satellite for about 2000 stars were analysed. This sample of stars only contains KOIs (Kepler Objects of Interest), particularly those with multiple systems. KOIs are stars with confirmed and/or candidate planets. The light curves were calibrated and corrected, namely removing Kepler instrumental artefacts and transits, to analyse the star's signals. From this procedure, as a work in progress, we pretend to extract information on the period of rotation and magnetic activity. In the theoretical component, in the future, will be made stellar evolution models to see the effect of magnetic activity (the difference between the simulations and the observational data). This study thus aims to study the impact of stellar activity on the habitability of exoplanets.

Keywords: Habitable zone; Magnetic activity; KOI, solar-like stars.

References

[1] Garraffo, C. et al. (2017) "The threatening magnetic and plasma environment of the TRAPPIST-1 planets," The Astrophysical Journal, 843(2). Available at: https://doi.org/10.3847/2041-8213/aa79ed.

[2] Alvarado-Gómez, J.D. et al. (2020) "An earth-like stellar wind environment for Proxima Centauri C," The Astrophysical Journal Letters, 902(1). Available at: https://doi.org/10.3847/2041-8213/abb885.

[3] Gallet, F. et al. (2016) "Impacts of stellar evolution and dynamics on the habitable zone: The role of rotation and magnetic activity," Astronomy & Astrophysics, 597. Available at: https://doi.org/10.1051/0004-6361/201629034.

[4] Vidotto, A.A. and Jardine, M. and Cameron, A.C. and Morin, J. and Villadsen, J. and Saar, S.H. and Alvarado, J. and Cohen, Ofer and Holzwarth, V. and Poppenhaeger, K. and Reville, V.: 18th Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun Proceedings of Lowell Observatory (9-13 June 2014) Edited by G. van Belle & H. Harris, 18,65-79 (2015)

[5] Lanza, A.F. (2022) "The role of interactions between stars and their planets," Demographics of Exoplanetary Systems, pp. 85–140. Available at: <u>https://doi.org/10.1007/978-3-030-88124-5_2</u>.

20691 | Application of realistic magnetic-cycle reconstruction to sun-as-a-star observations

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Abstract

One of the Sun's many interesting intricacies is its magnetic activity, which is seen to vary over a period of approximately 11 years known as the Solar Cycle. Various phenomena arise from this activity displaying its complexity, namely dark sunspots and bright faculae in the Sun's photosphere. Bright faculae are usually associated with dark spots, being formed around them. Throughout the cycle, the number, location and properties of these features change, and the understanding of this change has been of increasing interest both regarding the Sun as well as other solar-like stars, which has motivated the creation of parametrized models that can be constrained observationally. This work follows from the research developed in [1] where it was aimed at reconstructing the behaviour and properties of dark sunspots during the solar cycle using such a parametrized model. The resulting parametrized model is here extended introducing the reproduction of the behaviour and properties of the solar bright faculae existing around sunspots. The sunspot and faculae properties to be simulated are here studied using data from the Michelson Doppler Imager (MDI) on board of the Solar and Heliospheric Observatory (SOHO) across Solar Cycle 23. Our results show that the new extended model is able to reproduce the behaviour of sunspots and their associated faculae throughout the solar cycle. This represents a step forward towards realistic modelling of stellar magnetic activity, particularly useful for its mitigation in order to find Earth-like planets around Sun-like stars.

Keywords: sun; solar-cycle; magnetic-activity; solar-activity; sunspots; faculae.

References

[1] Santos, A. R. G., Cunha, M. S., Avelino, P. P., & Campante, T. L. (2015). Spot cycle reconstruction: an empirical tool-Application to the sunspot cycle. Astronomy & Astrophysics, 580, A62.

20738 | Fundamental cosmology from ANDES precision spectroscopy

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Abstract

The main drivers of both science and design of the ArmazoNes high Dispersion Echelle Spectrograph (ANDES), one of the instruments of the forthcoming Extremely Large Telescope (ELT), are the fundamental cosmology observations. Within these, there are the detection of the redshift drift and tests of the universality of physical laws, for which separate forecasts have already been reported. We have developed a forecast code based on the Fisher Matrix analysis for the combination of these two observables. With this we can demonstrate the synergies between two ANDES datasets and quantifying the improvements in cosmology and fundamental physical parameter constraints for two separate theoretical paradigms. This work is under review at MNRAS.

Keywords: Cosmology: cosmological parameters – Cosmology: dark energy – Cosmology: observations – Methods: analytical – Methods: statistical.

Acknowledgments

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20784 | Analytical solutions for cosmic superstrings evolution: Preliminary results

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Abstract

Cosmic strings arise naturally in both unifying theories and superstring inspired inflation models. In the latter case, fundamental superstrings produced in the very early universe may have stretched to macroscopic scales, in which case they are known as cosmic superstrings.

To better understand the underlying physical mechanisms and eventually constraint highresolution experimental data defect fingerprints, analytical developments are needed. In this work, we have studied the asymptotic solutions of the generalised velocity-dependent one-scale model for current-carrying strings. This analysis, and the interpretation of the physical mechanisms that govern the evolution of such networks, also reveal the expansion rates that are compatible with each solution branch, namely under which conditions it would be possible to have charge and current solutions that are not erased through the universe expansion.

Keywords: Cosmic strings, topological defects, superconducting strings.

21052 | Cosmographic constrains on the variation of the proton-to-electron mass ratio *Clerfeuille, Celia, CAUP, Portugal*

Abstract

Most extensions of the canonical theories of cosmology forecast spacetime variations of nature's fundamental couplings, such as the proton to electron mass ratio μ , or the fine structure constant α .

Constrains on the evolution of physical quantities through time (or redshift) often result from the fit of a given model to a set of astrophysical measurements. Cosmography, an approach based on the expansion of the quantity as a Taylor series, is an alternative to the 'model-fitting' method that provides model independent results.

Here we apply this methodology to a set of μ and α measurements from various datasets, to constrain the evolution of μ , alone at first, and then combined with α .

In particular, we show how the combination of local atomic clock experiments and astrophysical measurements provides strong constraints on the first and second terms of the cosmographic series.

Keywords: cosmology; fundamental coupling; cosmography.

References

[1] C. J. A. P. Martins, F. P. S. A. Ferreira, P. V. Marto, Varying fine-structure constant cosmography, Physics, Physics Letters B (2022)

[2] A. Shelkovnikov, R.J. Butcher, C. Chardonnet and A. Amy-Klein, Stability of the proton-toelectron mass ratio, Phys. Rev. Lett. 100 (2008) 150801

[3] C J A P Martins, The status of varying constants: a review of the

physics, searches and implications, 2017 Rep. Prog. Phys 80 (2017) 126902

21282 | Varying Alpha in the galaxy

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Abstract

Physical laws are commonly thought to be universal, with fundamental constants being time and space independent. But recent observations of the acceleration motivate the questioning of this assumption. A detection of such variations would imply a fifth force of nature and the violation of the Einstein Equivalence Principale. We focus on space variation of the fine-structure constante, studying a model where its value is driven by a coupling to the dark matter density. We explore how the dependance of alpha on the Galactic centre distance depends on the choice of dark matter density profile and one the scalar field and dark matter masses, and discuss prospects for constraining these models with current and future data.

Keywords: cosmologie, fine structure constant, galaxy.

References

[1] Variation of \$\alpha\$ from a Dark Matter Force, Hooman Davoudiasl and Pier Paolo Giardino.



BIOLOGICAL SCIENCES



20550 | Social behaviour between Lemur catta in Zoo da Maia

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Abstract

Lemur catta is a diurnal lemur specie, known as ring-tailed lemur, from Madagascar Island. The hierarchy in this species is extremely important for a cohesive and helpful group $^{(1)}$, where there is a dominant female at the top, followed by the other females, and, in the end, the males ⁽²⁾. In Zoo da Maia, Portugal, two couples were introduced in 2021 with already one resident couple, therefore, it was important to study the social interaction after this introduction to understand if the lemur group was well-stablished. In this context, this study aims to analyse the dominance pattern, as well as a diurnal activity pattern, a lemurs' activity budget/day and the behaviour diversity of each lemur and during the day of all lemurs. Observations were done and were divided in two phases: ad libitum⁽³⁾ (25 hours for one week) and focal observations⁽³⁾ (three times a day, during 5 minutes for each individual, for 19 days). The aggressive, submissive, affiliative, play and physiological behaviours for each lemur were observed and registered. It was observed a diurnal activity pattern, which matched with the wildlife, with more activity in the morning and more behaviour variability in the afternoon. The individual behaviours were more notable in males and the group behaviours more in females. Besides that, the most dominant individual of the group was the female of the first couple, which indicated the social adaptation of the introduced lemurs. After analysing data, it was highlighted a huge percentage of affiliative behaviours (>50%) and a negligible percentage of aggression or submission behaviours (<1%). Therefore, we concluded that the group was cohesive, well-established and with a good relation between them. Moreover, it was advised the necessity of more cognitive stimulus creation to increase the play (0,41%) to contribute for the improvement of lemurs' activity and cognition.

Keywords: *Lemur catta*; captive behaviour; diurnal activity pattern; behaviour diversity; hierarchy; social well-being.

Acknowledgments

This study could not have been carried out without the generosity of all the Zoo da Maia's team, mainly the co-authors of this article and Dr. Nuno, for all the support, availability and kindness.

References

[1] Junge, R. E., Williams, C. v., & Campbell, J. (2009). Nutrition and Behaviour of Lemurs. In Veterinary Clinics of North America - Exotic Animal Practice (Vol. 12, Issue 2, pp. 339–348). https://doi.org/10.1016/j.cvex.2009.01.011

[2] Kulahci, I. G., Ghazanfar, A. A., & Rubenstein, D. I. (2018). Consistent individual variation across interaction networks indicates social personalities in lemurs. Animal Behaviour, 136, 217–226. https://doi.org/10.1016/j.anbehav.2017.11.012

[3] Bateson, M., & Martin, P. (2021). Measuring Behaviour: An Introductory Guide (4th ed.). Cambridge: Cambridge University Press. <u>https://doi.org/10.1017/9781108776462</u>

20425 | Using Google Earth Engine, ecological niche models, and a web geographic information system for biodiversity monitoring

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Abstract

The current rate of biodiversity loss has become a major concern among scientists and conservationists worldwide. Despite local, regional, and global efforts to conserve biodiversity, the impact of human-related causes continues to pose a significant challenge on conservation efforts. Therefore, innovative and interdisciplinary approaches are essential to enhance the effectiveness of current conservation strategies. This research focuses on the Montesinho/Nogueira special protection zone (MN-SPZ). We compiled biodiversity data for major taxonomic groups (amphibians, birds, vascular plants, mammals, and reptiles), including highly threatened species, and estimated the potential species richness using ecological niche models generated from time series of satellite-remote sensing variables (i.e., SRS-ENMs). The modelling approach was entirely conducted in Google Earth Engine (GEE). We built maps of potential species richness with the temporal series of SRS-ENMs across the study area. Additionally, we created an intuitive and free web geographic information system (Web GIS) using the R package "shiny". The results revealed the presence of 1.286 species in MN-SPZ, with 47.886 compiled records. The Web GIS effectively mapped the distribution of each species, while the potential species richness analyses revealed regions with high and low potential richness for different taxonomic groups. This study provides evidence for the usefulness of SRS-ENMs, GEE, and a Web GIS in improving the decision-making process for biodiversity conservation, serving as a model for other national or international protected areas.

Keywords: Biodiversity conservation; ENMs; GEE; Potential species richness; R package "shiny"; Web GIS.

20418 | Amphibian species inventory and action plan for the freshwater habitats within the green areas of Porto

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Abstract

The urban freshwater habitats have a huge importance and influence on the ecological and environmental balance as well as the society well-being. These habitats can provide a variety of ecosystem services and are habitat for several species that depends on water to survive, like the amphibians. However, currently the small urban freshwater habitats are in massive decline, due to the urbanisation, agriculture, pollution and the decrease of green areas inside the cities. Amphibians are sensitive to the environment changes; therefore, they can be used as indicators species to evaluate the freshwater habitats conservation status and then create an action plan. The purpose of this project is to characterise the water-bodies inside the green areas of the city of Porto, in Portugal, do an inventory of the amphibian species that inhabit them and elaborate an action plan to protect these habitats. In this work 107 freshwater water-bodies have been inventoried, which only 26 contain amphibian species. In total, seven species of amphibians were observed. Serious threats were detected in 63 water-bodies that hinder their ecological development, such as the lack of marginal vegetation and access ramps for amphibians to move around, presence of alien invasive species and their incorrect maintenance. An action plan was developed aimed at local authorities stating mitigation measures for the different water-bodies to promote aquatic diversity at the urban level, including the construction of new ponds, the colonisation with aquatic plants and amphibians, and carrying out environmental education activities for the general public to raise awareness of the importance of these ecosystems.

Keywords: amphibians; ponds; urban gardens; action plan.

20516 | Macrofauna biodiversity assessment in a real scale constructed wetland for wastewater treatment

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Abstract

In rural and mountain areas there is a lack of adequate infrastructures to cope with sewage. Constructed wetlands (CW) may provide a supporting solution to this problem. CWs are biological treatment systems that mimic the phytoremediation processes found in natural wetlands, with an optimized configuration, for the improvement of water quality. They comprise substrate, selected vegetation and their associated fauna and microbial communities.

The aim of the present study is to assess the long-term performance of a CW implemented in a tourism unit in a rural area. The gradient effect of the nutrient load along the CW is also being investigated. The biodiversity associated to the system is also being assessed, specifically the fauna linked to the CW substrate bed.

The methodological approach has followed the periodical wastewater sampling at the CW inlet and outlet, and in selected sites along the bed, in order to understand the dynamics of the treatment system. Wastewater characterization comprise the analysis of nutrients, organic contents, pH, conductivity, as well as microbial parameters, namely total coliforms, and Escherichia coli. The fauna associated to the substrate has been analysed through the periodical setup pitfall traps and through the collection of core substrate along the CW bed.

The results will allow us to infer about the long-term wastewater treatment efficiency of the system and to relate it to the diversity of associated fauna of the CW and the established ecosystem. Preliminary results indicate a robust ecosystem with several trophic levels and a high biodiversity.

Keywords: constructed wetland, phytoremediation, nature-based solutions, wastewater treatment, biodiversity.

Acknowledgments

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20930 | Common dolphin (*Delphinus delphis*) distribution in Northern Continental Portugal – preliminary analyses

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Abstract

The common dolphin (Delphinus delphis) is a known delphinid species with a worldwide distribution. In mainland Portugal, it's the most abundant species, being sighted regularly, however, on the northern coast (N-PT) information on the species is still scarce. This study aims to investigate the spatial-temporal distribution of the common dolphin in the N-PT and the use of the habitat by the groups occurring in the area. The data used in this work was provided by the ATLANTIDA Project, within which fieldwork campaigns, from Caminha to Espinho (up to 12 nautical miles from the coast), allowed so far, the recording of 59 sightings of common dolphins (from June 2021 to September 2022). Sightings, and the calf presence/absence, have been analysed in relation to the season and water depth of the sighting location. For this last variable, statistical tests were conducted to confirm the relevance of the differences observed. In general, common dolphins have been found throughout all seasons, nonetheless, higher relative abundances were observed both in the summer and autumn. Regarding depth, there were no significant differences between groups with or without calves. On the other hand, when studying the seasonality of water depth where animals occurred, statistically significant differences were observed, with the minimum average depth for dolphin occurrence being recorded in winter (-25.4m \pm 7.66) and the maximum in autumn (-86.9m \pm 7.93). Overall, our results reinforce the hypothesis that the N-PT may be a breeding area given the recurrent presence of calf-mother pairs. Additionally, a higher presence of common dolphins in the summer and autumn seasons might be linked with specific environmental conditions, that may promote an increase in food resources. Given the lack of knowledge about the species inhabiting the waters of N-PT, there is an urgent need to continue further cetacean monitoring in the area.

Keywords: Northern Portugal, common dolphin, depth, sightings, seasons.

20801 | Assessing the efficiency of non-invasive samples and reduced representation library sequencing for genomic studies in primates from Sierra Leone

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Abstract

The order Primates is one of the most diverse groups of mammals, it has 16 families, 79 genera and more than 500 species [1]. Sierra Leone is highly diverse in non-human primate species, some of them are threatened or are critically endangered due to habitat fragmentation, bushmeat hunting, illegal trade, and climate change [2]. It is of utmost importance to conserve and study these populations, including their genetic diversity. In this regard, genetic non-invasive samples (gNIS) are relevant because of the possibility to do population genetic studies without direct contact with the primates and minimal interference in their routines and habitats.

In our study, we focus on three species classified as Endangered or Critically Endangered: Red Colobus (*Piliocolobus badius*), Western Black-And-White Colobus (*Colobus polykomos*) and Western Chimpanzee (*Pan troglodytes verus*). We collected primates faeces samples and performed a proof of concept study using MobiSeq, a Reduced Representation Library (RRL) genotyping method based on targeting specific transposable elements (TEs) of the genome and their flanking region [3]. TEs can be found in and throughout the genome of several taxa, constituting approximately 50% of the genome of primates [4].

It has been demonstrated that MobiSeq works on tissue samples from modern and degraded historical DNA [3]. However, the applicability of this technique on samples from varied sources, such as faeces, had remained to be tested. We obtained promising results, as 54% of our samples (64 out of 119 samples) were approved in the final quality control procedure before sequencing. From the initial sequenced library, we obtained satisfactory results with an average of 471.098 sequencing reads generated per sample. These results will allow us to continue studying these populations and developing the protocol in order to obtain even better insights and, potentially, expand its application to other taxa and sample types.
Keywords: MobiSeq; Reduced representation library; Genomics; Genetics; Bioinformatics; Transposable elements; Genetic non-invasive samples; Faeces; Primates; Red Colobus; Western Black-And-White Colobus; Western Chimpanzee; Proof of concept.

References

[1] Estrada, A., Garber, P. A., Rylands, A. B., Roos, C., Fernandez-Duque, E., di Fiore, A., Anne-Isola Nekaris, K., Nijman, V., Heymann, E. W., Lambert, J. E., Rovero, F., Barelli, C., Setchell, J. M., Gillespie, T. R., Mittermeier, R. A., Verde Arregoitia, L., Kone, I., & Li, B. (2017). Impending extinction crisis of the world's primates: Why primates matter. In *22 Serge Wich* (Vol. 16). https://doi.org/10.1126/sciadv.1600946

[2] Lindsell, J. A., Klop, E., & Siaka, A. M. (2011). The impact of civil war on forest wildlife in West Africa: Mammals in Gola Forest, Sierra Leone. *ORYX*, *45*(1), 69–77. https://doi.org/10.1017/S0030605310000347

[3] Rey-Iglesia, A., Gopalakrishan, S., Carøe, C., Alquezar-Planas, D. E., Ahlmann Nielsen, A., Röder, T., Bruhn Pedersen, L., Næsborg-Nielsen, C., Sinding, M. H. S., Fredensborg Rath, M., Li, Z., Petersen, B., Gilbert, M. T. P., Bunce, M., Mourier, T., & Hansen, A. J. (2019). MobiSeq: De novo SNP discovery in model and non-model species through sequencing the flanking region of transposable elements. *Molecular Ecology Resources*, 19(2), 512–525. https://doi.org/10.1111/1755-0998.12984

[4] Han, K., Konkel, M. K., Xing, J., Wang, H., Lee, J., Meyer, T. J., Huang, C. T., Sandifer, E., Hebert, K., Barnes, E. W., Hubley, R., Miller, W., Smit, A. F. A., Ullmer, B., & Batzer, M. A. (2007). Mobile DNA in Old World monkeys: A glimpse through the rhesus macaque genome. *Science*, *316*(5822), 238–240. <u>https://doi.org/10.1126/science.1139462</u>

20557 | Ecotoxicological impact of the bioinsecticide SPINTOR® on earthworms *Eisenia fetida*

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Abstract

The application of biopesticides has grown due to an increase in more sustainable agricultural practices, replacing the use of synthetic pesticides. SPINTOR® (SPI) is a commercial formulation of the active ingredient spinosad, a naturally occurring product derived from the fermentation of the soil actinomycete Saccharopolyspora spinosa. Regardless of its efficacy as a pesticide against several pests, it is also possible that this product be bioactive in other environmental compartments, against non-target organisms, due to the conservation of the metabolic pathways amongst species. Previous studies have already shown the harmful effects of this bioinsecticide to non-target organisms, as shown for bees Apis mellifera. Eisenia fetida is an oligochaete, representatives of soil fauna, and a model organism in soil ecotoxicological studies. Taking this into consideration, the present study aimed to evaluate the potential adverse effects of SPINTOR® on the earthworm E. fetida. For that purpose, a natural soil was spiked with environmentally relevant concentrations (0.00 up to 1.49 mg of active ingredient/kg of soil_{dw}) to assess the effects in terms of avoidance and reproduction (following ISO standard protocol). An acute exposure of 48 h was also performed (using the same concentrations). After the acute exposure and the reproduction assay, the adults were processed to analyse several biomarkers (oxidative stress, energy reserves, and neurotransmission) and possible genotoxic effects (comet assay). Although no impact was observed on earthworms' reproductive outputs, results from E. fetida chronically exposed (28 d) revealed significant changes in the energetic metabolic pathways and the prooxidant performance. However, SPI in spiked natural soil could indeed cause significant damage in the nucleus of E. fetida after 48 h of exposure. This entails that SPINTOR® can have an impact on oligochaete's health which affects their essential functions in the terrestrial ecosystem.

Keywords: Oligochaete; Reproductive activity; Genotoxicity; Metabolic and physiological disorders.

Acknowledgments

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20544 | Leça River: An assessment of pollution and macro-litter impact on the ecological status

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Abstract

Water is one of the most important resources of life in the world, however, it's also one of the most affected ecosystems due to anthropogenic activities. Besides contaminants, a growing environmental concern about litter, namely plastics, has been registered in recent years. As consequence of these pressures, aquatic ecosystems loss their natural characteristics, biodiversity and ecological quality. To monitor the anthropogenic impacts and ecological status of water bodies, the European Union created the Water Framework Directive (WFD) in which they commit to achieving a good ecological status in all water bodies. The main objective of this study was to assess the ecological status of Leça River according to the WFD approach and categorize the riverine litter present on the riverbanks. Four sites were selected in the lower portion of the river: Lionesa (P1), Goimil (P2), Gatões (P3) e Guifões (P4). The sampling was conducted monthly and started in September 2022, and physical and chemical parameters were measured. The macroinvertebrates community were sampled using a hand net. For the characterization of the collected litter was used the OSPAR commission. The physical and chemical results showed that all sites were classified as a moderate ecological status due to a high concentration of nutrients (NH4, NO2, NO3, and PO4) recorded always above the reference limits for good/high ecological status (e.g., in september 22 the phosphate concentration was about 140 times higher than the limit - 0.10 mg PO4 /L - in P1). The results of the macroinvertebrates community showed that Leca river has a poor to bad ecological status in all sampling sites, due to the low richness and diversity values. The preliminary analyses of the litter showed a predominance of plastics and fabrics (e.g., food packages and clothes).

Keywords: water bodies, WFD, biological elements, debris.

20790 | Environmental DNA as a cetacean monitoring tool in the Northern Coast of Continental Portugal

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Abstract

In recent decades, environmental DNA (eDNA) has emerged as a promising monitoring tool in the marine conservation landscape, for its potential to collect data on the presence and abundance of biological communities with insufficient knowledge and/or difficult access for sampling. Advances in Next-Generation Sequencing (NGS) techniques, such as DNA metabarcoding, result in a new approach to studying complex biological communities, such as oceanic ones, by enabling multi-species detection in mixed samples. In the ATLANTIDA Project, this tool is being optimized with the goal of detecting and identifying cetacean species on the northern coast of continental Portugal, without relying on visual monitoring. To this end, a molecular biology-based methodology is being developed and tested in positive control samples, consisting of a mixture of DNA extracted directly from muscle tissue or gums of cetaceans with eDNA samples collected in ATLANTIDA dedicated at-sea surveys. Firstly, a bibliographic review was performed to select the most suitable universal primer set for marine vertebrates. Following that, several optimization tests have been conducted, through conventional Polymerase Chain Reaction (PCR), to identify the most efficient DNA amplification protocol for mitochondrial 16S. From these tests, we were able to detect cetacean DNA in positive control samples up to very low concentrations, with salt water not inhibiting the reaction. Quantitative PCR was also performed to assess if there is a specific melting curve profile for each of the target species and if that can be detected in environmental samples. Although we were able to determine a curve profile in tissue samples, that was not verified in eDNA ones. Lastly, samples with higher extracted DNA concentration were sent for sequencing in Illumina. In conclusion, although the effectiveness of resorting to eDNA for cetacean monitoring programs remains unclear, these results represent a step forward towards that goal.

Keywords: eDNA, PCR optimization, genomics, cetacean detection, cetacean sampling

Acknowledgments

This work is framed within the ATLANTIDA Project, research line 2, that aims to monitor spatial and temporal distribution patterns of biodiversity in the North Coast of Portugal. This project was also awarded with a grant under the Blue Young Talent Plus (BYT) program, funded by Fundação Amadeu Dias.

20996 | Host -mycobacteria interactions: Who will claim the iron throne?

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Abstract

Iron is essential for living organisms due to the assemblage of processes it engages in. However, in its free form, it has nefarious effects to the organism. Thus, iron storage, absorption and distribution are tightly regulated.

In their quest for survival, pathogens try to access host's iron whilst avoiding its toxicity, thus impacting host's iron homeostasis. On the other hand, the host has several antimicrobial strategies based on the modulation of the pathogen's access to iron.

In basal conditions, serum iron is mostly bound to transferrin. However, we previously found that *Mycobacterium avium* infection in the mouse significantly alters the profile of iron-binding serum proteins. We call this alteration the "iron-shift". It is still unknown what proteins bind iron and how this event is regulated. Interestingly, although serum ferritin is usually assumed to be comprised of L subunits, we previously found that H-ferritin is released from myeloid cells to circulation during infection.

This work strived to unveil the kinetics of the iron shift, the identity of iron-binding proteins, and how this relates to the immune response.

It was found that serum ferritin concentration increased throughout infection whereas serum iron levels remained relatively stable. Size exclusion chromatography (SEC) of serum samples from infected animals revealed that the iron-shift started three weeks after infection, in line with the release of proinflammatory cytokines and it was maintained until 8 weeks post infection. This iron-shift was also observed in mice deficient for CCL2, INFy or iNOS, indicating that none of these players is needed for this phenomenon. The fractions obtained by SEC are now being subjected to LC-MS to determine to which proteins iron is bound to. Moreover, the relationship between the release of serum iron proteins and inflammatory processes is also being assessed. This analysis is critical for the identification of new relevant effects of infection on host's iron metabolism.

Keywords: Iron; host-pathogen interaction; serum iron binding proteins, mycobacterial infection. **Acknowledgments**

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21038 | Interaction dynamics between marine communities of Annelids (Annelida) and Myxozoan parasites (Myxozoa)

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Abstract

Myxozoa are cnidarian endoparasites that threaten wild and cultivated fish stocks worldwide [1]. These parasites present complex life cycles that involve alternation between a temporary vertebrate host and a definitive invertebrate host. Members of the class Myxosporea have a myxosporean stage that mainly develops in fish, and an actinosporean stage that takes place in annelid hosts [2]. Though there are over 2,400 myxosporean species reported to date, only about 60 have their life cycle described [3]. Difficulties in the annelid handling, namely from the marine environment, and typically low prevalence of myxosporeans' infection in these hosts, hinder our knowledge of myxosporean-annelid interactions [4]. Thus, this study aimed to provide insight into the biodiversity, spatial and temporal distribution of annelid communities (remarkably polychaetes and oligochaetes), and related myxosporeans communities in marine environment. To fulfill this objective, estuarine sediment and coastal substrates were collected monthly from the Minho River estuary and Moledo beach, respectively. Collected annelids were morphologically identified following identification keys, and then microscopically examined for the detection of myxosporean infection and morphological analysis of actinospores. Annelids and myxosporeans were identified based on the amplification and sequencing of the 16S rRNA and 18S rDNA genes, respectively. Preliminary results disclose a rich diversity of the annelid communities in the sampling locations, including members of Naididae, with new actinosporean types belonging to the sphaeractinomyxon collective group found infecting marine oligochaetes and being molecularly linked to mugiliform-infecting Myxobolus. Thus, this research extends our knowledge of the diversity and interaction of annelid and myxosporean communities in the Minho River estuary, while reinforcing the functionality of the sphaeractinomyxon morphotype and their oligochaete hosts in promoting transmission to mullets.

Keywords: Myxosporea, Polychaeta, Oligochaeta, Minho River estuary, Northern Portuguese coast, Molecular biology

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References

Woo, P., and Buchmann, K. Fish Parasites: Pathobiology and Protection. CABI Publishing, 2012;
 383 pp.

[2] Lom, J., and Dykova, I. Myxozoan genera: definition and notes on taxonomy, life-cycle terminology, and pathogenic species. Folia Parasitologica, 2006, 53(1), 1–36.

[3] Eszterbauer, E., Atkinson, S., Diamant, A., Morris, D., El-Matbouli, M., Hartikainen, H. Myxozoan Life Cycles: Practical Approaches and Insights. In Myxozoan Evolution, Ecology and Development; Okamura, B., Gruhl, A., Bartholomew, J.L., Eds.; Springer international Publishing, Switzerland, 2015; pp.175–198.

[4] Alexander, J.D., Kerans, B.L., El-Matbouli, M., Hallett, S.L. and Stevens, L.

Annelid-Myxosporean Interactions. In Myxozoan Evolution, Ecology and Development; Okamura, B., Gruhl, A., Bartholomew, J.L., Eds.; Springer International Publishing, Switzerland, 2015; pp. 217–234.

21137 | Transcriptome sequencing unveils novel miR-195 targets associated to MSC differentiation and proliferation

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Abstract

Bone fractures, caused either by traumatism or diseases such as osteoporosis or bone tumours, lead to morbidity and mortality¹. Around 5% to 10% of bone fractures are non-union with impaired healing² that require novel strategies. Mesenchymal stem/stromal cells (MSCs)-based therapies can potentially aid these patients, due to the osteogenic potential of MSCs. MicroRNAs (miRNAs), including microRNA-195 (miR-195), control MSC differentiation and proliferation³. This study aims to identify targets of miR-195 in human bone marrow-derived MSC.

MSCs obtained from patients undergoing anterior cruciate ligament rupture surgery were transfected with miR-195 antagonist (anti-miR-195) or scrambled control. RNA was extracted 48h post-transfection for bulk RNA sequencing (bRNA-seq). Association of differently expressed genes (DEG) with molecular mechanisms and tissue expression profiles was determined by distinct algorithms. Quantitative real-time polymerase chain reaction (qRT-PCR) and immunocytochemistry (ICC) was performed to validate candidates miR-195 targets.

Results from the bRNA-seq identified 309 differentially expressed protein-coding transcripts in anti-miR-195 transfected cells versus control (199 upregulated and 110 downregulated). Gene ontology analysis revealed 115 DEG were involved in ECM structure and organization, cell cycle and proliferation, angiogenesis and/or are expressed in the bone marrow. ASPH and NAMPT transcripts were validated by qRT-PCR as a miR-195 targets in 6 MSC donors (P<0,05). Differences at the protein levels have also been shown for distinct targets.

In conclusion, we show that miR-195 targets transcripts involved in MSC proliferation and differentiation. However, more extensive target validation is required in the future as well as *in vivo* studies to address the therapeutic impact of miR-195 antagonist.

Keywords: microRNA, bone fractures, MSC, transfection, gene expression.

Acknowledgments

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References

[1] Einhorn, et al., Nat. Rev. Rheumatol., 2015.

- [2] Padilla-Eguiluz et al., Injury, 2021
- [3] Almeida et al., Oncotarget, 2016

20499 | Improvement of aging hallmarks through mitotic epigenetic bookmarking

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Abstract

The average life expectancy has increased greatly, and it is estimated that 1.6 billion people will be over 65 years old by 2050. Research in aging has therefore become increasingly relevant as a means of improving health and quality of life. Among the hallmarks of aging are epigenetic alterations, which play a key role in aging-related diseases. However, the underlying mechanisms and reasons for these changes are not yet fully understood. One possibility is the loss of epigenetic memory, associated with spatial genome disorganization. H3K9me2 is a conserved, specific mark of nuclear peripheral heterochromatin that is retained through mitosis. We hypothesize that the H3K9me2-mediated 3D architectural mitotic guidepost may be disrupted in progeria (HGPS) and aged cells, which typically exhibit nuclear lamina defects and have low mitotic proficiency. Moreover, our group recently demonstrated that transgene induction of the transcription factor Forkhead box M1 (FOXM1) and small-molecule enhancement of the major microtubule-depolymerizing activity mediated by KIF2C, not only rescue genomic instability and senescence, but also epigenetic shifts and nucleus morphology. Altogether, this raised the hypothesis that these novel senomorphic strategies may rescue nuclear lamina reassembly and heterochromatin lamin-associated domain (LAD) repositioning at mitotic exit. Using highresolution confocal microscopy, we found a decrease in global H3K9me2 levels and a loss of compartmentalization at the nuclear periphery in elderly and progeroid mouse adult fibroblasts (MAFs). In elderly MAFs, H3K9me2 bookmarking appeared to be deregulated during mitosis. Furthermore, KIF2C small-molecule and FOXM1 transgene inductions could rescue the spatial positioning of H3K9me2 in interphase and mitosis. These findings will deepen the mechanistic understanding of how epigenetic changes arise during aging and unveil startling reprogramming strategies with translational potential.

Keywords: aging; epigenetic bookmarking; heterochromatin LADs; FOXM1.

20540 | Feedback regulation behind age-associated cell cycle slowdown as a potential anti-aging target

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Abstract

As the human lifespan increases, aging-associated diseases are escalating, urging for new strategies for healthspan extension. Loss of proliferative capacity contributes to tissue deterioration along aging, but little is known on how cell cycle decline ends up in a state of irreversible cell cycle arrest known as senescence [1]. Our lab has previously shown that cell division/mitotic decline and senescence outcomes in aged fibroblasts are a result of Forkhead Box M1 (FOXM1) downregulation, the major transcription factor of mitosis-related genes [2]. The mitotic duration was shown to be short, constant and insulated from other cell cycle phases due to a double positive-feedback loop involving cyclin-dependent kinase 1/cyclin B1 complex (CDK1-CYCB1). Remarkably, disturbance of this feedback leads to a progeny unable to cycle [3]. Since CDK1-CYCB1 induces FOXM1 activity and vice-versa [4], we wondered if FOXM1 downregulation decreases the positive-feedback strength with aging, leading to mitotic decline. Using neonatal, FOXM1-depleted neonatal, elderly and FOXM1-overexpressing elderly human dermal fibroblasts, that expressed CYCB1-YFP, we tracked the dynamic distribution of CDK1-CYCB1 in mitosis by livecell imaging. Results showed that cells with low and high FOXM1 levels exhibit increased and reduced perdurance, respectively, of the CYCB1-YFP signal compared to controls, suggesting that positive-feedback weakening with aging, due to low FOXM1 levels, can be rescued by FOXM1 overexpression. To confirm if the positive-feedback weakening leads to cell progeny that is prone to senesce, we used correlative live-cell/fixed-cell microscopy for CYCB1-YFP imaging followed by immunostaining of senescence markers such as p21 and p16. We concluded that p21 and p16 levels are increased in daughter cells whose mother cells had weaker CDK1-CYCB1 positivefeedback. Overall, these results reinforce FOXM1 overexpression as a potential senostatic therapy rescuing senescence phenotypes.

Keywords: aging; mitosis; FOXM1; CDK1-CYCB1; positive-feedback loop; senescence.

References

[1] J. C. Macedo, S. Vaz, and E. Logarinho, "Mitotic Dysfunction Associated with Aging Hallmarks," in Cell Division Machinery and Disease, M. Gotta and P. Meraldi Eds. Cham: Springer International Publishing, 2017, pp. 153-188.

[2] J. C. Macedo et al., "FoxM1 repression during human aging leads to mitotic decline and aneuploidy-driven full senescence," Nature Communications, vol. 9, no. 1, p. 2834, 2018/07/19 2018, doi: 10.1038/s41467-018-05258-6.

[3] Ana R. Araujo, L. Gelens, Rahuman S. M. Sheriff, and Silvia D. M. Santos, "Positive Feedback Keeps Duration of Mitosis Temporally Insulated from Upstream Cell-Cycle Events," Molecular Cell, vol. 64, no. 2, pp. 362-375, 2016/10/20/ 2016, doi: https://doi.org/10.1016/j.molcel.2016.09.018.

[4] R. H. Costa, "FoxM1 dances with mitosis," Nature Cell Biology, vol. 7, no. 2, pp. 108-110, 2005/02/01 2005, doi: 10.1038/ncb0205-108.

20868 | Understanding the nucleation and dynamics of axonal membrane periodic skeleton

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Abstract

With the advent of the super-resolution microscopy, a unique arrangement of actin cytoskeleton, the membrane periodic skeleton (MPS) was identified in neurons [1]. The MPS is a complex network of actin rings interlinked by tetramers of spectrin, providing mechanical support to axons. Our previous data indicate that the MPS is an actomyosin network, able to control axonal expansion and contraction, being crucial in the regulation of axonal diameter [2]. Currently, actin nucleation and arrangement within actin rings remains to be fully understood. This work focuses on investigating the role of different actin nucleators, Arp2/3 and formins, responsible for the branched and linear actin polymerisation, respectively, in the maintenance and formation of the MPS actin rings. For that, hippocampal primary neurons on different days in vitro (DIVs) were treated with complementary drugs, CK666 and SMIFH2, which inhibit Arp2/3 and formins, respectively. Moreover, we are also evaluating how Arp2/3 and formins affect actin rings nucleation by using genetic approaches (shRNA and CrisprCas9). Analysis using super-resolution microscopy namely tau STED indicates that the MPS formation is compromised either by inhibiting Arp2/3 or formins. However, their inhibition at later DIVs does not compromise MPS maintenance. Our data supports that the MPS is initially a network of branched and linear actin filaments. As actin ring maturation occurs, Arp2/3-dependence is lost whereas formins are required until later stages of actin ring maturation. Our results suggest that the complementary action of actin nucleators is needed to provide for the timely MPS assembly, as in actin rings formed in other biological contexts.

Keywords: actin rings; spectrin; super-resolution; axons.

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References

- [1] Xu, K., et al. Actin, spectrin, and associated proteins form a periodic cytoskeletal structure in axons. *Science* 2013, *339*, 452-456, doi:10.1126/science.1232251.
- [2] Costa, A.R., et al. The membrane periodic skeleton is an actomyosin network that regulates axonal diameter and conduction. *Elife* 2020, *9*, doi:10.7554/eLife.55471.

21177 | Modulating ascorbate transport in hippocampal microglia to target learning and memory deficits in the Thy1- α Syn mice model of Parkinson's disease

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Abstract

Parkinson's disease (PD) is a neurodegenerative disorder that presents motor and non-motor symptoms such as deficits in learning and memory. Vitamin C is an essential central nervous system (CNS) antioxidant molecule. Ascorbate (its reduced form) uses the SVCT2 (sodium vitamin C co-transporter isoform 2) to enter microglial cells. These cells are the main immune resident cells present in the CNS. Microglial proinflammatory activation is triggered during PD progression and can influence the neurodegeneration observed in PD. During microglial activation, SVCT2 expression is downregulated, leading to decreased amounts of ascorbate inside microglia, which is pivotal for triggering microglial proinflammatory activation. Recently, studies suggest that microglial proinflammatory activation correlates with the memory decline observed in PD.

In line with this, we asked if the SVCT2 overexpression in microglia ameliorates some of the PD non-motor features, such as the learning and memory deficits observed in PD. To answer this question, we used the Thy1- α Syn mice model, which presents an increased expression of human wild-type α -Syn under the regulation of the Thy1 promoter. To induce SVCT2 overexpression, we injected AAV particles into the mice hippocampi, resulting in three experimental groups: Wild-type and Thy1- α Syn mice injected with the control vector (only expressing the reporter (mCherry)), and Thy1- α Syn mice injected with the SVCT2 vector.

Regarding behavioural tests, although we observed minor changes in the olfactory test, translating into low improvements in hyposmia in Thy1- α Syn injected with the SVCT2, a significant improvement in Thy1- α Syn injected with the SVCT2 were observed at 4 and 6 months old in learning and memory using the Moris Water Maze test.

This work, therefore, highlights the importance of the SVCT2 transporter expression in microglia and its potential role in ameliorating some features of PD, such as learning and memory deficits.

Keywords: Parkinson's disease; Microglia; Ascorbate; SVCT2

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21057 | Amphetamine and Methylphenidate elicited partial protection against the dopaminergic neurotoxin paraquat in differentiated SH-SY5Y cells

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Abstract

Introduction: Parkinson's disease (PD) is one of the most common neurodegenerative disorders, worldwide [1]. Paraquat (PQ) and 6-hydroxydopamine (6-OHDA) are well-known dopaminergic toxins that have been used to modulate PD [2]. Meanwhile, psychostimulants, such as amphetamine (AMPH) and methylphenidate (MPH), are capable of increasing monoamine levels in the synaptic cleft [3] and appear to increase synaptic plasticity and increase dendritic complexity in certain areas of the brain [4]. These proprities might represent mechanisms by which they could provide neuroprotection.

Objetive: Evaluate whether AMPH and MPH can promote neuroprotection against two dopaminergic toxins *in vitro*, as well as to study the potential putative mechanisms involved.

Material & Methods: Human SH-SY5Y cells were differentiated with retinoic acid and 2-O-tetradecanoyl-phorbol 13-acetate for 7 days to acquire a dopaminergic phenotype. After differentiation, SH-SY5Y cells were exposed to AMPH or MPH (0.001-10 μ M) or toxins (31.25-500 μ M for 6-OHDA and 5000-100 μ M for PQ) for 24 hours. The reduction of 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-2H-tetrazolium bromide (MTT) and the uptake of neutral red (NR) assays were used to assess cytotoxicity. In addition, the mitochondrial membrane potential, evaluated by the JC-1 probe, and the production of reactive species, evaluated by the DCFH-DA probe, were analysed. Statistical analysis was conducted by One-way ANOVA and Two-way ANOVA repeated measurements followed by a multiple comparisons test, with p<0.05 considered meaningful. For 6-OHDA and PQ, the lethal concentration of 50% (LC 50) values were obtained by analysis of the MTT and NR concentration-toxicity curves, which were fitted using least squares as the fitting method.

Results: No meaningful neurotoxicity was observed either for AMPH or MPH at the tested concentrations (0.001-10 μ M). On the other hand, 6-OHDA and PQ induced neurotoxicity in a concentration-dependent manner, with LC50 being 125 and 500 μ M, respectively. Cells exposed to AMPH and MPH (1 μ M) had no effects on mitochondrial membrane potential, however,

increased reactive species production. Whereas cells exposed to 6-OHDA and PQ revealed a decrease in mitochondrial membrane potential, only 6-OHDA increased reactive species production. Pre-incubation with AMPH or MPH 1 μ M partially reduced the neurotoxicity induced by PQ at the LC50 concentration, while no protective effect was attained against 6-OHDA. Conclusion: AMPH and MPH appear to protect SH-SY5Y cells from PQ-induced toxicity. Further studies are needed to reveal the mechanism behind this neuroprotection.

Keywords: amphetamine, methylphenidate, neurotoxin dopaminergic, neuroprotection, Parkinson's disease.

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References

[1] Zesiewicz, T.A., *Parkinson disease*. CONTINUUM: Lifelong Learning in Neurology, 2019. 25(4): p. 896-918.

[2] Bové, J., et al., *Toxin-induced models of Parkinson's disease*. NeuroRx, 2005. 2(3): p. 484-494.
[3] Farone, Stephen V. The pharmacology of amphetamine and methylphenidate: Relevance to the neurobiology of attention-deficit/hyperactivity disorder and other psychiatric comorbidities. Neuroscience & Biobehavioural Reviews, 2018, 87: 255-270.

[4] Bales, J.W., Kline, A. E., Wagner, A. K., & Dixon, C. E., Targeting Dopamine in Acute Traumatic Brain Injury. The open drug discovery journal, 2010. 2: p. 119-128.

21157 | *Gelidium* sp. by-products as a valuable ingredient for European seabass aquafeeds

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Abstract

The world's human population will surpass 10 billion people by the end of the century. As such, food demand is increasing, pressuring food industries to match the necessity. Aquaculture presents itself as a solution to cope with the food demand issue, being a fast-growing food sector (FAO, 2022). Fish meal (FM) is still an important ingredient as a protein source for aquafeeds, especially for carnivore diets (Oliva-Teles et al., 2015). Although, its use leads to the overexploitation of wild fish stocks. Thus, this work seeks to reduce FM inclusion in aquafeeds and look for more eco-friendly alternatives such as macroalgae by-products. Therefore, it aims to use Gelidium industrial residues from agar production, respecting an idea of a circular economy, to seek the most sustainable ingredients for aquafeeds. For this purpose, a growth trial was performed, where 4 different inclusion levels of Gelidium by-products were tested in diets for European seabass (0%, 5%, 10%, and 15%). A 5th diet was formulated with 15 % inclusion of Gelidium by-products treated with 1 N NaOH and autoclaved for 30 min at 120°C. Diet's effects on fish growth performance, feed utilization, and body composition were assessed. Diets were distributed to triplicate groups of 20 fish with an initial body weight of 38g and fish were fed for 7 weeks at 24°C. Results showed no differences in final body weight, weight gain, daily growth index, feed efficiency, and protein efficiency ratio between the diets. Nevertheless, a slight increase in feed intake was found in fish fed diets with 5 % untreated and 15% treated Gelidium by-products compared to fish fed a diet with 15 % untreated Gelidium by-products. Body composition analysis is still ongoing, but the results will be presented at 16º IJUP edition. In conclusion, the results have shown a good acceptance of the diets by the European seabass juveniles, with no negative effects on growth performance and feed utilization with inclusion levels of Gelidium by-products up to 15 %.

Keywords: Aquafeeds; Alternative ingredients; Macroalgae; Gelidium; European seabass.

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References

[1] FAO. (2022). The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation. FAO Rome.

[2] Oliva-Teles, A., Enes, P., & Peres, H. (2015). Replacing fishmeal and fish oil in industrial aquafeeds for carnivorous fish. Feed and feeding practices in aquaculture, 203-233.

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Diets	Control	G5	G10	G15	G15+T	SEM
Initial body weight (g)	38.0	38.0	38.0	38.0	38.0	0.0
Final body weight (g)	95.0	94.5	88.0	82.2	87.3	2.4
Weight gain (g kg ABW^{-1} da y^{-1})	17.5	17.4	16.1	15.0	16.0	0.5
Daily growth index ¹	2.4	2.4	2.2	2.0	2.2	0.1
Feed intake (g kg $ABW^{-1} day^{-1}$)	20.9 ^{ab}	21.9 ^b	21.6 ^{ab}	20.5ª	22.1 ^b	1.7
Feed efficiency ²	0.8	0.8	0.7	0.7	0.7	0.0
PER ³	1.8	1.7	1.7	1.6	1.7	0.0
Survival (%)	100.0	100.0	95.0	100.0	100.0	1.0

Table 1 Growth performance and feed utilization of European seabass fed the experimental

Values presented as means (n = 3) and pooled standard error of the mean (SEM). Means in the same row with different superscript letters differ significantly (P < 0.05).

1DGI: daily growth index= ((final body weight 1/3 – initial body weight1/3) / time in days) × 100. 2FE: feed efficiency = wet weight gain/dry feed intake.

3PER: protein efficiency ratio = wet weight gain/crude protein intake.

21187 | Prebiotic potential of fermented olive pomace paste – A by-product with potential to promote health and well-being

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Abstract

Rapid population growth leads to higher consumption, which in turn increases output and waste generation [1]. One of the largest industries producing by-products is the olive oil industry, mainly in the Mediterranean region [2]. The olive oil extraction process has a yield of approximately 20%, so at the end of the process 80%, is waste [2]. These residues have phytotoxic action due to their chemical characteristics, and they are currently an emerging environmental hazard [3]. Yet, the human food sector is interested in this chemical composition, which is exceptionally rich in phenolic compounds as antioxidants, and may be valued with a more mindful and sustainable approach [4]. The purpose of this study was to investigate the possibility to ferment OPP (from Trás-os-Montes) with its own microbiota at different temperatures and analyse it potential as a prebiotic. To analyse the prebiotic potential, samples from different fermentation days were collected (without fermentation, 48hrs, 96hrs, 32 days of fermentation) and with different concentrations of each these 2.5%, 5% and 10%. Monoculture suspension of Lactobacillus fermentum - confirmed probiotic - was prepared with 0.3 McFarland, 1 ml of this suspension was inoculated in 9 ml of MRS broth with the OPP sample [5]. To compare the results, the same protocol done only with the broth (blank), with glucose addition (control) and inulin addition (reference prebiotic) replacing OPP. After the incubation (48hrs, 37°C), serial dilutions were done and the number of colony forming units (CFU/mL) was determined using pour plate method (48hrs, 37°C). The results showed a prebiotic potential of OPP, i.e., showing higher growth in the samples with OPP. The prebiotic activity increases with OPP concentration and decreases with the fermentation time. This research could conclude that OPP has a prebiotic potential, further steps of *in vitro* and *in vivo* analysis will be needed to confirm the prebiotic capacity [6].

Keywords: Olive oil by-product; fermentation; prebiotic, food security.

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References

[1] D. Victor, "World Population Reaches 8 Billion, U.N. Says," 2022-11-15 2022.

[2] "THE WORLD OF OLIVE OIL - International Olive Council," 2022-01-13 2022.

[3] F. Rodrigues, F. B. Pimentel, and M. B. P. P. Oliveira, "Olive by-products: Challenge application in cosmetic industry," Ind. Crops Prod., vol. 70, pp. 116-124, 2015, doi: https://doi.org/10.1016/j.indcrop.2015.03.027.

[4] M. A. Nunes et al., "Chemical Composition and Antimicrobial Activity of a New Olive Pomace Functional Ingredient," (in en), Pharmaceuticals, Article vol. 14, no. 9, p. 913, 2021-09-10 2021, doi: 10.3390/ph14090913.

[5] Y. Bao et al., "Screening of potential probiotic properties of Lactobacillus fermentum isolated from traditional dairy products," Food Control, vol. 21, no. 5, pp. 695-701, 2010.

[6] T. B. Ribeiro et al., "Prebiotic effects of olive pomace powders in the gut: In vitro evaluation of the inhibition of adhesion of pathogens, prebiotic and antioxidant effects.," Food Hydrocolloids, vol. 112, 2021, doi: https://doi.org/10.1016/j.foodhyd.2020.106312.

20695 | Exploring the potentialities of strawberry tree fruits from Natural Park of Montesinho – A first screening

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Abstract

Arbutus unedo L. fruit, also known as the strawberry tree, is a native species of the Mediterranean region [1]. This species is traditionally used for medicinal purposes and the production of alcoholic beverages [2, 3]. The strawberry tree fruit present an interesting nutritional value, being rich in fatty acids, sugars, phenolic compounds, vitamins, dietary fibers, and minerals [3]. This bioactive composition is responsible for different pharmacological properties [4], such as antioxidants, which attract the interest of food, nutraceutical, and cosmetic industries [2].

This work aims to obtain an eco-friendly extract from *A. unedo* L. rich in bioactive compounds to be incorporated in a cosmetic formulation. Briefly, the fruits were obtained in the Natural Park of Montesinho in October 2022 and extracted by Ultrasound-assisted extraction (UAE) using water as solvent. The effect of extraction time (15-90 min) was studied on the total phenolic content (TPC), *in vitro* antioxidant/antiradical activity, and reactive oxygen species (ROS) scavenging capacity. The intensity used was 30 W/m2. The extract obtained at 60 min presented the highest TPC (30.27 mg GAE/g dw) and antioxidant/antiradical activity (ABTS=30.36 mg AAE/g dw; DPPH=43.83 mg TE/g dw; FRAP=415.61 µmol FSE/g dw). Regarding the ROS scavenging capacity, a IC50 of 19.78 µg/mL was achieved for the hypochlorous acid, while for superoxide radical and peroxyl radical the IC50 were, respectively, 90.51 µg/mL and 0.19 µmol TE/mg dw. The phytochemical profile is now being evaluated by HPLC/DAD. These results highlighted the richness of *A. unedo* fruit extracted by UAE in bioactive compounds with potential use as a cosmetic active ingredient.

Keywords: Arbutus unedo L.; ultrasound-assisted extraction; green extraction; valorization.

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References

[1] Macchioni V, Santarelli V, Carbone K. Phytochemical Profile, Antiradical Capacity and alpha-Glucosidase Inhibitory Potential of Wild Arbutus unedo L. Fruits from Central Italy: A Chemometric Approach. Plants (Basel). 2020;9(12). [2] Martins J, Pinto G, Canhoto J. Biotechnology of the multipurpose tree species Arbutus unedo: a review. Journal of Forestry Research. 2022;33(2):14.

[3] El Haouari M, Assem N, Changan S, Kumar M, Dastan SD, Rajkovic J, et al. An Insight into Phytochemical, Pharmacological, and Nutritional Properties of Arbutus unedo L. from Morocco. Evid Based Complement Alternat Med. 2021; 2021:1794621.

[4] Ben Salem I, Ouesleti S, Mabrouk Y, Landolsi A, Saidi M, Boulilla A. Exploring the nutraceutical potential and biological activities of Arbutus unedo L. (Ericaceae) fruits. Industrial Crops and Products. 2018; 122:6.

20554 | Ultrasound-assisted extraction of goji berries: Bioactive composition and prohealthy properties

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Abstract

Lycium barbarum fruit, also known as goji berries, have been used for years in herbal medicine [1]. The plant grows in Asian regions [1, 2], presenting a high nutritional value and a rich bioactive composition, particularly in phenolic compounds, vitamins, sugars, organic acids and minerals [3]. The potential healthy properties of goji berries, such as antioxidant, antimicrobial and anti-inflammatory effects, have been highlighted in recent years [1, 4, 5], allowing to classify the fruit as a "superfruit" [2, 6] with interest for different industries, such as food, nutraceutical or cosmetic [4].

This study aims to evaluate the optimal ultrasound-assisted extraction (UAE) conditions of polyphenolic antioxidants from L. barbarum berries using a mathematical model, Response Surface Methodology. The effects of solid:liquid ratio (2.5-10.0% w/v), time (20-60 min), and intensity (30–70 W/m2) on the total phenolic content (TPC) and antioxidant/antiradical activities were investigated. The optimal conditions were achieved using a solid: liquid ratio of 8.75% (w/v) and an intensity of 59 W/m2 for 56.21 min. The optimal extract achieved a high TPC (23.87 mg GAE/g dw) and antioxidant/antiradical activity (ABTS=15.15 mg AAE/g dw; DPPH=10.25 mg TE/g dw; FRAP=105.97 µmol FSE/g dw). The radical oxygen scavenging capacity was also considerable (superoxide dismutase (O2[•]): IC50=225.25 μg/mL; hypochlorous acid (HOCl): IC50=12.99 μg/mL; oxygen radical absorbance capacity (ORAC): 0.147 µmol TE/mg dw). The in vitro cell assays demonstrated that the optimal extract did not affect the viability of intestinal cells (Caco-2 and HT29-MTX) in concentrations lower than 100 μ g/mL, presenting results between 80% and 100%. The phenolic composition is being performed. These results emphasize the great potential of goji berries extracted by UAE for different industrial applications. Further studies focus on in vitro intestinal permeation should be performed to understand the bioactive compounds that are absorbed after ingestion.

Keywords: *Lycium barbarum*, response surface methodology, ultrasound-assisted extraction, antioxidant activity

Acknowledgments

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References

- [1] D. Donno, et al., Journal of Functional Foods, 18 (2015) 1070-1085.
- [2] B.B. Vidovic, et al., Antioxidants, 11 (2022) 248.
- [3] T.C.S.P. Pires, et al., Industrial Crops and Products, 122 (2018) 574-581.
- [4] F. Teixeira, et al., International Journal of Molecular Sciences, 24 (2023) 4777
- [5] H.J. Hsu, et al., Nanotechnology, 28 (2017) 135103.
- [6] V. Magalhães, et al., Journal of Functional Foods, 92 (2022) 105038.

21055 | *Solanum betaceum* Cav. Leaves: an open door for antidiabetic properties discovery

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Abstract

Solanum betaceum Cav. is a plant that belongs to the Solanaceae family and is commonly known as tamarillo or Brazilian tomato tree. Beyond its use as food crops, tamarillo is used in traditional medicine due to their biological properties, including antioxidant, anti-obesity, anti-inflammatory, anticancer, and antinociceptive activity [1]. Despite there being numerous studies involving the fruit, there is no scientific knowledge about the tamarillo tree leaves.

The phenolic profile and the antidiabetic potential of *S. betaceum* leaves was disclosed for the first time in this work. *S. betaceum* leaves aqueous extract revealed a phenolic profile mainly composed by hydroxycinnamic acids, rosmarinic acid being the predominant compound (Fig. 1). Although the aqueous extract had shown be potentially able to contribute to glycaemia control by its capacity to inhibit α -glucosidase (Fig. 2), it was more effective towards human aldose reductase (Fig. 2), a key-enzyme in polyol pathway that is implicated in the development of diabetic microvascular lesions. The extract still exhibited potent capacity to intercept biologically relevant radicals ('NO and O2^{•-}) and to completely inhibit the peroxidation of linoleic acid. The antidiabetic effects revealed by the extract are probably related with its phenolic composition. The biological potential of *S. betaceum* leaves pointed out by this work and the lack of studies about this natural matrix encourages further works to fully unveil the antidiabetic potential of this plant material and opens door for a valorisation of a species at high risk of extinction.

Keywords: S. betaceum leaves, Phenolic profile, Diabetes, Oxidative stress

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References

[1] Cragg GM et al. Biochim Biophys Acta. 2013;1830(6):3670-95.



Figure 1: Representative HPLC-DAD chromatogram of the phenolic profile of S. betaceum leaves aqueous extract Detection at 320 nm. (1) 3-O-Caffeoylquinic acid, (2) 4-O-Caffeoylquinic acid, (3) Chlorogenic acid, (4) Caffeic acid, (5) rosmarinic acid, (6 and 9) unknown kaempferol glycoside derivatives, (7 and 8) unknown hydroxycinnamic acid derivatives.



Figure 2: α -Gucosidase and aldose reductase inhibitory effect by the S. betaceum aqueous extract. Results are expressed as mean ± SD of three independent experiments, each performed in triplicate.

20500| Development of Gluten-Free Bread with Flaxseed Oil Cake: A Comprehensive Study on Technological, and Nutritional Properties, and Sensory Quality Evaluation

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Abstract

Valorisation of food wastes is a growing concern in the food industry, and the use of by-products could improve environmental sustainability of the food production chain [1]. The gluten-free diet has limitations, thus developing new products that address these is important. A gluten-free bread (GFB) is a staple food, however, it tends to be of low nutritional value and has poor texture [2]. Flaxseed Oil Cake (FOC), a by-product of flaxseed oil extraction, is a gluten-free ingredient containing dietary fibre and valuable nutrients, in particular essential fatty acids and proteins. On the other hand, fortification of GFB with FOC may impact its organoleptic profile and overall taste [3]. Therefore, it is important to balance the nutritional benefits with the sensory acceptance. In this study, FOC was introduced into GFB as a substitute of starches (5%, 15%, and 30%). Experimental GFB were evaluated for technological parameters, nutritional value, and sensory features. In comparison to the control GFB, all experimental GFBs with FOC had higher nutritional value. Moreover, GFB enriched with 15% FOC exhibited optimal technological characteristics and was rated the highest in overall quality by the sensory panel. This study outlines the advantages of incorporating FOC into GFB as a promising approach to developing a palatable gluten-free product, offering additional nutritional and health-related benefits. The proposed use of FOC in GFB contributes to some extent to valorisation and better management of this by-products of the vegetable oil industry, being an environmentally friendly solution that contributes to a circular economy.

Keywords:

Flaxseed, Gluten-Free Breadmaking; Technological Properties; Nutritional Value; Sensory Quality

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References

[1] Ancuța P, Sonia A. Oil Press-Cakes and Meals Valorization through Circular Economy Approaches: A Review. Applied Sciences. 2020;10(21):7432.

[2] Aguiar EV, Santos FG, Krupa-Kozak U, Capriles VD. Nutritional facts regarding commercially available gluten-free bread worldwide: Recent advances and future challenges. Critical Reviews in Food Science and Nutrition. 2023;63(5):693-705.

[3] Taglieri I, Sanmartin C, Venturi F, Macaluso M, Zinnai A, Tavarini S, et al. Effect of the Leavening Agent on the Compositional and Sensorial Characteristics of Bread Fortified with Flaxseed Cake. Applied Sciences. 2020;10(15):5235.



Figure 1: The visual appearance of surface and cross-section of exemplary control GFB and GFBs enriched with flaxseed oil cake.

21026 | Characterization of cardosins PSIs expression and sorting pathways in *Arabidopsis* under stress

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Abstract

As sessile organisms, plants have developed modifications in the production and trafficking of proteins and in the remodelling of endomembranes to overcome adverse conditions caused by abiotic stresses. Cardosins A and B, aspartic proteinases present in the thistle flowers, have emerged as model systems, internationally recognized, to study intracellular trafficking. Interestingly both are responsive to stress conditions. Cardosins precursors include a 100 amino acid domain named Plant Specific Insert (PSI). The PSIs of Cardosins A and B are vacuolar sorting domains that, although sharing high similarity, mediate the sorting of proteins through different routes: the conventional ER - Golgi route that is mediated by PSI B and the unconventional route that is modulated by PSI A, in which a Golgi bypass occurs. It is known that stress situations can alter the targeting of proteins to the vacuole in unconventional ways, thereby altering the route towards a Golgi-independent pathway. The present work aims to evaluate if transgenic Arabidopsis plants overexpressing PSI A or PSI B respond differently when subjected to different abiotic stresses (osmotic, oxidative, saline and by metals). Our results on PSI B localization in root cells revealed different patterns of accumulation and a considerable reduction in subcellular movements under stress situations. Besides, analysis of the localization of PSI B in cotyledon leaves under all stress conditions showed that it was predominantly found in the vacuole, as predicted, but also in the endoplasmic reticulum and in small aggregates in the cytoplasm. These formations, which have the same form as protein bodies, appear to be of varying sizes and dispersed in different areas depending on the stress condition. In conclusion, the study of PSI A and PSI B has given us insight into plant stress coping mechanisms and how the PSI domain may affect the plant's resistance to stress.

Keywords: abiotic stress; plant-specific insert; protein trafficking; unconventional route.

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21184 | Cynara cardunculus PSIs form homo and/or heterodimers depending on the pH

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Abstract

The Plant Specific Insert (PSI) is a unique 100 amino acid domain present in some plant aspartic proteinases (APs), that is cleaved out during their maturation process. *In vitro* experiments showed that isolated PSIs have biological activity such as lipid membrane interaction, antimicrobial activity, induction of membrane permeabilization and modulation. Furthermore, several reports from *in vivo* studies showed that the PSI domain is associated with the vacuolar targeting of APs. PSI domains from cardosin A and cardosin B, two cardoon APs, are able to sort proteins to the vacuole via different pathways. Cardosin A PSI (PSI A) allows for a Golgi bypass, mediating an unconventional route to the vacuole by sorting proteins directly from the Endoplasmic Reticulum (ER) to the vacuole. In contrast, cardosin B PSI (PSI B) follows the classic ER – Golgi - Pre-Vacuole route. Moreover, it has been reported that PSI's dimerization can be a prerequisite for their mediated transport, as an acidic pH promotes helicity in the PSI structure and favours its activity through homodimerization.

To further increase our knowledge on cardoons' PSIs dimerization, we aimed to study the relevance of low pH in the dimerization processes of PSI A and PSI B, by testing their interaction, under different pH conditions: PSI A-PSI A, PSI A-PSI B and PSI B-PSI B. We performed a pull-down assay at pH 6.8 and 7.4 using PSI A/B-GST fusion as bait and FLAG-PSI A/B fusion as prey. Glutathione agarose beads were used for the isolation of interacting complexes. Interactions were detected using techniques with different sensitivities such as Coomassie blue and Silver staining and Western blot. Interactions between PSI A-PSI B and PSI B-PSI B were observed at pH 6.8, and at pH 7.4 we observed interactions between PSI A-PSI A, PSI A, PSI B and PSI B-PSI B. The PSIs interactions at pH<6.5 will be assessed using a FLAG immunoprecipitation assay and the interactions between the PSIs *in vivo* will be validated by 2in1 rBiFC.

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20786 | Combined and individual toxicity of glyphosate and copper in tomato plants (*Solanum lycopersicum L.*)

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Abstract

Over the last decades, the growing global population demands higher agricultural production. To improve crop yield and control weeds and diseases, agriculture has been dependent on the use of chemical fertilizers and pesticides (such as herbicides, insecticides, and fungicides) [1]. However, the mismanagement of these chemicals led to soil contamination, particularly in farming areas. Indeed, pesticide residues of different compounds, including glyphosate (GLY) and copper (Cu), are usually found in agricultural soils, where they can present non-target phytotoxicity [2], [3]. Still, risk assessments often overlook the effects of exposure to a mixture of compounds [4]. Thus, the main goal of this study was to investigate the individual and combined effects of GLY and Cu, as soil contaminants, on crops, using tomato plants (Solanum lycopersicum L.) as a model. For this purpose, plants were grown for 28 days under controlled conditions in soils contaminated, or not, by GLY (10 mg kg-1) and/or Cu (75 mg kg-1). Exposure to GLY and Cu induced an acute inhibition of plant growth, which was exacerbated upon their combination. In terms of oxidative status, hydrogen peroxide (H2O2) did not change among treatments, but lipid peroxidation was increased in shoots of Cu and GLY co-exposed plants. Regarding the nonenzymatic antioxidant machinery, differential effects were noticed among groups. While GLY single exposure increased the levels of proline (Pro) and glutathione (GSH) and ascorbate/dehydroascorbate ratio, Cu and the mixture only stimulated the accumulation of GSH and Pro, respectively. Thus, these results clearly show that exposure to GLY and/or Cucontaminated soils disrupts the growth and physiological status of tomato plants. Moreover, these findings also highlight that the combined action of these stressors induced a much more pronounced effect against plant growth in comparison with each stress, most likely as a result of the disruption of the cellular redox homeostasis.

Keywords: Herbicides; Oxidative stress; Antioxidant system; Reactive oxygen species.

References

[1] FAOSTAT, Pesticides use, pesticides trade and pesticides indicators. FAO, 2022. doi: 10.4060/cc0918en.

[2] S. Branco-Neves et al., 'An efficient antioxidant system and heavy metal exclusion from leaves make Solanum cheesmaniae more tolerant to Cu than its cultivated counterpart', Food Energy Secur, vol. 6, no. 3, pp. 123–133, Aug. 2017, doi: 10.1002/fes3.114.

[3] C. Soares, R. Pereira, S. Spormann, and F. Fidalgo, 'Is soil contamination by a glyphosate commercial formulation truly harmless to non-target plants? – Evaluation of oxidative damage and antioxidant responses in tomato', Environmental Pollution, vol. 247, pp. 256–265, 2019, doi: 10.1016/j.envpol.2019.01.063.

[4] V. Geissen et al., 'Cocktails of pesticide residues in conventional and organic farming systems in Europe – Legacy of the past and turning point for the future', Environmental Pollution, vol. 278, p. 116827, Jun. 2021, doi: 10.1016/j.envpol.2021.116827.

20870 | Histochemistry and electron microscopy of the palps from the polychaete *Hediste diversicolor* (Müller, 1776)

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Abstract

Polychaetes (Phylum Annelida) respond to various sensory stimuli, through many different organs/appendages, like palps (partitioned in palpophores - posterior section, and palpostyles - anterior section), which are quite common in several taxa, varying in shape and structure. Although it is known that palps contain muscular and nervous tissue, the fine structure and cellular composition of these appendages from many polychaete families are poorly known, especially for in Nereididae. Thus, this research aims to study the fine structure of the palps of the commercial nereidid species: Hediste diversicolor.

Animals were relaxed in a 7.5% solution of MgCl2 mixed 1:1 with isotonic saltwater. Palps were removed and processed for transmission electron microscopy (TEM). Semithin sections were either stained with methylene blue-azure II, or used for histochemistry techniques, including tetrazonium coupling reaction, periodic acid-Schiff reaction and Alcian blue. Ultrathin sections were contrasted with uranyl acetate and lead citrate, and viewed on using a JEOL 100 CXII electron microscope, operated at 60kV.

Ultrastructural observations revealed the presence of a thick outer cuticle. Epithelial cells formed numerous microvilli that crossed the cuticle extending outwards. Cells are connected by zonulae adherentes, septate junctions and desmosome-like structures. Four types of secretory cells could be observed scattered throughout the periphery of the palps, displaying distinct ultrastructural arrangement of the endoplasmic reticulum, Golgi apparatus, and vesicles. The potential diversity of secretions produced in these secretory cells is highlighted by differences in the composition and contents of their respective vesicles, as observed in both TEM and histochemical reactions. Typical annelid muscular tissue and nervous tissue is present in both palpophore and palpostyle, but is more predominant in the palpostyle area. The latter further displayed ciliary structures with apparent sensory functions.

Keywords: Nereididae; Ragworm; Fine structure; Sense organs; Histochemistry.

21040 | The impact of Polychaeta meal (*Alitta virens*) on European seabass acute stress response

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Abstract

Common practices in aquaculture production often include procedures, such as fish manipulation for triages and transportation, which can act as stressors (Conti, 2006). Stressed fish are more susceptible to infection, potentially leading to massive losses for aquaculture producers (Orduna, 2021). Hence, stress mitigation strategies, including the development of new functional feeds, are on demand. In the present work, polychaeta meal (PM, *Alitta virens*), a rich source of protein and long-chain polyunsaturated fatty acids, was used to replace fish meal (FM) and the impact on the oxidative status and immunologic response of European seabass (*Dicentrarchus labrax*) was assessed using the following isoproteic (51% DM) and isolipidic (16% DM) diets: a control diet containing fish meal, and three experimental diets containing PM at different concentrations (10% - PM2.5, 20% - PM5, 40% - PM10) to replace fish meal. After 93 days of feeding, fish underwent an acute stress challenge and after 1 hour of recovery, plasma and liver were collected from stressed fish and were compared to those of non-stressed fish (n = 18).

Stress induced a significant increase in all biomarkers analysed, regardless of the dietary treatment. PM diets promoted an increase in plasma glucose levels regardless of the stress, but lactate levels were increased only in stressed fish. PM also impacted liver redox status, boosting basal glutathione content and GST activity. GR activity was also reduced in fish fed PM5, after the stress challenge. The impact of the diets on humoral parameters will be further discussed. These results suggest that PM modulates European seabass acute stress response, but further studies should be done regarding the impact of PM on stress mitigation.

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20704 | Molecular characterization of thyroid tumours of dogs - a multicentric Portuguese series

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Abstract

Thyroid carcinoma (TC) is the most common endocrine malignancy in both humans and canine. Even though the two species share some histopathological features, the molecular dynamics of veterinary thyroid tumours is still unclear, and the potential of this species as animal models remains to be assessed. In human TC, mutations in BRAF, NRAS, HRAS, KRAS genes (key players in the MAPK pathway), and in TERT promoter are key predictors of diagnosis, prognosis, and treatment of thyroid neoplasms. However, when it comes to veterinary medicine, molecular studies on tumours are scarce, evidencing the need of further investigation regarding the molecular pattern of these tumours. Therefore, our aim was to clarify if the same molecular players of human TC are present in canine thyroid tumours and result in the same biological consequences. Our study population was composed of 57 formalin-fixed paraffin-embedded (FFPE) tissues from canine thyroid tumours comprising 5 adenomas (9%) and 52 carcinomas (91%). We performed DNA extraction, PCR, and Sanger sequencing of exons 16 of BRAF (n = 53), exon 2 of NRAS (n = 42), exon 3 of HRAS (n = 43), and exon 3 (n = 31) and 4 (n = 20) of KRAS. Silent variants on HRAS (p.(asp47=) / c.307C>T) (n = 16/43, 37%) and NRAS (p.(glu106=) / c.693G>A) (n = 1/42, 2.4%) were detected. However, no mutations were found. This lower mutation burden, compared to human TC, may suggest that the tumorigenesis of canine TC may be triggered by different players or by different mechanisms. We are now moving to the evaluation of the MAPK cascade status to assess if this pathway is overactivated regardless of mutational status of the commonest effectors in humans. Hopefully, this approach will contribute to an early diagnosis, risk stratification, and treatment options, ultimately improving the outcome of this disease in companion animals.

Keywords: Comparative pathology; Canine tumours; Sequencing; Oncobiology; Thyroid carcinoma

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References

[1] cancer.sanger.ac.uk

[2] Tate, J. G., Bamford, S., Jubb, H. C., Sondka, Z., Beare, D. M., Bindal, N., Boutselakis, H., Cole, C. G., Creatore, C., Dawson, E., Fish, P., Harsha, B., Hathaway, C., Jupe, S. C., Kok, C. Y., Noble, K., Ponting, L., Ramshaw, C. C., Rye, C. E., . . . Forbes, S. A. (2019). COSMIC: the Catalogue Of Somatic Mutations In Cancer. Nucleic Acids Res, 47(D1), D941-D947. https://doi.org/10.1093/nar/gky1015



Figure 1: Thyroid tumours carcinogenesis, a comparative approach between human and dog species. Prevalence of the most typical TC mutations in humans retrieved from COSMIC database [1, 2].

20795 | Zebrafish as a model to study Amyotrophic Lateral Sclerosis

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Abstract

Amyotrophic Lateral Sclerosis (ALS) is a neurodegenerative disease characterized by the degeneration of upper and lower motor neurons. In most cases, this disease is sporadic, while 10% of cases have a defined genetic cause. Pathophysiological mechanisms include loss of proteostasis, autophagic and mitochondrial dysfunction, increased oxidative stress and lipid peroxidation, and motor axonopathy. Zebrafish is a widely used animal model to study neurodegenerative diseases due to its high genetic homology with humans, rapid development, easy maintenance, and optical transparency of embryos. Bisphenol A (BPA) [1] and β methylamino-L-alanine (BMAA) [2] have been proposed for the chemical induction of ALS models in zebrafish. Here, we aimed to characterize the face and predictive validity of these models. To study ALS phenotypes, we measured the activity (tail coiling and swimming) and motor axon length of BPA- and BMAA-treated zebrafish embryos and larvae. In BPA-treated zebrafish, we also evaluated the levels of autophagy and stress markers by western blot; 4-hydroxynonenal (4-HNE), a marker of lipid peroxidation, by dot blot; and the formation of reactive oxygen species (ROS) using the fluorescent probe dihydroethidium by microscopy. We then tested the effect of riluzole and edaravone, approved ALS drugs, in rescuing the phenotypes induced by BPA. We observed that sublethal BPA (and, to a lesser extent, BMAA) exposure reduced zebrafish motor activity. BPA exposure increased lipid peroxidation, oxidative stress, and the levels of Grp78, a marker of ER stress. Edaravone – but not riluzole – rescued the BPA-induced hypoactivity. Edaravone also rescued the BPA-induced increase in Grp78, but not in 4-HNE or ROS levels. In conclusion, the BPA-induced zebrafish model shows ALS-consistent motor impairments and stress markers. Edaravone rescues BPA-induced motor impairments, possibly by reducing ER stress. Thus, zebrafish is a promising model to study ALS, showing moderate face and predictive validity.

Keywords: Amyotrophic Lateral Sclerosis, Zebrafish, Bisphenol A, β-methylamino-L-alanine, Edaravone, Riluzole, Grp78, Reactive Oxygen Species, 4-Hydroxynonenal

Acknowledgments

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References

[1] Morrice JR et al. (2018) Sci. Rep. 8(1): 4890. <u>https://doi.org/10.1038/s41598-018-23018-w</u> [2] Powers S et al. (2017) Toxical Sci. 157(1):129.40. https://doi.org/10.1092/toxsci/kf/020

[2] Powers S et al. (2017) Toxicol. Sci. 157(1):129-40. <u>https://doi.org/10.1093/toxsci/kfx020</u>

20955 | Study of Susceptibility to *Perkinsus Olseni* on three commercial clam Species

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Abstract

The protozoan parasite *Perkinsus olseni* is a global threat to bivalve mollusks, including economically valuable species such as *Ruditapes decussatus*, *Ruditapes philippinarum*, and *Venerupis corrugata*. Probably, the introduction of the parasite in Europe occurred by the exotic species *R. philippinarum* that came from an endemic area of Perkinsosis. This clam species was introduced in Europe due to its higher growth and survival performance, compared to autochthonous species populations.

This study aimed to investigate the response of these three clam species to the parasite by exposing their seed (5-7 mm length) to two concentrations of parasite: a low concentration and a high concentration of *P. olseni* zoospores. A control without parasite was also included. The progression of the infection was followed for one month and samples were taken over four time periods (48 hours, 7, 14 and 30-days post infection) to assess short and longer-term responses. Quantitative PCR was used to identify and quantify the presence of the parasite.

Results revealed significant differences in the responses of each clam species to the parasite with *R. decussatus* showing increasing parasite numbers throughout the experiment, suggesting higher vulnerability to the disease. Conversely, *R. phillippinarum* demonstrated a more effective response to the parasite, with lower parasite numbers observed in the short and long term, while *V. corrugata* showed an intermediate response, falling between the other two species.

In conclusion, these findings highlight the variable response of three clam species to *P. olseni*, suggesting that *R. philippinarum* may be less susceptible to the parasite, while *R. decussatus* may be the more vulnerable. This study provides valuable information for understanding and managing the impact of *P. olseni* on clam populations.

Keywords: *Perkinsus* infection; Bivalve infection; *Ruditapes decussatus, Ruditapes philippinarum, Venerupis corrugate.*
20830 | Profiling the developmental toxicity of cannabinoids in zebrafish embryos

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Abstract

Cannabis is the most consumed illegal drug in Europe and several countries adopted more permissive laws towards its recreative consumption [1]. Cannabis consumption is increasing in pregnant women in several developed countries [2,3], and cannabinoids were detected in the meconium of around 5 % of newborns born in Spanish public hospitals [4]. Thus, it is important to evaluate the impact of the exposure to cannabinoids during the embryonic development. Zebrafish is a vertebrate model suitable for high-throughput and developmental studies due to its fast and ex-utero development. Here, we characterized the developmental toxicity of key cannabinoids using zebrafish embryos. Embryos were chronically exposed from 4 hours post fertilization (hpf) to increasing concentrations (0.2 - 20μ M) of: tetrahydrocannabinol (THC) and cannabidiol (CBD), which are the most abundant cannabinoids in Cannabis; and cannabidivarin (CBDV) and cannabigerol (CBG), cannabinoids whose therapeutic potential is under active research and for which it is unknown the effects of a chronic exposure during embryonic development. Concentration-response curves and developmental and cardiovascular phenotyping were performed. CBD and CBG were lethal within the concentration range tested, presenting a LC₅₀ of 15 \pm 4 μ M and of 12 \pm 3 μ M, respectively. CBD (6 μ M), CBDV (20 μ M) and CBG (6 µM) reduced hatching rate, and induced bradycardia and abnormalities in more than 20 % of the embryos at 76 hpf: CBD and CBG induced cardiac oedema and tail necrosis, while CBDV induced cardiac oedema and yolk sac necrosis. Here, we show that the tested cannabinoids, except THC, are toxic during embryonic development at the low micromolar range, increasing the awareness about the risks of cannabis consumption during pregnancy.

Keywords: Cannabinoids; Zebrafish; Development, Endocannabinoid system.

Acknowledgments

FCT: UIDB/04378/2020; UIDP/04378/2020; LA/P/0140/2020; DL57/2016/CP1346/CT0016.

References

[1] Freeman, A. et al. (2019) Neurosci Biobehav Rev. 107: 696-712.

- [2] Young-Wolff, K. et al. (2022) JAMA Netw Open. 5(12): e2246912.
- [3] Koto, P. et al. (2022) BJOG 129: 1687-94.
- [4] Lozano, J. et al. (2007) Acta Paediatr. 96(12): 1734–1737.

20727 | The Ghrelin Gene in Sperm whale (*Physeter macrocephalus*): a mutational validation assessment

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Abstract

Land to water evolutionary transition encompassed drastic physiological, morphological and behavioural modifications in Cetacea – the iconic group of whales, dolphins and porpoises. A growing body of research has emphasized the strong impact of Gene Loss as a molecular mechanism promoting adaptation to a new environment.

The Ghrelin (GHRL) gene is responsible for encoding the ghrelin-obestatin preproprotein, whose role includes appetite stimulation and osmoregulation. The presence of disruptive mutations in GHRL of sperm whales (Physeteridae and Kogiidae) has been evaluated and validated using bioinformatic tools, however no attempt has been made so far to confirm the gene coding status through other approaches, including classical polymerase chain reaction (PCR).

To this aim, we extracted genomic DNA from a previous collected biopsy sample of a sperm whale (*Physeter macrocephalus*) and performed PCR reaction targeting both exons 1 and 2 of GHRL. The resulting sequences validated previous reported mutations, described from the genome assembly. Thus, GHRL loss in sperm whale appears real. Possible explanations for the erosion of this gene include the putative absence of fasting periods, likely resulting in the occurrence of relaxed selection to maintain a gene whose function became obsolete.

In conclusion, our results emphasize the importance of using PCR-based approaches to validate previous described in silico disruptive mutations. Specifically, for GRHL, more studies will be needed to understand the reasons for this lineage specific gene loss.

Keywords: Gene Loss; Ghrelin; sperm whale.

Acknowledgments

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20932 Can atorvastatin and 17α -ethinylestradiol disrupt lipid pathways in brown trout?

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Abstract

Hypolipidemic drugs and artificial estrogenic compounds are now prevalent environmental pollutants suspected of causing dyslipidemia in fish. Within this context, this study investigated the effects of atorvastatin (ATV; a hypolipidemic), 17α -ethinylestradiol (EE2; an estrogen) and a combination of both (MIX) in juvenile brown trout. Control was a saline solution, and solvent control was the saline solution with ethanol and DMSO. Fish (n=10/condition) were injected twice a week for two weeks. Endpoints included biometry, blood lipid biochemistry, hepatic lipid droplets quantification, liver mRNA expression and gonadal status. Liver weight and hepatosomatic index (HSI) increased in the EE2 and MIX groups. Triglycerides were higher in the EE2 animals and lower in the ATV. ATV also reduced cholesterol and LDL. HDL levels diminished across all groups. The cytoplasmic load of lipid droplets in hepatocytes was higher the EE2 and MIX groups, and all experimental groups showed heterogeneity in the size and spatial distribution of the droplets. Estrogen receptor α (ER α) and vitellogenin A (VtgA) mRNA levels were upregulated by EE2 and MIX. Likewise, the classic statin target 3-hydroxy-3-methyl-glutaryl-CoA reductase (HMGCoAR) was upregulated by EE2 and ATV. Acyl-CoA long chain synthetase 1 Acsl1 and fatty acid synthase (FAS) mRNA levels were upregulated by EE2, whilst fatty acid binding protein 1 (Fabp1) showed an inverse pattern. ATV and MIX caused a downregulation of apolipoprotein AI (ApoAI) and peroxisome proliferator-activated receptor y (PPARy) mRNA levels. MIX only upregulated peroxisome proliferator-activated receptor α (PPAR α) mRNA levels. Gonadal development was identical across groups. In summary, all endpoints demonstrated that ATV, EE2 and their combination caused disruptions in lipid metabolism in brown trout after in vivo exposures, uncovering specific effects of the MIX.

Keywords: atorvastatin, 17α-ethinylestradiol, brown trout, dyslipidaemia, lipid metabolism.

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20593 | Identification and production of immunogenic antigens targeted by vaccination against neosporosis

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Abstract

Neospora caninum is a parasite capable of infecting multiple warm-blooded animals, including cattle and canids. Infected cattle experience high rates of abortion, making neosporosis one of the most important causes of economic loss in beef and dairy industries. Since chemotherapeutic treatments against the parasite are not considered viable solutions, vaccination is seen as the most cost-effective treatment. Our group developed a mucosal immunization strategy using Neospora caninum membrane protein extracts (NcMP) as antigens against cattle neosporosis. To refine our vaccination strategy, it would be important to identify the key antigenic targets. The main objectives of our study were: 1) the identification of NcMP's immunodominant antigens; 2) the production of recognized proteins in the recombinant form to be used in immunization studies. NcMP were separated in one and 2D-SDS-PAGE gels and the bands/dots recognized by IgG obtained from immunized bovines, using Western Blot, were excised and identified by massspectrometry. N. caninum microneme protein 1 (NcMIC1) and granule dense protein 7 (NcGRA7), which were previously found immunodominant in immunization studies in mice [1], were also identified here. Other proteins preferentially recognized by bovine IgG were surface antigen 1 (NcSAG1), surface related sequence 25 (NcSRS25) and thioredoxin-dependent peroxide reductase. NcGRA7 was first chosen for protein synthesis in the recombinant form (rNcGRA7) in Escherichia coli. Recombinant NcGRA7 was successfully expressed and purified and its recognition by bovine antibodies generated by immunization was evaluated by ELISA and Western Blot. rNcGRA7 (33 kDa) was recognized by immunized bovine serum IgG but not by IgG from control animals.

Altogether, the immunodominant proteins identified here might constitute promising immunogens to be used in future vaccination studies.

Keywords: Neospora caninum; antibodies; antigen identification; recombinant protein synthesis.

References

[1] Ferreirinha, P., et al. Vaccine, 2016. 34 (50): p. 6250-6258 DOI:10.1016/j.vaccine.2016.10.056

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21234 | Metformin induced epigenetic changes in zebrafish embryos

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Abstract

Metformin (MET) is a first line oral therapy for the treatment of type 2 diabetes mellitus and it is also used in cancer and polycystic ovary syndrome. This drug is commonly detected in surface waters, because when consumed, it isn't metabolized by the human body. MET is thought to be the highest drug by weight released into the aquatic environment and its usage is expected to globally increase. There are some evidences of MET's epigenetic modulation in humans, but still little is known regarding its epigenetic effects in non-target organisms.

Because of that, the objective of this study was to assess the potential of MET to induce intergenerational alterations (i.e., F1 non exposed generation) in the epigenetic machinery of *Danio rerio* (zebrafish) embryos, that resulted from a full-cycle parental exposure (F0) to environmentally relevant concentrations of this drug, ranging from 361 to 13 000 ng/L. For that, we evaluated, through qRT-PCR, the expression of 5 key genes associated with the regulation of the epigenome, i.e. dnmt1, ezh2, hat1, hdac1 and riox1. This way we aimed to assess the intergenerational epigenetic effects of MET in non-exposed organisms.

Our results showed an upregulation of all the genes screened, even in low MET concentrations, which translated into an apparent repression of gene transcription, in particular associated with embryonic development and cell differentiation. Histone modifications were detected at lower concentrations, showing that MET has a greater impact in histones than in DNA methylation. These results suggest that embryos that had a parental exposure to MET may present functional dysregulations and morphological alterations, as was reported in previous studies. These epigenetic changes may also impact later stages of the organisms' life cycle and on a larger scale, the whole population's profile and adaptability.

Keywords: Metformin; Epigenetics; Transgenerational effects.

Acknowledgments

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References

[1] Alves, N., Neuparth, T., Barros, S., & Santos, M. M. (2021). The anti-lipidemic drug simvastatin modifies epigenetic biomarkers in the amphipod Gammarus locusta. Ecotoxicology and Environmental Safety, 209, 111849. https://doi.org/10.1016/j.ecoenv.2020.111849

 [2] Cavalieri, V. (2020). Histones, their variants and post-translational modifications in zebrafish development. Frontiers in Cell and Developmental Biology, 8, 456. https://doi.org/10.3389/fcell.2020.00456

[3] Neuparth, T., Machado, A., Montes, R., Rodil, R., Barros, S., Alves, N., Ruivo, R., Castro, L.F.C., Quintana, J., Santos, M.J.E.I., 2020. Transgenerational inheritance of chemical-induced signature:

a case study with simvastatin. Environ. Int. 144, 106020. https://doi.org/10.1016/j.envint.2020.106020Nishitani, S. (2022). Capturing the epigenome: Differences among blood, saliva, and brain samples. In Epigenetics of Stress and Stress Disorders (pp. 239-256). Academic Press. https://doi.org/10.1016/B978-0-12-823039-8.00006-X



Figure 1: mRNA expression levels of the epigenome related genes used for this study (dnmt1, ezh2, hat1, hdac1 and riox1), relative to rpl8, in 48 hpf D. rerio embryos resulting from a full life-cycle parental exposure to MET. Error bars indicate standard errors and asterisks (*) represent significantly different expression values from the control treatment (p <0.05) (n=8).

20511 | Cooperation between BRCA2 and the Spindle Assembly Checkpoint for embryo survival *in Caenorhabditis elegans*

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Abstract

During embryonic development, cells proliferate to originate different tissues. Faithfull DNA duplication and division during embryonic cell proliferation are ensured by mechanisms that safeguard DNA integrity. Malfunction of these mechanisms underlies many congenital diseases, cancer, infertility, and birth defects.

The breast cancer susceptibility gene, BRCA2, is a well-known genome caretaker in proliferative cells as it regulates DNA duplication, repair, and segregation. Given its central role, BRCA2 depletion in mice leads to embryonic lethality. In humans, the inheritance of mutations in one allele of BRCA2 increases the predisposition to breast and ovarian cancers, while the acquittance of BRCA2 mutations in both alleles is associated with the rare congenital disease, Fanconi anemia (FA). Although FA patients survive embryogenesis, they have severe developmental defects and develop early-onset tumors in several tissues. These clinical phenotypes reflect the high rates of genome instability in the cells of these patients; however, how *Brca2* FA cells still manage to proliferate and sustain embryonic development is unknown.

We set out to investigate this in the genetically tractable *C. elegans* animal model using CRISPR-Cas9, RNA interference and fluorescence microscopy. Our preliminary data reveal that, as in humans, a fraction of BRCA2-depleted embryos manage to survive and develop into adults, although with developmental defects. Interestingly, we found that disturbing the spindle assembly checkpoint (SAC) severely reduces the survival of BRCA2-depleted embryos. Strikingly, we also observed an increased accumulation of DNA damage in germline cells depleted of both BRCA2 and SAC proteins. Altogether, our data suggest a crosstalk between BRCA2 and SAC to maintain DNA integrity during gametes and embryo development, providing important insights for the development of therapeutic strategies for patients with BRCA2 mutations.

Keywords: genome instability; cell proliferation; cancer; Fanconi Anemia.

21150 | A novel lentivirus system to decode the non-coding DNA associated with Type-2 Diabetes risk

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Abstract

Type-2 diabetes (T2D) is a major global health issue. Genetic susceptibility to T2D has been linked to single nucleotide polymorphisms (SNPs) that overlap with predicted enhancers, suggesting that altered transcriptional regulation contributes to this disease's pathogenesis. In this work we aim to: 1) develop an enhancer reporter assay suitable for large-scale enhancer testing, 2) validate predicted human beta-cell enhancers potentially associated with T2D development and 3) functionally decipher the nucleotide code of the validated enhancers.

We have built a lentivirus compatible with the large-scale cloning of libraries of enhancers, containing a minimal promoter and GFP as a reporter gene, to assess the activity of cloned enhancers. Using a previously validated endocrine pancreas enhancer, we tested several minimal promoters and different architectures of the lentivirus. We cloned enhancers upstream of the minimal promoter, the most simplified approach to test enhancer activity, or downstream, a configuration that potentially recapitulates the endogenous enhancer-promoter interaction by chromatin looping. This allowed us to find the best solution that generates the highest signal-tonoise ratio, while simultaneously maintaining endogenous conditions regarding enhancer functionality. Next, we have used biochemical marks associated with enhancer activity and T2Dassociated SNPs to define a list of approximately 300 candidate enhancer regions (CERs). We cloned this library of CERs in the developed lentivirus, infected MIN6 cells, and through FACSsorting, we isolated clones from single cells carrying CERs capable of increasing GFP expression. We are currently mutating GFP-controlling CERs by CRISPR/Cas9 to correlate CERs nucleotide changes with changes in their function. The findings of this study are crucial to decode the underlying mechanisms of enhancer nucleotide sequences and their impact on gene expression and ultimately T2D development.

Keywords Type-2 diabetes (T2D); Enhancers; Chromatin; Lentivirus.

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20948 | Combining stereology and cytology for prognostication of canine cutaneous mast cell tumours

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Abstract

Mast cell tumors (MCTs) are the most common skin neoplasm in dogs and cytology plays a major role in their diagnosis. In order to achieve tailored pre-surgical therapeutical planning, reliable cytological prognostic parameters should be identified. Quantitative morphological parameters, such as the nuclear area (NA), are highly reproducible, objective, and allow the establishment of cutoffs. The NA estimated by stereological methods in cytological smears of MCTs has been associated with the histological grade, pointing to a potential prognostic value of this parameter. In the present study, the prognostic value of the stereological estimation of the NA in cytology samples of MCT was assessed. A retrospective survival study was designed, including a case series of 37 MCT, for which clinical follow-up data was available. The cytological smears originally stained with May Grünwald-Giemsa were destained and restained with hematoxylin-eosin (HE) for clear visualization of the nuclear borders. NA was estimated by the 2D-nucleator stereology method in 100 cells in each smear. Survival analysis was performed, using Cox proportional hazards regression and Kaplan-Meier curves. The increase in the mean NA and NA \geq cutoff 62.8 μ m² were associated with shorter overall survival. The estimation of the NA by stereological methods in HE-restained cytology smears is a prognostic factor in dogs with cutaneous MCTs and can aid therapeutic planning prior to surgery.

Keywords: cytology; dogs; mast cell tumours; stereology.

21051 | Optimisation of an intranasal immunisation protocol against toxoplasmosis using *Toxoplasma gondii* membrane antigens

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Abstract

Toxoplasma gondii is a successful zoonotic parasite with a worldwide distribution that affects a wide variety of homeothermic animals. This obligate intracellular protozoan is the etiological agent of toxoplasmosis, a disease affecting immunocompromised individuals, causing cerebral or ocular lesions. Primary infection during pregnancy may lead to abortion or congenital toxoplasmosis, with diverse neonatal clinical manifestations such as mental retardation, blindness, epilepsy or even death. Despite the *T. gondii* broad distribution and the severity of the symptoms it can cause, there is still no vaccine preventing disease in humans. Therefore, it is urgent to develop an effective vaccine that can prevent and control toxoplasmosis.

This project aimed to optimize an intranasal immunization protocol using membrane antigens from *T. gondii* (TgMP) plus CpG adjuvant. Two TgMP doses (0.4 mg/kg animal or 1.2 mg/kg animal) were tested to determine the minimal quantity of TgMP able to induce protection. Two parameters were evaluated in the BALB/c mouse model: the induced protection against *T. gondii* infection and the induced TgMP-specific humoral response. The parasite load of spleen, peritoneal exudate (PE) and liver was assessed by qPCR, using primers and a probe specific to *SAG1*. The TgMP-specific IgG1 and IgG2a titres in serum and TgMP-specific IgA in intestinal lavage fluids of mice were quantified by Enzyme-Linked Immunosorbent Assay (ELISA). Intranasal immunization with both doses of TgMP led to a similar significant reduction of the parasite load in the PE and spleen, concomitantly with a similar significant increase of TgMP-specific serum IgG1 and IgG2a, when compared with CpG sham-immunization. These results indicate that the amount of TgMP can be reduced in the immunization protocol without reducing its efficacy. Future experiments will be carried out with the smaller quantity of TgMP, contributing to a significant reduction in the costs invested in this research.

Keywords: Toxoplasma gondii, TgMP, intranasal immunization.

21104 | Tackling the trans-kingdom transcription regulatory machinery: can plant pioneer transcription factors remodel animal chromatin?

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Abstract

Pioneer transcription factors (PTFs) are a subtype of transcription factors (TFs) that are able to bind to compacted chromatin and recruit chromatin remodelers to establish open chromatin regions, triggering transcription and controlling gene expression programs. Here we aim to test the plant to animal trans-kingdom functional conservation of PTFs, driving chromatin accessibility by recruiting orthologue chromatin remodelers. LEAFY (LFY) and LEAFY COTYLEDON1 (LEC1) are two PTFs described in plants (*Arabidopsis thaliana*) known to open chromatin and trigger transcription in the two target promoters AP1 and FLC, respectively. The zebrafish is an animal model amenable for transgenesis and genetic engineering. In this work we first aim to test if plant promoters AP1 and FLC can drive expression in zebrafish embryos and secondly determine if LFY and LEC1 can target AP1 and FLC in zebrafish cells, suggesting that they are able to recruit animal chromatin remodelers.

We have cloned the AP1 and FLC promoters in a promoter test vector with GFP as reporter gene. We microinjected these vectors in zebrafish embryos at one cell stage and observed that for AP1 6 embryos out of 113 presented few mosaics of GFP expressing cells. Similarly, for FLC, we detected 5 positive embryos out of 82 injected. To exclude that AP1 and FLC promoters might act as minimal promoters, driving expression only when in the presence of enhancers in *cis*, we have introduced a midbrain enhancer downstream of GFP. After the injection of these improved vectors, we have not observed GFP expression. These results suggest that the plant promoters are mostly inactive in vertebrate cells, the ideal low noise condition to test their response to ectopic expression of the plant PTFs LFY and LEC1 in zebrafish embryos, which we are currently testing. Here, we will present our latest results and conclusions regarding the conservation of the mechanisms of chromatin remodeling driven by PTFs in two trans-kingdom species.

Keywords: Pioneer transcription factors; Zebrafish; Chromatin remodelers; Arabidopsis thaliana.

21088 | Identification of mRNA signatures by bioinformatic analysis in cancers related to tobacco smoking

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Abstract

Tobacco smoking causes eight million global deaths annually, three million of which are directly linked to cancer. Alternative polyadenylation in the 3'UTR (3'UTR-APA) and intronic polyadenylation (IPA) are co-transcriptional mechanisms that produce alternative mRNA isoforms by selecting different polyadenylation signals. It is currently understood that, due to 3'UTR-APA, cancer cells tend to produce mRNAs with shorter 3'UTRs than normal cells, while truncated mRNAs caused by IPA may disrupt tumour suppressive gene functions. This project aims to use bioinformatics methods to find if tumours related to tobacco smoking share a specific profile of mRNAs produced by 3'UTR-APA and IPA that may serve as potential risk biomarkers and therapeutic targets. To achieve this aim, RNA-Seq data from three different cancers related to smoking habits (lung, bladder, and head & neck) were retrieved from the TCGA database, collecting tumour and normal pairs for each cancer type. Using a pipeline developed by our group, the APAtizer, two algorithms, DaPars2 and APAlyzer, were used to identify APA events. Both algorithms show that 3'UTR-APA shortening events are increased in the tumours when compared to normal samples: DaPars2 identified 32 genes with common 3'UTR-APA mRNA signatures in these three cancers, with 28 undergoing 3'UTR shortening and 4 undergoing 3'UTR lengthening. Notably, the APAlyzer was more efficient in identifying 3'UTR-APA events than DaPars2: 318 in total, with 291 genes undergoing 3'UTR shortening, and 27 genes undergoing 3'UTR lengthening. APAlyzer additionally identifies IPA events, and our results showed 22 common IPA upregulated genes to the three cancers.

In conclusion, smoking-related cancers exhibit mRNA signatures with a significant increase in 3'UTR-APA shortening and IPA events. The new mRNA signatures identified in this study by bioinformatic tools may direct experimental research for their validation as potential risk biomarkers and therapeutic targets in tobacco-induced cancers.

Keywords: Alternative Polyadenylation; Cancer; mRNA signatures; RNA-Seq; Bioinformatics

Acknowledgments

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Figure 1: Computational Workflow of this project.

21158 | Functional glycoproteomics characterization of gastric cancer cells expressing selectin ligands

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Abstract

Gastric cancer is the fifth most common cancer type and the fourth leading cause of cancer death in the world. A high percentage of gastric cancer patients are diagnosed with advanced disease, hence, it is crucial to improve detection methods so that early stages can be identified and to discover cancer-specific therapeutical targets for the treatment of advanced disease [1].

Gastric cancer is associated with significant changes in the cellular glycome, namely, an increase in truncated O-glycans, β 1,6-branched N-glycans, fucosylation, and sialylation [2]. Regarding sialylation, one of the most common sialylated structures in cancer is sialyl-Lewis a (sLe^a), a terminal epitope found in N-glycans and O-glycans. sLe^a plays a role in metastasis and tumour progression since it acts as a ligand for E-selectin. However, because it is not exclusively expressed in cancer, exploring the cellular glycoproteome to identify proteins expressing sLe^a for precise targeting is imperative [3].

Thus, we aim to characterize the glycoproteome of gastric cancer cells expressing sLe^a to identify potential cancer-associated targets and evaluate the functional impact of this glycan on these cells. To achieve this, the expression levels of the enzymes involved in the synthesis of sLe^a (B3GalT5, ST3GAL3 or FUT3) were assessed in AGS cells through RT-PCR. The results showed that B3GalT5 has the lowest expression, therefore, a knock-in of this enzyme was carried out. O-glycomics was performed to validate the expression of this glycan in the glycoengineered cell line. Both transfected and non-transfected cells exhibited a similar glycome profile, with an abundance of core 1 and short core 2 structures. Further investigation on the abundance of Lewis antigens precursors of types 1 and 2 chains is required. If type 2 precursors are the most predominant, a knock-out of B4GALT might be required, but, if type 1 precursor levels are higher, additional transfections of ST3Gal3 or FUT3 might be needed to achieve sLe^a expression.

Keywords: Gastric cancer; glycosylation; glycomics; sialyl-Lewis a

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References

[1] P. Petryszyn, N. Chapelle, and T. Matysiak-Budnik, "Gastric Cancer: Where Are We Heading?," (in eng), Dig Dis, vol. 38, no. 4, pp. 280-285, 2020, doi: 10.1159/000506509.

[2] C. A. Reis and A. Magalhães, "Glycosyltransferases and Gastric Cancer," in Glycosignals in Cancer: Mechanisms of Malignant Phenotypes, K. Furukawa and M. Fukuda Eds. Tokyo: Springer Japan, 2016, pp. 17-32.

[3] E. Fernandes et al., "Nucleolin-Sle A Glycoforms as E-Selectin Ligands and Potentially Targetable Biomarkers at the Cell Surface of Gastric Cancer Cells," Cancers (Basel), vol. 12, no. 4, Apr 2 2020, doi: 10.3390/cancers12040861.

20776 | A gene loss "road" underpins the absence of the platypus stomach

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Abstract

How phenotypes are modified during the course of evolution is a fundamental question in biology. Gene Pseudogenization via the accumulation of loss-of-function mutations has been proposed as a powerful driver of evolutionary change and adaptation to drastic ecological transitions. Here, we investigate the evolution of monotremes (currently composed of a single platypus and four echidna species), which constitute a quite tantalizing lineage of early-diverging mammals. This group of predatory mammals displays a number of specific anatomical features, including, interestingly, the absence of a classical vertebrate organ: the stomach with gastric glands. The targeted loss of genes involved in digestion (pepsinogens) and acid secretion (proton pump genes) has been previously correlated with the evolutionary emergence of this agastric phenotype. Thus, to further dissect the molecular architecture of this phenotype, we investigated 110 genes in two available genomes of monotremes—Ornithorhynchus anatinus (platypus) and Tachyglossus aculeatus (echidna)—using a combination of phylogenetics and comparative genomics to decipher variations in gene repertoire. Target genes, including stomach enriched and group-enriched genes, were retrieved from the Human Protein Atlas, as well as functional information for each protein. Using the NCBI database we deduced synteny conservation between human, platypus, echidna and chicken (the outgroup) genomes. PseudoChecker, an automatic online tool, was used to detect gene remnants when full gene sequences were apparently absent. Our findings show that Ca9 (involved in the formation of gastric acid), Vsig1 (functioning in mucus-secreting cells) and Trim50 (stimulating starvation-induced autophagy activation) have been secondarily lost in monotremes, in agreement with the observed agastric phenotype. Overall, we suggest that the loss of this organ constitutes one of the most tantalizing examples of phenotype modification occurring via gene loss.

Keywords: gene-loss; stomach; monotremes; platypus; gene-pseudogenization; synteny.

20558 | Recruitment and loading of Dynein-2 into cilia to ensure their signaling functions

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Abstract

Cilia are microtubule-based structures present at the surface of most cells, where they perform a variety of key roles throughout development. The building and function of all types of cilia rely on intraflagellar transport (IFT; Figure1). During IFT, the Kinesin-2 motor drives the anterograde movement of IFT particles (known as IFT trains), carrying the assembling blocks and other cargo, from the cilium's base to its tip. In the opposite direction, the Dynein-2 motor powers retrograde IFT trains, transporting ciliary signaling molecules towards the cytoplasm to activate cell proliferation/ differentiation pathways. Although mutations in Dynein-2 subunits have been linked with severe ciliopathies in humans, very little is known about the mechanisms regulating Dynein-2 availability inside cilia and its function during IFT.

Using *Caenorhabditis elegans*, our lab recently uncovered that WDR60 is critical for the binding of Dynein-2 to IFT trains transported anterogradely towards the tip by Kinesin-2. Consequently, the loss of WDR60 severely impairs Dynein-2 incorporation and its availability at the tip of cilia to initiate retrograde IFT (De-Castro et al., 2022).

Taking advantage of knock-in fluorophore-tagged Dynein-2 subunits and IFT proteins, we now set out to determine which subunits of IFT trains bind WDR60 to modulate the anterograde transport of Dynein-2. We found that three subunits of the IFT-B complex, IFT20, IFT54, and IFT172, associate with WDR60 to promote Dynein-2 entry into cilia. Consistent with this, retrograde IFT was severely impaired in mutants from all of these subunits. We are now in the process of mapping the WDR60 domains that bind to these IFT-B subunits. Finally, we aim to mimic patient mutations within the IFT binding regions of WDR60 to investigate their impact on IFT and cilia function. Altogether, our research reveals how WDR60 connects Dynein-2 to anterograde IFT trains, and sheds light on the molecular causes of WDR60-associated ciliopathies.

Keywords: Dynein; Molecular motors; Cilia; Intraflagellar transport; Cilium-dependent signaling; Ciliopathies

Acknowledgments

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References

 [1] De-Castro, A. R. G., Rodrigues, D. R. M., De-Castro, M. J. G., Vieira, N., Vieira, C., Carvalho, A. X., Gassmann, R., Abreu, C. M. C., & Dantas, T. J. (2022). WDR60-mediated dynein-2 loading into cilia powers retrograde IFT and transition zone crossing. Journal of Cell Biology, 221(1). https://doi.org/10.1083/jcb.202010178.



Figure 1: Illustration of the intraflagellar transport (IFT). Kinesin-2 motors power the anterograde movement of IFT trains from the ciliary base towards the tip. The WDR60 subunit of Dynein-2 binds the IFT-B complex allowing this motor to be transported to the ciliary tip. In the opposite direction, Dynein-2 motors power the retrograde movement of IFT trains from the tip towards the base. (Adapted from De-Castro et al., 2022)

21160 | Enzymatic activity in a high-throughput fluorimetric dengue virus protease assay for dengue virus serotypes

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Abstract

Dengue virus (DENV) is a significant public health issue, with millions of people infected annually worldwide. DENV has four known serotypes that may cause severe dengue haemorrhagic fever, dengue shock syndrome and even fatal outcomes. Due to challenges such as genetic diversity and antibody-dependent enhancement, there is currently no specific treatment for DENV, and vaccines have limited efficacy towards all serotypes simultaneously [1].

Being an essential component of the viral replication cycle, the DENV NS2B/NS3 protease (DENVpro) is an attractive target for drug development [2]. Therefore, in this study, we will characterize and compare the DENVpro from all four DENV serotypes in a biochemical assay with the aim to identify serotype-specific or pan-serotype inhibitors.

A standard operating procedure for the cloning, expression, and purification of the recombinant DENVpros was established. The purified enzymes were then assessed for their activity using a fluorescence resonance energy transfer (FRET) assay, evaluating different substrates, additives, and buffer conditions. The kinetic parameters of the enzymes were determined and compared. Eventually, the optimized assay was used to evaluate the inhibitory activity of known DENV2 protease inhibitors against all four serotypes.

With our findings we expect to identify serotype-specific or pan-serotype protease inhibitors for the DENVpro that can set the basis for the development of broadly acting antivirals. Overall, the results of this work will contribute to the development of new therapeutics against DENV infections, which could potentially help reduce the global burden of this disease.

Keywords: Dengue virus, protease, NS2B/NS3, biochemical protease assay, FRET substrate.

References

[1] Obi, J. O., Gutiérrez-Barbosa, H., Chua, J. V., & Deredge, D. J. (2021). Current Trends and Limitations in Dengue Antiviral Research. *Tropical medicine and infectious disease*, *6*(4), 180. https://doi.org/10.3390/tropicalmed6040180

[2] Behnam, M. A., Nitsche, C., Boldescu, V., & Klein, C. D. (2016). The Medicinal Chemistry of Dengue Virus, *Journal of medicinal chemistry*, *59*(12), 5622–5649. https://doi.org/10.1021/acs.jmedchem.5b01653

20651 | A computational approach to build a RHDV primer database from the literature

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Abstract

The rabbit hemorrhagic disease virus (RHDV) is a lagovirus of the family *Caliciviridae* that causes the rabbit hemorrhagic disease, which is characterized by a highly contagious, acute, and fulminating liver disease. Due to the high genetic diversity, it is important to correctly identify the RHDV strains circulating in farm and wild rabbits, to implement adequate control measures. Reverse transcription (RT)-PCR is a highly sensitive and fast method that allows the detection and identification of RHDV genotypes and uses a pair of oligonucleotides (primers) to amplify a portion of the genome. If followed by Sanger sequencing, it further enables strain characterization. This work intends to automatically retrieve primers from the literature and build a RHDV primer database.

We searched articles in NCBI PubMed using the keywords "RHDV", "Rabbit hemorrhagic disease virus", "Rabbit haemorrhagic disease virus" and "Rabbit calicivirus". We obtained 790 references that were imported into Zotero, where we successfully downloaded 593 PDF files that were converted into text file format in PDF Shaper. We uploaded the files in Orange, where we developed a process to retrieve the primers from the articles, based on regular expressions that identify the primer sequences. Hereafter, we validated the results by checking the length of the primers and performing a BLAST search of each primer against the RHDV genome.

The RHDV primer database will sort the published oligonucleotides according to the conservation of the sequences. This will allow the selection of the best primers for strain characterization and more efficient PCR reactions. As this tool will be freely available, it can help less-experienced researchers to achieve optimal RHDV detection and characterization.

Keywords: Rabbit hemorrhagic disease virus; Oligonucleotides; Primers; Data mining; Database.

20871 | Deciphering the transcriptomics of the *Conus* species' natural venoms

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Abstract

Cone snails are iconic species known for centuries for their beautifully conical seashells, which were and still are actively sought after for trophies and decorative assets. Although the shells are prized for jewellery since ancient times and considered a treasure for collectors, only recently special attention was diverted to the capacities of these species' venoms. As it turns out, these snails produce a predatory venom containing many complex compounds, each with high affinity for a certain class of receptors. These compounds act in a variety of ways, being highly relevant for a broad field of biomedical applications if more effort is directed to their studies.

With such goal in mind, this work aimed to contribute to the deciphering of the molecular diversification of these marine gastropods' natural predatory venoms. The methodology was developed to decode the genomic background as well as the relationships among the proteins of these marine predators' venoms. By studying all available transcriptomes of the *Conus* genus' species using comparative genomics and bioinformatics assessments, multiple-step analysis based on the results obtained enabled the weaving of several conclusions. In short, in this work it is reported (1) the number and functions of the shared genes found to be uniquely expressed in the venom glands of all 20 *Conus* species analysed, (2) a correlation of assembly size with the number of unique genes found, (3) evidence for symbiotic microorganism relationships within the venom gland, and (4) an agreement with previous works regarding transcriptomic duplication levels.

Furthermore, increasing scientific evidence pointing for a central role of nAChRs in the SARS-CoV-2 infection gave rise to the idea of possible applications for conotoxins in the Covid-19 disease treatment. Therefore, in this work a preliminary attempt was made at reporting any matching sequences between the transcriptomes of *Conus* species and SARS-Cov-2, but evidence of a genomic relation is yet to be found.

Keywords: Conus; transcriptomics; venom gland; shared GO IDs; symbiosis; Covid19.

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References

[1] https://hdl.handle.net/10216/146508; Accessed in 14/03/2023.

20736 | Nuclear receptors and the mussels that "don't get better with butter"

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Abstract

Freshwater mussels (Mollusca; Bivalvia; Unionida) are filter-feeding invertebrates responsible for keeping the water clear and play a significant role in nutrient dynamics between the substrate and the water column. They are among the most endangered animal groups as their life cycle depends on specific local hosts and their low mobility impairs the ability to move into more favourable environments when faced with anthropogenic or biotic pressures. Nuclear receptors (NRs) are a superfamily of mostly ligand-activated transcription factors that regulate a wide range of biochemical and cellular reactions. NR function may then be reflective on how certain species will fare in set conditions. Despite this, the basic knowledge of how many and which NRs are present, remains understudied on these endangered species. Therefore, the lack of research on NRs in freshwater mussel species and their endangered status make them prime targets for further investigation. To this effect, the NR sequences were obtained through multiple blasts against genomes of freshwater species using Crassostrea gigas (marine mussel) NRs as a reference. Phylogenetic analysis was used to infer the orthology of the aligned NR sequences. The main difference observed was the number of NRs in the NR1P group between the freshwater species and their marine counterparts. Moreover, unpublished data from our group demonstrated that the expression of at least one NR1P member was significantly affected in the freshwater mussel gill under different water temperatures. Thus, differences in the modus operandi, expression levels and patterns of NRs may be related to different responses of these species to environmental stimuli. This work offers a framework that will allow future investigation on ligand-binding interactions and functions of specific NRs, and their possible use as biomarkers to study adaptation processes on endangered species.

Keywords: nuclear receptors; freshwater mussel; phylogeny; biomarkers; climate change.

Acknowledgments

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20958 | Sans Glomeruli: the recurrent origin of aglomerular kidneys in teleosts

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Abstract

Background: The nephron, the fundamental unit of the kidney, evolved in the ancestor of the Bilateria from the elaboration of an ultrafiltration-based organ to produce urine. The functional segmentation of the nephron is present in most extant vertebrate lineages, with the presence of a filtering element, the glomeruli—a network of capillaries contained within the Bowman's capsule. This filtration system is based on a specific cell type, the podocyte, which displays slit diaphragms through which a regulated filtration takes place ultimately forming the urine. Strikingly, not all vertebrate kidneys display a glomerular structure. Seven marine teleost lineages have been classified as "aglomerular" on the basis of morphology, including the iconic Syngnathidae (seahorses, seadragons and pipefishes) (figure 1). In marine environments, water conservation is paramount. The molecular foundations for the independent emergence of the aglomerular phenotype has never been systematically addressed in a comparative context.

Results: Here, we show that a set of structural proteins, including nephrin and podocin, as well as specific glucose transporter have been subject to targeted deletion in Syngnathidae, a genetic condition previously undescribed in vertebrate species. Furthermore, comparative genomics, phylogenetic analysis and RNA seq approaches indicate that some lineages classified as "aglomerular", do retain the molecular components of a glomerular filtration system – e.g., nephrin, and thus require a reassessment.

Conclusion: Finally, we propose that aglomerulism evolved independently in various teleost lineages as an energy saving adaptation, since it does not require high rates of energy-intensive water reabsorption. Together our results highlight the essential role of secondary gene loss in generating phenotypic diversity.

Keywords: Gene loss; Kidney; Glomeruli; Teleosts.

Acknowledgments

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Figure 1: Phylogenetic representation of aglomerular groups in bony fishes. The groups which include aglomerular fish species are highlighted in red (species conditions after Senarat et al. (2022).

20972 | Upregulation of Vps27 mediates the mitochondrial derepression and increased lifespan of yeast cells lacking the Sit4 protein phosphatase

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Abstract

Saccharomyces cerevisiae Sit4p is a catalytic subunit of a PP2A-like Ser/Thr protein phosphatase, homologue to the human PP6. It has been implicated in the regulation of the cell cycle, pH and monovalent ions homeostasis, carbohydrate and lipid metabolism, nutrient sensing and signalling, vacuolar acidification and morphology, mitochondrial function, and chronological lifespan. Our results (unpublished) revealed that the levels of the vacuolar sorting protein 27 (Vps27) increase 4.1-fold on vacuolar membranes of sit4 Δ cells. In addition, SIT4 deletion increases yeast lifespan in a Vps27-dependent manner, as the sit4 Δ vps27 Δ double mutant exhibited a shortened lifespan. Vps27 is a class E protein that interacts with Hse1 to form a heterodimer referred as endosomal sorting complex required for transport-0, ESCRT-0. Vps27 binds to ubiquitinated cargo and to the PIP3-rich endosomal membrane, initiating the cargo sorting into multivesicular bodies. This study aims to unravel the role of Vps27 in the regulation of vacuolar and mitochondrial functions and chronological lifespan by Sit4. For that, we analysed autophagy and cytoplasm-to-vacuole targeting (CVT) pathways. The autophagic flux was significantly decreased in sit4A and sit4Avps27A mutant cells but the CVT pathway was induced in sit4 Δ and sit4 Δ vps27 Δ mutants. These suggests that Sit4 regulates autophagy and CVT pathways in Vps27 independent manner. Notably, in contrast with sit4A and vps27A single mutants, the *sit4* Δ *vps27* Δ double mutant was unable to grow on a non-fermentable (respiratory) carbon source. Plus, VPS27 deletion suppressed the increase of mitochondrial respiration in sit4 Δ cells, and the $sit4\Delta vps27\Delta$ double mutant exhibited a very low oxygen consumption rate. These results suggest that Vps27 is critical for mitochondrial fitness and lifespan extension in *sit4* Δ cells.

Keywords: Sit4, Vps27, chronological lifespan, vacuoles, mitochondria, protein trafficking, autophagy, cytoplasm-to-vacuole targeting (CVT).

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20716 | Application of the FISH technique in the research for chromosomal mosaicism in samples of buccal mucosa

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Abstract

Mosaicism is the term used to describe the presence of two or more genotypically distinct cell lines in an individual from a single zygote [1]. The representativity of this phenomenon in the total DNA content of the genome varies significantly between individuals, which may or may not raise clinical concern. The clinical significance and severity of any disease underlying this phenomenon, it strongly depends from a wide range of factors, among them: the stage of embryonic development, the type of genomic, genetic or epigenetic variation, the number of cells affected and the distribution and involvement of the affected tissue [2]. Until today, mosaicism has been described as responsible for numerous spontaneous abortions [3], failures in the implantation of the embryo [4], congenital abnormalities [5], developmental delays [6] and cancer [7]. This work aimed to contribute to the advancement of knowledge in this area. It was intended to apply the technique of Fluorescence In Situ Hybridization (FISH) in the investigation of chromosomal mosaicism in 7 samples of buccal mucosa with suspicion of chromosomal mosaicism and 3 samples of buccal mucosa with chromosomal mosaicism previously confirmed in the blood diagnosis of patients. The results obtained allowed to corroborate the results obtained in the blood diagnosis of the patients, as well as to quantify the cell lines present in the buccal mucosa samples of the individuals. This work allowed to highlight the importance of a multidisciplinary approach in the precise and concrete diagnosis of mosaic individuals or with suspected chromosomal mosaicism, also underline the relevance of diagnosis in estimating the risk of recurrence, genetic counseling, pathological consequences and/or prognosis of individuals with chromosomal mosaicism. This type of approach has also shown its usefulness whenever there is evidence that leads to the suspicion of a case of chromosome mosaicism that is not previously confirmed in blood or skin diagnosis.

Keywords: Clinical Cytogenetics; Chromosomal mosaicism; Oral mucosa; Fluorescence *In Situ* Hybridization.

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References

[1] Campbell, I. M. et al. (2015) 'Somatic mosaicism: Implications for disease and transmission

genetics', Trends in Genetics, 31(7), pp. 382–392. doi: 10.1016/j.tig.2015.03.013.

[2] Martínez-Glez, V. *et al.* (2020) 'A six-attribute classification of genetic mosaicism', Genetics in Medicine, 22(11), pp. 1743–1757. doi: 10.1038/s41436-020-0877-3.

[3] Vorsanova, S. G. *et al.* (2005) 'Evidence for high frequency of chromosomal mosaicism in spontaneous abortions revealed by interphase FISH analysis', Journal of Histochemistry and Cytochemistry, 53(3), pp. 375–380. doi: 10.1369/jhc.4A6424.2005.

[4] Baart, E. B. *et al.* (2006) 'Preimplantation genetic screening reveals a high incidence of aneuploidy and mosaicism in embryos from young women undergoing IVF', Human Reproduction, 21(1), pp. 223–233. doi: 10.1093/humrep/dei291.

[5] Kouru, K. H. *et al.* (2011) Hidden mosaicism for a structural chromosome rearrangement: a rare explanation for recurrent miscarriages and affected offspring?, Fertility and Sterility. Elsevier Inc. doi: 10.1016/j.fertnstert.2010.09.022.

[6] Santos-Simarro, F. *et al.* (2021) 'Mosaic Variegated Aneuploidy syndrome 2 caused by biallelic variants in CEP57, two new cases and review of the phenotype', European Journal of Medical Genetics, 64(11), pp. 1–7. doi: 10.1016/j.ejmg.2021.104338.

[7] Steinke-Lange, V. *et al.* (2021) 'Somatic mosaics in hereditary tumor predisposition syndromes', European Journal of Medical Genetics, 64(12). doi: 10.1016/j.ejmg.2021.104360.



CHEMISTRY



20404 | Olive pomace valorisation by obtention of bioactive compounds enriched extract

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Abstract

Polyphenols are a chemically diverse class of compounds that have antioxidant activity and thus can prevent systemic and/or localised inflammation by restoring the redox balance and via modulating inflammatory responses. These biochemical characteristics of polyphenols are associated with a decrease in risks of several diseases making them compounds of interest. These are mainly obtained through the diet since they can be found in a variety of foods, like fruits and vegetables. However, processed food based on antioxidant rich fruits and vegetables do not always conserve these in the final product.

One such example is olive oil. Its industry by-products, like olive pomace (OP) and olive oil wastewater, conserve higher amounts of phenolic compounds compared to the olive oil produced due to their chemical characteristics. Having this in mind, a simple extraction design was accessed to recover these compounds and any remaining lipids. For this, olive pomace was kindly given by a local olive oil mill in Mirandela, Portugal, collected after the pressing stage. Fresh pomace was lyophilized, to reduce the water content, and extracted through an ultrasound-assisted extraction in different conditions and using a couple of eco-friendly solvents in order to optimise the extraction of polyphenols and any remaining lipids. The extracts were then characterised regarding its antioxidant activity, through multiple assays, as well as polyphenol and lipid content.

This work seeks to add value to OP and promote a circular economy concept through the execution of a simple, fast, and eco-friendly extraction to recover its retained polyphenols and residual lipids.

Keywords: Olive Pomace, Extraction, Polyphenols, Antioxidant, Lipids.

20757 | Valorisation of rice by-products

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Abstract

Rice Husk (RH) is a potential residue for valorization, since it is highly available and is disposed by rice mill industry as a waste. Silica-rich RH is mainly underutilized, on-site burned or landfilled, leading to environmental problems [1]. From the calcination process at high temperature the resulting waste, designated rice husk ash (RHA) is obtained with a microporous structure and contains around 85% to 90% of silica [2]. From RHA is also possible to obtain a sodium silicate solution that can be used to synthetize ordered mesoporous silicas. Another important sector that needs attention is the fossil energy consumption. To replace fossil energy, namely diesel consumption, biomass platforms, such as , alkyl levulinates have shown great potential as synthetic fuels [3]. In particular, there's a big interest in the production of ethyl levulinate (EL) due to its potential for being produced in large quantities from bio-renewable feedstocks [4]. EL can be synthetize from 5-hydroxymethylfurfural (HMF), that is considered one of the most important platforms. For that, a series of $-SO_3H$ functionalized silica-based catalysts were prepared from rice husk and their performance was investigated on the conversion of HMF into EL, using microwave irradiation.

Keywords: Rice Husk; Biocatalyst; Biodiesel; Silica-rich material

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References

[1] Gupte, A. P; *et.al*. Rice waste streams as a promising source of biofuels: feedstocks, biotechnologies and future perspectives. Renew. Sustain. Energy Rev. 2022, 167, 112673. https://doi.org/10.1016/j.rser.2022.112673.

[2] Singh, B. Rice husk ash. In Waste and Supplementary Cementitious Materials in Concrete; Elsevier, 2018; pp 417–460. https://doi.org/10.1016/B978-0-08-102156-9.00013-4.

[3] Jia, S.; *et. al.*. Fast and efficient upgrading of levulinic acid into long-chain alkyl levulinate fuel additives with a tungsten salt catalyst at low temperature. Sustain. Energy Fuels 2020, 4 (4), 2018–2025. https://doi.org/10.1039/C9SE01287G.

[4] Kim, J.; Han, J. Bio-based process for the catalytic production of ethyl levulinate from cellulose. Appl. Energy 2021, 300, 117430. https://doi.org/10.1016/j.apenergy.2021.117430.



Figure 1: Rice Husk Applications.

20507 | Magnetic cork-derived porous composites as adsorbents for water remediation technologies

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Abstract

Cork, a renewable lignocellulosic material obtained from the bark of cork oak [1] generates a considerable amount of waste during its manufacturing process. [2] Recently, there has been a growing interest in the valorisation of such materials, namely in the preparation of cork wastederived materials as alternative adsorbents due to its low cost, sustainability, wide availability of feedstocks and remarkable adsorptive capacities.[3].

We have explored the potential application of cork powder (CP) in the preparation of advanced magnetic adsorbents with enhanced adsorptive capabilities for water remediation. CP was used to produce two types of composite materials following different synthetic methodologies. The first method involves the impregnation of previously synthesized magnetite nanoparticles (MNP) into the porous framework of cork powder (MNP_CP), the second involves the impregnation of CP with a selected transition metal (Fe) followed by pyrolysis under inert atmosphere, leading to the formation of a magnetic biochar (Fe_BCP). The adsorptive ability of the magnetic cork-derived materials was evaluated for the removal of fluoroquinolone antibiotics, using levofloxacin (LVX) as model molecule. The adsorption studies were carried out by fluorescence spectroscopy through monitoring of the fluorescent emission of LVX.

Optimization of the experimental parameters, namely initial pH, contact time, adsorbent loading, was performed and adsorption kinetics was studied. Both materials adsorbents exhibited remarkable adsorptive capacities in short periods of time for the removal of levofloxacin from aqueous solutions. The proposed materials combine the low cost of the precursors, sustainable transformation of solid wastes into value-added products, easy magnetic separation and adsorptive performance highlighting its exceptional potential for application in water remediation.

References

- [1] A. Matos, et al., Mater. Des., vol. 85, pp.230-239, 2015.
- [2] H.-K. Lai, et al., Chem. Eng. J., vol. 332, pp. 717-726, 2018.
- [3] C.P. Silva et al., Bioresour. Technol., vol. 250, pp. 888-901, 2018.

20708 | Study of the contamination of deactivated mines soils with potentially toxic elements using sequential extraction procedures

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Abstract

Weathering and erosion of minerals and rocks naturally rich with heavy metals can contaminate surrounding areas.[1] In fact, soils act as a sink and a source of potentially toxic elements (PTEs) since they are non-biodegradable and can persist in the environment for long times, ultimately altering soil properties, decreasing soil fertility and contaminating crops.[2,3] Moreover, anthropogenic activities such as mining, agriculture, traffic and fossil fuel combustion constantly release heavy metals into the environment.[1,2]

The mining activity is considered the major anthropogenic source of environment contamination by heavy metals. It changes the layout of the soil and produces huge amounts of waste that are deposited in the surrounding areas in the form of heaps and tailings. The exposure of rocks and minerals to environmental conditions and the lack of proper monitoring and treatment of the residues strongly increase the occurrence of acid mine drainage (AMD) contributing to the mobilization of the PTEs from mining sites or waste piles to the surrounding soils and aquatic systems.

This work aimed to study the presence and dissemination of mercury species from residues produced by currently deactivated mines in Portugal, providing information about the risks imposed by it to the environment and human health. First, the pseudo-total concentration of Hg in the soil samples was obtained followed by application of a sequential extraction procedure (SEP), the USEPA 3200, to evaluate Hg bioavailability since PTEs toxicity to organisms is strongly influenced by the chemical forms in which they are found in the environment.

The obtained data for the risk assessment of Hg revealed the negative environmental impact of the mining activity in the studied regions emphasizing the risks arising from untreated and exposed mine wastes, the need for control and monitoring of heavy metals and also intervention for the remediation of the contamination in those mine regions.

Keywords: mercury, heavy metals, mine soil, soil contamination, sequential extraction, cold vapor atomic absorption spectroscopy.

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References

[1] Jaishankar, M.; Tseten, T.; Anbalagan, N.; Mathew, B. B.; Beeregowda, K. N. Toxicity, Mechanism and Health Effects of Some Heavy Metals. Interdiscip. Toxicol. 2014, 7 (2), 60–72. https://doi.org/10.2478/intox-2014-0009.

[2] Demková, L.; Jezný, T.; Bobulská, L. Assessment of Soil Heavy Metal Pollution in a Former Mining Area-before and after the End of Mining Activities. Soil Water Res. 2017, 12 (4), 229–236. https://doi.org/10.17221/107/2016-SWR.

[3] Reis, A. T.; Davidson, C. M.; Vale, C.; Pereira, E. Overview and Challenges of Mercury Fractionation and Speciation in Soils. TrAC - Trends Anal. Chem. 2016, 82, 109–117. https://doi.org/10.1016/j.trac.2016.05.008.

21013 | Simultaneous purification and quantification of organic nanoparticles loaded with small molecules using hydrodynamic-based separation and light scattering detection Araújo, Susana L. M., LAQV, REQUIMTE, Departamento de Ciências Químicas, Faculdade de Farmácia, Universidade do Porto, Portugal

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Abstract

Numerous nanoparticles (NPs) have been developed aiming at providing improved therapeutics for several health threatening conditions¹. Nevertheless, the characterization of NPs quality attributes remains challenging, hampering their translation from the laboratory bench to the market². Encapsulation efficiency - EE (*i.e.* quantity of drug associated to NPs in relation to the added amount) is an attribute of mandatory evaluation, as it critically impacts therapeutic outcomes and side effects³. However, efficient separation of loaded NPs from free molecules, without compromising NPs integrity, is required for accurate EE determination. Having this in mind, this work aims to establish a mild separative procedure under a conventional HPLC system with fluorescence/light scattering detection, to simultaneously purify organic NPs (polymeric and lipid-based NPs) from free molecules and quantify both fractions. To accomplish this, chromatographic separation was performed using a monolithic stationary phase, elution conditions with a low amount of organic modifier and a low flow rate. The quantification of NPs and of free molecules was performed by light scattering and fluorescence measurements, respectively. The separation and quantification of both fractions was accomplished within 20 min. A linear correlation of analytical signals for NPs ($t_{retention} \approx 1 \text{ min}$) and free molecules ($t_{retention} \approx 9$ min) for increasing concentrations of formulation ($R^2 > 0.9930$) was observed, as required for quantitative purposes. The integrity of the NPs after the chromatographic run was confirmed after analysis of the eluted fractions by dynamic light scattering. The proposed method enabled the purification of NPs from free molecules, and their quantification in different formulation batches, including NPs made of different materials (polymers and lipids), only requiring 20 µL of diluted NPs. Future studies will be focused on the suitability of the proposed method for assessing the stability of NPs and NPs drug cargo when these are exposed to biological matrices.

Keywords: Nanomedicine; separative methods; encapsulation efficiency; drug delivery; HPLC.

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References

[1] Halwani, A. A. Pharmaceutics 2022, 14 (1), 21, 106

[2] Halamoda-Kenzaoui, B., et al. Wiley Interdiscip. Rev.-Nanomed. Nanobiotechnol. 2019, 11 (1),

17, e1531,

[3] Marques, S. S., et al. Molecules 2020, 25 (8), 15, 1879
20789 | New strategy to conjugate PEG lipids with amino acids for surface functionalization of nanoparticles

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Abstract

To reach specific targets and deliver efficiently drugs, the surface of lipidic nano delivery system can be functionalized with targeting molecules (e.g., small molecules, proteins, peptides) [1]. Polyethylene glycol (PEG) lipids are the most common building block for the assembly of nano delivery systems, and they can be conjugated with different targeting molecules [2]. Usually, the linkage between PEG and targeting molecules is accomplished using *N*-hydroxysuccinimide and dicyclohexylcarbodiimide as coupling agents. However, this reaction is time-consuming and produces undesired by-products [3].

Herein, we propose a new strategy for the functionalization of 1,2-distearoyl-sn-glycero-3-phosphoethanolamine-*N*-[amino(polyethylene glycol)-2000] (DSPE-PEG2000-NH2) using the coupling agent (1-cyano-2-ethoxy-2-oxoethylidenaminooxy)-dimethylamino-morpholino-carbenium hexafluorophosphate (COMU) [4]. As proof of concept, D-amino acids with different chemical properties were selected as targeting molecules. Depending on the nature of the D-amino acid, the procedure can be performed in one step or in two steps (Scheme 1). The conjugation reaction step provided the desired DSPE-PEG2000-D-amino acids conjugates in good yields (up to 96%) and their structures were elucidated by spectrophotometric methods. In comparison with the traditional coupling strategy, our proposal comprises fewer coupling steps, requires a stoichiometric amount of COMU, and gives origin to water-soluble side products. This versatile and environmental-friendly method is suitable for the functionalization of different nanoparticles which makes it relevant for the future of surface modification of the nanoparticles.

Keywords: surface functionalization; PEGylated nanoparticles; carbodiimide; green chemistry.

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References

[1] Sanità, G.; Carrese, B.; Lamberti, A. Nanoparticle Surface Functionalization: How to Improve Biocompatibility and Cellular Internalization. *Front. Mol. Biosci.* **2020**, *7*.

[2] Ibrahim, M.; Ramadan, E.; Elsadek, N. E.; Emam, S. E.; Shimizu, T.; Ando, H.; Ishima, Y.; Elgarhy,
O. H.; Sarhan, H. A.; Hussein, A. K.; Ishida, T. Polyethylene Glycol (PEG): The Nature,
Immunogenicity, and Role in the Hypersensitivity of PEGylated Products. *J. Control. Release* 2022, 351, 215–230.

[3] Pinto, R. M.; Monteiro, C.; Costa Lima, S. A.; Casal, S.; Van Dijck, P.; Martins, M. C. L.; Nunes, C.; Reis, S. N-Acetyl-I-Cysteine-Loaded Nanosystems as a Promising Therapeutic Approach Toward the Eradication of Pseudomonas Aeruginosa Biofilms. *ACS Appl. Mater. Interfaces* **2021**, *13* (36), 42329–42343.

[4] Albericio, F.; El-Faham, A. Choosing the Right Coupling Reagent for Peptides: A Twenty-Five-Year Journey. *Org. Process Res. Dev.* **2018**, *22* (7), 760–772.



Scheme 1: New strategy for the functionalization of DSPE-PEG2000-NH2 with D-amino acids. A) one-step synthesis of DSPE-PEG2000-NH-D-amino acid and B) two-step synthesis of DSPE-PEG2000-NH-D-amino acid.

20709 | Probing (tri)phosgene-free assembly of semicarbazides in aza-peptide synthesis

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Abstract

Semicarbazides are commonly used for the assembly of peptidomimetic drugs due to similar electronic and structural properties to amides [1,2] allowing for strong interactions with proteins and other biological targets [3] However, contrary to amides, semicarbazides display high resistance against degradation by peptidases/amidases [2].

The incorporation of semicarbazides into peptide motifs is typically slow due to the stability of the reactants, thus resulting in long reaction periods and/or poor yields.[4] As such, highly reactive carbonylation agents like phosgene and triphosgene are often used to speed up the process [4]. However, these reactants are extremely hazardous, requiring special conditions for their manipulation and storage.[4] A simpler alternative employs the use of chloroformates, carbonyldiimidazole, and related compounds for carbonylation, which are more stable, safer, and easier to manipulate [4]. However, despite the practicability of these carbonylation agents, they usually require high temperatures and long reaction times to achieve moderate to high yields [4]. In this work, the synthesis of semicarbazides via activation of carbazate intermediates generated from hydrazines and chloroformates as carbonylation reagents is described by acid-catalysis with para-toluenesulfonic acid. Not only the reaction time and the temperature is reduced but the formation of side products is minimized, thereby simplifying the purification process. This optimized protocol is expected to rescue chloroformates as effective carbonylation agents.

Keywords: Aza-peptides; Carbonylation; Semicarbazides.

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References

Begum, A.; Sujatha, D.; Prasad, K. V. S. R. G.; Bharathi, K. Asian J. Chem. 2017, 29, 1879-1887.
 Zega, A. Current Med. Chem. 2005, 12, 589-597.

[3] Proulx, C., Sabatino, D., Hopewell, R., Spiegel, J., Ramos, Y.G. & Lubell, W.D. *Future Med. Chem.* **2011**, *3*, 1139-1164.

[4] André, F.; Marraud, M.; Tsouloufis, T.; Tzartos, S. J.; Boussard, G. J. Pept. Sci. **1997**, *3*, 429-441.

20423 | Development of superoxide anion sensing compounds based on chemiluminescent coelenterazine

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Abstract

Superoxide anion is a reactive oxygen species that acts as a signaling molecule within the organism, being overexpressed in certain pathologies, like cancer, acting as a specific marker of the disease [1]. Considering this, it became of high priority to develop methods capable of detecting superoxide level variations with high sensitivity and specificity.

One emerging approach is the use of chemiluminescent (CL) compounds, such as the widely studied marine coelenterazine (Clz), as sensing probes, which can emit light upon contact with superoxide anion [2]. However, a significant restriction was noted in terms of the emission intensity, which is reduced in aqueous environments [3].

With this in mind, during my Master's Thesis I was involved in the development and characterization of two novel Clz analogues, which presented a CL reaction triggered by the presence of superoxide anion. More relevantly, these analogues showed significantly enhanced and longer-lived light-emission in aqueous solution than native Clz [4, 5]. Their biocompatibility was also demonstrated [5]. Thus, the new molecules showcase the potential to be employed as dynamic and sensitive superoxide anion probes, which can be useful in bioimaging/bioanalytical applications.

Keywords: Superoxide Anion; Cancer; Chemiluminescence; Coelenterazine; Sensing Probe.

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References

- [1] Bronsart, L.L. et al. Mol. Imaging and Biol., 2016, 18, (2), 166-171
- [2] Pinto da Silva, L. et al. Eur. J. Med. Chem., 2019, 183, 111683
- [3] Lourenço, J.M. et al. J. Lumin., 2018, 194, 139-145
- [4] Silva, J.P. et al. Chemosensors, 2022, 10, (5), 174
- [5] Silva, J.P et al. J. Photochem. and Photobiol. A: Chemistry, 2023, 434, 114228

20679 | Preparation of catalysts for the sustainable conversion of glycerol into fuel additives

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Abstract

The growing awareness of the environmental and energetical impact of fossil fuels has turned attention into research of new energy alternatives. Biodiesel, in particular, has become increasingly popular as a non-toxic and biodegradable fuel. The transesterification reaction that originates biodiesel also produces glycerol as a by-product (approximately 10% of total biodiesel production), causing an overplus of glycerol in the fuel industry.[1] Acetalization of glycerol originates solketal, an environmentally friendly substance used as a fuel additive.[2] Heteropolyacids, also known as polyoxometalates, are reported as active catalysts for acetalization reactions.[3] From these, phosphomolybdic acid (H₃PMo₁₂O₄₀) and phosphotungstic acid (H₃PW₁₂O₄₀) were studied in their homogeneous form. Optimization study was also achieved using both catalysts. Catalysts showed satisfactory catalytic behaviour, achieving 97% conversion of glycerol with high selectivity for solketal. These results allowed further research of these heteropolyacids in acetalization reactions, by immobilizing both acids (phosphomolybdic and phosphotungstic) in solid supports. Therefore, this communication tends to present innovative methods of heterogenization of these heteropolyacids and their catalytic application in glycerol conversion.

Keywords: acetalization, glycerol, polyoxometalates, heteropolyacids, mesoporous silica

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References

[1] Akram, F., et al., Current trends in biodiesel production technologies and future progressions: A possible displacement of the petro-diesel. Journal of Cleaner Production, 2022. 370.

[2] Corrêa, I., R.P.V. Faria, and A.E. Rodrigues, Continuous Valorization of Glycerol into Solketal: Recent Advances on Catalysts, Processes, and Industrial Perspectives. Sustainable Chemistry, 2021. 2(2): p. 286-324.

[3] Juliao, D., F. Mirante, and S.S. Balula, Easy and Fast Production of Solketal from Glycerol Acetalization via Heteropolyacids. Molecules, 2022. 27(19).



Figure 1: Graphical abstract of the production of glycerol, and its transformation into solketal.

20935 | New hybrid carbon/metal sulfide nanomaterials for application in smart textiles with energy storage and harvesting properties

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Abstract

Societal demand on energy harvesting and storage options keeps growing, influenced in multiple sides by the lack of energetic resources, alongside a push into newer, green, ones, culminating in a quest for innovative energy-related technologies. In order to find an answer to this demand, we turn to nanotechnology. Through textiles functionalization with nanomaterials, we may impart new functionalities, including energy storage and harvesting capabilities [1]. A multitude of products can be developed using these smart textiles, including luminous outfits, intelligent sensors and health management devices.

In this work, novel hybrid carbon/metal sulfide nanomaterials were prepared and used as electrode materials in the development of thermally-chargeable supercapacitors. The hybrids were prepared through the functionalization of carbon nanotubes with tungsten and bismuth sulfides. As a means of comparison, the metal sulfides were also synthesized *ex situ* in the absence of the carbon nanomaterial. The morphology, structure and chemical composition of the developed materials were thoroughly evaluated using various techniques, such as X-ray diffraction, electron microscopy, energy-dispersive X-ray spectroscopy, Fourier transform infrared spectroscopy and Raman spectroscopy, in order to tune the conditions of synthesis of these materials to obtain high purity metal sulfide phases. Afterwards, the produced nanomaterials were incorporated into textile fabrics following a process that is already well-established in the industry, making it more easily implementable [2]. The final step involved the stacking of two textile electrodes, with a solid-gel electrolyte in-between, to design devices with sandwich-type architecture. The energy harvesting and energy storage performance of the devices will be investigated.

Keywords: Carbon Nanotubes, Metal Sulfides, Supercapacitors, Energy Storage, Energy Harvesting

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References

[1] Teixeira, J., Costa, R. M., Pires, A., Pereira, A., & Pereira, C. (2021). Hybrid dual-function thermal energy harvesting and storage technologies: towards self-chargeable flexible/wearable devices. Dalton Transactions, 50(29), 9983–10013.

[2] Costa, R. M., Guedes, A., Pereira, A., & Pereira, C. (2020). Fabrication of all-solid-state textile supercapacitors based on industrial-grade multi-walled carbon nanotubes for enhanced energy storage. Journal of Materials Science, 55(23), 10121–10141.

21076 | Extraction of volatile carbonyl compounds from wood-based panels by GDME-HPLC-DAD

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Abstract

Wood-based panels (WBPs) is the generic term used for board products made from fibres, particles and/or veneers, which include particleboards (PBs), medium-density fibreboards (MDFs), plywood, and others. The fibres or particles are bonded together by an adhesive, creating a mixture that will harden through heat and pressure, resulting in a solid panel [1].

In recent years, indoor air quality and the effects of poor indoor air quality on human health has been a topic of concern due to the increase of time spent indoors by the general population [2]. Given their use in furniture and building materials, WBPs are a source of emission of a broad group of indoor air pollutants, the volatile organic compounds (VOCs).

Gas-diffusion microextraction (GDME) [3] is a simple sample preparation technique that allows the extraction, derivatization and concentration of volatile compounds from liquid and solid samples, by collecting the gaseous analytes that cross a permeable membrane into an acceptor solution.

In this work, GDME was used to extract volatile carbonyl compounds from PBs and MDFs through derivatization with 2,4-dinitrophenylhydrazine. Several studies were performed to optimize the use of GDME, which include the cleaning procedure, evaluation of the method's precision, optimization of GDME extraction parameters (through a one variable at a time (OVAT) approach and by experimental designs, namely, a 2⁴ factorial design for screening and a Box-Behnken design), evaluation of the degree of variability of different PB and MDF samples, among others. A suitable optimization of the chromatographic conditions, which involved testing different gradient elution methods and HPLC columns, was performed. Furthermore, HPLC-MS/MS studies were performed to identify the VOCs extracted from PB and MDFs samples.

Keywords: Volatile organic compounds; wood-based panels; gas-diffusion microextraction.

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References

[1] T. Adcock and M. P. Wolcott, in Encyclopedia of Materials: Science and Technology, Elsevier, 2001, 9678-9683.

- [2] T. Adamová, J. Hradecký and M. Pánek, Polymers, 2020, 12.
- [3] I. M. Ferreira, D. O. Carvalho, M. G. da Silva and L. F. Guido, Foods, 2021, 10.

20655 | Functional MOF-based materials with the potential as sustainable heterogeneous catalysts

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Abstract

The investigation of materials able to be recyclable and effective to catalyse the transformation of organic compounds into add-valuable products is an area of constant development.

Metal-organic frameworks (MOFs) are porous crystalline materials with a structure formed by organic ligands and inorganic metal centres (discrete metal or metal clusters). Frequently, these materials have large specific surface area, high porosity and an adjustable structure, characteristics that have great interest in catalysis and others. To date, a variety of functional materials (such as metallic nanoparticles [NPs], quantum dots [QDs], polyoxometalates [POMs], etc) have been integrated with MOFs to create MOF composites/hybrids [1].

POMs are economically and environmentally attractive compounds in several oxidative reactions; however, their efficiency in pure form is quite limited due to their solubility in organic solvents [2]. To overcome this problem, in this work, we propose the immobilization of active POMs on solid support suitable (MOF) to perform catalysis creating a composite, in this case, $PMo_{12}@MOF-808$. [3] Briefly, the MOF-808 consists of a polyhedral structure formed by the Zr(IV) metal cluster, $[Zr_6O_4(OH)_4$ (- CO_2)₆]₆⁺, and are coordinated by benzene-1,3,5-tricarboxylic acid, H₃BTC).

The MOF-808 was synthesized by two different methodologies: solvothermal and at room temperature. This last procedure is more sustainable to prepare composite PMo₁₂@MOF-808. The composite material was already tested as heterogeneous catalyst and demonstrated a promissing activity for the oxidation reaction of geraniol. Furthermore, other MOF-based heterogeneous catalysts have been developed by a controlled thermal treatment of MOF-808 and new Zr MOFs, namely the UiO-66-NH₂ and MOF-801. These MOF-derived materials have been tested as catalysts also for ring-opening reactions involving epoxides

Keywords: Metal-Organic Frameworks, Solvothermal Synthesis, Polyoxometalates, Heterogemeous Catalysis, Thermal treatment

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References

[1] Wang, F.W., et al., *Study on the performance of a MOF-808-based photocatalyst prepared by a microwave-assisted method for the degradation of antibiotics*. Rsc Advances, 2021. **11**(52): p. 32955-32964.

[2] Granadeiro, C.M., et al., Oxidative catalytic versatility of a trivacant polyoxotungstate incorporated into MIL-101(Cr). Catalysis Science & Technology, 2014. 4(5): p. 1416-1425.
[3] Fernandes, S.C., et al., Synergistic combination of the nanoporous system of MOF-808 with a polyoxomolybdate to design an effective catalyst: simultaneous oxidative desulfurization and denitrogenation processes. Sustainable Energy & Fuels, 2021. 5(16): p. 4032-4040.



Figure 1: Representation of the composite synthesis formed by MOF-808 and PMo12 [3]

20901 | Tackling Parkinson's disease by modulation of dopamine receptors using chiral non-proteinogenic melanostatin analogs

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Abstract

Parkinson's Disease (PD) is the second most common neurodegenerative disease worldwide, affecting up to 16 million people.[1] Currently, PD treatments, which focus on dopamine (DA) reinforcement, can decrease motor symptoms in the early stages of the disease, but their use often comes associated with significant side effects (e.g., motor fluctuations, dyskinesias) and eventually loss of effectiveness.[2] Therefore, new pharmacological alternatives are mandatory to manage PD motor symptoms.

Melanostatin (MIF-1) is an endogenous neuropeptide (L-prolyl-L-leucyl-glycinamide) that acts as a positive allosteric modulator of DA D_2 receptors (D_2R), showing great potential for the treatment of PD in clinical trials.[3] However, the clinical application of MIF-1 is hindered by its low gastrointestinal (GI) permeation and high vulnerability to catabolism by peptidases.[4]

In this work, a library of novel MIF-1 analogs bearing chiral *cis*-2-aminocyclopentane-1-carboxylic acids as proline surrogates were synthesized in an attempt to improve the pharmacokinetic properties of the neuropeptide while sustaining/improving its biological activity. These compounds were subjected to pharmacological assays, namely by evaluating cAMP mobilization in CHO cells expressing D₂R. Cytotoxicity evaluation was carried out in human SH-SY5Y cells, following differentiation with retinoic acid and tetradecanoylphorbol acetate to acquire a more dopaminergic phenotype, through the MTT reduction and neutral red uptake assays.

In the functional assays, two of the synthesized peptidomimetics showed a decrease up to 10fold in the half-maximal effective concentration of DA, at 0.01 nM, comparing favorably with MIF-1. More so, none of the peptidomimetics showed significant toxicity up to 200 μ M in both assays performed. Through *in silico* studies, these analogs are suggested to have improved pharmacokinetic properties, being expected to exhibit higher GI permeability and resistance towards peptidases than MIF-1.

Keywords: Melanostatin; Neuropeptides; Non-proteinogenic Amino Acids; Parkinson's Disease

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References

[1] Parkinon's Disease *How common is Parkinson's Disease*? Retrieved from https://parkinsonsdisease.net/basics/statistics. Accessed on February 25, 2022.

[2] Thanvi, B. R.; Lo, T. C. N. Postgrad. Med. J. 2004, 80, 452-458.

[3] Kastin, A. J.; Barbeau, A Can. Med. Assoc. J. 1972, 107(11), 1079-1081.

[4] Kastin, A. J.; Hahn, K.; Erchegyi, J.; Zadina, J. E.; Hackler, L.; Palmgreen, M.; Banks, W. A. *Biochem. Pharmacol.* **1994**, *47* (11), 699-710.

21066 | Chiral derivatives of flavones with potencial antitumor activity: synthesis and structure elucidation

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Abstract

Cancer is a concerning health issue that requires constant development of novel drugs. Flavones are a class of flavonoids with promising antitumor activity [1]. Modification of the 2-phenylchromen-4-one backbone of flavones with chiral moieties has been showing to enhance their antiproliferative activity against tumor cell lines. Among the chiral modifiers of flavones, amino acid moieties were particularly associated with an improvement in selectivity and bioavailability [2,3, 4].

In this work, four new chiral derivatives of flavones were synthesized through coupling reaction of a carboxyflavone with both enantiomers of the methyl esters of leucine and further hydrolysis to achieve the derivatives of amino acids. Firstly, the hydroxyflavone TriCe was obtained by direct thermal cyclocondensation of phloroglucinol and an appropriately substituted benzoylacetate in a solvent-free approach. After, a carboxyflavone derivative of TriCe (TriCe-Ac) was generated as intermediate for the stereoselective synthetic reaction between TriCe-Ac and both enantiomeric pairs of amino esters using COMU[®] as green coupling reagent. Finally, the amino acid derivatives of TriCe-Ac were obtained by mild alkaline hydrolysis of methyl esters.

The new compounds were structurally elucidated by IR, 1H NMR, 13C NMR, HMBC and HSQC techniques. The enantiomeric purity and the antiproliferative activity of synthesized compounds are under evaluation. The new chiral derivatives of flavones generated in this work will contribute for the discovery of new anticancer drugs.

Keywords: flavone; antitumor activity; chirality; leucine; enantioselectivity; synthesis.

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References

[1] Panche, A. N., Diwan, A. D. & Chandra, S. R. Flavonoids: an overview. J. Nutr. Sci. 5, 1–15 (2016).

[2] Gangopadhyay, A., Chakraborty, S., Jash, S. K. & Gorai, D. Cytotoxicity of natural flavones and flavonols against different cancer cells. J. Iran. Chem. Soc. 2021 195 19, 1547–1573 (2022).

[3] Pinto, S. F. Pinto, C. Enantioselective synthesis of new flavonoids with potential antitumor activity. Master' Thesis, FFUP, (2021).

[4] Pinto, C., Cidade, H., Pinto, M. & Tiritan, M. E. Chiral flavonoids as antitumor agents. Pharmaceuticals 14, (2021).

20560 | Impact of deposition parameters on the coalescence stage of thermally evaporated ionic liquids

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Abstract

The wettability of ionic liquids (ILs) at the mesoscopic scale has significant implications in various scientific fields and technologies, particularly under vacuum conditions, where these materials exhibit unique characteristics [1-3]. This study investigates the effect of differentiation in some deposition parameters, such as the deposition rate and substrate temperature, on the process of nucleation and growth, specifically droplet formation, distribution, morphology, and spreading of IL films deposited onto solid surfaces through vacuum thermal evaporation. The ILs used in this study have an alkylimidazolium cation $(C_nC_1 \text{ im})$ (n=2 and n=8) and either bis(trifluoromethylsulfony)imide (NT f_2) or triflate (OTf) as the anion. The IL samples were simultaneously deposited on surfaces of indium tin oxide (ITO) and ITO substrates coated with silver (Ag), using Knudsen cells as evaporation sources. The film morphology (micro- and nanodroplets) was evaluated by scanning electron microscopy (SEM). The experimental results demonstrate that changing the mass flow rate has a more significant impact on the wettability of the substrate to ILs than a small increase in substrate temperature. An increase in the deposition rate intensifies droplet coalescence of $[C_2C_1im][NTf_2]$ and $[C_2C_1im][OTf]$ on ITO surfaces, while a minor effect is observed on the Ag surface, due to good adhesion between ILs and the metallic surface. On the other hand, the long-chain ILs ($[C_8C_1im][NTf_2]$ and $[C_8C_1im][OTf]$) display an inherent tendency to form coalesced droplets that are independent of the deposition rate.

Keywords: vapor deposition; thin films; micro- and nanodroplets; nucleation and growth; coalescence; mass flow rate; surface and interfacial tension; Ag; ITO-coated glass; SEM.

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References

[1] Matsumoto, Y. *Molecules* **2023**, *28*, 1991.

[2] Costa, J.C.S.; Alves, A.; Bastos, M.; Santos, L.M.N.B.F. Phys. Chem. Chem. Phys. 2022, 24, 13343.

[3] Teixeira, M.S.M.; Santos, L.M.N.B.F.; Costa, J.C.S. Colloids Interfaces 2022, 6, 46.

20668 | Thermodynamic study of 9-phenylacridine by calorimetry

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Abstract

A thermodynamic study of 9-phenylacridine is presented. This compound (with structural formula depicted in figure 1) belongs to the acridine family, having applications in the pharmaceutical industry given its therapeutic benefits, in particular due to anticancer activity [1].

This study primarily involves calorimetric techniques, namely differential scanning calorimetry (DSC), combustion calorimetry (CC) and Calvet microcalorimetry (CM).

The thermal analysis of 9-phenylacridine was performed by DSC in order to identify possible crystal-crystal transitions and determine the temperature and enthalpy involved relative to the crystal-liquid transition. The CC technique allowed to measure the heat involved in the complete oxidation of 9-phenylacridine; from this parameter the enthalpy of formation in the crystalline state has been calculated, with the consequent evaluation of the inter- and intramolecular interactions existing. The CM technique was also used to determine the enthalpy of sublimation, a measure of the strength of intermolecular interactions present in the crystalline phase.

The enthalpy of formation of 9-phenylacridine in the gas phase was determined by combining experimental data obtained from the calorimetric techniques. Considering the gas phase as the reference state to establish relationships structure-energy-reactivity among related molecules, this work constitutes a significant contribution to the thermal characterization of acridine derivatives.

Keywords: 9-phenylacridine; enthalpy of sublimation; enthalpy of formation.

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References

[1] S. Hansda, G. Ghosh, and R. Ghosh, "9-phenyl acridine photosensitizes A375 cells to UVA radiation," *Heliyon*, vol. 6, no. 9, Sep. 2020, doi: 10.1016/j.heliyon.2020.e04733.



Figure 1: Structural formula of 9-phenylacridine.

20895 | Thermophysical properties of bathophenanthroline: A multitechnique approach Silva Ferraz, José M., CIQUP-IMS, Department of Chemistry and Biochemistry, Faculty of Sciences, University of Porto, Porto, Portugal Ciccioli, Andrea, Dipartimento di Chimica, Sapienza University of Roma, Rome, Italy Vecchio Ciprioti, Stefano, Dipartimento di Scienze di Base ed Applicate per l'Ingegneria (S.B.A.I.),

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Abstract

This communication is concerned with the experimental studies that have been developed to determine the thermophysical properties and thermal behaviour of bathophenanthroline (4,7-diphenyl-1,10-phenanthroline), a nitrogen tricyclic compound (with structural formula depicted in figure 1). It is a well-known chelating agent with relevant applications in organic semiconductor devices [1]. This work arises from the severe lack of thermodynamic information regarding the title compound.

During the first stage of the study, the sample characterization was performed by gaschromatography and Karl-Fischer titration.

The thermal behaviour study of the title compound in the condensed phases has been performed by differential scanning calorimetry and thermogravimetric techniques. Several different approaches have also been employed to determine the thermophysical properties. These include calorimetric techniques such as vacuum drop-microcalorimetry and different effusion based methods.

Keywords: Bathophenanthroline; Phenanthroline Derivative; Thermal Analysis; Calorimetry; Effusion Methods.

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References

[1] Farinhas, J.; Ferraria, A. M.; do Rego, A. M. B.; Morgado, J.; Charas, A. Understanding the Role of Phenanthroline as Interlayer in Bulk Heterojunction Organic Photovoltaic Cells. ChemistrySelect 2016, 1 (18), 5638-5646. DOI: 10.1002/slct.201600574.



Figure 1 – Structural formula of bathophenanthroline.

20797 | Smart textiles for the production and storage of energy from human residual heat

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Abstract

The development of devices that combine the high energy density of batteries with the long cycle life, high power density and fast charging of supercapacitors is necessary for more efficient electrical energy storage [1]. Textile supercapacitors, a new energy storage technology, are beginning to be used in the healthcare, sports and defence industries to power low-consumption devices. The evolution of these technologies was significantly influenced by the expansion of the Internet of Things market. All-in-one thermally chargeable supercapacitors (TCSCs) are multifunctional devices that combine the features of supercapacitive energy storage and thermal energy harvesting. This technology has recently blossomed to fulfil the needs of wearable electronics [2].

This work is focused on the preparation of textile electrodes based on carbon nanotubes (CNTs) combined with poly(3,4-ethylenedioxythiophene) polystyrene sulfonate (PEDOT:PSS) and/or silver and their application in the design of new TCSCs. The textile electrodes were prepared by impregnation of cotton fabric with CNTs and application of layers of PEDOT:PSS and/or Ag by screen printing. The textile electrodes were characterized by optical and electron microscopy, X-ray diffraction, Raman and FTIR spectroscopy.

The TCSC devices were produced by assembling the textile electrodes with a solid-gel electrolyte sandwiched in between. The electrochemical performance of the TCSCs was evaluated by electrochemical impedance spectroscopy, cyclic voltammetry, and galvanostatic charge/discharge method. The devices demonstrated to be capable of producing and storing energy when exposed to a temperature gradient due to the Soret effect.

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References

[1] Nano, W., Do, C., & Storage, E. (2014). What Nano Can Do for Energy Storage. 1, 5369–5371.
[2] Teixeira, J. S., Costa, R. S., Pires, A. L., Pereira, A. M., & Pereira, C. (2021). Hybrid dual-function thermal energy harvesting and storage technologies: Towards self-chargeable flexible/wearable devices. Dalton Transactions, 50(29), 9983–10013.

20807 | The effect of diabetes in the endothelial membrane: a biophysical study

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Abstract

Type 2 diabetes (T2D) is a chronic condition that affects over 400 million people worldwide. T2D is characterized by elevated plasma glucose levels (hyperglycemia), which is the main cause of multiple life-threatening complications to highly vascularized organs such as the heart, kidneys, eyes, and brain and co-morbidities¹.

Chronic hyperglycemia triggers a cascade of metabolic alterations that lead to microvascular complications and significant impact on the endothelium³. Though many studies have investigated the effect of T2D on the expression of membrane proteins and receptors in animal and cell models⁴, little is known about the changes that take place to the cell membrane.

To achieve this, we developed a complex phospholipid membrane model enriched with cholesterol and (glyco)sphingolipids aimed to mimic the epithelial membrane under normoglycemic conditions. The hyperglycemic conditions were mimicked by the synthesis of glycated phosphatidylethanolamine (DMPE-glyc). The presence of DMPE-glyc adducts was confirmed by tandem mass spectrometry (ESI-MS/MS) revealing they are Amadori products.

Anisotropy studies conducted on the epithelial model under normo and hyperglycemic conditions, as well as the data obtained from DLS measurements, revealed changes in membrane fluidity and transition temperature, suggesting that the glycation of DMPE altered the biophysical properties of the membrane.

This membrane model will be the basis to investigate the impact of polyphenol-lipid interactions and assess the potential of Mediterranean-type diet as a nutritional strategy in the prevention and management of diabetes in the pre-diabetic population.

Keywords: hyperglycemia, lipid glycation, anisotropy, membrane fluidity, DLS

Acknowledgments

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References

[1] Javeed N, Matveyenko A V. Circadian etiology of type 2 diabetes mellitus. Physiology. 2018;33(2):138–50.

[2] Rehman K, Akash MS. Nutrition and Diabetes Mellitus: How are They Interlinked? Critical Reviews in Eukaryotic Gene Expression. 2016 ;26(4):317-332.

[3] Kini S, Rehman S, Pafford RG, Carr C. Acute diabetic complications. Emerg Med. 2006;38(10):44–51.

[4] Pilon M. Revisiting the membrane-centric view of diabetes. Lipids Health Dis. 2016 Sep 27;15(1):167.

21070 | Stimuli-sensitive nanovectors based on bio-inspired photosurfactants for intracellular delivery of anti-cancer drugs

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Abstract

One of the main current challenges of colloid science at the interface with nanomedicine is the development of smart drug delivery systems. These systems are designed to yield a more efficient and safe drug release in the desired action site, compared to the drug administered alone [1,2]. They consist of colloidal nanostructures with response to a wide range of stimuli, such as temperature, pH, irradiation, redox media, enzymatic activity, among others [3]. Doxorubicin and paclitaxel are two important chemotherapeutic agents that show high toxicity and low aqueous solubility, respectively. To circumvent these drawbacks, they can be encapsulated in stimuli-responsive vesicles to improve their activity and simultaneously reduce toxicity to ensure maximum treatment safety [4].

In this work, we develop a new potential smart drug delivery system based on vesicles composed by a mixture of a cationic and an anionic surfactant (catanionic vesicles). The cationic surfactant consists of a novel chalcone derivative (a photo-responsive molecule), while the anionic one is sodium dodecyl sarcosinate, a commercial, biocompatible amino acid-derived amphiphile. These nanocarriers can respond to irradiation [5] with or without pH variation due to the presence of the chalcone derivative. We prepared catanionic mixtures with different mixing ratios and concentrations, mapping their phase behaviour. We were able to obtain net negatively charged vesicles that are stable, respond to light exposure and can effectively encapsulate doxorubicin. This type of studies will be later extended to paclitaxel. Results will be shown encompassing light microscopy, dynamic and electrophoretic light scattering, fluorescence and UV-Vis spectroscopy and surface tension data.

Keywords: catanionic vesicles; smart drug delivery system; stimuli-responsiveness; nanomedicine.

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References

[1] Dhawan, V.V. and M.S. Nagarsenker, Catanionic systems in nanotherapeutics–Biophysical aspects and novel trends in drug delivery applications. Journal of Controlled Release, 2017. 266: p. 331-345.

[2] Lopes, R. C. G., Silvestre, O. F., Faria, A. R., do Vale, M. L. C., Marques, E. F., & Nieder, J. B. (2019). Surface charge tunable catanionic vesicles based on serine-derived surfactants as efficient nanocarriers for the delivery of the anticancer drug doxorubicin. Nanoscale, 11(13), 5932-5941.

[3] Oliveira, I.S., et al., Stimuli-Sensitive Self-Assembled Tubules Based on Lysine-DerivedSurfactants for Delivery of Antimicrobial Proteins. Chemistry–A European Journal, 2021. 27(2):p. 692-704.

[4] Seidel, Z.P., et al., Photo-triggered delivery of siRNA and paclitaxel into breast cancer cells using catanionic vesicles. ACS Applied Bio Materials, 2020. 3(11): p. 7388-7398.

[5] Basílio, N. and L. García-Río, Photoswitchable vesicles. Current Opinion in Colloid & Interface Science, 2017. 32: p. 29-38.2

21087 | Stimuli-responsive hybrid polymer/lysine-based hydrogel for topical applications

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Abstract

Ongoing research on nanomaterials and colloidal science, particularly, in smart drug delivery, made possible the development of delivery vehicles capable of efficiently transporting entrapped therapeutic agents to targeted sites.

Topical delivery is an enticing route of drug administration since it allows for a painless and affordable approach, with increased patient compliance. Polymer hydrogels have been used for topical applications, due to their high biocompatibility and tissue-resemblance, making them ideal platforms for local treatments [1]. Poloxamer polymers form nanostructured hydrogels through spontaneous, temperature-sensitive self-assembly [2]. Some amphiphilic molecules, such as surfactants, can also form gels via self-assembly into tubular structures which can be pH and temperature-sensitive allowing the controlled release of encapsulated bioactive molecules [3]. The combination of both components gives rise to a novel stimuli-responsive surfactant-polymer hybrid system with potential for topical application.

In this work, our goal was to investigate the interactions between surfactant tubules and a poloxamer hydrogel matrix. For this we used the lysine-based surfactants 14Lys10 and 10Lys14 to form pH- and temperature-sensitive tubules, which were then dispersed in poloxamer hydrogels of differing polymer concentrations, formed by either Pluronic F127 or P84 (Figure 1). Surface tension measurements were used to evaluate the interfacial behaviour of both components individually and when mixed, and thus study their molecular interactions. Structural characterization was carried out using light microscopy and cryo-SEM. Thermodynamic parameters, relating both to the neat and mixed hydrogel phase transitions, were obtained through DSC. Additionally, the rheological profile of the gels was evaluated through various rheometric tests, to determine significant parameters such as flow point, zero-shear viscosity, linear viscoelastic range and temperature-induced rheological transitions [4].

Keywords: Poloxamer hydrogel; Lysine-derived surfactants; smart-drug delivery; stimuliresponsiveness; nanomedicine.

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References

[1] Marzi, M., Rostami Chijan, M., & Zarenezhad, E. (2022). Hydrogels as promising therapeutic strategy for the treatment of skin cancer. *Journal of Molecular Structure*, *1262*(3), 133014. https://doi.org/10.1016/j.molstruc.2022.133014

[2] Russo, E., & Villa, C. (2019). Poloxamer Hydrogels for Biomedical Applications. *Pharmaceutics*, *11*(12), 671. https://doi.org/10.3390/pharmaceutics11120671

[3] Oliveira, I. S., Machado, R. L., Araújo, M. J., Gomes, A. C., & Marques, E. F. (2021). Stimuli-Sensitive Self-Assembled Tubules Based on Lysine-Derived Surfactants for Delivery of Antimicrobial Proteins. *Chemistry - A European Journal, 27*(2), 692–704. https://doi.org/10.1002/chem.202003320

[4] Stojkov, G., Niyazov, Z., Picchioni, F., & Bose, R. K. (2021). Relationship between structure and rheology of hydrogels for various applications. *Gels*, *7*(4). https://doi.org/10.3390/gels7040255



Figure 1: Molecular structure of (A) Lysine-based surfactants and (B) F127 and P84 poloxamers; Cryo-SEM images of (C) surfactant tubules and (D) surfactant-polymer mixtures.

20773 | Computational modelling of electrodes for lithium-ion batteries

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Abstract

After their discovery, carbon nanomaterials have been theoretically and empirically studied for a wide gamma of applications. The unique properties seen in these substances solidified them as the most common anode in lithium-ion batteries (LIB) and tailor the future of humanity energetic footprint. On that grounds, this study proposed and analysed, through density functional theory (DFT) calculations, several carbon-based compounds as potential candidates to be implemented in LIBs [1].

The electronic properties of graphene and graphyne-1, with and without several substituents, were theoretically estimated to verify their aptitude as electrodes for LIBs. The results show that the nitro and carbonyl substituted graphene and graphyne were the most promising ones while fluorine and other ligands did not appear to enhance the potential of electrode.

Keywords: lithium-ion battery (LIB); electrode; density functional theory (DFT); graphene; graphyne; carbon nanomaterial.

References

[1] Kim, S., Kim, K. C., Lee, S. W., & Jang, S. S. (2016). Thermodynamic and redox properties of graphene oxides for lithium-ion battery applications: a first principles density functional theory modeling approach. *Physical Chemistry Chemical Physics*, *18*(30), 20600-20606.



Figure 1: Pristine graphene and pristine graphyne respectively.

20810 | Atomistic MD simulations of adsorption of greenhouse gases in magnetic ionic liquids

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Abstract

The increasing levels of toxic and greenhouse gases (CO_2 and NH_3) emissions urge new efficient techniques of gas capture and separation. An additional attractive outcome of such separation is further reutilization of otherwise pollutant gases [1].

Due to their outstanding properties, such as low vapor pressure and melting point, ease in adjustment of composition to control gas solubility and selectivity, ionic liquids (ILs) have been a common choice for gas capture [2]. Currently, magnetic ionic liquids (MILs) have gained attention due to their ability to respond to external magnetic fields as their hydrophobicity and magnetic susceptibility makes them promising solvents for separations [3].

This work focuses on theoretical approach to describe the adsorption of toxic gases in MILs using trihexyl(tetradecyl)phosphonium cation, $[P_{66614}]^+$, paired with metal-based anions, namely, tetrachloroferrate(III), $[FeCl_4]^-$, tetrachloromanganate(II), $[MnCl_4]^{2^-}$, hexachlorogadolinium(III), $[GdCl_6]^{3^-}$ (see Fig. 1). The study was performed through molecular dynamics (MD) simulations, a fast and eco-friendly technique. It allowed to address the CO₂ capture process by different MILs, as well as the efficiency of capture of different potentially dangerous gases by $[P_{66614}][FeCl_4]$ MIL. In this research, the solvation free energy was computed, as well as the structural characteristics in terms of radial and spatial distribution functions were analysed. The effect of the temperature was also accessed.

Keywords: magnetic ionic liquids; molecular dynamics; greenhouses gases.

Acknowledgments

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References

[1] Feider, N.O., et al., *Molecular dynamics simulations of a dicationic ionic liquid for CO2 capture*. Journal of Molecular Liquids, 2021. **335**: p. 116163.

[2] Singh, S.K. and A.W. Savoy, *lonic liquids synthesis and applications: An overview*. Journal of Molecular Liquids, 2020. **297**: p. 112038.

[3] Pierson, S.A., et al., Synthesis and characterization of low viscosity hexafluoroacetylacetonate-based hydrophobic magnetic ionic liquids. New Journal of Chemistry, 2017. 41(13): p. 5498-5505.



Fig. 1. Optimized geometries of studies ions and gases: (a) $[P_{66614}]^+$, (b) $[FeCl_4]^-$, (c) $[MnCl_4]^{2-}$, (d) $[GdCl_6]^{3-}$ anions, and (e) carbon dioxide, $[CO_2]$, (f) sulphur dioxide, $[SO_2]$, (g) ammonia, $[NH_3]$, (h) methane, $[CH_4]$ gases. The black, white, marron, green, pink, cyan, purple, red, yellow, and blue spheres represent carbon, hydrogen, phosphorus, chlorine, iron, manganese, gadolinium, oxygen, sulphur, and nitrogen atoms, respectively.

20729 | To dimerize or not to dimerize: A computational study of sPLA2 in vipers' venom

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Abstract

Almost 350 men, women and children die from snakebite envenoming daily. Out of the 20 neglected tropical diseases (NTDs) recognized by the World Health Organization, snakebite envenoming is the only one that is not infectious. However, it is responsible for the same number of deaths per year compared to the other diseases on the list.

Since 1901, the only cure available to address this NTD has been an antibody-based treatment that consists of antibodies produced by large mammals' immune systems in response to small amounts of the injected venom. Unfortunately, this treatment is highly costly, needs cold storage conditions and several doses, that are frequently followed by adrenaline shots. Finally, it can lead to several failures, due to its high specificity regarding the snake species.

The lack of information regarding the structural characteristics of the venom's proteic composition is a barrier that needs to be overcome in order to develop a new, less expensive, and easy-to-store alternate treatment. To fulfill this necessity, this research seeks to answer whether the phospholipase A₂, a principal snake venom component, dimerizes in solution and, if so, which conformation it will adopt.

First, we performed molecular dynamics simulations on the *Bothrops asper* viper's sPLA₂ dimer to mimic how its structure would behave in a biological environment.

Given the results and the emerging data that states a broad range of dimeric conformations, our next step focused on a structural comparison between the dimers that were experimentally obtained for various types of vipers.

Furthermore, the different varieties of conformations were grouped according to their similarity. Finally, for each group, molecular dynamics simulations were carried out.

To our knowledge, this is the first structural study that seeks the answer to a life-long question — if there is a more favorable $sPLA_2$ dimer conformation or if the enzyme does not dimerize at all.

Keywords: viper; venom; molecular dynamics; dimer.

References

[1] Puzari, U., Fernandes, P. A., & Mukherjee, A.K. (2021). Advances in the Therapeutic Application of Small-Molecule Inhibitors and Repurposed Drugs against Snakebite. In *Journal of Medicinal Chemistry* (Vol. 64, Issue 19).

[2] Gutiérrez, J., & Lomonte, B. (1995). Phospholipase A2 myotoxins from Bothrops snake venoms. In *Toxicon* (Vol. 33, Issue 11).

[3] Oliveira, A.L., Viegas, M.F., da Silva, S.L. *et al.* (2022) The chemistry of snake venom and its medicinal potential. *Nat Rev Chem* **6**, 451–469.



Figure 1: Graphical depiction of the molecular dynamics simulations that were performed on the *B. asper* viper's sPLA₂ dimer.

20845 | Development of polymeric nanoparticles to ameliorate catechol-Omethyltransferase inhibitor induced hepatotoxicity

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Abstract

Parkinson's disease (PD) is the second most prevalent neurodegenerative disorder and is characterized by the loss of dopaminergic neurons with a consequent depletion of the neurotransmitter dopamine (1). Despite that catechol-O-methyltransferase inhibitors, such as tolcapone, are the most used in PD therapy to reduce the clinical symptoms, the chronic supplementation of these type of drugs leads to mobility's fluctuation up to 70% of the patients (2). Furthermore, tolcapone has a highly hepatotoxic profile, leading to the introduction of a "black box" warning and intensive monitoring requirements during its application (3).

Recent developments in nanoscience allowed for the development of new functional nanomaterials with well-defined properties that can be part of a solution to solve several drawbacks, namely cytotoxic aspects (4).

With this in mind, the aim of the project is the development of a new polymeric carrier based on poly (lactic-co-glycolic acid) (PLGA) nanoparticles with controlled drug release features in order to overcome the hepatotoxic issues of tolcapone. In this work, the optimization of the encapsulation of tolcapone in PLGA nanoparticles was performed using nanoprecipitation method (5). Various synthetic procedures were performed to tune both morphological and physicochemical features of these nanoparticles. For each process the size, surface charge, encapsulation efficiency and controlled drug release kinetics were evaluated using dynamic light scattering and ultra-high performance liquid chromatography. Additionally, the cytotoxic profile of the best nano formulations was also evaluated in hepatocarcinoma (HepG2) cells as *in vitro* model.

Our findings showed that PLGA nanoparticles presented a typical biphasic release profile and an improvement of the cytotoxicity profile in comparison to the free tolcapone in HepG2 cells. In the future, the permeability of optimized nanoparticles will be evaluated in relevant *in vitro* cell-based models.

Keywords: Parkinson; COMT inhibitor; drug release; hepatotoxicity; PLGA nanoparticles.

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References

[1] P. Nirale, A. Paul, K. S. Yadav, *Life Sci* **245**, 117394 (2020).

[2] M. Fabbri, J. J. Ferreira, O. Rascol, CNS Drugs 36, 261-282 (2022).

[3] C. W. Olanow, a. t. T. A. Panel, Archives of Neurology 57, 263-267 (2000).

[4] M. Pinto et al., Ageing Research Reviews **79**, 101658 (2022).

[5] C. Fernandes et al., ACS Applied Materials & Interfaces 10, 39557-39569 (2018).
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Abstract

Electron correlation has been extensively studied in the last decades due to its central role in physical and quantum chemistry. The nature of this energy still eludes the chemists, being frequently distinguished in various forms, such as dynamic and static correlation.¹

In this work, some naphthalene and fluorene derivatives were studied with the aim to comprehend how the correlation energy in relatively large aromatic systems behaves when certain changes to the molecule structure are made. To achieve this, the compounds were firstly synthesized and characterized using UV-Vis and NMR spectroscopy. The standard molar entropies, enthalpies and Gibbs energies of sublimation were measured using the Knudsen Quartz Crystal Effusion technique, by measuring the vapor pressures as a function of temperature. The standard molar enthalpies of formation in the crystalline phase were determined by mini-bomb Combustion Calorimetry. Using these results, the standard molar enthalpies of formation in the gas phase were derived. With the use of the homodesmotic reaction scheme shown in Fig. 1, the π conjugation energy in the molecules studied was experimentally quantified, and its dependence on molecular structure (type of spacer and position of phenyl rings) analysed. Molecular energetics was tentatively described by computational calculations using various levels of theory: DFT, HF, MP2, Coupled Cluster, and Configuration Interaction. Most of the molecules studied exhibited noteworthy energetic stabilization as a consequence of π conjugation, which was also manifested in their optical properties and more planar molecular structures (lower phenyl-spacer dihedral angles). However, the HF, MP2, and DFT results were unable to describe the experimental findings, suggesting the importance of static correlation in these systems.

Acknowledgments

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References

[1] Raghavachari, K.; Anderson, J. B. Electron Correlation Effects in Molecules. The Journal of Physical Chemistry 1996, 100 (31), 12960–12973.



Figure 1: Homodesmotic reaction in the gaseous phase used in this study.

20979 | Pyrrolidine-fused chlorin conjugated gold nanoparticles for photodynamic therapy

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Abstract

Cancer is one of the deadliest diseases of today. Current treatments, such as radiotherapy and chemotherapy, can lead to serious side effects due to non-specific cell destruction. To reduce these side effects, new approaches are being developed. Photodynamic therapy (PDT) consists of the administration of a photosensitiser (PS) that can be excited by light of a specific wavelength, ideally in the phototherapeutic window (650-850 nm) [1]. In the presence of oxygen, the excited PS leads to the production of reactive oxygen species (ROS), affecting the tumour cells and surrounding blood vessels, leading to tumour destruction.

Ideally, the PS should have a high affinity for tumour tissue. Here, the use of transport systems can enhance the action and targeting of the PDT. Gold nanoparticles are promising due to their low toxicity, biocompatibility, and easy functionalisation [2] with both photosensitiser and targeting molecules.

This work aims to find new pathways to conjugate synthetic chlorins with gold nanoparticles (AuNPs) and find new chemical properties to improve the photosensitisation process. As part of this research, a pyrrolidine-fused chlorin was synthesised through the 1,3-dipolar cycloaddition reaction of *meso*-tetrakis(pentafluorophenyl)porphyrin with azomethine ylides [3]. This chlorin with a free amine can react with the carboxylic of 11-mercaptoundecanoic acid (MUA)- coated gold nanoparticles *via* carbodiimide (EDC) / *N*-hydroxy succinimide (NHS), forming an amide bond. Synthetic procedures and characterisation of the resulting ChlorNH₂ – AuNPs conjugate will be addressed. There were verified three pieces of evidence of bonding: (i) a shift in absorption band related with AuNPs, (ii) the drop of both nanoparticles and chlorin absorption bands after centrifugation, and (iii) the resulting pellet's emissive properties at 650 nm.

Furthermore, new pyrrolidine-fused chlorins are being synthetised to develop new pathways to nanoparticle conjugation.

Keywords: Photosensitisers; Chlorins; Gold nanoparticles; Photodynamic therapy.

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References

- [1] Dabrowski, J.M. et al. (2016). Coordination Chemistry Reviews 325, 67–101.
- [2] Sperling, R.A. et al. (2008). Chemical Society Review 37, 1896-908.
- [3] Almeida, J. et al. (2021). Organic & Biomolecular Chemistry 19, 6501-6512.



ChlorNH₂ – AuNPs Conjugate

Photodynamic Therapy

Figure 1: ChlorNH2- AuNPs conjugate for PDT.

20539 | Searching for new antifungals to combat the multidrug resistant fungi

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Abstract

Fungal pathogens and infections have been an increasing public health concern in the last decades due to the increase of immunocompromised patients and the microbial resistance to commonly used antifungal drugs. The search for new antifungal compounds arises to contest these issues, and as well the limited treatment options with associated tolerability and toxicity problems, drug-drug interactions, low spectrum of action and others.

Eugenol is a natural product who has demonstrated several promising activities, such as antifungal activity. Furthermore, several eugenol derivatives have proven to be effective antifungal agents, which led to the idea of creating new eugenol hybrids.

In this work, eugenol hybrids from marine compounds, previously synthesized by our research group, were tested for antifungal activity. The antifungal activity was measured using the broth microdilution method in terms of the minimum inhibitory concentration (MIC) and accordingly to the CLSI protocols. Additionally, new eugenol compounds were designed inspired by ibrexafungerp, a recently approved antifungal agent, with the intent to subsequently test their antifungal activity.

Herein the MIC results and the synthetic procedure for obtaining new derivatives by "click chemistry" reactions will be presented.

Keywords: novel antifungals; hybrids; antifungal activity.

Acknowledgments

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CRIMINOLOGY AND LAW



21185 | Factors which influence prosecutors' decisions to charge or to not charge in rape crimes against women: the (dis)crediting of the victim

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Abstract

Prosecutors play a crucial role in criminal procedure's outcomes, being labelled as the "gatekeepers" of criminal justice. Many rape cases do not progress beyond the investigation stage, which makes the identification of the factors associated with Prosecutors' decision-making particularly relevant. Hence, this investigation aims to analyse and identify the factors which indicate the discrediting of female rape victims, and how they influence the prosecutorial decision to press charges on a rape case, through a qualitative analysis, allied with quantitative elements. For that purpose, the data collection was carried out by analyzing 80 cases processed in the Departamento de Investigação Criminal (DIAP) of Oporto, particularly 40 decisions to prosecute and 40 decisions to not prosecute, between January 2015 and December 2021, using content analysis technique. Based on the reviewed literature, two groups of factors associated with prosecutors' decisions were identified, namely, legal and extralegal factors, which include victim, offender, incident, and process characteristics. The results obtained suggest that the prosecutors' decision to charge or to not charge is influenced, primarily, by legal factors, such as the assessment of the victim's statements, which act a first procedural "sieve" that defines the course of the investigation. Nonetheless, and especially concerning the decision to not charge, extralegal factors play an important role, especially in cases where evidence (preponderant legal factor) is scarce and, therefore, prosecutors are led to assess the victim's credibility with recourse to extralegal factors. Amongst the latter, victim cooperation, whose absence impedes the gathering of evidence, and resistance to the assault stand out and are reflected, in a qualitatively differentiated manner, in the decision to charge and to not charge.

Keywords: Rape; prosecutorial decision; credibility; legal factors; extralegal factors.

20829 | Hate crimes against LGBT community replication of Walters, Paterson, Brown, and McDonnell study

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Abstract

Although there are no Portuguese statistics on hate crimes against the LGBTI+ community (lesbian, gay, bisexual, trans, intersex), several studies by the FRA (European Union Agency for Fundamental Rights) show that this social group is highly victimized due to its characteristics. One of the studies found that, in 2019, 58% of LGBTI+ participants reported having, in the last five years, offensive or threatening situations at work, on the street, on public transport, in a store, or on the internet, including sexual incidents (FRA, 2020). This type of crime, as explored throughout this work, has a significant direct and indirect impact both psychologically, verbally, physically, and socially.

Despite the prevalence of this crime in the lives of LGBTI+ people, this is still a topic very little explored by academic research, especially regarding trans people and their secondary victimization. This lack of research is particularly noticeable in Portugal, compared to some countries (such as Brazil), demonstrating that they are more advanced in this matter. Also important to notice that not all countries have legislation on hate crimes (Perry & Franey, 2019), and even when there's legislation, gender identity is not always included in the classification of hate crimes (Walters et. al., 2017), which shows how much greater attention to this topic is needed.

To fill the gap in Portuguese academic research, this investigation, using a quantitative methodology, aimed to provide an updated overview of hate crimes against LGBTI+ people based on a national and international literature review. Seeking to reflect the Portuguese context, it was implemented an adaptation of Walters et.al. (2017) study, to analyse in which way hate crimes against the LGBT community impact their indirect victims and how those perceive the action of law enforcement, public prosecution, and government regarding this crime. Specifically, the intention was to characterize the experiences of direct and indirect victimization, as well as compare the levels and prevalence of direct and indirect victimization among lesbians, gays, and bisexuals with people who identify as trans. Furthermore, the present study aimed to verify if there were any differences between the perceptions of LGB and trans people regarding the identities mentioned above.

The results show that more than half of the sample (63.1%; M = 3.59) reports having been a victim of verbal abuse/harassment, this being the most prevalent form of victimization. As for indirect victimization, the most prevalent form is also verbal abuse/harassment (83.1%; M = 5.57). It should be noted that, contrary to the conclusions of the original study, there are no statistically significant differences between the prevalence of direct and indirect victimization between LGB people and trans people.

It is important to state, that the majority of victimization suffered by LGBT people in the sample is due to hate crimes. Without the element of discrimination, LGBT people would experience less victimization.

Regarding the impact itself, it was possible to conclude that, in general, most people report feeling vulnerable (75.2%), insecure (79.9%), fearful (63.4%), avoid having demonstrations of affection in public for fear of being victimized (68.4%) and are afraid to share that they are LGBT

(55.8%). It should be noted that there are no statistically significant differences in feelings between LGB people and trans people.

As for the perception of the Government and Police, we conclude that, in general, there is a negative perception regarding the effectiveness of the mentioned institutions, and there were no statistically significant differences regarding this perception between LGB people and trans people. Likewise, there were no statistically significant differences regarding the influence of previous contact with the Police and the MP.

Keywords: LGBT, hate crimes, discrimination, victimization, police, legislation.

References

[1] Walters, M. A., Paterson, J., Brown, R. & McDonnell, L. (2017). Hate Crimes Against Trans People: Assessing Emotions, Behaviours, and Attitudes Toward Criminal Justice Agencies. Journal of Interpersonal Violence, 35, 21-22. 10.1177/0886260517715026

[2] Perry, J. & Franey, P. (2019). Policiamento de Crimes de Ódio contra pessoas LGBTI: formação para uma resposta policial profissional. Conselho da Europa. <u>http://cid.cig.gov.pt/Nyron/Library/Catalog/winlibimg.aspx?skey=05726608EEF84939BD8CC5AE</u> <u>B08B2700&doc=96615&img=141592</u>

[3] FRA - European Union for the Fundamental Rights. (2020). A long way to go for LGBTI equality. <u>https://fra.europa.eu/en/publication/2020/eu-lgbti-survey-results</u>

20569 | The role of social media as perpetuation mechanisms of victim blaming and slutshaming – an empirical study

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Abstract

Victim blaming emerges as a phenomenon marked by the increase of opinions and positions that blame victims for the crimes they were targeted by, arguing that they contributed – consciously or unconsciously – to their own victimization, thus being labeled by the public opinion as just as or more responsible than their offender. Mainly aimed at female victims of sexual violence, this blaming, often combined with slut-shaming narratives that seek to judge women based on their perceived sexual activity, promotes the scrutiny of the victim's conduct in search of their censorship, all while tries to justify or even excuse the conduct of the offenders.

These discourses are, in most cases, expressed in online social networks, platforms that have promoted not only the greater visibility of the phenomena under study, but also the proliferation of violent and misogynistic speeches against women.

The present investigation analyses four news about rape cases of women published online on the Facebook pages of two portuguese newspapers, with the scrutiny of a total of 313 comments. The selection of these news was carried out according to two criteria: the perception about the victim (ideal victim versus victim in a vulnerable state) and the relationship between victim and offender (known offender versus unknown offender).

Through the employment of content analysis on the online comments to the specified news, it was possible to conclude that, despite the vast majority of the observed speeches being against the offender, a very significant set of comments in the sample were composed of victim blaming and slut-shaming narratives that sought not only to blame the attack on the victim, their conduct and their state at the time of the rape, but also to discredit their victimization experience reported through, namely, their demonization. These and other results will be further discussed and the implications will be outlined.

Keywords: victim blaming, victims, rape, social networks, slut-shaming.

References

[1] Schoellkopf, Julia Churchill (2012). Victim-Blaming: A New Term for an Old Trend. Lesbian Gay Bisexual Transgender Queer Center, 33. https://digitalcommons.uri.edu/glbtc/33/

 [2] Sills, Sophie, Pickens, Chelsea, Beach, Karishma, Jones, Loyd, Calder-Dawe, Octavia, Benton-Greig, Paulette, & Gavey, Nicola (2016). Rape Culture and Social Media: Young Critics and a Feminist Counterpublic. Feminist Media Studies, 16(6), 935-951. https://researchspace.auckland.ac.nz/handle/2292/30994

[3] Stubbs-Richardson, Megan, Rader, Nicole E. & Cosby, Arthur G. (2018). Tweeting rape culture: Examining portrayals of victim blaming in discussions of sexual assault cases on Twitter. Feminism & Psychology, 28(1), pp. 90-108. https://doi.org/10.1177/0959353517715874

[4] Nascimento, Ana Luiza Tinoco (2017). "Cultura do estupro" e a culpabilização da vítima ou o arquétipo da Condessa Szemioth. [Dissertação de Mestrado] Faculdade de Direito da Universidade de Coimbra.

[5] Webb, Lewis (2015). Shame transfigured: Slut-shaming from Rome to cyberspace. First Monday, 20(4), 1-23. http://dx.doi.org/10.5210/fm.v20i4.5464

[6] Zaleski, Kristen L., Gundersen, Kristin K., Baes, Jessica, Estupidian, Ely, & Vergara, Alyssa (2016).
"Exploring rape culture in social media forums." Computers in Human Behaviour, 63, 922-927.https://doi.org/10.1016/j.chb.2016.06.036

20594 | Predictors of perceived wrongfulness and harmfulness of crime among residents in Portugal

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Abstract

Crime seriousness is increasingly central in contemporary criminal policy. In fact, crime seriousness assessments underly public discourse and legal theory and praxis, highlighting the potential of public perceptions of crime seriousness as a more rigorous and precise measure of crime seriousness. However, while the literature shows a considerable degree of intracultural and cross-cultural consensus on these perceptions, there also remains a significant amount of variation. Following this, the current work explores the two central components of crime seriousness – perceived wrongfulness and harmfulness of crime – examining the extent to which sociodemographic characteristics, conservation values, legal cynicism, religiosity, and exposure to media coverage of crime are responsible for the heterogeneity present in them. A survey administered to 408 residents in Portugal indicates that only legal cynicism has a consistent impact on crime wrongfulness perceptions for the four crime groups considered and some impact on crime harmfulness perceptions for lighter scenarios of conventional crimes. As for conservation values and religiosity, the only effects are seen, respectively, on perceived wrongfulness and perceived harmfulness of heavier scenarios of conventional crimes. Exposure to media coverage of crime does not seem to inform judgements on these two perceptions variables. Sociodemographic characteristics and victimization experiences explain little variation in crime seriousness, wrongfulness, and harmfulness judgements.

Keywords: Perceived crime seriousness, wrongfulness, harmfulness, conservation values, legal cynicism, religiosity, exposure to media coverage of crime.

20701 | Examining the role of Self-Control and Social Learning components in explaining malicious hacking behaviours

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Abstract

In the last few decades, the proliferation of the internet and the use of computers has profoundly changed criminal behaviour, starting to be held in cyberspace. One of the fastest-growing crimes is hacking, described as an illegal and unauthorized activity, associated with the intrusion and manipulation of a computer (Yar, 2006). Although it presents harmful impacts for victims, the criminal knowledge about its motives and predictors is underdeveloped, especially in the Portuguese context. The present study explores malicious hacking behaviours, having as the main objective to examine the applicability of two criminological theories in explaining these conducts. Specifically, we intend to analyse the role of self-control from Gottfredson and Hirschi's (1990) General Theory of Crime and the four components of Aker's (1998) Social Learning Theory. Data for the present research were collected through an online survey administered to a Portuguese sample (n= 680, 38.8% women), with an average age of 28 years. In total, 23.2% of participants reported practicing at least one malicious hacking behaviour in the last 12 months. The prevalence of malicious hacking behaviour was higher among males (28.9% in men versus 14.4% in women). Moreover, a negative relationship was found between self-control and the execution of hacking, in which individuals who practice these behaviours report lower levels of self-control than non-hackers. These results and their implications will be discussed.

Keywords: social learning; self-control; cybercrime; hackers; hacking; criminological theories.

References

[]1 Akers, R. L. (1998). *Social learning and social structure: A general theory of crime and deviance*. Boston: Northeastern University Press.

[2] Gottfredson, M. R., & Hirschi, T. (1990). A General Theory of Crime. Stanford University Press.
[3] Yar, M. (2006). Cybercrime and society. Sage Publications.

20676 | The relationship of social contacts with prisoners' mental health - a systematic review

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Abstract

Studies have consistently shown that the prevalence of poor mental health among prisoners is considerably higher than in the general population (Birkie et al., 2022). Prisoners with mental health problems will often have several other vulnerabilities, such as substance misuse, poor physical health, poor life skills and histories of trauma (Aureli et al., 2020; Baranauskiene et al., 2020; Benavides et al., 2019). However, it is not clear how common mental disorders are associated with the inmates' social life.

Therefore, this systematic review aimed to identify the relationship of social contacts with inmate prisoners' mental health. This includes assessing the strength of associations between social contacts, social support, social networks and social relationships and common mental disorders. This study has been conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). A protocol was developed and registered in PROSPERO. A search strategy was applied to four databases (Medline via OvidSP, PsycInfo, Scopus and Web of Science). The screening process of the retrieved publications was divided in two phases, conducted by two reviewers and supervised by two others. The quality assessment entailed the use of an adapted version of the Effective Public Health Practice Project (EPHPP) quality assessment tool for quantitative studies. The data is reported through a narrative synthesis.

A total of 2792 articles were retrieved in the initial literature search. After removing 742 duplicates, 2050 articles were incorporated in the initial title and abstract screening phase. During this phase articles were excluded if social contacts were not explicitly assessed and described by a validated instrument; if the studies did not address any association between social contacts and mental health and if they did not present a quantitative design. After the application of the exclusion criteria, the remaining articles were assessed for a full-text review.

This review's findings help to raise awareness of the risk and protective factors on prisoners' mental health, including overcrowding, enforced solitude, lack of privacy, isolation from social networks and insecurity about future prospects.

Keywords: Prison, Social contacts, Mental health, Systematic review.

References

[1] The relationship of social contacts with prisoners' mental health - a systematic review.PROSPERO2023CRD42023372942Availablefrom:https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42023372942

[2] Aureli, N., Marinucci, M., & Riva, P. (2020). Can the chronic exclusion-resignation link be broken? An analysis of support groups within prisons. Journal of Applied Social Psychology, 50(11), 638-650.

[3] Baranauskienė, I., Kovalenko, A., & Leonova, I. (2020). The social-psychological factors influencing women-prisoners' feeling of loneliness. Social welfare: interdisciplinary approach, 10, 56-65.

[4] Benavides, A., Chuchuca, J., Klaic, D., Waters, W., Martín, M., & Romero-Sandoval, N. (2019). Depression and psychosis related to the absence of visitors and consumption of drugs in male prisoners in Ecuador: a cross sectional study. BMC psychiatry, 19(1), 1-7.

[5] Birkie, M., Necho, M., Tsehay, M., Gelaye, H., Beyene, A., Belete, A., Asmamaw, A., Tadesse Tessema, Z., Bogale, K & Adane, M. (2022). Depressive, anxiety symptom frequency and related factors among prisoners during the COVID-19 pandemic in northeastern Ethiopia, a cross-sectional study. Frontiers in psychiatry, 13.

20767 | The contact of migrant women victims of crime with Portuguese criminal agencies

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Abstract

In this paper we intend to analyse the experience of contact between victimized migrant women in this country and the criminal police agencies. Through the application of Narrative Analysis as a qualitative methodology, under the specific framework of Narrative Victimology, we intend to understand the victims' perspective on the impact of their migrant status on the treatment received at the criminal police agencies, on their satisfaction with the assistance provided, and on the occurrence of secondary victimization. The research data are collected from semistructured interviews conducted in an online format with victims who sought assistance at police agencies. By means of the narrative analysis of the data, it is verified in terms of results that, just as a satisfactory police assistance service can be developed, countless failures and mistreatment may occur when approaching the victims, resulting from the reproduction of stereotypes and inadequacies regarding the victim identity, which translate into preconceived judgments, guilt, lack of cultural sensitivity and of adequate orientation, which may lead them to relive pains already felt when suffering a crime. To these negative consequences Victimology calls secondary victimization which, in Robalo's (2019) understanding, is derived from the reaction of individuals or institutions to the experience lived by the victim and can encompass the depreciation that law enforcement agencies may manifest towards the victim. Added to vulnerability after suffering victimization, these women experience differentiated challenges resulting from their migration status, which sometimes intersect with other factors such as gender, race, class, type of crime, and can potentiate the occurrence of further harm. It is a scenario that deserves attention in view of the constant migratory flows and the feminization of migration, which have also brought to the center of the victimological debate new issues to be analysed.

Keywords: Migrant Status; Intersectionality; Secondary Victimization.

References

[1] Robalo, T. (2019). Breve Introdução à Vitimologia. Edições Almedina.

20875 | The Verde Eufémia Movement in Silves revised: What do the Portuguese Government and the Media have to say?

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Abstract

Mainstream research about terrorism has focused primarily on religious and far-right extremism over the last few decades. However, environmental extremism has also been raising concerns. Due to climate change and the ingrowing number of people mobilizing politically around the phenomenon, it is believed that violent manifestations of environmental extremism will grow in frequency and intensity. In Portugal, one of the most prominent events occurred in 2007, when the group Verde Eufémia raided a field of transgenic modified corn in Silves, destroying about one hectare of corn. This event was classified by Europol as an act of single-issue terrorism. However, little is known about how this event was perceived and interpreted at the national level. The present study aims to analyse political and media discourses around what occurred in Silves. The goal is to understand the perceptions and interpretations this event held in political and media discussions, namely in terms of extremism and terrorism. For that purpose, a qualitative research was carried out, analyzing parliamentary debates on this topic, the Internal Security Annual Report of 2007, the year of the incident, (Relatório Anual de Segurança Interna [RASI] 2007), and media articles.

Preliminary results show that the Portuguese government did not recognize the event as more than a simple act of property destruction. In that sense, it ended up being accused by the political opposition of legitimizing the acts and for not taking an adequate legal action against the group of extremist activists.

Moreover, the RASI 2007 also did not identify the event as any form of extremism or terrorism. Finally, media also covered the event mostly as an act of property destruction, naming the perpetrators as mere "activists". However, it was emphasized that the police forces and the government should not have acted so passively and permissively. Results will be discussed in light of extremism and terrorism literature.

Keywords: environmental activism; extremism; terrorism; Verde Eufémia.

20764 | Public discourse towards volunteering in prisons: An infodemiology study of Twitter data

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Abstract

Worldwide volunteering plays a key role in society by helping many people who face different challenges and problems. Among the different types of volunteering, features volunteering that supports people in jail. Prison volunteering contributes to the rehabilitation of prisoners in their community and wider society. However, little is known about the general population's attitudes toward prison volunteering. Research using Twitter data has been increasing since it provides open and easy access to its public content and aims to measure the user's interest and attitude towards a certain area.

This study aimed to identify the general population's attitudes toward prison volunteering. We conducted a content analysis of publicly available data on the social network Twitter during the period from January 1st, 2017 to October 26th, 2022. Each tweet collected through Tweet Binder was examined and categorized based on a codebook that was created to match this study's research question. This codebook consisted of classifying the tweets according to the type of content (Volunteering opportunities, Volunteering experiences, Prisoners as providers, Prisoners as recipients, Volunteering as jail time alternative, and Volunteering impact); quantifying as positive or negative, and the type of user (Prisoners who provide volunteering support to other, Volunteers who provide support to prisoners and unidentified user). An emotion analysis was also conducted, as well as an analysis of the number of retweets and likes generated by each tweet as an indicator of user interest.

In a total of 5001 tweets in Portuguese, the content most posted about was about Volunteering as a jail time alternative. A total of 1193 of the tweets were classified as positive, 354 were negative and 3454 were neutral. With respect to the emotion analysis, anger was the most expressed among the users, and regarding the type of users, the majority were unidentified users.

Keywords: Volunteering; Prisons; Social Media; Twitter; Attitudes.

21144 | Visual patterns in phishing identification: An eye-tracking study

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Abstract

Phishing is one of the fastest growing fraudulent practices and represents several risks to victims and society in general. One of the most common means to launch phishing attacks involves sending a fraudulent email in which the attacker acts as a reputable entity in order to deceive people into revealing sensitive information.

The present research intends to understand how individuals analyse these phishing emails and identify them correctly or not. Concretely, it aims to explore which are the common elements (e.g., sender email, hyperlinks) that individuals pay attention to not fall into phishing. Taking these objectives into consideration, eye tracking methodology allows us to investigate the visual patterns in email inspection and may provide insights into understanding what are the most important elements to decide if the email is phishing or not. For this study, 30 emails (15 legitimate, 15 phishing) were subdivided into two groups (G1, G2) and presented to participants who watch a set of 15 emails. After seeing each email, participants were asked to distinguish between phishing and legitimate emails. The sample was composed of 40 participants (70.5% female, mean age 28 years) invited to participate among university members and social media.

Overall, it was found that individuals identify the emails more correctly when they take longer to look at the salutation's email (p=.014). They also identify the emails more correctly when looking more at the body of the email (p=.045) and at the urgency elements (p=.046). Moreover, when emails are phishing individuals look more at the sender's email (p=.038). Other common features of phishing emails such as misspellings, in the current study, did not present a relationship with the correct email identification.

The implications of the findings are discussed in the light of literature.

Keywords: phishing; emails; identification; eye-tracking.

21181 | Mass media and fear of crime: a multi-methodology

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Abstract

Fear of crime is a multifaceted phenomenon that cannot be solely explained by crime rates, but also by other individual, social and contextual factors. Among them, one of the best predictors of fear of crime is gender, in which has been discovering that women report higher levels of fear of crime despite being less likely to be victimized. Explanations have been developed to address this paradox, such as the Shadow Hypothesis, which claims that women believe that any crime will culminate in sexual assault or rape, of which they will be victims (Ferraro, 1995). Additionally, it is also known that in what concerns to crime, the media tend to distort its coverage, by exaggerating the frequency and severity of the rarest offenses and undervaluing the most common ones, which helps to increase fear of crime.

Although the relationship between fear of crime, gender and media has been scientifically explored, most of studies are based on surveys or interviews. Therefore, the current study, experimental in nature, uses Eye Tracking techniques to understand women's perceptions to urban environments after reading news which varied in the type of crime. Furthermore, it explores how general fear of crime, previous victimizations and media consumption influence the perceptions of urban contexts.

Three groups of participants were created, according to the presented conditions of news (rape, robbery and no crime - neutral) from a national newspaper, and a set of 10 urban pictures distinguished by the degree of insecurity were selected. Pre-test was undertaken and results showed that individuals focus their gaze on cues evidenced in the scientific literature as associated with fear of crime, such as graffiti and deteriorated properties; Moreover, in the images with lower levels of insecurity, their gaze is directed towards people, and mainly, to the prospect of the image. These and other results will be presented and discussed.

Keywords: fear of crime; feeling of insecurity; mass media; eye tracking; multi-methodology.

References

[1] Ferraro, K. F. (1995). *Fear of crime: Interpreting victimization risk*. State University of New York.



20403 | Industry 4.0 Open Innovation Ecosystems: Transformations induced by digitalization

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Abstract

Digitalization has, throughout the last decade, increasingly gained attention from scholars and practitioners, due to its possibly redefining role for the economy and society. Previous studies have demonstrated that due to the 4th industrial revolution, organisations would face both challenges and opportunities, which will ultimately lead to business model innovation. Concurrently, it has been proved that the University-Industry linkages can boost businesses innovation capabilities. However, very little information is available regarding how Industry 4.0 is altering the Portuguese open innovation ecosystem. Additionally, it is lacking research on novel Industry 4.0 business models and how Universities can participate as strategic partners, in the development of business model innovation.

Therefore, based on an in-depth qualitative methodology, an analysis is performed on the current state of University-Industry linkages surrounding the University of Porto, as well as an assessment of how Industry 4.0 can affect these linkages. In addition, it is analysed a business model prompted by transformations Industry 4.0-related. The findings will provide managerial and University level decision-makers with supporting evidence for policy suggestions.

Overall, the findings suggest that, currently, firms are more available to engage in partnerships with Universities, specifically to attract talent and knowledge. Both University and Industry agents consider Industry 4.0 as a potential disruptor which will lead to the approximation of both organisations. Regarding business model innovation, the selected business model seems to fit the characteristics of Industry 4.0 business models.

Consequently, business policy makers who aim to reinforce their innovation capabilities, in an increasingly competitive business landscape, should consider including Universities as key strategic partners, when engaging in business model innovation strategies. University policy makers should take action to showcase the knowledge (namely technologies and services) created internally, in order to help firms increase their innovation capabilities, accelerate the 4th industrial revolution and, consequently, catalyse the region's economic growth.

Keywords: Enterprise; Automation; Innovation; Open Innovation; Industry 4.0.

Acknowledgments

I would like to acknowledge the contribution of all the interviewees. The knowledge shared was vital for the development of this research project. Above all, I hope I can contribute to their practice with the results.

21230 | Portugal and Germany: Economic relationship during World War II (1939-1945) Monteiro, Patrícia, FLUP, Portugal

Abstract

This paper focuses on the economic relations between Portugal and Germany during the Second World War. Faced with the dichotomy between its treaty with an old ally, the Great Britain, and its ideological affinity with the views of the totalitarianisms fighting for the Axis, Portugal adopted a policy of (false) neutrality. This allowed it to have a more independent position and to act along the flows of the economic business, opting for the most favorable. After 1940, the relations between Portugal and Great Britain were drastically affected by the actions and divergencies between Salazar and the British government, namely the abandonment of the neutrality status in an hypothetical case of German invasion of the peninsula; the destruction of certain mainpoints in Portugal to slow down German advancement; and the "Schell network" created in 1941 by the Special Operations Services of Great Britain counting with the helping hand of PCP members and oppositionists to Salazar's regime. On 22 June 1941, Germany started the attack to the Soviet Union, creating a movement against the spread of communism and the support of the Germans. Against this backdrop, this paper aims to understand the major correlation between German needs and Portugal's exportation. It does so by studying the treaty of 24 January 1942, according to which Portugal should export wolframium to the 3rd Reich in exchange for German products and, in last case scenario, convertibles to gold. Even though Portugal had mainly commercialized with the Great Britain, during 1941 and 1943, Germany became the second largest importer of Portuguese products. The novelty we aimed to bring is a new perspective in this subject using the Marxism theory of the International Relations, which focus on the oppression inherent to the capitalism regime, and studying how the small state of Portugal may have been pushed to certain decisions by the influence and fear of Germany as a powerful state.

Keywords: History, International Relations, Economics, Salazarism, Nazism.

References

[1] LOUÇÃ, António - Portugal visto pelos nazis: documentos 1933-1945. Lisboa: Fim de século, 2005.

[2] LOUÇÃ, António - Hitler e Salazar: comércio em tempos de guerra. Lisboa: Parsifal, 2022.

[3] LOFF, Manuel - O nosso século é fascista! O mundo visto por Salazar e Franco (1936-1945).Porto: Campo das Letras, 2008. (Campo da história). ISBN 978-989-625-256-4.

[4] LOFF, Manuel - Salazarismo e Franquismo na época de Hitler (1936-1942): convergência política, preconceito ideológico e oportunidade histórica na redefinição internacional de Portugal e Espanha. Porto: Campo das Letras, 1996. (Campo da história). ISBN 972-610-000-3.

[5] TELO, António José - A neutralidade portuguesa e o ouro nazi. Lisboa: Quetzal, 1989. ISBN 972-564-419-0.

[6] Nunes, João Paulo Avelãs - O Estado Novo e o volfrâmio (1933-1947): projectos de sociedade e opções geoestratégicas em contextos de recessão e de guerra económica. Coimbra: [Edição do Autor], 2005.



ENGINEERING



20834 | Energy and performance aware multi-drone placement for fustainable flying networks

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Abstract

Unmanned Aerial Vehicles (UAVs) are used for a wide range of applications. Due to their capability to operate almost everywhere, their ability to hover above the ground, and their capacity to carry cargo on-board, UAVs are perfect platforms for carrying communications nodes, including Wi-Fi Access Points. This gave rise to the concept of flying networks. In scenarios where the deployment of terrestrial networks is not feasible, the use of flying networks emerged as a solution to provide wireless connectivity. Flying networks are especially suitable for temporary events, such as disaster management scenarios and crowded events. However, the management of the communications resources in flying networks imposes significant challenges, especially regarding the positioning of the UAVs so that the Quality of Service (QoS) offered to the ground users served is maximized. Moreover, unlike terrestrial networks that are directly connected to the electrical grid, UAVs rely on on-board power sources that need to be recharged. In order to maximize the UAVs' flying time, the energy consumed by the UAVs needs to be minimized. For single UAV placement, different solutions that consider energy consumption have been proposed in the literature. When it comes to multi-UAV placement, the state-of-the-art solutions focus on maximizing the coverage area. However, they do not address the energy-aware multi-UAV placement problem in networking scenarios where the ground users may have different QoS requirements and may not be uniformly distributed across the area.

We propose an energy-aware multi-UAV placement algorithm able to define the minimum number of UAVs required and their optimal trajectories, in order to minimize the energy consumption in a flying network providing wireless coverage while ensuring the targeted QoS requirements. Preliminary results show significant energy efficiency gains without compromising the network performance offered when using the proposed algorithm.

Keywords: Aerial Networks, Energy-aware, Flying Networks, Quality of Service (QoS), Unmanned Aerial Vehicles (UAVs), UAV placement.

20643 | Jet fighter real time tracker

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Abstract

The current project presents a Proof of Concept for developing an optical-guided air-to-air missile system, using Convolutional Neural Networks (CNN) in order to obtain object tracking reliability on a self-guidance lock-on against enemy planes.

To fulfil such requirements, a simulated environment was created using Unreal Engine 4 (UE4), taking inspiration from other simulators for AI applications. The environment is composed of open assets downloaded from the UE4 Marketplace. It is procedural, with randomised variations of terrain being placed as the jet and missile progress through the map. The target Jet can assume two different appearances and flies on a predetermined route with speed variations.

In total, one camera was used for aesthetics and two cameras for data gathering: one to capture the missile perspective and other for the respective segmentation ground truth. By using a simulated environment, a large and diverse dataset can be generated for training without additional costs.

To achieve the proposed goal, a semantic segmentation model was used, relying on a ResNet50 backbone and FPN decoder architecture. The ResNet50 is a popular CNN that uses a residual system to allow the network to be deeper [1], while The FPN decoder works based on a top-down pyramid, enabling it to handle different feature sizes for upscaling [2].

The model was trained with two class-weighted losses combined, focusing on tackling the imbalances of the generated datasets, in both number and size of each class' examples. As a result, the model achieved a combined loss of 1.77, Intersection over Union of 0.79, and precision of 88%. Specific features, like bounding boxes, and an estimation of rotation and altitude were extracted from the segmentation using traditional Computer Vision techniques.

This work presents a concept on using CNNs for missile guidance through image detection. The objective was accomplished, but future work includes training a fully autonomous missile using reinforcement learning.

Keywords: Computer Vision; Deep Learning; Convolutional Neural Networks; Semantic Segmentation; Object Detection.

Acknowledgments

This work was developed as the final project for Computer Vision classes lectured by Professor Miguel Tavares Coimbra and Professor Hélder Filipe Pinto de Oliveira.

References

[1] He, K., Zhang, X., Ren, S., & Sun, J. (2015). Deep Residual Learning for Image Recognition. doi:10.48550/ARXIV.1512.03385;

[2] Lin, T.-Y., Dollár, P., Girshick, R., He, K., Hariharan, B., & Belongie, S. (2016). Feature Pyramid Networks for Object Detection. doi:10.48550/ARXIV.1612.03144.



Figure 1: Frame extracted from the simulation



Figure 2: Ground-Truth segmentation image from Figure 1



Figure 3: Figure 1 version segmented by the proposed model



Figure 4: Feature extraction from the segmented image

20546 | Adaptive optics photometry and astrometry using machine learning

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Abstract

Context: Photometry and astrometry of stellar clusters is a key methodology in contemporary astronomy. Adaptive optics images exhibit a significant degree of spatial and temporal variability in the point spread function, which is challenging for classical approaches. These rely on point spread function fitting to detect and compute photometric and astrometric quantities. Machine learning techniques are extremely popular due to their precision, reliability, and computational cost, and they outperform their counterparts, especially on datasets with significant noise and variance. This is the particular context of adaptive optics.

Aims: Our goal is to develop an automatic point source-detector that provides reliable and complete photometry and astrometry of stellar cluster fields.

Methods: We will use simulated adaptive optics images of clusters with the ground truth to train the network and to quantify: a) the source detection efficiency; b) the accuracy of the photometry and astrometry of machine learning-driven algorithms compared to classical DAOPHOT-like approaches. We will then apply the algorithm to real data.

Results: We show that the algorithm has a significantly higher source detection efficiency than classical approaches. It obtained a much higher recall on simulated data when compared to DAOPHOT, reaching 63.7%, while DAOPHOT got 37.3%, both with very similar precision, 93.7% for our model and 96.3% for DAOPHOT. In real data, the model obtained 8507 coinciding predictions and 26225 extra predictions compared to the catalogue. While DAOPHOT only got 7175 coinciding predictions and 5430 extra predictions.

Keywords: Point source detection; Adaptive Optics; Machine learning; Object detection; Deep learning; Simulated Images; Photometry.

21092 | Conditional AI-based generation of diffusion MRI images

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Abstract

Quantitative MRI aims to extract reproducible measures in regards to tissue property. However, a single MRI contrast is only able to provide so much information, hence the need for combinations with other modalities for further exploration. It is here that Diffusion MRI is introduced, albeit with a catch: the bigger the dimensionality of the MRI Acquisition Space, the more the scan acquisition times become prohibitive, thus making multi-contrast MRI experiments somewhat ad hoc and time-inefficient, at least for clinical usage [1]. The project at hand intends to both shorten Diffusion MRI acquisition times and further expand and augment the dataset of this scan modality. Moreover, the final concept envisions the implementation of all manners of Machine Deep Learning algorithms to generate patient-specific Diffusion MRI scans within a range of certain user-defined scanner attributes, such as b Value, TI TE and Gradient Strength values. We propose various methods of artificially generating Diffusion MRI Scans, with varying degrees of success, which we can group into two categories: the voxel-wise ones, which attempt to have the model be more informed on how voxels from one settings combination correlate to others in the same position [2]; and image-wise models, which will recreate the image fully in a user-conditional manner. The project's main goal is, therefore, to output an algorithm that is able to generate images for new, never seen before patients with the required specificities and scanner parameter settings, so as to prevent said patient from spending immense amounts of time inside a MRI Scanner, as well as aid physicians and specialised radiologist in their diagnosis by providing accurate dMRI images for any requested settings, within a certain realistic range. By and large, results up until this point have been inconclusive as to the possibility of such Conditional Generation and though Simples models are able to generalise well for previously seen image parameter combinations, even for unseen Patients, the generation of images with nonprovided combinations still remains undone.

Keywords: Diffusion MRI; Generative Models; Deep Learning; Image Generation,

References

[1] C. Tax, F. Grussu, E. Kaden, L. Ning, S. Rudrapatna, J. Evans, S. St-Jean, A. Leemans, S. Koppers, D. Merhof, A. Ghosh, R. Tanno, D. Alexander, S. Zappala, C. Charron, S. Kusmia, D. Linden, D. Jones, and J. Veraart, "Cross-scanner and cross-protocol diffusion mri data harmonisation: a benchmark database and evaluation of algorithms", NeuroImage 195, 10.1016/j.neuroimage.2019.01.077 (2019);

[2] D. Moyer, G. Ver Steeg, C. M. W. Tax, and P. M. Thompson, "Scanner invariant representations for diffusion mri harmonization", Magnetic Resonance in Medicine 84, 2174–2189 (2020).



Figure 1: Example Slice for Test Patient: Original, Reconstruction & MSE Heatmap

20529 | Benchmarking of educational systems: Using Stochastic Frontier Analysis to assess country performance in education and training in the European Union

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Abstract

Education is a fundamental element for the advancement of society. It has an impact not only on individuals, but also on the growth of the economy and social development. Furthermore, it is important to ensure that education systems operate to maximize the results produced from the available resources, which are often constrained, i.e., to guarantee that existing assets are used efficiently. Therefore, it becomes imperative to measure efficiency in this sector by evaluating education systems. Stochastic Frontier Analysis (SFA) assumes relevance in this problem. Although multicollinearity makes it difficult to estimate in practice a translog production function, SFA has the advantage of evaluating efficiency while explicitly addressing statistical noise. By combining SFA and the Malmquist productivity index, we can evaluate convergence in the context of European education systems in light of the 2030 Strategic Framework for Education and Training. Ultimately, this work comprises a unique approach to address this knowledge gap regarding a subject where Data Envelopment Analysis is the predominant methodology. Preliminary results point to heterogeneous efficiency scores among the sampled education systems, with mixed findings in terms of the statistical significance of efficiency determinants. Further tests concerning these systems' convergence are required.

Keywords: Stochastic Frontier Analysis; European education systems; Malmquist productivity index; Convergence; Efficiency measurement.

Acknowledgments

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21241 | Analysis of educational outcomes in European regions

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Abstract

Recognizing that education is a critical factor in the development of society, the European Union has set the ambitious goal of becoming a global leader in delivering high-quality education and training. To achieve this goal, the EU has established the ET2030 framework, which outlines strategic objectives, benchmarks, and six indicators to be met in this field. However, given the diverse contextual conditions of European regions, it is crucial to evaluate the compliance of this strategy through an analytical and data-driven analysis that takes into account regional heterogeneity and the evolution of each region over time.

To this end, this research employs a composite indicator and a benefit-of-the-doubt approach that considers five out of the six ET2030 indicators. A robust conditional analysis using contextual variables is also developed to measure the relative efficiency of European Regions at a NUTS I level. Additionally, a trend analysis is conducted through a global Malmquist index, using data from several annual time series.

The methodology utilized in this research includes the Data Envelopment Analysis (DEA) technique, which enables the assessment of the efficiency of the decision-making units (DMUs) being compared. By employing DEA, it is possible to identify which regions are performing well and which regions may need to improve their education systems. Through this approach, the research aims to identify peers for each region, enabling them to learn from each other and draw policies that take regional heterogeneity and best practices into account.

Soon, the results of the analysis described above will be available. The necessary models to conduct this analysis are currently undergoing their final validation phase.

Keywords: Data Envelopment Analysis, Composite Indicator, Global Malmquist Index, Robust Conditional Analysis, Europe, Education and Training.

20616 | Effects of a graphene-based polymeric surface on marine biofilm development

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Abstract

Due to its economic and ecological consequences, biofouling is a widely recognised concern in the marine sector. One of the first and most important steps in marine biofouling is biofilm formation by microorganisms, which can contribute to subsequent colonisation and attachment by macrofouling organisms. In recent years, the search for non-biocidal-release antifouling coatings has increased, with carbon-nanocoated surfaces showing promising antifouling activity. This work aimed to investigate the antibacterial mechanisms of action of graphene, as well as to produce and assess the impact of a graphene-based polymeric surface on biofilm development by the representative marine bacterium Cobetia marina.

The effects of graphene nanoplatelets (GNP) on C. marina cells were evaluated by flow cytometry after exposure to 5 wt.% GNP for 24 h. Subsequently, a polydimethylsiloxane surface with 5 wt.% GNP (G5/PDMS) was synthesized and characterized concerning hydrophobicity and topography. The efficacy of this surface in mitigating biofilm formation was investigated over 42 days under controlled hydrodynamic conditions, simulating those found in real marine environments.

When treated with 5 wt.% GNP, C. marina exhibited membrane damage, higher metabolic activity, and produced more endogenous Reactive Oxygen Species. Additionally, biofilms formed on G5/PDMS had a lower cell count and thickness, up to 43% less than those formed on PDMS, demonstrating its antifouling effect. Further examination of the biofilm structure revealed that mature biofilms grown on the graphene-based surface had fewer empty spaces (34% reduction) and a smaller biovolume (25% reduction) than PDMS. These findings suggest that the GNP-based surface is effective in inhibiting C. marina biofilm development and could be used as a promising marine antifouling coating.

Keywords: marine biofouling; antifouling surfaces; graphene; Cobetia marina; biofilm formation

Acknowledgments

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20406 | AI-based systems for water loss reduction in a distribution network

Sá Couto, Juliana G., Faculdade de Engenharia da Universidade do Porto, Portugal

Abstract

Problem: Water companies are now adopting new electromagnetic sensor technologies to collect information about the pressure and flow of water in their distribution networks. Besides monitoring and reporting, real-time information can be used to detect and predict anomalies such as pipe bursts and leakages in the network. The early identification of such anomalies is of utmost importance to trigger the most suitable maintenance procedures and minimize their impacts. In this context, the use of AI-based detection approaches is a key benefit of these technologies.

This work was developed during a curricular internship at SCEMAI within the scope of a project with Águas de Gaia, EM, SA, aiming the development of AI-based solutions to optimize domestic water distribution networks. This work presents a data-driven leak detection method, based on a binary logistic regression, that predicts the probability of leakage occurrence given the input and output flows measured with sensors placed in the extremities of a pipe segment.

Solution: The method was applied to experimental data obtained from 50 leakage episodes (observed in pipes with a similar average flow), in a total of 4500 leakage/non-leakage time points. The evaluation was performed via confusion matrix performance metrics (e.g. precision, recall, specificity, accuracy, F1-score and Cohen's κ) computed for train and test partitions, respectively, with 70% and 30% of the data. This procedure was repeated by randomly splitting the data into 100 different train/test partitions (cross-validation) to compute the average performance and its variability across different data partitions.

The proposed method exhibits high performance showing, on average, 96.85% of accuracy, 85.11% of F1-score, and 83.36% of Cohen's κ across the train, with a standard deviation lower than 1.00% for all metrics. The test results were, respectively, 96.86%, 85.35%, and 83.60% with standard deviations lower than 2.00%. The results also indicate that the average leakage burden (i.e. time from its onset to maintenance) in the experimental data is 195 min. When a leakage is detected, the average return (i.e. prediction to maintenance delay) can reach 125 min, thus potentially reducing the average loss by 70 min. Consequently, the operational activity can be optimized since the system is able to create real-time alerts when a leak occurs and potentially mitigate the water loss.

Conclusion: The proposed method was designed to be used in a real-time framework within a smart water infrastructure and holds the property of being scalable so that it can be applied to different operational situations, including to pipes with different dimensions.

Keywords: Artificial Intelligence, Binary logistic regression, Leaks detection, Water Distribution Networks.

21195 | An algorithm using an envelope spectrum analysis for Out-of-Roundness detection in railway wheels

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Abstract

The work presented aims to detect railway vehicle wheel flats and polygonised wheels using an envelope spectrum analysis [1-3], with the methodology presented in Figure 1. The monitoring system for detection of defective wheels, particularly wheel flats and polygonal wheels for this work, is modelled after wayside monitoring systems. Then, three types of wheel flat profiles and three periodic out-of-roundness harmonic order ranges for the polygonal wheels are evaluated in the simulations, along with analyses implemented using only healthy wheels for comparison. The simulation implements track irregularity profiles modelled based on the Federal Railroad Administration. Moreover, the train-track dynamic interaction simulations are conducted using the in-house software VSI—Vehicle-Structure Interaction Analysis [4,5]. From the numerical calculations, the dynamic responses of several strain gauges and accelerometer sensors located on the rail between sleepers are evaluated. Regarding defective wheels, only the right wheel of the first wheelset is considered as a defective wheel, but the detection methodology works for various damaged wheels located in any position. Wheel flat can be detected from two indicators: significant lag between the amplitudes and amplitude difference of the analysis between damaged and healthy wheels, but polygonised wheels are only distinguished from healthy ones by the lag of the signal. The effects of track irregularity profiles do not significantly influence wheel defect detection. In contrast, train speed influences the responses of the envelope spectrum, as higher speeds lead to higher peak amplitude values. In the presence of a wheel flat, the algorithm is capable of detecting a defective wheel considering both types of sensors, however, when a polygonal wheel passes through a system, the algorithm is able to detect a damaged wheel only when the signal is evaluated by accelerometers. The above results from the application of the methodology are shown in Figures 2-8.

Keywords: algorithm; numerical simulation; train–track interaction; validation; wheel out-of-roundness; wayside condition monitoring; wheel flat; polygonised wheel

Acknowledgments

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References

[1] Mosleh, Araliya, Pedro Aires Montenegro, Pedro Alves Costa, and Rui Calçada. 2021. "An
approach for wheel flat detection of railway train wheels using envelope spectrum analysis"StructureandInfrastructureEngineering,17:12,1710-1729.https://doi.org/10.1080/15732479.2020.1832536

[2] Mosleh, Araliya, Pedro Aires Montenegro, Pedro Alves Costa, and Rui Calçada. 2021. "Railway Vehicle Wheel Flat Detection with Multiple Records Using Spectral Kurtosis Analysis" Applied Sciences 11, no. 9: 4002. https://doi.org/10.3390/app11094002

[3] Gonçalves, Vítor, Araliya Mosleh, Cecília Vale, and Pedro Aires Montenegro. 2023. "Wheel Out-of-Roundness Detection Using an Envelope Spectrum Analysis" Sensors 23, no. 4: 2138. https://doi.org/10.3390/s23042138

[4] Neves, S.G.M., Pedro Aires Montenegro, Álvaro Azevedo, and Rui Calçada. 2014. "A direct method for analyzing the nonlinear vehicle–structure interaction" Engineering Structures, vol. 69, pp. 83-89. https://doi.org/10.1016/j.engstruct.2014.02.027

[5] Montenegro, Pedro Aires, Sérgio G.M. Neves, Álvaro Azevedo, and Rui Calçada. A Nonlinear Vehicle Structure Interaction Methodology with Wheel Rail Detachment and Reattachment. In Proceedings of the 4th International Conference on Computational Methods in Structural Dynamics and Earthquake Engineering, Kos Island, Greece, 12–14 June 2013. https://doi.org/10.7712/120113.4533.C1269
20749 | Incorporation of nanomaterials in high pressure laminates for the improvement of energetic efficiency of facades

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Abstract

Under the background of global warming and populational growth, there is a considerable worldwide energy demand for cooling systems due to rising temperatures, leading to an increase in energy consumption. Moving towards energy efficient buildings, passive temperature regulation, not requiring any power input and with no contributions to greenhouse gases emissions, is an appealing alternative for the cooling of buildings. Daytime radiative cooling is a passive and sustainable cooling technology that releases heat directly to outer space through thermal radiation, taking advantage of the transparent atmospheric window between wavelengths of 8 and 13 μ m. Nanomaterial-based solar reflective coatings using cool pigments are an extremely promising approach for passive cooling applications. Since near-infrared radiation (NIR) makes up for around half of the total solar energy that reaches Earth, to mitigate indoor temperature increase, under direct sunlight, a coating should reflect the incoming solar infrared energy (800–2500 nm), while also maintaining visible light transparency (400–700 nm) to avoid visual changes. Embedding micro and nanoparticles with high reflectivity and emissivity in the NIR spectrum, in high pressure laminates (HPL) for exterior facades, can lead to excellent indoor cooling performance. In this work, the use of micro and nanoparticles of titanium dioxide (TiO2), zinc oxide (ZnO), alumina (Al2O3) and silica (SiO2) in the outer layer of the laminate for efficient passive cooling was evaluated. The outer layer was sprayed with a water-based dispersion containing the nanoparticles, which is easy to implement in the production process of laminates, cost effective and scalable. After pressing, the proposed final product showed increased reflectance in the NIR spectrum with the potential for reducing the indoor temperature during the day, while maintaining its aesthetic characteristics, evaluated through colorimetric and brightness parameters.

Keywords: passive cooling; high pressure laminates; daytime radiative cooling; nanomaterials; near-infrared reflectance; transparent coatings.

References

Veloso, R.C., Souza, A., Maia, J. et al. Nanomaterials with high solar reflectance as an emerging path towards energy-efficient envelope systems: a review. J Mater Sci 56, 19791–19839 (2021);
Du, T., Niu, J., Wang, L., Bai, J., Wang, S., Li, S., & amp; Fan, Y. (2022). Daytime radiative cooling coating based on the Y2O3/tio2 microparticle-embedded PDMS polymer on energy-saving buildings. ACS Applied Materials & amp; Interfaces, 14(45), 51351–51360.

21208 | Characterisation of eco-friendly high-performance concrete

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Abstract

HPC are advanced cementitious composites featuring self-compacting ability, superior mechanical properties, durability, and a polished aesthetic appearance. Those features allow slender structural elements, with thinner cross sections and lighter. However, from a materials point of view (and not only), some issues need to be addressed, namely regarding sustainability. Portland cement and supplementary cementitious materials (SCM) are important constituents of HPC mixture design. In Portugal, the ready market of available SCM provides essentially limestone filler. Using locally available SCM reduces costs and CO2 emissions allocated to concrete production, particularly valorising local and abundant industrial waste or by-products. The current work presents the design and characterisation of more eco-friendly HPC. The HPC sustainability was pursued via high dosages of cement replacement using, limestone filler and glass powder, as partial cement replacement.

METHODOLOGY: HPC were formulated and specimens were to assess the following properties: flowability (EFNARC), electrical resisticity (two electrods method) and mechanical strength (EN 196-1). A wide range of flowable composites were obtained (flowability between 252 and 346.5 mm). The electrical resistivity results varied between 69.63 and 178.80 Ω m. The compressive strength results presented a narrow variation between 87.26 and 101.99 MPa. The results obtained seem to be adequate for HPC.

MAIN CONCLUSIONS: It was shown that ground glass could be successfully applied in HPC as a high-volume cement replacement material (up to 40%), thus widening the types of SCM available, and reducing CO2 emissions using less cement. Besides, fine glass powder enhanced durability (increased resistivity), thus providing great opportunities for value-adding and cost recovery by replacing expensive imported materials like silica fume or metakaolin.

Keywords: concrete; high-performance concrete; sustainable concrete; fresh properties; mechanical properties; shrinkage.

Acknowledgments

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21003 | Lipid extraction and enzymatic biodiesel production from microalgae *Aurantiochytrium sp.*: Exploratory studies

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Abstract

Microalgae are lipid-rich microscopic eukaryotic algae that can be used as a more sustainable alternative source of edible oils, currently the most common feedstock for biodiesel production. The present study aims to (i) compare different extraction procedures of microalgae oil, to define the most effective procedures aiming further biodiesel production and (ii) evaluate biodiesel enzymatic production from oil of *Aurantiochytrium* sp..

Several lipid extraction methods were used, including Soxhlet extractions (8 h) and room-temperature extraction (72 h). Further, enzymatic transesterification of the extracted oil (24 h; 35 ¹/₂C; 150 rpm, 30 wt.% enzyme loading, 6:1 methanol:oil molar ratio) was conducted.

According to the results, high extraction temperatures cause microalgae oil degradation, lowering biodiesel quality and modifying its fatty acid composition. Using oil extracted at room temperature (23 % lipid content), it was possible to obtain around 55 wt.% of biodiesel purity by transesterification with methanol. Under the same reaction conditions, the transesterification of oil extracted at a higher temperature (Soxhlet) led to a significantly inferior biodiesel purity (around 30 wt.%).

It is anticipated that the enzymatic biodiesel production from microalgae oil extracted at room temperature will contribute to the creation of more sustainable processes to replace fossil fuels.

Keywords: Microalgae; Aurantiochytrium sp.; Lipid extraction; Enzymatic biodiesel production

Acknowledgements

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20658 | Impact of a dynamic thermal insulation system on indoor thermal comfort and energy consumption - Numerical simulation

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Abstract

The building envelope separates the inside from the outside environment and is responsible for maintaining indoor thermal comfort. This way, adaptive facades (building envelopes that are able to adapt to external climate conditions), are being studied because they allow the reduction of energy consumption and the increase of occupants' thermal comfort. Dynamic thermal insulation systems have been emerging, as they allow the control of heat transfer through the façade.

This work aims to analyse the behaviour of a low mass and a high mass building, varying the U-value of its walls (U=0,35 or 0,6 or 1 W/m2°C), localized in Porto. Using housing models defined in the ASHRAE Standard 140 [1,2] (case 600 for low mass and case 900 for high mass), twenty-four simulations were performed using DesignBuilder. The annual simulations allowed to analyse occupants' thermal comfort, based on the adaptative model defined in EN 16798 [3]. For this analysis two indicators were used: (i) indicator 1 reveals the severity of discomfort by assessing the difference between discomfort temperature by overheating and the corresponding comfort limit temperature defined by EN 16798; (ii) indicator 2 shows the percentage of time with discomfort by overheating. In this work, it was also calculated the amount of energy required to cool down the space to achieve thermal comfort.

Figure 1 shows that indicators 1 and 2 decrease with the increase of the U-value because more energy is released through de envelope in situations of overheating. When a cooling system is used, energy consumption decreases when the U-value increases, especially in the building with high thermal mass. It can be concluded that although the thermal mass limits the thermal amplitude, this effect is not reflected in the discomfort indicators, with the lower thermal mass configuration showing a better performance.

Keywords: adaptative façade, dynamic thermal insulation, thermal comfort, energy consumption, numerical simulation.

Acknowledgments

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References

[1] ANSI/ASHRAE Standard 140-2004 Building Thermal Envelope and Fabric Load Tests. DesignBuilder Version 1.2.0, June 2006.

[2] ANSI/ASHRAE Addendum a to ANSI/ASHRAE Standard 140-2001 - Standard Method of Test for the evaluation of Building Energy Analysis Computer Programs. ANSI, 2004.

[3] Guideline for using indoor environmental input parameters for the design and assessment of energy performance of buildings. EN 16798-2, 2014.



Figure 1: Results of the numerical simulation: (a) Indicator 1 – severity of discomfort by overheating; (b) Indicator 2 – percentage of time with discomfort by overheating; (c) Energy consumption to achieve thermal comfort.

21145 | Design, 3D printing and analysis of lattice structures: Stochastic Voronoi

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Abstract

Generative Design combines design and engineering, to provide several solutions to a problem. Lattice structures are developed, with the objective of retaining one property while trying to decrease another. These structures are gaining importance, because they allow the reduction of time, energy and material during the manufacturing process [1]. There are two types of lattice structures, Periodic and Stochastic. The first ones consist of structures that present a single cell shape and that are developed by repetition in the three axes and the second ones are structures that present a random distribution of cells and cell shapes. For this study, only Stochastic type lattice structures were developed, that were modelled as 20 mm test cubes, through the Rhinoceros 3D software. The splitting of the cells was performed by a Voronoi 3D function of the modelling software. During the modelling process of the porous test cubes it was noticed that the Stochastic Voronoi structures had design parameters that could be changed, namely the number of cells within the 20 mm cubic sample and the value of the wall thickness. The porous cubes were modelled with only 0.4 mm of wall thickness and with number of points of 500, 750, 1000, 2000, 3000, 4000, 5000 and 6000 (see figure 1). After the modelling was done, three dense cubes and three cubes of each configuration, were printed on a DLP 3D printing technology to be tested and analysed in terms of mechanical strength, apparent porosity, pore size and mass. Analysing the data obtained, it was noticed that the mechanical properties, the mass and the apparent porosity of the porous samples increased with the number of points, however, the pore size value decreased.

This study arises, from the lack of knowledge of literature that displays the effect of configurations of this type of structures in dense objects and from the goal of designing porous structures in components of biodegradable implants to be printed in SLM.

Keywords: DLP 3D Printing; Generative Design; Lattice Structures; Stochastic; Voronoi

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References

[1] Helou, M., & Kara, S. (2018). Design, analysis and manufacturing of lattice structures: An overview. International Journal of Computer Integrated Manufacturing, 31(3), 243–261. https://doi.org/10.1080/0951192X.2017.1407456.



Figure 1: Image representative of the studied configurations.

20474 | Influence of windings design on the thermal performance of core-type power transformers using mineral oil and natural ester as cooling fluid

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Abstract

Power transformers (PT) are devices used worldwide in the transmission and distribution of electrical energy, being essential for the transformation of high transmission voltages into lower voltages for both domestic and industrial usage. Studies focusing on the internal cooling of PTs are conducted to improve their performance and to avoid the degradation of its insulation materials due to excessive heat, which jeopardizes the transformer lifetime and ultimately leads to its failure. This work aimed to study the influence that the design of the windings of a core-type PT plays in its internal cooling, when performed by mineral oil and natural ester, and to develop a machine learning tool capable of predicting the thermal behaviour of the winding.

Steady-state CFD simulations were performed, considering a 2D axisymmetric model (validated with a 3D axisymmetric model and experimental data) of a core-type PT winding. The axial channel width, radial channel height, and Reynolds number at the winding entrance were the parameters studied. The geometric parameters effect on the winding thermal performance was inferred through the evaluation of the top-oil, average-oil, average-winding and hot-spot temperatures; hot-spot factor and Nusselt number. A machine learning tool was trained to predict the correlations between the PT design parameters and the results obtained in the simulations.

As main results, it was observed that: 1) the trend of pressure drop along the winding is not affected by the heat transfer phenomena; 2) the Reynolds number is the parameter that most affects the temperature distribution inside the winding; 3) the geometric parameter that most influences the results is the width of the axial channels, and 4) the natural ester showed better cooling performance, but higher pressure drop.

The machine learning tool showed to be highly promising in predicting the thermal performance of a core-type PT, however it needs to be fed with more data to ensure a wider and more accurate use.

Keywords: core-type power transformers; CFD; machine learning; windings; internal cooling; mineral oil; natural ester; heat transfer; flow; numerical simulation.

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01-0247-FEDER-039906), under the PORTUGAL 2020 Partnership Agreement, through the European Regional Development Fund (ERDF).

21151 | Evaluation of primary and secondary Aluminium Alloys properties

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Abstract

With more and more restrictions being applied to the emission of pollutant gases, the automotive industry is looking for alternatives to replace structural steel components to minimize fuel consumption. In combustion engine vehicles, a 100 kg reduction in vehicle weight leads to a reduction in fuel consumption of between 0.3 and 0.5 L/100 km and a reduction of 8 to 11 g of CO2/km. In electric vehicles, this reduction is also becoming increasingly important, since a reduction of about 10 % in weight leads to an increase in range of about 13.7 % [1].

The main alternative is the use of aluminium alloy injected components. However, due to high injection speeds used in high-pressure die casting there is air trapping inside the liquid metal which leads to a deterioration of mechanical properties and the impossibility of performing heat treatments due to the blistering phenomenon.

The present work aims to identify the differences in microstructure and mechanical properties between primary (AlSi10MnMg and AlMg4Fe2) and secondary (AlSi10Mg(Fe) and AlSi12(Fe)) aluminium alloys. Additionally, it is intended to understand the influence of T6 heat treatment and the use of vacuum during injection on gas porosities and mechanical properties.

The defects analysis of the samples was performed using computed tomography (non-destructive method) to understand the distribution of defects along the parts. A comparison of the mechanical properties was made between the primary and secondary alloys, as well as, between the conventionally and vacuum-assisted injected parts. Results show that the higher percentage of iron in the secondary aluminium alloys negatively affects the elongation of these alloys and that the vacuum level used was not sufficient to improve the mechanical properties.

Keywords: Aluminium; High-pressure die casting.

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References

[1] Czerwinski, F. Current Trends in Automotive Lightweighting Strategies and Materials. Materials 2021, 14, 6631.

21082 | Additive manufacturing using sustainable feedstock obtained from metal scrap

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Abstract

Subtractive manufacturing methodologies leave considerable amount of residue, usually used in downcycling approaches. This study evaluated an upcycling solution to produce metallic powder feedstock for additive manufacturing (AM) processes. Direct Energy Deposition (DED), as an AM process, is noteworthy for repairing damaged parts, producing coatings and even for printing complex and large geometries. Thus, the use of upcycled feedstocks can create a closed life cycle adding value to residues as new raw materials.

In the current study, AISI 303 stainless steel chips are transformed into powders through disc milling. The produced powder particles were analysed for the determination of size, size distribution and shape. These characterizations were performed using sieving analysis, laser diffraction and scanning electron microscopy. The produced feedstock selected for DED presented a size of 38 μ m to 212 μ m and flaky shaped particles.

The printing process by DED was carried out on AISI 1045 steel using a powder feed rate of 5.2 g/min (to provide maximum possible flowability), varying laser power (LP) and scanning speed (SS). The best results (having metallic aspect, the least burning and scatters, and acceptable bead geometry dilution) were achieved applying 750 W and 5 mm/s as LP and SS, respectively. The printed material and interface were evaluated through metallography (microstructure of printed material, interface and the heat affected zone) and hardness measurements. The optimization of printing energy influenced the success of printing this non-conventional powder feedstock. The presence of in-situ formed oxides was detected in the austenitic microstructure of the printed material. This dissimilar interface was defect free. The microstructure and the hardness of the interface and HAZ were affected by the number of printed layers.

Keywords: Additive Manufacturing; Metallic Chips; Milling; Powder Characteristics; Microstructure.

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20877 | Automatic Identification of Macroscopic Constitutive Parameters using a Multi-Scale Model based on Computational Homogenisation

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Abstract

The mechanical behaviour of materials is a result of their underlying microstructure. Multi-scale models accounting for the microstructural details can be employed to assess the influence of the micro-constituents on the resulting macroscopic behaviour. The number of crystals contained in the microstructure model, the level of anisotropy in each grain, as well as the underlying plastic behaviour, play a major role in the macro-structural response obtained from multi-scale analysis. In this work, finite element simulations of an Advanced High Strength Steel (AHSS) alloy were performed at two different scales. The potential for optimising the mechanical properties by tailoring the microstructure is associated to the need for developing micro-mechanical models that can accurately predict the deformation mechanisms that arise. Together with these microstructural models, computational tools such as Computational Homogenisation enable multi-scale finite element simulations, where micro-mechanical phenomena are linked to the macroscopic behaviour of the material.

The goal of this work was to obtain the macroscopic constitutive model capable of reproducing the mechanical response of a given microstructure model. To that end, Representative Volume Elements (RVEs) of a given microstructural model were generated and simulated under different loading conditions. Thereafter, the responses obtained under such loading conditions were used to calibrate classical constitutive models, using an automatic parameter identification tool and different optimisation algorithms. The calibrated models were, then, validated against the multi-scale model, in two virtual experiments. In both cases, accurate results were obtained, and the computing time is reduced in 5 orders of magnitude. Finally, the mechanical responses of these models were also assessed with experimental results for the material of interest, where the evolution of the shear strain is well captured.

Keywords: Multi-scale Models, Computational Homogenisation, Constitutive Modelling, Advanced High Strength Steels, Parameter Identification

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21246 | Antimicrobial effect of photoactive phytochemicals on *Staphylococcus aureus* by themselves and combined with antibiotics

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Abstract

Nowadays, a high incidence of infections are related to the Staphylococcus aureus bacterial pathogen, which are usually treated with antibiotics. However, in a society where antibiotic resistance is a problem, such treatment becomes particularly difficult. The systems that can be used to overcome resistance to conventional antibiotics are still poorly understood. In this context, the use of plant-derived photoactivatable compounds in antimicrobial photodynamic therapy (aPDT) has emerged as an attractive and cost-effective way to suppress bacterial resistance mechanisms. The project aims to develop an innovative aPDT approach combining less effective antibiotics with natural plant products (such as phytochemicals) with photosensitizing activity to develop a new and natural system to combat chronic wound infections. In this work, five phytochemicals and eight antibiotics were combined and tested to determine if a pair resulted in enhanced antimicrobial activity. Using the disc diffusion method, 9 combinations resulted in possible potentiation. In the checkerboard test performed afterwards, out of these 9 combinations, only two were found to be synergistic: Mupirocin/Gallic Acid and Mupirocin/Quercetin. However, none of the 9 combinations were labelled as non-synergic because the results of the checkerboard test appeared to be influenced. In both assays, the paired compounds revealed a minimum inhibitory concentration (MIC) at least four times smaller than the MIC of the antibiotics and phytochemicals separately. Two selected phytochemicals, Berberine and Curcumin, were used to optimise the photoactivation assay in which irradiation was applied using an LED emitting visible light at 420 nm in an optimized power density of 30mW/cm2 with a duration of 10 min. This work can help to further deepen the knowledge in the antibiotic resistance problematic and possibly lead to a potential solution using phytochemicals.

Keywords: antibiotic resistance; aPTD; phytochemicals; infections.

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20793 | Synthetic fuels or valued chemicals production from biogas - A thermodynamic study

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Abstract

Almost 80% of the total energy consumed in the world comes from non-renewable sources, which has been causing several well-known problems, like global warming [1]. Therefore, alternative energy sources have been explored to find a solution for this problem. This work aims at the valorisation of biogas (renewable source), using it as a raw material to produce alternative and sustainable biofuels, and valuable chemicals.

A thermodynamic equilibrium analysis of different syngas (a mixture of H2 and CO) applications obtained from combining biogas dry reforming (CH4+CO2 \leftrightarrow 2H2+2CO) with steam reforming (CH4+H2O \leftrightarrow 3H2+CO) was carried out via the Gibbs free energy minimization method using the software ASPEN PLUS. Results showed that syngas was produced with different H2/CO molar ratios according to different operating conditions used (pressure, temperature and steam-tocarbon ratio - S/C). The syngas was valorised in different ways, such as in the synthesis of methanol and dimethyl ether (DME). Based on the methane conversion, it was found that higher temperatures (\geq 800 °C) and atmospheric pressure accounted for better performance at the reformer, with very low coke formation. It was found that to produce the highest methanol yield, a H2/CO ratio of 1.6 is suitable (yield of 77.5%) if the product from the reformer was directly fed into the methanol reactor, while a ratio of 2.0 (yield of 77.3%) if the unconverted water was removed after the reformer. Regarding the production of DME, two possible routes were analysed: (i) directly from the syngas in a single reactor and (ii) two-step route that first produces methanol and converts it to DME. The optimum H2/CO ratio was 1.40 yielding 64.5% for the first case and 56.7% for the second case. Once again, the removal of water did not affect the maximum DME yield.

Results obtained from this theoretical analysis seem promising for subsequent experimental validation of the proposed technological solutions for biogas valorisation.

Keywords: biogas; syngas; sustainable biofuels; thermodynamic study.

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References

[1] Gómez-Castro, F.I. and C. Gutiérrez-Antonio, Chapter 1 - Biomass: The driver for sustainable development, in Biofuels and Biorefining, F.I. Gómez Castro and C. Gutiérrez-Antonio, Editors. 2022, Elsevier. p. 1-23.

20480 | Catalysts for the conversion of molasses into value-added products

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Abstract

Lately, the decline in fossil fuels and environmental concerns resulting from overdependence on petroleum resources for fuels and chemicals, have led to a search for alternative biofuel production methods. 5-Hydroxymethylfurfural (HMF) is an important platform molecule that acts as a bridge between biomass and biofuels, but current methods for producing HMF from hexoses are industrially irrelevant due to the high cost and low availability of the substrate.

Sugarcane molasses is a by-product of sugar refining, normally used for feeding livestock. However, its carbohydrate-rich composition and low-price make it a suitable substrate for producing HMF. Nevertheless, not a lot of research dealing with the catalytic conversion of sugarcane molasses into HMF can be found.

The present study investigated the one-pot production of HMF from industrial-grade sugarcane molasses using a microwave reactor. When the reaction was carried out without a catalyst, an HMF yield of only 15 % was obtained. Thus, a series of solid-acid heterogeneous catalysts were produced and tested in this reaction. In addition, the reaction conditions (temperature, catalyst mass, and reaction time) were optimized to maximize the HMF yield, and its highest value was obtained with a catalyst mass of 0.07 g, at a temperature of 190 °C and a reaction time of 20 min. The catalytic results are shown in Figure 1. The highest HMF yield (of 49.7 %) was reached by a catalyst containing -SO3H groups. HMF production was strongly affected by its instability in water, molasses impurities, and humins formation.

This methodology for HMF production from sugarcane molasses has the potential to reduce dependence on fossil fuels by providing a new way to benefit from industrial waste, using an environmentally friendly and economically feasible procedure since an industrial waste was used as a substrate, water as a solvent, and biomass-based materials as catalysts.

Keywords: Sugarcane molasses; 5-Hidroxymethylfurfural; biomass; biofuels; industrial waste.

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Figure 1: Effect of the prepared catalysts in the HMF yield obtained from the reaction (at the optimal conditions) of an 86 g/L solution of sugarcane molasses in ultrapure water.

21163 | Photocatalytic synthesis of aromatic aldehydes using g-C3N4 immobilized on LED-NETmix photoreactor

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Abstract

Aromatic aldehydes have a wide range of applicability, as flavouring agents, fragrances or precursors for pharmaceutical products. The conventional synthesis of aromatic aldehydes often requires high temperature and pressure, hazardous solvents and metallic catalysts [1-3]. These reactional conditions are not favourable, neither environmentally nor economically. So, photocatalysis is presented as an alternative to conventional methods for aromatic aldehydes synthesis.

By using graphitic carbon nitride (g-C3N4) as the photocatalyst, the oxidation of aromatic alcohols to the respective aldehydes is achievable at room temperature and atmospheric pressure using water as a solvent. Since g-C3N4 is an optical semiconductor with a narrow bang gap energy, the reaction can be performed under visible-light irradiation. To avoid catalyst loss, g-C3N4 was immobilized on calcium alginate. Calcium alginate was prepared using sodium alginate, a type of biomass soluble in water, as the precursor. The immobilization was reached by reacting a sodium alginate hydrogel with calcium ions. The LED-NETmix photoreactor works simultaneously as a static mixer and as reactor, providing a large irradiated area per reaction volume.

In this work, the LED-NETmix photoreactor was used for the photocatalytic conversion of anisyl, benzyl and piperonyl alcohols, to the respective aromatic aldehydes using g-C3N4 immobilized on calcium alginate film. The oxidation of anisyl alcohol to anisaldehyde showed the highest values of conversion, selectivity and yield of 87, 83 and 42 %, respectively. To increase the availability of active sites and, consequently, the photocatalytic efficiency, g-C3N4 nanosheets were used as the photocatalyst, and the effect of the catalyst load in the film was studied for the selective conversion of anisyl acohol. Using a catalyst load of 2.4 g/L, 63 % of anisyl alcohol conversion was reached with 64 and 56 % of anisaldehyde selectivity and yield, respectively, after 3 hours of visible-light irradiation.

Keywords: photocatalysis, aromatic aldehyde, immobilization, alcohol oxidation, NETmix

Acknowledgments

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References

[1] Wu, L., S. An, and Y.F. Song, Heteropolyacids-Immobilized Graphitic Carbon Nitride: Highly Efficient Photo-Oxidation of Benzyl Alcohol in the Aqueous Phase. Engineering, 2021. 7(1): p. 94-102;

[2] Sengupta, K.K., T. Samanta, and S.N. Basu, Kinetics and mechanism of oxidation of ethanol, isopropanol and benzyl alcohol by chromium(VI) in perchloric acid medium. Tetrahedron, 1986.
42(2): p. 681-685;

[3] Scott, S.L., A. Bakac, and J.H. Espenson, Oxidation of alcohols, aldehydes, and carboxylates by the aquachromium(IV) ion. Journal of the American Chemical Society, 1992. 114(11): p. 4205-4213.

20574 | Carbon nitride materials for the H2O2-assisted photocatalytic degradation of pharmaceuticals.

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Abstract

Nanotechnology has been one of the fastest developing fields of science. In particular, the synthesis of nanostructured catalysts derived from graphitic carbon nitride (GCN) is considered very promising due to the material's intrinsic conductivity and photoactivity, essential for a variety of catalytic applications, such as photocatalytic treatment of contaminated waters [1]. In this work, several photolysis and heterogeneous photocatalysis reactions were performed, using three different materials to evaluate their photocatalytic activity. Furthermore, to increase the effectiveness of the treatment, photocatalytic peroxidation reactions were also performed using hydrogen peroxide (H2O2).

The GCN materials were synthesised by calcination in a microwave furnace, using either dicyandiamide or urea as the precursor to originate CN-D and CN-U, respectively. The TiO2 material was a commercial sample. The photo-activated reactions were performed in a glass reactor equipped with a system of 4 visible-light emitting diodes. Different dosages of the photocatalysts, pollutants and H2O2 were studied.

When comparing three different photocatalysts, the highest removals of pollutants were obtained with GCN-U (as shown in Figure 1 for carbamazepine – CBZ) owing to the increased surface area and enhanced charge transfer abilities, as demonstrated by photoluminescence studies. Moreover, the degradation efficiency was improved by adding H2O2 (2.5 mmol L-1). It is well known that CBZ is difficult to degrade by conventional methods; however, this research has revealed that, under visible-light irradiation and using an appropriate catalyst, it is possible to achieve up to the complete degradation of this compound.

Keywords: Photocatalysis; Carbon Materials; Advanced Oxidation Processes; Organic Contaminant; Carbon Nitride.

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References

[1] John, A., M.S. Rajan, and J. Thomas, Carbon nitride-based photocatalysts for the mitigation of water pollution engendered by pharmaceutical compounds. Environmental Science and Pollution Research, 2021. 28(20): p. 24992-25013.



Figure 1: Degradation of CBZ ([CBZ]0 = 10 mg L-1) under photocatalysis ([GCN-D] = [GCN-U] = [TiO2] = 0.5 g L-1) or photocatalytic peroxidation ([H2O2] = 2.5 mmol L-1 and [GCN-U] = 0.5 g L-1).

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Abstract

Currently, consumers search for innovative products with biological ingredients, functional characteristics, and/or "green" labels. In this sense, it is important to satisfy the consumer's needs by creating new and healthy alternatives. Pickering emulsions, stabilized by solid particles, have been increasingly studied due to their high physical stability and ability to create functional and label-friendly solutions, making them a promising strategy for the food industry.

The present work aims to produce Pickering emulsions stabilized by nano-hydroxyapatite (n-HAp) particles. The effect of n-HAp particle concentration (5 - 15% wt.%) and oil/water ratio (50 - 80% oil phase content) on emulsion stability was evaluated using various methodologies, including droplet size, emulsion type, optical microscopy, and rheological analysis; Pickering emulsions were monitored immediately after production (t0) and after seven days of storage (t7). Finally, a supercritical extract derived from food waste (olive leaves) was incorporated into the emulsion, and its stability was re-evaluated. The results indicate that the produced Pickering emulsions have good stability for the tested period of 7 days, except for the 80/20 oil/water Pickering emulsion, which revealed phase separation after a few hours of production. Additionally, Pickering emulsions with smaller droplet diameters were produced for higher n-HAp concentrations. The emulsion with the extract was also stable, meaning that the incorporation did not affect the emulsion stability.

The Pickering emulsions produced in this work revealed to be promising for food purposes as an alternative to synthetic emulsifiers and to stabilize bioactive compounds, opening a new perspective for innovative food products development, namely edible sauces.

Keywords: Pickering Emulsions, Nano-hydroxyapatite, Supercritical Extract.

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20712 | Evaluation of the effect of Fosfomycin incorporated grafts in the prevention of vascular grafts infections

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Abstract

Vascular grafts infections (VGIs) are life-threatening complications, occurring in 0.2-6% of vascular prosthetic placements (1). These include limb amputation, pseudo-aneurysm, septic emboli, aorto-enteric fistulae, septic shock and death (2).

Fosfomycin is a low molecular weight antibiotic with activity against staphylococci and good antibiofilm properties (3). We aim at developing an antimicrobial coating for vascular grafts by incorporating antibiotics to prevent VGIs, limiting bacterial adhesion and therefore preventing biofilm formation.

The Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) values of Fosfomycin against Staphylococcus epidermidis (ATCC 35984) were determined by broth microdilution method (4). The GelsoftTM graft was cut with a 6 mm biopsy punch and Fosfomycin was incorporated at different concentrations. The samples were incubated with Staphylococcus epidermidis, and the *in vitro* antimicrobial efficacy was evaluated by time killing assays at 0,1,2,3 and 7 days by colony-forming unit (CFU) counting (5). Finally, the grafts were sonicated to determine the number of adherent bacteria also by CFU counting.

The MIC values for Fosfomycin against Staphylococcus epidermidis were between 1-0.5 μ g/mL and the MBC was 2 μ g/mL. The bactericidal effect of the grafts with Fosfomycin incorporated was detected at concentrations \geq 2.5 mg/mL at all time points (Figure 1). After sonication at day 7, no bacteria adherence was observed in the surface of the grafts at concentrations \geq 5 mg/mL (Figure 2).

The GelsoftTM grafts with Fosfomycin incorporated were able to release the antibiotic, killing the bacteria and inhibiting bacterial adhesion to the grafts surface in a concentration dependent way. This suggests a novel solution for the treatment and prevention of vascular grafts infections.

Keywords: Vascular grafts; infections; antibiotic; Fosfomycin.

References

[1] Gharamti A, Kanafani ZA. Vascular Graft Infections: An update. Vol. 32, Infectious Disease Clinics of North America. W.B. Saunders; 2018. p. 789–809;

[2] Calligaro KD, Veith FJ, Yuan JG, Gargiulo NJ, Dougherty MJ, Ricotta J, et al. Intra-abdominal aortic graft infection: Complete or partial graft preservation in patients at very high risk. J Vasc Surg. 2003;38(6):1199–204;

[3] Saravolatz LD, Pawlak J. In vitro activity of fosfomycin alone and in combination against Staphylococcus aureus with reduced susceptibility or resistance to methicillin, vancomycin, daptomycin or linezolid. Journal of Antimicrobial Chemotherapy. 2022 Nov 14;

[4] Determination of minimum inhibitory concentrations (MICs) of antibacterial agents by broth dilution. Clinical Microbiology and Infection. 2003 Aug;9(8):ix–xv;

[5] Berard X, Puges M, Pinaquy JB, Cazanave C, Stecken L, Bordenave L, et al. In vitro Evidence of Improved Antimicrobial Efficacy of Silver and Triclosan Containing Vascular Grafts Compared with Rifampicin Soaked Grafts. European Journal of Vascular and Endovascular Surgery. 2019 Mar 1;57(3):424–32.



Figure 1: Staphylococcus epidermidis CFU counting in incubation media at days 1,2,3 and 7.



Sonicated Grafts (after 7 days)

Figure 2: Staphylococcus epidermidis CFU counting of sonicated grafts at day 7.

20407 | Development of a knee positioning system for X-ray environment

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Abstract

With the rising incidence of knee pathologies, the number of X-rays for diagnosis, evaluation, and monitoring of knee stability is increasing. These types of evaluations involve radiography under physical stress. Despite being an improvement to physical examination regarding the physician's bias, stress radiography is performed manually in a lot of healthcare facilities. To avoid exposing the physician to radiation and to decrease the number of X-ray images rejected, positioning systems for knee stress radiography were developed. These systems have improved the objectivity and reproducibility during stress radiographs, but have failed to be radiolucent or ergonomic with a simple set-up.

A prototype of a medical device for the positioning of the patient's knee during stress radiography is proposed. This system is composed of two main structures: the foot and the lower limb supports. The foot support comprises a foot holder with Velcro straps, that keeps the foot of the patient in neutral position. This holder is combined with a load cell, with the goal of tracking the force applied. It is coupled with a linear guide rail, that is connected to a stepper motor controlled by a desktop application. The main function of this app is to perform a desired stress test until a defined force or a limit of the linear guide working stroke is reached. The second structure consists of a radiolucent triangle positioner that provides the necessary angle of flexion of the lower limb for the tests.

Lab and clinical trials were carried out to evaluate the viability and applicability of the functioning of the positioning system. The results of the trials were promising, maintaining all the subjects with an average body type with the knee at 30°, and the foot at 90°, and obtaining X-ray images of the desired stress tests without any artefacts. This system has provided a more objective and detailed stress test examination, whilst avoiding the exposure of physicians to radiation, which was confirmed by clinical partners.

Keywords: Anteroposterior view, knee joint, positioning system, skyline view, stress radiography.



Figure 2: Knee positioning system for X-ray environment

21200 | Extraction of information theory-based indices from fetal-maternal heart rate simultaneous signals

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Abstract

Despite fetal acidemia having a low incidence in developed countries (< 0.6%), its early diagnosis is essential to prevent irreversible neurological damage, morbidity, or death. Before and during birth, the standard procedure for its diagnosis resorts to cardiotocography to assess the fetal heart rate (FHR) and uterine contractions. However, this method has limitations regarding its validity, reproducibility, and interpretation agreement between expert clinicians.

Simultaneous analysis of FHR and maternal heart rate (MHR) has already been able to overcome one of the main problems described in the literature: the temporary capture of the MHR as that of the fetus. Nevertheless, few papers assess the FHR–MHR relationship. Nonlinear methods have achieved promising results in analysing both signals, and previous research has sustained the possibility of improving fetal acidemia detection.

The main goal of this work is to estimate quantities related to the causal statistical structure of coupled FHR–MHR dynamic processes and evaluate their discriminant capacity for the diagnosis of fetal acidemia. Several entropy-based measures were implemented in a real database with MHR and FHR signals from the last two hours before birth: Multiscale of Approximate, Sample, Fuzzy, Permutation, Conditional, Dispersion, Bubble and Attention Entropy; Cross-Approximate, Cross-Sample, Cross-Fuzzy, Cross-Permutation and Cross-Conditional Entropy; Self and Transfer Entropy. Their discriminant capacity was evaluated with the Mann-Whitney U test, having obtained significant results for the penultimate ten minutes before birth for Multiscale Sample Entropy of FHR and Transfer Entropy from FHR to MHR.

Future work will incorporate longitudinal models to assess the evolution of entropy throughout time for acidemic and non-acidemic fetuses and an association of the indices with clinical variables. The best discriminatory indices will potentially allow fetal acidemia detection before the current diagnostic method.

Keywords: fetal heart rate; maternal heart rate; fetal acidemia; entropy; simultaneous monitoring.

20659 | Mucoadhesive nanoparticles for the nose-to-brain delivery of gemcitabine for glioblastoma therapy

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Abstract

Glioblastoma Multiforme (GBM) is the deadliest brain tumor in adults and despite the treatments available, it is still incurable. Gemcitabine (GEM), currently approved for the treatment of solid tumors, has shown potential for the treatment of GBM. GEM is not an alkylating agent, thus it can circumvent O6-methylguanine–DNA methyltransferase-mediated resistance, one of the main limitations of conventional treatment with the gold-standard drug (temozolomide) [1].

However, GEM's therapeutic efficacy is limited due to factors such as its short plasma half-life, poor blood-brain-barrier (BBB) penetration, and dose-limiting toxicity [2]. Thus, in this work, poly (lactic-co-glycolic acid) (PLGA) nanoparticles (NPs) for GEM nose-to-brain delivery were proposed. This route is a successful method for delivering drugs into the brain, which allows overcoming the BBB. Chitosan (CH), a mucoadhesive polymer, was used to coat the NPs to prolong the period of adherence in the nasal cavity [3].

GEM-loaded CH-PLGA NPs were prepared using a double-emulsion solvent evaporation method. To optimize the preparation protocol of the NPs, a Central Composite Design was implemented, to study the effect of the amount of PLGA, surfactant concentration, volume of solvents, and number of sonication cycles on the NPs' properties. 27 independent nanoformulations were produced, and NPs presented sizes ranging from 143 to 879 nm, PDI from 0.076 to 0.476, positive zeta potential values ranging from 10.1 to 51.4 mV, and encapsulation efficiency values ranging from 1.8% to 41.8%. Statistical analysis (ANOVA) was then used to determine the optimal experimental conditions to produce optimized NPs with suitable features for nose-to-brain delivery (size below 200 nm, low PDI values and positive zeta potentials).

Future experimental work includes studying the *in vitro* stability and release of the optimized NPs in simulated physiological conditions, and NPs' *in vitro* therapeutic efficacy in human cells.

Keywords: Glioblastoma Multiforme; Gemcitabine; Nanoparticles; Poly (lactic acid-co-glycolic acid); Chitosan; Nose-to-brain Delivery.

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NET3/0001/2021). FCT supported M.J.R. under the Scientific Employment Stimulus - Individual Call – (CEEC-IND/01741/2021).

References

- [1] C. Bastiancich et al. Drug Discov. Today, vol. 23, no. 2, pp. 416–423, Feb. 2018.
- [2] P. Y. Liyanage et al., Nanoscale, vol. 12, no. 14, pp. 7927–7938, Apr. 2020.
- [3] J. Xie, et al. Biomaterials, vol. 224, p. 119491, Dec. 2019.

20780 | Tumour-targeting nanoparticles for glioblastoma therapy with antioxidant compounds

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Abstract

Glioblastoma (GBM) is an invasive malignant glioma with a reduced survival rate, and a high probability of recurrence since the current therapy is not curative [1]. Gallic acid (GA) has been explored as an alternative approach since it has anti-cancer properties and low toxicity to healthy cells. When used in the free form, GA shows low solubility and stability, compromising its use [2]. Also, the anatomical location of GBM implies the passage of the bioactive molecule through the blood-brain barrier (BBB) which is impermeable to most of the molecules. Using nanoparticles (NPs) for the encapsulation of GA will increase its stability and allow it to release the content effectively into the target tissue.

Thus, we develop poly (lactic-co-glycolic acid) (PLGA) NPs for GA delivery. The NPs were prepared using the single-emulsion solvent evaporation method. To improve their targeting ability, the NPs were modified with folic acid (FA), since its receptor is overexpressed in the BBB and GBM cells [3].

GA-loaded PLGA NPs were prepared, and to optimize the NPs' properties, different experimental parameters were varied (amount of PLGA, surfactant concentration, number of sonication cycles, and FA molecules per NP). For this, a Central Composite Design (CCD) was implemented where 30 nanoformulations were produced. The produced NPs presented sizes ranging from 113 to 372 nm, polydispersion index values from 0.026 to 0.333, zeta potential values ranging from -23.4 to -6.6 mV, and encapsulation efficiency (EE) values ranging from 13.2% to 57.6%. After their production, Analysis of Variance (ANOVA) was used to perform the statistical analysis of the model and to determine the optimal experimental conditions to prepare optimized NPs with adequate physicochemical properties for brain delivery. Future work will include *in vitro* stability tests under simulated physiological conditions and *in vitro* evaluation of therapeutic activity in human GBM cells.

Keywords: Glioblastoma Multiforme; Gallic Acid; Blood-brain Barrier; Nanoparticles; Poly (lactic acid-co-glycolic acid); Folic Acid.

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NET3/0001/2021). FCT supported M.J.R. under the Scientific Employment Stimulus - Individual Call – (CEEC-IND/01741/2021).

References

[1] K. Anjum et al., Biomedicine and Pharmacotherapy, vol. 92. Elsevier Masson SAS, pp. 681–689, Aug. 01, 2017;

[2] Z. Jing et al., IUBMB Life, vol. 73, no. 2, pp. 398–407, Feb. 2021;

[3] A. Hassani, M. M. S. Azarian, W. N. Ibrahim, and S. A. Hussain, Sci Rep, vol. 10, no. 1, Dec. 2020.

21077 | Polymeric nanoparticles for the delivery of a non-alkylating agent for glioblastoma therapy

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Abstract

Glioblastoma (GBM) is the most frequent and aggressive primary brain tumour in adults. Current therapy with the alkylating agent temozolomide is ineffective, mostly due to resistance mechanisms mediated by the DNA repair proteins. [1]. Recently, non-alkylating drugs have been evaluated in clinical trials to circumvent this resistance. Chloroquine (CHO), used for malaria prevention/therapy, has shown anti-GBM activity by suppressing the cell cycle and promoting GBM cells death [2]. However, its use has limitations, including low stability, high toxicity to healthy tissues, and poor ability to cross the blood-brain barrier (BBB).

To overcome these limitations, polylactic-co-glycolic acid (PLGA) nanoparticles (NPs) were proposed to encapsulate CHO. The NPs were prepared using the double emulsion-evaporation method. Experimental variables such as the quantity of PLGA, number of sonication cycles, amplitude of sonication, and organic solvent/water ratio were varied to develop a formulation with appropriate characteristics such as size, polydispersity index (PDI), zeta potential, and high encapsulation efficiency (EE) 6 independent formulations were prepared The influence of various factors on NPs properties has been investigated in several studies, and NPs exhibited sizes between 152-190 nm, PDIs ranging from 0.04 to 0.08, zeta potentials between -13.8 and -8.0, and EE from 28 to 51%. The results showed that an increase in PLGA amount led to higher EE values since polymer concentration leads to a viscosity increase of the inner organic phase, that can hinder drug loss into the outer aqueous phase. Additionally, increasing the number of sonication cycles and amplitude also led to an increase in EE and a reduction in size as the sonication promotes the breaking of droplets into smaller ones. Future studies will include NPs optimization to improve their EE, as well as studies to evaluate their stability and drug release in simulated physiological conditions.

Keywords: Glioblastoma Multiforme; Brain delivery; Non-alkylating drug; Chloroquine; Nanoparticles; Polylactic-co-glycolic acid

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NET3/0001/2021). FCT supported M.J.R. under the Scientific Employment Stimulus - Individual Call – (CEEC-IND/01741/2021).

References

[1] Tan, A.C., et al., Management of glioblastoma: State of the art and future directions. CA Cancer J Clin, 2020. 70(4): p. 299-312. <u>https://doi.org/10.1007/s10637-015-0275-x</u>;

[2] Roy, L.-O., M.-B. Poirier, and D. Fortin, Chloroquine inhibits the malignant phenotype of glioblastoma partially by suppressing TGF-beta. Investigational New Drugs, 2015. 33(5): p. 1020-1031. <u>https://doi.org/10.1007/s10637-015-0275-x</u>.

21131 | Exploring the antimicrobial properties of light-activated graphene-containing hydrogels

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Abstract

Hydrogels are promising materials for use in tissue engineering. However, they have poor mechanical properties. This can be overcome by the incorporation of graphene oxide (GO) in the hydrogel [1]. GO has also been shown to have antibacterial properties, being an antibiotic-free strategy to prevent medical device infections. Previous work in our group demonstrated that GO films, when irradiated with low-power near-infrared (NIR) light, kills 99% of bacteria via photothermal and photodynamic effects [2]. However, there are no studies reporting the antibacterial action of GO-containing hydrogels using NIR-irradiation with low-power (below 330 mW/cm2; maximum allowed skin exposure according to the ANSI).

The aim of this work is to evaluate whether the incorporation of GO in hydrogels confers antibacterial activity towards surrounding bacteria when irradiated with low-power NIR light, and to determine if the presence of proteins interferes with GO antibacterial activity.

An integrated system with NIR LEDs operating at different low-power (45 - 63 mW) was used to irradiate GO films (controls) and GO-containing pHEMA hydrogels. Antibacterial studies were performed over 4h towards a Staphylococcus epidermidis bacterial suspension, and bacteria viability was assessed by colony forming units assay. It was shown that the antibacterial effect of GO films increases with the increase of the LED power, and that for power higher than 60 mW, the LED alone kills bacteria, so higher power should not be used. The presence of plasma proteins does not interfere with GO antibacterial effect. GO incorporation into pHEMA hydrogels produces an antibacterial effect of 57% when irradiated with NIR. To evaluate the antibacterial mechanism of action of the GO-containing hydrogels, temperature tests and ROS formation assays are being performed.

In conclusion, it has been demonstrated that the antibacterial effect of GO is dependent on LED power and that incorporating GO in pHEMA hydrogels promotes antibacterial properties.

Keywords: antibacterial; graphene; hydrogel; NIR-radiation.

References

[1] Pereira, A.T., et al., Graphene-based materials: the key for the successful application of pHEMA as a blood-contacting device. Biomaterials Science, 2021. 9(9): p. 3362-3377;

[2] Henriques, P.C., et al., Graphene films irradiated with safe low-power NIR-emitting diodes kill multidrug resistant bacteria. Carbon, 2021. 180: p. 10-21.



ENVIRONMENT



20519 | Recognizing the significance of indoor air quality: case study of Portuguese homes

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Abstract

As people spend a large part of their time at homes, maintaining a good indoor air quality in homes is essential for their health and well-being. Particulate matter (PM) is one of the most health-relevant pollutants. Depending on their size, particles deposit in the human respiratory system thus causing various adverse health effects. Thus, the main objective of this study was to evaluate mass concentrations of different PM fractions and number concentrations of ultrafine particles (UFP) in indoor air of private dwellings. Particle mass concentrations ($PM_{0.5}$, PM_1 , $PM_{2.5}$, PM₅ and PM₁₀) and UFP were continuously (25-75h) monitored at four homes (H1-H4) situated in Oporto Metropolitan Area. The obtained results showed relatively low levels of indoor PM (range of 37.5–49.5 \mathbb{D} g/m³ for PM₁₀; 4.93-17.5 \mathbb{D} g/m³ for PM_{2.5}). Both PM₁₀ and PM_{2.5} fulfilled the Portuguese protective thresholds in H1-H4. Considering specific PM, means (for each home) ranged as 2.41–7.8022g/m³ for PM_{0.5}, 3.18–12.8 2g/m³ for PM₁, and 19.5–40.9 2g/m³ for PM₅. The obtained data showed strong correlations (r_s =0.741–0.974) for size fractions with particles of similar sizes, indicating a possible similar origin. For UFP, the mean was 5.56×10^3 #/cm³, with the lowest levels at H4 (mean of 2.33×10³). Ventilation and occupants' combustion activities, such as candles burning and cooking emissions were among the observed indoor emission sources, the latter being especially relevant for increase of UFP concentrations. Understanding role of UFP to IAQ in homes, why and how they are emitted, and their toxicity and health outcomes will allow for proper risk assessments and consequently establishment of public health protection strategies.

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20670 | Development of novel Eucalyptol - Sawdust composite for the slow-release of odours from plywood

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Abstract

Taking into account the recent increased interest in products made from environmentally friendly and natural ingredients, as well as reusing the waste, including innovative products in the wood industry and considering the wish of customers to have a pleasant long-lasting smell indoors, we were developed a new sustainable product based on one-side laminated plywood with novel composite Eucalyptol – Sawdust finish.

This finish aims to serve as a mechanical Eucalyptol release impediment for a longer releaseacting period. To properly evaluate Eucalyptol release, it was first developed an analytical procedure for its determination, which was based on gas chromatography coupled with a flame ionisation detector (GC – FID). This procedure allowed the quantification of Eucalyptol with Limits of Detection (LOD) and Quantification (LOQ) of 0.70 g/m³ and 2.11 g/m³, respectively, and with linearity up to 18.6 g/m³. Sawdust was characterized in terms of granulometry, moisture content and scanning electron microscopy (SEM) porosity evaluation, to determine the best Eucalyptol – Sawdust ratio for odour absorption, for the first time for this purpose. Evaluation of the Eucalyptol release from the composite was performed during a six-month period. It was found that the release occurred with an exponential decay performance and a first-order velocity constant of 0.0169 per day. The half-life was determined to be of 48 days. It was also found that the duration of Eucalyptol release is dependent on the quantity of the composite, having been determined a relationship between amount of composite and aperture diameter. Thus, a new composite was developed for the controlled and slow release of odours, thereby providing a framework for the design of novel wood products with commercial value.

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20541 | Contamination assessment at the abandoned mining complex of Ribeiro da Serra (Portugal)

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Abstract

The former Sb-Au mine of Ribeiro da Serra (RS) in Gondomar operated between 1858-1889 and left behind multiple industrial facilities and waste piles that represent a potential source of contamination. To find out if this hypothesis is true, 54 soil samples were analysed by inductively coupled plasma mass spectrometry. This work integrated multi-statistical analysis to infer the distribution of potentially toxic elements (PTEs) with spatial interpolation.

The Sb-Au deposits are mostly at the inverse flank of the Valongo Anticline. These deposits are hosted in metasedimentary country-rocks from the Cambrian/Precambrian Schist-Greywacke Complex and in Breccias from the Lower Carbonic.

Due to the non-parametric distribution of these elements, the Kernel Density Distribution algorithms was chosen to model the spatial distribution. The spatial distribution of arsenic (As), antimony (Sb), and lead (Pb) shows a contamination path from the North, uphill of the mine, and passing through the RS mine, following the drainage valley towards the South. The PCA highlights a statistical association between As, Sb, Pb. According to the PTEs reference thresholds of soil for agricultural use, defined by the Portuguese Environmental Agency (APA), the soils in RS can present high concentrations of Sb, As and Pb with maximum detected values for each PTE, exceeding the threshold 533x, 130x, and 10x, respectively.

The Enrichment Factor (EF) assessed the presence and the intensity of anthropogenic contamination on the soil. The EF shows a high to extremely high enrichment in As and Sb, and significant enrichment for Pb. The local geochemical background (from uphill), despite having lower values of Sb and As than soils collected downhill, when compared with the APA reference values, still presents an enrichment within the maximums of Sb (68x) and As (58x). It is important to consider the higher natural enrichment for these PTEs due to local mineralizing events.

Keywords: geochemical mapping, antimony, environmental geochemistry, contamination, potentially toxic elements

Acknowledgments

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20486 | The unknown biota of the artificial ponds of Gens

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Abstract

Portuguese polymetallic mining activities were essential for the local development of the economy and were in exploitation until the early 1970s. However, these activities process valuable pit materials and leave significant amounts of tailings susceptible to erosion and chemical weathering, representing a potential risk to the environment. Overall, the surrounding ecosystems are exposed to a high concentration of heavy metals and acidic water. Thus, this work aims to characterize the ecosystem of three artificial ponds located in Gens, inserted in the Parque das Serras do Porto (PSeP). These ponds arose due to open pit mining and ore washing, that has occurred in the last century. Characterization was conducted regarding the physicalchemical (PC) parameters, biological elements (Chlorophyll a concentration, phytoplankton, and macroinvertebrates communities) in different sampling periods, during the year 2022/2023, according to the Water Framework Directive guidelines (3x in the summer and 1x in each other season). Results of PC showed that the three artificial ponds are classified with a reasonable ecological potential, due to the low pH values (< 4) and high nutrient concentrations recorded. For example, the total nitrogen concentrations (e.g. at September P1 - 600 mg/L and P3 - 700 mg/L) were always above the threshold values for a good ecological potential (8 mg/L). On the other hand, the chlorophyll a concentrations recorded comply with the environmental quality standards values (< 9.66 μ g/L). Results of the macroinvertebrates community showed that P1 as the higher diversity and richness values, namely in July and August (H'=2.066 and s=12, respectively), while the highest abundance was observed in P3 recorded in July (N=244, being 65.57% Oligochaeta specimens commonly found in polluted environments). According to the results obtained, further study will be necessary to assist in the management of measures of these aquatic ecosystems integrated in the PSeP Regional Protected Landscape.

Keywords: Mining activities; Mining drainage; Bioindicators

20837 | Detecting toxic dinoflagellates (*Dinophysis* spp.) using electrochemical genosensors

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Abstract

Aquatic environments are important economic and ecological sources for human activities (e.g. fisheries, tourism, agriculture and aquaculture). However, the increase in those practices has, over the years, compromised the integrity of these ecosystems. Runoffs of terrestrial nutrients (from, for example, agricultural and industrial waste) and higher surface temperatures are believed to have transformed these ecosystems into favourable habitats for algae growth and proliferation. As a result, the frequency in phytoplankton microalgae blooms is rising worldwide. These microorganisms are mostly harmless, however certain species, namely belonging to dinoflagellates (e.g., *Dinophysis* spp.) produce toxins that pose a potential risk for human health. Therefore, the need for technological developments towards fast and precise detection of these toxin-producing microalgae is critical to prevent socioeconomical damages and assess the ecological status of marine ecosystems.

In this work, an analytical approach based on an electrochemical genosensor device was developed to create a low-cost platform able to detect two dinoflagellate species from the genus *Dinophysis*: *D. acuminata* and *D. acuta*, which are lipophilic toxin producers responsible of diarrhetic shellfish poisoning (DSP) in humans.

The design of this DNA-based sensor consists of several steps including: i) Sensing phase: consisted by a mixed self-assembled monolayer (SAM) composed by a linear DNA capture probe

(DNA-CP) and mercaptohexanol (MCH) onto disposable screen-printed gold electrodes (SPGE) surface; ii) Hybridization of complementary DNA sequence (DNA target) by using a sandwich format assay with enzymatic labels and iii) Electrochemical detection by chronoamperometry using an enzymatic scheme to amplify the electrochemical signal.

The best analytical conditions were used to study the relationship between electrochemical signal and DNA target concentration, to produce the best electrochemical genosensor device.

Keywords: dinoflagellates, *Dinophysis* spp., electrochemistry, genosensor.

Acknowledgments

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21193 | Characterization of saltmarsh diatoms in the Lima River Estuary: Community composition and Raman Spectroscopy applied for environmental diagnosis

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Abstract

The effects of climate change are evident and undeniable. Salt marshes and estuarine ecosystems require frequent environmental monitoring due to their complexity and extent [1]. Diatoms are eukaryotic unicellular algae that have shown to be cost-effective, great bioindicators of water quality assessment and monitoring, and have been used for decades for this purpose [2, 3]. However, studies and taxonomic information concerning estuarine and marine species are much less frequent compared to studies performed in freshwater species. Thus, the main objective of this work was to characterise diatom diversity in the Lima River Estuary. A total of 90 different diatom species belonging to 49 genera were identified in the 24 samples collected. In parallel, Raman spectroscopy was applied to verify its applicability in diatom specie from this estuary. This simple and fast technique can be used as an environmental diagnostic tool. There is promising evidence that, in the future, it could replace the taxonomic identification of species, which requires a lot of experience and is quite time-consuming. A total of 15 Raman bands that characterise the Raman spectrum in diatoms were observed in the species Navicula gregaria (867 cm⁻¹, 920 cm⁻¹, 961 cm⁻¹, 1013 cm⁻¹, 1160 cm⁻¹, 1180 cm⁻¹, 1198 cm⁻¹, 1270 cm⁻¹, 1315 cm⁻¹, 1350 cm⁻¹, 1390 cm⁻¹, 1445 cm⁻¹, 1527 cm⁻¹, 1606 cm⁻¹ and 1656 cm⁻¹). A PLS analysis demonstrated the changes in the physiological state of the species in different locations, since each band can be attributed to molecular vibrations of pigments and frustule components. The information obtained reveals the great diversity of the diatom community in the Lima River estuary and establishes the importance of monitoring these ecosystems in a constantly changing climate. It is essential to continue to monitor ecosystems such as the Lima River estuary, using more species in Raman Spectroscopy to better understand the different environmental pressures to which communities are exposed and their ecological preferences and boundaries.

Keywords: Diatoms, Saltmarsh, Estuary, Monitoring, Raman Spectroscopy, Environmental Diagnosis.

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References

[1] Salimi, S., Almuktar, S. A. A. A. N., & Scholz, M. (2021). Impact of climate change on wetland ecosystems: A critical review of experimental wetlands. In Journal of Environmental Management (Vol. 286). Academic Press. https://doi.org/10.1016/j.jenvman.2021.112160

[2] Xue, H., Zheng, B., Meng, F., Wang, Y., Zhang, L., & Cheng, P. (2019). Assessment of aquatic ecosystem health of the wutong river based on benthic diatoms. Water (Switzerland), 11(4). https://doi.org/10.3390/w11040727

[3] Kuefner, W., Ossyssek, S., Geist, J., & Raeder, U. (2020). The silicification value: a novel diatombased indicator to assess climate change in freshwater habitats. Diatom Research, 35(1), 1–16. https://doi.org/10.1080/0269249X.2020.1722246

21102 | Land use changes before and after the nuclear accident near Chornobyl city

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Abstract

The nuclear accident of Chornobyl (Ukraine) is one of the two accidents classified as a Major accident on the International Scale of Nuclear Events, along with the Fukushima accident in 2011, in Japan. On April 26^{th,} 1986, the nuclear reactor nº 4 exploded leading to the biggest release of radioactive products into the atmosphere in the history of the civil nuclear industry. For ten days huge quantities of iodine-131 and cesium-137 were released and, although a lot of this material was deposited nearby the central, the lightest materials were scattered by the wind across present-time Ukraine, Belarus as well as some parts of Europe. Thirty-six hours after the accident an exclusion zone of 10 km was designated from which all people were evacuated along with their pets, however, due to the subsequent fallout of radioactive particles the exclusion zone suffered an increase from 10 to 30 km. The evacuation led to a complete abandonment of the land inside the exclusion zone. The objective of this work is to analyse, through remote sensing technics, what type of changes occurred in the land use inside the Chornobyl Exclusion Zone after the accident. For the study in question images of the Landsat satellite were selected every 5 years from the year of the accident, proceeding to its classification with QGIS and the Semi-Automatic Classification Plugin. Two images were classified per year, except for some whose classification was not possible due to the low quality or high presence of clouds. A total of 15 images were classified and divided into two groups - Foliage and No Foliage. The results show a natural progression of the original vegetation to more complex processes of succession, noting especially the decrease of agricultural fields over the years in contrast to an increase in general vegetation. The abandonment of the territory had a positive impact, surpassing the long-term impacts of radiation.

Keywords: Chornobyl, radiation, vegetation, changes, QGIS, Landsat.

20947 | Environmental risk assessment of Estarreja chemical complex

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Abstract

The @10Years project aims to start a process of risk assessment (RA) of a contaminated area surrounding the Estarreja Chemical Complex (ECC). The contamination is mainly due to improper disposal of solid wastes and discharge of liquid effluents into the nearest channels and ditches. As a first step (Tier 0), bibliographic research on soil contamination of this area was carried out, which allowed to perform a risk calculation based on the collected information and mapping the data. The results of this first phase showed that in surrounding area of the ECC, adverse effects to the environment may occur, particularly in the vicinity of the S. Filipe Ditch one of the channels that received effluents from the ECC. Based on these results, it was decided to continue to Tier 1, focusing the work on the area adjacent to S. Filipe ditch. Thus, this work aims to perform a RA in this area and identify the best methods to go further with an Environmental RA, in a broader area. In this sense, 23 composite soil samples were collected and fully characterized for: general soil parameters (pH, organic matter content, conductivity, water holding capacity); the pseudototal content of inorganic elements (e.g.: Cr, As, Cd, Pb, and more); ecotoxicological tests with terrestrial organisms and aquatic organisms. The data was used to calculate the environmental risk associated to the presence of contaminants in soils, based on two lines of evidence (chemical and ecotoxicological). The results indicate that the contamination remains at this site, revealed by the number of samples with levels above the soil screening values, but its effects on terrestrial and aquatic organisms are not as severe as expected. For some organisms no significant effects were observed, and the ecological LoE risk was only unacceptable in one sample. The inconsistencies observed between the two lines of evidence indicate that there is great uncertainty in the results and that it is necessary to proceed to Tier 2.

Keywords: Risk Assessment, Soil contamination, heavy elements, Estarreja Chemical Complex, Ecotoxicology.

20990 | Methallothionein-encoding genes are differentially (down)regulated in young leaves of *Arabidopsis thaliana* by exposure to high Ni levels

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Abstract

With the rise of environmental pollution, the concentration of available heavy metals (HM) in the biosphere has increased, impacting environment and humans. Metallothioneins (MT) are low molecular weight cys-rich proteins, responsible for the detoxification of HM in the cells. This gene-encoded protein family can chelate metals, regulate cellular metal homeostasis and the detoxification process, preventing HM from interfering with the cell mechanisms. The different arrangements of the Cys residues confer MT the ability to bind and sequester various HM and allow them to be classified into types 1, 2, 3 and 4. It has been shown that Arabidopsis thaliana expresses 7 MT (MT1A, MT1B, MT1C, MT2A, MT2B, MT3, MT4A, MT4B) and even though it's being studied and has been for a couple of decades, still much is not known regarding their individual response to some HM. Therefore, the expression of each A. thaliana MT was analysed in young leaves using RT-qPCR in response to a post-germination 21-day exposure to increasing concentrations of Ni – 2.5 mg/L; 5 mg/L; 7.5 mg/L; 10 mg/L. Among MT1s, only MT1A had a significative reduction in its expression with the three higher Ni concentrations (5 mg/L; 7.5 mg/L; 10 mg/L) of 49.33%; 29.72%; 21.20%, respectively. Both MT2A and MT2B had a significative decrease in expression when exposed to 7.5 mg/L Ni of 36.95% and 51.41%, correspondingly; but only the MT2B suffered a decrease of 59.87% when exposed to 10 mg/L Ni. MT3 expression was similar to that of MT2B, being reduced by 66.03% and 49.51%, respectively. MT4s did not show any alterations regarding their expression. These results show that Ni induced a decrease in the expression of most MT-encoding genes in young leaves. It would be interesting to do this analysis in other organs to confirm if this reduction in expression is systemic when it comes to A. thaliana's response to Ni.

Keywords: Metallothioneins; Arabidopsis thaliana; Ni; gene expression; RT-qPCR.

20664 | The influence of different concentrations of nickel in the phytochelatin synthase 1 gene expression in *Arabidopsis thaliana*'s young leaves

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Abstract

Plants have evolved in order to be able to counteract stresses caused by environmental changes, like the rise in concentrations of heavy metals in the soil, such as nickel (Ni). Ni is essential for plants since these cannot complete their life cycle without it. In this way, there are systems of chelation of metal ions by specific ligands in plants, so that their distribution is favourable and the stress they provoke while in excess may be decreased. Currently, these chelators are well characterized and studied, like phytochelatins (PC). These belong to a family of cysteine-rich peptides which are synthetized from reduced glutathione or cysteine-rich polypeptides by transpeptidation by the enzyme phytochelatin synthase (PCS; EC 2.3.2.15), that is directly activated by certain heavy metals. A. thaliana has two PCS enzymes: PCS1 and PCS2, both non-redundant, being PCS1 the more abundant, and PCS2 having a low constitutive expression throughout the plant. The purpose of this work was the study of AtPCS1 expression in young leaves of wild-type A. thaliana grown for 21 days after germination with increasing Ni concentrations – Omg/L; 2.5mg/L; 7.5mg/L; 10mg/L. RNA was extracted from young leaves and the expression of AtPCS1 was attained by RT-qPCR ($n \ge 3$). There was a decrease in AtPCS1 expression at 7.5mg/L and 10mg/L of 65.22% and 81.92%, respectively. In the concentrations of 2.5 and 5mg/L of Ni no significant changes were observed. The data obtained strongly shows that these Ni concentrations had an inhibitory role in AtPCS1 expression in young leaves, raising the hypothesis that other chelating strategies were activated to protect the younger leaves from the stress caused by the metal, such as glutathione, organic acids, among others. Also, the hypothesis that young leaves may be protected from excess Ni by other plant organs cannot be excluded and, therefore, this analysis should be extended to other organs, such as old leaves and roots.

Keywords: phytochelatin synthase 1; Arabidopsis thaliana; RT-qPCR.

21067 | Microplastics contamination of zooplankton from the Douro and Lima estuaries

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Abstract

Microplastics (MPs) are plastic debris with less than 5 mm size that can be mistaken as food by prey and ingested by organisms such as zooplankton. Upon ingestion, MPs may cause injuries and possibly death of these organisms. The present work aims to evaluate MPs contamination of zooplankton from the Douro and Lima estuaries. During 1-year, seasonal surveys were conducted to collect zooplankton from different sites in each estuary. In the laboratory, major zooplanktonic groups were quantified using a Bogorov chamber. Water samples were also collected for MPs characterization. MPs presence in two of the most abundant zooplankton groups (copepods and chaetognaths) was assessed using a dedicated protocol previously optimized. MPs retrieved from water samples and zooplanktonic organisms were characterized by size, shape and colour, and the polymer was identified by FTIR analysis. MPs were present in all water samples, and the two estuaries presented similar mean MPs concentration (Lima: 2.8 ± 2.3 MPs L-1; Douro: 2.4 ± 1.9 MPs L-1). Zooplanktonic organisms were also contaminated, chaetognaths exhibiting relevant concentrations, not only in the Lima $(5.9 \pm 6.1 \text{ MPs ind-1})$, but also in the Douro estuary $(5.3 \pm 5.2 \text{ ms})$ MPs ind-1). On the other hand, copepods tended to have lower levels of MPs contamination, also in the two estuaries (Lima: 2.3 \pm 2.1 MPs ind-1; Douro: 3.7 \pm 4.1 MPs ind-1). Results of ratios between ecological relevant lifeform pairs of zooplankton and MPs are discussed to infer effects of MPs in plankton functioning.

Keywords: Microplastics; zooplankton; estuaries.

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HEALTH SCIENCES



20465 | A systematic review of diet and special educational needs in paediatrics

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Abstract

Special Educational Needs (SEN) refer to children and adolescents needing additional educational support. Diet during pregnancy and paediatric age can influence the prevalence/severity of symptoms in SEN-related conditions/disabilities. This review aims to summarize associations between (i) pregnant women's diet and the prevalence of SEN-related conditions/disabilities among children/adolescents; (ii) the diet of children/adolescents with SEN-related conditions/disabilities and their symptomatology/well-being. A literature search was carried out on Medline? and Scopus?, according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The following inclusion criteria were considered, for each aim: (i) children/adolescents ≤ 19 years; pregnant women's diet/nutrition; diagnosis of SENrelated conditions/disabilities in children/adolescents; (ii) children/adolescents \leq 19 years; children/adolescents' diet/nutrition; symptomatology/well-being of children/adolescents with SEN-related conditions/disabilities. Eighty-seven articles were included, referring to 10 different SEN-related conditions/disabilities, from which Attention-Deficit/Hyperactivity Disorder (ADHD) (41 articles) and Autism Spectrum Disorder (ASD) (34 articles) stand out. It doesn't seem to exist an association between maternal caffeine consumption and ADHD risk. A negative association between pregnant multivitamin moderate supplementation and the risk of ASD diagnosis was found. A positive association was found between high-sugar foods and beverages intake during childhood/adolescence and ADHD symptoms. Maternal breastfeeding and children/adolescents' vitamin D supplementation seem to improve ASD behavioural symptoms. These results are relevant to help the development of guidelines for dietary recommendations for this target population. PROSPERO registration number: CRD42022313235.

Keywords: special educational needs; systematic review; diet; paediatric age; pregnancy; children; adolescents.

20484 | Evaluation of the impact of beliefs about medicines on medication adherence

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Abstract

Introduction: Poor adherence to the prescribed medication hinders therapeutic success. Among others, lack of information and misbeliefs about medicines can partially explain why patients refuse a therapeutic drug strategy to fight disease.

Objective: This study aimed to identify the relationship between beliefs about medicines and medication adherence in patients visiting three community pharmacies in the Porto district.

Methods: This cross-sectional study was conducted between Feb-Sep 2022. Data were collected using two validated questionnaires, the Medication Adherence Report Scale $(MARS-P9)^{[1]}$ where higher scores mean higher adherence, and the Beliefs about Medicines Questionnaire $(BMQ)^{[2]}$ comprising two subscales (necessities – N and concerns - C). Sociodemographic information was also collected. The study was approved by the FFUP Ethics Committee (ref: 12-03-2022-EST) and all participants signed an informed consent form. Data were processed using SPSS v25. All tests were performed at a significance level of 5%.

Results: The mean age of the 160 patients enrolled was 62.6 years, 62.5% were females, 51.2% were retired from working, 61.9% had an education \leq 9th grade, 86.9% were living with someone and 56.5% reported average health status. The median MARS-P9 score was 39 (range 9-45). BMQ results were higher in the N subscale (mean=19.75; SD=3.39) compared to C (15.25; SD=4.86), with an N-C mean of 4.51 (SD=6.02). MARS-P9 correlated with BMQ N-C (p=0.003; rho:0.227). MARS-P9 correlated with the BMQ C subscale (p<0.001; rho: -0.295), but not with the BMQ N subscale (p=0.599). BMQ N-C showed a weak correlation with age (p=0.011; Sig.:0.196) but not with the remaining socio-demographic variables studied.

Conclusion: Adherence behaviour measured with MARS-P9 correlated with beliefs about medicines, but especially with the concerns subscale of the BMQ. This demonstrates the convenience of tailoring the interventions to improve adherence.

Keywords: Chronic diseases, medication adherence, beliefs about medicines.

References

[1] Sampaio R, Cruz M, Pinho S, Dias CC, Weinman J, Castro Lopes JM. Portuguese Version of the Intentional Non-Adherence Scale: Validation in a Population of Chronic Pain Patients. Front Pharmacol. 19 de julho de 2021; 12:681378.

[2] Salgado T, Marques A, Geraldes L, Benrimoj S, Horne R, Fernandez-Llimos F. Cross-cultural adaptation of the Beliefs about Medicines Questionnaire into portuguese. Sao Paulo Med J. abril de 2013;131(2):88–94.

20559 | Development and use of a meditation app (Med@Med) by medical students: motivations, adherence and emotional effects

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Abstract

Medical students report high stress levels which affect their well-being and health. Due to the high rates of self-perceived stress amongst the medical students of the Faculty of Medicine of Porto (FMUP), we performed a project with three goals: (1) develop a meditation app (Med@Med), created specifically for the FMUP students, consisting of 21 daily consecutive short-guided meditation practices recorded in Portuguese; (2) evaluate the motivations and interests for using the app; (3) analyse the persistence and emotional benefits of the Med@Med app.

Students (N=147) adhered to the project. The main motivations reported were: try a meditation practice for the first time (33%), decrease stress/anxiety (25%) or implement a daily meditation routine (16%). The motivation to adhere was high (7.3 \pm 3.2, scale 1 to 10). Participants that received daily motivational Whatsapp messages to use the app, in lay language, were more prone to access the practices. If the messages contained a short summary of scientific results about the benefits of meditation, the adherence decreased to levels similar to students that did not receive any messages. Additionally, students were invited to choose an icon identifying a basic emotion (joy, fear, disgust, anger or sadness), or no emotion at all, before and after each meditation practice. Results showed that the emotional patterns changed in the 2 moments, specifically with a detected decrease in the self-identification of the icons fear and sadness. Furthermore, students were asked to complete the EROS (Emotion Regulation of Others and Self) scale, before initiating the first meditation and at the end of the project. An improvement on the intrinsic emotional regulation subscale (p<0.01).

This exploratory study shows that medical students of FMUP are generally motivated to use the Med@Med meditation app. Strategies to improve their persistence should be considered inasmuch that the results obtained indicate improvements in emotion-related parameters.

Keywords: Stress; Mindfulness; Well-Being; Health

20912 | Efficacy of topical vitamin C in melasma and photoaging: A systematic review

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Abstract

Background: Vitamin C is a micronutrient present in high concentrations in normal skin and a highly prescribed cosmeceutical, well-known for protecting against UV-induced pigmentation and for regulating collagen production.

Aim: This systematic review aims to assess if topical vitamin C could be effective in reversing photoaging signs and treating melasma.

Methods: Prospective, randomized controlled trials (RCT) assessing protocols with topically applied vitamin C in patients with melasma or photodamage were searched in Medline, CENTRAL and Scopus databases until the 12th of May 2022. Risk of bias was conducted in accordance with Cochrane Collaboration's tool for assessing risk of bias in randomized trials, using RevMan 5.0.

Results: Seven publications were included, with 139 volunteers in total. Studies that evaluated topography of skin indicated that the treated skin appeared smoother and less wrinkled, which was supported by biopsies data. On objective assessments of pigmentation, there was a significant lightening of the skin treated, but clinical and self-assessment results didn't corroborate this finding. Hydration improved equally in the vitamin C and placebo treated sites. Conclusions: This study revealed that vitamin C is effective in treating uneven, wrinkled skin and has depigmentating properties, but long-term use may be needed to achieve noticeable changes. Q-switched Nd:YAG laser-associated protocols appears beneficial in enhancing vitamin C effects and more studies are needed to confirm this and assess ideal concentrations. These results suggest vitamin C may be a suitable alternative for treating melasma and photoaging.

Keywords: vitamin C; melasma; photoaging; solar lentigines; photodamage; wrinkles.

20920 | T(AHR)getting the AHR: mapping the road of a xenobiotic sensor, from disease to a therapeutic target

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Abstract

Treatment and disease are complex scenarios involving many players, including the Aryl Hydrocarbon Receptor (AHR). The AHR is a highly conserved ligand-dependent transcription factor initially discovered as a xenobiotic sensor, which recently gained recognition as a major player in different biological contexts, from health to disease, to a therapeutic target ¹. Our group and others have shown that AHR modulation in different scenarios, including by therapeutic drugs, impacts disease outcomes and treatment efficacy, including in cancer and bacterial infections ^{1–3}. Albeit, the extent of clinically approved drugs with AHR modulatory properties and the elicited AHR functions is largely unknown. Our research aims to identify novel drugs with AHR modulatory properties.

We conducted a systematic and unbiased evaluation of 3178 drugs for their AHR modulatory properties using a luciferase cell reporter assay ^{2,4,5}, identifying 228 hits as potential AHR agonists or antagonists (including known AHR ligands, validating our approach). The respective EC_{50s} or IC_{50s} were calculated and AHR modelling studies predicted 53 agonists and 31 antagonists to bind to AHR. Through Pathway Analysis and Data Mining approaches, we classified the hits according to their roles in different pathways, diseases, and targets. An anticancer and anti-infection molecule is currently being tested for its AHR modulatory properties, and for the assessment of the AHR role(s) in its therapeutic mechanism and drug-resistance phenotypes. Validation studies will involve *in vitro* (e.g. gene expression analysis, enzymatic assays, ligand binding studies)^{2,4-6} and *in vivo* approaches (e.g. zebrafish larvae)^{2,5,7}.

In all, we have identified different therapeutic drugs with AHR modulatory properties, enabling us to gain a deeper understanding of the biology of AHR in disease, of its role in resistance mechanisms, and the identification of potential repurposing drugs targeting this receptor, paving the ground for future therapeutic approaches.

Keywords: Aryl Hydrocarbon Receptor; Disease; Drug Therapy; Drug Resistance.

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References

[1] Corre, S. *et al.* Sustained activation of the Aryl hydrocarbon Receptor transcription factor promotes resistance to BRAF-inhibitors in melanoma. *Nat. Commun.* 9, 4775 (2018).

[2] Puyskens, A. *et al.* Aryl Hydrocarbon Receptor Modulation by Tuberculosis Drugs Impairs Host Defense and Treatment Outcomes. *Cell Host Microbe* 27, 238-248.e7 (2020).

[3] Murray, I. A., Patterson, A. D. & Perdew, G. H. Aryl hydrocarbon receptor ligands in cancer: friend and foe. *Nat. Rev. Cancer* 14, 801–814 (2014).

[4] Moura-Alves, P. *et al.* AhR sensing of bacterial pigments regulates antibacterial defence. *Nature* 512, 387–392 (2014).

[5] Moura-Alves, P. *et al.* Host monitoring of quorum sensing during Pseudomonas aeruginosa infection. *Science* 366, 1629 (2019).

[6] Stinn, A., Furkert, J., Kaufmann, S. H. E., Moura-Alves, P. & Kolbe, M. Novel Method for Quantifying AhR-Ligand Binding Affinities Using Microscale Thermophoresis. *Biosensors* 11, 60 (2021).

[7] Lozza, L. *et al.* The Henna pigment Lawsone activates the Aryl Hydrocarbon Receptor and impacts skin homeostasis. *Sci. Rep.* 9, 10878 (2019).

21098 | 3D Printing of decellularized ECM and graphene hybrid hydrogels for cardiovascular applications

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Abstract

The extracellular matrix (ECM) supports cellular behaviours, emerging as a promising biomaterial for tissue regeneration. When decellularized, dECM [1] partially maintains native tissue architecture and shape, being amenable to digestion for the fabrication of hydrogels that exhibit weak mechanical properties. In this study, we use graphene materials, with excellent mechanical and antimicrobial properties and biocompatibility, [2,3] to design dECM/graphene inks for 3D printing [4] of scaffolds for cardiac regeneration.

For this, we mixed 3% and 4% (w/v) dECM, with two types of graphene oxide (GO) suspensions: a lab made (GO1) and a commercially available (GO2), in concentrations from 5-100% (w/v). We also tested different printing substrates (plastic, glass, and Sigmacote-treated glass), temperatures (RT & 37° C), and support baths (water & dextran).

SEM images showed ECM fibers intertwined with the GO1 sheets that aggregate in higher concentrations. Complex modulus of dECM improves more than 33x upon GO1 incorporation. Lower concentrations of dECM (3%) and GO (5-10%) and the use of glass substrates produced filaments with poor shape fidelity. GO2 mixed better in dECM and produced filaments with better shape fidelity. With Sigmacote-treated glass, the printing fidelity is not as good as with plastic, but fibres detachment after printing is improved. At 37°C, gelation is faster than RT, but gels dry within 1 min. Water as support bath improved shape fidelity but the filaments float, while in dextran the filaments dissolved precluding the scaffold fabrication. ECM 4%/GO2 25% with Sigmacote-treated glass at RT, seems to be the most adequate conditions for printing as it shows the best shape fidelity and detachment from substrate. However, it has been observed that dECM and GO separate during printing, resulting in uneven filaments. This should be solved by improving ink homogenization.

In conclusion, GO improves ECM printability, and we expect to obtain a stable scaffold and conduct biological assays.

Keywords: 3D Printing, ECM, ECM scaffolds, graphene, graphene oxide, hydrogels, tissue engineering.

References

[1] Schneider, K. H. et al. Decellularized human placenta chorion matrix as a favorable source of small diameter vascular grafts. *Acta Biomater*. 29, 125–134 (2016).

[2] Pereira, A. T. et al. Graphene Oxide Coating Improves the Mechanical and Biological Properties of Decellularized Umbilical Cord Arteries. *ACS Appl. Mater. Interfaces* 13, 32662–32672 (2021).

[3] Henriques, P. C. et al. Graphene Surfaces Interaction with Proteins, Bacteria, Mammalian Cells, and Blood Constituents: The Impact of Graphene Platelet Oxidation and Thickness. *ACS Appl. Mater. Interfaces* 12, 21020–21035 (2020).

[4] Moura, D., Pereira, R. F. & Gonçalves, I. C. Recent advances on bioprinting of hydrogels containing carbon materials. *Mater. Today Chem.* 23, 100617 (2022).

20865 | Inhibition of mitochondrial deubiquitinases as a potential therapeutic strategy in *in vitro* and *in vivo* models of mitochondrial dysfunction

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Abstract

Mitochondrial diseases are the most common inherited neurometabolic disorders. They can be caused by mutations in mitochondrial DNA (mtDNA), where the amount of mutated mtDNA is a major determining factor for the clinical severity [1]. Mitochondrial deubiquitinases reduce the ubiquitination of mitochondria, limiting its autophagic degradation (mitophagy) [2]. We tested the hypothesis that the inhibition of mitochondrial deubiquitinases rescues mitochondrial dysfunction and reduces the mutated mtDNA load by promoting the selective degradation of dysfunctional mitochondria (inc. with more mutated mtDNA). We inhibited the mitochondrial deubiquitinase USP30 with MF-094 in zebrafish larvae treated with the dopaminergic toxin MPP⁺ (a mitochondrial complex I inhibitor), and in cybrid cells bearing m.3243A>G (MELAS syndrome) and m.8993T>G (NARP syndrome) mtDNA mutations. We validated the MPP⁺-treated zebrafish as a mitochondrial dysfunction model: MPP⁺ inhibited complex I, reduced metabolism, induced degeneration of tyrosine-hydroxylase positive neurons and decreased sensorimotor reflexes and spontaneous movement in zebrafish. MF-094 rescued sensorimotor reflexes and travelled distance of MPP⁺-treated zebrafish. This supports USP30 inhibition as a promising strategy to counteract mitochondrial dysfunction. Then we tested it in mitochondrial disease models. MF-094 induced mitophagy in MELAS and NARP cells as evaluated by imaging with the mitokeima probe, and increased mtDNA copy number in MELAS cells, but not in NARP cells. These results suggest that USP30 inhibition may induce mitochondrial biogenesis in MELAS cells compensating the degradation of dysfunctional mitochondria. 7-days treatment with MF-094 were insufficient to alter the mutated mtDNA load. This work supports the strategy of targeting mitochondrial deubiquitination to attenuate mitochondrial dysfunction, although further experiments with extended treatment duration are required to clarify the effects of this strategy upon mutated mtDNA.

Keywords: Mitochondria; Mitochondrial diseases; Deubiquitination; Treatment.

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References

Ng YS et al. (2021) Lancet Neurol. 20(7): 573-84;
Clague MJ et al. (2019) Nat. Rev. Mol. Cell. Biol. 20(6): 338-52.

20438 | Total Tumour Load to assist in the decision for additional axillary surgery in the positive sentinel node breast cancer patients

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Abstract

The Total Tumour Load (TTL) concept has been demonstrated to accurately predict the status of the non-sentinel lymph nodes (NSLN) in breast cancer patients. In 2019, our centre implemented the TTL cut-off of 30,000 CK19 mRNA copies/ μ L as sole criterion for deciding on performing ALND. This retrospective, unicentric, study analysed 87 cT1-3N0 breast cancer patients treated consecutively in a period of two years and aimed to evaluate the performance of this criterion. Secondary objectives included the comparison of the criterion versus our previous Clinical Decision Rule (CDR) versus ACOSOG Z0011 criteria for avoiding an ALND in proportion of patients spared an ALND and in proportion of patients left with a surgically untreated metastasized axilla. An interim analysis revealed new TTL cut-offs for deciding on performing an ALND.

The 30,000 CK19 mRNA copies/ μ L criterion yielded an area under the ROC Curve (AUC) of 0.849, a false positive (FP) rate of 30.1% and a positive predictive value (PPV) of 38.9%. The 30,000 CK19 mRNA copies/ μ L criterion spared 58.6% of the patients an ALND versus 41.4% with CDR versus 73.6% with Z0011 and left 0.0% patients with a surgically untreated metastasized axilla versus 21.4% with CDR versus 42.9% with Z0011. The new TTL cut-off of 260,000 CK19 mRNA copies/ μ L for deciding on an ALND yielded an AUC of 0.753, a FP rate of 13.7% and a PPV of 47.4%. This new criterion spared 78.2% of the study sample an ALND and left 35.7% of metastasized axillae surgically untreated.

This study emphasizes the need to find a new balance between locoregional control and the morbidity associated with Berg levels I+II axillary lymph node dissection.

Keywords: Breast cancer; Sentinel node; OSNA; Total tumour load; Non-sentinel node; Axillary lymph node dissection.

20504 | Differences among a Portuguese cohort of BRAC pathogenic/likely pathogenic variants carriers choosing risk reducing mastectomy or intensive breast surveillance

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Abstract

Purpose: Women with BRCA1 and BRCA2 (BRCA1/2) pathogenic/likely pathogenic (P/LP) variants have a higher risk to develop breast and ovarian cancer. In structured high-risk clinics, risk-reducing measures are adopted. This study aimed at characterizing these women and identify factors that may have influenced their choice between risk reduction mastectomy (RRM) or intensive breast surveillance (IBS).

Methods: This study reviewed retrospectively 187 clinical records of affected and unaffected women with P/LP variants of the BRCA1/2 genes, from 2007 to 2022, of which 50 chose RRM while 137 chose IBS. The research focused on personal and family history and tumour characteristics and their relation with the preventive option chosen.

Results: Among women with personal history of breast cancer, a higher proportion opted for RRM compared to those asymptomatic (34.2% vs 21.3%, p=0.049), with younger age determining the option for RRM (38.5 years vs 44.0 years, p<0.001). Among women with personal history of ovarian cancer, a higher proportion opted for RRM compared to those without that history (62.5% vs 25.1%, p=0.033), with younger age determining the option for RRM (42.6 years vs 62.7 years, p=0.009). Women who had bilateral salpingo-oophorectomy were more likely to choose RRM than those who did not (37.3% vs 18.3%, p=0.003). Family history was not associated with preventive option (33.3% vs 25.3, p=0.346).

Conclusions: The decision for the preventive option is multifactorial. In our study, personal history of breast or ovarian cancer, younger age at diagnosis and previous bilateral salpingo-oophorectomy were associated with the choice of RRM. Family history was not associated with the preventive option.

Keywords: BRCA; breast cancer; pathogenic/likely pathogenic variants; risk-reducing options.

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20589 | Molecular characterisation of cutaneous melanoma

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Abstract

Cutaneous melanoma (CM) is the least frequent but deadliest kind of skin cancer, highlighting the aggressiveness of these tumours. As a result of prolonged exposure to UV radiation, CM harbours one of the highest mutation rates among all malignancies^{1,2}. The three most common mutations occur in *BRAF* and *NRAS* genes, both important for the mitogen-activated protein kinase pathway upregulation³, and in the telomerase reverse transcriptase promoter, which is linked to a poor prognosis⁴. Although current therapies have improved patients' overall survival, low response rates and treatment resistance remain as major challenges for melanoma treatment. Therefore, melanoma investigations have shifted their interest to microRNAs (miRNAs), like miR-125a, miR-155 and miR-579, noncoding RNAs that affect the hallmarks of cancer and are potential melanoma biomarkers⁵.

The aim of this project is to study the molecular alterations of melanomas, and to correlate them with the patients' clinicopathological data and follow up, to identify possible prognostic and/or therapeutic biomarkers.

The mutational status analysis was performed by the Sanger method in primary tumours, metastatic lymph nodes, and metastases collected at Hospital de Santarém and Hospital dos Capuchos. Whereas miRNA expression, from primary tumours collected at Hospital de Santarém, was analysed by RT-PCR.

The median age of the studied series was 65 years, where most melanomas were primary tumours (83%), located in the limbs (54%), from superficial spreading subtype (52%) and

associated with advanced melanoma stages, with higher Breslow index (67%), vertical growth phase (74%) and $\geq 1/\text{mm}^2$ mitotic rate (71%). So far, 46% of *BRAF*, 26% of *NRAS* and 15% of *TERT* p mutations were found.

The work is still ongoing, but our preliminary results suggest that the studied alterations play a role CM progression. The discovery of potential prognostic and/or therapeutic biomarkers will aid in melanoma patient prognosis and therapy improvement.

Keywords: melanoma; treatment; *BRAF, NRAS; TERT*p; miRNA

Acknowledgments

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References

[1] Guo W, Wang H, Li C. Signal pathways of melanoma and targeted therapy. Signal Transduct Target Ther. 2021;6(1)

[2] Turner N, Ware O, Bosenberg M. Genetics of metastasis: melanoma and other cancers. Clin Exp Metastasis [Internet]. 2018;35(5–6):379–91

[3] The Cancer Genome Atlas Network. Genomic Classification of Cutaneous Melanoma The Cancer Genome Atlas Network. Cell [Internet]. 2015;161(7):1681–96.

[4] Griewank KG, Murali R, Puig-Butille JA, Schilling B, Livingstone E, Potrony M, et al. TERT promoter mutation status as an independent prognostic factor in cutaneous melanoma. J Natl Cancer Inst. 2014;106(9).

[5] Varrone F, Caputo E. The miRNAs role in melanoma and in its resistance to therapy. Int J Mol Sci. 2020;21(3).

20645 | Dissecting the roles of the Aryl Hydrocarbon Receptor in melanoma: from a sensor to a regulator of the melanoma microenvironment

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Abstract

Cutaneous melanoma is a skin cancer that originates in melanocytes, which are the cells responsible for producing melanin [1]. The malignant transformation of melanocytes is triggered by genetic and environmental factors, including ultraviolet radiation [1]. In melanoma, melanocytes lose their interaction with keratinocytes which leads to the proliferation and invasion of tumour cells [1]. Therefore, it is crucial to understand the molecular pathways involved in the crosstalk between melanocytes/melanoma cells and other cells in the microenvironment to improve the current or develop new treatments for melanoma. The aryl hydrocarbon receptor (AHR) is a ligand-dependent transcription factor with the capacity to bind a large number of ligands, being implicated in numerous cellular functions, such as proliferation, differentiation, apoptosis and immune cell recruitment [2]. Significantly, the AHR can regulate melanogenesis and inflammation, and has important roles in tumourigenesis, including in melanoma where its activation has been linked to the development of resistant cells to the drug therapy [3].

Our group has shown that the AHR can bind bacterial pigments and regulate immunity to infection [4]. Similarly, we hypothesised that the AHR can sense melanin and modulate the Melanoma microenvironment. Our preliminary data show that melanin exposure of Keratinocytes (HaCaT), Macrophages (THP-1) or Melanoma cells (Mel501) lead to increased AHR activation, assayed by luciferase-reporter assays and gene expression analysis. Further, *in silico* modelling suggest a potential direct binding of the AHR to melanin. In all, our data shows that the AHR can act as a melanin sensor. Further studies will evaluate the role of the AHR in the melanoma microenvironment, both *in vitro* and *in vivo*. This work will illuminate molecular sensing and signalling pathways underlying melanoma susceptibilities and microenvironmental dynamics, with potential implications for treatment strategies.

Keywords: Aryl hydrocarbon receptor; Melanoma; Melanin; Melanoma microenvironment.

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References

[1] Wang, J.X., M. Fukunaga-Kalabis, and M. Herlyn, *Crosstalk in skin: melanocytes, keratinocytes, stem cells, and melanoma.* J Cell Commun Signal, 2016. **10**(3): p. 191-196.

[2] Stockinger, B., et al., *The aryl hydrocarbon receptor: multitasking in the immune system*. Annu Rev Immunol, 2014. **32**: p. 403-32.

[3] Corre, S., et al., Sustained activation of the Aryl hydrocarbon Receptor transcription factor promotes resistance to BRAF-inhibitors in melanoma. Nat Commun, 2018. **9**(1): p. 4775.

[4] Moura-Alves, P., et al., *AhR sensing of bacterial pigments regulates antibacterial defence*. Nature, 2014. **512**(7515): p. 387-92.

20649 | The role of glycans in modulating innate immunity towards cancer prevention

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Abstract

In 2020, over 500 000 cases of bladder cancer (BC) were diagnosed, which resulted in around 200 000 deaths¹. Bacillus Calmette-Guérin (BCG) is often used as an adjuvant immunotherapy in early, high risk and non-muscle invasive BC. It is described that this bug triggers a memory-like enhanced immune phenotype that reprograms innate immune cells, including monocytes². However, the mechanism that facilitates this process is not well understood, and not all patients have a positive response.

BCG has relevant glycan structures on its surface, namely lipomannans, which can be sensed by innate cells carrying pattern-recognizing receptors (PRRs)³. Glycans are carbohydrate structures added by enzymes to lipids or proteins, and they cover the cell membrane of all cells, forming the glycocalyx. This plays a major role in several cellular processes, such as tumour immunoediting and progression⁴. Previous work from our group demonstrated that aberrant expression of complex branched N-glycans is linked to tumour evasion in colorectal cancer, and the removal of these structures lead to a reinvigorated immune response⁵.

To this end, we aimed to use glycans to trigger a more pro-inflammatory phenotype on monocytes, increasing the capacity of these cells to sense and kill tumour cells based on the recognition of BCG-like glycan moieties. In silico analysis shows that monocytes previously exposed to certain stimuli with pro-inflammatory priming capabilities show an increased expression of glycan binding receptors. As a proof of concept, we isolated monocytes from healthy donors and exposed to different glycan structures. We observed an increased expression of PRRs and pro-inflammatory cytokine production by monocytes, when exposed to BCG-like glycans. In the future, we plan to co-culture these cells with BC cell lines to evaluate their tumour killing capability.

Keywords: bladder cancer; BCG; glycans; memory-like innate phenotype.

References

[1] Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2021).
Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36
Cancers in 185 Countries. CA: A Cancer Journal for Clinicians, 71(3), 209-249.
https://doi.org/https://doi.org/10.3322/caac.21660

[2] van Puffelen, J. H., Keating, S. T., Oosterwijk, E., van der Heijden, A. G., Netea, M. G., Joosten, L. A. B., & Vermeulen, S. H. (2020). Trained immunity as a molecular mechanism for BCG

immunotherapy in bladder cancer. Nature Reviews Urology, 17(9), 513-525. https://doi.org/10.1038/s41585-020-0346-4

[3] Alves, I., Fernandes, Â., Santos-Pereira, B., Azevedo, C. M., & Pinho, S. S. (2022). Glycans as a key factor in self and nonself discrimination: impact on the breach of immune tolerance. FEBS Letters, 596(12), 1485-1502. https://doi.org/https://doi.org/10.1002/1873-3468.14347

[4] Pinho, S. S., & Reis, C. A. (2015). Glycosylation in cancer: mechanisms and clinical implications. Nature Reviews Cancer, 15(9), 540-555. https://doi.org/10.1038/nrc3982

[5] Silva, M. C., Fernandes, Â., Oliveira, M., Resende, C., Correia, A., de-Freitas-Junior, J. C., Lavelle, A., Andrade-da-Costa, J., Leander, M., Xavier-Ferreira, H., Bessa, J., Pereira, C., Henrique, R. M., Carneiro, F., Dinis-Ribeiro, M., Marcos-Pinto, R., Lima, M., Lepenies, B., Sokol, H., . . . Pinho, S. S. (2020). Glycans as Immune Checkpoints: Removal of Branched N-glycans Enhances Immune Recognition Preventing Cancer Progression. Cancer Immunology Research, 8(11), 1407-1425. https://doi.org/10.1158/2326-6066.Cir-20-0264

20652 | Ubiquitination default as a familial non-medullary thyroid cancer marker

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Abstract

Introduction: Hereditary thyroid cancer accounts for approximately 10% of all thyroid cancer cases. Familial non-medullary thyroid cancer (FNMTC) arises from thyroid follicular cells and is diagnosed when the disease is present in two or more first-degree relatives in the absence of other known familial syndromes [1,2]. A 36 year-old woman was diagnosed with oncocytic variant of papillary thyroid carcinoma, along with her twin 19 year-old daughters. By Next Generation Sequencing (NGS) a germline mutation (p.G486R) in ubiquitin-specific protease 42 gene (USP42) was found. USP42 belongs to the family of deubiquitinating enzymes (DUBs), known for regulating cell cycle arrest, apoptosis, and other relevant cellular functions. Consistent evidence has shown that deregulation of DUBs may lead to tumorigenic processes.

Aim: Validate USP42 alteration as an underlying cause of FNMTC.

Materials and methods: To validate our hypothesis we are currently conducting in silico analysis resorting to online available NGS databases. *In vitro* assays using Nthy-ori 3-1 cell line are being performed. siRNAs are being used to silence the USP42 gene. CRISPR-RNP methodology will be used to knockout the USP42 gene and also to knock-in the p.G486R mutation found in this family. Morphologic and functional assays will be performed in the transformed cell clones. Finally, *in vivo* assays will be conducted in zebrafish to replicate *in vitro* results.

Results: Through 2 NGS databases, we inferred that USP42 has an augment in copy number variation (CNV) and sporadic mutations can occur. Human thyroid tissue normally expresses the USP42 gene. By siRNAs we successfully silenced this gene in human thyroid Nthy-ori 3-1 cell line, as verified by RT-PCR RNA analysis. Protein expression is currently being analysed by Western blot technique and cellular functional assays are being conducted at the same time.

Conclusion: If our hypothesis is verified, USP42 may be used as a potential prognostic marker on FNMTC.

Keywords: USP42, Hereditary thyroid cancer, germline mutation.

References

[1] Capezzone, M., et al. "Familial non-medullary thyroid cancer: a critical review." Journal of Endocrinological Investigation 44 (2021): 943-950.

[2] Orois, Aida, et al. "Familial non medullary thyroid carcinoma: Beyond the syndromic forms." Endocrinología, Diabetes y Nutrición (English ed.) 68.4 (2021): 260-269.

20867 | Evaluation of a new player in renal fibroblast activation

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Abstract

Chronic kidney disease (CKD) is a highly prevalent pathology characterized the progressive loss of kidney function that may culminate in End Stage Kidney Disease and the need for dialysis or kidney transplant. Among several other biological processes, inflammation, and fibrosis - characterized by an excessive synthesis and deposition of extracellular matrix (ECM) proteins – are the main hallmarks of CKD progression but still, very little is known regarding the biological pathways underlying CKD onset and development and there are no effective treatments.

Our group has identified a microduplication of a gene (code: PxX) in a patient with multiple malformations and unexplained CKD, which has been shown to have a crucial role in ECM formation and stability, with potential implications in the pathophysiology of organ fibrosis that remains to be clarified.

In this work, we studied the role of PxX in the modulation of the TGF β 1 mediated fibrotic processes of renal fibroblasts. For this aim, primary human kidney fibroblast cell cultures were exposed to different concentrations of TGF β 1 – the major profibrotic pathway identified in the kidney – for different time periods and the effect in the main fibrotic and inflammatory markers as well as in PxX expression was analysed by RT qPCR.

Results showed a major decrease of *PxX* gene expression at 24h of treatment that recovered to basal levels from 48h to 5 days of TGF β 1 treatment. Interestingly, a similar expression profile was found for *col4a1* and *bcl2*, that contrasted during the first 24h with *tgf\beta1*, *bax* and *casp3* expression. The findings on similar expression between these five genes suggest an intimate connection between the regulation of these genes' expression by an unknown common pathway. Overall, data suggests a previously unidentified, time-dependent, enrolment of PxX in the response of kidney fibroblasts to an inflammatory insult highlighting this protein as a putative novel pathophysiology pathway in kidney fibrosis.

Keywords: CKD; fibrosis; ECM; PxX; Cell Cultures

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20853 | Understanding the role of extracellular vesicles derived from mutant KRAS colorectal cancer cells on T-cell activation and exhaustion

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Abstract

KRAS inhibition revealed initial good clinical responses, frequently associated with the reactivation of the immune system. However, tumours recur shortly after treatment begins, suggesting that alternative immunosuppressive mechanisms exist to impair anti-tumour responses. We hypothesize that extracellular vesicles (EVs) secreted by KRAS-inhibited cells carry microRNAs that trigger tumour immune evasion through T cells exhaustion.

An in-silico analysis of microRNAs targeting immune checkpoints (IMC) crossed with publicly available data on microRNAs regulated by mutant KRAS revealed alterations on the total levels of several microRNAs and/or a shift in their localization between the cancer cell or its-derived EVs in KRAS-inhibited cells (Fig1).

We further characterized the EVs secreted by KRAS-inhibited and control cells cultured in 2D and 3D conditions. Nanoparticle tracking analysis revealed no differences on EVs mean and mode sizes between KRAS-inhibited and control cells and regardless culture conditions (Fig2A, B). Though, we observed that the average number of EVs/cell was significantly higher in 3D comparing to 2D. More so, while in 2D there was no difference on the number of secreted EVs/cell between KRAS-inhibited and control cells; in 3D, KRAS-inhibited cells secreted significantly lower amounts of EVs than control cells (Fig2C). Notably, EVs from 3D KRAS-inhibited cells carried increased amounts of RNA comparing to control cells-secreted EVs (Fig3A). The differences are even more striking considering the total RNA (cellular and EV) produced by cells. While 2D KRAS-inhibited cells produced higher amounts of total RNA which is kept inside the cell, most of the RNA produced by 3D KRAS-inhibited cells is packed in EVs and so more prone to regulate the expression profile of recipient cells.

Future functional studies and microRNA expression analysis will evaluate the role of EVs and EVsenclosed microRNAs on T-cell exhaustion upon KRAS-inhibition.

Keywords: microRNA, immunosuppression, KRAS, colorectal cancer, mutation

Acknowledgments

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References

[1] Cha, D. J. et al. KRAS-dependent sorting of miRNA to exosomes. Elife 4, (2015).


Figure 1: Candidate microRNAs that are simultaneously regulated by KRAS and predicted to target immune checkpoint molecules. Total expression levels and microRNAs showing statistically different total expression levels between DLD-1 and DKs-8 (A); microRNAs assigned to cells and exosomes in DLD-1 and DKs-8 (B); microRNAs with statistically different expression levels in DLD-1 and DKs-8 cells and exosomes, though without differences in terms of total expression (C). * p<0.05; ***p<0.001



Total number of EV / Total number of viable cells



С

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Figure 2: Nanoparticle tracking analysis of isolated EVS. (A) and (B) EVs mean and mode sizes in each experimental condition. (C) Quantity of EVs per cell in each experimental condition was obtained by normalizing the total number of EVs isolated in each experiment to the total number of viable cells producing these EVs (cells detached from 2D monolayers or dissociated 3D spheroids). Graphs represent the mean ± standard deviation of at six biological replicates. p<0.05; *p<0.01, ****p<0.001



Figure 3: (A) Concentration of RNA per EV in each experimental condition. (B) Concentration of the total RNA (cellular and EVs) per cell in each experimental condition. Graphs represent only one biological replicate

20860 | P-cadherin-mediated cell-cell adhesion: its role on immune evasion in metastatic breast cancer

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Abstract

P-cadherin (P-cad) expression is an important poor prognostic factor in breast cancer, by promoting collective cell invasion, stem-like properties and impairment of the oxidative stress [1]. P-cad expression possibly identifies a partial epithelial-to-mesenchymal transition (EMT) state [2], since its expression is early promoted by EMT inducers, such as hypoxia [3]. Interestingly, EMT plasticity has already been implicated in the immune-response, mostly by *in silico* models [4]. Bednarczyk *et al.* also showed, *in vitro*, that the secretome of M1 tumor-associated macrophages (TAMs) drive cancer cells to a partial EMT phenotype [5]. Importantly, our group has demonstrated that P-cad is significantly associated with the PD-L1 immune checkpoint in a series of breast cancer samples [6,7]. Also, Haixia *et al.* demonstrated, *in vitro*, an association between P-cad expression and tumor-infiltrating immune cells in tongue squamous cell carcinomas [8]. However, besides these particular significant associations, the role of P-cad in the modulation of the immune system was never deeply explored.

Thus, we hypothesized that P-cad -mediated cancer cell-cell adhesion could be probably contributing for the aggressiveness of breast cancer cells, through its capacity to induce the escape to the immune system. To prove this hypothesis, we aimed to establish 3D breast tumor immune spheroids (TIS) through the co-culture of monocytes from healthy donors (approved by CHUSJ Ethics Committee for Health (protocol 90/19)) with MCF7/AZ breast cancer cells and further evaluate the ability to escape the immune system in TIS showing different levels of P-cad expression. Currently, we have already established the formation of TIS with 1:1 and 1:2 ratio

between cancer cells and monocytes. We also demonstrated that TrypLE[™] Select is the best reagent to be used in MCF-7/AZ TIS, since it presents a 90% cell viability measured by Trypan blue, in comparison with a 50% and 30% of Accutase[™] and Versene[™], respectively. Although we are still optimizing the best protocol, at the end of this project, we expect to demonstrate that P-cad cell-cell adhesion induces immune evasion mechanisms, contributing to its poor prognostic role in breast cancer.

Keywords: P-cadherin; metastatic breast cancer; immune evasion; clusters.

References

[1] A. S. Ribeiro *et al.*, "P-cadherin functional role is dependent on E-cadherin cellular context: A proof of concept using the breast cancer model," *J. Pathol.*, vol. 229, no. 5, pp. 705–718, 2013.
[2] A. S. Ribeiro and J. Paredes, "P-cadherin linking breast cancer stem cells and invasion: A promising marker to identify an 'intermediate/metastable' EMT state," *Front. Oncol.*, vol. 4, no. January, pp. 1–6, 2015.

[3] B. Sousa *et al.*, "The basal epithelial marker P-cadherin associates with breast cancer cell populations harboring a glycolytic and acid-resistant phenotype," *BMC Cancer*, vol. 14, no. 1, pp. 1–13, 2014.

[4] S. Sahoo *et al.*, "Immunosuppressive Traits of the Hybrid Epithelial/Mesenchymal Phenotype," *Front. Immunol.*, vol. 12, no. December, pp. 1–16, 2021.

[5] R. B. Bednarczyk *et al.*, "Macrophage inflammatory factors promote epithelial-mesenchymal transition in breast cancer," *Oncotarget*, vol. 9, no. 36, pp. 24272–24282, 2018.

[6] A. Polónia, R. Pinto, J. F. Cameselle-Teijeiro, F. C. Schmitt, and J. Paredes, "Prognostic value of stromal tumour infiltrating lymphocytes and programmed cell death-ligand 1 expression in breast cancer," *J. Clin. Pathol.*, vol. 70, no. 10, pp. 860–867, 2017.

[7] C. Noronha *et al.*, "PD-L1 tumor expression is associated with poor prognosis and systemic immunosuppression in glioblastoma," *J. Neurooncol.*, vol. 156, no. 3, pp. 453–464, 2022.

[8] H. Wang, T. Yu, and L. Mao, "Placental-Cadherin, a biomarker for local immune status and poor prognosis among patients with tongue squamous cell carcinoma," *Eur. Arch. Oto-Rhino-Laryngology*, vol. 279, no. 7, pp. 3597–3609, 2022.

20925 | Evaluating the chemosensitizing effect of Pentoxifylline in pairs of sensitive and multidrug-resistant non-small cell lung cancer cell lines

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Abstract

Non-small cell lung cancer (NSCLC) patients who are not eligible for single-agent immune or target therapies have platinum-based chemotherapy as the only therapeutic approach available. However, multidrug resistance (MDR) to chemotherapy is frequent. Identifying novel and effective drug combinations is necessary.

Chitinase-3-like 1 (CHI3L1) is a promising therapeutic target since: i) it is highly expressed in almost all cancer cell types; ii) it activates several cancer-related pathways; [1] iii) high serum levels are correlated with poor prognosis and survival in patients with NSCLC; [2] and iv) CHI3L1 inhibition induces chemosensitization of several tumor cells [3]. Previous work also showed that pentoxifylline (PTX), a known CHI3L1 inhibitor [3] and an approved drug for peripheral vascular disease, has antitumor activity in some cancer models. This work aimed to verify the effect of PTX as a sensitizer of two pairs of sensitive/MDR NSCLC cell lines to different chemotherapeutic regimens.

The cytotoxic effect of PTX combined with different drug regimens (Paclitaxel, Vinorelbine or Carboplatin individually, and Vinorelbine plus Carboplatin) in the sensitive and MDR counterpart NSCLC cell lines was evaluated by the sulforhodamine B assay. The effect of PTX on the expression levels of CHI3L1 and other downstream proteins (β -Catenin, p-Akt and p-ERK) was assessed by Western blot. TCGA analysis was performed to evaluate correlations between CHI3L1 levels and NSCLC patient's survival under the different drug regimens.

Our results showed that PTX sensitized both pairs of sensitive/MDR NSCLC cell lines to the different drug regimens tested, decreasing the expression levels of CHI3L1 and downstream proteins. TCGA analysis demonstrated that high levels of CHI3L1 are associated with low overall survival of patients with NSCLC under the different drug regimens.

Altogether, our data suggests that PTX increases the response of sensitive and MDR NSCLC cells to various cytotoxic drugs.

Keywords: Non-Small Cell Lung Cancer, Chitinase 3-like 1, Pentoxifylline

Acknowledgments

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References

- [1] Zhao, T., et al., Chitinase-3 like-protein-1 function and its role in diseases. Signal Transduct Target Ther, 2020. 5(1): p. 201.
- [2] Johansen, J.S., et al., High serum YKL-40 level in patients with small cell lung cancer is related to early death. Lung Cancer, 2004. 46(3): p. 333-40.
- [3] Xavier, C.P.R., et al., Chitinase 3-like-1 and fibronectin in the cargo of extracellular vesicles shed by human macrophages influence pancreatic cancer cellular response to gemcitabine. Cancer Lett, 2021. 501: p. 210-223.

20926 | Heroin and tramadol accelerate telomere shortening in human SH-SY5Y neuroblastoma cells

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Abstract

Opioid abuse is a growing global concern, with opioids being responsible for most drug-related deaths and health complications. Recent studies have suggested that opioid abuse may be associated with accelerated aging, but the underlying mechanisms remain poorly understood, particularly in the brain, their main target. Here, we assessed the effects of opioids on telomere length, an aging hallmark, in human SH-SY5Y neuroblastoma cells exposed to heroin (mainly used recreationally) and tramadol (commonly used analgesic).

Metabolic activity (MTT reduction) and plasma membrane integrity (lactate dehydrogenase release) were assessed in human SH-SY5Y neuroblastoma cells exposed for 24h to 1nM-100mM heroin and tramadol. Cells were then incubated with 1nM and 1µM of either opioid every 2 days for approximately 60 days (from cell passage 22 to 32). Absolute telomere length was measured by qPCR, as the ratio between telomere and single-copy gene (IFNB1) lengths. Vehicle (0.1% HBSS) and basal (untreated cells at passage 22) controls were also tested. The expression of a set of proteins involved in the maintenance of telomere length, including TCAB1, TRF1, Rap1, and TPP1, was determined by Western blot at cell passage 29 and 30.

Neither heroin nor tramadol affected the cells' membrane integrity or metabolic activity up to 100 μ M. Our data showed a general decrease in telomere length in control conditions between passage 23 to 32, with a slightly higher decrease observed in opioid-treated cells at both concentrations tested. The overexpression of TCAB1, TRF, Rap1, and TPP1, compared to the vehicle, was also observed following exposure to heroin or tramadol, particularly at 1 nM, suggesting an attempt by the cellular machinery to compensate for telomere attrition.

Overall, we evidenced that a recreational and a therapeutically-used opioid may accelerate aging via telomere shortening, highlighting the need for further research to better understand these effects.

Keywords: Heroin, Tramadol, Accelerated Aging.

20872 | Pyrazoles as potential modulators of inflammation through the inhibition of COX-2 activity and human leukocytes' oxidative burst

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Abstract

The inflammatory process is a complex and tightly regulated cascade of events that involves the production of prostaglandins (PG) by the inducible isoform cyclooxygenase 2 (COX-2) and the production of reactive pro-oxidant species. When the production of these mediators becomes excessive, it can lead to chronic inflammation and associated diseases such as diabetes, rheumatoid arthritis, and cancer. Unfortunately, many existing anti-inflammatory agents are associated with unwanted side effects. Therefore, there is a critical need to discover new and effective compounds that can modulate the inflammatory cascade.

In this study, an extensive panel of structurally related pyrazoles holding diverse structures and substitutions were tested *in vitro* against human COX-2, and ex vivo in human whole blood, through the measurement of prostaglandin E_2 (PGE₂) production. Their potential inhibitory effect against human leukocytes' oxidative burst was also studied.

The results showed that some of the tested compounds had a significant inhibitory effect on COX-2 activity, and pyrazoles 4 and 11 (Figure 1) excelled as the most potent inhibitors, with $IC_{50} < 25 \mu$ M. Nonetheless, among the tested compounds only 1 was able to inhibit both the COX-2 activity and the PGE₂ production. The tested pyrazoles, namely pyrazole 4, also demonstrated a potential inhibitory effect ($IC_{50} < 5 \mu$ M) against human leukocytes' oxidative burst. These results represent a significant contribution for the design and development of new anti-inflammatory molecules.

Keywords: Pyrazoles, Cyclooxygenase 2, Inflammation.

Acknowledgments

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Figure 1: Chemical structure of some of the studied pyrazoles.

20985 | Targeting BRCA-1-mediated DNA repair in pancreatic ductal adenocarcinoma therapy

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Abstract

Pancreatic ductal adenocarcinoma (PDAC) is a highly devastating disease with poor prognosis. Due to its aggressiveness and high propensity to acquire therapeutic resistance, 5-year overall survival rate is approximately 10% [1]. Currently, the standard first-line therapy consists of regimens including gemcitabine or FOLFIRINOX. However, both display a limited benefit and induce severe secondary effects [1,2]. To counteract these limitations, effective targeted therapeutic agents have been pursued for PDAC. In particular, the poly (ADP-ribose) polymerase (PARP) inhibitor (PARPi), olaparib has been used to treat BRCA1/2 mutated cancers, exploiting deficiencies in homologous recombination (HR), to trigger synthetic lethality in cancer cells [3]. Nevertheless, PDAC resistance to this therapy is commonly observed, representing a major clinical limitation [3]. Recently, our group has disclosed the compound BBIT20, which inhibits HR through disruption of the BRCA1/BARD1 interaction [4]. Additionally, BBIT20 induced cell death and exhibited synergistic effects with cisplatin and olaparib, in breast and ovarian cancer cells.

In this work, we studied the anti-tumour effect of BBIT20 on PDAC cells. BBIT20 showed potent growth inhibitory effect associated with cell-cycle arrest in G1 phase and induction of apoptosis. A reduced expression of key regulators in HR was also observed, and the mechanism of action of BBIT20 was confirmed. Further, the exposition to increasing concentrations of BBIT20, during several rounds of treatment, did not induce resistance. Additionally, BBIT20 stimulated the expression of tumour suppressor microRNA's.

In conclusion, BBIT20 represents a promising therapeutic agent for PDAC treatment, not inducing resistance, and potentially overcoming acquired resistance in PDAC.

Keywords: Pancreatic ductal adenocarcinoma, Targeted therapy, Homologous recombination

Acknowledgments

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References

[1] Grossberg, A.J., et al., CA: A Cancer Journal for Clinicians, 2020. 70(5): p. 375-403.

[2] Kays, J.K., et al. Journal of Cachexia, Sarcopenia and Muscle, 2018. 9(4): p. 673-684.

[3] Mekonnen, N., Frontiers in oncology (2022). 12.

[4] Raimundo, L., et al., British Journal of Pharmacology, 2021. 178(18): p. 3627-3647.

21030 | Functional glycoproteomics characterization of gastric cancer cells expressing immature O-Glycans

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Abstract

Gastric cancer (GC) is currently managed through chemotherapy, radiotherapy and surgery, which often fail to prevent disease progression. Targeted therapies and immunotherapy have provided significant, yet insufficient, improvements (1). Targeting specific glycans or glycoproteoforms may complement conventional cancer detection and treatment, leading to better theragnostic settings. Aberrant protein glycosylation is a hallmark of cancer due to its contribution to carcinogenesis, cancer progression and metastasis characterized by the overexpression of short-chain O-glycans such as Sialyl-Tn (STn) antigen, being mostly absent in the corresponding healthy tissues (2). STn is overexpressed in more aggressive and advanced gastric tumours and is associated with tumour progression and poor prognosis (3). This project aims to functionally characterize the glycoproteome of GC cells expressing immature O-Glycans. Considering this, the AGS cell line was genetically modified using CRISPR/Cas9 to knockout the C1GALT1 gene and reflect a stable glycophenotype expressing STn. The model was validated by Indel Detection by Amplicon Analysis and Sanger sequencing. Three clones with different out-of-frame indel formations were selected, and a single clone with silent mutations was chosen to provide a phenotypic control cell line. The clones were submitted to flow cytometry and immunofluorescence assays, which confirmed the expression of STn antigen for all clones with high median fluorescence intensities when compared to wild-type control, and the consequent abrogation of extended O-glycans due to silencing of C1GALT1. Of note, we will validate the glycophenotype of our clones by glycomics and posteriorly study the functional impact of STn expression. Then, defining the glycoengineered cells' glycoproteome will also be mandatory. Understanding the functional glycoproteomics implications of silencing relevant glycoproteins in cancer will help envisage future molecular targets for early diagnosis and new therapies.

Keywords: Gastric cancer (GC); Glycosylation; O-glycans; Sialyl-Tn antigen (STn)

Acknowledgments

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References

[1] Businello G, Galuppini F, Fassan M. The impact of recent next generation sequencing and the need for a new classification in gastric cancer. Best Practice & Research Clinical Gastroenterology. 2021;50-51:101730.

[2] Fernandes E, Soares J, Cotton S, Peixoto A, Ferreira D, Freitas R, et al. Esophageal, gastric and colorectal cancers: Looking beyond classical serological biomarkers towards glycoproteomics-assisted precision oncology. Theranostics. 2020;10(11):4903-28.

[3] Pinho S, Marcos NT, Ferreira B, Carvalho AS, Oliveira MJ, Santos-Silva F, et al. Biological significance of cancer-associated sialyl-Tn antigen: Modulation of malignant phenotype in gastric carcinoma cells. Cancer Letters. 2007;249(2):157-70.

21049 | MicroRNAs profile associated with Enzalutamide resistance in prostate cancer

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Abstract

Androgen deprivation therapy (ADT) has been the standard treatment for advanced and metastatic Prostate Cancer (PC), but most patients develop resistance progressing to castrationresistant PC(CRPC), which is the most aggressive form. Enzalutamide (ENZ) is a second-generation antiandrogen developed for CRPC, but most men develop resistance. Therapy's resistance has been associated with deregulation of microRNAs(miRNAs), whose potential as biomarkers has been raising interest. We aimed to identify a miRNAs profile associated with ENZ resistance. An in vitro model of ENZ resistance was established through continuous exposure of LNCaP (hormone-sensitive cell line) to increasing ENZ concentrations at endpoints (2.5, 5, 10, 20 and $30\mu M$ (LNCaP-ER). To validate the resistant phenotype, metabolic capacity, cell cycle and mRNA expression levels of AR and PSA were assessed. MiRNAs from LNCaP-ER and LNCaP cells were quantified through NanoString® nCounter human miRNA expression assay. A bioinformatic analysis was performed using miRTarbase and Cytoscape STRINGapp. LNCaP-ER cells were metabolically active, cell cycle remained unaltered at each concentration endpoint, and there was a significative decrease of PSA and AR expression confirming ENZ resistance. A miRNA profile of 12 upregulated and 13 downregulated miRNAs was identified. A cluster of 57 potentially upregulated proteins, among which are HIF-1A and EGFR, and a cluster of 84 potentially downregulated proteins, such as Notch1 and FOXO1 was constructed and functional enrichment analysis revealed terms such as "SMAD binding", "HIF-1 Signalling pathway" and "Regulation of cell death", which have already been associated with PC development and therapy resistance. In conclusion, this miRNAs profile associated with ENZ resistance seems to be related with a

deregulation of pathways involved in cell differentiation, proliferation and survival opening the door to the definition of new biomarkers of follow-up of CRPC patients' management.

Keywords: Prostate Cancer; Enzalutamide; MiRNA; Therapy resistance.

21165 | "Radiocommunication": unravelling the role of extracellular vesicles in rectal cancer radioresistance

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Abstract

Rectal cancer is responsible for over 30% of the colorectal cancer burden worldwide, contributing heavily for the high incidence and mortality rates of gastrointestinal tract malignancies in 2020. Importantly, in Portugal, rectal cancer alone, represented the fifth most incident cancer, comprising of almost half of all new colorectal cancer diagnoses in 2020. Short course neoadjuvant radiotherapy is the standard treatment method for these patients, often accompanied by chemotherapy. Although effective, radiotherapy still leaves up to 30% of the patients experiencing either no response or local recurrence after treatment due to variable levels of radioresistance. As such, there is an urgent need for more efficient therapies to be combined with ionizing radiation which can be achieved by exploring molecules involved in radioresistance mechanisms, which may be hidden within the tumour microenvironment and its intercellular communication network. With this in mind, the aim of our research is to understand how the rectal cancer secretome may contribute to radioresistance, by using a biomimetic 3D model, the multicellular spheroid. We have established this in vitro model, characterized it, and optimized it to suit integrative radiobiology and EV studies. Using the SW837 cell line, cultured in different conditions, we were able to form spheroids with a nutrient and oxygen gradient, show their versatility as a platform in terms of readout options, prove they undergo DNA damage and repair activation when submitted to the patient-mimetic therapy scheme. Furthermore, we proved this model is suitable for EV-related studies, by successfully isolating EVs with a high grade of purity for multi-omic studies. We plan to continue this work by submitting more replicates to proteomic analysis and RNAseq. We also aim to use a different rectal cancer cell line, SW1463, and to form radioresistant pairs in house, SW837RR and SW1463, to further explore radioresistance mechanisms.

21174 | Potential anticancer activity and pharmacokinetics of novel 4-thiazolidinonequinolines dimers

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Abstract

Cancer is a major public health problem and one of the main causes of death throughout the world. It is a critical area of research, and recently there has been growing an interest in synthetic molecules with anticancer potential. This study focused the synthesis of 4-thiazolidinone-quinoline dimers and assessment of their biological activity against cancer cells. This study also aims to explore the chemical diversity of this series of molecules and draw structure-activity relationships.

The study started with 10 compounds (Fig. 1) that bore distinct chemical traits. Initially, all molecules were assessed for their impact towards the gastric and lung cancer cell lines AGS and A549. This allowed the identification of the three most promising molecules, namely 5, 9 and 10, which reduced cell viability about 50%. After this step, the three molecules were further studied for their mechanism of action, namely impact in cell membrane integrity and caspases activation. Preliminary data shows the ability of the molecules to activate caspases-3/8 between 200-300%, which is an advantageous trait for putative anticancer drugs. Assessment of plasma membrane integrity show no impact of the molecules, thus ruling out the advent of necrosis. Fragment-based chemometrics suggest that the molecules can exhibit a favorable pharmacokinetic, namely due to adequate logP and potential for intestinal absorption.

Future experiments will further the study of the mechanism of cytotoxicity to better understand the mechanism of death and putative selectivity profile towards cancer cells.

Keywords: cancer; 4-thiazolidinone-quinolines dimers.



Figure 1: Chemical structure of the molecules synthesized and evaluated biologically.

20883 | Bioactive dialysis membranes- incorporation of lipophilic antioxidants

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Abstract

Hemodialysis treatment is required in patients with end-stage chronic kidney disease. However, this treatment is associated with inflammatory responses and oxidative stress, induced by the contact of blood with dialysis membranes, increasing morbidity and mortality. Our aim was to develop membranes able of reducing the oxidative stress by scavenging free radicals during the hemodialysis procedure.

Hydroxytyrosol is an antioxidant extracted from the olive tree and has a high anti-radical activity. However, due to its high hydrophilicity, it is not effectively trapped in polysulfone membranes. Thus, more lipophilic esters of hydroxytyrosol were synthesized by esterification with butyric (HyTy-C4), caprylic (HyTy-C8) and palmitic (HyTy-C16) fatty acids¹.

Subsequently, polysulfone membranes containing 2-tocopherol (reference control) and the synthetized antioxidants at concentration of 12, 24 and 60 2M were prepared. It was found that the compounds were fully incorporated into the membrane, with no leakage when in contact with aqueous solutions.

The membrane antioxidant capacity was determined using the DPPH radical assay. All compounds were found to have high or similar antiradical activity, compared to 🛛-tocopherol. Further studies are planned to evaluate the biocompatibility/bioactivity of these modified bioactive membranes.

Keywords: Chronic kidney disease; antioxidants; hydroxytyrosol; hemodialysis; polysulfone membranes.

References

[1] Almeida, J., et al., J Agric Food Chem, 2016. 64(25): p. 5274-83

20965 | New peptide-based construct for wound healing: biophysical and biochemical profiling

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Abstract

Antimicrobial resistance is a spiralling worldwide concern, as ineffective treatment of infections may lead to serious or even life-threatening conditions. Alternatives to conventional antibiotics have been explored to fight this problem, e.g. antimicrobial peptides¹. Recently, Gomes et al. designed peptide-based constructs, aiming at their application for the treatment of infected wounds, providing antimicrobial action and faster healing. These peptides, 3.1-PP4 and its isomer PP4-3.1 combine the antimicrobial peptide (AMP) 3.1 with the collagen-boosting peptide (CBP) PP4². The same authors later replaced the AMP by an antibacterial ionic-liquid (IL), affording an IL-PP4 conjugate ³. In vitro studies revealed that while 3.1-PP4 has improved activity against Gram-negative bacteria, its isomer PP4-3.1 and the IL-PP4 conjugate both exhibit a broad spectrum of antimicrobial action. In this work, we aim at understanding the biophysical profile and the mechanism of action (MOA) of these peptides against Gram-positive and Gram-negative bacteria. Thus, the peptide-bacterial membrane interaction was studied using liposomes of POPC:POPG (1:1) and total extract of Escherichia coli through the determination of the partition constant (K_p) by spectrofluorimetry. Dynamic Light Scattering (DLS) measurements were performed to understand possible aggregation effects ⁴. Atomic Force Microscopy (AFM) was further used to elucidate the MOA of the peptides against Staphylococcus aureus ATCC 29213 and E. coli ATCC 25922. The results revealed similar K_p values for both peptides in liposomes of POPC:POPG (1:1). It was not possible to calculate K_p in liposomes of total extract of *E. coli*, however, the spectra suggest that peptides are embedded in the membrane. DLS experiments suggest that 3.1-PP4 induces aggregation of lipid vesicles, while PP4-3.1 induces aggregation and disaggregation of lipid vesicles. AFM results showed that these peptides induce different alterations in the membranes, suggesting different MOA.

Keywords: peptides; bacteria; liposomes.

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References

[1] Moretta, A.; Scieuzo, C.; Petrone, A. M.; Salvia, R.; Manniello, M. D.; Franco, A.; Lucchetti, D.; Vassallo, A.; Vogel, H.; Sgambato, A. *Frontiers in Cellular and Infection Microbiology* **2021**, 453.

[2] Gomes, A.; Bessa, L. J.; Fernandes, I.; Ferraz, R.; Mateus, N.; Gameiro, P.; Teixeira, C.; Gomes, P. *Frontiers in Microbiology* **2019**, *10*, 1915.

[3] Gomes, A.; Bessa, L. J.; Fernandes, I.; Aguiar, L.; Ferraz, R.; Monteiro, C.; Martins, M. C. L.; Mateus, N.; Gameiro, P.; Teixeira, C. *Microbiology Spectrum* **2022**, *10* (4), e02291-21.

[4] Ferreira, A. R.; Teixeira, C.; Sousa, C. F.; Bessa, L. J.; Gomes, P.; Gameiro, P. *Membranes* **2021**, *11* (1), 48.

20409 | Outcomes of a QST protocol in healthy subjects and in chronic pain patients: A controlled clinical trial

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Abstract

Chronic pain is an important cause of disability with a high burden to the society. Quantitative sensory testing (QST) is non-invasive multimodal method used to discriminate function of nerve fibres. The purpose of this study was to provide a reproducible, simpler, and clinically feasible QST protocol using heat pain stimulus to help characterizing and monitor chronic pain. A sample of 40 healthy young heathy medical students and 50 chronic pain patients were evaluated in individual sessions comprehending Brief Pain Inventory questionnaire, followed by QST assessments divided in three proposed tests: pain threshold, suprathreshold and tonic pain. In the chronic pain group, a significantly higher pain threshold (hypoesthesia) and higher pain sensibility (hyperalgesia) at threshold temperature were demonstrated when compared to healthy participants. Sensibility to suprathreshold and tonic stimulus did not prove to be significantly different in both groups. The main results demonstrated that the heat threshold QST tests can be helpful in evaluating hypoesthesia and that the sensitivity threshold temperature test can demonstrate hyperalgesia in chronic pain individuals. In conclusion, this study demonstrates the importance of using tools such as QSTs as a complement to detect changes in several pain dimensions.

Keywords: Chronic pain; Quantitative Sensory Testing; Osteoarthritis; Preoperative pain; Heat pain threshold; Analgesia; Opioid misuse; Quality of life.

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Figure 1: Mean \pm SD heat pain threshold temperatures in control group and CPG (°C). * p<0,05 for comparison of mean threshold temperatures between the control group and the CPG using Mann Whitney U test. [Heat Pain Threshold test]



Figure 2: Mean ± SD pain sensitivity in suprathreshold tests in control group and CPG (NRS at 36°C, HPT and 49°C) * p<0,05 for comparison of mean NRS values for HPT temperatures between the control group and the CPG using Mann Whitney U test (SPSS). HPT: Heat pain threshold. NRS: Numeric rating scale. [Suprathreshold Pain Sensitivity test]

20521 | The role of nutritional/food intervention and physical exercise in overweight individuals

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Abstract

The treatment of overweight and noncommunicable chronic diseases requires intervention in eating habits and physical exercise. The objective was to study the nutritional/food intervention and prescription of physical exercise, in a nutrition consultation (NC) environment, on anthropometric evolution, compliance with the food plan (FP), motivation and adherence to treatment, in overweight individuals. All had two assessments (0 and 1st month). Anthropometric data, physical exercise and food intake were collected. Self-perception of FP compliance, motivation, and food weighing habits were assessed. All had an individualized FP, but the intervention group (IG) was prescribed home exercise. Twenty-three adults of both sexes (mean age 48years) were included. There was a reduction in weight (-0.6kg), BMI (-0.2kg/m2) and fat mass (-1.1kg/-0.8%) and lean mass increase (0.2kg/0.5%) only in IG and reduction of waist and hip circumferences in both (more accentuated in IG). Compared to the FP, all reported a higher contribution of protein to the total energy value, more accentuated in the control group (CG) (5.1%), the IG reported a higher contribution of lipids (1.0%) and all reported lower intake of energy, vegetables, fruit, doses of "bread/equivalents(eq)" and fat and higher intake of "meat/eq". The CG reported lower intake of vegetables and fat, while the IG reported lower intake of "bread/eq". The CG considers themselves more compliant (p=0.393) and although the IG is more motivated, both report high motivation to continue treatment. Combining an individualized FP with physical exercise, in NC, seems to help in weight control, but given what was reported, it is necessary to invest in improving patients' understanding of the strategies outlined.

Keywords: compliance; physical exercise; motivation; obesity; food plan.

20631 | Milking dairy products towards hypertension regulation

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Abstract

Hypertension reduces life expectancy since it increases the risk of cardiovascular diseases. In alternative to conventional drugs, which cause several side effects, novel bio-based strategies are under investigation [1]. Polyphenols are plant-based nutraceuticals that raised interest due to their range of biological activities. In particular, epigallocatechin-3-gallate (EGCG) and resveratrol (Resv) are linked to cardioprotective properties [2][3]. However, their implementation in disease control is limited by low bioavailability. Nanoencapsulation can circumvent this issue by facilitating the delivery of polyphenols [4]. Milk proteins, namely casein micelles (CM), are natural carriers with binding abilities that allow high encapsulation efficiencies, controlled and targeted release of bioactives [5]. Given the valuable properties of CM as nanocarriers, this work aimed to develop a formulation to regulate hypertension through the encapsulation of antihypertensive polyphenols. Briefly, casein was extracted from skimmed milk through isoelectric precipitation. Nanoencapsulation of EGCG and Resv was achieved by resuspending lyophilized casein in EGCG or Resv stock solutions under magnetic agitation, producing EGCG and Resv loaded micelles (CM-EGCG, CM-Resv). EGCG and Resv were encapsulated in CM with high encapsulation efficiencies of 90% and 72%, respectively. These nanosystems exhibited excellent results concerning size distribution, and mid-term storage stability. They were also associated with high rates of antioxidant activity. Antihypertensive activity was evaluated in vitro through the inhibition of angiotensin-I converting enzyme (ACE). ACE inhibition (Figure 1) was significant for both CM-EGCG and CM-Resv (approximately 70%). Thus, these formulations exhibit the potential to act as a nutraceutical for hypertension control. In fact, the nanostructures can protect polyphenols and ensure higher bioavailability, and simultaneously allow the modulation of blood pressure signalling pathways.

Keywords: Nutraceutical; casein micelles; resveratrol; epigallocatechin gallate; nanoencapsulation; hypertension.

Acknowledgments

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References

[1] B. Malinowski, R. Ignacio, F. Leighton, and C. G. Hill, "Bioactive Compounds and Their Effect on Blood Pressure — A Review," *Nutrients*, vol. 12, no. 6, p. 1659, 2020, doi: 10.3390/nu12061659.

[2] J. Ouyang, K. Zhu, Z. Liu, and J. Huang, "Prooxidant Effects of Epigallocatechin-3-Gallate in Health Benefits and Potential Adverse Effect," *Oxid. Med. Cell. Longev.*, vol. 2020, pp. 1–14, Aug. 2020, doi: 10.1155/2020/9723686.

[3] I.-A. Jang *et al.*, "Effects of Resveratrol on the Renin-Angiotensin System in the Aging Kidney," *Nutrients*, vol. 10, no. 11, p. 1741, Nov. 2018, doi: 10.3390/nu10111741.

[4] M. T. Bazana, C. F. Codevilla, and C. R. de Menezes, "Nanoencapsulation of bioactive compounds: challenges and perspectives," *Curr. Opin. Food Sci.*, vol. 26, pp. 47–56, 2019, doi: 10.1016/j.cofs.2019.03.005.

[5] U. Sadiq, H. Gill, and J. Chandrapala, "Casein micelles as an emerging delivery system for bioactive food components," *Foods*, vol. 10, no. 8, p. 1965, 2021, doi: 10.3390/foods10081965.



Figure 3: ACE activity after exposure to different nanoformulations. The positive control corresponds to the maximum activity of ACE. Samples of lyophilized casein blended in phosphate buffer (CM-CTRL) or in phosphate buffer with 10% of ethanol (CM-CTRL 10% EtOH) were used as controls for EGCG loaded micelles and Resv loaded micelles, respectively. All samples decreased ACE's activity, which indicates that CM, CM-EGCG and CM-Resv have ACE inhibitory properties and can act in hypertension regulation.

20711 | Determinants of food consumption in a university context

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Abstract

Displaced students face more difficulties managing their diet due to their higher independence in food choices and exposure to unhealthy food options. Canteens, bars and vending machines are responsible for a large part of college students' food supply.

The aim of this study was to analyse UPorto students' eating habits inside the campus and their satisfaction with these food supply services.

A convenience sample of 173 UPorto students (83.2% females) with a mean age of 23 years (sd = 6) was accessed using a self-completion online questionnaire including questions on students' placement, preferable place to have lunch on campus, general satisfaction with the campus canteen, and frequency of vending machines use during lunch, among others.

The most frequent lunch places were "at home" (29.1%) and "in the UPorto canteen" (26.2%), with no statistical dependence between being displaced or not and the place chosen to have lunch (p = 0.756). Regarding the general satisfaction with the canteen, non-displaced students reported a degree of satisfaction closer to the upper limit than displaced students (median = 4.0 vs. 3.0), despite not reaching statistical significance (p = 0.083). Most of the sample (54.7%) never used vending machines at lunch, with no significant differences between displaced and non-displaced students (median frequency of use = 0.0 vs. 0.5; p = 0.178). Also, no association was found between the satisfaction with food offer in canteens and the frequency of use of vending machines (r = 0.018, p = 0.842).

These data suggest there is no need for a specialized intervention regarding displaced students. Despite that, UPorto should take an active role in defining eating habits and focus on providing more access to healthier products.

Keywords: food habits; university; students; displacement; vending machines; canteens.

20726 | FCNAUP student's satisfaction with U. Porto canteens

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Abstract

Introduction: University canteens may promote healthy habits, but students' perceptions about them tend to be unfavourable. Accessing satisfaction and understanding the reasons behind dissatisfaction may improve their use. As FCNAUP's canteen is under discussion, it is important to access the self-perceived needs and preferences of its students. Aim: To study the characteristics associated with U. Porto canteens satisfaction by FCNAUP students.

Methodology: In this cross-sectional study 98 FCNAUP students answered an online questionnaire including sociodemographic and academic data, information on meals and canteen use: sex, age, civil status, housing type, curricular year, time spent in and time to get to the faculty, food choices' main driver, origin and setting of the student's lunch, frequency of canteens use and satisfaction with them. We applied chi-square's, Student's t, Mann-Whitney's, Kruskall-Wallis' and Friedman's tests, and Spearman's correlations, with an α =5%. Post-hoc analysis used Bonferroni's correction.

Results: Only 41.2% of students attended the canteen at least once a week and 31.7% were not satisfied with the meals. General satisfaction was not significantly associated with sex, civil status, housing type, food choices' main driver or time to get to the faculty, canteens' frequency or lunch origin (p>0.05). Satisfied students were younger (age: median = 20 vs. 22, p=0.011) and had lower education (median = 3^{rd} vs 2^{nd} grade, p=0.020). The satisfaction differed (p<0.001) between features: dessert and menu were the most appreciated and the least appreciated were infrastructure and service (soup and main dish had intermediate appreciation). Conclusions: Being younger and attending lower curricular year were the only variables associated with satisfaction. Infrastructure and service were the least appreciated features. These results should be borne in mind when developing the FCNAUP's canteen.

Keywords: Nutrition, Students, University, Canteen, Canteen use, Satisfaction, Determinants

Acknowledgments

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References

[1] Aires C, Saraiva C, Fontes MC, Moreira D, Moura-Alves M, Gonçalves C. Food Waste and Qualitative Evaluation of Menus in Public University Canteens-Challenges and Opportunities. Foods. 2021; 10(10)

 [2] Czarniecka-Skubina E, Górska-Warsewicz H, Laskowski W, Jeznach M. Consumer Choices and Service Quality in the University Canteens in Warsaw, Poland. Int J Environ Res Public Health.
 2019; 16(19)

[3] Deliens T, Clarys P, De Bourdeaudhuij I, Deforche B. Determinants of eating behaviour in university students: a qualitative study using focus group discussions. BMC Public Health. 2014; 14:53.

20915 | Agreement analysis between dual energy x-ray absorptiometry and bioelectric spectroscopy as methods for estimating body fat content

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Abstract

Introduction: Estimations of body fat (BF%) are widely used in clinical practice as predictors of metabolic and cardiovascular diseases and to provide diet and lifestyle recommendations. Bioelectric impedance analysis (BIA) is a common method to estimate BF%. Studies have found a strong correlation between dual energy x-ray absorptiometry (DXA) and BIA derived results. However, the same is not observed for agreement. To our knowledge, the agreement between BIA by bioelectric spectroscopy (BIS), the gold standard for BIA, and DXA was never assessed in an adult's community sample.

Aim: We aimed to study the agreement between DXA and BIS-derived BF%.

Methods: In this cross-sectional analysis, participants were instructed to fast and to avoid physical exercise for at least 8 hours prior to the examination. Before carrying out the evaluations, participants were asked for compliance with the standardized conditions. Whole BF% was estimated by DXA using a Hologic WI densitometer and by BIS using a Impedimed SBF7, in a consecutive manner to account for the exact same conditions. Spearman correlates (ρ), absolute agreement (%), agreement to adjacent quartiles (%), and quadratic weighted kappa coefficient (κ) were calculated.

Results: 87 participants (aged 18-69, 67.8% women) were included. Median BF% (25th-75th) measured by DXA and BIS were 26.9% (21.7%-32.1%) and 26.7% (21.5%-30.9%), respectively. BF%

measurements were highly correlated (ρ =0.856). Quartiles from both measurements had an absolute agreement of 62%, which increased to 98% when accounting for the adjacent quartiles. Quadratic weighted agreement was classified as very high (κ =0.821).

Conclusions: Very high levels of agreement between DXA and BIS for the estimation of BF% were obtained in subjects that were in ideal conditions for assessments. Thus, BIS seems to be a good and convenient candidate for estimating BF% in community individuals when DXA is not available, as BIS is portable, less expensive and does not require differentiated skills.

Keywords: nutritional assessment; body fat mass; body composition; dual energy x-ray absorptiometry; bioelectric spectroscopy.

Acknowledgments

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21197 | Lbx1 and Tlx3: imposing distinct neuronal fates through phosphorylation

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Abstract

The proper balance between excitatory and inhibitory neurons in the spinal cord ensures the correct integration of pain signals. In a developmental point of view, the choice between the glutamatergic vs GABAergic differentiation routes is one of the most primary aspects of neuronal precursor fate decisions as it defines the functional properties of a neuron. This dichotomy is defined in the developing dorsal spinal cord, by the combinatorial action of several transcription factors, including Lbx1 and Tlx3. However, the combination of different transcription factors is not sufficient to explain how distinct neuronal populations arise from the same progenitor pool. Our hypothesis is that the Lbx1 phosphorylation pattern is altered in the presence of Tlx3. To understand how these two proteins cooperate Lbx1 phosphorylated residues were identified by large-scale immunoprecipitation followed by LC-MS analysis of phospho-enriched Lbx1 protein. The functional impact of these aminoacid residues were assessed by generating phospho-defective mutants using a site-directed mutagenesis approach.

These Lbx1 variants were then analysed by western-blot and 2D isoelectric focusing to characterize putative changes in Lbx1 phosphorylation pattern in the absence/presence of Tlx3. Moreover, the impact of each phosphosite mutation on Lbx1 transcriptional activities were evaluated either by luciferase reporter assays using Lbx1 target enhancers and qPCR expression analysis of Lbx1 target genes in the presence/absence of Tlx3.

Together, our results unravelled a unique Lbx1 phosphorylation signature specific to Tlx3-positive glutamatergic neurons, which will be an important step toward the understanding of the mechanisms governing cell fate decision of neurons that will build the spinal pain circuitry.

Keywords: transcription factor, Lbx1, Tlx3, neurodevelopment, neuronal fate commitment.

20946 | What is the evidence for dietary and nutritional interventions in ADHD?

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Abstract

Introduction: Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common neurodevelopmental disorders worldwide, affecting ~7% of children and adolescents. Diet has emerged as a potential treatment option and specific dietary interventions have been proposed as coadjuvant treatments. These include nutritional supplements containing vitamins, minerals, and polyunsaturated fatty acids (PUFAs), gut microbiome-targeted interventions with biotics, and elimination diets.

Objectives: The purpose of this study is to summarize the existing evidence for the clinical use of dietary and nutritional interventions in ADHD.

Methods: A literature search was conducted between September and October 2022 using the PubMed, Scopus and Google Scholar databases.

Results: Studies have shown that vitamin D and vitamin D + magnesium supplementation, as adjuvant therapy, improve ADHD symptoms only when baseline levels are insufficient/deficient. Conversely, no evidence was found for iron or zinc (either alone or in combination with stimulants), nor for PUFA supplementation. Regarding biotics, some studies demonstrate the benefits of *Lactobacillus rhamnosus GG* and of multi-species probiotic supplementation in cognitive function, health-related quality of life and ADHD symptomatology. However, synbiotic supplementation had no specific effect on ADHD symptomatology. Elimination diets have insufficient evidence and lack high-quality RCTs.

Discussion: While some studies reported that dietary supplements may have beneficial effects, severe methodological limitations were observed, such as short intervention periods, lack of randomization, placebo, and prospective monitorization of the long-term effects of the supplementation. Moreover, elimination diets may lead to nutritional deficiencies and, consequently, poor growth in children, so caution is advised.

Conclusion: More robust scientific evidence is required for these dietary interventions to be implemented as part of ADHD therapy.

Keywords: ADHD; dietary interventions; neurodevelopment; nutrition.

References

[1] Pinto S, Correia-de-Sa T, Sampaio-Maia B, Vasconcelos C, Moreira P, Ferreira-Gomes J. Eating Patterns and Dietary Interventions in ADHD: A Narrative Review. Nutrients. 2022;14(20).

20960 | Hedonic hunger and food intake in patients undergoing bariatric surgery

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Abstract

Hedonic hunger is related to the desire to consume food for pleasure. It is associated with a tendency for highly palatable foods, which may lead to excessive consumption. The study of these factors in patients undergoing bariatric surgery will assist on characterizing unfavorable phenotypes for therapy compliance. The aim of this study was to evaluate hedonic hunger in patients who underwent bariatric surgery and study its relation with sex, age, education, time after surgery, food intake, stages of change and depression. 154 individuals were evaluated (83.8% women; median age = 47 years; IQR = 14) who underwent bariatric surgery between 6months and 6 years ago. A questionnaire was applied to assess hedonic hunger (Power of Food Scale), social desirability and stages of change in relation to healthy eating. Demographic data and self-reported anxiety or depression were recorded. Food intake was obtained by food survey using a photographic manual for quantification. The median score on the Power of Food Scale was 1.7 and the median energy intake was 1269 kcal/day. Longer post-surgery time (rs = 0.193; p = 0.016), lower social desirability (rs = -0.259; p = 0.001) and greater energy intake (rs = 0.288; p < 0.001) were related to higher levels of hedonic hunger. Participants on the stage of change of action and maintenance had lower levels of hedonic hunger (median = 1.6 vs. 2.3; p < 0.001). Levels of hedonic hunger were positively associated with energy intake, and both were associated with time after surgery, similarly to earlier stages of change or relapse, which were associated with longer times after surgery. These results suggest that the food choices of patients who underwent bariatric surgery changes over time, to less healthy patterns.

Keywords: Hedonic hunger; Food intake; Stages of change; Bariatric surgery.

21172 | Determinants of students' use of food consumption resources available at the University of Porto

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Abstract

University students' unhealthy eating patterns are a prevalent problem. It is important to account which factors impact their meals when planning health interventions. The aim of this study was to relate the use of the different U.Porto resources for food consumption by students with their sociodemographic. A convenience sample of students aged 18 years or above completed an online questionnaire including questions about sociodemographic and academic characteristics and the use of U.Porto's food consumption resources. Binary logistic regression models were used to relate sociodemographic and academic features with the use of different resources. The sample comprises 173 participants (83.2% females): 46.2% are 18-20 years old, 42.2% are 21-25 years old and 11.2% are \geq 26 years old. Compared to students of other levels of education, bachelor's degree students (77.5% of total) are more likely to use a SASUP canteen (OR: 4.734, 95% CI: 1.742-12.867). Displaced students are more likely to use a SASUP canteen (OR: 1.943, 95% CI: 1.007-3.750). Compared to FCNAUP students (56.6% of total), non-FCNAUP students are more likely to use U.Porto's bars (OR: 4.256 95% CI: 2.237-8.098), vending machines (OR: 2.098, 95% CI: 1.138-3.870) and drinking fountains (OR: 2.178, 95% CI: 1.121-4.231). Older students (21-25 years old and \geq 26 years old) are less likely to use a SASUP canteen (OR: 0.410, 95% CI: 0.197-0.850 and OR: 0.863, 95% CI: 0.295-2.524, respectively), U.Porto's bars (OR: 0.343, 95% CI: 0.169-0.699 and OR: 0.294, 95% CI: 0.096-0.902, respectively) and spaces for food consumption (OR: 0.442, 95% CI: 0.229-0.855 and OR: 0.372, 95% CI: 0.137-1.011, respectively). Both general sociodemographic and more specific academic characteristics are related to the use of food consumption resources by U.Porto students and may thus influence their food consumption. These features should be considered when developing health-promoting interventions, which should be targeted to specific subgroups of students.

Keywords: food choices; food consumption; meals; public health; university students.
20857 | Metaverse platforms for socialization and communication of science on respiratory health

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Abstract

Introduction: The digital environment named as metaverse is a collective and immersive virtual space, which allows real-time interaction. The ConectAR collaborative network intends to develop a metaverse environment aimed to socialization and disseminating scientific knowledge on respiratory health, easy to access through multiple devices and free of charge. There are several metaverse platforms available, and not all of them fulfill this purpose.

Objective. In the present work, we intend to evaluate current metaverse platforms in order to decide which one is the most appropriate for the purposes above-mentioned.

Methods. Firstly, several platforms were selected according to the following criteria: 1) availability in Portugal; 2) integration with APIs; 3) a robust SDK; 4) hosting on a secure and free server; 5) created not exclusively to one metaverse area (games, socialization, etc.). Secondly, platforms were evaluated in terms of the characteristics hereinafter: 1) purpose; 2) ways of access and its devices; 3) extension and quality of system documentation; 4) technological potential of the system; 5) community's size and engagement.

Results: Decentraland, Roblox, Second Life, Spatial and VRChat platforms were selected. Decentraland is dedicated to the exploration of virtual worlds and collecting NFTs, only accessible by computer. Roblox, despite having wide access, focuses on gaming. Second Life, Spatial and VR Chat are aimed at socializing and exploring virtual worlds, but Spatial is the only one which has both broad access and works on a browser.

Conclusion. Spatial is the most appropriate for socializing and communicating science, it has an easy access, technological potential for 3D modelling, animation and code. In this sense, it has a potential to create a more interactive and responsive virtual environment. The reason why it was the platform chosen to build the metaverse environment of ConectAR network.

Keywords: metaverse; digital health; virtual environments; multi-participant environments; immersive technologies.



Figure 1: visual abstract [Eduardo Bonini]

20590 | Analysis and comparison of diagnostic laboratorial tests of patients with Primary Ciliary Dyskinesia

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Abstract

Introduction: Ciliopathies manifest since birth causing severe patient health disabling. They are caused by abnormal cilia axoneme structure and/or function. One major genetic condition is Primary ciliary dyskinesia (PCD). Diagnostic tests include transmission electron microscopy (TEM) for structural cilia axoneme analysis and high-speed video microscopy (HSVM) for live-cell cilia motion analysis.

Aims: To compare TEM to HSVM regarding the efficacy of diagnosis in a population of patients diagnosed with ciliopathy.

Material and methods: Patients (n=37) with a clinical suspicion of PCD were studied by TEM and HSVM. In TEM, the structure of the axoneme was classified as normal or abnormal (class-1 and class-2); with the variation in ciliary beat axis and ciliary deviation (SD), giving grades of clinical severity: normal, moderate (Bronchiectasis type, BQ) and severe (PCD type). HSVM measured cilia beat frequency (CBF), manually (CBF-M) or with a software (CBF-S) and the percentage of cilia with dyskinetic beating patterns (CBP-DK).

Results: Of the 37 patients, 9 cases (28.1%) presented a normal axoneme ultrastructure and 23 cases (71.9%) presented an abnormal axoneme ultrastructure indicative of PCD, all with altered HSVM values. Correlation values between SD values and CBF or CBP-DK were non-significant, indicating lack of association. Between CBF-M and CBF-S a high correlation was found, providing an equation that can estimate the CBF-M value from the CBF-S value and vice versa, allowing the use of only one method.

Conclusions: Most PCD cases present both altered axoneme morphology and HSVM values. However, a normal TEM ultrastructure does not exclude PCD as there is not always a correlation between morphological defects and abnormal function. These results indicate that neither TEM nor HSVM can be used alone as diagnostic tests. In addition, the results enabled to construct a mathematical formula that facilitates the HSVM diagnosis.

Keywords: ciliopathy, Primary Ciliary Dyskinesia, cilia, transmission electron microscopy, highspeed video microscopy, axoneme

20601 | Evaluation of stereochemical stability and enantioselectivity of MDPV enantiomers on SH-SY5Y human neuronal cells

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Abstract

Synthetic cathinones, such as 3,4-methylenedioxypyrovalerone (MDPV), are broadly abused chiral psychoactive compounds [1]. Since enantiomers can undergo racemization in certain conditions [2] and might display different properties (enantioselectivity) [3], studying the stereochemical stability and biological/toxicological effects of both enantiomers of synthetic cathinones are of pivotal relevance. To obtain the single enantiomers, enantioresolution by liquid chromatography (LC) using chiral stationary phases (CSPs) has been the elected technique [1].

In this study, the semi-preparative separation of MDPV enantiomers was optimized and a racemization study was performed, both by LC using polysaccharide-based CSPs. Potential enantioselectivity was evaluated by assessing cytotoxicity endpoints (metabolic activity and lysosome integrity) and the expression of proteins involved in neuroplasticity—brain-derived neurotrophic factor (BDNF) and cyclin-dependent kinase 5 (Cdk5)— using the SH-SY5Y neuroblastoma cell line [4].

The enantiomers were successfully separated by the optimized LC method with good resolution and enantioselectivity, being collected with high enantiomeric ratios, recovery rates, and stability up to 48 h at room temperature and 24 h at 37 °C. Racemization was only affected by higher temperatures. No enantioselectivity was observed in the SH-SY5Y cell line for any of the parameters analysed.

Keywords: enantioresolution; enantioselectivity; liquid chromatography; MDPV; racemization; SH-SY5Y cells; synthetic cathinones

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References

- [1] Almeida AS, et al., Molecules. 2022; 27(7):2057
- [2] Huang Z, et al., J Sep Sci. 2020; 43(7):1240-7.
- [3] Silva B, et al., J Anal Toxicol. 2018; 42(1):17-24
- [4] Almeida AS, et al., Molecules. 2023; 28(5):2121.

20618 | Investigation of mitochondrial pyruvate carrier inhibition as a therapeutic approach for Huntington's disease

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Abstract

Mitochondrial pyruvate carrier (MPC) is a key regulator of cellular metabolism. MPC inhibition was protective in Parkinson's and Alzheimer's disease models, however the underlying neuroprotective mechanisms remain unclear. Evidence suggests that MPC inhibition may activate or inhibit the integrated stress response (ISR; a signaling pathway aiming to restore cell homeostasis), depending on the pathophysiological conditions [1,2]. The ISR has emerged as a potential therapeutic target in neurodegenerative disorders – its pharmacological activation reduced accumulation and aggregation of mutant huntingtin (mut-Htt) in models of Huntington's disease (HD), a neurodegenerative disorder without cure [3]. We hypothesize that MPC inhibition activates the ISR and attenuates the proteotoxicity of mut-Htt in a HD cell model. PC12 cells with inducible expression of N-terminal wild-type (wt-) or mut-Htt were treated with the MPC inhibitor UK5099 (UK) for 72h. UK increased resazurin metabolism in a concentration-dependent manner in both cells, indicating that UK is biologically active. UK acidified the culture medium, consistent with increased glycolysis when the MPC is inhibited. In cells expressing wt-Htt, UK increased the levels of phospho-eIF2 α , the master regulator of the ISR; while maintained the levels of the ISR effector CHOP unchanged. In cells expressing mut-Htt, which presented a higher basal ISR activation than cells expressing wt-Htt (higher phospho-elF2 α levels), UK decreased phospho $eIF2\alpha$ levels. These results suggest that, despite UK activating the ISR in control conditions, it diminished the ISR activation induced by mut-Htt. UK maintained unaltered soluble and aggregated mut-Htt levels under the tested conditions. Altogether, our results suggest that MPC inhibition with UK is ineffective in altering mut-Htt protein homeostasis in a model that presents rapid aggregation of the N-terminal fragment of mut-Htt, but it may be a potential approach to modulate the ISR in HD.

Keywords: Huntington's disease; Integrated stress response; Metabolism; Mitochondrial pyruvate carrier; Neurodegenerative disease; Protein aggregation

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References

- [1] Bader DA et al *Nat Metab*. 2019; 1(1): 70-85
- [2] Gansemer ER et al *iScience*. 2020; 23(5):101116
- [3] Sundaram JR et al ACS Chem Neurosci. 2019; 10(8): 3575-3589

20849 | New mitochondria-targeted hydroxycinnamic and hydroxybenzoic acids derivatives as innovative agents for the treatment of Parkinson's disease

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Abstract

Parkinson's disease (PD) is a neurodegenerative disease with early death of dopaminergic neurons in the *substantia nigra pars compacta*, characterized by Lewys body formation, iron accumulation, ferroptosis, among others [1,2]. PD treatment remains a huge challenge for scientific community and there is currently no effective drug capable of stopping/delaying PD progression. As such, the development of new therapeutical strategies acting in several mechanisms involved in PD has been extensively explored. Phenolic acids are recognized as privileged structures in drug discovery due to their vast biological activities [3,4]. Accordingly, a series of hydroxycinnamic (HCA) and hydroxybenzoic (HBA) acids derivatives were developed to target oxidative stress and iron overload. Thus, the main objective of this work was to evaluate, *in vitro*, the neuroprotective effects of new HCA and HBA derivatives against the harmful effects of 2 aggressors, Fe(III) and erastin, mimicking 2 mechanisms involved in PD neuropathology, iron overload and ferroptosis, respectively.

Differentiated SH-SY5Y cells were used and compounds cytotoxicity evaluated, 24h after exposure, by the neutral red (NR) uptake and resazurin reduction assays, to select non-cytotoxic concentrations. The compounds' neuroprotective effects were evaluated by the NR uptake assay,

24h after exposure to Fe(III) (500 and 1000 μ M), erastin (20 and 40 μ M), or to the combination of both aggressors [100 μ M Fe(III) + 2 μ M erastin), in the presence or absence of compounds. The results demonstrated that 10 of the 11 compounds significantly reduced Fe(III)-induced cell death, while 7 afforded a significant protection against erastin cytotoxicity. Regarding the simultaneous exposure to Fe(III) + erastin, all compounds selected for this assay demonstrated to be neuroprotective.

These results highlight that these compounds can act as promising multitarget drugs for PD treatment, reversing the harmful effects of an excess iron and ferroptosis.

Keywords: Parkinson's disease; neuroprotection; hydroxycinnamic acids; hydroxybenzoic acids.

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References

[1] Balestrino, R.; Schapira, A.H. V Parkinson Disease. *Eur. J. Neurol.* **2020**, *27*, 27–42, doi:10.1111/ene.14108.

[2] Lew, M. Overview of Parkinson's Disease. *Pharmacotherapy* **2007**, *27*, 155S-160S, doi:10.1592/phco.27.12part2.155S.

[3] Benfeito, S.; Oliveira, C.; Fernandes, C.; Cagide, F.; Teixeira, J.; Amorim, R.; Garrido, J.; Martins, C.; Sarmento, B.; Silva, R.; et al. Fine-Tuning the Neuroprotective and Blood-Brain Barrier Permeability Profile of Multi-Target Agents Designed to Prevent Progressive Mitochondrial Dysfunction. *Eur. J. Med. Chem.* **2019**, *167*, 525–545, doi:10.1016/j.ejmech.2019.01.055.

[4] Razzaghi-Asl, N.; Garrido, J.; Khazraei, H.; Borges, F.; Firuzi, O. Antioxidant Properties of Hydroxycinnamic Acids: A Review of Structure- Activity Relationships. *Curr. Med. Chem.* **2013**, *20*, 4436–4450, doi:10.2174/09298673113209990141.

20973 | Development of new stable catechin formulations for cognitive development enhancement

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Abstract

Currently there is a growing incidence of diseases like autism spectrum disorder, Alzheimer's, and Down's Syndrome, that affect cognitive stability and development. In 2015, 10.5 million people were diagnosed in Europe, with a projection reaching 13.4 million by 2030.^{1, 2} These numbers lead for the urgency to develop new therapies, whether is to improve lifestyle and independence, at a personal and professional level, or a possible cure.

Natural products, such as catechins, have shown a huge potential in improving the lifestyle of these patients. Recent studies have reported improvements in preserving memory tasks and motor functionalities in patients with Down's syndrome³, partial protection of TH-positive dopaminergic neurons in Parkinson's disease⁴, and a reduction of reactive lipid peroxidation induced by oxygen species in Alzheimer's disease.⁵⁻⁷

Catechins are phenolic compounds already marketed as supplements. However, they have an inherent bitter and astringent taste,⁸ making them difficult to administer. Also, their extraction often requires the use of non-green techniques, by using organic solvents.

In this study, catechins like epigallocatechin and epigallocatechin gallate were extracted using natural solvents available on the market, such as maple syrup and stevia (an option for diabetics), and identified by HPLC-MS. After assessing extraction yields, rheology properties and temperature-light-time stability assays, stevia extract showed the most promising results.

Catechin-enriched extracts were incorporated in an oral pharmaceutical formulation to improve their bioavailability. This formulation showed stability under extreme conditions. However, the dosage was only suitable to low-weight children. To overcame this, a syrup is being developed.

Once completed the characterization and stability tests, these formulations will be applied in an *in vitro* simulated human digestion, and its bioavailability and permeability to the bloodstream verified.

Keywords: catechins; cognitive development; pharmaceutical formulations; bioavailability

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References

[1] International, A. s. D. *Dementia facts & figures*. <u>https://www.alzint.org/about/dementia-facts-figures/</u> (accessed 2023 11/03/2023).

[2] EURACTIV, S. M. *Rising dementia numbers in EU causes alarm.* 2016. https://www.euractiv.com/section/health-consumers/news/rising-dementia-in-the-eu-causesalarm/ (accessed 2023 11/03/2023).

[3] de la Torre, R.; de Sola, S.; Hernandez, G.; Farré, M.; Pujol, J.; Rodriguez, J.; Espadaler, J. M.; Langohr, K.; Cuenca-Royo, A.; Principe, A. Safety and efficacy of cognitive training plus epigallocatechin-3-gallate in young adults with Down's syndrome (TESDAD): a double-blind, randomised, placebo-controlled, phase 2 trial. *The Lancet Neurology* **2016**, *15* (8), 801-810.

[4] Guo, S.; Yan, J.; Yang, T.; Yang, X.; Bezard, E.; Zhao, B. Protective effects of green tea polyphenols in the 6-OHDA rat model of Parkinson's disease through inhibition of ROS-NO pathway. *Biological psychiatry* **2007**, *62* (12), 1353-1362.

[5] Fernandes, L.; Cardim-Pires, T. R.; Foguel, D.; Palhano, F. L. Green Tea Polyphenol Epigallocatechin-Gallate in Amyloid Aggregation and Neurodegenerative Diseases. *Frontiers in Neuroscience* **2021**, *15*, Review.

[6] Choi, Y.-T.; Jung, C.-H.; Lee, S.-R.; Bae, J.-H.; Baek, W.-K.; Suh, M.-H.; Park, J.; Park, C.-W.; Suh, S.-I. The green tea polyphenol (–)-epigallocatechin gallate attenuates β -amyloid-induced neurotoxicity in cultured hippocampal neurons. *Life sciences* **2001**, *70* (5), 603-614.

[7] Jeremic, D.; Jiménez-Díaz, L.; Navarro-López, J. D. Past, present and future of therapeutic strategies against amyloid- β peptides in Alzheimer's disease: A systematic review. *Ageing research reviews* **2021**, *72*, 101496.

[8] Rossetti, D.; Bongaerts, J.; Wantling, E.; Stokes, J.; Williamson, A.-M. Astringency of tea catechins: More than an oral lubrication tactile percept. *Food Hydrocolloids* **2009**, *23* (7), 1984-1992.

21171 | The integrated stress response activation as a novel mechanism of striatal vulnerability in Huntington's disease

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Abstract

Huntington's disease (HD) is a neurodegenerative disease characterized by selective striatal vulnerability and caused by mutated huntingtin (mut-Htt) protein. Mitochondrial (MT) dysfunction was identified as a possible mechanism for the striatal vulnerability in HD - in comparison with other brain regions, striatum (STR) is more vulnerable to MT dysfunction and striatal mitochondria present membrane hyperpolarization [1] - but the detailed mechanisms are incompletely known. As MT hyperpolarization may activate the integrated stress response (ISR), a signalling pathway that lowers protein synthesis, via OMA1-DELE1-HRI pathway [2,3], we propose that STR presents a high activation of the ISR, lowering the protein synthesis and the capacity to cope with proteotoxic stress. We evaluated if culturing U2OS cells in galactose medium, which makes cells more susceptible to MT dysfunction, activates the ISR, and we studied differences between the STR and cortex (CTX) regarding: 1) activation of ISR and protein clearance pathways by western-blot (WB) using STR and CTX samples of wild-type (wt-) and HD transgenic mice (R6/2); 2) Htt proteostasis by fluorescence microscopy using STR and CTX primary neurons transfected with wt- and mut-Htt. Culturing U2OS cells in galactose raised p-elF2 α levels, an ISR marker, suggesting ISR activation. STR of wt mice had higher levels of the ISR effector ATF4 than CTX, supporting the ISR activation in STR. Synthesis of transfected protein EBFP and overall protein content lowered in STR neurons compared to CTX, and R6/2 STR had lower levels of markers of the protein clearance pathways than CTX. Therefore, STR has lowered protein synthesis, which can hinder proteostasis capacity. Indeed, STR neurons had a lower threshold for aggregation than CTX neurons, despite lower soluble and aggregated mut-Htt levels. Our data suggest that ISR activation may contribute for striatal vulnerability in HD, by lowering protein synthesis and rendering STR more vulnerable to proteotoxic stress.

Keywords: Huntington's disease; striatal vulnerability; integrated stress response; metabolism; proteostasis; protein clearance pathways.

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References

[1] Pickrell et al. (2011) J Neurosci. 6;31(27):9895-904;

- [2] Mick et al. (2020) eLife 9:e49178;
- [3] Fessler et al. (2020) Nature 579, 433–437.

20522 | Comprehensive assessment of environmental fungus-reactive T cells response in hypersensitivity pneumonitis patients

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Abstract

Hypersensitivity pneumonitis (HP) is an interstitial lung disease that results in parenchymal and small airways inflammation and culminates in breathlessness, negatively impacting patient's quality of life and survival. HP is initiated by an exaggerated immune response triggered by the inhalation of a variety of environmental antigens. The identification of the triggering antigen is a cornerstone of the diagnostic algorithm, and importantly, exposure avoidance ameliorates the clinical outcomes. However, the inciting antigen is not identified in a large proportion of patients. A difficult to identify, but common inciting antigen, is exposure to household fungi.

We pioneered the indoor characterization of household fungal exposure in HP patients' houses. Up to now, we have visited 35 residences, characterized their building environment, and collected indoor air samples using a single-stage microbiologic air impactor. Collected samples were quantified and fungal species were identified according to standardized methodology. A total of 21 (60%) patients had either toxic levels of specific fungus or indoor levels superior to outdoor ones. We found a total of 28 different fungal species, being *Cladosporium* spp. and *Penicillium* spp. the most prevalent ones.

Based on this, we are currently developing a novel diagnostic method for HP, through the analysis of mold-reactive T cells response. For that, we are stimulating peripheral blood mononuclear cells from HP patients and co-inhabitants, with inactivated fungi antigens isolated from the

corresponding household. Importantly, different fungal antigen concentration and fungal cocktails are being tested as potent stimulators to be used for day-to-day diagnosis purposes, avoiding the need for house inspections. In some patients, we observed an increased T cell activation and proliferation associated with an augmented secretion of T cell mediated cytokines which could be of great importance to future diagnostic methodologies.

Keywords: Hypersensitivity Pneumonitis, Interstitial Lung Disease, Household Fungi, T cell response

References

[1] Bellanger AP, Reboux G, Rouzet A, Barrera C, Rocchi S, Scherer E, et al. Hypersensitivity pneumonitis: A new strategy for serodiagnosis and environmental surveys. Respir Med. 2019;150:101-6.

[2] Nogueira R, Melo N, Novais e Bastos H, Martins N, Delgado L, Morais A, et al. Hypersensitivity pneumonitis: Antigen diversity and disease implications. Pulmonology. 2019;25(2):97-108.

[3] Santos V, Martins N, Sousa C, Jacob M, Padrão E, Melo N, et al. Hypersensitivity pneumonitis: Main features characterization in a Portuguese cohort. Pulmonology. 2020;26(3):130-7.

20613 | Post-COVID-19 symptom burden and recovery: a longitudinal study

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Abstract

Introduction: Post-COVID-19 is an emergent and often debilitating condition, yet individual symptom burden and long-term evolution are still being explored.

Methods: In this longitudinal retrospective study, we analysed data from 52 patients followed from March 2021 to September 2022 at a post-COVID-19 consultation in a tertiary hospital in Porto, Portugal.

Results: The most frequently reported symptoms were fatigue (82.7%), physical impairment (75%) and altered memory (57.7%). Over sixty percent reported at least one symptom with high burden on daily life. Depression (p<0.01), among other mental illnesses (p<0.05), were identified as risk factors for higher symptom burden. We found an association between the number of acute-phase and post-COVID-19 symptoms [beta=0.63, 95% CI (0.16, 1.09), p<0.01]. Eleven patients (21%) reported recovery of their previous health status, at an average of 12.5 months after acute COVID-19.

Conclusions: Despite most patients not fully recovering after a one-year follow-up, most reported improving their health status over time. Patients with higher number of acute-phase symptoms or with previous mental illness may be at increased risk of post-COVID-19 condition and high symptom burden on daily life, respectively. Certain symptoms with both high frequency and high burden, namely physical impairment and fatigue, may in the future be considered priorities in patient management.

Keywords: post-COVID condition; long COVID; symptom burden; COVID-19

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MT and MG conceptualized the study design, MG, TL and MS analysed and interpreted the results. All authors wrote and revised the manuscript. All authors read and approved the final manuscript and abstract.

20682 | Identification of Serotransferrin modifications in Hereditary Hemochromatosis patients and healthy subjects

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Abstract

Hereditary Hemochromatosis (HH) is a widespread genetic autosomal recessive disease in white populations, with a prevalence of 1 in 300 to 500 individuals. HH is characterized by excessive iron absorption and increased body iron stores. Iron deposition in several organs may cause cardiac problems, hypogonadism, diabetes, arthropathy and cirrhosis [1]. Transferrin (Tf) is the protein responsible for iron transport in circulation, possessing two equivalent lobes that can bind one Fe³⁺ each. Iron-binding by Tf is necessary for iron internalisation, being the most important mechanism for iron delivery to cells [2]. Additionally, Tf bound iron acts as a signal for iron availability, participating in the regulation of iron metabolism responses [3]. Tf plays an important role in HH, mediating the distribution of excessive iron through different organs. However, posttranslational modifications of Tf, such as glycosylation, phosphorylation, glycation and oxidation, can modulate its iron-binding capacity and its function in a physiologically relevant manner [4]. To study these modifications and their distribution, blood samples from HH patients from the Hospital Santo António were collected. Controls were a group of healthy blood donors. Tf was purified from serum samples and analysed by mass spectrometry based proteomics. Results show that the most abundant modifications are non-enzymatic glycation, oxidation, and carboxylation. Control samples were found to have a higher degree of glycation in Lys206 and Lys534, both of which are involved in iron-binding. Surprisingly, the level of protein oxidation was also found to be greater in controls than in HH samples. Additionally, carboxylation of Asp63, part of the ironbinding site in Tf N-terminal, has been found in samples from both groups. The identified PTMs occur at aa residues involved in Tf iron-binding and are likely to play a relevant role in Tf function, but further investigations are required to ascertain their physiological role.

Keywords: Iron Overload, Hemochromatosis, Serotransferrin, Post-translational modifications, Mass Spectrometry, Proteomics.

Acknowledgements

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References

[1] Porter, J.L. and P. Rawla, *Hemochromatosis*, in *StatPearls*. 2022, StatPearls Publishing Copyright © 2022, StatPearls Publishing LLC.: Treasure Island (FL).

[2] Gomme, P.T., K.B. McCann, and J. Bertolini, *Transferrin: structure, function and potential therapeutic actions.* Drug Discov Today, 2005. 10(4): p. 267-73.

[3] Kleven, M.D., S. Jue, and C.A. Enns, *Transferrin Receptors TfR1 and TfR2 Bind Transferrin through Differing Mechanisms*. Biochemistry, 2018. 57(9): p. 1552-1559.

[4] Silva, A.M.N., et al., *Human transferrin: An inorganic biochemistry perspective.* Coordination Chemistry Reviews, 2021. 449: p. 214186.



Figure 1: Representation of the workflow for the identification of human transferrin post-translational modifications. Transferrin was purified from serum samples, and analysed by nanoLC-MS. Serotransferrin structure is depicted in green, with relevant residues highlighted in orange and blue.

20688 | Portuguese literacy regarding infertility and assisted reproduction techniques

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Abstract

Over the years we have witnessed an increase in the prevalence of infertility [1] and the use of assisted reproductive technology (ART) [2]. These trends make determining whether the general public is well informed about them critical. Previous research conducted in Portugal revealed that people lack substantiated and accurate knowledge [3]. This study aims, six years later, to assess if the Portuguese population's knowledge of infertility and ART techniques has improved.

The data was collected using a structured questionnaire divided into four sections: social demographic data, infertility, ART techniques, bioethical opinion, and Portuguese legislation. A total of 440 responses were received, with females and males accounting for 69.8% and 30.2%, respectively. At the time of the survey, 51.8% and 36.8% of respondents were in high school or had completed their higher education, respectively. Although 64.8% identify infertility as a disease recognized by the World Health Organization, and 72.9% acknowledge that 15 out of every 100 couples in Portugal are infertile, only 51.4% understand what infertility is.

Even though 88.2% believe there is a lack of information on the subject, 92.5% do not attend or seek lectures, debates, or information on infertility. Regarding the causes of infertility, 91.4% claim to understand them and 87.7% attribute it to age. As far as ART techniques, 71.8% claim to know at least one, with 89.1% believing that these techniques do not violate societal ethical principles, and 74.5% supporting the development of new techniques. Younger participants were particularly enthusiastic about this development while those aged over 50 were reluctant.

Finally, it was discovered that Portuguese are well-informed about infertility in general, with female being more informed than male participants. Nonetheless, Portuguese are thirsty for accurate information about infertility, while emphasizing the importance of scientific advancement in this field and expressing their support for it.

Keywords: Infertility; Portugal; ART.

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References

[1] Te Velde E, Habbema D, Leridon H, Eijkemans M. The effect of postponement of first motherhood on permanent involuntary childlessness and total fertility rate in six European countries since the 1970s. Hum Reprod 2012;27:1179–1183.

[2] Wyns C, Bergh C, Calhaz-Jorge C, De Geyter C, Kupka MS, Motrenko T, Rugescu I, Smeenk J, Tandler-Schneider A, Vidakovic S et al.; European IVF-monitoring Consortium (EIM)‡ for the European Society of Human Reproduction and Embryology (ESHRE). ART in Europe, 2016: results generated from European registries by ESHRE. Hum Reprod Open 2020;2020:hoaa032.

[3] Almeida-Santos T, Melo C, Macedo A, Moura-Ramos M; Are women and men well informed about fertility? Childbearing intentions, fertility knowledge and information-gathering sources in Portugal. Reprod Health 2017;14(1):91. doi:10.1186/s12978-017-0352-z.

21186 | Importance of climate change manifestations and urban green areas on the potential expansion of ixodid vectors

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Abstract

Urban development combined with climate change can trigger negative effects in the ecosystems. Although the recognized environmental benefits, the implementation of urban green areas can increase the number of habitats favorable to the spread of ixodid vectors, as well as to increase its contact with humans and animals, which may constitute a public health problem. Nowadays, to increase the effectiveness of health services intervention, is necessary to create multidisciplinary teams. In this context, geography, through Geographic Information Systems (GIS), plays a crucial role. This software contributes to operate and export geographic alphanumeric information in a global, regional, or local scale.

The aim of this study was to conjecture the potential vulnerabilities of climate change and the expansion of urban green areas on the occurrence of ixodid vectors in urban environments. Besides, it is intended to demonstrate the application of GIS methodology in delimiting higher risk zones and to propose new locations for ixodid vectors surveillance.

The study area was composed by four municipalities of Porto metropolitan zone (Northern Portugal). The study was divided into three topics: characterization of local climate conditions, climate forecasts as well as green areas, surveillance data of ixodid vectors in the study area, identification of susceptible and risk areas of ixodid vectors expansion.

The expansion of vectors in urban area was confirmed, evidencing that climate change combined with urban green areas can result in an increased dissemination of ixodid vectors in urban environments, consequently, may increase the incidence of diseases transmitted by them. This study shows that GIS constitute a profitable tool for a more fruitful site demarcation of ixodid vectors monitoring, increasing the success of its capture in the free-living phase. The more active identification of risk areas will allow health services to take more effective measures.

Keywords: Climate Change; Urban Green Areas, Public Health; Ixodid Vectors; Geographic Information Systems (GIS)

21169 | Associated factors related to self-perception of health status among University of Porto students

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Abstract

Unhealthy eating patterns are usually prevalent in university contexts. Students' health status self-perception may be both cause and consequence of eating habits and their determinants. Despite their higher knowledge, nutrition students don't necessarily have better eating habits. The aim was to relate being or not a nutrition student and food choice determinants with U.Porto students' self-perception of health status. A convenience sample of 173 students (83.2% females) aged 18 years or above (median age = 22,5 years old) completed an online questionnaire including sociodemographic and academic characteristics, self-perception of health status and food choice determinants. Binary logistic regression models were used to predict self-perception of health status based on the other characteristics. The main factors that influence food consumption were 'habit or routine' (29.1%), 'the attempt to carry out a healthy diet' (22.7%), 'taste of foods' (14.5%) and 'convenience in the preparation of foods' (13.4%). FCNAUP students (56.6% of total) are more likely to self-perceive as healthier (OR: 2.525, 95% CI: 1.236-5.155). Students who selected 'the attempt to carry out a healthy diet' as their major food choice determinant are more likely to self-perceive as healthier (OR: 2.897, 95% CI: 2.688-12.204), while those who selected 'convenience' (OR: 0.314, 95% CI: 0.098-1.008), 'habit or routine' (OR: 0.394, 95% CI: 0.144-1.074) or 'the taste of foods' (OR: 0.362, 95% CI: 0.115-1.143) are less likely to selfperceive as healthier. The relationships between food choice determinants and self-perception of health status may help to conduct health interventions for U.Porto students, as they allow focusing on both general (health) and specific (food) features, and different motivation sources. Nutrition students' self-perception of a better health status must be valorised considering objective health measures.

Keywords: health status; food choices; food consumption; public health; university students.

21275 | Content validity of a patient reported experience measure for patients with rheumatoid arthritis in Portugal

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Abstract

Background: Rheumatoid arthritis (RA) is an increasing major global public health challenge, with significant morbidity and mortality. The evaluation of RA patients' perceptions has a positive influence in their health outcomes and overall experience of care, which demonstrates the importance of using an instrument capable to do this assessment. The Commissioning for Quality in Rheumatoid Arthritis Patient-Reported Experience Measure (CQRA-PREM) is an instrument for that purpose that is already validated and in use in the United Kingdom (UK) and Netherlands. In Portugal, there is no validated instrument enable to evaluate the experience of patients with RA about the health care received.

Objective: To translate, cultural adapt and validate the CQRA-PREM for the Portuguese population.

Methods: A qualitative study using focus groups was conducted to evaluate CQRA-PREM content validity. The CQRA-PREM was first translated and cultural adapted to Portuguese by two researchers, and after back translation, a panel of experts agreed on the preliminary Portuguese version of CQRA-PREM. Patients with RA were recruited from a rheumatology centre at a tertiary university hospital centre to participate in focus group meetings. Before the focus group they filled in the preliminary version of CQRA-PREM.

Results: Twelve participants (median 54 (44.5-58) years old; 92% female) were included in two focus groups. Participants considered the questionnaire as "simples" and with adequate questions. Patients pointed as extremely important being treated with dignity and respect and considered the awareness of the multidisciplinary team and the presentation of support programs and organizations as areas for improvement. The Cronbach's alpha was 0.94 for the total questionnaire and between 0.71 and 0.91 for the domains.

Conclusion: The Portuguese version of the CQRA-PREM is acceptable and valid in the perspective of patients with RA to assess the quality of care provided by the health care services through the experience of patients with RA.

Keywords: Rheumatoid Arthritis; Patient Reported Experience Measure; Focus Groups; Perception of patients; Cultural adaptation and content validation

References

[1] Miranda, L.C., et al., *Finding Rheumatoid Arthritis Impact on Life (FRAIL Study): economic burden.* Acta Reumatol Port, 2012. 37(2): p. 134-42.

[2] Bosworth, A., et al., Development and Validation of a Patient Reported Experience Measure (PREM) for Patients with Rheumatoid Arthritis (RA) and other Rheumatic Conditions. Curr Rheumatol Rev, 2015. 11(1): p. 1-7.

[3] Beckers, E., et al., Validation and implementation of a patient-reported experience measure for patients with rheumatoid arthritis and spondyloarthritis in the Netherlands. Clin Rheumatol, 2020. 39(10): p. 2889-2897.

[4] Christalle, E., et al., *Development and content validity of the Experienced Patient-Centeredness Questionnaire (EPAT)-A best practice example for generating patient-reported measures from qualitative data*. Health Expect, 2022. 25(4): p. 1529-1538.

[5] Smolen, J.S., et al., *EULAR recommendations for the management of rheumatoid arthritis with synthetic and biological disease-modifying antirheumatic drugs: 2022 update.* Ann Rheum Dis, 2023. 82(1): p. 3-18.

21285 | Revisiting the biomarkers for Coronary Artery Disease and Stroke using a bioinformatics perspective

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Abstract

Background: Cardiovascular and cerebrovascular diseases (CVDs), respectively, coronary artery disease (CAD) and stroke, are the leading causes of death and morbidity. Atherosclerosis is implicated in the pathophysiology of both these diseases. Early diagnosis may be the answer to reduce the health and economic burden of CVDs.

Objective: We aim to uncover potential biomarkers to determine the risk of CAD and stroke by analysing proteins associated with both diseases and their potential of being used in clinical practice.

Methods: Two separate literature searches were used to obtain the articles that combined CAD or stroke with omics terms. The data was analysed by automatic text mining using the VOSviewer software, which identified proteins associated with both diseases. These proteins were compared with genes previously associated with CAD and stroke as disclosed in the DisGeNET database. ProteomeXchange datasets were used to confirm our results and STRING for functional enrichment analysis.

Results: This study resulted in 22 proteins associated with both diseases. Protein–protein interaction analysis revealed that these proteins were associated with many biological processes related to atherosclerosis. ADIPOQ, ALB, APOE, CRP, CST3, MMP1, MMP2, MMP3, MMP7, MMP8, MMP9, SAA1, and TNF are secreted and can be measured in biofluids. The genes identified with the highest level of evidence, according to DisGeNET, are ADIPOQ, APOE, CRP, MMP9, NOS3, PPARG, PTGS2, and TNF.

Conclusion: In conclusion, the most promising biomarkers seem to be ADIPOQ, APOE, CRP, MMP9, and TNF and they should be studied as a panel of potential predictors of CVDs.

Keywords: Cardiovascular diseases; Cerebrovascular diseases; Coronary artery disease; Stroke; Biomarkers; Bioinformatics; Bibliometric analysis; VOSviewer

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20661 | PR interval in hypertrophic cardiomyopathy patients: A worthy risk factor?

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Abstract

Background: Hypertrophic cardiomyopathy (HCM) is the most common inherited cardiac disease and atrial fibrillation (AF) is one of the most feared complications in adult patients. Periodic Holters are recommended during the follow-up, although the impact of this monitoring on the prevention of cardioembolic events is still unknown. Recently, the presence of 1st-grade atrioventricular block (1st AVB) was independently associated with HCM-related death.

Methods: From a cohort of HCM patients (pts) of a university hospital centre São João. we analysed those in sinus rhythm at first appointment, seeking relationships of PR interval duration with different clinical and imaging variables and with the occurrence of events.

Results: A total of 97 pts were included - 58,8 % men, mean age of 51±19 years. Median PR duration at first visit was 160 (interquartile range – IQR – 41) ms and 14% had a PR duration >200ms. Fatigue was the most common complaint (28,9%) and 32,0% had family history of premature sudden cardiac death. Beta-blockers were prescribed in 63,5% of cases. Mean echo left atrium (LA) diameter and indexed volume were 31±16 mm and 27±26 ml/m2, median left ventricle ejection fraction was 63,5 (IQR 7)% and mean E/E'value was 5,6±5,7. Basal or after Valsalva obstructive gradients were present in 2 patients. On cardiac magnetic resonance (CMR), 62,9% had late enhancement; of those, 98,3% was intramyocardial. On Holter, 4,5% of patients showed episodes of nonsustained ventricular tachycardia and 3,0% had paroxysmal atrial fibrillation/flutter.

During median 4,3 (IQR 5,8) years of follow-up, 35 cardiovascular events occurred: 13 had atrial arrythmia (Flutter or Atrial Fibrillation); 2 underwent cardioverter defibrillator implantation for secondary prevention, 8 patients had stroke, 4 had acute coronary syndrome, and 8 had other HCM related complications that led to hospitalization. There were two deaths associated to other medical conditions, more precisely related to oncologic pathology.

Presence of 1st AVB or PR duration greater than 200 ms was not associated with the occurrence of the composite of events (p=0,921 and p=0,611). On the other hand, PR duration was associated with development of *de novo* AF/AFL (median PR of 160 ms in the no event group VS 183 ms in the FA/FLA group, p=0,029).

We found association between PR duration and echo parameter E/E'ratio after multivariable analysis. We did not find any association with LV volumes and LV Ejection Fraction (p>0,05). Also, it was associated with greater maximum cardiac frequency on Holter after univariable analyses (p=0,017).

Conclusions: In our cohort of sinus rhythm HCM patients, 1st AVB was present in minority of patients and was not associated with events during FUP. However, a normal but larger PR duration was associated with de development of AF/AFL. These results reinforce that PR duration on ECG may be valuable for risk stratification in HCM patients. We found association between PR interval larger than 200 ms and presence of E/E` ratio. This last parameter is associated with diastolic heart disfunction. More studies need to be conducted to test increase PR interval has a potential finding of altered heart function in HCM patients.



Keywords: Hypertrophic cardiomyopathy, Atrial Fibrillation, E/e` ratio, cardiovascular events

Figure 1: Kaplan Meier Curve regarding development of atrial fibrillation or atrial flutter during follow up considering 2 groups of PR interval duration (cutoff of 160 ms).

21044 | MicroRNAs in Kidney-Heart Fibrosis

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Abstract

Chronic kidney disease (CKD) affects 10% of the worldwide population and is characterized by a progressive inflammatory and fibrotic state that may, ultimately, lead to end-stage kidney disease and the need for renal replacement therapies. Among several comorbidities, CKD is a major independent risk factor for cardiovascular diseases (CVD), representing a 500-fold increase of cardiovascular events. Recently, some studies have shown a relationship between CKD and CVD, however the pathophysiological mechanisms underlying these conditions are still unknown. In recent years, microRNAs (miRNAs) have emerged as important regulators of gene expression and have been associated with a wide spectrum of human diseases. In fact, CKD and CVD share common pathological mechanisms, as a chronic inflammatory state that contributes to the development of fibrotic processes, leading to organ failure and numerous miRNAs that have been implicated in both CKD and CVD alone. However, so far, the role of circulating miRNAs in the intercommunication between CKD and CVD has not yet been addressed.

In this project, we aimed to investigate the expression of a selected panel of circulating miRNAs in plasma samples from CKD patients and explore its association with kidney function and interstitial fibrosis in renal biopsies, as well as with cardiovascular outcomes.

qRT-PCR analysis showed significant differences in the miRNA expression pattern between healthy blood donors (with preserved kidney function assessed by the creatinine level) and CKD patients, highlighting a relevant role of these miRNAs in CKD and its major outcomes.

The analysis of microRNA expression as putative predictors of CKD progression, major cardiovascular events and tissue fibrosis may allow, for the first time, the identification of a microRNA signature associated with CKD progression and cardiovascular risk that may serve simultaneously as biomarkers and therapeutic targets for this disease and its outcomes.

Keywords: Chronic kidney disease; cardiovascular disease; microRNAs; biomarkers

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21190 | Characterization of inflammatory pathways and fibrosis in human endometriosis

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Abstract

Endometriosis is an inflammatory disease characterized by the presence of ectopic endometrial tissue, predominantly in the pelvic cavity. The growth of endometrial tissue depends on ovary-secreted estrogen, however, ectopic endometrium also seems to have a role in the secretion of estrogen and in the perpetuation of inflammation. Activation of inflammatory pathways leads to the fibrosis of tissues.

The aim of this study is to elucidate inflammatory pathways in human endometriosis by assessment of expression of galectin-3 and F4/80, markers of macrophages, and progesterone receptor (PR), which mediate anti-inflammatory effects. As well, proliferating cell nuclear antigen (PCNA), cytochrome P450-17A1 (CYP17A), markers of cell proliferation and steroidogenesis, respectively; and vascular endothelial growth factor (VEGF), promoter of angiogenesis, were analysed in eutopic and ectopic tissues of women with endometriosis.

Tissues were harvested during surgeries from women with endometriosis (n=25) and from controls with uterine myoma (n=14). Sections were stained with H&E, Masson's Trichrome and Picrosirius Red for computer-assisted fibrosis quantification. Protein markers semi-quantification by western blotting is ongoing.

Preliminary histological characterization demonstrated that ectopic tissues present a disorganized cellular pattern comparatively with eutopic samples. Also, increased levels of collagen and fibrosis were observed in the endometriosis group, mainly in the ectopic tissue of women with endometriosis. All the studied proteins were identified in both eutopic and ectopic endometrial tissues by western blotting.

In sum, histological qualitative results demonstrate higher levels of fibrosis in ectopic tissue of women of endometriosis. To confirm this finding morphometric studies and molecular characterization are in progress.

Keywords: endometriosis, fibrosis, inflammation.

21227 | Guarding a young heart: What keeps rare proliferative cardiomyocytes in the heart?

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Abstract

The non-proliferative profile of adult cardiomyocytes established the heart as a terminally differentiated post-mitotic organ for quite a long time. However, recent reports of cellular turnover and cardiomyocyte (re)genesis throughout the lifespan revoked this notion ^{[1][2]}. Since identification of cardiac stem cells for the myocardium have evaded all efforts applied so far, *de novo* muscle formation in the heart is considered to rely on the proliferation of CM that re-enter the cell cycle have increased over the last decade and point, overall, to a rare population/s of cells displaying a more immature phenotype. To assess this regenerative capacity of the heart, it is necessary to address the lack of cell signatures to prospectively isolate the unique diving CM.

We identified CD24, a typical inflammation modulator molecule often expressed in tumour cells, expressed at high levels in the embryonic heart. Cell surface expression of CD24 enabled isolation of a population of immature CM that decreased during development to represent only a minute cell fraction in the adult heart. Interestingly, detection of CD24 expression in the adult myocardium increased following ischemic injury ^[4].

Using in-situ immunolocalization, flow cytometry, FACS and transcriptomic profiling, we set out to identify the dynamics *in vivo* of CD24+CM in the murine heart, specifically at the first week post birth, a time at which the organ is still capable to engage a regenerative response to injury. Furthermore, to gain insight on the molecular mechanisms involved, we are employing an *in vitro* siRNA knockdown strategy and pharmacologic inhibition targeted to molecules presumptively involved in regulation of CD24 expression in CM. Our latest data on the neonatal heart will be shown and discussed.

Keywords: Heart; Neonatal; Regeneration; CD24; Myocardial Infarction.

References

[1] Bergmann, O. et al. (2009) "Evidence for cardiomyocyte renewal in humans", Science. Available at https://doi:10.1126/science.1164680.

[2] Bergmann, O. et al. (2015) "Dynamics of Cell Generation and turnover in the human heart," Cell, 161(7), pp. 1566–1575. Available at: https://doi.org/10.1016/j.cell.2015.05.026.

[3] Senyo, S.E. et al. (2012) Mammalian heart renewal by pre-existing cardiomyocytes, Nature News. Nature Publishing Group. Available at: https://www.nature.com/articles/nature11682

[4] Valente, M., Resende, T., Nascimento, D., Burlen-Defranoux, O., Soares-da-Silva, F., & Dupont, B. et al. (2019). Mouse HSA+ immature cardiomyocytes persist in the adult heart and expand after ischemic injury. PLOS Biology, 17(6), e3000335. doi: 10.1371/journal.pbio.3000335

20545 | Characterization of microglial response to environmental enrichment: The role of the RhoGTPase Rac1

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Abstract

Microglia, the quintessential immune cell of the CNS, have now been recognized to be crucial for a plethora of learning phenomena. Yet, the microglial molecular drivers required for homeostatic learning related to cognitive performance remain largely elusive. To mimic this type of homeostatic and highly effective brain stimulation, we employed a protocol of environmental enrichment (EE) in adult mice. EE protocols have long been held to emulate a 'natural' learning process and are known to enhance cognitive performance, including in brain diseases.

Here, we combined conditional cell-specific gene targeting, high-throughput phosphoproteomics, bioinformatics, and animal behaviour to verify whether and how microglia participate in such a learning process.

Phosphoproteomics profiling of microglia identified five main signalling modules triggered by EE, the biggest of which was RhoGTPase signalling. Inside this module we were able to rank the signalling pathways of the most important RhoGTPases, and single out Rac1 as the key regulator. We also found various cytoskeleton proteins with altered phosphorylation status, including many GEFs, GAPs, and coffilin1. To understand how important microglial Rac1 was for the EE response, we ablated Rac1 specifically in adult microglia. Results showed that Rac1 modulated more than 70% of microglial phosphoproteins during EE. Finally, we performed a battery of cognitive tests in control and cKO mice and found that removing Rac1 from microglia prevented them from having any EE-dependent improvement in cognitive performance.

Overall, microglia play an essential role in EE, and EE-induced improvements in the cognitive performance occur in a microglial Rac1-dependent manner.

Keywords: microglia, RhoGTPases, high-throughput omics, neuronal plasticity, cognition

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20639 | The importance of catechol and free hydroxy groups on chalcones' antioxidant activity

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Abstract

During inflammatory processes, a state of oxidative stress may occur resulting from an oxidative imbalance, where large amounts of reactive species are released at the inflammation site. This condition may affect several cellular structures and lead to the development of chronic inflammatory diseases (e.g. rheumatoid arthritis and atherosclerosis).

Chalcones are natural compounds, precursors of flavonoids, with known antioxidant activity, and thus may have potential for the development of anti-inflammatory drugs. This study evaluated a group of structurally related hydroxylated and methoxylated chalcones (C0 to C6, Fig. 1) for their ability to scavenge hydrogen peroxide (H_2O_2), superoxide anion radical ($O_2^{\bullet^*}$), nitric oxide (*NO) and hypochlorous acid (HOCI) using chemiluminometric, colorimetric and fluorimetric methods. Out of the seven studied chalcones, C1 and C2 showed selectivity in the scavenging $O_2^{\bullet^*}$ and *NO in a concentration-dependent manner. Interestingly, the most active chalcones in HOCI scavenging presented low IC₅₀ values (around 1 μ M), and only C0 and C3 showed no activity. The active compounds generally showed superior potency compared to the positive controls used. The structure-activity relationship analysis shows that hydroxylated chalcones have higher antioxidant activity than methoxylated chalcones. The presence of free hydroxy groups on the A-ring, as well as a catechol group on the B-ring, are important features for chalcones' antioxidant activity.

Keywords: Antioxidant activity; Chalcones; Oxidative stress; Reactive Prooxidant Species; Structure-activity relationship.

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- CO) R1=R2=R3=R4=R5=H
- C1) R1=R2=R4=R5=OH, R3=H
- C2) R1=R2=R3=R4=R5=OH
- C3) R₁=R₂=R₃=R₄=R₅=OMe
- C4) R1=R2=OH, R3=H, R4=R5=OMe
- C5) R1=R2=R3=R4=OH, R5=H
- C6) R1=R2

=R₃= OH, R₄=R₅=H Figure 1: Chemical structures of the studied chalcones (C0 - C6).

20769 | The effect of the glutathione pathway on the cytotoxicity of sunitinib, doxorubicin and bortezomib in AC16

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Abstract

Introduction. The number of cancer survivors has grown over the years due to more efficacious treatments. Nonetheless, these treatments present serious adverse effects, namely cardiotoxicity. Doxorubicin (DOX) interacts with DNA, sunitinib (SUN) is a multikinase inhibitor, and bortezomib (BTZ), is an inhibitor of proteasome. All have their clinical used limited for their inherent cardiotoxicity. Some of these therapies have their adverse effects associated with oxidative stress. Of note, glutathione (GSH) is the most important intercellular antioxidant, thus a pathway worth researching.

Objectives. To study the influence the GSH precursor N-acetylcysteine (NAC), or the γ -glutamylcysteine synthetase inhibitor, L-buthionine sulfoximine (BSO) on the cytotoxicity of SUN, DOX and BTZ in human differentiated AC16 cardiac cells.

Methods. AC16 cells were seeded in DMEM-F12, allowed to attach and then differentiated with horse serum for 24h. Differentiated cells were exposed to different concentrations of SUN (1– 20μ M) or DOX (0.1– 10μ M) or BTZ (0.01– 20μ M) for 24 or 48h. At the end of the incubation point, two cytotoxicity assays were done: the MTT reduction and neutral red uptake. Then, two concentrations of SUN (1 and 10μ M), DOX (0.1 and 1μ M) and BTZ (1 and 0.01μ M) were co-incubated with BSO (25 and 50μ M) or NAC 1 mM for 24h.

Results and discussion. A time and concentration-dependent cytotoxicity was observed for the three drugs, being the degree of toxicity as follows: BTZ>DOX>SUN when equimolar concentrations were compared. Regarding data with BSO and NAC, a small but significant protection was achieved with NAC towards the cytotoxicity of DOX. No other meaningful changes were seen.

Conclusion. This work showed that DOX, SUN and BTZ cause significant cytotoxicity in AC16 cells. As far as oxidative stress goes, more studies are needed, and other oxidative signalling pathways can be addressed, specifically pathways related to nuclear factor erythroid 2–related factor 2 (Nrf2).

Keywords: Cardio-Oncology; Doxorubicin; Sunitinib; Bortezomib; Glutathione.

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20787 | Nitrite ingestion as an emerging trend in suicide: investigating in vitro cytotoxicity

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Abstract

Introduction: Self-poisoning from ingested nitrites is an uncommon form of suicide, but we are currently witnessing an increase in this type of intentional intoxication, including in Portugal. In red blood cells, nitrites are oxidized, producing nitrate and methemoglobin, a dysfunctional form of hemoglobin incapable of transporting oxygen. Death is usually attributed to methemoglobinemia, but information is lacking on additional toxicity mechanisms [1,2]. An *in vitro* investigation of sodium nitrite and sodium nitrate toxicity towards potential target organs was conducted.

Methods: To assess *in vitro* cytotoxicity, H9c2 (cardiac), Caco-2 (intestinal) and SH-SY5Y (neuronal) cells were cultured and exposed to sodium nitrite and sodium nitrate for 4h at 37°C, 5% CO₂. Cell viability assays [neutral red uptake (NR) and MTT reduction (MTT)] were performed at a wide concentration range (25–400mM) to obtain full concentration-toxicity curves.

Results: IC50 values (mM) for sodium nitrite and sodium nitrate, respectively, obtained for each assay and for each cell line were: in H9c2 cells: NR (IC50=220.3; IC50=148.1, P<0.0001); MTT (IC50=231.6; IC50=134.4, P<0.0001); Caco-2 cells: NR (IC50=248.4; IC50=238.4, P<0.0001); MTT (IC50=281.3; IC50=275.5); SH-SY5Y cells: NR (IC50=153.7; IC50=151.6); MTT (IC50=196.2; IC50=173.8, P<0.0001).

Conclusion: Studies of the direct cytotoxicity of nitrites and nitrates were the first step towards understanding possible mechanisms of toxicity beyond methemoglobinemia. However, no significant cytotoxicity was observed at biologically relevant concentrations of sodium nitrite and sodium nitrate for any of the tested cell lines. In the future, other mechanistic pathways will be investigated to better understand these intoxications and find more efficient treatments.

Keywords: nitrites; methemoglobinemia; suicide; poisoning; forensic toxicology.

References

[1] Durão C, Pedrosa F, Dinis-Oliveira RJ. A fatal case by a suicide kit containing sodium nitrite ordered on the internet. J Forensic Leg Med, 73: 101989, 2020

[2] Durão C, Pedrosa F, Dinis-Oliveira RJ. Another suicide by sodium nitrite and multiple drugs: an alarming trend for "exit"? Forensic Sci Med Pathol, 17: 362-366, 2021
20811 | Optimization and evaluation of lipid metabolism modulation by hydroxylated flavonoids using an *in vitro* model of preadipocytes

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Abstract

Obesity is classified by WHO as the epidemic of the 21st century, being associated with fat accumulation and expansion of the adipose tissue^[1]. Adipogenesis is a process during which fibroblast-like preadipocytes develop into mature adipocytes, capable of producing and storing triglycerides^[2], while lipogenesis corresponds to the process of generation of new lipid molecules. Together, they partially drive fat accumulation, a hallmark of the disease. Presently, the few existing pharmacotherapeutic options for obesity are associated with low efficacy and undesirable side effects, so the search for new and safer molecules that can be used for obesity treatment is of great importance. Flavonoids are naturally occurring compounds associated with diverse biological activities^[3]. A panel of hydroxylated flavonoids were tested for their ability to modulate lipidic metabolism using an in vitro cellular model of obesity (pre-adipocytic cell line 3T3-L1). An optimization of conditions for 3T3-L1 cells chemical differentiation was made to achieve this objective. The best results were achieved for a differentiation time of 10 days, using pantothenic acid and biotin in the medium and variable insulin concentrations along the differentiation process. Cell viability assays were performed before and during the differentiation process to find the flavonoid's non-toxic concentrations for the cells in different differentiation stages, and most of the tested compounds showed to be non-toxic in concentrations starting at 12.5 µM. Oil Red O Staining assays were performed to evaluate flavonoids lipid metabolism modulation. From the compounds tested, Myricetin was able to reduce the lipid content in a concentration of 12.5 μ M, while Herbacetin and Apigenin did not show a significant effect. The results of this work suggest that some of the tested flavonoids should be further explored as potential anti-obesity molecules, through modulatory activities of the lipid metabolic process.

Keywords: Obesity; Flavonoids; Adipogenesis; Preadipocytes differentiation

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References

[1] Ghaben, A.L. and P.E. Scherer, *Adipogenesis and metabolic health*. Nat Rev Mol Cell Biol, 2019. 20(4): p. 242-258.

[2] Ali, A.T., et al., Adipocyte and adipogenesis. Eur J Cell Biol, 2013. 92(6-7): p. 229-36.

[3] Rufino, A.T., et al., *Flavonoids as antiobesity agents: A review*. Med Res Rev, 2021. 41(1): p.556-585.

20828 | Defining Prrxl1 transcriptional program in developing dorsal root ganglion neurons

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Abstract

Dorsal Root Ganglion (DRG) sensory neurons transduce and relay peripheral sensory input for spinal processing [1]. Several transcription factors have been reported to play a role in the generation of DRG neurons, however the molecular mechanisms underlying remains mostly unknown.

The paired related homeobox protein-like 1 (Prrxl1) is required for the assembly of the nociceptive DRG-spinal cord neuronal circuit. Prrxl1 is expressed in both developing DRG nociceptors, which transduce temperature and noxious stimuli, and excitatory neurons of spinal cord dorsal horn (dSC), suggesting that it is involved in establishing connectivity [2,3]. In fact, *Prrxl1* knock-out (*Prrxl1-/-*) mice show abnormal differentiation followed by cell death of excitatory dorsal horn neurons at late embryonic development and reduction of the total number of DRG nociceptors by about 30% at early postnatal stage [2,4].

We hypothesized that Prrxl1 might control a complex genetic program that may differ between the DRG and dSC. To define the transcriptional program under the regulation of Prrxl1, we performed a genome-wide study combining chromatin immunoprecipitation followed by next generation sequencing (ChIP-Seq) with microarray expression profiling using E14.5 DRGs from *Prrxl1-/-* and wild type mice (WT). Through integration of bound and deregulated genes, we identified a list of putative genes directly regulated by Prrxl1. We validated some of these target genes by assessing their deregulation in *Prrxl1-/-* embryos through *in situ* hybridization. We found that expression of *Adcyap1*, which encodes a neuropeptide involved in nociceptor signaling, was decreased in DRGs from *Prrxl1-/-* embryos, but not in the dSC. In contrast, *Slit1*, a gene involved in axonal guidance and migration, was not altered in the DRGs, but it was markedly reduced in the dSC of *Prrxl1-/-* as compared to WT embryos.

This research will provide new insight into the molecular mechanisms controlled by Prrxl1 during the development of DRG nociceptors.

Keywords: Neurodevelopment; Dorsal Root Ganglion; Transcription Factors; Gene expression

References

- [1] Krames, E. S., et al, Pain Medicine, 2014
- [2] Chen, Z. F., et al, *Neuron*, 2001
- [3] Ding, Y. Q., Development, 2004
- [4] Rebelo, S., Molecular and Cellular Neuroscience, 2006

20782 | A cross-sectional study on radiomic analysis of the hostile neck anatomy in Abdominal Aortic Aneurysms

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Abstract

Background: Abdominal aortic aneurysm may be corrected by EndoVascular Aneurysm Repair (EVAR), if a viable sealing zone is available in the proximal aneurysm neck for endoprosthesis anchorage.¹ The field of radiomics studies massive amounts of data extracted from medical imaging in order to detect complex patterns invisible to the naked eye.² We propose that a radiomic-based aneurysm neck assessment can accurately predict the neck anatomical adequacy. Methods: In this pilot cross-sectional analysis, 38 patients that underwent EVAR in a single-center tertiary institution (2009-2019) and had a preoperative computed tomography available were studied. Horos® software was used to classify patients in either "non-hostile" or "hostile" proximal aneurysm neck based on neck diameter, extension, conicity, calcification and angulation. 3D radiomic models of the proximal sealing zones were manually segmented by two independent blinded observers, utilizing the 3DSlicer® software. PyRadiomics extension was used to extract 107 radiomic features from each segmentation. Radiomic features with highest interobserver agreement were analysed using partial least squares-discriminant analysis to identify the strongest predicting features to differentiate non-hostile from hostile aneurysm necks. A bootstrapping analysis was performed to validate the model.

Results: 22 of the 38 patients included in this study had hostile neck. 18 radiomic features were identified to have an intercorrelation coefficient >0.9: 15 of these were texture-based and 3 were first-order features. After bootstrapping, PLS analysis allowed to discriminate two different groups, corresponding to non-hostile and hostile neck.

Conclusions: Results suggest that the overwhelming majority of radiomics analysis with a nonhostile neck result could accurately predict proximal sealing zone adequacy, which could aid in deciding on whether endovascular repair or other treatment modalities are most suitable. Further research with a larger sample size is needed.

Keywords: Abdominal aortic aneurysm; Aneurysm neck; Endovascular procedures; Computed tomography; Radiomics.

References

[1] Wanhainen A, Verzini F, Van Herzeele I, Allaire E, Bown M, Cohnert T, et al. Editor's Choice -European Society for Vascular Surgery (ESVS) 2019 Clinical Practice Guidelines on the Management of Abdominal Aorto-iliac Artery Aneurysms. Eur J Vasc Endovasc Surg. 2019;57(1):8-93.

[2] Lambin P, Leijenaar RTH, Deist TM, Peerlings J, de Jong EEC, van Timmeren J, et al. Radiomics: the bridge between medical imaging and personalized medicine. Nat Rev Clin Oncol. 2017;14(12):749-62.



Figure 4: Bootstrapped scores scatter plot of the selected radiomic features using PLS-DA.

20629 | Antimicrobial and antibiofilm effect of phytochemicals as a potential treatment against healthcare-associated infections

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Abstract

The treatment of bacterial infections has been troubled by the increased resistance to antibiotics [1, 2]. Thus, it is crucial to discover novel and effective therapies to control and eradicate planktonic and sessile bacterial cells [3]. Phytochemicals have demonstrated broad-spectrum and effective antibacterial effects as well as antibiotic resistance-modifying activity [4]. In this study, perillyl alcohol and hydrocinnamic acid were characterized for their antimicrobial and antibiofilm action against Escherichia coli CECT 434. Furthermore, dual and triple combinations of these phytochemicals with chloramphenicol and amoxicillin were investigated for the first time. Perillyl alcohol had a minimum inhibitory concentration (MIC) of 256 µg/mL and a minimum bactericidal concentration (MBC) of 512 μ g/mL. Hydrocinnamic acid had a MIC of 2048 μ g/mL and an MBC > effects 2048 μg/mL. Checkerboard demonstrated synergism or additive for chloramphenicol/perillyl alcohol, chloramphenicol/hydrocinnamic acid, and amoxicillin/hydrocinnamic acid. The analysis with Combenefit showed synergism for various concentrations of amoxicillin with each phytochemical and mainly at low concentrations of

chloramphenicol. Regarding the biofilms, both phytochemicals provided a total elimination of colony-forming units (CFU), for 5×MIC and 10×MIC. The highest percentages of metabolic inactivation (88.5% \pm 0.8% for 10×MIC) and biomass reduction (61.7% \pm 1.6% for 10×MIC) were obtained for *E. coli* treated with amoxicillin. All combinations resulted in high efficacy concerning metabolic inactivation and revealed moderate efficacy in terms of biomass reduction. Considering the culturability of sessile cells, synergism was determined for 20.0% of combinations, additivity for 60.0%, and indifference for 20.0%. The results of this study highlighted the potential of combinatorial therapies for microbial and biofilm control, where phytochemicals play an important role as resistance-modifying agents.

Keywords: Antibiotic recalcitrance; Biofilm eradication; *E. coli* infections; Plant-based natural product; Combinatorial therapy; Phytochemical-antibiotic interaction.

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References

[1] Kolář, M. Bacterial Infections, Antimicrobial Resistance and Antibiotic Therapy. *Life (Basel)* 2022, 12(4).

[2] Terreni, M; Taccani, M; Pregnolato, M. New Antibiotics for Multidrug-Resistant Bacterial Strains: Latest Research Developments and Future Perspectives. *Molecules* 2021, 26(9).
[3] Ma, R; Hu, X; Zhang, X; Wang, W; Sun, J; Su, Z; Zhu, C. Strategies to prevent, curb and eliminate biofilm formation based on the characteristics of various periods in one biofilm life cycle. *Front Cell Infect Microbiol* 2022, 12:1003033.

[4] Khare, T; Anand, U; Dey, A; Assaraf, Y.G.; Chen, Z.S.; Liu, Z; Kumar, V. Exploring Phytochemicals for Combating Antibiotic Resistance in Microbial Pathogens. Front Pharmacol 2021, 12:720726.

20881 | Interactions between microorganisms and siderophores for biocontrol of fish pathogens in aquaculture industry

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Abstract

The aquaculture industry has been one of the most significantly increasing in recent years to fulfil global needs as the human population and demand have grown substantially. Nevertheless, with this exponential expansion comes an increase in the frequency of fish disease outbreaks, threatening the fish's health and causing considerable financial losses to the aquaculture business. Some of these pathogens are found in marine habitats, including Tenacibaculum maritimum, Edwardsiella tarda, and Vibrio anguillarum [1]. Iron is one of the nutrients needed for pathogenicity and subsequent host colonization of pathogenic bacteria. In recent years, it has become clear that siderophores are organic compounds required for iron absorption by a wide range of microbes and plants [2,3]. The competition between the siderophore produced by biocontrol agents and the transferrin produced by pathogens in building complexes with iron is a critical element of the biocontrol process. Because of its substantially larger iron stability constants, the siderophore is invariably the winner. [3]. In this study, a library of microorganisms, isolated from an aquaculture RAS biofilter, will be tested to evaluate how well they can suppress the mentioned pathogens when no siderophores are present, in their presence, or the presence of conjugated siderophores. So far, all microorganisms in the library have been tested against Edwardsiella tarda in the absence of any of the siderophores, and no sensitivity has been observed. Yet, the few that have already been tested against Tenacibaculum maritimum have shown partial inhibition, and in some cases, effective inhibition. The major goal is to understand if siderophores may enhance and potentiate these microorganisms' ability to inhibit one other and if their presence influences the natural population of RAS biofilter systems.

Keywords: Fish Pathogens, microorganisms, siderophores, aquaculture.

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References

[1] D. B. Almeida et al., "Microbial community dynamics in a hatchery recirculating aquaculture system (RAS) of sole (Solea senegalensis)," Aquaculture, vol. 539, Jun. 2021, doi: 10.1016/J.AQUACULTURE.2021.736592.

[2] M. L. Lemos and M. Balado, "Iron uptake mechanisms as key virulence factors in bacterial fish pathogens," J Appl Microbiol, vol. 129, no. 1, pp. 104–115, Jul. 2020, doi: 10.1111/JAM.14595.

21006 | Bioprospection of antibiotics and biofilm inhibitors from under-exploited filamentous fungi

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Abstract

In the past century, antibiotics revolutionized the way infectious diseases were treated, saving millions of lives. However, bacteria, in particular these infectious, may develop antibiotic resistance in such a way that the speed of development of new drugs does not follows the development of resistance. Filamentous fungi have a vast, largely unexplored metabolome, giving them great potential for novel antibiotic discovery. The One Strain MAny Compounds (OSMAC) approach is a valuable tool in this regard and aims to vary culture conditions to obtain a wider range of metabolites. In this study, five under-explored fungal species were used, aiming to identify compounds with antibiotic or antibiofilm properties produced by them. They were grown in different culture media, under deep fermentation for 7 and 14 days, with changing conditions of aeration and agitation, and the resulting supernatants were tested for their antimicrobial activity against Gram-positive and Gram-negative bacteria using the disk diffusion method. All fungi grew on the different media and under the diverse process conditions. It was found that Coprinopsis spilospora metabolites inhibited Staphylococcus aureus growth and demonstrated antibiofilm properties. They reduced the biofilm in 30% in crystal violet staining, metabolic activity by 82% in Alamar blue test, and viable cells counts by 96% in CFU counting. Co-culture and disk diffusion test results also showed that this supernatant has a slight effect against Escherichia coli. The pioneer results obtained in the present study highlight the relevance of bioprospection for antibiotic discovery.

Keywords: Antibiotic bioprospection; Biofilm control; Bioprocess; Filamentous fungi.

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21119 | Bioprospecting marine actinobacteria for the discovery of new antibiotics

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Abstract

By 2050, it is predicted that 10 million deaths will occur due to infections caused by multidrugresistant bacteria [1]. To address this issue, the World Health Organization (WHO) published a list of priority pathogens, for which it is essential the development of new antibiotics. Actinobacteria are very prolific in the production of bioactive natural molecules [2]. Although bioprospecting of actinobacteria has been focused on terrestrial strains, marine actinobacteria represent a promising source of bioactive molecules, due to their diversity and adaptability to distinct environments [3].

In this study, we evaluated the antimicrobial activity of organic extracts obtained from actinobacteria isolated from macroalgae and deep-sea samples against *Pseudomonas aeruginosa* ATCC 27853, *Escherichia coli* ATCC 25922 and *Staphylococcus aureus* 29213, included in the WHO priority pathogens list, as well as *Enterococcus faecalis* 29212. The extracts were also tested against three fish bacterial pathogens - *Vibrio anguilharum* ATCC 19264, *Yersinia ruckeri* DSM 18506 and *Pseudomonas anguiliseptica* DSM 12111. The antimicrobial activity was evaluated through disk diffusion, determination of minimal inhibitory concentration (MIC), synergy tests – against *E. faecalis* B3/101, *S. aureus* 74/24 and *E. coli* SA/2 – and inhibition of biofilm formation assays.

Although none of the extracts exhibited significant MIC values, some showed a synergistic potential that lacks verification through the checkerboard method. Notably, one of the extracts revealed synergistic potential against all three multidrug-resistant strains. We also found that dissolving the extracts in DMSO intensified their antimicrobial activity. Furthermore, four extracts revealed antibiofilm potential.

Future goals include evaluating the activity of actinobacterial extracts against cancer cell lines. Our findings highlight the potential of actinobacteria as a source of novel and natural antimicrobial agents against multidrug-resistant bacteria.

Keywords: Antibiotics, Actinobacteria, Multidrug-resistant bacteria.

References

[1] J. O'Neill, "The review on antimicrobial resistance," Arch. Pharm. Pract., vol. 7, no. 3, p. 110, 2016.

[2] J. Bérdy, "Bioactive Microbial Metabolites," J. Antibiot. (Tokyo)., vol. 58, no. 1, pp. 1–26, 2005, doi: 10.1038/ja.2005.1.

[3] A. Undabarrena et al., "Exploring the diversity and antimicrobial potential of marine actinobacteria from the comau fjord in Northern Patagonia, Chile," Front. Microbiol., vol. 7, no. JUL, 2016, doi: 10.3389/fmicb.2016.01135.

21142 | Plant products as resistance-modifying agents to recycle old antibiotics

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Abstract

In recent decades, the escalating trend of multidrug-resistant bacteria has posed a severe threat to global public health by limiting therapeutic options and increasing mortality rates [1, 2]. Consequently, novel treatment strategies have been under exploitation, being plant-derived compounds, i.e., phytochemicals, an emerging promise to face this challenging issue as they offer a panoply of advantages - from structural diversity and multiple modes of action to safety [3, 4]. In this study, five phytochemicals (linalool, verbenone, chrysin, crocin, and papaverine) were used to assess their antimicrobial activity and then their potentiation effect on ten antibiotics from different classes (ciprofloxacin, methicillin, oxacillin, amoxicillin, erythromycin, gentamicin sulfate, tobramycin, tetracycline, fusidic acid, and mupirocin). The minimum inhibitory concentrations (MIC) and minimum bactericidal concentrations (MBC) of all phytochemicals were determined against Escherichia coli CECT 102 and Staphylococcus epidermidis ATCC 35984 using the microdilution assay. Linalool exhibited promising results, with MIC and MBC values of 800 µg/mL for E. coli and a MIC of 400 µg/mL for S. epidermidis. Similarly, verbenone showed significant potential with a MIC of 2000 μ g/mL for both bacteria. The remaining compounds showed MIC and MBC values exceeding 2000 µg/mL. Moreover, to initially appraise the synergistic effects between the phytochemicals and antibiotics, the disc diffusion method was used, and results revealed a clear potentiation effect for verbenone, linalool, crocin and chrysin when combined with erythromycin. These molecules when combined as natural deep eutectic solvents further demonstrated promising effects against the bacteria in planktonic state and biofilms. To date, this study has revealed promising results, supporting phytochemicals as agents capable of modifying resistance and their great prospect in combating this pressing global predicament.

Keywords: antimicrobial resistance; bacteria; phytochemicals; synergy; natural deep eutectic solvents.

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References

[1] Varela, M.F., et al., Bacterial Resistance to Antimicrobial Agents. Antibiotics, 2021. 10(5): p. 593.

[2] Catalano, A., et al., Multidrug Resistance (MDR): A Widespread Phenomenon in Pharmacological Therapies. Molecules, 2022. 27(3): p. 616.

[3] Ayaz, M., et al., Synergistic interactions of phytochemicals with antimicrobial agents: Potential strategy to counteract drug resistance. Chemico-Biological Interactions, 2019. 308: p. 294-303.

[4] Elmaidomy, A.H., et al., Antimicrobial potentials of natural products against multidrug resistance pathogens: a comprehensive review. RSC Advances, 2022. 12(45): p. 29078-29102.

21176 | Exploring the presence of probiotic bacteria in the oral cavity

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Abstract

Introduction: Probiotic bacteria have been found to play an important role in many aspects of human health and wellbeing, from immunoregulation to neuromodulation. It has been suggested that probiotics can also be beneficial to oral health, as their presence in the oral cavity may prevent the growth of microorganisms associated with caries, halitosis, candidiasis, and periodontitis. Typically, probiotic species are isolated from faecal samples, and not many studies focus on probiotics of oral origin, making it difficult to know the prevalence of these species in the oral cavity.

Objective: This study aims to explore the presence and prevalence of probiotic bacteria in the oral cavity of human subjects.

Materials and Methods: Saliva samples collected from 36 participants (stored at -80°C in Brain heart infusion (BHI) broth with 10% glycerol) were directly cultured in De Man, Rogosa and Sharpe (MRS) Agar. After 48 hours of growth at 37°C in anaerobic conditions, all distinct-looking colonies were reisolated and identified using MALDI-TOF MS.

Results: All identified species belong to the *Bifidobacterium*, *Lactobacillus*, *Lactococcus*, and *Streptococcus* genera and have been previously reported to have probiotic activity. Within our participants, there were individuals with 0 (22.2%), 1 (36.1%), 2 (36.1%), or 3 (5.6%) distinct species of probiotic oral isolates. *S. salivarius* was the most prevalent species, present in 50% of the population, followed by *S. parasanguinis*, with a prevalence of 19.4%, *S. mitis* (16.7%), *S. oralis* (8.3%), and *L. fermentum* (5.6%). *B. bifidum*, *B. longum*, *Lactobacillus oris*, *L. paracasei*, *L. plantarum*, *L. rhamnosus*, *L. salivarius*, and *Lactococcus lactis* were all prevalent in 2.8% of the population.

Conclusion: Probiotic bacteria were present in the oral cavity of 77.8% of participants, suggesting probiotics as common colonizers of the oral cavity. *Streptococcus* spp. were the most prevalent, followed by *Lactobacillus* spp.

Keywords: Probiotics; Oral cavity, Oral microbiome.

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21213 | Antimicrobial action of phytochemical extracts from selected invasive plant species

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Abstract

Plants are recognised sources of compounds with high biotechnological impact. Among those compounds, phytochemicals have particular importance since they are responsible for plants' protection against external factors like stresses and pathogens. Due to the sustainability inherent to naturally derived products, phytochemicals have been widely studied and used as food preservatives and pharmaceutical agents. This potential generates interest in them since they may be part of the solution against antibiotic-resistant bacteria, potentiating antibiotics and other antimicrobials. Invasive plant species are a group of plants that do not naturally belong to a habitat where they are present. Usually, they grow faster than autochthonous species, harming the biodiversity of those places. The absence of measures to combat this issue has led to a global problem. There is a lack of studies about these species, especially from a biochemical perspective, particularly on the bioactive compounds that make these species stronger than the native ones. This work aims to evaluate the phytochemical potential of selected invasive plant species to validate the hypothesis that this underexplored biomass may have high biotechnological potential. In that way, two invasive plant species, Agave americana (leaves) and Tradescantia fluminensis (stem and leaves, separately), were harvested in the national territory and the antimicrobial activity of their extracts was evaluated. These were obtained by conventional solidliquid extraction using water, hexane, ethanol, and methanol as solvents. The most promising solvents, ethanol and methanol, were also used to perform solid-liquid extraction by Soxhlet. The antimicrobial activity of the crude extracts was evaluated by the disc diffusion method against Escherichia coli and Staphylococcus epidermidis, showing very relevant results in growth inhibition of both species. The extracts prepared with ethanol and methanol showed the most promising antimicrobial effects.

Keywords: *Agave americana*; antimicrobial activity; bioactive compounds; extraction methods; invasive plants; phytochemicals; *Tradescantia fluminensis*

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20585 | A potential new antifungal agent proposed by a project-based learning approach

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Abstract

In the Optional Curricular Unit (CU) "Drug Design and Sustainable Synthesis of Drugs" of the 4th year of the Integrated Master of Pharmaceutical Sciences at FFUP ¹, a project/problem based learning (PBL) approach was applied in which students had to propose a new drug with feasibility of being obtained, presenting the strategies supported with methodologies essential to Pharmaceutical Chemistry (such as computer-assisted drug design and green chemistry principles) to solve problems.

Within the scope of this CU, antifungal resistance was identified as a problem by the World Health Organization (WHO), especially concerning fluconazole (FLC), the most commonly used azole. Recent data from the Centers for Disease Control and Prevention shows a fourfold increase in FLC-resistant *Candida* isolates in the bloodstream in just a few years ², raising serious alarm as *Candida albicans, C. auris* and three other *Candida* species are on WHO's list of priority pathogenic fungi ³.

The study of interactions between FLC and normal and mutated Erg11 enzymes was carried out using CB-Dock. Structural modifications on FLC were proposed to restore lost interactions, using ChemSketch and ArgusLab. ADMET Lab 2.0 was employed to screen the library of designed analogues according to their Absorption, Distribution, Metabolism, Excretion, and Toxicity (ADMET) properties, with the maximum toxicity of FLC being applied as an exclusion criterion. The synthesis of the four virtual hit compounds was planned based on Green Chemistry and sustainable principles.

Analog DS_1 was identified as the most promising due to its high affinity for the mutated Erg11 and potential efficient, making it the optimal choice for further development and *in vitro* studies. Future studies will experimentally validate the proposal.

Keywords: Computer-assisted drug design; antifungal resistance; Candida albicans; fluconazole

References

[1]https://sigarra.up.pt/ffup/pt/ucurr_geral.ficha_uc_view?pv_ocorrencia_id=502316 (accessed 2023 March).

[2] Centers for Disease Control and Prevention.*Antimicrobial Resistance in Candida*. CDC, 2020. https://www.cdc.gov/fungal/diseases/candidiasis/antifungal-resistant.html (accessed 2023 March).

[3] World Health Organization. *WHO fungal priority pathogens list to guide research, development and public health action*. 2022. <u>https://www.who.int/publications/i/item/9789240060241</u> (accessed 2023 March).

20909 | Administration of antimicrobials on an outpatient basis after early discharge at the Matosinhos Local Healthcare Unit: Clinical and economic evaluation

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Abstract

The Outpatient Parenteral Antimicrobial Therapy (OPAT) is the parenteral administration of at least 2 doses of antibiotic on different days, without hospitalisation of the patient. Its main goal is to allow clinically stabilised patients to continue therapy in an alternative location (*e.g.* at home), to improve the patient's quality of life, avoid exposure to nosocomial infections and reduce costs.

The Matosinhos Local Healthcare Unit (MLHU) pioneered in Portugal the implementation of an OPAT-based practice (i.v. administration of antimicrobials) on an outpatient basis after early hospital discharge. Although the MLHU has this practice in place since 2009, it has not yet been fully evaluated. Previously, a methodology was developed and preliminary assessments were carried out.

This work aims to conclude the ongoing retrospective cohort study to characterise OPAT in MLHU and assess its clinical and economic outcomes.

In the study period (2015 – 2020) 113 cases of OPAT were recorded, corresponding to 111 patients, most of them elderly and male. Most cases were due to respiratory and urinary infections. The majority of the patients had 2 or more comorbidities (mean=5.3), the most prevalent was hypertension. Hospitalisations in the year before admission ranged from 0 to 5 (median=1). In 85 cases, 38 microorganisms were identified (most prevalent: *Klebsiella pneumoniae* ESBL (+) and *Pseudomonas aeruginosa*). The length of hospitalisation before early discharge ranged from 0 to 118 days (median=11). 19 antibiotics were used, ertapenem being the most common. Carbapenems accounted for 36.3% of the antibiotics prescribed and cephalosporins for 27.5%. Hospital readmission rate was 12.4%. The number of comorbidities of patients was found to increase the probability of readmission.

A preliminary evaluation indicates that the MLHU OPAT provides significant economic gains, allowing savings of around 60% compared to conventional hospital treatment.

Overall, the results are in line with programmes in other countries.

Keywords: Outpatient parenteral antimicrobial therapy, OPAT, infection, microorganisms, multidrug-resistant bacteria, antimicrobial agents, antimicrobial therapy management, clinical outcomes, economic evaluation.

20977 | Development and characterization of mycobacterial biofilm models to study drug susceptibility

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Abstract

The Mycobacterium genus comprises different species, including the highly pathogenic *M. tuberculosis* and *M. leprae* and nontuberculous mycobacteria (NTM). The latter are mostly environmental species. However, NTM like *M. avium* and *M. abscessus* are opportunistic pathogens causing infection in immunocompromised individuals or patients with underlying pulmonary diseases. NTM diseases are characterized by their chronicity and antimicrobial resistance.

NTM are known to form biofilms in water-related environments, soil, food products and biomaterials. Biofilms are bacterial aggregates encased in an extracellular matrix adherent to a surface. These communities are important for bacterial survival and growth in extreme conditions and inside the host, offering protection against the immune system and drugs. Mycobacterial biofilms are considered an important pathogenic factor, being involved in the establishment of infection and evasion from the host's immune system, helping to explain why NTM infections are chronic and extremely difficult to treat.

This study aims to characterize biofilm formation in mycobacteria, such as *M. smegmatis*, *M. abscessus*, and *M. avium*. To accomplish this, we grew biofilms by incubating planktonic cultures in culture media without shaking at 37°C, tight-capped. After 2 days, *M. smegmatis* formed pellicle-like structures on the air-media interface and adhered to plastic. The adherence was confirmed by crystal violet assay. Biofilms formed by *M. abscessus* take at least 2 weeks to develop, whereas for *M. avium* no adherence is observed. We now pretend to test different strains of *M. abscessus* and *M. avium*, specifically smooth and rough strains, as the composition of the cell wall is directly linked to the ability to adhere and form biofilms. We will also detect the presence of cellulose, a biomarker of mycobacterial biofilms by staining with Calcofluor White. The development of these mycobacterial biofilms will allow to test and find new drugs and strategies to target these structures.

Keywords: Mycobacterium; biofilms; drug susceptibility; antimicrobials.

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21073 | Impact of maternal obesity on early-life microbiota-induced immune system priming

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Abstract

Background: Early-life gut microbiota is modifiable and susceptible to external factors such as delivery mode and maternal microbiota [1]. In this period, the gut microbiota exerts a vital role in the development of the child's immunity and any disruption to its composition can impair the proper maturation of the immune system, causing future health issues [2]. Considering the mother's impact on the baby's gut microbiota, as one of the main sources of microorganisms, it is crucial to evaluate this link, and whether the mother's health status can influence the infant's gut microbiota and, thus, the immune response.

Aim: To understand the impact of maternal obesity on child's gut microbiota immunomodulation ability, from one month up to one year postpartum.

Methods: Gut microbiota of infant stool samples was separated by a series of centrifugations and inactivated by UV radiation. The gut microbiota was then used to stimulate monocyte-derived dendritic cells (DCs) and T cells, and their activation levels were evaluated by flow cytometry.

Results: The results indicate that the gut microbiota enabled DC activation, as evidenced by the increased expression of CD86 and CD40. As for the impact on the adaptative immunity, assessed by T cell activation in cocultures with DCs, it was observed that the gut microbiota enabled early T cell activation, through the higher expression of CD69. Preliminary results, with a limited number of samples, showed no significant differences when comparing the activation levels of DCs and T cells, between infants of obese and lean mothers, and throughout time.

Conclusions: A protocol was successfully optimized for separating and inactivating infant gut microbiota and, later immune cell stimulation. It was concluded that infant gut microbiota could stimulate immune cells from the innate and adaptive immune systems. However, further studies are needed to clarify if maternal obesity influences child immune priming.

Keywords: Microbiota, Dysbiosis, Obesity, Early Life, Immunity.

Acknowledgments

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References

[1] Martin, R. *et al* (2016). Early-Life Events, Including Mode of Delivery and Type of Feeding, Siblings and Gender, Shape the Developing Gut Microbiota. *PloS one*, *11*(6), e0158498.

[2] Milani, C. *et al* (2017). The First Microbial Colonizers of the Human Gut: Composition, Activities, and Health Implications of the Infant Gut Microbiota. Microbiology and molecular biology reviews: MMBR, 81(4), e00036-17.

20823 | *In vitro* pharmacological targeting of retinoid-related pathways affects dengue virus infection

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Abstract

Dengue virus (DENV) is an arbovirus responsible for dengue fever (DF) disease, which is endemic in tropical and subtropical regions. Currently, other regions as Europe are at risk of outbreaks due to the vectors spreading, caused by globalization and climate change [1]. The study of genetic susceptibility factors to DF, in several populations [2-5], has identified associated genes in three related pathways involving the nuclear transcription factor retinoid X receptor (RXR): the vitamin D receptor (VDR)/RXR pathway, the liver X receptor (LXR)/RXR pathway and the peroxisome proliferator activated receptor alpha (PPARA)/RXRA pathway. As there are no specific treatments for DF, this work aims to test *in vitro* the effect of four known modulators of these pathways – bexarotene, vitamin D3 (VitD3), 25-hydroxycholesterol (25-HC), rosiglitazone – against DENV infection. Bexarotene is a retinoid that selectively activates RXRs, potentially interfering with all the RXR-related pathways. VitD3 activates vitamin D receptor (VDR). 25-HC is an intermediate in cholesterol metabolism, interfering in the LXR/RXR pathway. Rosiglitazone binds to PPARA.

First, we evaluated the compounds cytotoxicity in Vero (African green monkey kidney) and Huh-7 (human liver) cell lines and inferred a range of safe concentrations [0.5 to 100µM] to be used in the infection assays. The cell lines were exposed to the compounds for 1h, and then infected with the DENV2 strain, in a multiplicity of infection (MOI) of 1 (under BSL3 conditions). After 48h incubation, the cells were fixed, immunofluoresced against DENV and stained with a nuclear marker. Readouts and images were obtained in the Operetta CLS[™] high-content analysis system. The compounds bexarotene, VitD3 and 25-HC reduced DENV infection, presenting an IC₅₀ of 19.71µM, 17.72µM and 1.71µM, respectively, in infection assays. Rosiglitazone had no effect on infection. These results provide useful insights into which RXR-related pathways should be targeted to treat DF disease.

Keywords: dengue fever disease; dengue virus; retinoid x related pathways; compounds tests.

Acknowledgments

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References

Guzman, M.G., et al., Nat Rev Dis Primers, 2016. 2:16055
 Loke, H., et al., Am J Trop Med Hyg, 2002. 67:102-106

- [3] Whitehorn, J., et al. BMC Infectious Diseases, 2017. 17:412
- [4] Oliveira, M., et al., PLOS Negl Trop Dis, 2018. 12:e0006202

[5] Sierra, B., et al., PLOS Pathogens, 2017. 13:e1006220



Figure 5: (A) Schematic representation of the *in vitro* infection assays. (B) Representative immunofluorescence image of the effect of bexarotene on DENV infection of Vero cells. Blue corresponds to DAPI staining of cell nuclei and green corresponds to DENV's Envelope protein, indicating infected cells.



HERITAGE STUDIES



20485 | Historic Architecture of Porto: A project of communication and valorisation

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Abstract

This presentation frames part of the research being developed for the FLUP Master's dissertation, entitled 'Arquitetura: modos de ver e comunicar. Um projeto sobre arquiteturas do Porto desenvolvido na empresa SWARK'.

The present study had as its main objectives the analysis of two architectures from the universe of the SWARK internship host entity- with house-hunting activity of historic houses in Porto-, as well as the dissemination of the architectural heritage of the city of Porto on the digital platforms of the company.

Methodologically, the corpus of work integrates sources and bibliographical references from the fields of Architecture and Heritage, as well as others. Complementing the scientific body of this work- at Casa Burguesa, Casa Periurbana and Palacete between the end of the 19th century and the beginning of the 20th century-, special mention should be made of the fieldwork carried out simultaneously, which greatly consolidates and enriches the theoretical work.

The study of these architectures, inserted in the universes of the casa burguesa and casa periurbana and located in Rua de Cedofeita and Rua do Gólgota, respectively, aims to promote an integrative analysis of the social, economic, cultural conjunctures related to the dwellings. On the other hand, this study does not focus exclusively on the investigation of these two case studies, but also focuses on their physical dissemination with a generalized population. Digitally, through QR codes placed on the facades of architectures, free access to the community of investigations carried out will be made possible.

The theoretical investigation of various architectural typologies carried out for and the analysis of case studies allowed the development of another heritage promotion activity. The architectural elements that characterize the buildings in the city of Porto were subject of a heritage communication process on the social networks of the company SWARK.

The research, in addition to allowing an effective sharing of investigation with the general population, also promotes greater awareness among the community about the value of its actions for the preservation of heritage. Inherent is also the potential for expansion of this work to a greater universe of architecture in the city of Porto.

21242 | Urbanism in the Empire of Brazil (1822-1889): reflections from the plans of the cities of Teresina and Aracajú

De Oliveira, Erysson Faustino, Faculty of Arts and Humanities (FLUP), Portugal

Abstract

Brazilian urban historiography has been exhaustively dedicated to the study of nineteenthcentury cities, architecture and modernist urbanism, to the detriment of an approach that considers the processes and urban projects in vogue during the Empire of Brazil (1822-1889). This was a period marked by the foundation and reform of the main Brazilian cities, in particular, the provincial capitals in the east and north. In this sense, we propose an exploratory study on the urban plans of Teresina and Aracaju – due to their premeditated and inaugural character –, whose objectives are rooted in understanding how the urban programs are articulated in their historicalgeographical, political, and sociocultural contexts, examining the trajectories and influences of architects, engineers and masters of public works, and to identify ruptures and permanence in the planning logic(s) of these cities. In addition to adding layers of interpretations about Brazilian cities in the imperial period, the analysis of representations, drawings and images of both cities shed light on luso-brazilian urbanism and its intersection with other urban cultures, in addition to making known the role of the master-builder João Isidoro da Silva França and military engineer Sebastião José Basílio Pirro in the materialization of urban design, three centuries after the founding of Salvador.

Keywords: Urbanism; Brazil Empire; Teresina; Aracaju.

Acknowledgments

This research work was carried out in the context of the Curricular Units "Architecture Studies I" and "Project Methodology and Research I", within the scope of the Master in Art History, Heritage and Visual Culture of the Faculty of Arts and Humanities of the University of Porto, during the first semester of the academic year 2022/2023.

20889 | Aeneas transporting his father Anchises and the Penates followed by the Young Ascânio: analysis of a seventeenth-century sculpture

Dias, Francisca, Faculdade de Letras da Universidade do Porto, Portugal

Abstract

A hero of Greco-Roman mythology, Aeneas, the son of the goddess Aphrodite and Anchises, has his story narrated in Homer's Iliad, and among other works, in Virgil's Aeneid. Beloved by the Gods, who protect him in the heroic adventures he is thrown into, he still has a greater destiny to fulfil.

This oral presentation focuses on the analysis of the sculpture entitled Aeneas transporting his father Anchises and the Penates followed by the Young Ascânio, attributed to the Genoese sculptor Fillipo Parodi (1630-1702), produced around 1661. It is a work of white marble that is found in the reserves of the Calouste Gulbenkian Museum in Lisbon, approached in this investigation from the analysis methods of figures such as Aby Warburg (1866-1929), Fritz Saxl (1890-1948) and Erwin Panofsky (1892-1968).

Following these methods, we will analyse the classical passages that gave motive to this work, from the moment when Aeneas (and his family) fled from the city of Troy, which had been sacked by the Greek army.

In this line of thought, the journey of this sculpture will be traced until the moment of its arrival in Portugal, and we will examine the problems regarding it's attributions, as well as the journey that this particular motif took throughout history.

The meaning of the motif will also be discerned - a symbol of Roman pietas and having in mind that this particular work was inspired by the Berninian model with the same invocation - This classical hero appears represented in this sculpture, invested with an ethical message.

To conclude, at the end of this oral presentation, and from the applied methods of analysis mentioned above, we will realize the different forms of analysis that can be applied to a work of art. Its cultural importance, as well as the preponderance that this particular motif had over time in different supports, from medals, to painting and sculpture.

Keywords: Aeneas; Aeneid; Iliad; Fillipo Parodi; marble sculpture.

Acknowledgments

Work carried out within the scope of the discipline of Imagem e Contexto I of the First Year of Master's Degree of History of Art, Heritage and Visual Culture.

References

[1]https://cdn.gulbenkian.pt/museu/wp-content/uploads/sites/5/2013/10/Inv-544-1200x1600.jpg



Figura 1: Fillipo Parodi, Aeneas transporting his father Anchises and the Penates followed by the Young Ascânio, 1661.

21139 | The Art of Forgery

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Abstract

Forgery is one of the biggest challenges that the art world faces today, being responsible for the recession of the national art market. The problem is already duly identified and involves courts, police, and cultural agents, as well as the regular citizen. Nevertheless, this theme is still barely discussed in the academic environment, specifically in the History of Art, in Portugal. Thus, this investigation, within the scope of the master's degree in Art History, Heritage, and Visual Culture, aims to understand, analyse, and reflect on the nature and particularities of the phenomenon of forgery in Portuguese territory and to contribute to the awareness of the problem.

Starting from the exhibition: "A Arte do Falso" (2020 -2021), held at the Alfândega do Porto, on the occasion of the celebration of the 75th anniversary of the Judiciary Police, we explored various issues related to the subject of forgery in order to achieve this goal. At the same time, and in the context of the curricular internship at the Museological Nucleus of the Northern Directorate of the Judiciary Police, it was developed a critical reflection on the theme, complemented by information collected at the host institution, current legislation, newspaper reports on relevant cases, specific literature, movies, series, etc.

Keywords: Forgery; Judiciary Police; Northern Directorate; A Arte do Falso; Exhibitions.

20562 | Archaeobotanical study of the Northwest Necropolis of Olisipo (Lisbon): Preliminary Results

Sousa, Catarina, Faculty of Arts and Humanities of University of Porto, Portugal Ferreira, Daniela, FLUP; CITCEM: Transdisciplinary Culture, Space and Memory Research Gate, University of Porto, Portugal Vaz, Filipe C., CIBIO-BIOPOLIS: Research Center in Biodiversity and Genetic Resources, Associated Laboratory, University of Porto, Portugal Tereso, João, CIBIO-BIOPOLIS; UNIARQ – Archaeology Center, University of Lisbon; CEIS20 – Center for Interdisciplinary Studies, University of Coimbra; MHNCUP – Museum of Science and Natural

History, University of Porto, Portugal

Rebelo, Paulo, Neoépica, Lda., Portugal Peça, Pedro, Neoépica, Lda., Portugal Bolila, Catarina, Neoépica, Lda., Portugal

Abstract

A section of the Roman Northwest Necropolis of Olisipo (modern day Lisbon) was identified within the framework of an archaeological intervention in Calçada do Lavra (Arroios, Lisbon) under the direction of Paulo Rebelo, Pedro Peça and Catarina Bolila (Neoépica, Lda.). This necropolis was used between the 2nd and 4th centuries AD and comprised both cremation and inhumation burials. Several samples of sediment for archaeobotanical analysis were collected in pyre and secondary cremation contexts and are being analysed as part of my Master's degree in Archaeology hosted by FLUP and CIBIO-BIOPOLIS. The objectives are twofold: 1) understand how the roman population of Olisipo interacted with the plant resources available in the region and 2) reveal the role plants and foodstuffs performed in Roman religious and cremation rituals.

Samples were processed by bucket and machine-assisted flotation. The charcoal analysis followed standard methodology with species identification and the recording of anatomical characteristics capable of providing paleoenvironmental and paleoethnobotanical data. The identification of fruits and seeds also followed standard methods and was based on their morphology.

Results of the 13 samples analysed so far provided a fairly diverse picture comprising 20 taxa of trees and shrubs. The presence of wood from Quercus sp. type evergreen, Quercus sp. type deciduous and Pinus pinaster were the most frequent and already expected due to analogue studies and their presence in the region. On the other hand, the presence of other taxa with potential economic value, such as Ficus sp., Vitis vinifera, Laurus nobilis and Olea europea could be indicating the expansion of arboricultural practices during the Roman period. The presence of carbonized wood of Fagus sp. is enigmatic and requires further enquiry. Additionally, some of the samples contained carbonized seeds, namely cereals, which are still to be analysed.

Keywords: Archaeobotany; Olisipo; Roman period; Cremations.

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21136 | Road's cultural heritage: EN2 case study

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Abstract

This paper aims to study the road heritage present on the Estrada Nacional 2 (EN2). This national road was created as a result of the 1945's national road plan and constitutes a milestone in the history of Portuguese road communication because it crosses the entire country's length, connecting the north and the south of Portugal.

It is essential to recognize not only the road itself but also the equipment associated with the national roads, such as fountains, road workers houses, viewpoints, rest areas, bridges, bus stops, and signs, all of which were a responsibility of the Junta Autónoma de Estradas (JAE), an organization responsible for the road's management.

The main objective of this research is to find out which support infrastructures are associated with national roads, using the EN2 as a case study.

By studying this subject, we are deepening the knowledge about the heritage aspects of this national road, understanding how these equipments appeared, how they are similar or different to other national and international cases, their new uses, as well as contributing to the valuation of this type (road) inserted in the heritage field, currently still little researched.

The road evolution, the loss of functionality and meaning of many of the structural and supplementary elements associated with roads are prone to degradation, destruction, and replacement, making it necessary to study these objects as a way to value and protect. There is still no specific study of these equipments that reflect its value as a patrimonial object, so this research opens the way for an investigation regarding them.

Keywords: EN2; Estrada Nacional 2; Cultural Heritage.

20591 | Embroider the poem, conquer identity - a study of love handkerchiefs as a sign of feminine affirmation

Brandão, Sara, Faculdade de Letras da Universidade do Porto, Portugal

Abstract

The present investigation studies the handkerchief of love in the relationship between its verbal and iconic elements, for a broader and more comprehensive approach. For the textual dimension of the handkerchiefs, we essentially focused on an approach of their enunciation, but also of their formal and stylistic aspects. From a survey of embroidered lovers' handkerchiefs of the 19th, 20th and 21st centuries, with a special interest in the oldest works, carried out in museums and private collections, we organized the corpus of one hundred and thirty-four embroidered works, which we analysed.

This investigation culminated in an exhibition entitled: "Love handkerchiefs: centuries of embroidered poetry in the feminine". This exhibition, long side the investigation, explored, through drawing, the dimensions of the tradition popularly known as "lovers' handkerchiefs". This work aims to contextualize this embroidered art with the illiterate or barely literate woman who executed it, as well as to reconstitute its original intentions, adulterated by the "Política do Espírito" ("Politics of Spirit") of the Estado Novo (Portuguese dictatorship regime) and by the touristic boom of the 21st century. In turn, the eighty-two works in colored pencil that I've drawn [figure 1], question the lack of access to the Portuguese cultural heritage, questioning the role of cultural structures in democratizing and educating about the country's artistic heritage.

The present investigation recognizes the love handkerchief as a vindicating act of feminine affirmation, in a time when access to school was interdicted to women. Yet, they embroidered individual and collective love, between passion and revolt, but their voices, carved on linen cloths, have been silenced and replaced by misplaced narratives. Since the future is built on memory, this exhibition seeks to restore the place of speech they had long ago earned.

Keywords: Lovers' handkerchiefs; Embroiderer; Women's Writing; Cultural Heritage; Illiteracy.



Figure 1: Drawing replica of a love handkerchief from 1893.
20575 | Ariano Suassuna: Contributions to the appreciation of Codel Literature

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Abstract

Cordel Literature was recognized by IPHAN in 2018 as a Brazilian Intangible Cultural Heritage. For this, a bibliographic review was carried out as a methodology to introduce what Cordel Literature is and its trajectory in history. It is intended to understand why this literature was recognized as Brazilian Intangible Cultural Heritage and what was necessary to acquire its heritage status. This communication aims to verify whether the Brazilian writer Ariano Suassuna contributed by means of his life and work to the appreciation of the Cordel Literature. It seeks to identify who Ariano Suassuna was and cross some readings of his work with the Cordel to comprehend how the Cordel Literature influenced his work, especially O Auto da Compadecida and O Romance d'A Pedra do Reino e o Príncipe do Sangue do Vai-e-Volta. In addition to revisiting his work, it analyses what the Armorial Movement, created by Ariano Suassuna, was and how it relates to Cordel. And finally, to verify, despite a tangential participation, that Suassuna was able to contribute to the appreciation of Cordel Literature in Brazil.

Keywords: Cordel Literature, Brazilian Intangible Cultural Heritage, Ariano Suassuna.

Acknowledgments

I would like to acknowledge and give my warmest thanks to my Professor Maria Leonor Botelho for her support and supervision. I would also like to thank Marco Haurélio and Juvenal Bernardes for their time and guidance through this research.



HISTORY, POLITICAL AND SOCIAL SCIENCES



20448 | A portrait of the grey areas of medieval sexuality - Alcoviteiras and Sorceresses Pinto, Ana, Faculdade de Letras da Universidade do Porto, Portugal

Abstract

This paper addresses the theme of the grey areas of Portuguese sexuality in medieval Portugal, taking into detailed consideration the alcoviteiras and sorceresses. The choice of this theme has the intrinsic attempt of giving voice to these women, in order to understand who they were and why they were so important in the functioning of the Portuguese prostitution of the 15th century. Firstly, it is important to understand if prostitution was really a necessary evil or if it was a way that these women found to live a minimally inviting life, so that they had control over their own bodies. Although this may or may not be a reality, we already know that many women found themselves confined to this life because of circumstances they could not control.

Secondly, I will analyse the various strata of medieval Portuguese prostitution, without leaving aside all those who were part of it. Throughout time, the tendency is always to analyse those who appear to us most as "members" of this part of society. Who were these women, what did they do, what did they earn from their profession, were they married, widowed or single? Furthermore, it is particularly interesting to understand how these women were judged and sentenced. I also came across references to the children resulting from the relationships these women. Having said this, there were also references to the letters of legitimation, which intrigued me so much. It is important to understand how these letters affected medieval bastardy and the way these children were seen in medieval society.

As far as sources are concerned, over 40 letters of pardon present in the Chancellery of King John II were analysed throughout this paper. I also extended the sources to the ordinances, such as the Alfonsinas's Ordinances which enlightened me with regard to the legislation.

Finally, I hope this paper answers all the above questions and tries to give a voice to these women.

Keywords: Middle Age; Prostitution; Women; Alcoviteiras; Sorceresses.

References

[1] ANTT, Chancelaria Régia, Chancelaria de D. João II.

[2] Ordenações Afonsinas, livro V. Lisboa: Fundação Calouste Gulbenkian, 1984.

20646 | Institution and people: social networks between the city and the Oporto cathedral chapter in the 14th century

Nunes, Margarida, Faculdade de Letras da Universidade do Porto, Portugal

Abstract

In the Middle Ages, the cathedral is defined as an institution formed by clerics whose function is to assist the bishop in fulfilling his religious obligations, ensuring the liturgical service of the cathedral necessary for the salvation of souls. Succeeding the bishop, the chapter represents, at the local level, the highest point of ecclesiastical power, occupying a specific place in the social elite of the city.

The main objective of this communication will be to identify, individually and collectively, the members of the chapter, to assess the relationship of this institution in the networks that sustain the Oporto oligarchy. It is intended to observe its particular place and role in the city, and its integration in a concrete reality. At the same time, it will be fundamental, in order to consolidate the theoretical context of the present work, to characterize the members of the chapter in terms of their social and family origins, ecclesiastical career, network of dependence and clientele. To know this group means to know the expressions of their power in the city, the influence of their social origins in their connection to the Porto oligarchy, and the impact of these social networks on the destiny of society and the church.

To this end, the use of the prosopographical method and the reading of a vast set of documentation and bibliography allowed us to reconstruct the 14th century chapterhouse, consisting of 26 dignities and 126 canons. With this reconstitution we verify that the chapter recruitment took place, in most cases, at the local and regional level, followed by recruitment in Lisbon and Braga, these last ones associated to the accumulation of canonicates and prebends. Also, the presence in the chapter of local families, connected to the municipal administration, is verified. As a collective organisation, the chapterhouse is characterised by putting in first place the defence of its economic and jurisdictional interests, which result in disputes throughout the 14th century with the local population. The protection of their interests was clearly visible in the contention which opposed, on one side, the bishop and the chapter, and on the other side the city and the king. In other words, these considerations allow the established of the social dialogue between the Chapter and the medieval society of Oporto.

Keywords: catedral clergy, urban elites, Religious History, Social History.

20570 | The Portuguese "Magdalene's": a study on prostitution and its implications in Portuguese society in the fourteenth and fifteenth centuries *Ramos, Isabela, Faculty of Arts, Portugal*

Abstract

This research focuses on the brothels in medieval Portuguese cities – specifically in Porto, Coimbra and Lisbon – during the 14th and 15th centuries. The objective of this investigation is to give historicity to the phenomenon of prostitution, and through it to understand the social status of these women in a society of male supremacy. In addition, it will analyse how a part of Portuguese society thought about themes that involved sexuality, marriage, betrayal and prostitution itself based on the period mentality - that was very controlled and influenced by Christian morals.

Methodology of the investigation: The proposal is to contextualize specific cases of some 'Cartas de Perdão', developing their meaning based on the legislation of the time, which expands the documentary corpus of this work by also involving the 'Ordenações Afonsinas', 'Cortes Portuguesas', 'Livro de Leis e Posturas', 'Livro Posturas Antigas de Lisboa', 'Livro de Posturas do Concelho de Lisboa', 'Livro das Posturas Antigas da cidade de Évora'.

Results: Based on the sources, it can be concluded that the Royal Power acted with the intention to regulate prostitution and not simply prohibiting it, or criminalizing it, because it was seen as a guarantee of public morals, a source of income for the cities and less urban sexual violence. Although, in this research the theory that understand prostitution as an institution of peace is called into question. Indeed, it was not a crime to go to the brothels, however the Royal Power saw as a criminal the one who made a living from prostitution of others. Furthermore, it was noticed that prostitution was accepted even in an extremely religious society, and the clerics had relationships with prostitutes. Even nuns turned out to be prostitutes – or at least they were accused of being prostitutes, as we studied on the case of the Monastery of *Recião*. In general, it is clear that the prostitutes were morally excluded and partially integrated into the population.

Keywords: Brothels; Prostitution; Medieval Portuguese cities.

21237 | Rule, contravention and punishment among friars of the Order of Santiago: a 16th-century case study

Wisniewski, Glauber, Faculdade de Letras da Universidade do Porto, Portugal

Abstract

This is the historical case study of a verdict found in the Livro dos Copos, a parchment codex whose composition began in 1484 by request of D. João II of Portugal. The codex contains the cartulary of the portuguese Order of Santiago issued between the 12th and 18th centuries, mainly composed of documents confirming the order's rights, privileges, and jurisdictions, both in the secular and religious spheres.

Among the documents presented in the codex is a verdict received by a certain Joham da Figueira, prior of the Order of Santiago in Tavira, Algarve. The verdict was issued on 23 February 1507, by the bishop of Fez, who acted as the apostolic judge on this case. The prior was accused by the bishop of Silves and his vicars of having committed a series of infractions between the years 1504 and 1507. These ranged from insults and threats towards the bishop and his vicars to allegations of wrongful appropriation of resources belonging to the Church (see Fig. 1).

Every aspect of a knight's life was governed by regulations defined in the book of rules and statutes of the Order of Santiago. The rules were usually followed by a penitential code that typified different types of misconduct and provided the appropriate punishment for each given situation. Guided by this code, we conducted a typological analysis of the infractions committed by prior Joham da Figueira. We also compared the punishment prescribed in the book of rules, the one suggested by the indictment and what was decided in the final verdict. In this case, a relief in the severity of the punishment against the defendant was perceived.

The arguments used by the prior in his defense and the considerations made by the judge on the verdict are discussed to give the decision-making process of this case further context. Our aim is to help improve the understanding of the social role performed by knights of religious-military orders and how ecclesiastical justice worked in the early 16th-century Algarve.

Keywords: military orders; order of Santiago; microhistory.

References

 BROWN, Richard D. – Microhistory and the post-modern challenge. Journal of the Early Republic. Philadelphia: University of Pennsylvania Press. https://doi.org/10.2307/3124983. Vol. 23, No. 1 (Spring 2003), pp. 1-20.

[2] FONSECA, Luís Adão da – Livro dos Copos. Porto: Fundação Eng. António de Almeida, 2006. (Militarium Ordinum Analecta, 7). ISBN 918-972-8386-66-5.

[3] BARBOSA, Isabel M. de C. Lago – A Ordem de Santiago em Portugal nos finais da Idade Média.
In Militatium Ordinum Analecta, 2. Porto: Fundação Eng. António de Almeida, 1998, pp. 97-319.
[4] COSTA, Paula Pinto – Norma e desvio na Ordem do Hospital. História: Revista da Faculdade de Letras. Porto. Série III, Vol. 3 (2002), pp. 49-62.

[5] GOMES, Wilson Ricardo M. – O crime em Portugal no final do século XV: uma janela para a sociedade medieva? Porto: Faculdade de Letras da Universidade do Porto, 2015. Dissertação de Mestrado.

LIST OF INFRACTIONS COMMITED BY JOHAM DA FIGUEIRA, PRIOR OF THE ORDER OF SANTIAGO	
Date	Accusation
N/A	Refusal to receive an oath from the vicar of Tavira
N/A	Neglect in administering sacraments
January, 12, 1504	Refusal to swear an oath while giving a testimony
February, 26, 1505	Participation in sacraments of divine office while excommunicated
February, 27, 1505	Insulted and threatened the bishop and his vicars; refusal to obey to the bishop and and his vicars
February, 1505	Refusal to baptise two infants, and to allow another cleric to baptise them
Easter, 1505	Threatened a married woman for testifying against him; insulted and threatened the bishop and his vicars
March, 1505	Refusal to revoke the excommunication of a man and throwing away the revocal charter
Lent, 1506	Refusal to give communion to several members of the community
May, 18, 1506	Refusal to send the vicar the visitation charter for which he was responsible
N/A	Misappropriation of resources from the Church on several occasions

Figure 1: Table of infractions which Joham da Figueira was accused of.

20494 | Representations of the February 1927 military movement in Porto and Lisbon daily press

Silva, Daniel, Faculty of Arts and Humanities of University of Porto, Portugal

Abstract

In 1926, as a result of the political and economic difficulties experienced in Portugal under the First Republic, a military coup took place that put an end to 16 years of parliamentary and democratic experience, giving rise to the so-called Military Dictatorship that ruled the country until 1933. The breakdown of democratic freedoms - such as the end of freedom of expression and of assembly - fostered a dynamic opposition that led to a revolt, at the beginning of February 1927, in Porto and then in Lisbon, starting a clandestine movement known in Portuguese historiography as Reviralho. This rebellion resulted in a heavy defeat for the military and civilians who revolted against the situation in power. Despite the existence of censorship, the press played an important role in the dissemination of information, a subject that is dealt with in the present research, through the analysis of three daily newspapers from Porto and three from the capital, during a period of two months, which intends to study the type of coverage given to the insurrection, what information was made available and what was withheld from the population, the forms of omission and silencing, as well as the possible influences that the consolidation of the Dictatorship had in this matter.

Keywords: Military Dictatorship; opposition; Reviralho; press; representations

Acknowledgments

I want to thank to teacher, Profª Drª Conceição Meireles Pereira, for the knowledge provided.

References

- [1] O Comércio do Porto, February-March 1927;
- [2] O Comércio do Porto Edição da Tarde, February-March 1927;
- [3] Diário do Porto, February-March 1927;
- [4] Diário de Lisboa, February-March 1927;
- [5] A Voz, February-March 1927;
- [6] O Século, February-March 1927.

20556 | Cartography in historical context: Comprehension and application

Souza, Bernardo, FLUP, Portugal

Abstract

Observing the use of maps, charts, and similar resources in historical research, it is necessary to indicate that while it may not be necessary for researchers to know the deep technical procedures involved in map-making, it is important to be aware of the limitations and potentialities of maps. Cartography can be a coercive "picture" with considerable power [1], and that it has limited accessibility for people without vision (partial or total).

At the same time, maps can serve as bases that can be augmented with additional information or easily compared. Collaboration with capable individuals for the elaboration of maps is also important to surpass the lack of spacial context of the research. Such individuals, for example in UP, can be found in the Infographics department of FLUP, where technical knowledge is available for aid, support, and collaboration. Nonetheless, access, knowledge, and reflection of conceptual aspects are vital to allow collaboration with different agents and scientific fields.

This approach has been put into practice, as we have used cartography as a resource in our investigation focused on a territorial unity across multiple levels of reality and different time lapses. Maps have served as historical sources and quantitative vessels of information, but we have also explored qualitative data from historical sources, including their translation, composition, and synthesis into visual data in replicable models of qualitative maps [figure 1-2].

Keywords: Cartography; Qualitative maps; map-making.

Reference

[1] WOOD, Denis – The Power of Maps. New York: The Guilford Press, 1992. ISBN: 0-89862-492-4.

20515 | Spoils of the past: The role of memory in the Russo-Ukrainian conflict

Campos, Ana, Faculdade de Letras da Universidade do Porto, Portugal de Sousa, Inês, Faculdade de Letras da Universidade do Porto, Portugal Magalhães, Constança, Faculdade de Letras da Universidade do Porto, Portugal Quarteu, Hugo, Faculdade de Letras da Universidade do Porto, Portugal

Abstract

In the context of the Russo-Ukrainian conflict, this paper draws from the conceptual framework of memory diplomacy to explore how and for which international goals memory has been employed in Russian and Ukrainian diplomacy since 2014. Previous research has continuously shown how memory is instrumentalised in domestic politics, but its employment to achieve international goals has only recently become object of study. Nevertheless, memory diplomacy offers a valuable addition to the interpretation of diplomatic practices of both Ukraine and Russia. This research is based on a content discourse analysis of speeches and official statements of both countries, which concern interpretations of the past, since the beginning of the conflict.

Keywords: Russia, Ukraine, Memory Diplomacy, Memory Studies, Diplomacy, War

Acknowledgments

Prof. Dr. Joana Castro Pereira

20595 | Revisiting the concept of "nation" in the 21st century through the analysis of Jair Bolsonaro's political speeches (2018-2022)

Aquino, Cássio L., Faculdade de Letras da Universidade do Porto (U. Porto), Portugal

Abstract

This work analyses how the concepts of "nation" and "nationalism" are being instrumentalized by far-right leaders as part of their program of political legitimation in the 21st century. This occurs amid to the growing rise of authoritarian movements in the context of the crisis of western liberal democracies. In this paper, the political figure under analysis is Jair Bolsonaro. Through a qualitative study of his political speeches between the 2018 and 2022 presidential election campaigns, it is demonstrated how the former president of Brazil used such concepts to inflame and mobilize his political supporters while presenting his understanding of what the "Brazilian nation" actually was in both its domestic and international contexts. The research also observes how the external political environment influenced the narrative constructions that headed up this conceptualization, particularly by the example of Donald Trump, former president of the United States. To this end, drawing on scientific literature on the topic, the work exposes how Trump's political methods, and his nationalist content, influenced Bolsonaro's government and inaugurated a new historical moment for far-right leaders in the American continent. The analysis is based on a critical perspective in relation to the concepts of "nation" and "nationalism", seeking to understand the new role they assume in the 21st century and their connections and linkages with the past, thus contributing to discussions about the emergence of new far-right political leaders who have "nationalism" as a vital part of their political programs and its consequences for the democratic state.

Keywords: Nation; Nationalism; Bolsonaro; Political Speeches; Brazil; Liberal Democracy Crisis.

20528 | They Silenced Her, the story of the death of journalist Shireen Abu Akleh by the International Journalism of Al Jazeera and The Washington Post *Cortez, Inês, Universidade do Porto, Portugal*

Abstract

On May 11, 2022, Palestinian-American journalist Shireen Abu Akleh was killed in Jenin, West Bank, Palestine, victim of a sniper shot while working on a report. At the time she was shot, Abu Akleh was wearing a helmet and a bulletproof vest with the word "Press" written on it. The journalist was a correspondent for the Al Jazeera television channel since 1997 and an influential personality in the Arab world, known for covering news about Israel and Palestine conflict.

Several media outlets around the world reported the journalist's death. Al Jazeera pointed out Israel has the culprit, while The Washington Post cited this media channel as the source who pointed Israel as the "most likely" responsible. Abu Akleh's case led to the involvement of three countries: Palestine and the United States of America, due to the journalist's dual nationality, and Israel, which has strong economic relations with the United States of America and is the main suspect. Besides, The Palestinian Ministry of Information has stated that 45 Palestinian journalists have been killed by Israeli forces since the year 2000, which raises the possibility of an attack on freedom of speech.

To explore whether Al Jazeera and The Washington Post showed the same facts and conclusions about the death of journalist Shireen Abu Akleh, this presentation showcases the history and the importance of international journalism, as well as a quantitative and a qualitative analysis of the news published by the two online newspapers from 11th May to 19th May – one week and two days after the funeral in Jerusalem.

The investigation concludes that Al Jazeera and The Washington Post did not show the same facts and conclusions about the killing of the journalist and that Al Jazeera took a position against the position of Israel and the United States of America, mainly with language, highlighting the importance of the reader to be aware of the approaches the media make to the facts.

Keywords: International Journalism; News Framing; Speech Analysis; Content Analysis.

Acknowledgements

Professor Paulo Frias Maria Vieira and Nuno Fragoso

References

[1] Chlarke, J. & Bromley, M. (2012). International News in the Digital Age: East-West Perceptions of a New World Order, edited by Clarke, J. & Bromley, M. New York, Routledge, pp. 3-16. [2] de Vreese, C. (2005). News Framing: Theory and Typology, Information Design Journal. Accessed on 29th December 2022. Available in https://www.researchgate.net/publication/250888488 News Framing Theory and Typology [3] Richardson, J. E. (2008). Language and Journalism: An expanding research agenda. Journalism Volume Journalism: Studies: 9, issue 2: Language and https://www.tandfonline.com/doi/abs/10.1080/14616700701848139

[4] Shah, D. V., Watts, M. D., Domke, D., & Fan, D. P. (2002). News framing and cueing of issue regimes. Explaining Clinto's public approval in spite of scandal. Public Opinion Quarterly, 66, pp. 339-370.

[5] Williams, K. (2011). International Journalism. London, SAGE Publications Ltd, pp. 1-32, 45-68.

20927 | The modalities of non-formal education at a secondary school in the municipality of Porto

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Abstract

In a context of pluralization of educational processes, there is a growing relevance of non-formal education, even at scholar institutions. With a view to developing scientific, cultural, civic, and humanistic conscience, precise strategies at different scales (national, municipal, and scholarly) have been serving as a basis for practices that are parallel and transverse to more formal educative models. This paper presents a qualitative and exploratory research whose purpose is to analyse the offers and experiences of non-formal education in a secondary school in the city of Porto. More specifically, through document analysis, we framed the clubs and projects of the studied school in the "Perfil dos Alunos à Saída da Escolaridade Obrigatória" (2017) and in the "Carta Educativa do Porto" (2017). Furthermore, we applied semistructured interviews to different interlocutors (teacher and students) to analyse certain dimensions associated with the sociodemographic composition of the Clube de Teatro, its fundamentals, actions, impacts, participations of actors in the Clube, and the relationship between the Clube and the school. As future clues of analysis, it might be important to consider the satisfaction of the students who participate in scholarly experiences outside formal education spheres. On the other hand, if it is expectable that the existence of a diversity of clubs and projects – which encompass the various areas of competences foreseen in the "Perfil" - can increase the possibilities of captivating students, that is not separated from the institutional complex characterized by the excessive focus on results, besides other points. This is where the need to diagnose and examine the activities and contexts of non-formal education appears, in which sociologists can have an important role, for example in the inversion of some generalized disinvestment in this student community in regards to learning opportunities that coexist with the conventional ones.

Keywords: non-formal education; secondary school; Clube de Teatro.



LITERARY, CULTURAL AND LANGUAGE STUDIES



20531 | Agrippa's declamatio in defending women's cause

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Abstract

This presentation deals with the Renaissance *declamatio*, species of the of the epididic genre, in order to ascertain the seriousness of the Cornelius Agrippa's argumentation in his *treatise De nobilitate et praecellentia foeminei sexus*. Given the discordant interpretations of the work since its publication, as a satirical text, paradoxical or serious treatise, the classic tradition of this typology and its development in the Renaissance are analysed, as well as Agrippa's considerations on the *declamatio* woven in defence of the correct reading of one of his *declamationes*. This paper aims to evaluate the adequacy of this type of discourse to the argumentation in favour of women, on how the choice of this typology extends the limits, in the treatment of the condition of women. Therefore, we seek to relate the claim of liberty to present arguments that might or might not coincide with the author's opinion with the open defence of women and their rights in this treatise that was used from its publication in 1529 onward as a source for arguments in favour of the women's cause.

Keywords: Rhetoric, Declamatio, Agrippa, Gender.

References

[1] Van der Poel, Marc, (1989), "The Latin Declamatio in Renaissance Humanism", *The Sixteenth Century Journal*, Vol. 20, № 3, 471-478.

[2] Van der Poel, Marc, (1991), *Cornelius Agrippa, the humanist theologian and his declamation*, Leiden, Nova Yorque, Koln, Brill.

21037 | Saint and warrior: representations of King Sebastian in Camões' lyric and epic poems

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Abstract

Recent Camonian studies draw attention to the central role of the figure of King Sebastian in *Os Lusíadas*, for whom, according to Aguiar e Silva [1], the poet wrote his epic. We intend to focus the figure of the young king through the eyes of Camões' epic and lyrical, by studying the relationship between the poet's Ottava III (*Sobre a seta que o Sto Padre mandou a el-Rei Dom Sebastião*) and the Dedication inscribed in his epic.

Born on St. Sebastian's day a few days after his father's death, Sebastian insured the Portuguese political independence from Spain dominance and concentrated on him very high expectations. Both texts reveal Camões' favourable position to the conquest of Northern Africa. In Ottava III, Camões invokes St. Sebastian as a sign of the victory of faith over paganism. By bringing the King closer to his homonymous saint, Camões predicts Portugal's victory over the Moors. As he will do in the Dedication of *Os Lusíadas*.

Also, in the Ottava Camões resorts the saint relics to build with them the image of a victorious king. There is a contamination of the arrow-relic offered by the Pope with the war arrow that he'll use in the battle against the Moors. Likewise, the arm-relic of the saint, offered in 1527 to King João III, is transposed onto the arm of King Sebastian, to appeal to the advance on North Africa: *que sereis braço forte e soberano/contra o soberbo gládio mauritano*.

In the epic, the same incentives and advice are addressed to the king, this time represented as a warrior (*Alexandro em vós se veja*), not forgetting, however, to encourage him to sanctity: *que assi se abre o caminho à santidade*.

We will demonstrate how, from different sources, both texts by Camões correspond formally and thematically, in order to guide Sebastian towards the North Africa. And how, in these warnings and advice, both texts are connected to the *Specula Principis* genre.

Keywords: Camões; King Sebastian; St. Sebastian; Ottava III; Os Lusíadas.

References

[1] Silva, Vítor Aguiar e. Dicionário de Luís de Camões. 2011, 128-134.

20611 | Political challenges in contemporary literature: new approaches of literary and social engagement in the work of authors Annie Ernaux and Chahdortt Djavann *Coelho, Ana Beatriz, Faculdade de Letras da Universidade do Porto, Portugal*

Abstract

Based on the research developed in my master's dissertation, this paper aims to offer a critical reading of literary militancy/engagement in contemporary French literature through the strategies that emerge from the work of authors Annie Ernaux and Chahdortt Djavann. Firstly, we briefly contextualize how the genre of the novel has evolved over the last few decades in order to discuss the porosity of theoretical boundaries between fiction, autobiography and autofiction in today's literary production (and particularly in the texts of both writers): in an era marked by the re-emergence of writing as a form of intervention – in the present context of a Sartrean postliterature that seems more invested in the notion of "literary engagement" (engagement littéraire) than an "engaged literature" (littérature engagée) – we focus on the multiple ways in which the author is or can be implied in the text, in order to assess the potentialities and mechanisms of legitimation of militancy as a relevant standpoint. Both authors, presenting two very distinct backgrounds, expose complex interpretations of different aspects of literary devices and contribute to new understandings of the power (or influence) of literary texts in accurately describing political, religious and/or economic realities. Recently awarded the Nobel Prize in Literature (October 2022), Ernaux addresses numerous topics such as the impact of class and sexual constraints in the construction of one's perception of the world while Iranian-born French writer Chahdortt Djavann writes about identity and the feminine condition in Islam. These authors highlight how every personal/individual history is inherently a collective one and propose new ways of perceiving the effect of literary mediation in the establishment of current social paradigms.

Keywords: Annie Ernaux; Chahdortt Djavann; engagement; autofiction.

20563 | Masculinity and marriage in Auto dos Enfatriões

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Abstract

Providing as an exploratory foundation of an ongoing thesis titled "Masculinity in marriage: the ideal husband on sixteenth century Portuguese theatre", created as part of the program to achieve a master's degree in Literary, Cultural and Interart Studies at the Faculty of Arts and Humanities; our presentation aims to understand the masculinity construct portraited in Luís de Camões' Auto dos Enfatriões, first published in 1587. To achieve such goal, it is imperative, firstly, to understand what the sixteenth century Iberian moralists and treatise writers about marriage thought the necessary characteristics of a perfect husband were. Anfatrião's marriage with Almena is ultimately destroyed by his wife's failure to obey the triad of marital benefits postulated by Saint Augustine in his De Bono Conjugali – proles, fides and sacramentum – but, because she is deceived by Júpiter, a god that can shapeshift to look exactly like Anfatrião, we believe that it is too unfair to point Almena has the sole cause of the collapse of this marriage. The same we say for Anfatrião. Even though it is his departure from their household that enables Júpiter to have two intimate encounters with Almena – and such a story serves as a warning for married men who wish to embark to the New World –, Anfatrião is a warrior, one of the types of men that for Francisco de Osuna, in his Norte de los Estados (1531), have a legitimate reason to be away from his wife for some time. Through the entire plot, Anfatrião shows knowledge of other husband's duties defended by Iberian moralists, such as having the correct servants and protect the marriage's honour, which, although having more aspects to it, depends heavily on the wife's and/or daughter's behaviour. Not even Júpiter, the one left of this love triangle, can be at fault for breaking this marriage as he is constrained by an even greater force, the one who is the true culprit of this plays' tragic ending: Love.

Keywords: gender; marriage; masculinity; sixteenth century; theatre.

Acknowledgments

A special thank you to Professor Zulmira C. Santos and Doctor Paula Almeida Mendes for supervising our thesis, this presentation and mentoring us in our first steps as a researcher.

20633 | "Movens" and "efficiens": the concept of causality in Aquinas' First Way Costa, Gonçalo, Faculdade de Letras da Universidade do Porto, Portugal

Abstract

Saint Thomas Aquinas' First Way attempts to prove the existence of God through the existence of motion. The argument is that motion requires a cause, and that this chain of causes cannot extend infinitely. While Aquinas believed this argument to be the most manifest of all, there has been immense debate among his 20th century disciples regarding it. One of such debates regards the meaning of "movens" or mover/motor. Some, like, for instance, Maritain, Wippel, Woodbury, and Garrigou-Lagrange, argue that "movens" should be understood simply as an efficient cause, while others, such as Gilson and MacDonald, suggest it can also be understood as a final cause. In this paper, I will analyse the discussion around the meaning of "movens" and argues that, within the context of the First Way as presented in Summa Theologiae, "movens" and "efficiens" should be taken as synonymous. After surveying the opinions of various Thomist philosophers from the last century, I will present the positions of MacDonald and Gilson. MacDonald suggests that the concept of "movens" can be extended to include final cause whenever a motion is caused by a rational being, while Gilson argues that such an extension needs be made, considering medieval cosmology and Aristotelian philosophy, at the point of reaching an immaterial, christian-like, God. I will defend the position that "movens" and "efficiens" can be used interchangeably within the context of the First Way. Against MacDonald, I will argue that his fails to interpret Thomistic anthropology, while Gilson's reasons will be shown to be dismissible. Finally, I will offer positive arguments in favor of my thesis and conclude that "movens" and "efficiens" are synonymous within the context of the First Way.

Keywords: Thomas Aquinas; Natural Theology; First Way; 20th Century Thomism; Étienne Gilson; Scott MacDonald; Mover; Efficient Cause; Final Cause.

References

- [1] Thomas Aquinas, Summa Theologiae.
- [2] Thomas Aquinas, De Principiis Naturae.
- [3] Thomas Aquinas, Commentaria In Octo Libros Physicorum.
- [4] Aristotle, Physics.
- [5] Étienne Gilson, "Prolégomènes à la 'Prima Via'".
- [6] Scott MacDonald, "Aquinas's Parasitic Cosmological Argument".

20928 | Passive constructions in European Portuguese and Mandarin

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Abstract

The passive voice is one of the most complex topics in the field of Portuguese syntax. In European Portuguese, there are several ways to construct a sentence of the passive voice, such as syntactic passive, passive se, and adjectival passive. Each construction has its property. In the Chinese language, passive voice also has more than one forms, they can mainly be distinguished as passives with Bei(被) and passives without Bei(被). As natural languages, the passive constructions of Portuguese and Chinese must have some similarities. However, one of them is a Western language, and the other is an Eastern language, so there must be many differences. The present paper will focus on the introductions and comparisons of the passive voice constructions of European Portuguese (EP) and Mandarin at the syntactic level, with the main aim of enumerating and characterizing the passive voice of Portuguese and Chinese (Chinese in the present text indicates Mandarin, chinese dialects will not be covered in this paper); Making comparisons of the passive voice between the two languages, to discuss the differences and the similarities; Presenting some possible applications of this study in intercultural communication. After the comparisons and analysis of the passive constructions, we will find that there are some similar features, for example, the direct object of the active sentence becomes the subject in the passive sentence but the thematic papers remain the same; the passives without Bei in Chinese can correspond to the adjectival passives of EP at the semantic level. There are also many differences, for example, the syntactic structure of passive clauses is different because EP has inflection while Chinese does not; the position of internal argument in passives in Chinese is more fixed than in EP; Chinese has no passive construction which corresponds to the passives se of EP, etc.

Keywords: Passive voice; Syntax; European Portuguese; Chinese; Comparison.

References

[1] Duarte, I (2003). A família das construções inacusativas. In M. H. M. Mateus et al., Gramática da língua Portuguesa. Lisboa: Caminho.

[2] Paiva Raposo, E. B. (2013), "Orações passivas". In Gramática do Português(vol.1). Lisboa: Fundação Calouste Gulbenkian.

[3] Yu, X. (2021). The Rules and Translation Skills for the Conversation of Portuguese Passive Voice into Chinese. In *JOURNAL OF MACAO POLYTECHNIC INSTITUTE (Vol. 24, Ser. 81)*. Macao: Macao Polytechnic Institute.

[4] Li, S. (1994). Modern Chinese Passive Studies. Beijing: Peking University Press.

20597 | Grammatical descriptions of verbal reduplication in Nheengatu and Tsonga: the first steps for a typological description

Granja, Fábio B., Faculdade de Letras da Universidade do Porto, Portugal Vital, Átila A., Faculdade de Letras da Universidade Federal de Minas Gerais, Brazil

Abstract

Despite it being a rare phenomenon in Indo-European languages, reduplication has been extensively studied in the field of descriptive linguistics. For the purposes of this study, it can be defined as a non-concatenative process that does not function through the addition of specific and regular morphemes to a base. Instead, the repetition of a root is what gives the reduplicated word its final meaning [1]. This work presents a critical comparison of the grammatical description of reduplication in two languages: Modern Tupi (a.k.a. Nheengatu) and Tsonga (a.k.a. Xichangana), spoken in the Amazon Rainforest and in Southeast Africa, respectively. We have compared grammars and articles about these languages in terms of their description of their reduplicative systems [2] [3]. Our analysis considered the characterization of the process in dynamic and stative verbs and in transitive and intransitive verbs. The main issues found in the materials were: i) the traditional classification of certain words as adjectives in Nheengatu, considered as outdated [2]; ii) the semantic analysis of verbs that can be partially reduplicated in Tsonga. The former can be better explained as in Tsonga, which instead of adjectives has stative verbs [3]. The latter can be best understood as single iterative verbal actions that affect the same entity, as is the case in Nheengatu [2], and not as micro-repetitions of these same actions such as proposed in [3]. The limitations of the study are mainly related to the scarcity of descriptive materials of both languages and the constraint of our findings to only two languages. Further research could benefit from expanding the proposals presented here to languages whose grammatical descriptions present similar problems.

Keywords: reduplication; typology; nheengatu; tsonga.

References

[1] Hurch, B., & Mattes, V. (2009). Typology of reduplication: The Graz database. The use of databases in cross-linguistic studies, 301-328.

[2] CRUZ, A. (2011). Fonologia e gramática do Nheengatu: a língua geral falada pelos povos Baré, Warekena e Baniwa. 2011 (Doctoral dissertation, Tese (Doutorado em Linguística) - Vrije Universiteit, Utrecht, The Netherlands).

[3] Ngunga, A., & Simbine, M. C. (2012). Gramática descritiva da língua changana. Centro de Estudos Africanos.

21240 | Photography as resurgence: Os Memoráveis, by Lídia Jorge

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Abstract

Lídia Jorge has long been interested in the themes of memory, Portugal's colonial past and the Carnation Revolution — or April 25. In *Os Memoráveis*, her latest romance, published in 2014, a photograph is at the centre of the narrative that questions the consequences of April 25 and faces them with the hopes of those who participated in it. Depicted in the photograph, taken more than a year after April 25, are members of different movements among the revolutionaries during a dinner, as well as the chef and the photographer.

Maria Machado's — the protagonist — parents, her estranged mother Rosie Honoré and her famous journalist father António Machado, are among those revolutionaries, present at the dinner only by chance. Without them knowing, she starts filming a documentary about the day the revolution happened using the photograph as point of departure. The photograph serves as evidence of a moment in history in which Portugal's whole future was at stake. There was immense possibility for a free and just society after decades of dictatorship, and it represented, at the same time, the moment of collapse of those same dreams.

In my research, I focused on the theme of photography used as a device for preserving and restituting memory, as well as a device for deceiving. This study researches these themes, along with the idea of the arrested moment, the question of truth (a matter long attached to photography), by opposing the emptiness of official narratives with the possibility of recovering truth through photography and text, the contingency that permits it and finally, the generational responsibility of dealing with the past's consequences and preserving it's memory.

Keywords: Photography; memory; interarts, history, literature.

References

[1] Barthes, R. (1984). A Câmara Clara (J. C. Guimarães, Trad.). Editora Nova Fronteira. (Obra original publicada em 1980).

[2] Benjamin, W. (1994). Obras Escolhidas (S. P. Rouanet, Trad.). Editora Brasiliense.

[3] Berger, J. (2015). About Looking (edição eletrônica). Bloomsbury Publishing Plc. (Obra original publicada em 1980).

[4] Cadava, E. (1997). Words of light: theses on the photography of history I. Princeton University Press.

[5] D'Angelo, M. (2006). A modernidade pelo olhar de Walter Benjamin. Estudos avançados, 20, 237-250.

[6] Didi-Huberman, G. Imagens Apesar de Tudo. (V. Brito & J. P. Cachopo, Trad.). KKYM. (Obra original publicada em 2004)

[7] Jorge, L. (2018). Os Memoráveis. Leya. (Obra original publicada em 2014).

[8] Medeiros, P. D. (2020). Herança de sombras: memória, pós-memória e responsabilidade em 'Os Memoráveis' de Lídia Jorge. Colóquio/Letras, (205), 79-97.

[9] Sontag, S. (2005). On Photography (edição eletrônica). RosettaBooks, LLC. (Obra original publicada em 1974).

21272 | Mysteries of narration: Adaptation strategies in Mistérios de Lisboa (2010) Almeida, André, Faculdade de Letras da Universidade do Porto, Portugal

Abstract

Mistérios de Lisboa is a *feuilleton* novel by Camilo Castelo Branco published in 1854. One of the most distinctive elements of this work is the multiplicity of plotlines it contains: the novel is deliberately constructed through *mise en abyme*, i.e. told through stories within stories that incessantly intertwine, with no apparent end in sight. In 2010, Chilean filmmaker Raúl Ruiz directed an adaptation that faithfully follows (albeit with some tweaks here and there) both the plot and the labyrinthine structure of Camilo's novel. In fact, the abovementioned mise en abyme structure was what most attracted Ruiz to the novel.

Firstly, I will elucidate a few of the original novel's narratological traits, namely how the narrator of the first section of the book identifies and positions himself. This narrator is diegetically defined as the true author of the book and sets the stage for other narrators to appear and take control of the narrative voice, allowing the said *mise en abyme* structure to emerge. Secondly, I examine how Ruiz's adaptation translates these elements into the medium of film and explain how the movie resembles and/or distances itself from novel in terms of the aesthetic strategies it employs. Ruiz's adaptation is particularly intriguing not only due to the fact that he is an experimental filmmaker (who nonetheless chose to re-envision the work of one of the most well-established figures of the Portuguese canon), but also because he has made his filmmaking poetics explicit, namely via the publication of two theorical books about cinema that I link back to this adaptation and his particular take on *Mistérios de Lisboa*. I will primarily focus on «Book One» of Camilo's novel, as it is where the narratological strategies I described are first deployed and where Camillo's escalating subversion of it is most visible.

Keywords: Adaptation studies; Narratology; Film; Camilo Castelo Branco; 19th century novel (...).

20899 | Character transformation through intertextuality: Woody Allen's Madame Bovary

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Abstract

This paper explores the character development of Madame Bovary in Woody Allen's short story, *The Kugelmass Episode* (1977). Under the framework of intertextuality, this study analyses the transformation of Madame Bovary's character and its significance. This research intends to show in what way the intertextual references to Gustave Flaubert's novel *Madame Bovary* (1856) are essential to understand the character's unconventional development.

The bibliographical research focus on theoretical-critical texts, allowing for a comparative study between Woody Allen's short story and Flaubert's novel, with a particular emphasis on the relational circumstances of Emma Bovary and the way they are transversal to both texts. For the development of this line of reasoning, authors like E.M. Forster (1927), Graham Allen (2000) or Carlos Reis (2015) are fundamental.

One must reflect on the double condition of Madame Bovary as a character, considering her status both as a *flat* character and as a *round* character. Furthermore, the intertextual level is clearly proposed not only by the explicit summoning of certain works, but also by the concept of *metalepsis* that takes intertextuality to another level.

Emma Bovary managed to survive beyond Flaubert's point of view, and this makes the reader's first contact with her not as abrupt as it would typically be, given each individual's literary repertoire. In a short story, the reader rarely feels any intimacy towards the characters, as they do not evolve due to the brevity of the genre in which they are inscribed. For the reader who knows Flaubert's Emma Bovary, it is difficult to abandon what they have grasped about her as a *round* character. However, Woody Allen's Madame Bovary is a *flat* character since she only exists as a function of the single thread of action in which the narrative concentrates all its tension. Contrary to her development in the novel, Woody Allen's Emma remains stagnant and does not undergo any significant development.

Keywords: Madame Bovary; intertextuality; character; narrative forms; metalepsis.

21107 | African American collective consciousness in literature and hip-hop: a conversation between Toni Morrison's Song of Solomon and Kendrick Lamar's *To Pimp a Butterfly*

Oliveira, Diogo, Faculdade de Letras, Universidade do Porto, Portugal

Abstract

This paper aims to explore how the collective consciousness, memory, history and trauma is presented throughout the arts in late 20th century and early 21st century. To achieve this, I look at Toni Morrison's celebrated novel, *Song of Solomon* (1977), one of her canonical works, and Kendrick Lamar's third hip-hop album, *To Pimp a Butterfly* (2015), which helped him cementing his reputation as a spokesman for his generation, leading him to win a Pulitzer for his next studio album. Despite being almost forty years apart, both works debate the same themes, albeit in different manners: *SOS* tells the story of Macon "Milkman" Dead III and his journey to reconnect with these roots, experiencing racial violence and discord between peers, whereas, in *TPaB*, Lamar makes a reassessment of all this and adds another theme to the conversation: the role of an African-American celebrity turned leader in the 21st century. With this, is also my purpose to analyse how the role and even the medium of arts have changed and what means artists employ to connect with audience, from civil rights to leaders, to novelists and now music artists, and how this change occurred in the 21st century.

Keywords: African American; Toni Morrison; Kendrick Lamar; *Song of Solomon; To Pimp a Butterfly*; African American literature; hip-hop; memory; trauma; racial violence.

21093 | The spirit in the machine: Religion and its representation in science fiction *Oliveira, Joel, Faculdade de Letras da Universidade do Porto, Portugal*

Abstract

Science fiction is a genre of literature with the distinguishing feature that it focuses on science, or, more specifically, the potential future of science. And, in our current society, the domain of the scientific is not commonly associated with religion, which would make us believe that the same would be true for science fiction.

Science has a long history with religion, stretching to the beginning of our history. In today's world, most people see a separation between the two, and maybe even a war against one another, where science defies religious dogma, and religion goes against our attempts at progress. But this is a recent development, and idea that has it's beginning in the XIX century. Before all that, science and religion coexisted and, by the most part, helped one another; many theologians were scientists, or the contrary if we prefer. And if we look closely, science fiction mirrors this history.

Science fiction is filled with representations of religious activities, discussion on the topic and religious references. In some stories is a malevolent force that defies the protagonist, or a supernatural belief held by inferior alien races, or even another way of acquiring knowledge, and even a form of surviving in a difficult reality, even if that reality has advanced technology. Religion appears constantly in the works of this genre, a genre one would expect has very little to do with the spiritual part of human life.

In studying these religious representations in works of science fiction of established and new authors we can, thus, understand in a more meaningful way the intermingling of these two dimensions of human society and what that means. Also, since this is a genre of "cognitive estrangement" as many specialists say, when a work of science fiction presents us and alien world, this is but a transformation of our current world in a way that makes us question and understand our own better. So, studying religion in this context is also doing it in the current present time.

Keywords: Science-fiction; Religion; literature

20847 | Ain't I a Human?: Prison writing and the right to speak

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Abstract

How does one define the meaning of the word "prison"? When one speaks of "incarcerated people", who are we talking about? What do people currently write behind bars? These were some of the questions that led me, in my master's thesis, to research and analyse literary testimonies produced by prisoners since the beginning of our century. During the course of my research, I found texts by people whose imprisonment was considered an abuse of human rights and testimonies from experiences of legal incarceration, both in Portugal and abroad.

I divided my project into different parts. Firstly, I conducted a thorough theoretical research about the prison as an historical phenomenon and analysed literary work done by prisoners of conscience detained at Guantanamo Bay detention camp. Secondly, I delved into the topic of legal incarcerations and made a comparative analysis of the Argentinian case and the Portuguese case. I compared writings from *Memórias do Cárcere Revisitadas* (2013), an anthology that resulted from a reading and creative writing workshop held in the Prison of Guimarães, with work done by Argentinian incarcerated authors Liliana Cabrera, Gastón Brossio, and those who participated in *El Silencio que Grita* (2021), an anthology of poems written during a writing workshop hosted by the writer J. M. Coetzee, in San Martin Prison. Finally, I was allowed to enter prisons in Porto where I personally collected an array of prison writings from four people who write regularly behind bars. Despite the existence of prison newspapers and inter-prison literary competitions, these texts remain invisible and forgotten, incapable of crossing the rigidity of prison bars.

Thus, in this paper I will explain what makes "prison writing" a distinct literary genre, using some of the texts that I analysed in my thesis. I will try to show the social power of prison writing and the relevance of its dissemination for the construction of a more democratic world.

Keywords: Prison Writing; Contemporary Incarcerated Voices; Human Rights.

References

[1] Caron, Bettina. 2021. «Testimonios de Escritura En La Cárcel. Antología». In Leer Literatura En El Encierro, 197–210. Buenos Aires: Metafrasta.

[2] Falkoff, Mark, ed. 2007. Poems from Guantánamo. The Detainees Speak. Iowa City: University of Iowa Press.

[3] Fundação Cidade de Guimarães, ed. 2013. Memórias Do Cárcere Revisitadas. Município de Vila Nova de Famalicão / Casa de Camilo.

[4] López, Ines Branco, ed. 2021. El Silencio Que Grita. Paris: Acedia.



PHYSICS



20525 |Intelligent Optical Tweezers for high-throughput applications

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Abstract

Optical tweezers are a versatile tool for researching biological systems at the micrometer scale, due to their manipulation and probing capabilities [1], since particle dynamics are strongly affected by their shape and composition [3]. Despite paving the way for state-of-the-art applications in biomedical and biological sciences [1,2], these systems can be complex and timeconsuming to operate, not being suited for high-throughput applications. Besides, the lack of reproducibility in conventionally operated setups presents itself as one of their main limitations. Regardless of the need for intelligent systems, completely autonomous approaches to optical trapping are still hard to find. This regards both the system control and sample manipulation and the integration of modules for signal acquisition and data processing. In this work, we describe our efforts for the implementation of an autonomous setup capable of manipulating and analyzing the physical properties of microscopic particles, using the forward scattered optical signal. Our system includes algorithms for automatically scanning the samples while detecting, trapping and classifying microscopic particles. Preliminary results show several advantages, including the capacity to conduct faster and more complex experiments with improved reproducibility. With this system, we have been able to successfully distinguish between different sizes of polystyrene and polymethyl methacrylate beads, with accuracies over 85%.

Keywords: Optical Tweezers, Optical Trapping, Automation.

Acknowledgments

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References

[1] Jones, Philip, Onofrio Maragó, and Giovanni Volpe. Optical tweezers. Cambridge: Cambridge University Press, 2015.

[2] Chen, Hui-Chi, and Chau-Jern Cheng. "Holographic Optical Tweezers: Techniques and Biomedical Applications." Applied Sciences 12.20 (2022): 10244.

[3] Carvalho, Inês Alves, et al. "Particle classification through the analysis of the forward scattered signal in optical tweezers." Sensors 21.18 (2021): 6181.

21065 | Artificial photonic synapses for neuromorphic computing

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Abstract

Memristors, as neuromorphic nanocomponents, are promising candidates to revolutionize many areas such as Quantum Computing, AI, Machine Learning and Biophysics [1]. Besides the known synaptic behaviour under electric stimulation, we explore the tunning of their properties through optical manipulation [2, 3]. For the photosensitive switching layer we used DR1 (4-[ethyl (2hydroxyethyl) amino]-4'-nitroazobenzene) on PMMA (poly (methyl methacrylate)), doped with TiO2 (crystallized as rutile) and ZnO nanoparticles on top of a Cu electrode. We varied the concentration (0.01, 0.05 and 0.1%wt) and the spin-coating velocity (400, 1500, 2200 and 5000 rpm) to control the thickness. The electrical measurements were made using POGO tips and a 2400 Keythley Sourcemeter and for optical stimulation we used a 460nm LED. Synaptic learning was observed through the repetition of cycles, showing higher conductivity for tinner layers and higher concentrations. After 20 min of irradiation of linearly polarized blue light, the resistance decreased, as shown in Fig. 1. The samples of 0.05% and 1500 rpm showed an endurance of 40-50 cycles for TiO2 and 28 cycles for ZnO and a lower time retention for TiO2. After irradiation, endurance turned to be 17 cycles for TiO2 and 23 cycles for ZnO and the time retention for TiO2 decreased but was almost the same for ZnO. To optimize and tune these properties, we will include circularly polarized light, control the temperature, apply magnetic field and change the wavelength of incident radiation.

Keywords: Memristor; Synapse; Resistive switching; Optical computing; Photoisomerization.

Acknowledgments

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References

[1] Dimitri B. Strukov, Gregory S. Snider, Duncan R. Stewart, R. Stanley Williams. The missing memristor found. 2008 NaturePublishingGroup

[2] A.H. Jaafar, M.M. Al Chawa, F. Cheng, S.M. Kelly, R. Picos, R. Tetzlaff and N.T. Kemp. Polymer/ TiO2 nanorod nanocomposite optical memristor device. The Journal of Physical Chemistry C 125 (27), 14965-14973, 2021

[3] D. Kumar. Metal oxide resistive switching memory: Materials, properties and switching mechanisms. Ceramics International 2017



Figure 1: Linearly polarized light on ZnO (1500rpm and 0.01%wt)

20582 | Solving the Time-Independent Schrödinger equation with deep diffractive neural networks

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Abstract

The optical implementation of Machine Learning models has been recognized as a potential approach to solve problems associated with the electronic counterpart. Performing computation in the optical domain allows for better power efficiency and speed, while being inherently prone to scalability and parallelization. One such architecture is known as the Deep Diffractive Neural Network (D²NN) and is shortly described in the following.

In the D²NN framework, information is encoded in a laser beam and propagates through layers, consisting of Spatial Light Modulators (SLMs). Each SLM can be seen as a 2D array of configurable pixels for phase modulation, representing the network trainable parameters (neurons). Between SLMs, the field propagates in free-space, or preferably through some non-linear material acting as an activation function. At this stage, diffraction promotes connectivity between neurons of successive layers. Finally, the optical intensity is measured as the output of the network - where non-linearity may also be introduced via detector saturation.

In this work, the PyTorch framework was used for developing a computational model for D²NN networks. An FFT-based direct integration method is employed to simulate Rayleigh-Sommerfeld diffraction between layers. Then, backpropagation is applied to find optimal phase masks such that the D²NN may perform a given task.

As a case application, we attempt to predict ground state solutions for the Time-Independent Schrödinger equation in 1D. A data set was generated by solving the equation with classical finitedifference methods, for arbitrary well-shaped potentials. The simulated D²NN shows capability for predicting the wave function corresponding to the specified potential. Further work will be aimed at the experimental realization of the D²NN model, starting with the physical validation of the simulated model, and probing its robustness to noise.

Keywords: Optics; Neural Networks; Deep Diffractive Neural Networks.

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References

[1] D. Mengu, Y. Luo, Y. Rivenson and A. Ozcan, "Analysis of Diffractive Optical Neural Networks and Their Integration with Electronic Neural Networks," in IEEE Journal of Selected Topics in Quantum Electronics, vol.26, no.1, pp.1-14, Jan.-Feb.2020, Art no.3700114, doi: 10.1109/JSTQE.2019.2921376.

[2] Radu, A., Duque, C.A. Neural network approaches for solving Schrödinger equation in arbitrary quantum wells. Sci Rep 12, 2535 (2022). <u>https://doi.org/10.1038/s41598-022-06442-x</u>.

21050 | Simulation and characterization of AgFeTiO2 nanostructures for plasmonic multipurpose sensing

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Abstract

Surface plasmon resonance (SPR) of free electrons in metal-dielectric bilayer nanostructures occurs by the incidence of light with matching wave vector at the interface, triggering planar propagation of electromagnetic (EM) surface waves. Such resonance is characterised by the absorption of light at the resonant wavelength, being noticeable by a sharp absorption peak in the EM spectrum. The confinement of the enhanced EM fields in structures smaller than the wavelength creates a strong dependence of these electron oscillations – also called surface plasmon polaritons (SPP) – on the optical properties of both media, described by the dielectric function [1]. This dependence allows the development of plasmonic-based sensors, which have attracted attention due to high sensitivity to external refractive index (RI), but also enabling measurements of other physical parameters such as magnetic fields through magnetization of a layer fabricated at the top of the plasmonic structure.

AgFeTiO2 layered devices were studied for application in refractometric and magnetic field sensing applications. The optimal structures were chosen through simulation work on the plasmonic and magneto-optical properties of thin film structures by the transfer matrix method (TMM). The samples were fabricated by RF magnetron sputtering deposition on planar glass substrates and characterised in a modified Kretschmann configuration setup.

A refractometric sensitivity of 11079nm/RIU was obtained for an AgFeTiO2 structure with thicknesses of 30, 10 and 20 nm, respectively.

An average sensitivity to magnetic fields of 19.7nm/T was obtained for an AgFeTiO2 structure with thicknesses of 30 nm of Ag and 50nm of TiO2, with varying thicknesses of the Fe layer (5, 7.5, 10 and 12.5nm).

These preliminary studies show that the proposed structures may provide interesting alternatives for optical sensing, also opening possibilities of integration in other optical platforms, such as optical fibres.

Keywords: Surface Plasmon Resonance; magneto-plasmonics; optical sensors;

References

[1] Becerra, Diana Martín. Active Plasmonic Devices: Based on Magnetoplasmonic Nanostructures. Springer, 2016.

20864 | Collaborative opportunities in Multimodal Sensor Fusion

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Abstract

Collaborative multimodal sensing leverages the information gathered from different sensing modalities to find synergies or cooperation strategies that enhance the capabilities of standalone techniques. On the context of spectral imaging, more specifically, mineral identification, two techniques are predominantly used, laser-induced breakdown spectroscopy (LIBS) [1] and hyperspectral imaging (HSI) [2]. LIBS is known as the most interpretable and accurate technique and allows for localized analysis based on the principle of atomic emission with relevant information contained in the relative intensity of various emission lines corresponding to different elements. Pairing it with whisk broom scanning technique introduces imaging capabilities but despite its advantages, acquisition speeds are still lacking [3]. HSI on the other hand uses an axial entrance slit combined with push broom scanning allowing for fast acquisition, and represents the electromagnetic spectra on the surface of a sample, related to its optical properties with relevant information contained in the slope, bending, and depth of specific regions of the spectra corresponding to bending and/or stretching of relevant molecular bonds and although rich in information, traditional pipelines often result in convoluted models leading to underwhelming classification capabilities.

In this work we strive to build a robust model for mineral identification, using two different approaches, (I) effectively increase our features space using mid-level fusion to combine LIBS and HSI taking advantage of their complementary information, and (II) use our best unsupervised classification as a supervisor for HSI training, effectively building a self-learning model that takes advantages of HSI's fast acquisition rates combined with its information rich spectra.

Keywords: Laser-induced breakdown spectroscopy; Hyperspectral Imaging; Collaborative Sensing; Self-learning.

Acknowledgments

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References

[1] Harmon, Russell S., et al. "Laser-induced breakdown spectroscopy—An emerging analytical tool for mineral exploration." Minerals 9.12 (2019): 718.

[2] Okada, Natsuo, et al. "Automated identification of mineral types and grain size using hyperspectral imaging and deep learning for mineral processing." Minerals 10.9 (2020): 809.
[3] Paradis, Marie-Chloé Michaud, et al. "ECORE: A new fast automated quantitative mineral and elemental core scanner." Minerals 11.8 (2021): 859.
21265 | 4DCT Imaging: Implementation and study of different respiratory binning methods

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Abstract

Four-Dimensional Computed Tomography (4DCT) is a commonly used imaging technique in clinical practice to evaluate respiratory induced motion of internal structures during external radiotherapy planning.

This imaging technique involves the real-time recording of a respiratory signal, simultaneously with an over-sampled CT image acquisition obtained by re-imaging the same anatomy section during a full respiratory cycle. The over-sampled CT images are then sorted into several bins based on the information obtained from the respiratory signal. Such a sorting procedure results in the classification of the CT images into several respiratory-sorted image bins, such as end-exhale, mid-inhale, etc. [1]

In this study, three respiratory binning methods were compared: phase, pseudo-phase, and amplitude. Although the phase binning method is currently the most used method in commercial 4DCT systems, some studies have shown that using an amplitude binning method can result in better quality 4DCT images with fewer artifacts due to irregular breathing. [2,3,4]

For the study, sinusoidal waveforms were computationally generated and were used to simulate different breathing patterns on a respiratory phantom which internal movements are directly correlated with the amplitude of the breath waveform. Thus, 4DCT exams of the respiratory phantom were acquired, and each of the developed binning methods were computationally applied to the acquired respiratory signal, generating 10 different respiratory bins. Finally, the acquired CT images were sorted into these respiratory bins, generating 10 different respiratory-sorted images which are representative of each respiratory bin.

This study shown that, comparing to the phase binning method: (1) the pseudo-phase and amplitude binning methods need a larger number of over-sampled CT images to generate complete respiratory-sorted images, (2) the pseudo-phase and the amplitude binning methods associate to the mid respiratory bin a respiratory-sorted image more representative of the end-exhale respiratory segment, (3) the amplitude binning method generate respiratory-sorted images with less artefacts due to amplitude variability observed between respiratory cycles.

Keywords: 4DCT; phase binning; amplitude binning; respiratory sorting.

References

[1] P. Keall, T. Yamamoto e Y. Suh, "Chapter 1 - Introduction to 4D Motion Modeling and 4D Radiotherapy," in 4D Modeling and Estimation of Respiratory Motion for Radiation Therapy, Springer, 2015, pp. 1-21.

[2] Lu W, Parikh PJ, Hubenschmidt JP, Bradley JD, Low DA. A comparison between amplitude sorting and phase-angle sorting using external respiratory measurement for 4D CT. Med Phys. 2006.

[3] Abdelnour AF, Nehmeh SA, Pan T, Humm JL, Vernon P, Schöder H, Rosenzweig KE, Mageras GS, Yorke E, Larson SM, Erdi YE. Phase and amplitude binning for 4D-CT imaging. Phys Med Biol. 2007.

[4] Li H, Noel C, Garcia-Ramirez J, Low D, Bradley J, Robinson C, Mutic S, Parikh P. Clinical evaluations of an amplitude-based binning algorithm for 4DCT reconstruction in radiation therapy. Med Phys. 2012.

20799 | Photo-thermoelectric plasmonic systems: Towards green wireless energy transfer

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Abstract

Wireless energy transfer has started to become more important in technological advancement as the demand for new energy sources due to climate change intensifies. The reason for this is that wireless energy transfer reduces energy waste, including such energy loss from heat, and it is directly related to green energy sources. The amount of chemical wastes generated by portable gadgets is also greatly reduced by this novel form of energy transmission, which offers a new way to power them without the requirement for routine charging of huge batteries.

In the wake of this scenario, the European WIPTHERM project was set up with the objective of reshaping the paradigm of space travel and radically altering how we see energy conversion. This project proposes an alternative way to collect and maximise the energy output of this devices: through plasmonics, which is the branch, within the area of nanophotonics, responsible for studying the behaviour of plasmons, quasiparticles that represent the oscillation of electrons in the conduction band of metallic nanostructures. By coupling plasmons with the thermal properties of a given material it's possible to increase the temperature gradient (Mark L. Brongersma, 2015) imposed and then to have the best energy output for the respective devices. To achieve energy absorption optimization, plasmonic grating systems designed of PMMA covered with gold will be numerically simulated using the COMSOL Multiphysics software. A fiber laser with a wavelength of 1450 nm will serve as the heat source. The gold thickness will be adjusted from 5 nm to 100 nm, the cavity spacing from 1 μ m to 2 μ m, among other parameters, in order to achieve that. We will present the optimized structure's frequency spectrum alongside the study of the optical spectrum, varying structure parameters to show that. Later, using nanoimprint lithography, these will be manufactured and framed in thermoelectric devices for CubeSat technologies energy conversion (Iris Prinz, 2021).

Keywords: Plasmonics, Thermo-plasmonics, Nanoimprint, Simulations.

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References

Iris Prinz, M. J. (2021). Journal of Applied Physics, 129(13).
 Mark L. Brongersma, N. J. (1 de 2015). Nature nanotechnology, pp. 25-34.

21091 | On the Magnetic and Structural Phase transitions in Fe49Rh51

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Abstract

Material optimisation for environmentally friendly magnetic refrigeration maybe be achieved using magnetocaloric materials presenting magnetostructural first-order phase transitions, FOPTs. Although these are known for enhanced entropy and adiabatic temperature changes near their magnetic field driven FOPT, a significant relaxation of the magnetization with time has been reported in La(Fe,Si)13 alloys, one of such materials, after a magnetic field is driven and then paused at an intensity close to that of a given critical field, found to be the minimum necessary field to onset the FOPT [1].

Naturally, to maximise a device's operation frequency, and subsequent performance, this effect must be well understood. As such, a methodical characterization of this phenomenon has been carried out in a bulk Fe49Rh51 sample by designing an experiment that isolates each of the relevant parameters, such as temperature, magnetic field intensity and magnetic field sweep rate. To this end, for a set of temperatures below the AFM to FM transition, a magnetic field has been applied and subsequently paused at intensities around that of the critical field using a range of magnetic field sweep rates, enabling the measurement of the magnetization's relaxation over time.

The relaxation time of Fe49Rh51's magnetization was observed to last over 300 seconds when a magnetic field whose intensity is close to that of the critical field was applied, as shown in the image below. Furthermore, an increase in the magnetization's relaxation time was observed with increasing field sweep rate, highlighting the importance of circumventing magnetic relaxation in engineering a high frequency heat transfer device. Lastly, the magnetization's time derivative after the magnetic field is halted was shown to exhibit a linear relation with applied field for a range of values past but near the critical field, as well as a sweep rate dependent saturation value for intensities surpassing this range.

Keywords: First-order Phase Transition; Magnetoelastic Transition; Magnetocaloric Effect.

Acknowledgments

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References

[1] Lovell, E., Pereira, A. M., Caplin, A. D., Lyubina, J. & Cohen, L. F. (2015). Dynamics of the First-Order Metamagnetic Transition in Magnetocaloric La(Fe,Si)13: Reducing Hysteresis. Advanced Energy Materials, 5(6), 1401639. doi:10.1002/aenm.201401639



Figure 1: a) Profile of the magnetic field applied isothermally to an Fe49Rh51 sample in the AFM state. b) The resulting relaxation of magnetization over time. As the magnetic field intensity is varied past that of the critical field, a decrease in relaxation time is observed.

$20622\ |\ Bi_2Te_3$ topological insulators on flexible substrates: towards Spin-orbitronics devices

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Abstract

The expected breakdown of Moore's Law for transistor evolution has sparked a hunt for novel device designs and materials to keep up the growth of Information Technology (IT). Topological Insulators (TI) are quantum materials characterized by an insulating bulk and metallic surface edge states [1], observed in the band structure as a spin-textured Dirac cone where spin and momentum are locked. This unique structure grants them exotic transport properties, leading TI to be discussed for applications in a variety of fields [2], particularly Spin-orbitronics, a subfield of Spintronics that explores the spin-to-charge conversion in high spin-orbit coupling (SOC) materials and has the potential to bring widespread uptake of spin-based computation, in logic and memory devices.

Despite being a "hot topic" in solid state physics, experimental research on TI is in its infancy, and finding methods which are both affordable and effective for fabricating bulk TI and achieving control over the surface states remains challenging [3]. To face it, our research focuses on the characterization of sputtered Bi2Te3 thin films of varying thickness (10, 25, 50, 100 and 200 nm), a material with a well-documented topological phase that organizes in a Van der Waals structure, through a wide range of techniques – studying their morphology, through SEM and XRD, and transport properties, by measuring their Seebeck and Hall coefficient. In particular, this work analyses the influence of temperature annealing at different temperatures (ranging from 100-350°C) on the enhancement of the topological conduction channel by measuring the Weak Antilocalization Effect (WAL) of the Magnetoresistance at cryogenic temperatures [4].

The samples are developed in flexible substrates as a novelty, in line with the burgeoning technological development trend of moving towards multifunctional, wearable technologies, such as electronic skin, biosensors, and flexible displays. This is an area in which TIs have yet to be explored, placing our research at the edge of IT innovation.

Keywords: Condensed matter; topological insulators; nanofabrication; flexible substrates;

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References

[1] J. Moore, "The Birth of Topological Insulators (Review)," Nature, vol. 464, pp. 194-198, March 2010.

[2] L. Smejkal, Y. Mokrousov, B. Yan e A. MacDonald, "Topological Antiferromagnetic Spintronics," Nature Physics, vol. 14, pp. 242-251, 2018.

[3] S. F. Teixeira, A. M. Pereira, A. L. Pires e e. al., "Electronic Conduction Channels Engineered in Topological Insulator Sputtered Thin Films," APS Applied Electronic Materials, vol. 4, nº 12, pp. 5789-5798, December 2022.

[4] Y. Salawu, J. Yun, J. Rhyee e e. al., "Weak antilocalization, spin–orbit interaction, and phase coherence length of a Dirac semimetal Bi0.97Sb0.03," Nature Scientific Reports, vol. 12, p. 2845, 2022.

21251 | Interplay between interactions and incommensurability in 1D narrow-band moiré system

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Abstract

Quasi-periodicity is a current hot topic in condensed matter systems since it drastically changes the nature of the single particle eigenstates. Even in 1D systems the states suffer a transition from extended to critical or localized. Here we study the fate of those states in the presence of electron-electron interactions. We consider a 1D tight-binding model with sinusoidal modulated nearest-neighbours hoppings with nearest neighbour repulsion. To study the effect of interactions, we employ a variational mean-field approach to obtain the charge distribution across the lattice.

In this presentation we will show that the critical states in the incommensurate case generate a quasi-fractal charge density wave (CDW) for any finite interaction strength, U, with a high number of wave vectors contributing to the charge order. Increasing U, there is a transition to a CDW with only a few wave vectors characterized by a peak in the localization length in the wave vector space. On the other hand, in the periodic limit at high potential strength, there is a transition between a gapless state to a Periodic-Moiré CDW with the period of the potential. At sufficiently high U, there is no major difference between the periodic and quasi-periodic cases.

These results unveil the important role of incommensurability in low-dimensional interacting electron systems. They raise the question whether quasi-periodicity is equally relevant in moiré superlattices of 2D materials like graphene, which is yet to answered.

Keywords: Quasi-Periodicity; Interactions; Mean Field.



PSYCHOLOGY AND SCIENCES OF EDUCATION



20401 | The Online Lighthouse Mentalization Based Treatment for parents: Feasibility and caregivers' perceived processes of change

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Abstract

Impairment of parental mentalizing function has been associated to the risk of psychopathology, child neglect, and intergenerational abuse. In recent years, face-to-face mentalization-based therapies for parents (MBT-P) have been developed but there is a growing need for online treatment versions, which has been enhanced during the COVID-19 pandemic. This paper studies the preliminary effectiveness of the online version of the Lighthouse MBT-P programme, and the feasibility of the research protocol used for its idiographic routine monitoring. A total of 14 caregivers participating in two online groups filled in the Helpful Aspects of Therapy and the I-PROM PSYCHLOPS questionnaire session-by-session, for routine monitoring of processes and outcomes. Caregivers also reported the changes they perceived at the end of the programme in the Change Interview. Treatment effectiveness was explored via thematic analysis of the positive and negative changes at discharge and the on-going intermediate changes involved. Results provided preliminary evidence on the effectiveness of the online version of Lighthouse MBT-P to promote parental reflective function and sensitivity and to reduce parental distress. As parents mentalized past and present experiences, they often reported to be understanding and increasingly more aware of their own and other's mental states and changing thoughts and feelings to regulate emotions. In sum, the build of trust in the group and facilitators, the increased awareness of one's own and others' mental states and the mentalization of negative emotions among parents seem to be the key mediators of change in the Lighthouse programme. The online routine monitoring protocol presented adherence issues and needs further adjustments, for which participants' and therapists' views and opinions provided valuable insight.

Keywords: Mentalization, Online Therapy, Parental intervention, Lighthouse programme, Change processes, Idiographic routine monitoring.

20978 | Demands of caring: Emotion regulation and exhaustion on youth residential care workers

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Abstract

Due to the physical and emotional demands of their work, children and adolescents residential care workers may be particularly vulnerable to emotional exhaustion. However, there is a lack of investigation about the variables that contribute to explain the emotional exhaustion in residential care workers. We hypothesize that emotion regulation may play an important role, due to the nature of the relational dynamics between the care workers and vulnerable children and adolescents. The present study aims to investigate the effect of individual (e.g., age, sex, education level, emotional regulation) and contextual variables (child-caregiver ratio) on emotional exhaustion of care workers. This study is part of a broader project funded by the Portuguese Foundation for Science and Technology (PTDC/PSI-ESP/28653/2017) – CareMe Project. The sample consisted of 212 caregivers from 21 residential care settings in Porto. Selfreport measures included a sociodemographic questionnaire, the Oldenburg Burnout Inventory (OLBI) and the Affect Regulation Checklist (ARC). Results showed high emotional exhaustion levels in residential care workers. Using hierarchical multiple regression significant predictors of exhaustion were found, namely younger age, female, higher education levels, longer service time in the residential home, higher child-care workers' ratio, higher dysregulation levels, and lower adaptative reflection levels. The model explained 33% of the variance of emotional exhaustion. These results stress the importance of individual and contextual factors in the explanation of emotional exhaustion. After controlling for the remaining variables effects, the contribution of emotional regulation stood out. For a more effective prevention of emotional exhaustion and promotion of care workers' well-being, residential care training and monitoring should consider the need for developing emotion regulation skills, beyond important contextual changes, as the child-care workers' ratio.

Keywords: residential care; caregivers; emotional exhaustion; emotional regulation; hierarchical multiple regression.

20402 | SOS Suicide: The dynamics of emotional support helplines and the counsellors' experience

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Abstract

Telephone helplines are a suicide prevention strategy that can reduce suicidality and improve callers' mental health. Despite the importance of research in this area, studies in this field are scarce. This investigation aimed to systematize research on suicide prevention helplines, to portray their functioning in the Portuguese context and to characterise the experience of counsellors in providing the service. Two studies were carried out: a secondary study using a scoping review and a primary study using the collection of qualitative and quantitative data from emotional support helpline actors — coordinators and counsellors. In the secondary study, 57studies were included out of the 1255 reports that were initially discovered. Research in this domain focused on four themes: scientific evidence about helplines' effectiveness, the mode of operation of those helplines, callers, and counselors. Most studies were primary, quantitative, descriptive, and exploratory and used self-report instruments. Among the scientific evidence about helplines' effectiveness, decreases in clinical indicators, such as suicidal behaviours, stood out. Regarding the callers' experiences, no studies were found. The primary study showed that emotional support helplines have protocols for calls with suicidal content, and almost all counsellors have dealt with this issue. Not all counsellors systematically evaluate the risk of suicide. Most of the suicidal callers were at risk of suicide, and practises such as exploring the details and reasons for suicidality were used. The counsellors demonstrated medium-high perceived competence, which differed significantly depending on the type of counsellor, but not based on suicide prevention training or educational attainment. This investigation enabled us to systematise the extent, nature, and scope of research on telephone helplines, identify helpline practises related to suicidality, and describe the counsellors' experience in the provision of the service.

Keywords: telephone helpline; emotional support; suicide prevention.

20856 | Suicidal behaviours prevention and help-seeking barriers and facilitators in university students

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Abstract

University students are a risk group for suicide ideation and behaviours, enhancing the urgency of implementing suicide prevention programs. Peers can have a key role due to a low treatment rate. Suicide knowledge and intention to intervene might be effective strategies to increase the identification and assistance of students at risk. Efforts should be made to better understand barriers and facilitators experienced by students in seeking treatment to improve help-seeking behaviour and treatment engagement. This study aimed to analyse suicidal behaviours and factors related to suicide risk, identify the level of suicide prevention knowledge and intention to intervene when a peer is at suicide risk and characterize help-seeking attitudes and behaviours, including perceived barriers and facilitators of the university students. Differences in suicide prevention knowledge, intention to intervene and help-seeking attitudes were analysed according to sex and suicide-related variables. 626 Portuguese university students responded to an online questionnaire. A higher prevalence of suicidal behaviours was found among displaced students, from the LGBTIQ community, attending an unintended course, with a poor academic performance suggesting to be at higher suicide risk. Portuguese university students presented a high suicide prevention knowledge, intention to intervene with a peer at suicide risk and positive help-seeking attitudes. Suicide prevention knowledge had an effect on intention to intervene. Awareness and support and non-disclosure to family were identified as facilitators in seeking treatment and self-reliance, lack of resources and perceived stigma as barriers. Students at risk presented higher suicide prevention knowledge but worse help-seeking attitudes. Male students had lower suicide prevention knowledge, lower intention to intervene and worse help-seeking attitudes. This study enhances the relevance of a suicide prevention plan aimed at university students and its priority actions.

Keywords: suicide prevention; suicidal behaviours; help-seeking; suicide prevention knowledge; intention to intervene.

21219 | LGBTQ+ Inclusive school policies and practices and students' mental health in Portugal

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Abstract

There is a lack of research on exploring differences in perceptions of LGBTQ+ inclusive policies and practices between LGBTQ+ and cisheterosexual students, and few studies analyzing the role of a sexual and gender diversity curriculum on different mental health and well-being outcomes of LGBTQ+ students. In the present study, we aimed to, firstly, provide an overview of the perception of students (N = 989), who attended Portuguese schools from the 7th to the 12th grade, regarding the existence and implementation of some LGBTQ+ inclusive policies and practices. Secondly, we explored possible disparities between LGBTQ+ and cisheterosexual youth, concerning their perceptions of the aforementioned policies and practices. Finally, we explored possible differences in LGBTQ+ students' depression, general anxiety, resilience, and self-esteem levels, as a function of their perception on the existence of inclusive curricula, regarding LGBTQ+ issues. Generally, findings revealed that only a minority of students mentioned that their schools had comprehensive anti-bullying policies and that the curriculum was inclusive of LGBTQ+ issues. Additionally, more than half of students perceived knowing where to go within their school for information or support concerning sexual and gender identity issues. Results also suggest that LGBTQ+ students are more likely to report a more negative perception on the existence of an inclusive curriculum, and cisheterosexual students a more positive perception. Finally, LGBTQ+ students who perceive the curriculum to be less inclusive are more likely to report higher levels of depression and lower levels of resilience and self-esteem. Our findings suggest that promoting LGBTQ+ discussions in the school context is an important aspect for sexual and gender minorities' well-being.

Keywords: LGBTQ+, perceptions, LGBTQ+ inclusive policies and practices, inclusive curriculum, mental health, well-being.

21152 | Feedback: (when) it results?

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Abstract

This investigation intends to analyse the feedback process in the improvement of students' learning in Mathematics. More specifically, I formulated three questions: 1) How does the feedback given by the teacher favor the teaching-learning process? 2) How do students value, or not, the feedback process and this type of assessment (QA-Feedback-QA)? 3) How does the feedback process promote, or not, the improvement of their learning?

The formative assessment moments that will be provided will have the objective of preparing the summative assessment. Thus, whenever appropriate, small tasks will be proposed to the class, with a maximum duration of 20 minutes. Students will solve the task and hand it in to the teacher who will later provide feedback on that resolution.

In one of the following classes, the teacher will return the commented task to the students, asking them to read it, try to answer (when applicable) the questions asked, follow the suggestions given and, after that, redo the task and bring it to the classroom, but it is not intended to deliver this reformulation/new version of the resolution. After that, giving the students a few days, the teacher will check that all the students have done what they wanted and a new task will be proposed, very similar to the first one, so that the research questions can be answered. Given the resolution of the new task, this one must be delivered again and will only have comments written using symbology. Given the nature of the outlined objective, I will adopt a qualitative and interpretative approach to understand the mathematical activity of students in the formulation of problems in the context of the classroom. For this purpose, data will be collected through: (i) written records; and (ii) interviews.

Keywords: formative evaluation; feedback.

20765 | Analysis of the Hikikomori phenomenon - an infodemiology study of Twitter data in Portuguese

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Abstract

Hikikomori is a concept that refers to the extreme isolation of individuals in their own homes, lasting at least six months. In recent years social isolation has become an important clinical, social, and public health problem and this phenomenon has particularly called the attention of the Japanese government. However, to this day, although Portuguese is one of the six most spoken languages in the world, no studies have analysed the attitudes towards this phenomenon expressed in Portuguese.

In this study, we aimed to explore the content of tweets related to the Hikikomori phenomenon in the Portuguese language, classify them into different categories and measure the reach and interest of users in this phenomenon.

We conducted a mixed methods analysis of all publicly available tweets in Portuguese language using the hashtag #Hikikomori between 1st January 2012, and 19th October 2022. The tweets were classified, according to their content (positive/negative, concept information, personal stories, curiosities) and the type of user (Hikikomori itself, Hikikomori family/friends, and others). We also conducted an emotion analysis and analysed the number of retweets and likes generated by each tweet as an indicator of user interest in a given topic.

In a total of 13915 tweets, 10731 were classified as negative, and 3184 as positive. Regarding the content, curiosities were the most posted topic, and were more retweeted and liked. Within the user type, Hikikomori itself stands out as the one that posts the most tweets. With respect to emotion analysis, neutral emotions were the most expressed by the users. Worldwide, most of the Hikikomori related tweets in Portuguese are posted in Europe.

Twitter is a good tool to study the Hikikomori phenomenon since the people affected often use social networks as a refuge.

These findings show that the Hikikomori phenomenon has not only been spoken in Japanese but also in Portuguese. The majority of tweets report Hikikomori negatively.

Keywords: Hikikomori; loneliness; social isolation; mental health; internet; social media; social withdrawal; internet addiction.

21109 | The Impact of self-distancing on emotion regulation and moral reasoning in juvenile delinquents

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Abstract

The present study aimed to assess the impact of self-distancing on emotional regulation and moral reasoning in juvenile delinquents. Self-distancing is a recent psychological technique that involves writing about emotional experiences from a third-person perspective, for example, through the use of the personal pronoun "He/She". Several investigations have shown that self-distancing is primarily effective for vulnerable populations, associating it with the adaptive processing of adverse experiences [1-2]. Positive effects have been documented on emotional regulation, moral reasoning, conflict, and problem resolution [3-5]. It is argued that the distanced perspective favors broader and more objective interpretations which, in turn, allows one to reconstruct and attribute new meanings to negative events. As it is recognized that young offenders have difficulties in these areas, self-distancing may be beneficial to them.

By resorting to a sample of 57 participants, delinquent (n = 31) and non-delinquent (n = 26), we assessed the influence of self-distancing on affect and moral decision-making and compared its effects with the adoption of a first-person perspective (self-immersion). Participants were randomly assigned to self-distanced or self-immersed conditions and performed a written reflection about a negative interpersonal event. Contrary to our predictions and prior findings, self-distancing did not influence moral judgement, nor did it seem to promote participants' emotional adjustment. Specifically, self-distancing was associated with an increase in negative affect and a decrease in positive affect, especially in the nondelinquent group. Similarly, self-distancing was linked to higher levels of recounting than reconstruction. Reconstruction was higher in the self-immersed condition. These results are discussed in light of the current self-distancing conceptualization, as well as the specificities of the groups studied. Finally, starting points for future research are outlined.

Keywords: self-distancing; self-immersion; emotion regulation; moral reasoning; juvenile delinquency; writing

Acknowledgments

We gratefully thank General Directorate of Reintegration and Prison Services (DGRSP), the educational centers and Vila Nova de Gaia's high school for their collaboration in the study. We also thank Diana Sousa, Filipa Moreira, Sofia Teixeira and Francisca Abreu for their assistance in study administration.

References

[1] Ayduk, O., & Kross, E. (2010). Analyzing negative experiences without ruminating: The role of self-distancing in enabling adaptive self-reflection. Social and Personality
Psychology Compass, 4(10), 841-854. <u>https://doi.org/10.1111/j.1751-9004.2010.00301.x</u>
[2] Margola, D., Travagin, G., & Dennis, J. L. (2018). Taking a step back: Self-distancing dynamics in adolescent writing about peer problems. Journal of Adolescence, 65, 6-15. <u>https://doi.org/10.1016/j.adolescence.2018.02.007</u>

[3] Kross, E., Gard, D., Deldin, P., Clifton, J., & Ayduk, O. (2012). 'Asking why" from a distance: Its cognitive and emotional consequences for people with Major Depressive Disorder. Journal of Abnormal Psychology, 121(3), 559-569. <u>https://doi.org/10.1037/a0028808</u>

[4] Kross, E., & Grossmann, I. (2012). Boosting wisdom: Distance from the self enhances wise reasoning, attitudes, and behaviour. Journal of Experimental Psychology, 141(1), 43-48. https://doi.org/10.1037/a0024158

[5] Finkel, E. J., Slotter, E. B., Luchies, L. B., Walton, G. M., & Gross, J. J. (2013). A brief intervention to promote conflict reappraisal preserves marital quality over time. *Psychological Science*, 24(8), 1595-1601. <u>https://doi.org/10.1177/0956797612474938</u>

20463 | The impact of perceived inefficacy of the justice system on reactions to the deviance

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Abstract

Currently, the Portuguese population is in a state of disbelief regarding the country's justice system [1]. Such disbelief may impact how people deal with deviants [2]. We present an experiment (N = 112) which aims to understand the effect of perceived (in)efficacy of the justice system on how individuals deal with deviant behaviour and on their commitment to the Portuguese society. Participants either learned that the justice system was effective or ineffective in dealing with a hit-and-run case. Participants also stated their level of nationalism and patriotism, perceived threat to the nation's prestige posed by perceived (in)efficacy of the justice system, negative emotions, and attitudes towards acceptance, informal social control, and exclusion of the offender. Based on Subjective Group Dynamics Theory [3], we expected stronger exclusive attitudes and willingness to exert informal social control, and lower acceptance attitudes as well as a lower commitment to society facing inefficacy of the justice system (as compared to the efficacy condition), that should be mediated by perceived threat to the nation's prestige and negative emotions. Results partially support our predictions, suggesting that perceived inefficacy of the justice system decreases willingness to accept and predicts a stronger intention to exert informal social control over the offender. We propose that facing inefficacy of the justice system, individuals become less inclusive of deviant members and more motivated to exert action (informal social control) to compensate such inefficacy.

Keywords: Justice Inefficacy; Threat Perception; Emotional State; Nacional Identity; Reaction to Deviance.

References

[1] OCDE (2022), Building trust to reinforce democracy: Main findings from the 2021 OECD survey on drivers of trust in public institutions, Building Trust in Public Institutions, OECD Publishing, Paris, https://doi.org/10.1787/b407f99c-en

[2] Pinto, I. R., Marques, J. M., & Paez, D. (2016). National identification as a function of perceived social control: A subjective group dynamics analysis. Group Processes & Intergroup Relations, 19(2), 236–256. <u>https://doi.org/10.1177/1368430215577225</u>

[3] Marques, J. M., Abrams, D., Páez, D. & Hogg, M. A. (2001). Social categorization, social identification, and rejection of deviant group members. In M. Hogg & R. Tindale (Eds.) Blackwell Handbook of Social Psychology. (pp. 400-424). Oxford, UK: Blackwell.

20457 | Psychological barriers moderate the attitude-behaviour gap for climate change

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Abstract

Behavioural change has been increasingly recognized as a means for combating climate change. However, being concerned about climate problems and knowing the importance of individual actions in mitigating them is not enough for greater adherence to a more sustainable lifestyle. Psychological barriers such as (1) finding the change unnecessary; (2) conflicting goals; (3) social influences; (4) lack of knowledge; and (5) tokenism have been proposed as an explanation for the gap between environmental attitudes and actions. Yet, so far, this hypothesis has remained untested. This study aimed to assess if psychological barriers moderate the association between environmental attitudes and climate action. A sample of Portuguese individuals (N = 937) responded to a survey measuring climate change beliefs and environmental concerns as an index of environmental attitudes, a scale of self-reported frequency of environmental action, and finally, the dragons of inaction psychological barrier scale. Our participants revealed generally elevated positive environmental attitudes. These attitudes were positively and moderately related to greater self-reported frequency of environmental action in areas such as reusing materials, reduced consumption of animal products, water and energy saving, and airplane use, but not driving less. Critically, the association between attitudes and behaviour was negatively moderated by psychological barriers for the reuse, food, and saving domains, but not for driving or flying. In conclusion, our results corroborate the assumption that psychological barriers can partly explain the attitude-behaviour gap in the climate action domain.

Keywords: Climate Change, Environmental Attitudes, Psychological Barriers, Attitudes-Behaviour Gap

Acknowledgments

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21260 | The Why Behind the Buy: exploring the moderation effect of normative influence on self-expression through fashion clothing and conspicuous consumption Nardin, Valentina V., University of Porto, Portugal Lins, Samuel, University of Porto, Portugal

Abstract

Fashion consumers frequently choose their clothing as a form of self-expression, either stating 'this is who I am' or expressing 'this is what I want to become'. Understanding consumption as a social behaviour with different meanings allows us to explore the drivers of this behaviour anchored to social group values and individuals' susceptibility to the norms of the groups they belong to or aspire to belong to. This study aimed to investigate whether and how the susceptibility to normative influence (SNI) impacts the relationship between young adults' beliefs on their clothing as possessions that allow them to define and express their 'self,' and their conspicuous consumption orientation (CCO) to (1) buy products that other relevant people buy, (2) show originality, (3) express social status, and (4) purchase attention-grabbing products. 573 residents in Portugal (415 women), with a mean age of 20.62 years (SD = 3.48), were recruited online between November 2022 and January 2023. Moderation analyses were conducted on SPSS using Hayes' PROCESS macro model 4. The findings showed that SNI moderates the relationship between self-expression through clothing (SEC) and CCO. Lower levels of SNI rendered the relationship between SEC and CCO factors 1, 3, and 4 non-significant. However, with intermediate levels of SNI, the relationship became positive and statistically significant, and even stronger with higher levels of SNI. SNI was not found to be a significant moderator of the relationship between SEC and CCO factor 2. The implications of this study include the possibility of interventions that foster conscious consumption of fashion clothing by reducing young adults' susceptibility to normative influence via, for example, increasing their self-esteem, so that their urge to express their 'self' through clothing is oriented more towards themselves than towards fulfilling the expectations of their peers.

Keywords: social influence; conspicuous consumption; normative influence; self-expression; fashion consumption.

20982 | How context and children's characteristics promote the child's right to participation

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Abstract

The Convention on the Rights of the Child views children/adolescents as active subjects of their development and citizens with the right to participate in all matters that concern them. However, research is scarce and there is a gap on studies aiming to explore the perspective of children/adolescents. The present study is part of a national project (Projeto Adélia) developed by the National Commission for the Promotion of the Rights and the Protection of Children and Young People. It aims to identify and analyse the perspectives of children/adolescents. The main objectives are to (1) analyse to what extent the level of participation of children/adolescents varies according to individual and contextual variables, and (2) understand how individual and contextual variables affect (in)equity in the right to participation. The sample consisted of 13734 participants aged 6 to 18 years old. Results showed that, while girls perceived more participation in family related dimensions (e.g., Participation in Household Chores), boys perceived higher Participation in Extracurricular Activities. Regarding place of residence, overall, children/adolescents living in urban municipalities tended to identify more opportunities to participate. Nonetheless, adolescents residing in rural municipalities identified more Participation in the School. Lastly, it was found that the perception of Participation within the Family and Autonomy grows with age. In contrast, Participation in Extracurricular Activities is perceived as lower by older adolescents. As children/adolescent's development is fostered whenever they play an active role in their socio-cultural contexts, it is crucial that opportunities for participation, reflection and communication exist and are available to all children/adolescents despite gender, age group and place of residence. Thus, this study's implications for practice will allow for the creation of spaces/contexts that respect and promote every child/adolescent's right to participation.

Keywords: children's rights; participation rights; children's perspective; adolescents' perspective.

20405 | Family functioning pre and post-pediatric cancer: A qualitative approach

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Abstract

Introduction: Pediatric cancer experience can result in several difficulties for the family¹. Some aspects such as family cohesion, flexibility, routines, and rituals are important to consider in family functioning, especially in pediatric cancer^{2,3,4}.

Method: This study aimed to understand the cancer experience in the family system, in specific the implications in family cohesion, flexibility rituals, and routines. Three temporal periods of the family's experience were considered (before diagnosis, during treatment, and during the interview moment) and two members of the same family were interviewed. The sample includes 20 family members of 12 survivors, who participated in a semi-structured interview, individually. Through thematic analysis, 3 themes emerged: Family Functioning, Disease's Adaptation, and Disease's Repercussions.

Results: The Family Functioning theme shows that family routines and rituals could undergo changes, but not always because of cancer (i.e., pandemics, meaning, family life cycle), and, in some families, it returns from what it was before diagnosis. Regarding cohesion and flexibility, it was verified balanced families in both dimensions. According to Disease's Adaptation theme, family members react in different ways according to the disease's stage, but other family members and health professionals can facilitate the disease's adaptation. However, some difficulties emerged, namely economics and psychosocial. At last, Disease's Repercussions theme reflects on lessons during the cancer experience and sequelae that remains in survivors.

Conclusions: Family routines and rituals can undergo changes due to cancer's consequences, especially when they relate to sequelae. Finding balanced families on cohesion and flexibility can be associated with the relationship between family members before diagnosis, making it important for later changes during disease stages. These results underline the need for ecological intervention during all periods of cancer.

Keywords: pediatric cancer; family functioning; survivor; family.

References

[1] Bates, C., Palloto, I., Moore, R. M., Fornander, M., Covitz, L., & Gillette, M. (2021). Family rules, routines, and caregiver distress during the first year of pediatric cancer treatment. Psycho-Oncology, 30(9), 1590–1599. https://doi.org/10.1002/pon.5736

[2] Kim, H., Zhou, E. S., Chevalier, L., Lun, P., Davidson, R. D., Pariseau, E. M., & Long, K. A. (2020). Parental behaviours, emotions at bedtime, and sleep disturbances in children with cancer. Journal of Pediatric Psychology, 45(5), 550–560. https://doi.org/10.1093/jpepsy/jsaa018

[3] Rolland, J. S. (2012). Mastering family challenges in serious illness and disability. In F. Walsh (Ed.), Normal family processes (pp. 452–482). New York: The Guilford Press.

[4] Santos, S., Crespo, C., Canavarro, C., Kazak, A. (2015). Family rituals and quality of life in children with cancer and their parents: The role of family cohesion and hope. Journal of Pediatric Psychology, 40(7), 664–671. https://doi.org/10.1093/jpepsy/jsv013.



Figure 1: Categories and subcategories of the theme "Family Functioning"



Figure 2: Categories and subcategories of the theme "Disease's Adaptation"



Figure 3: Categories and subcategories of the theme "Disease's Repercussion"

20974 | Adoptee- and adopter-related predictors of adoption (in)stability

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Abstract

Adoptive families face complex difficulties and challenges, which can create instability in the adoption relationship. The present study aims to address the research gap regarding adoption instability by exploring Portuguese adoptive families' postadoption experiences. The specific goals are to study postadoption difficulties, identify an adoption instability indicator, explore correlations among instability, adoptee-, and adopter-related variables, and explore predictors of instability. A total of 95 adopters participated in the study, allowing for data on 95 adoptees. Descriptive, correlation and hierarchical regression analyses were performed. Results indicated a low incidence of adoption difficulties, although interruption of personal time and management of the child's challenging behaviours showed a higher/stronger difficulty level. A stabilityinstability continuum that comprises the multiplicity and diversity of adoption experiences was found. Findings also validated the postadoption instability indicator, encompassing the objective strain, subjective strain, and adopter commitment measures, which were significantly, positively, and highly correlated, yet presenting, simultaneously, specific differences that strengthen their complementarity and enrich the indicator of overall (in)stability. Regarding adoptee-related factors, older age, older age at adoption placement, and behavioural and emotional problems emerged as significant predictors of adoption instability. Concerning adopters, parental selfefficacy was a significant protective factor, while depression and specialized support were identified as risk factors. These findings provide relevant data concerning families' postadoption pathways and suggest important research and implications for practice, namely, on postadoption support. This study confirmed the lack of support received by adoptive families in Portugal, emphasizing the urgent need to implement accessible, adequate, and duly specialized postadoption support services.

Keywords: postadoption instability, adoption difficulties, adoptive families, risk and protective factors.

20568 | The relationship between perceived stress and marital quality in remarriage families

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Abstract

Several studies show that remarriage can be a stressful event, since it changes family boundaries, which can make them ambiguous. Introducing new family members implies a renegotiation of roles and relationships, adaptation to the culture of the two families and the redistribution of resources (such as time, space, money and affection). In this way, studies conclude that remarriage families report higher levels of stress than nuclear families. In turn, stress is associated with marital quality. But only one study reveals the association between stress and marital quality in remarried relationships.

The present study uses the couple as the unit of analysis and aims to understand the relationship between perceived stress and marital quality in remarriage relationships.

Methodology: The study included 96 Portuguese couples who had been in a heterosexual marital relationship for at least 6 months (with cohabitation), in which at least one element of the couple had already been married or had previously cohabited. The data collection procedure was carried out exclusively online, through a sociodemographic questionnaire, the Perceived Stress Scale and the Dyadic Adjustment Scale-Revised.

Results: The analyses carried out show that there is a negative effect of stress on the quality of the individual marital relationship and on that of the female partner. This means that higher levels of individual stress are associated with lower levels of marital quality perceived by the individual. There is also an effect of male stress on the quality of the relationship perceived by women, but in the case of men, there is no significant effect of female stress on the marital quality perceived by men. It was also found that women report lower levels of marital quality and greater stress than men, however there are no differences in relation to women with and without stepchildren residing in the household.

Conclusion: This study suggests that there is a negative association between perceived stress and marital quality in remarried relationships, and so far, there have been few studies that have shown this association. The study also suggests that the negative effects of stress are reflected not only in the relational quality of himself but also in that of his partners.

Keywords: perceived stress, marital quality, remarriage families.

20851 | Breakup adjustment: The impact of self-differentiation and fear of intimacy

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Abstract

One of the major tasks in emerging adulthood is the development of interpersonal relationships, namely romantic relationships. Romantic relationships can become the main source of emotional security and intimacy, where the individual can explore his identity. However, breakups will inevitably take place and it is important to understand which factors promote or hinder breakup adjustment. The purpose of the present study is to analyse whether higher levels of self-differentiation lead to a better adjustment to breakup in romantic relationships, and whether fear of intimacy moderates this relationship.

We recruited 377 participants aged between 18 and 29 years old, who had ended a romantic relationship less than 1 year ago, childless and not cohabiting with a new partner. Participants completed sociodemographic and clinical questions, and the Fisher Divorce Adjustment Scale-Short Form, the Differentiation of Self Inventory—Short Form, Fear of Intimacy Components Questionnaire. We performed linear regression analysis and estimated interaction effects.

No gender differences were found for breakup adjustment and self-differentiation. Compared to men, women had higher levels of fear of losing the self, and lower levels of fear of losing the other. Adjustment to breakup was positively associated with self-differentiation and fear of losing the self, but negatively associated with fear of losing the other. Moderation analysis revealed significant interactions.

This study suggests that young adults with higher levels of self-differentiation will show better adjustment to breakup. Further research is needed to analyse gender as a confounder in interaction effects between fear of intimacy and self-differentiation in breakup adjustment. These results are important to intervene more effectively in these issues.

Keywords: young adults; breakup adjustment; self-differentiation; fear of intimacy.

21078 | The social representations of the Internet in education in Cabo Verde: The case of three secondary schools in the city of Praia

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Abstract

The integration of the Internet in education goes beyond its spread and use, encompassing assimilation processes that reflect our efforts to face and familiarize with it. Variations in its understanding and use based on context settings, as previously observed by several researchers, makes the Theory of Social Representations a powerful theoretical tool for its study, providing instruments for the analysis of the divergences in its interpretation between different social groups. Despite the relevance emphasized by different authors on its use in the study of technologies and their constant changes, there are few studies that approach the Internet from the perspective of this theory.

This study aimed to explore the social representations of the Internet in cape verdean education, through a societal approach, by studying the case of three secondary schools, distinguished by their organizational regime/typology and the communities where they are located. 326 students from the 11th and 12th grade were surveyed through a questionnaire and data was analyzed through quantitative and qualitative processes.

The results show that the social representations are organized in a content-medium axis and in a process-effect axis, having been observed that the school and the place of residence, together with the attitudes in relation to the Internet, are variables that contribute significantly to the positioning on the axes.

These results are important as they contribute to literature in the field, bringing new perspectives such as the study in a sociocultural context not previously studied and the approach of natural groups, as well as testing the adequacy of instruments used in the field in other contexts.

It is also relevant to a more solid understanding of students' current perceptions, ideas and experiences with the Internet in order to help institutions outline more effective strategies for the integration of this resource based on the clues given by the results.

Keywords: Social Representations; Internet; Education; Cabo Verde.

20489 | Perceptions of medical students of the Faculty of Medicine of the University of Porto towards the role of histology and embryology: should students be heard during the curricular reviews?

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Abstract

Updates in the medical curriculum are necessary to prepare the future medical doctors but the opinions of the medical students are seldomly collected during curricular reviews. In the recent process of adjusting the medical curriculum at the Faculty of Medicine of the University of Porto (FMUP), a large survey was performed to inquire the students' perspectives about Histology and Embryology.

Medical students completed a structured and anonymous online questionnaire about Histology and Embryology. The questionnaire was prepared using questions of previous surveys performed in Europe and additional questions specifically prepared to this study. Questions referred to teaching methods, clinical relevance, use of virtual microscopes and association of Histology and Embryology with other subjects of the medical curriculum.

A large and representative population of students (n=462) participated. Students in clinical years were more likely to recognise the clinical relevance of Histology (p=0.016) and Embryology (p<0.001). Most students (about 90%) agree that teaching of these subjects would benefit from a clinical orientation. Students highlighted that Histology is crucial to understand Biopathology and agree (75%) that an integration of Histology with Biopathology would be positive. Most students (55%) agree that slide microscopes are more useful than virtual microscopes.

Gathering the medical students' perceptions using large surveys as in the present study may be useful to adapt teaching methods which may increase the motivation. In the case of Histology and Embryology at the FMUP providing more clinically oriented teaching is currently performed. Students of clinical years have strong clinical perspectives of Histology and Embryology and their enrolment in teaching of Histology and Embryology can account to increase motivation of younger students. Consulting medical students in the development of the medical curriculum is relevant as they should be more active and engaged in building their education.

Keywords: Medicine; Students; Histology; Embryology; Biopathology; Teaching; Virtual microscopes.

Acknowledgments

We would like to thank all the medical students of the Faculty of Medicine of the University of Porto (Portugal) for their kind participation.



Figure 1: Total sample answers to the questions related with Histology



Figure 2: Total sample answers to the questions related with Embryology



Figure 3: Total sample answers to the questions related with teaching methodologies

20458 | Do writing motivational beliefs feed off each other and predict writing performance? A cross-lagged approach in middle grades

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Abstract

Writing is a powerful tool for communicating, thinking, and learning. According to most contemporary models and empirical research on writing, motivation is an important factor that influences writers' engagement, effort, actions and, therefore, their performance. However, little is known about the associations between different motivational beliefs and the directionality of their links to performance. To overcome this gap, we adopted a longitudinal approach to study the reciprocal associations between writing attitudes, self-efficacy in three writing domains (viz., ideation, conventions, and self-regulation), five incentives for writing (viz., curiosity, emotional regulation, boredom relief, grades, and competition), and writing quality in middle school. We collected data from 532 Portuguese students in two waves: when they were in Grade 4 and one year later, in Grade 5. In each wave, participants completed three self-report motivation-related questionnaires and wrote two opinion essays, whose overall quality was examined by two judges targeting creativity, coherence, syntax, and vocabulary. Using the R system for statistical computing, we conducted a cross-lagged panel analysis. Results showed two main findings. Concerning the links between beliefs, they were generally associated with each other within and between Grades 4 and 5. Specifically, writing attitudes seemed relevant to the development of self-efficacy for writing self-regulation and intrinsic incentives to write. Concerning the motivation-performance links, we found that most beliefs were concurrently linked to writing quality in Grade 5, which did not happen in Grade 4. Moreover, self-efficacy for writing conventions in Grade 4 significantly predicted writing quality in Grade 5. These results contribute to better understand writing motivation, reinforce the relevance of longitudinal designs, and provide teachers with clues about where to start to promote positive motivational beliefs in middle school.

Keywords: writing motivation; writing attitudes; writing self-efficacy; writing motives; writing quality; longitudinal design.

21000 | The present and future of teaching: Analysis of the processes of knowledge transmission between cooperating teachers and interns

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Abstract

Due to the constant evolution of work organization, as well as the demographic changes that occur worldwide and are characterized by the progressive aging of the population, professional knowledge transmission has become particularly relevant as there is a growing need to preserve and transmit the knowledge detained by experienced workers, to the so-called "novices".

Therefore, the present study focuses on the analysis of knowledge transmission processes between cooperating teachers and interns, during the Supervised Teaching Practice. In order to understand how these processes take place, under what conditions they occur, what factors impact them and what knowledge is transmitted between experienced and "novice" teachers, a non-experimental and exploratory qualitative research approach, based on semi-structured interviews, was used. This study had a total of seven participants, comprised of four interns and the three supervising teachers who accompanied them throughout the 2021/2022 school year.

The results revealed similar positions between interns and cooperating teachers regarding the factors to be considered in the transmission of information, along with various aspects that interfere with knowledge transmission, which are consistent with the constraints associated with the work activity of teaching. Additionally, the data from this research showed the cooperating teachers play a key role in the transmission of knowledge that allows for the establishment of a bridge between the interns' formal education and the reality of the teaching work activity. Furthermore, the results highlight an innovative dimension of the knowledge transmission process, which is the interns' impact, particularly in terms of potentializing the learning of the cooperating teachers through "mirrored" observation, as well as that of other interns as a result of a relationship based on mutual help, which interferes with their proximal development zone.

Keywords: Knowledge Transmission; Teaching; Cooperating Teachers; Interns.

21129 | Today adolescents, tomorrow (possible) parents. A systematic review of evidence on fertility education in adolescence

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Abstract

In developed countries, the first child's birth tends to be increasingly postponed. This decision, often involuntary, emerges from sociocultural changes in Western societies characterized by greater investment in education paths, professional careers, and job uncertainty. However, such a decision is not always based on adequate levels of reproductive awareness, which can lead to a framework of unwanted infertility and subsequent negative emotional impact. In Portugal and several countries, concern regarding this issue has led to measures and projects that aim to raise literacy in sexual and reproductive health. However, there has yet to be any study that sought to systematize the evidence around this issue. Through the current systematic review, we intend to address this gap in the literature, summarizing the available evidence on fertility knowledge and education in adolescents (10-24 years old). After duplicates are removed (n= 1791) we highlight the following exclusion criteria: 1) the study does not measure fertility awareness or does not include a fertility care intervention (n= 3969). 2) The study sample does not represent adolescence: mean age between 12 and 22 OR age range between 10 and 24 (n= 382). 3) The study is a review, opinion or brief report paper (n= 304). Results: A total of 6918 emerged from the search string in the following databases: PsycInfo, Web of science, PubMed and Scopus. Following abstract analysis, 4655 articles were excluded leaving only 472 for full text analysis. Preliminary results indicate that, despite the considerable number of articles found, only a small percentage (6.8%) of them addressed the issues of reproductive awareness, which reveals a thematic gap in adolescent population.

Keywords: fertility awareness; education health; adolescence (...).

21222 | The effect of sexual dimorphism on facial attractiveness: A deep learning approach

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Abstract

"Mirror, mirror on the wall - who's the fairest of them all?" [1]. Evolutionary theories in psychology suggest that sexually dimorphic traits are linked to perceived attractiveness, with more masculine men [2,3,4] and feminine women [5,6,7] being judged as more attractive. Additionally, symmetry has been associated with facial sexual dimorphism [8,9] and attractiveness [10,11,12]. Recently, deep learning techniques, such as Convolutional Neural Networks (CNN), have been used to predict facial attractiveness [13,14,15]. The objective of the present work is to test if beauty prediction algorithms are replicating human biases concerning facial sexually dimorphic traits. Our hypotheses are: congruent manipulations (masculinized men and feminized women) will be rated as more attractive (H1); and symmetrized versions will be perceived as more attractive (H2). This work uses transfer learning to predict facial attractiveness [16,17,18]. A set of six image recognition models were trained in four facial pictures databases with attractiveness ratings (n = 6848). The best model, VGG-19 [19], was fine-tuned achieving a high prediction correlation of .84 in the test-set. With respect to the first hypothesis, we found a surprising interaction effect between gender and sexual dimorphism. The feminized versions of the women's faces were perceived as more attractive than the masculinized ones, as well as the feminized versions of the men's faces compared to the masculinized ones. Previous studies also found a preference for feminized versions, both for males and females [6,20]. Concerning the second hypothesis, despite the symmetry main effect that was observed, post-hoc analyses suggested that symmetry increased facial attractiveness but only for feminized and masculinized versions of the female faces. Visualizations provided in Figure 1. Our data provides new evidence towards the understanding of facial attractiveness both from an algorithmic point of view as well as from the human behaviour itself.

Keywords: facial attractiveness; sexual dimorphism; symmetry; beauty prediction; explainable AI.

References

[1] Grimm, J. & Grimm, W. (1812). Snow White. In Grimms' Fairy Tales.

[2] Penton-Voak, I. S., & Chen, J. Y. (2004). High salivary testosterone is linked to masculine male facial appearance in humans. Evolution and Human Behaviour, 25(4), 229–241. https://doi.org/10.1016/j.evolhumbehav.2004.04.003

[3] Thornhill, R., & Gangestad, S. W. (2006). Facial sexual dimorphism, developmental stability, and susceptibility to disease in men and women. Evolution and Human Behaviour, 27, 131–144. https://doi.org/10.1016/j.evolhumbehav.2005.06.001

[4] Johnston, V. S., Hagel, R., Franklin, M., Fink, B., & Grammer, K. (2001). Male facial attractiveness: evidence for hormone-mediated adaptive design. Evolution and Human Behaviour, 22, 251-267. <u>https://doi.org/10.1016/S1090-5138(01)00066-6</u>

[5] Fraccaro, P. J., Feinberg, D. R., DeBruine, L. M., Little, A. C., Watkins, C. D., & Jones, B. C. (2010).
Correlated male preferences for femininity in female faces and voices. Evolutionary Psychology, 8(3), 447–461. https://doi.org/10.1177/147470491000800311

[6] Perrett, D., Lee, K., Penton-Voak, I., et al. (1998). Effects of sexual dimorphism on facial attractiveness. Nature, 394, 884–887. https://doi.org/10.1038/29772

[7] Foo, Y., Simmons, L., & Rhodes, G. (2017). Predictors of facial attractiveness and health in humans. Scientific Reports, 7, 39731. https://doi.org/10.1038/srep39731

[8] Gangestad, S. W., & Thornhill, R. (2003). Facial masculinity and fluctuating asymmetry. Evolution and Human Behaviour, 24, 231–241. https://doi.org/10.1016/S1090-5138(03)00017-5
[9] Little, A. C., Jones, B. C., Waitt, C., Tiddeman, B. P., Feinberg, D. R., Perrett, D. I., Apicella, C. L., Marlowe, F. W., & Reimchen, T. (2008). Symmetry is related to sexual dimorphism in faces: data across culture and species. PLoS ONE, 3, e2106. https://doi.org/10.1371/journal.pone.0002106
[10] Fink, B., Neave, N., Manning, J. T., & Grammer, K. (2006). Facial symmetry and judgments of attractiveness, health and personality. Personality and Individual Differences, 41(3), 491-499. https://doi.org/10.1016/j.paid.2006.01.017

[11] Jones, B.C., Little, A.C., Penton-Voak, I.S., Tiddeman, B.P., Burt, D.M., & Perrett, D.I. (2001). Facial symmetry and judgments of apparent health: Support for a "good genes" explanation of the attractiveness-symmetry relationship. Evolution and Human Behaviour, 22(6), 417-429. https://doi.org/10.1016/S1090-5138(01)00083-6.

[12] Perrett, D.I., Burt, D.M., Penton-Voak, I.S., Lee, K.J., Rowland, D.A., & Edwards, R. (1999). Symmetry and human facial attractiveness. Evolution and Human Behaviour, 20(5), 295-307. https://doi.org/10.1016/S1090-5138(99)00014-8.

[13] Bougourzi, F., Dornaika, F., & Taleb-Ahmed, A. (2022). Deep learning based face beauty prediction via dynamic robust losses and ensemble regression. Knowledge-Based Systems, 242, Article 108246. https://doi.org/10.1016/j.knosys.2022.108246.

[14] Gan, J., Xie, X., Zhai, Y., He, G., Zeng, J., Bai, Z., Labati, R., Piuri, V., & Scotti, F. (2022). Facial beauty prediction fusing transfer learning and broad learning system. Soft Computing. Advance online publication. https://doi.org/10.1007/s00500-022-07563-1

[15] Gao, L., Li, W., Huang, Z., Huang, D., & Wang, Y. (2018). Automatic facial attractiveness prediction by deep multi-task learning. In 2018 24th International Conference on Pattern Recognition (ICPR) (pp. 3592-3597). IEEE. https://doi.org/10.1109/ICPR.2018.8545033

[16] Gan, Junying & Scotti, Fabio & Xiang, Li & Zhai, Yikui & Chaoyun, Mai & He, Guohui & Zeng, Junying & Bai, Zhenfeng & Labati, Ruggero & Piuri, Vin-Cenzo. (2020). 2M BeautyNet: Facial Beauty Prediction Based on Multi-Task Transfer Learning. IEEE Access. PP. 1-1. 10.1109/ACCESS.2020.2968837.

[17] Vahdati, E., & Suen, C. (2019). Female facial beauty analysis using transfer learning and stacking ensemble model. In C. Yang, F. Hussain, A. Abraham, & S. Liu (Eds.), Advances in Computational Intelligence: 15th International Work-Conference on Artificial Neural Networks, IWANN 2019, Gran Canaria, Spain, June 12-14, 2019, Proceedings, Part II (pp. 270-282). Springer. https://doi.org/10.1007/978-3-030-27272-2_22

[18] Zhai, Y., Huang, Y., Xu, Y., Gan, J., Cao, H., Deng, W., Labati, R., Piuri, V., & Scotti, F. (2020). Asian female facial beauty prediction using deep neural networks via transfer learning and multi-
channel feature fusion. IEEE Access, 8, 94742-94752. https://doi.org/10.1109/ACCESS.2020.2980248

[19] Simonyan K, Zisserman A. (2014). Very deep convolutional networks for large-scale image recognition. https://arxiv.org/abs/1409.1556

[20] Rhodes, G., Hickford, C., & Jeffery, L. (2000). Sex-typicality and attractiveness: Are supermale and superfemale faces super-attractive? British Journal of Psychology, 91(Pt 1), 125-140. https://doi.org/10.1348/000712600161718



Figure 1: Attractiveness predictions for the non-symmetrized and symmetrized versions, both for male and female facial images.



SPORT SCIENCES



20430 | Influence of temperature on mechanisms inducing post-activation potentiation: a randomized study

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Abstract

Post-activation potentiation (PAP) is defined by Sale (2002) as an increase in the force/torque of an electrically evoked contraction after submaximal and maximal conditioned contractions. In other words, it is an increase in peak isometric force contraction or low frequency/torque tetanic force after (i) a series of evoked stimuli, (ii) an evoked tetanic contraction, or (iii) a maximal voluntary contraction (MVC) (e.g., conditioned contraction). The study and analysis of the relationship between the physiological phenomena associated with PAP and temperature manipulation could be an asset for the targeted intervention of professionals, particularly coaches and strength and conditioning coaches. The objectives were identifying the relevance of this phenomenon for the increase of performance in explosive sports athletes and explore the relationship between temperature and the occurrence of the PAP phenomenon. For that, a quantitative, cross-sectional, descriptive-correlational study with 14 athletes was carry out at the Biomechanics Laboratory of Porto (LABIOMEP). The protocols consisted of 3MVC before 10 stimuli with the current defined by the analysis of the M-wave and H-reflex at the beginning of the session. Then, the cooling or heating packs (depending on the protocol) were placed around the leg for 5 min, or the subjects remained that time at room temperature (protocol control). The protocol ended with the performance, again, of the 10 stimuli under the same conditions of current. With that, no significant differences were found in the variables in the PAP activation exploration protocol except for the MVC values (MVC with p=0.041; H-reflex with p=0.362; Mwave with p=0.258). Furthermore, no advantages were found in the manipulation of temperature under the mechanisms of activation of this phenomenon. In conclusion, further studies are needed to understand the activation of PAP mechanisms and the importance to sports performance and if cold and local heat applications genuinely modify the mechanisms of PAP activation with the exploration of different temperature manipulation methods and different exposure times to these instruments.

Keywords: Potentiation Post-Activation; Temperature; H-reflex; Maximal Voluntary Contraction; High Performance Training

References

[1] Sale, D. G. (2002). Postactivation potentiation: Role in human performance. *Exercise and Sport Sciences Reviews*, 30, 138-143.

20455 | Effects of fatigue on ground reaction forces in long-distance runners: An analysis of protocols and risk of bias

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Abstract

Running involves a cyclical series of impacts. Once gravity pulls us to earth, we apply a force on the ground that is met with an equal and opposite ground reaction force (GRF)[1]. GRF are a critical element acting on the joints of the lower limbs and the presence of fatigue has been shown to modify running biomechanics [2, 3]. This study aimed to identify, assess, and synthesize the current evidence on the effects of fatigue on GRF-related variables in long-distance runners. The PRISMA 2020 guidelines were followed. PubMed, Scopus, SPORTDiscus, and Web of Science were consulted in July 2022, followed by a search within reference lists and expert suggestions. Eligibility criteria included health competitive or recreational long-distance runners, performing running before and after an exercise-based fatigue-inducing protocol and assessing GRF-related variables during running using a treadmill or overground with a force plate. A total of 12 studies (n = 299 participants, 177 $\mathbf{Q} \otimes \mathbf{O}$ 122) were included in the study. There was considerable heterogeneity regarding age, competitive level, distances covered, nature of interventions, comparators and the testing methods, which inhibited performing a meta-analysis. Moreover, the included studies investigated different GRF-related variables (e.g. loading rate, active peak force and peak ankle plantarflexor). The GRF-related variables showed fatigue-related changes in 11 studies, but not all were significant. Most consistently across four of 12 studies loading rate increased (p = .01; p = .06; p = .04; p = .008) and impact peak force (Fpeak) significantly decreased (p < 0.05; p = 0.31[ES 0.40]; p < 0.005) post-fatigue. Three studies provided data for peak ankle plantarflexor moment and a significant decrease was observed in one study following the long run (p < .001; d 4.93 and Cl [10.40 - 15.96]). Risk of bias in the studies (see figure 1) was moderate to high and certainty of evidence was judged as very low. currently, the effects of fatigue on GRFrelated variables in long-distance runners are uncertain and it is unclear to what extent they may affect performance. Further studies should examine homogeneous samples to perform sensitivity analyses and investigate the potential effects of fatigue-inducing protocols on the GRF.

Keywords: biomechanics; fatigue; ground reaction forces; kinetics; running.

References

[1] C. Napier, *Science of running: analyse your technique, prevent injury, revolutionize your training.* Dorling Kindersley Limited, 2020.

[2] T. R. Derrick, D. Dereu, and S. P. McLean, "Impacts and kinematic adjustments during an exhaustive run," (in eng), *Medicine & Science in Sports & Exercise*, vol. 34, no. 6, pp. 998-1002, Jun 2002, doi: 10.1097/00005768-200206000-00015.

[3] M. I. Yusof, S. Shaharudin, and P. Sivalingarajah, "Does vertical ground reaction force of the hip, knee, and ankle joints change in patients with adolescent idiopathic scoliosis after spinal fusion?," *Asian Spine Journal*, vol. 12, no. 2, pp. 349-355, 2018, doi: 10.4184/asj.2018.12.2.349.



Figure 1: Risk of bias assessments (RoBANS). *Legend*: *Sample that was analysed as planned in the studies (not the initial pool of participants reported in the studies).

20640 | Post half-squat CMJ potentiation in sprint and jump male athletes

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Abstract

This study aimed to establish the optimal time intervals between a conditioning activity and the countermovement jump (CMJ) test performance in the light of the Post Activation Performance Enhancement (PAPE) protocol.

Eleven highly trained male sprinters and jumpers, (mean \pm SD, age: 22.7 \pm 4.5 years, stature: 180.4 \pm 7.2 cm, body mass: 74.8 \pm 5.5 kg) were submitted to three sets of five back-squats maintaining bar speed between 0,80 and 0,90 m/s (\pm 60%RM) as the conditioning activity. The participants completed three sessions, 48 h apart, where the protocol differed in the time interval between the conditioning activity and the post-test. Each athlete performed three CMJ before the squat sets (pre-test) and three CMJ 5, 7 or 9 min after the squat sets (post-test). It was used a Bertec 60x90 cm force platform with a sampling frequency of 2000 Hz to assess the CMJ values and surface electromyography to register the electrical activity of the medial vastus and biceps femoris during the trials. Results: five subjects showed significant improvement in jump height $(2.47\pm0.99\%)$. Three out of five with the 5 min interval $(2.69\pm0.69\%)$; one out of five with the 7 min interval (3.31%), and one out of five with the 9 min interval (0,99%). CMJ electrical activity after the conditioning activity seems to be concordant with CMJ performance. These findings suggest that time intervals influence PAPE, and the responses are extremely individualized. A high percentage of the subjects were PAPE non-responders. The small sample size is an evident limitation of this study due to the large number of non-responders. From these data it can be concluded that the more effective interval to potentiate CMJ is 5 minutes given that is linked to the higher bar velocities (0.80 and 0.90 m/s).

Keywords: Post Activation Performance Enhancement, Countermovement Jump, Squat, Track and Field.

References

[1] Blazevich, A. J., & Babault, N. (2019). Post-activation potentiation versus post-activation performance enhancement in humans: historical perspective, underlying mechanisms, and current issues. Frontiers in physiology, 10, 1359.

[2] Kilduff, L. P., Owen, N., Bevan, H., Bennett, M., Kingsley, M. I., & Cunningham, D. (2008). Influence of recovery time on post-activation potentiation in professional rugby players. Journal of sports sciences, 26(8), 795-802.

21015 | Polarized or threshold training: Is there a superior training intensity distribution to improve VO2max and endurance capacity in Wistar Han Rats?

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Abstract

The superiority of Polarized Training (POL) vs other training models is questionable due to conflicting results. This could be surpassed by rigorously controlled experimental studies. Our aim was to compare an eight-week POL vs Threshold Training (THR) protocol on maximal O_2 uptake (VO₂max) and endurance capacity (EC) in rats.

Fifteen male Wistar rats (336.1±30.4g) were divided in three groups: POL (n=5), THR (n=5), controls (CON, n=5), housed in cages with running wheel, 12/12h inverted light/dark cycle, 23°C, 50-60% humidity, with food and water *ad libitum*. After two-weeks of treadmill acclimatization, animals were tested for VO₂max (CLAMS Oxymax, Columbus Instruments). The speed corresponding to 60 and 90% VO₂max in POL and 50 and 75% VO₂max in THR were determined. EC was assessed by a treadmill exhaustion test (10° slope, initial speed 25m/min, 5m/min increments every 15min).

Both groups underwent eight-week, 5d/w treadmill running. POL performed 12min@90%VO₂max + 48min@60%VO₂max (80% low intensity/20% high intensity) while THR performed 5min@50%VO₂max + 48min@75%VO₂max (moderate intensity). Training duration was adjusted between groups to ensure similar O₂ uptake (POL=3128 O₂ L/day, THR=3277 O₂ L/day; p=.261). CON performed treadmill running 10min/d, 10m/min, 5d/w to equalize treadmill stress. At the end of the protocol animals were again assessed for VO₂max and EC.

At the beginning of the protocol there were no differences between groups in VO₂max (p=.051) or EC (p=.069). Although there were no differences in VO₂max between POL (80.6 ± 11.3 mL.Kg.min⁻¹) and THR (82.6 ± 9.7 ml.Kg.min⁻¹) at the end of training, VO₂max was higher in THR compared to CON (64.8 ± 2.9 mL.Kg.min⁻¹; p=.042). Both POL ($2056\pm122m$; p<.01) and THR ($2134\pm413m$; p<.01) had a significantly higher EC compared to CON ($823\pm223m$) at the end of the training protocol, but there were no differences in EC between POL and THR. In conclusion, there were no differences in VO₂max and EC after eight-week of POL or THR training.

Keywords: Polarized Training; Threshold Training; Training Intensity Distribution; Endurance Training; VO₂max; Endurance Capacity.

Acknowledgements

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21045 | Does adding high intensity exercise to an aerobic training intervention significantly increases skeletal muscle mass?

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Abstract

Aerobic training might favour muscle mass loss while high intensity exercise may stimulate hypertrophy. Our aim was to compare muscle mass and strength adaptations in continuous moderate intensity (THR) vs polarized training (POL) interventions.

Fifteen male Wistar rats (eight weeks, 336.1±30.4g) were divided in three groups: THR (n=5), POL (n=5), control (CON, n=5), housed in cages with running wheel, food and water *ad libitum*. Maximal O₂ uptake (VO₂max) was determined (CLAMS Oxymax, Columbus Instruments). Treadmill speed corresponding to 60 and 90% VO₂max in POL group and 50 and 75% VO₂max in THR group were recorded. Both groups underwent then 8-week, 5d/w treadmill running. POL performed 12min@90%VO₂max + 48min@60%VO₂max (high/low intensity) while THR performed 5min@50%VO₂max + 48min@75%VO₂max (moderate intensity). Training session duration was adjusted between groups to ensure similar O₂ uptake (POL=3128 O₂ L/day, THR=3277 O₂ L/day; p=.261). CON performed treadmill running 10min/d, 10m/min, 5d/w to equalize treadmill stress. At the end of the protocol grip strength was determined (Ugo Basile, Varese, Italy). *Soleus, gastrocnemius, tibialis anterior* and *triceps brachii* muscles were collected after sacrifice and weighted.

At the end of the training protocol, CON ($399\pm28g$) was heavier than POL (359 ± 21 ; p=.028) but similar to THR (365 ± 10 ; p=.066). No differences in *soleus* (p=.078) or *triceps brachii* (p=.825) muscles mass were identified. *Gastrocnemius* mass was lower in POL ($4.61\pm0.14g$) compared to CON ($5.07\pm0.34g$; p=.038), but similar between CON and THR ($4.74\pm0.23g$; p=.163) while *tibialis anterior* was heavier in CON ($1.64\pm0.057g$) compared to both POL ($1.44\pm0.043g$; p<.001) and THR ($1.50\pm0.073g$; p=.007). There were no differences between groups regarding handgrip strength (CON=1321±36kgf, POL=1262±103kgf, THR=1264±131kgf; p=.579).

Endurance training leads to decreases in muscle mass, which are not prevented by high intensity exercise. This effect did not compromise muscle strength.

Keywords: Polarized Training; Threshold Training; Skeletal muscle hypertrophy; Endurance Training; muscle strength

Acknowledgments

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21156 | Does ACL reconstruction with hamstring tendon autograft predisposes to a knee valgus alignment on initial contact during landing? A drop vertical jump movement analysis

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Abstract

The mechanism most correlated to anterior cruciate ligament tears is the simultaneous valgus and external rotation of the knee. This study investigated if anterior reconstruction ligament (ACL) reconstruction with hamstring tendon autograft predisposes to a "knee-in & toe-out" compared to ACL reconstruction with patellar tendon autograft and to healthy individuals during a drop vertical jump.

A three-dimensional markerless motion capture was used to conduct a case control study, collecting data from 11 healthy and 14 participants who underwent ACL reconstruction, eight with hamstring tendon autograft and six with patellar tendon autograft, while performing bilateral drop vertical jump. Joint kinematic variables such as angular positions, moments and velocities were obtained by processing video recordings with Theia Markerless system and Visual3D. Differences between groups were calculated using independent Sample T-test and One-Way ANOVA with Bonferroni post hoc adjustments.

No differences were found at peak knee valgus for maximum valgus, rotation and flexion of the knee (mean difference: -2.14 \pm 1.57 deg, p=0,187, 1.04 \pm 1.97 deg, p=0.601 and -10.29 \pm 11.82 deg, p=0.393), when comparing healthy participants with those who underwent ACL reconstruction. Knee extension angular moment and angular velocity were significantly higher on the healthy participants, when compared to participants who underwent ACL reconstruction with patellar tendon autograft (mean difference: 0.65 \pm 0.18 Nm/kg, p=0.004 and -111.51 \pm 38.31 deg/s, p=0.024).

In conclusion, ACL reconstruction with hamstring tendon autograft does not increase the risk of a valgus knee alignment movement on initial contact during landing. However, differences found in various parameters may justify the evaluation of the quality movement with a motion capture system while performing the drop vertical jump for the creation of specialized rehabilitation programs.

Keywords: Anterior Cruciate Ligament Injury, Drop Vertical Jump Test, Valgus Knee Alignment

20673 | The perceptions of youth male football technical coordinators on players' longterm developmental pathways and pedagogical approaches to training

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Abstract

Despite the importance given to the long-term developmental pathways in sport and to the pedagogical approaches to training in the achievement of sporting excellence, both topics have been studied in a dissociated way, compromising therefore its understanding. Thus, the present study aims to understand the perceptions of youth male football technical coordinators on concerning the long-term developmental pathways, the pedagogical approaches used in training, as well as the way they are related in practice. Semi-structured interviews were applied to eight youth football technical coordinators from national referenced clubs. A thematic analysis was carried out to scrutinize the data. It can be concluded that technical coordinators define talent using a holistic viewpoint, emphasizing its psychological and emotional aspects, rather than solely the physical or technical/tactical factors. Concerning their perspectives about the possible developmental pathways, these converge towards an eclectic and diverse approach in the first years of development, expressing the several benefits that it brings for the youth players in a long-term. Considering the specific practice (i.e., football) in the early years, the coordinators' perspective is that it should be based on fun and play activities, rather than highly structured and specific practice. However, when it comes to the pedagogical approaches to training, most of the participants presented a coach-centred perspective, although some coordinators admit that the player should be the centre of the training process and have an active role in their learning. The present study illustrated that coordinators have an updated knowledge regarding the advantages and disadvantages of some sporting pathways, but still rely on traditional perspectives regarding the pedagogical approaches used in training. These data thus provide relevant information to inform the practice field, and specifically the coach education programmes in football.

Keywords: long-term development; early specialization; early diversification; pedagogical approaches; teaching strategies; football.

20684 | The effects of three years of regular training and competition on selected and non-selected adolescent basketball players' skill development. The INEX study

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Abstract

Due to game demands, it is important that basketballers become highly skilled from an early age. Yet, available reports regarding technical skills' development in youth basketball are surprisingly scarce. We investigated the effects of a 3-year period of formal training and competition on skill development of selected and non-selected young basketball players. A total of 147 male players from two age-categories were divided into selected (U12 SL, n=24; U14 SL, n=18) and nonselected (U12_NSL, n=52; U14_NSL, n=53) according to coaching staff when forming elite regional teams. Players were followed consecutively over three years and assessed bi-annually in six technical skills. Although this mixed-longitudinal study generated six time-points, in this paper we only used data from baseline (T1=June 2017) and last follow-up (T6=December 2019). Groups were firstly compared in T1 and T6 using an independent-measures t-test; then, we relied on a repeated-measures t-test to examine changes across time in each group. Our findings showed that the U12 SL and U14 SL were more skilled (p<0.05) than their non-selected peers in T1 and T6 (except in both slalom tests in T1 and shooting and defensive movement tests in T6 in the U14 age-category). Apart from the shooting test in the U14 age-category, the U12_NSL and U14_NSL players obtained higher gains between T1 and T6 in all skill tests (p<0.001). In conclusion, selected players showed better technical skills at baseline and at follow-up. However, in non-selected basketballers gains were more significant than in selected ones. We suggest that basketball coaches be more careful when selecting young players and base their choices on putative longterm athletic potential. This is more important during the adolescent years because coaches' decisions are susceptible to be confounded by inter-individual differences in biological maturation and/or training experience that tend to vanish once players reach the senior level.

Keywords: technical skills; development; performance; youth players; basketball.

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20816 | Association between physical fitness and cognitive function among older adults' users of day centres with suggestive major neurocognitive disorder

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Abstract

Background: The aging process is characterized by biological and physical lessens, that compromise physical capacity and lead to cognitive impairment. This study aims to ascertain the association between physical fitness (PF) and global cognitive function (GCF) among older adults with suggestive major neurocognitive disorder (MND). Methods: Seventy-five older adults (76% women, 78±8.13 years) users of day centers were assessed for CF (MoCA) and PF (SFT and hand dynamometer). CF was expressed as total MoCA (dementia: MoCA<17) and according to cognitive domains (CD). Association between PF and CF was verified with partial correlation adjusted for age and BMI. Results: Aerobic fitness was associated with GCF (r=0.281;p=0.016), short-term memory (r=0.354;p=0.002) and language (r=0.277;p=0.018). Back scratch was associated with GCF (r=0.318;p=0.006), visuo-spatial capacity (r=0.311;p=0.007) and language (r=0.326;p=0.005). Time up&go was associated with language (r=-0.251;p=0.032). Seat and stand was associated with GCF (r=0.329;p=0.004), short-term memory (r=0.446;p<0.001) and language (r=0.004,p=0.337). Elbow flexion was associated with GCF (r=0.239;p=0.042) and language (r=0.254, p=0.030). Handgrip strength was associated with GCF (r=0.302;p=0.009), attention, concentration, working memory (r=0.234;p=0.047), language (r=0.241;p=0.040) and temporalspatial orientation (r=0.310,p=0,008). Conclusions: Results showed that PF and GCF and CD are correlated, highlighting the need to implement strategies to improve PF amongst older adults with MND.

Keywords: Physical Fitness; Global Cognitive Function; Cognitive Domains.

21138 | Gender differences in Functional Movement Screen patterns in older adults

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Abstract

Aging is related to the gradual loss of functional ability, which is an important component of elderly's quality of life (Barbosa et al, 2014). Consequently, there seems to be an increased risk of falling, compromising the autonomy of the elderly (Engers et al, 2014). We aimed to analyse differences in functional movement patterns between men and women aged 65 or older. The sample comprised 73 people (19 men, 54 women, median=72, Q1=69 and Q3=77). The functional ability was assessed using the Functional Movement Screen® battery (FMS), composed of seven standardized tests. Each test was scored on a scale of 0 to 3 based on movement performance. A total score was calculated sum of the seven tests, ranging 0-21. The Mann-Whitney U Test was used to statistical analysis on SPSS. Results revealed statistical differences between genders only in the shoulder mobility test (p=0.036) and in the push-up test (p=0.007), with a better performance of females in the first test and males in the second, respectively. No significant differences were found in the individual score of the remaining tests and in total score (p>0.05). Older men and women did not significantly differ in their functional performance in most of the elderly to engage in exercises that can improve their functional capacity.

Keywords: Movement Patterns; Mobility; FMS.

References

Barbosa, B. R., Almeida, J. M., Barbosa, M. R., & Rossi-Barbosa, L. A. (2014). Evaluation of the functional capacity of the elderly and factors associated with disability. *Cien Saude Colet*, *19*(8), 3317-3325. <u>https://doi.org/10.1590/1413-81232014198.06322013</u> Engers, P. B., Rombaldi, A. J., Portella, E. G., & da Silva, M. C. (2016). The effects of the Pilates

method in the elderly: a systematic review. *Rev Bras Reumatol Engl Ed, 56*(4), 352-365. https://doi.org/10.1016/j.rbre.2016.05.005

21235 | Fear of failure in competitive sports among youth athletes: A study on the role of self-control and coping

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Abstract

Despite the many benefits of youth's involvement in sports, it can also be a source of additional stress and fear of failure. Thus, the present study aimed to understand how athletes deal with fear of failure, considering their coping skills and self-control. A sample of 328 male players ranging from 11 to 18 years old (M = 14.8), from different types of sport and competitive levels, completed three self-report measures: Performance Failure Appraisal Inventory (PFAI)¹, Brief Self-Control Scale (BSCS)² and Brief Cope³. Descriptive statistics, Pearson correlations and multiple regression were used to analyse the data.

Results suggested that higher self-control was associated with a lower tendency to experience fear of devaluing one's self-estimate, fear of having an uncertain future, fear of important others losing interest, fear of upsetting important others, and fear of experiencing shame and embarrassment. Regarding the associations with coping, results suggested that emotion and avoidance-focused strategies tend to be associated with higher levels of fear of failure.

Regression analyses also revealed that athletes with lower levels of self-control are more prone to experience fear of failure during competition, for example, when facing fear of experiencing shame and embarrassment in large quantities, self-control is likely to decrease, as well as with fear of devaluing one's self-estimate. Therefore, self-distraction, self-blame and religion stood out in terms of predicting higher levels of fear of failure.

These findings indicate that adaptative coping and self-control are crucial in addressing the fear of failure. Therefore, practitioners should prioritize promoting effective coping strategies, such as planning, reframing, visualization, and seeking social and instrumental support to assist athletes in managing their fear of failure⁴. Furthermore, as self-control is highly associated with well-being⁵ promoting this skill among young athletes would enhance their satisfaction with sports.

Keywords: Fear of failure; coping; self-control; sports competition.

References

[1] Conroy, D. E., Metzler, J. N., & Hofer, S. (2002). Multidimensional fear of failure measurement: The Performance Failure Appraisal Inventory. *Journal of Applied Sport Psychology*, 14, 76-90.

[2] Tangney J.P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality*, 72, 271-324.

[3] Carver, C. S. (1997). You want to measure coping but your protocol's too long: Consider the Brief Cope. *International Journal of Behavioural Medicine*, 4, 92-100.

[4] Sagar, S. S., Lavallee, D., & Spray, C. M. (2009). Coping with the effects of fear of failure: A preliminary investigation of young elite athletes. *Journal of Clinical Sport Psychology*, *3*(1), 73-98.

[5] De Ridder, D., & Gillebaart, M. (2017). Lessons learned from trait self-control in well-being: Making the case for routines and initiation as important components of trait self-control. *Health Psychology Review*, *11*(1), 89-99.

20672 | Breaststroke pull-out velocity-time curve profile and kinematics: Comparison between male and female swimmers

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Abstract

The official rules for the breaststroke race start and turn sections allow to perform a single lower limbs and upper limbs action at any moment of the underwater path. While the most frequent approach is to perform the "lower limbs first" pull-out technique¹, it remains unclear if any sex difference may exist in this pattern. The current study aimed to compare the velocity-time curve profile and kinematics between male and female swimmers during the breaststroke pull-out technique. Sixteen swimmers (nine males and seven females) completed 3x25 m maximal breaststroke using the "lower limbs first" pull-out technique with the glide (from the wall pushoff until the streamlined position deviation for lower limbs action), propulsion (until the lower and upper limbs start to flex) and recovery (until the head breaks the water surface) being defined as underwater sequential phases. A mechanical speedometer retrieved the instantaneous data for each phase duration, distance, maximal velocity, and mean velocity calculations. Statistical Parametric Mapping (SPM {t}, 101 data points) was used to compare velocity-time curves of each phase and an independent-sample t-test was computed to assess sex differences ($p \le 5\%$). The velocity-time curve profile (Figure 1) showed sex differences in three time points of the glide phase (1st: 23.59-25.72%, p=0.04; 2nd: 31.56-42.34%, p<0.01; 3rd: 53.55-62.82%, p<0.01). The kinematic analysis revealed differences between males and females in maximal velocity (3.26±0.31 vs 2.78±0.20 m.s⁻¹, p<0.01) and mean velocity (2.08±0.17 vs 1.86±0.15 m.s⁻¹, p=0.01) of the glide phase, and in mean velocity (1.65±0.13 vs 1.51±0.10 m.s⁻¹, p=0.04) and maximal velocity of the upper limbs action (2.33±0.23 vs 1.91±0.07 m.s⁻¹, p<0.01) of the propulsion phase. Male and female swimmers differ in velocity-time curve profile and kinematics of the glide and propulsion phases during the breaststroke "lower limbs first" pull-out technique.

Keywords: biomechanics, curve profile, velocity, swimming, pull-out, sex

References

[1] McCabe, C., Mosscrop, E., Hodierne, R., & Tor, E. (2022). The characteristics of the breaststroke pullout in elite swimming. *Frontiers in Sports and Active Living*, 4, 963578. http://doi:10.3389/fspor.2022.963578



Figure 6: Velocity-time curves (mean and one standard) and comparison between male and female swimmers. Glide, propulsion, and recovery phases (upper, middle and lower panels, respectively; $p \le 5\%$).

20675 | Internal load during formal training and competition in young basketball players

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Abstract

This study addresses an apparently timeless question - do players and teams practice like they play? Although this is a common matter of debate among coaches, the available data concerning the training loads in youth basketball remains limited. Hence, we quantified and compared the internal responses between training and competition in an under-16 basketball team. Thirteen adolescent male basketball players, aged 15.30±0.88 years and with 7.31±2.53 years of accumulated training experience, were monitored during 32 formal basketball training sessions and 10 official games over 10 consecutive in-season weeks. Maximum heart rate (HRmax), relative heart rate (%HRmax), mean heart rate (HRmean), and the time spent on five different HR zones (zone 1=50-60% HRmax; zone 2=60-70% HRmax; zone 3=70-80% HRmax; zone 4=80-90% HRmax; zone 5=90-100% HRmax) were assessed. Then, absolute and relative internal load were calculated using the Summated Heart Rate Zones (SHRZ) model. Given the sample size, comparisons were done using the Wilcoxon signed-rank test. The results showed that adolescent basketballers attained higher HRmax (Z=-2.98; p<0.01; r=0.93), %HRmax (Z=-3.18; p<0.01; r=1.00), HRmean (Z=-3.18; p<0.01; r=1.00) and relative SHRZ (Z=-3.18; p<0.01; r=1.00) during competition, whereas absolute SHRZ (Z=-2.06; p<0.05; r=-0.65) was greater during formal training. Players spent more time during practices in HR zones 1, 2, and 3 (Z=-3.18; p<0.01; r=-1.00). Inversely, it was during games that players stood longer in HR zones 4 and 5 (Z=-3.18; p<0.01; r=1.00). In conclusion, the internal responses experienced by the youngsters during competition surpassed those experienced during formal basketball practices. Based on our findings, we recommend that basketball coaches monitor their players and design training sessions including tasks aligned with superior competitive demands.

Keywords: heart rate; internal training load; youth basketball; team sport.

20706 | Bone site-dependent responsiveness to swimming exercise in male Wistar rats

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Abstract

Swimmers usually show lower bone mass than athletes from high-impact sports or physically active counterparts, specially at weight bearing anatomical regions. In animal models this evidence is controversial. The aim of this work is describing rats' bone response to swimming in weight bearing and non-weight-bearing anatomical sites. Male Wistar rats were randomized into swimming (SG; n=9), swimming *plus* running wheel (SWG; n=10) or running wheel groups (WG; n=10). SWG and WG were individually housed in cages with running wheel. SG and SWG swam during eight-months, two hours/day, five days/week. Body weight, food intake and running distance were recorded. After sacrifice, gastrocnemius and soleus muscles were collected and weighted. Three-point bending test was performed to assess the femur biomechanical properties. Tibia (proximal; midshaft), femur (distal diaphysis; epiphysis) and lumbar vertebra geometry and trabecular (Tb) microarchitecture were analysed through micro-computed tomography.

No differences were found between groups regarding biomechanical variables and bone geometry parameters. At weight-bearing sites, SWG presented lower tibia Tb.number (p=.04; d^2 =0.22), lower femur Tb.volumetric bone mineral density (vBMD) (p=.003; d^2 =0.02) and higher tibia Tb.separation (p=0.04; d^2 =0.21) compared to WG. At non-weight-bearing sites, SG had higher lumbar Tb.connectivity (p=.001; η^2 =0.48) than other groups and both swimming groups showed lower Tb.separation (p<0.001; η^2 =0.46) than WG. Positive correlations were observed between body weight and tibia Tb.number (p=0.048; r= 0.37) and femur Tb.vBMD (p=0.01; r= 0.47). Body weight (p=0.002; η^2 =0.38) and muscle mass (p=0.002; η^2 =0.39) were higher in WG

compared to swimming groups. No differences in running distance or food intake were observed. Therefore, similarly to humans, swimming in rats might elicit a site-dependent bone response, with favorable microarchitectural effects at non-weight-bearing sites, but neutral effects at weight-bearing sites.

Keywords: Swimming; Bone tissue; Bone health

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20976 | Analysis of the swimming velocity profile obtained through inertial kinematics

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Abstract

Velocity is the key parameter in swimming performance¹. Speedometers have been frequently used to determine swimmers' velocity profile but, in the last years, several studies have been also conducted with inertial sensors. These sensors brought the possibility to continuously monitor swimming in specific aquatic environment for extended periods without major technical and logistical constraints². Being a promising tool, a more detailed analysis of the velocity profiles obtained for different swimming techniques are needed to determine its usefulness for swimmers' performance evaluation. The current study aimed to assess the speed of breaststroke swimmers using inertial sensors as an alternative to speedometers. A group of 16 trained swimmers (9 males and 7 females) with 19.63 \pm 2.63 years, 169.13 \pm 9.99 cm height and 62.25 \pm 10.82 kg, performed a 25 m breaststroke sprint starting in-water. An inertial sensor (GT9XActiGraph Link) was placed in swimmer's sacrum direction to access acceleration. All efforts were video recorded using a Go Pro camera (Hero Black 6). The acceleration curves (including push-off, underwater gliding and swimming phases) were used to determine the velocity variation over time, with negative swimming velocity values being observed in few swimmers, mainly corresponding to the lower limbs' recovery phase. However, no negative values were observed during the push-off and underwater gliding phases. It should be highlighted that cable speedometers do not measure negative speed values but, by observing our synchronized swimming images, it is clear a slight hip backward movement during the lower limbs' recovery. In conclusion, inertial sensors show a higher potential for breaststroke swimming velocity analysis compared to cable speedometers. However, further studies should be conducted to understand the relationship between fixed point kinematics (i.e sacrum) and the centre of mass displacement using IMU devices.

Keywords: Kinematics; Inertial sensors; Velocity variation; Breaststroke.

References

[1] Dadashi, F., Crettenand, F., Millet, G. P., & Aminian, K. (2012). Front-crawl instantaneous velocity estimation using a wearable inertial measurement unit. *Sensors (Basel, Switzerland)*, *12*(10), 12927-12939. https://doi.org/10.3390/s121012927

[2] Guignard, B., Rouard, A., Chollet, D., & Seifert, L. (2017). Behavioural Dynamics in Swimming: The Appropriate Use of Inertial Measurement Units. *Front Psychol, 8*, 383. <u>https://doi.org/10.3389/fpsyg.2017.00383</u>

21014 | Effect of polarized vs other types of endurance training intensity distribution on cardiorespiratory function: A systematic review with meta-analysis

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Abstract

The optimal regimen for training endurance athletes has mostly evolved by trial and error throughout time. Recent evidence suggests that Polarized Training (POL) distribution might be superior to other traditional training intensity distributions (TID) (e.g., threshold training and pyramidal training) for the improvement of endurance performance. Our objective was to systematically review and meta-analyse the evidence comparing the effect of a POL vs other TIDs interventions on surrogates of endurance performance in athletes and sedentary subjects.

The PRISMA 2020 guidelines were followed, and the protocol was beforehand registered at PROSPERO (CRD42022365117). PubMed, Scopus, and Web of Science were searched between the 10^{th} and 20^{th} october 2022. Studies were selected if they included: healthy subjects, a POL training group, other TID training groups, \geq four weeks intervention duration, one measurement before and after the intervention, assessed at least one of the following variables: VO₂max/peak, time-trial (TT), time to exhaustion (TTE) and speed or power at the second ventilatory or lactate threshold (VT₂/LT₂).

Searches yielded 276 reports, 18 of which met the inclusion criteria (n= 466 subjects). Of all the variables analysed, the pooled effect estimates suggest that POL is only superior to other TIDs in improving VO₂max/peak (SMD=0.24 [95% CI 0.01, 0.48]; z = 2.02 (p = 0.040); n = 284; l² = 0%). For all the remaining endurance performance surrogates analysed, POL was not shown to be superior to other TIDs, namely regarding TT (SMD = -0.05 [95% CI -0.31, 0.21]; z = -0.36 (p = 0.72); n = 233; l² = 0%), TTE (SMD=0.30 [95% CI -0.20, 0.79]; z = 1.18 (p = 0.24); n = 66; l² = 0%) and speed or power at VT₂/LT₂ (SMD=0.04 [95% CI -0.21, 0.29]; z = 0.32 (p = 0.75); n = 253; l² = 0%). Our results therefore suggest that POL is superior to other TIDs only in the improvement of VO₂max/peak but that it is similar to other TIDs on the remaining surrogates of endurance performance analysed.

Keywords: Polarized Training; Training Intensity Distribution; Endurance Training; VO₂max; Time Trial; Time to exhaustion; Lactate threshold

Acknowledgments

This work was funded by FCT grants UIDB/00617/2020 and LA/P/0064/2020. Giorjines Boppre is supported by FCT grant SFRH/BD/146976/2019.

20758 | Women's participation in decision-making positions in municipal sports management: A study in the Comunidade Intermunicipal do Tâmega e Sousa

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Abstract

The increasing of women's representation in top sport management positions is visible, yet men are still dominant in these roles, leading to a level of inequality in sport management. To understand how this phenomenon expands to local government sport management, this study aims to understand the participation of women in local government sport management. A survey with women holding relevant positions in the management of local sports in the municipalities belonging to the "Comunidade Intermunicipal do Tâmega e Sousa" was carried out. Six women composed the sample and were interviewed using a semi-structured script. Data reveals that women in local sports management are under-represented, in parallel to what happens in national and international sports organizations. Although they do not feel discriminated, they perceive that the stereotypes created persist in society regarding sport being for men and led by men, and family responsibilities being attributed to women, despite the fact that they take on the functions in the public sphere on a full-time basis just like men. Public policies were mentioned, more specifically the parity law as a means of leveraging women in the world of leadership and countering stereotypes and barriers, but they agree that women are capable or more capable than men, and should assume the decision-making positions by meritocracy and not by imposition of laws.

Keywords: Gender Equality; Gender Quotas; Sport Management; Leadership; Sport.

20940 | Effect of entrepreneurship training in sport university students

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Abstract

Several pieces of research have focused on initial training in entrepreneurship in higher education and the skills development of entrepreneurs (Naia et al., 2015). Entrepreneur training content is case-sensitive, results of effective change in the entrepreneurial attitude are diverse, and startup creation is minimal (Martin et al., 2013). Curiously, no studies focused on sport-students' as entrepreneurs. The purpose of the present study was to diagnose the impact that entrepreneurship training has on sport-students, particularly in developing an entrepreneurial attitude and in the consequent creation or innovation of companies. The sample consisted of 32 students of the Master in Sports Management at FADEUP from the academic years of 2019/2020 and 2020/2021 who attended the curricular unit of Sports Project Management. This curricular unit aims for students to apprehend knowledge related to entrepreneurship and innovation, develop the capacity for initiative, creativity, and autonomy, and acquire teamwork and project leadership skills. To understand the impact and effect of entrepreneurship training on students, the research team created and applied a questionnaire consisting of closed and semi-open questions. The answers treatment was qualitative and quantitative. The results showed that the training in entrepreneurship of sports students tends to be well accepted, corresponding to the expectations. Students consider the new knowledge applicable, namely improving professional performance. The topics considered as principal were brainstorming and business idea development. Students also suggested others like finance-related subjects. Entrepreneur training positively changed students' entrepreneurial attitudes within the same profile. Still, the sports field could need more expression in creating new companies (start-ups) and their innovation, a result that follows the literature.

Keywords: Entrepreneurship, Education, Entrepreneurial Attitude, Innovation, Creation.

References

Naia, A., Baptista, R., Januário, C., & Trigo, V. (2015). Entrepreneurship education literature in the 2000s. Entrepreneurship education literature in the 2000s (1), 111-135.

Martin, B. C., McNally, J. J., & Kay, M. J. (2013). Examining the formation of human capital in entrepreneurship: A meta-analysis of entrepreneurship education outcomes. Journal of Business Venturing, 28, 211-224.

21041 | How are sport participation patterns of youth team sport players shaping up? A snapshot from Portugal

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Abstract

This study aims to characterise the sports participation trajectory of 546 young male players of basketball (166), volleyball (79), football (113), water Polo (84) and handball (111) in Portugal. A retrospective questionnaire was used to identify sport starting age (general sports and main sport) and the quantity and type of sports undertaken during the early years of development (6 to 12 years old). A mixed-ANOVA and Chi-Square tests were implemented. Concerning the sport starting age and number of sports practised during the early years of development, results showed that all participants started involvement in sports at the same age (~ five years) and participated in the same number of sports during their early years (one or two sports). However, significant differences were observed related to the type of sports practised, namely in the age of initial participation in the main sport and in the age of specialisation. Here, football players started participating mainly in team games (football, futsal) and water polo players in CGS (centimetres, grams, or seconds) sports (swimming). Participants reported different ages for initial participation in: (i) main sport (football players started participating earlier, around 5-6 years), (ii) onset of specialisation (football players specialised earlier, around 7-8 years), (iii) types of sports engaged in (football players were involved in more team games and water polo in more CGS sports), and (iv), variations in weekly training hours (water polo reported more hours of training). This study provided empirical evidence for understanding effects of different sporting pathways on long-term athlete development. Some key incongruities between contemporary knowledge and practice are acknowledged. Further investigations should be developed examining trajectories in different sports, countries, genders, and cultural contexts.

Keywords: early specialisation, early diversification, quantity and type of sports, sporting pathways, youth sports.

21043 | Multidisciplinary swimming teaching model: Subjective teachers' perception

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Abstract

Swimming teaching has been focused on the learning of the four traditional swimming techniques and respective starts and turns. More recently, a multidisciplinary model has emerged¹, suggesting the inclusion of contents from other aquatic disciplines. This multidisciplinary approach is based on the differential learning concept² and is new for many swimming teachers, whose opinion about it is unknown. The current study intends to compare swimming teachers' subjective perception about the multidisciplinary model at the initial contact and after one year of use. Six experienced (> 5 years) swimming teachers (two males and three females) were interviewed at after three months and one year of using a multidisciplinary model composed by contents of swimming, artistic swimming and water polo. Interviews were semi-structured with focus in three main topics: difficulties in teaching artistic swimming and water polo, applicability of the model to young children and overall evaluation of it. Teachers' answers were transcribed verbatim. Data were analysed using deductive content procedures. In the initial contact, all revealed difficulty in teaching artistic swimming and two teachers in artistic and water polo. After one year, three had the same opinion, one mentioned water polo only and another no longer had difficulties with the process. Initially, two teachers referred to a positive impact in youngers motivation and four had difficulties in choosing and introducing the contents in this group. After one year, all gave very detailed technical information about the application of the model to the children, knowing exactly their major difficulties. The initial opinion about the teaching model was positive, even if was harder to teach and to make it clear for the learners. After one year, all teachers were very sure and enthusiastic about the positive effect of the model, both regarding learners' motivation and in water competence development. Multidisciplinary swimming teaching seems to be a promising model and should be promoted widely in swimming schools.

Keywords: Teaching, Swimming, Multidisciplinary model

References

[1] Vieira L, Sarmento M, Canossa S, Vilas-Boas JP, Fernandes RJ, Soares S (2022). Reflexão conceptual sobre a atual escola de natação decorrente de abordagens de âmbito multidisciplinar. Abstracts of the XLIV Technical and Scientific Congress of the Portuguese Association of Swimming Technicians - APTN & I European Swimming Coaches Conference. Revista Motricidade. Vol. 18 (Suppl. 1): 8.

[2] Tassignon, B., Verschueren, J., Baeyens, J.-P., Benjaminse, A., Gokeler, A., Serrien, B. and Clijsen, R. (2021). An Exploratory Meta-Analytic Review on the Empirical Evidence of Differential Learning as an Enhanced Motor Learning Method. Front. Psychol., Sec. Movement Science and Sport Psychology Volume 12 - 2021 | <u>https://doi.org/10.3389/fpsyg.2021.533033</u>

POSTER SESSIONS







AGROFOOD



20566 | A safe and targeted approach to developing specific bio-pesticides: identification of essential genes in the invasive pest red palm weevil (*Rhynchophorus ferrugineus*)

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Abstract

The current control methods to manage insect pests are often ineffective, highlighting the necessity for novel strategies, such as (RNAi) using double-stranded RNA (dsRNA) to control these pests, including the red palm weevil (RPW; *Rhynchophorus ferrugineus*), a palm tree damaging invasive insect.

In earlier studies, our team showed with great success that dsRNA-expressing bacteria targeting two housekeeping genes, α -actin and β -tubulin, significantly reduced gene expression and resulted in mortality in RPW larvae. Our current research expands on this accomplishment by focusing on building a cDNA library from RPW larvae tissue for RNAi screening of potential new specific targets for RPW control. Our strategy is an original and creative way to achieve targeted RNAi-based pest control, as we have developed a dsRNA delivery technique, by feeding RPW larvae the dsRNA-expressing bacterium.

First, a cDNA library will be constructed from total RNA of RPW's larval midgut tissue using the SMART[™] cDNA Library Construction Kit and cloned into a derivative of plasmid L4440 carrying two asymmetric Sfil restriction sites. The cloned cDNA library will be transformed into the long dsRNA-expressing *E. coli* HT115 strain. Recombinant clones will be incorporated into the larval diet and used to feed 1st instar RPW larvae. The clones that impair larval growth or cause larval mortality will be identified by reverse engineering and characterized by qPCR.

In this study, a novel delivery strategy for RNAi screening of a cDNA library is used to identify new target genes for RPW control. While reducing environmental impact and resistance development, the successful development of RNAi-based pest management approaches can increase ecological sustainability and agricultural productivity. The findings from this research could have implications for various agricultural and natural environments in addition to palm cultivation.

Keywords: bioassays; ecosystem health; environmentally friendly; insects; invasive pest; pest management; mutagenic plasmid; recombinant bacteria; targeted approach; sustainable agriculture; weevils.

Acknowledgments

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References

[1] Abe, F., Hata, K., & Sone, K. (2009). Life history of the red palm weevil, Rhynchophorus ferrugineus (Coleoptera: Dryophtoridae), in Southern Japan. Florida Entomologist, 92(3), 421-425.

[2] Ali, N., Datta, S. K., & Datta, K. (2010). RNA interference in designing transgenic crops. GM crops, 1(4), 207-213.

[3] Ayra-Pardo, C., Raymond, B., Gulzar, A., Rodríguez-Cabrera, L., Morán-Bertot, I., Crickmore, N., & Wright, D. J. (2015). Novel genetic factors involved in resistance to Bacillus thuringiensis in Plutella xylostella. Insect molecular biology, 24(6), 589-600.

[4] Ferry, M. (2019). Review Paper (Control: Insects) The world situation and the main lessons of 30 years of fight against the red palm weevil.

[5] Rabiey, M., Hailey, L. E., Roy, S. R., Grenz, K., Al-Zadjali, M. A., Barrett, G. A., & Jackson, R. W.
(2019). Endophytes vs tree pathogens and pests: can they be used as biological control agents to improve tree health? European Journal of Plant Pathology, 155(3), 711-729.

[6] Rodrigues, T. B., Mishra, S. K., Sridharan, K., Barnes, E. R., Alyokhin, A., Tuttle, R., Kokulapalan, W., Garby, D., Skizim, N. J., & Tang, Y.-w. (2021). First Sprayable double-stranded rNA-based biopesticide product targets proteasome subunit beta type-5 in Colorado potato beetle (Leptinotarsa decemlineata). Frontiers in plant science, 12.

[7] Santos, A. I., & Calafate, L. (2018). Espécies invasoras. Revista de Ciência Elementar, 6(1).

[8] Seebens, H., Blackburn, T. M., Dyer, E. E., Genovesi, P., Hulme, P. E., Jeschke, J. M., Pagad, S., Pyšek, P., Winter, M., & Arianoutsou, M. (2017). No saturation in the accumulation of alien species worldwide. Nature communications, 8(1), 1-9.

[9] Silva, D. Bacteria-mediated RNA interference in Rhynchophorus ferrugineus (Olivier, 1790). Thesis (Master's Degree in Cellular and Molecular Biology)– Department of Biology, Faculty of Sciences of University of Porto (FCUP).

[10] Zhu, K. Y., & Palli, S. R. (2020). Mechanisms, applications, and challenges of insect RNA interference. Annual review of entomology, 65(1).

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Figure 1: Schematic illustration of a cDNA library in bacteria, highlighting the different targeted genes and the dsRNA production system.

20835 | Reduction of tannin content in acorns: evaluation of different extraction methods

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Abstract

The acorn is a fruit of the Quercus genus, which includes oaks (*Quercus coccifera* L. and *Quercus robur* L.), cork oaks (*Quercus suber* L.) and holm oaks (*Quercus rotundifolia* Lam.). These are abundant in Portuguese territory and occupy about 36% of the national forest area.

Recently, interest in the research of this fruit as food has increased since this is a nutritious fruit with good content of calcium, iron, magnesium, potassium, phosphorus, vitamins A, vitamins E and unsaturated fatty acids. In addition, they have biologically active compounds, namely tannins, phenolic acids and flavonoids that are essential to maintain an adequate level of antioxidants that provide important functions in reducing the risk of cancer and degenerative disease. However, the consumption of tannins in high amounts can cause some health problems because they affect the bioavailability of the protein and are often considered anti-nutrients. To determine tannins in acorns, there are several extraction techniques, namely water immersion, thermal, chemical, and enzymatic hydrolysis. In this work two extraction techniques were carried out: water immersion, with water exchange at room temperature, for seven days, and thermal hydrolysis, particularly, boiling for 30 minutes. The results showed that extraction by immersion in water is more effective since it extracts 14 385.7 ± 719.0 mgEpicatechinEquivalents/L. However, after one day, the amount of tannins decreases. After seven days it only extracts 2108.3 \pm 232.4 mgEE/L, while thermal hydrolysis extracts 12 814.3 \pm 1527.5 mgEE/L after being boiled twice, although faster, there is energy expenditure. During the work, tannins in the dry matter will still be analysed until acorns can be obtained with a lower amount of tannins that do not cause a high bitterness and astringency for human consumption.

Keywords: acorn; tannins.

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20893 | Characterization of wine residues and potential application in food industry

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Abstract

The production and commercialization of wine is one of the most important economic activities in Portugal and is also responsible for a huge production of residues. The crescent environmental conscience and the government regulations increasingly promote more sustainable production practices creating new challenges, such as the reuse or the destination of the generated waste.

This study aims to determine the potential of the wine production residues as source of antioxidants for their possible incorporation in food products. For that, different residues, namely grape pomace, stalk and must from two different varieties (*Cerceal Branco* e *Tinta Miúda*), were used. This samples were submitted to different extraction techniques: ultrasound-assisted extraction (UAE), microwave-assisted extraction (MAE), subcritical water extraction (SWE) and conventional extraction (CE). Then, the obtained extracts were characterized by implementation of different spectrophotometric assays.

The results obtained revealed that SWE from *Cerceal Branco* grape stalk, extracted at 150° C, exhibited the highest total phenolic content ($16.9 \pm 0.1 \text{ mg GAE/g fw}$). Regarding total tannins content, the grape must from *Tinta Miúda* presented 499.6 ± 7.8 mg EE/g fw. The highest antioxidant activity, evaluated by ABTS and FRAP assays, was obtained for grape stalk from *Cerceal Branco* variety for the extracts obtained by SWE at 150° C and UAE ($19.9 \pm 0.3 \text{ and } 40.5 \pm 3.1 \text{ mg AAE/g fw}$, respectively). Work is in progress to identify the individual phenolic compounds of the obtained extracts which can be contributing to the presented antioxidant properties, using high performance liquid chromatography with diode array detection.

Keywords: wine residues; sustainability; antioxidants; extraction; functional products.

Acknowledgments

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20941 | Development of a bioactive food packaging based on starch, fibers from chestnut shells and chayote peel extract

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Abstract

The plastic films used in food preservation are associated with environmental pollution and health risks. In this study, the 37% ethanol extract of chayote (*Sechium edule*) peels (CpE) was added at 2, 4 and 8% (w/w) to the filmogenic solution of potato starch and fibers extracted from chestnut shells, and the obtained films were evaluated for their physical, mechanical, barrier and antioxidant properties, as well as their morphological characteristics. Additionally, the applicability of the developed active films to increase the shelf life of dried chayote was assessed (Figure 1).

CpE conferred a green coloration to the films without altering the infrared spectrum of the films. Moreover, all prepared active films were biodegradable and showed a continuous and compact morphological structure. With the increase in CpE concentration, the opacity, elongation at break, and water vapor permeability of the films increased, whereas the rigidity of the films decreased. The starch-fibers-based film containing 8% CpE presented higher color intensity, opacity, thickness, elongation at break, puncture deformation, solubility, antioxidant activity (59-83% of ABTS*+ inhibition) and phenolic compounds, while puncture strength decreased. Dried chayote wrapped with the starch-fibers/8%CpE-based film for a period of two weeks were well appreciated by an experienced sensory panel, showing pleasant smell and flavor. Moreover, the contents of vitamin C and phenolics contents in the dried chayote wrapped with the starch-fibers/8% CpE-based active film were higher than those in the unwrapped samples and packed with commercial plastic.

These results indicate that chayote peel extract is suitable for developing starch-fibers-based films with enhanced performance for food packaging.

Keywords: active film; starch; chestnut shells; chayote extract

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Figure 1: Development, characterization, and application of a bioactive food packaging based on starch, fibers from chestnut shells and chayote peel extract.

20993 | Sustainable extraction of antioxidant compounds from shrimp shell waste

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Abstract

Shrimp shells are an abundant residue due to the increase of its consumption on a global scale and they are mostly disposed into landfills or back into the ocean being associated with several environmental issues; therefore, it is urgent to find them a profitable end. Due to its chemical composition, shrimp shells can present themselves as an interesting source of antioxidant compounds, which can be used in high-value products.

The main goal of the present work was to efficiently extract antioxidant compounds from shrimp shells waste. For that, two environmentally friendly extraction techniques, namely ultrasound-assisted extraction (UAE) and subcritical water extraction (SWE), were optimized and compared to conventional extraction (CE). Then, to determine which one of tested extraction techniques was more efficient, different colorimetric methods, namely total phenolic (TPC) and carotenoid content (TCC), ABTS radical scavenging activity and Ferric Reducing Antioxidant power, were applied. From the tested techniques, SWE at 200°C presented the best results, with a TPC and TCC of 5.36±0.07 mg GAE/g dw and 59.8 ±1.0 mg carotenoids/g dw, which were at least 5-fold higher than the values reported for the CE (1.2±0.3 mg GAE/g dw and 9.0±0.1 mg carotenoids/g dw). Work is in progress to identify which individual phenolic compounds can be extracted from shrimp shell waste, using high performance liquid chromatography with diode array detection.

Keywords: shrimp shells; sustainability; antioxidants; sustainable extraction techniques.

Acknowledgments

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21001 | Nutritional characterization of coffee pulp, a by-product of coffee industry

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Abstract

Coffee industry creates a lot of waste and by-products, including pulp/husks, mucilage, parchment, defective beans, silverskin, and spent coffee grounds, most of which are disposed of in landfills [1]. This highlighted the need for research in order to make this industry more sustainable, contributing to a circular economy, and reducing waste. Recently, due to its nutritional value and health benefits, coffee pulp was approved as a novel food [2]. Existing research shows that coffee pulp contains a high concentration of bioactive substances such as phenolic compounds and caffeine [1].

The main objective of this study was to perform a nutritional characterization of the Colombian coffee pulp to better assess its potential applications. Dried samples were kindly provided by a Colombian producer through a national coffee importer and roaster company (JMV-José Maria Vieira, SA). The following parameters were determined: moisture, protein, lipids, dietary fiber (total, soluble, and insoluble), and ash contents by AOAC methods [3].

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The results showed that coffee pulp from *Coffee arabica* is mainly composed of dietary fiber (36.99% insoluble and 9.13% soluble, in dry weight [dw]). In addition, coffee pulp contains significant protein (10.23% dw) and ash (10.72% dw) contents, and a low-fat amount (1.70% dw). In conclusion, coffee pulp has an interesting nutritional profile and may be of interest in the development of functional foods that support sustainability, food security and health.

Keywords: Coffee arabica, novel food, food security.

Acknowledgements

This work was funded by the project PTDC/SAU-NUT/2165/2021- COBY4HEALTH- Can coffee byproducts decrease the risk of metabolic syndrome? A comprehensive approach to reduce waste and valorize health benefits, funded by Fundação para a Ciência e Tecnologia (FCT)/ Ministério da Ciência, Tecnologia e Ensino Superior (MCTES), Portugal.

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References

[1] Machado, M. et al. Critical Reviews in Food Science and Nutrition, (2023), 1-20.

[2] EFSA Panel on Nutrition, et al. EFSA Journal, 20 (2022), e07085.

[3] AOAC. Official Methods of Analysis of AOAC International, 21st ed. (2019), Volume 1.

21032 | Design and Characterization of a "Pera rocha do Oeste" and strawberry structured product

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Abstract

Structured Fruits (SFs) are textured products made with pulp fruit and small concentration of hydrocolloids. This study evaluated the addition of glycerol and the effect of dehydration of strawberries for a period of 6 or 12 hours in the preparation of a "Pera rocha do Oeste" and strawberry structured product. For this purpose, four SFs were prepared using 100 g of fruit (80 g of pear pulp + 20 g of strawberry) and a hydrocolloid composition of 2.25% agar and 2.4% locust bean gum in relation to agar. SFs were evaluated regarding pH, moisture, water activity, carbohydrates, reducing sugars, dietary fiber, and ash contents, as well as antioxidant activity (DPPH, FRAP and ABTS assays and total phenolic contents) and sensorial attributes by a group of 13 untrained panelist of both genders, using a five-point hedonic scale ("1-dislike extremely" – "5-like extremely").

The SF prepared with glycerol (sample B) and 6h-dehydrated strawberry (sample C) were scored with higher "global acceptance" and "general flavor". Samples A and B were the preferred products concerning the "pear flavor" attribute (mean score of 3.2), while the SF prepared with dried strawberry (samples C and D) were scored with higher "strawberry flavor" and "sour taste". Concerning the antioxidant capacity (ABTS++ results) of the formulated products, the mean values found were 168, 282, 328 and 442 mg Trolox Equivalents/ 100 g fw for samples A, B, C and D, respectively. The ABTS results were positively correlated with the results of DPPH, FRAP and total phenolic content assays. These results suggest that dehydration of strawberry for a period of 6 or 12 h contribute to the formulation of SF with higher antioxidant activity.

Overall, this study provides a promising perspective to produce a mixed "Pera rocha do Oeste" and strawberry structured product with good sensorial acceptance and antioxidant properties.

Keywords: structured fruits, hydrocolloids, pear, strawberry.

Acknowledgments

This work received financial support from PT national funds (FCT/MCTES, Fundação para a Ciência e Tecnologia and Ministério da Ciência, Tecnologia e Ensino Superior) through the projects UIDB/50006/2020 and UIDP/50006/2020. Elsa F. Vieira thanks FCT for funding through the Individual Call to Scientific Employment Stimulus (CEECIND/03988/2018) and to REQUIMTE/LAQV. Authors also thank the project SYSTEMIC "an integrated approach to the challenge of sustainable food systems: adaptive and mitigatory strategies to address climate change and malnutrition". The Knowledge hub on Nutrition and Food Security has received funding from national research funding parties in Belgium (FWO), France (INRA), Germany (BLE), Italy (MIPAAF), Latvia (IZM), Norway (RCN), Portugal (FCT), and Spain (AEI) in a joint action of JPI HDHL, JPI-OCEANS and FACCE-JPI launched in 2019 under the ERA-NET ERA-HDHL (no 696295).



Figure 1: Sensory profiles of mixed "Pera Rocha do Oeste" and strawberry SF based on averages of ratings by n= 13 panelists. Scale: 1-dislike extremely; 2-dislike slightly; 3-neither like nor dislike; 4-like slightly; 5-like extremely. Sample A - SF prepared with pear pulp (90 ℃, 15 min) + strawberry pulp (90 ℃, 3 min). Sample B - SF prepared with pear pulp (90 ℃, 15 min) + strawberry pulp (90 ℃, 3 min) + 10% glycerol. Sample C - SF prepared with pear pulp (90 ☉, 15 min) + (6 h) dehydrated strawberry. Sample D - SF prepared with pear pulp (90 ☉, 15 min) + (12 h) dehydrated strawberry.

21146 | The use of domestic dispensing systems towards extra-virgin olive oil preservation

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Abstract

Several olive oil household storage and serving devices are available to consumers who seek for consistent information on how to secure and extend their lifespan. This study aimed to assess the influence of serving approaches on extra-virgin olive oil (EVOO) quality through time.

Commercial EVOO was acquired in spraying cans, transferred to glass cruets and manual spraying glass bottles (N=3×3) and normal household conditions were simulated. Every 3 days, aliquots were taken to simulate regular domestic consumption. Every 2 weeks (Total=14 weeks), EVOO was analysed for free acidity, oxidation parameters (peroxide index - PI and UV absorbances) and antioxidants (vitamin E and polyphenols).

Results reveal that the devices had no influence on the total acidity (<0.2%). Contrarywise, both domestic devices showed exponential increments on oxidation (up to 4.5 times for PI) with a simultaneous decrease in antioxidants. The UV readings made possible to distinguish the two domestic approaches: lower primary oxidation was observed in the domestic spraying with no secondary oxidation, while higher oxidation was observed in the cruets.

These results show that different oxidations mechanisms contribute to the observed oxidation signs. Moreover, regardless of their higher price, commercial spray cans can preserve EVOO quality during usage. Despite showing signs of oxidation, the domestic sprays can constitute an 509economic way to delay EVOO oxidation.

Keywords: Oxidation; Extra-virgin olive oil; Quality control; Food chemistry.

Acknowledgments

The work was funded by UIDB/50006/2020 and UIDP/50006/2020 (FCT/MCTES). Beatriz Novais and Raquel Martins (COA/BRB/0035/2019) as Rebeca Cruz (2022.00965.CEECIND) are gratefully supported by FCT.

21148 | Adapting senior meals to overcome physiological impairment in the elderly: an analytical perspective

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Abstract

Malnutrition and nutritional deficits are common phenomena affecting the elderly. Therefore, the supply of nutrients must target all morphological and physiological changes that humans undergo through life.

To ascertain their nutritional adequacy, a nursing house (Oporto, Portugal) provided several meals belonging to regular and adapted ("soft") diets that were designed for elder with physiological restrictions. Samples (N=30) were analysed for both macronutrients (total protein, fat, ashes and dietary fibre) and micronutrients (fatty acids) following standard analytical protocols.

Statistical differences (*p*<0.05) were verified between diets for all nutritional parameters. Regular diets provided a higher load of all macronutrients in comparison to adapted ones. On the other hand, a greater consistency of the total energetic value per meal was found on the "soft" diets. Nutritional needs in advanced ages are usually increased due to the impaired absorption and efficient utilization of certain nutrients. Hence, lower energetic load in adapted meals reveal the importance of ensuring a higher energy intake throughout the day.

The outcomes of this study will be complemented with bioaccessibility studies, giving new insights on effective nutrition in the elderly, extremely relevant to overcome malnutrition and to contribute to reducing the impact of chronic diseases and thus promote active and healthy aging.

Keywords: Nutritional balance; Elderly; Quality control; Food chemistry.

Acknowledgments

The work was funded by UIDB/50006/2020 and UIDP/50006/2020 (FCT/MCTES) and by IJUP21—ITAU12 (UP). BN and RM (COA/BRB/0035/2019) as RC (2022.00965.CEECIND) are gratefully supported by FCT. LF and RS thank Amadeu Dias Foundation for their research grants.



ARCHITECTURE



20536 | Relationship between equipment and city (centralizing/structuring and transforming)

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Abstract

This study focuses on the relationship between equipment and city by identifying general aspects about the equipment-city relationship. Then, a set of architectural and urban parameters was defined (language, program-organization, scale), which could sustain a reflection on the objectives pursued. Third, the analysis focuses on the specific case study of Oporto, and it can be said that cities live from interactions between equipment with the urban network, which is often a precursor of urban development, either with the creation of new structuring axes, which meet the building, either by the existence of a plan/grid/axis, under development, where the deployment of equipment occurs as a carrier piece of urbanity. Regarding the case study of this dissertation we analyse the urban evolution of the city of Porto and its phases (until the XX century and the transition to the XXI), as well as the equipment, observing how these architectural buildings of varied program were integrated into the city as elements of centralizing/structuring and transforming character (context/scale/density, among others). Methodologically, simultaneously with the analysis, graphical elements of synthesis were elaborated at various scales, namely drawing combining the two instances (equipment-city) in the same analysis plan at scale 1:300. The study contributed to the discussion about the effect of the equipment operates in the city, at various scales (urban/architectural), beyond methodological approaches more focused and represented in one scale, rationalized and without overlaps

Keywords: Equipment; Urban Development; City.

20746 | From Architecture to the Industrialisation of Construction. A critical practice for the inclusive promotion of 21st century Housing

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Abstract

Throughout history, Architecture has kept up with the evolution and progress of Humanity by systematising new building systems that have been able to augment housing opportunities for all people. It is indisputable that 21st century Architecture faces great economic, social and environmental challenges, such as considerable population growth, high energy consumption, increasing greenhouse gas emissions, inflation, labour shortages and, essentially, a perpetuation of poverty around the world with implications in housing [1]. In light of these issues, this research proposes to discuss an agenda for a more Sustainable Society and an Architecture based on an essay on the most significant issue of the beginning of the century: the promotion of inclusive housing for all.

The research focuses on *new ways of building* making a return to the *machine à habiter* concept – a central theme of the modernist housing experience [2] – where the foundations for industrialised building systems are laid. Here, Architects assume the role of mediator and manager, promoting the integration of inter- and transdisciplinary knowledge and skills. Through the union between Architecture, Industry and Construction, social dynamics, habitability and maintenance of the built are explored. Thus, the Architect's domain is no longer solely focused on the design of objects and buildings, but includes new research and design methods, the exploration of sustainable materials and the collaboration with industrial organisations. By understanding this need for change, it is imperative to work cooperatively with Governments, Universities, Research Centres and building contractors that focus on transformations, processes and time scales, where the future becomes as determinant as the present, finding a real answer to the role of sustainability, ecology and ethics in contemporary practice, through the invention of a new building system for *House of All*, transforming the old-conventional into the new-modular.

Keywords: Architecture; Prefabrication; Industry; Construction; Sustainability; People.

References

[1] MELEGARI, Silvia. Making our Cities Sustainable: Building with wood. *Revolve Magazine*, Barcelona, June 2018. Available at: <<u>https://revolve.media/making-our-cities-sustainable-building-with-wood/></u>. Accessed on: 12 March 2023.

[2] BERGDOLL, Barry; CHRISTENSEN, Peter. *Home Delivery: Fabricating the modern Dwelling*. New York: The Museum of Modern Art, 2008, 12.



Figure 1: The evolution in the process of thinking Housing for Architecture, involving as many stakeholders as possible - sponsors, building contractors, civil society, industry, public or private funding, universities, cultural institutions and community (adapted by the author from MALTERRE-BARTHES, Charlotte. et al. How to do no harm. Quebec: Canadian Centre for Architecture, 2022. Available at: https://www.instagram.com/p/CnkKJP2L5wC/. Accessed on: 12 March 2023).

20843 | Within an architectural promenade

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Abstract

This study consists in an approximation to the Le Corbusier concept of *promenade architecturale* and its importance in the construction and experience of space through the understanding of the Maison La Roche-Jeanneret reasearch (1923-25).

This study begins with a search, a wandering in the realm of space, looking to understand the measures and the desires that it raises, the wills and tensions of the spaces that are observed and the reasons for its origin. Intensions that are organized in paths and moments and that in this idea of continuity, architecture never runs out of itself, it goes from space to the relationship between spaces, to the encounter with nature and our subconscious, our memory, reasoning and ultimately, creation.

It is a search to learn how to see space, with the movement as an essential element in the architectural conception, which is built over time and created with intention.

To deepen the understanding of this concept, we will focus on an in-depth study of Maison La Roche Jeanneret, particularly the house designed according to the desires of banker and modern art collector, Raoul La Roche. We intend-to study it in detail, its inception, design process and distinctive architectural themes that will inform the notion of promenade.

This study is part of an ongoing dissertation in FAUP's MIArq Course 2022/23 with the supervision of Prof. Helder Casal Ribeiro

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Keywords: Promenade; Space; Intencion.

20892 | Fragments: Perception of space through Photography

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Abstract

Since its origin photography has developed a close relationship with architecture. The architectural object would be one of the few subjects to meet the conditions suitable for long exposures. With the technical development this dependence became almost inverse, architecture would then be the one to depend on photography to communicate, in fact they've developed a ubiquitous relationship.

Photography presented itself, initially, as a technique detaining a great value of accuracy on its representation of reality. However, this apparent notion progressively gave way to a more comprehensive understanding integrating other dimensions and acknowledging its subjective nature.

In architecture, this shift was felt in the early 20th century through the work of photographers such as Julius Shulman or Lucien Hervé. Photography began to be recognized as an art form, and architectural photography was no exception. Photographers started to approach buildings not just as functional structures, but as works of art with their own aesthetic qualities.

The technological progress introduces new possibilities of representation and dissemination - greater accessibility and portability of the instruments, digital media, global networks of high visibility - and provides the exponential multiplication of the number of images corresponding to the same referent, and therefore to the fragmentation of its image.

Fragments: Perception of Space through Photography analyses photography as a representation method and technique that allows the communication and comprehension of the specific world of architecture and space. The dissertation dwells upon the evolution of the photographic technique highlighting some of its most relevant points for architectural expression. It seeks to show a fragmented perception and multifaceted rich insight of architecture or space through the work of photographers that take advantage of photography's expressive and subjective components to build their own interpretative visions.

Keywords: photography; architecture; representation; interpretation; communication; fragments.

20931 | LIVING VOICES FROM PORTO SCHOOL: Pedagogies and experiences of a collective, in the consolidation of the Identity

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Abstract

Developed within the research project Living Voices*, the present work focuses on the evolution of the Porto Architecture Course, from the point of view of two dimensions that simultaneously differ and complement each other, sometimes more formal, sometimes more informal.

Overall, attention is paid to the connections and informal relationships developed by a set of characters from the Porto School, in the same way that it reflects, in particular, on each protagonist, in their multiple experiences, focusing on a context that seeks to value interpersonal ties, informal transfers of knowledge, teachings and the School's identity. Starting from academic education, atmospheres and ambiences experienced at ESBAP, the group dynamics of the protagonists of the investigation are analysed, taking the idea of the group, as a collective, and its intervening role in different moments of the history of ESBAP and FAUP as a case study.

This way, on one hand, the formal history of the Course, based on written and official records, documents, that corresponds to the evolution of pedagogies, study plans and teaching methods, and is part of an institutional memory, adds, on the other hand, a more informal and personal perspective, told by the characters, students and teachers, who lived and participated in these transformations, and is translated into stories rescued from individual memories.

The oral history of the Course is told through direct testimonies, in experiences, intersections and 517interrelations that extend throughout the city, and, as a whole, conform a human sense of School. Thus, it is through the various evocations that an idea of Porto School is drawn up, based on a collective memory, a set of values and teachings, the joint action of a group that, despite its diversity, but as well in its unity, knew how to act and react, always between ruptures and continuities, building a sense of own identity, a collective one.

Keywords: Pedagogies, Experiences, Collective, Identity, School.

References

*The Living Voices project, by the Housing architectural design and forms of dwelling (AdC) research group, based at the Centre for Architecture and Urbanism Studies (CEAU), at the Faculty of Architecture of the University of Porto (FAUP), is developed under the guidance and coordination of Professors Doctors André Santos and Maria José Casanova, and focuses on a group of personalities, students and teachers, from the Porto School, from EBAP to FAUP.

20936 | The Contribution of Memory in the recognition of Identity: stories, testimonies and sharing as Living Voices of Porto School.

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Abstract

The dissertation, framed by the research project Vozes Vivas, had the purpose of approaching and understanding the role of Memory in the process of recognition of Identity, based on a personal reading of the testimonies and experiences of a group of characters that integrated the Porto School. Despite the singularity and specificity of each one, through the crossing of their speeches, an attempt was made to find an overall vision.

If the identity of each participant was built based on a journey that is continuously supported by experiences between colleagues and teachers, inside and outside the institution, that is, through their memories, the Identity of Porto School also followed their own path of awareness. This process would be influenced by external circumstances, by social, political, and cultural contexts, but above all, shaped by the personalities who gave it life, by their values and practices, by their participations and interventions, by what they first acquired as students and later sought to transmit in the role of teachers, that is, for their contributions.

By crossing the testimonies of three characters – from the decision of Architecture to entering the School, from the walls inside São Lázaro to the experiences in the city of Porto, from lessons with masters to sharing with colleagues, from extracurricular activities to cultural spaces, from professional experiences to the first collaborations, from teaching to the profession – the recognition of this set of dynamics sought to clarify the fundamental role of each character in the construction of the Collective Memory of this institution.

Thus, at a time when personal experiences become inseparable from collective life, the reflection on their paths and the understanding of the involvement and ties established with colleagues and teachers helps to builds and characterize a possible portrait of the ambiences and experiences of the Porto School.

Keywords: Memory; Identity; Porto School, Sharing, Characters.

21178 | Retrospective studies on the history of international and Portuguese urban planning

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Abstract

Throughout the development of my thesis, which largely focuses on the development of the global cities that so impactfully shape the 21st century, I take a moment to mention ana analyse some of the most prominent urban interventions of the last century.

In this particular chapter of my research, I focus on notorious examples of urban planning that took place in Portugal within the last 100 years, and I do so in order to portrait the history of urban planning in our country and how it has shaped its social and economic scene.

Despite the fascinating peculiarity of some of the examples that I will display, they were carefully chosen because they perfectly illustrate the evolution of urban planning in Portugal in a time where the worldwide socio-cultural scenario was going through major changes. Being some of them large scale projects, others, singular urban interventions.

Granted, the modernist school of thought that defined city planning and design throughout all Europe in the 20st century was of great influence on Portuguese architects.

Considering all of this, and in order to further elucidate the reader on Portuguese urbanism and city planning, this study will shed light on some pioneering study cases that shaped urban planning throughout all Europe.

As an introductory note, I will present some international study cases, that took place in the first half of the last century.

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The first case study we will take an in depth look at is CIAM, a yearly congress that pioneered some core modernist ideas. An event often associated with some of the greatest architectural masterminds, like Corbusier and Frank Wright, ultimately planned as a propaganda event for modernism ideals.

We will also study, obviously, at the famous Team 10. Composed by a diversified group of young architects, this intellectual cluster surfaces as a post-war alternative to CIAM, and is lead (mostly) by Allison and Peter Smithson.

Now, turning out attention to Portugal, we will study the plans for Costa da Caparica, by Cassiano Branco. A city plan made in the first half of the 20th century, a city meant for tourism and a globalized economy. We will follow how this plans never came to be, and how the site has since degraded.

We will also study Unidade Residencial de Ramalde, by Fernando Távora. A singular intervention in the city of Porto which marks the dawn of a new set of concerns in a country going through economic/social/cultural reshaping: affordable housing.

Lastly, we will analyse the Campus of University of Aveiro, by Nuno Portas. A singular urban intervention that encompasses a lot of lessons about urban planning that this seminal author portraits.

Keywords: Urbanism; Architecture; Sociology, Portugal, Porto, Modernism, Post-Modernism, Retrospective, Studies.



ARTS



20399 | The real image and the animated image

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Abstract

The present investigation departs from the universe of the real image and the animated image, with the aim of understanding how cinema and animation work in this context. This study addresses the development of this hybrid technique of styles, from the beginning and the use of more traditional means, like the 2D art, to the present day and the aid of more advanced technologies, like the 3D, CGI or AI, focusing on some case studies of cinematographic works. It's a combination of the real and the unreal; of realism, with fantasy; of the natural with the artificial, and a mixture of languages between aesthetic and semantic terms. These filming and drawing techniques will be worked on in a projetual animated short movie, which intends to cross them, in order to analyse their junction. This study will also have a main focus on the rotoscoping technique, which is famous in the world of animation and filming. This technique brings the reality of our universe to the animated screen, where the outline or specific elements intended are drawn on top of the constituent elements of each frame, resulting in an animated sequence having as reference elements or aspects of the original image. The result is an animated video sequence made from real video, but with artistic creativity. The objective is to give visibility to this topic that I intend to investigate and to the combination and preservation of these two areas. The possibility of carrying out an authorial and experimental work and the concern for working with this amalgam of techniques, is the factor that drives me to do this type of work, which will certainly bring implications and reflections to my artistic and professional life.

Keywords: cinema, animation, real image, animated image, optical objects, rotoscoping, short film.

References



Figure 1: "Who Framed Roger Rabbit", Robert Zemeckis, 1988.



Figure 2: "Mary Poppins", Robert Stevenson, 1964.



Figure 3: "Take on Me", A-HA, 1985.

20527 | Skills for A Next Generation project: the social role of the design towards inclusion

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Abstract

The Skills for A Next Generation project aims to create an inclusive environment at the University of Porto. Axis 4 is concerned with inclusion and equal opportunities, namely with the development of an accessible platform that aims to deliver tools for inclusion.

This study's goal is to understand how well designers perform in the digital world, how they can support social integration, and how they can improve users' digital experiences through accessible and inclusive contents and interfaces.

This project's methodology is based on Human-Centred Design and includes several phases that involve human perspective throughout the entire process and add value to conscious decision, better understanding, as well as the exchange of knowledge and experience. This methodology is deeply embedded in co-design sessions' participation towards the identification of the users' needs and expectations.

The related conclusions are based on Donald Schön's Reflection-in-Action approach, which is grounded on the epistemological practice. This enables the designer to assume a dual role by applying theoretical knowledge in practice and having a critical mindset towards the various stages of the process.

The web platform will be functioning in SIGARRA's system, deploying informative and gamified 523interactive content that are meant to support the Academic community in potential exclusive contexts, transforming those in inclusive experiences, namely in the classroom.

Keywords: Inclusion; Accessibility; Human-Centred Design; Reflection-in-Action.

Acknowledgments

Skills for a Next Generation project is co-funded by POCH - Programa Operacional Capital Humano, Portugal 2020 and Fundo Social Europeu (FSE).

References

[1] Schön, Donald A. (1987). Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions.

20581 | Working with Vision (Ware) - Graphic design in the corporate world

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Abstract

VisionWare is a company that operates in computer security and has partnerships spread throughout the European Union and Portuguese-speaking African Countries, with universities, schools, companies, judicial police and governmental organizations.

It seeks to keep its clients protected, prudent and responsible by advising them on the most effective methods of digital protection.

Currently, at the Communication Design level, the company maintains simple and thoughtful visual graphics line, betting on an accessible communication to the client, transmitting the seriousness that is attributed to it.

This poster objectives presents the internship at VisionWare: the development of skills and knowledge in editorial graphic design, in a corporate communication design environment through the development of projects such as a promotional flyer, illustrated manual, and merchandise with budgeting.

I collaborated in projects with different work dynamics such as the debate of different ideas and concepts in team meetings, presentation and defence of the various graphic alternatives developed and even the search for budgetary solutions for its realization, leading me to evolve in the professional environment in direct contact with superiors.

I showed myself more self-confident in the justification of ideas and managed to contribute to the success of the proposals.

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This internship also allowed me to understand the work process and the type of projects that are developed in the corporate business world, the requirements and expectations for each, deadlines for delivery and, finally, the designer's role in the business world.

Through understanding the initial work proposals I always carried out a direct and indirect visual research collecting important information related to what was asked of me. I analysed all the data collected projecting the ideas into initial sketches. Through the use of appropriate programs to the development of projects I always made several studies that were in line with the proposals. In the context of collaboration and teamwork, I developed several alternatives that were more in accordance with what the company wanted. I never stopped looking at design as aesthetic and functional to serve a purpose. I tried that all my work and the development of alternatives also took into account the impact on the market, be it on an aesthetic or economic level. I was careful, in this field, to develop projects that presented low cost in the final execution of the proposals, in terms of resources, techniques and materials used.

When, sometimes, the developed proposals generated a higher cost for the company in budgetary terms, I also defended the idea that many times a work done from scratch represents an added value, because the external visualization of the company will become more attractive and appealing, increasing it in this area.

On the other hand, the graphic projects were developed in a close relationship with superiors through discussion and analysis of ideas, concepts, doubts, proposals and expectations raised throughout the work process. This discussion and analysis allowed me to foresee a possible reception of the market (where VisionWare operates) to each project, since the superiors

themselves are in direct and daily contact with this, aware of their expectations and impressions in relation to the company.

I should mention that the visual and budgetary impact of the projects was what was expected by the company's superiors, having been mentioned by Mira Amaidas, VisionWare's designer, in the final meeting of the internship that, along the way, I responded positively to these expectations. The projects were concluded with final approval from superiors.

This process allowed me to critically evaluate the posture and good practices of a designer in a corporate environment, which usually develops projects within the values of the company itself and the market where it belongs.

Keywords: Curricular Internship, Graphic Design, Editorial Project, Corporate Environment, Cibersecurity, Business to Business.

Acknowledgments

I would like to express my deepest appreciation to those who are (in any way) with me in this adventure.

20720 | Dynamic brands in the Museological context - A rebranding project for the Linen Museum of Várzea de Calde, Viseu

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Abstract

For centuries, the handcrafted production of linen was present in the daily life of rural communities and intrinsically linked to the persistent and hard work of women. Nowadays, it is already a distant memory of the past. Initiatives such as the Linen Museum of Várzea de Calde are essential so that tradition, memory and the work of the field do not fall into oblivion in a society that is increasingly distant from this ancestral reality.

The motivation for this research is based on two points: an intrinsic aspect, derived from a great interest regarding the textile world and tradition; and extrinsic, which came from a previous knowledge of the establishment and its needs, and a strong desire to be able to demonstrate the value that the adoption of Design programmes can bring to small museums.

The aim of this study was to explore how the Linen Museum can benefit from a well-defined and applied Branding strategy. To do this a mixed approach was used, using different tools such as: case studies; interviews with a specific sample of people (individuals with varied relationships with the Museum); and questionnaires.

Through the results obtained, a Rebranding project was carried out, which turned the Museum's brand into a living organism, with the ability to quickly adapt to the constant changes and demands of the knowledge society in which we live. The results obtained were tested, allowing the work to be improved.

The aim was to lead the public to experience the linen in a holistic way. This was one of the main 526purposes of the project: to provide the experience of feelings and knowledge that we intend to preserve. Besides informing about the process of handmade linen production, there was a search to generate knowledge about the topic, through research, process and design thinking.

Keywords: Identity; Linen; Brand; Museum; Tradition.

20735 | The Design of Book Covers: graphic analysis between translations and reprints of the author Haruki Murakami

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Abstract

The book cover is like a face that tells a set of clues and visual codes that reflect the book's content in advance. The way the cover communicates is also a reflection of a cultural translation in which the reader is not always aware of its implications. Taking this into account, the importance of the designer's visual acuity can also be seen as a translator.

This dissertation aims to find graphic conventions on book covers by the bestseller author Haruki Murakami in order to tell if they represent its content and Murakami's writing style in its core. The first chapter is about the book as an object and the characteristic that we consider it as a whole mean of communication. The second part is entirely dedicated to the cover as a specific medium capable of negotiating the verbal with the visual. The case study addresses through archiving a diverse sample of covers published internationally and later its graphic analysis, an inside view on how certain graphic cues could be defining Haruki Murakami's novels around the world. Graphic features such as typography, images, color palette and composition that bring us closer to a common imagery present in all his works that may or may not reflect in accuracy his stories.

Based on the conclusions drawn from the case study, the aim was to take my perspective as a designer and simultaneously an avid reader of Murakami into consideration and give a personal insight informed by outputs from other readers and research about the covers that could be most closely to an accurate translation.

Keywords: Editorial Design; Visual Semiotic; Book Covers, Haruki Murakami.

21081 | Minimalism into a concept book: editorial design project about the Silent Living concept and its minimalist approach

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Abstract

A book can have multiple purposes, being the informative the most prominent. Nevertheless, a book can communicate not just by its informative content but also by its form. It can be the purpose itself instead of just being a mean for the message.

Originally as family houses, Silent Living spaces follow a minimalist approach, both for their aesthetics and architecture, as well as for the intrinsic values that distinguish them: the slow living, the nature surroundings and the authentic and significant experiences that are provided in this environment. In this context, the project Silent Living: a concept book comes to light, and more than just an informative book, it comprehends a symbolic and semantic approach, allowing sensations to be created throughout the book that tell a story about Silent Living. Thus, this project starts with a bibliographic research about the concept book, followed by the analysis of same kind cases, relevant either for their minimalist approach or for being a concept book, and an action research focused on acquiring a better understanding of how abstract concepts inherent to minimalism can be translated in an editorial and graphic way. Through the image curation, the materiality and the chromatic attitude, this concept book works as an extension of the Silent Living experience to the guests. The images are carefully handpicked to connect between them and create a suitable narrative, the senses are activated through textures and different kinds of papers and the color palette is composed of natural and coherent tones to not be garish or distracting.

This concept book aims to constitute a physical object representative of the concept that is intrinsic to Silent Living, not only for the words it contains but also for its attributes and the holistic relationship between them.

Keywords: Concept book; Editorial and graphic design; Silent Living; Minimalism; Architecture.

21179 | *Calendar*, Grupo Puzzle. Production, Destruction, and Forgetting of an Artwork Dixo, Sara, Faculdade de Letras da Universidade do Porto, Portugal

Abstract

This presentation seeks to deepen the study of a non-existent artwork (erased from the collective memory) by Grupo Puzzle due to its destruction by the population in a particular context, verified in the post-revolution of April 25th.

The International Art Meetings in Portugal (1974-1978) originated to move art and culture from the metropolitan centers to the peripheral populations. In 1977, the IV International Art Meetings took place in Caldas da Rainha, with the participation of numerous national and international artists, including Grupo Puzzle, formed by Albuquerque Mendes, Armando Azevedo, Fernando Pinto Coelho, Gerardo Burmester, Graça Morais, Jaime Silva, and João Dixo.

During the twelve days of the event, Grupo Puzzle performed a ritual with the title *Calendar*. Throughout the event, each member collected vestiges of other artists' performances and every day at seven o'clock in the afternoon would present them to the audience. Simultaneously, they displayed a painting and a reliquary, where they stored the previously gathered vestiges along with a strip from the artwork that was cut out by a formerly chosen member of the group. On the last day, the reliquary was buried. However, the local population outraged by the event dug up and destroyed the artwork. This occurrence resulted in almost forgetting the artwork's existence half a century later.

Following the exhibition GRUPO PUZZLE 1976-1981 in Bragança, at the Graça Morais Contemporary Art Center (09/17/2022 to 01/29/2023), where the non-existent artwork could be revisited, this presentation aims to study and question the phenomenon, starting from the analysis of the event at Caldas da Rainha, supported by the perspective of the newspapers of the time and the collection of limited testimonies and records about what happened. Moreover, questioning the Portuguese artistic culture in the present and the past responsible for the iconoclastic act that, in turn, resulted in the damning of memory.

Keywords: Forgotten, Grupo Puzzle, International Art Meetings in Portugal, Art Destruction, Damning of Memory, Portuguese Contemporary Art.

Acknowledgments

Work developed for the subject Metodologia de Projeto e de Investigação I, during the first semester of the first year of the Master's Degree in Art History, Heritage and Visual Culture.



Figure 1: Calendar, Grupo Puzzle. 1977.

20733 | The power of design expression in mental health field

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Abstract

Eating disorders, according to the National Eating Disorders Collaboration, are mental illnesses characterized by disturbances in behaviours, thoughts and attitudes toward food, weight or body shape. Of these, the most frequent are anorexia nervosa, bulimia nervosa, and binge eating, which have increased over the years, becoming a growing concern worldwide.

This project consists in the draw of a small impactful and interactive exhibition, whose goal is to inform and educate Portuguese society about eating disorders in order to assist their prevention. The design of the exhibition's graphic materials uses a conceptual variable digital font, developed to establish subtle analogies with some of the characteristics and sensations of living with these disorders, without reinforcing stereotypes. For example, sharp serifs as a means of representing social isolation, used as a protective mechanism. The font was combined with photography, giving rise to both digital artifacts, such as posters with augmented reality, as well as analog artifacts, namely, a brochure and typographic specimen, possible due to the potential that a variable font offers.

With this project, we intend to reinforce the semantic possibilities of typography, demonstrating how the shapes of a typeface can be associated with feelings and emphasize the expressive and aesthetic capabilities, which are often put in second place to legibility. Also to demonstrate how the designer can intervene in an educational sense and in the areas of health and well-being, in this case helping in the prevention and identification of behaviours that characterize these disorders, to prevent them from being triggered so frequently, avoiding drastic consequences, such as in some cases death. Both objectives attested by the evaluation of the experience, through interviews with a sample of visitors of the exhibition, ranging from professionals and people in recovery, to lay people in the field.

Keywords: Typography design; expressiveness - design authorship; social design; healthcare design; eating disorders; fonts; fontlab; display typography, Variable font, OTVar 1.9

Acknowledgments

This abstract was supervised by Professor Pedro Amado.



ASTRONOMY & MATHS



20653 | Numerical Simulations (HD and MHD) of planetary winds in the vicinity of stellar winds emanating from their host stars

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Abstract

Exoplanetary science has grown exponentially since the discovery of the first exoplanet orbiting a main-sequence star, and with the advancements in technology, a new pilar of research has emerged: understanding planetary atmospheres. As we now have the ability to compare theoretical predictions with observations, this area has become increasingly important. A significant fraction (about 56%, according to online catalogues) of extrasolar giant planets orbit their host stars at less than 0.1 AU, leading to significant atmospheric blow-off which strongly influences key aspects of planetary evolution. Also known as hydrodynamic (HD) evaporation, atmospheric blow-off is the planet's initial mass evaporation due to strong extreme-ultraviolet radiation from the host star. However, many open questions remain, requiring improved physical modelling to explain observed neutral atom velocity distribution and mass outflow rates (e.g. [1]). The aim of this project is to investigate the physical processes that impact the wind structure and outflow rates of a Hot Jupiter (HJ), such as wind anisotropy [2] and planetary magnetic fields [3]. To achieve this goal, it is used the astrophysical code PLUTO to conduct HD and MHD simulations and explored how the HJ's atmosphere heating affects the wind's strength. In the last part of this project, we intend to address the global interaction between planetary and stellar winds and compare the results of the simulations with observations.

Keywords: Hot Jupiter; atmospheric blow-off; hydrodynamic; magnetohydrodynamic; winds; outflow; anisotropy.

References

- [1] Koskinen T. T., Harris M. J., Yelle R. V., Lavvas P., 2013, Icarus, 226, 1678
- [2] Carroll-Nellenback, J., et al., 2017, MNRAS, 466, 2458
- [3] Owen J. E., Adams F. C., 2014, MNRAS, 444, 3761

20487 | Spectral Curves and Moduli Spaces of Higgs Bundles

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Abstract

A central idea in a first course of undergraduate Linear Algebra is the fact that a linear map from a vector space to itself is best understood through its eigenvalues and eigenspaces, i.e., the subspaces where the action of the linear map reduces to scaling by some number.

In this work, we aim to present a vast generalization of this idea by making the whole construction vary on a "nice" geometric object - a Riemann surface. We shall see how to assemble various vector spaces and linear maps on this object, leading us to the notion of a vector bundle, and how the familiar construction of eigenvalues and eigenspaces gives rise to a "spectral curve" and a family of lines on it, reflecting the geometry of the whole ensemble: the Riemann surface, the vector spaces, and the linear maps.

Spectral curves are crucial in the study of "moduli spaces of Higgs bundles" - important objects in active research in the areas of geometry and mathematical physics that parametrize pairs of vector bundles and "twisted" endomorphisms. We send the moduli space to a vector space (through a map called the Hitchin map) and we can then get a description of some of its fibres as either smooth tori or pinched tori, closely related to the spectral curve.

Keywords: endomorphism, eigenvalue, Riemann surface, vector bundle, Higgs bundle, moduli space, spectral curve

Acknowledgments

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References

[1] A. Beauville, M. S. Narasimhan, and S. Ramanan. ``Spectral curves and the generalised theta divisor.'' In: Journal für die reine und angewandte Mathematik 1989.398 (1989), pp. 169-179. doi: doi:10.1515/crll.1989.398.169

[2] E. Franco, P. B. Gothen, A. Oliveira, A. Peón-Nieto, ``Unramified covers and branes on the Hitchin system''. In: Advances in Mathematics 377 (2021), p. 107493, doi: https://doi.org/10.1016/j.aim.2020.107493

[3] N. J. Hitchin. ``The self-duality equations on a Riemann surface''. In: Proceedings of the London Mathematical Society S3-55.1 (July 1987), pp. 59-126. doi: <u>https://doi.org/10.1112/plms/s3-55.1.59</u>.

[4] E. Kienzle and S. Rayan. "Hyperbolic band theory through Higgs bundles". In: Advances in Mathematics 409 (Nov. 2022), p. 108664. doi: 10.1016/j.aim.2022. 108664.

[5] L. P. Schaposnik. "Higgs Bundles - Recent Applications". In: Notices of the American Mathematical Society 67.05 (May 2020), pp. 625–634. doi: 10.1090/noti2074.



Figure 1: The fibers of the Hitchin map [Rodrigo Pereira (made with TikZ), inspired by [3] and [4]]

20621 | Metaheuristics for finite automata minimization

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Abstract

In Formal Language Theory, a language is a finite or infinite set of words. One way to represent these languages is through the usage of a finite automaton. A finite automaton is a machine that by reading a word, symbol by symbol, changes its internal state, enabling it to recognise patterns that define its language, allowing this machine to decide if the input word is part of a language. The use of automata to represent a language, to which we call a regular language, has the advantage of being a relatively succinct representation. Automata are representations that are easily legible by humans and, at the same time, can be used by a computer to, with great efficiency, decide which words are part of a language.

A finite automaton is deterministic, if the behaviour of the automaton is fully determined by the last symbol that read and its current state. On the other hand, if when it reads a symbol the automata can change its internal state in more than one way, then we call it a nondeterministic finite automaton. The usage of nondeterministic automata is justified due to the ease of its generation, versus deterministic ones, and because nondeterministic automata are smaller than deterministic automata representing the same language. A nondeterministic and a deterministic automaton can represent the same language, in which case we say that they are equivalent.

The number of states of an automaton is an important characteristic for practical use. Although there are algorithms that quickly find the smallest DFA equivalent to a given DFA, the same problem for NFAs is much more difficult. Indeed, finding the smallest NFA equivalent to a given NFA is a problem that belongs to a class of problems of high complexity, called PSPACE.

With this work we study the possibility of, given a NFA, searching for states that have the same behaviour and merging them. This way, we try to find a smaller but equivalent NFA. We know that this process is unlikely to find a minimal NFA. This process terminates when no mergible pair of states are found, but it does not mean that it is minimal. However, we introduce a metaheuristic that randomly duplicates states in order to try to create new merging possibilities and, consequently, reduce the size of the resulting automaton. The goal is to reduce the number of states of a nondeterministic automaton beyond what we can achieve by simply merging equivalent states. Its likely that this process won't find the smallest automaton; however, given the high complexity of the classic systems, any contribution to a significant reduction on a nondeterministic automaton is valuable and can have an important impact on the practical applications of these models.

Keywords: Autómato, Expressões regulares, Linguagens formais, Non-deterministic automata, Grafos, Máquina de estados



BIOLOGICAL SCIENCES



20476 | Rooting test of chestnut cuttings from ColUTAD variety

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Abstract

The death of thousands of European chestnut trees was observed in the Atlantic areas of northern Spain and Portugal due to a fungus, Phytophthora cinnamomi. This fungus causes the so-called ink disease characterized by necrosis in the roots and the trunk of the trees and that can finally cause death. The severity of the symptoms has been related to the climatic and soil characteristics, which were shown to be more stressful on south-facing stands. A large part of the research work has focused on breeding programs to obtain plants resistant to ink blight. An example of a disease-resistant hybrid is the Portuguese hybrid ColUTAD. However, due to increasingly severe climate changes, it has become necessary to select new genotypes, better adapted to current soil and climate conditions, and associated with an efficient and accelerated production system, to meet the improved plant material market. Aware of this problem, the researchers have continued the improvement programs, struggling mainly with the enormous difficulty of achieving the vegetative propagation of ColUTAD using conventional techniques. This study will involve several phases, thus, in the first phase, obtaining new clones are obtained from cuttings of the year of ColUTAD trees implanted in a grove in Lordelo, Vila Real. From these, smaller cuttings will be cut, with different numbers of buds, which will be immersed in different concentrations of indole-3-butyric acid, a plant regulator used to induce the rooting of cuttings. The cuttings will be planted in vases with routine substrate and in 2-sized Jiffy Pellets and placed in a greenhouse. Later, foliar biochemical analyses will be carried out, using leaves of plants from the greenhouse, to evaluate the physiological status of plants through photosynthetic pigments, mineral analysis to detect possible nutritional needs, and characterization of phenolic compounds to indicate the greater or lesser susceptibility of the plant to the oomycete.

Keywords: Castanea, ColUTAD, IBA, rooting, vegetative propagation.

20610 | Studying the regulation and impact of iodine supplementation on the root system of *Arabidopsis thaliana*

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Abstract

Iodine is a highly necessary element for the production of hormones in the thyroid gland and, therefore, critical for human development. Unfortunately, iodine deficiency affects a large part of the world's population with a drastic, and negative impact on global human health. Iodine deficiency disorders (IDDs) are caused by consumption of foods with low iodine content, which is correlated with plants grown in poor iodine soils. In pregnant women, iodine deficiency can also lead to cretinism, a condition that causes irreversible mental and physical developmental delays of the fetus, which in extreme cases can be lethal.

Smart strategies to improve iodine intake are urgently needed. A new approach to tackle iodine deficiency may result from the development of iodine-enriched plants. Although there are already methodologies for the biofortification of foods with iodine, the knowledge behind the processes of absorption and regulation of iodine in plants is very scarce.

With this work, we aimed to understand how increasing concentrations of iodine affect the root physiology of the model plant *Arabidopsis thaliana*. The establishment of iodine tolerance thresholds will be important to define iodine supplement dosages without affecting plants' fitness and productivity. In addition, we will study the involvement of *Arabidopsis thaliana* putative iodine transporters in the regulation and homeostatic control of internal iodine. The present study will contribute to create robust biofortification strategies and breeding programs to improve the quantity and quality of iodine content in strategic crops.

Keywords: crop biofortification; iodine deficiency; iodine transporters; root development; Arabidopsis.

20637 | Inventory of small wetlands in Leça River basin in Matosinhos

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Abstract

Small wetlands are crucial for aquatic biodiversity, such as aquatic plants, invertebrates and amphibians. They provide multiple ecosystem services and benefits to people. Additionally, wetlands present in a river basin work as water retention basis, decreasing the risk of floods. The Leca river basin has suffered from drastically land use and land cover changes over the past years, and together with water pollution and waste disposal, they contributed to the degradation and disappearance of small wetlands. Moreover, the negative public perception of small wetlands and amphibians hamper their conservation. A large inter-municipality project is now aiming to restore the Leça river basin by creating a green and blue corridor, consisting in ecological restoration and monitoring of the area, involving the local community [1]. Therefore, this work aims to map the current distribution of small wetlands in Leca River basin in Matosinhos and characterise its aquatic biodiversity in terms of aquatic plants, macroinvertebrates and amphibians. To achieve this objective, this work is divided in three main methodologies: i) mapping wetlands in the Leça river basin in Google Earth, by searching in a buffer of one kilometre from each side of the river; ii) conducting structured interviews to local communities in the area to understand their knowledge of extinct and present wetlands, as well as their knowledge and perception of amphibian species; and ii) performing transects along the Leça river in Matosinhos to map existing wetlands and characterise aquatic biodiversity within the area. This work will allow to reveal critical points for freshwater biodiversity conservation within the area and contribute to the largescale ecological restoration of Leça river.

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Keywords: amphibians, aquatic ecosystems, ponds; public perceptions.

Acknowledgments

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References

[1] TSF (2021). "Intervenção de 71 quilómetros." Projeto de despoluição do rio Leça arranca no início do próximo ano. tsf.pt/portugal/sociedade/intervencao-de-71-quilometros-projeto-de-despoluicao-do-rio-leca-arranca-no-inicio-do-proximo-ano-15555275.html, accessed in 26/02/2023.

20681 | Characterization of vacuolar trafficking in *Arabidopsis thaliana vti11* and *vti12* mutants under abiotic stress

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Abstract

Plant growth and development is highly influenced by the environment. When plants are exposed to adverse environmental conditions, they can alter their physiological and cellular mechanisms to cope with them. Some of the adaptations developed are related to protein production and sorting, as well as organization of the endomembrane system. It is known that abiotic stress can trigger modifications in trafficking routes to the vacuole, since this organelle plays an important role in cell homeostasis, signalling and protein storage. SNAREs are proteins responsible for mediating vesicle fusion with target membranes. Therefore, they are extremely important for protein sorting within the cell. VTI11 and VTI12 are homologous SNAREs that form complexes with other SNAREs to mediate protein trafficking to lytic and storage vacuoles, respectively. Some evidence also links VTI12 to autophagy and exocytosis. One of our goals was to evaluate the expression levels of well-characterized genes involved in the vacuolar trafficking routes, in the background of vti11 and vti12 T-DNA Arabidopsis mutants submitted to different abiotic stresses (saline [S]; osmotic [H1, H2]; oxidative [Ox]; metal poisoning [Zn]). After confirming the genotype of the seeds by PCR analysis, they were submitted to the stress situations (S - 50 mM sodium chloride, H1 – 50 mM mannitol; H2 – 100 mM mannitol; Ox – 0.5 mM hydrogen peroxide; Zn – 150 µM zinc sulphate) for 12 days. Then, RNA was extracted from the seedlings to produce cDNA using a reverse transcriptase reaction. After that, the expression of the different genes involved in vacuolar pathways was evaluated by qPCR. A biometric analysis was also performed in order to assess how the root growth and the morphology of the aerial part of the plant were affected by the lack of those genes. Altogether, this work will contribute to a better understanding of how proteins involved in intracellular trafficking routes are important for the stress response.

Keywords: protein sorting, endomembrane system, abiotic stress, protein trafficking, vacuolar pathways, SNAREs, VTI11, VTI12, autophagy, exocytosis, T-DNA, *Arabidopsis*, PCR, RNA, cDNA, qPCR, biometric analysis.

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20740 | Molecular and morphometric analysis on *Quercus suber* L. and *Q. rotundifolia* Lam. and their natural hybrids in Portugal

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Abstract

Cork oak (Quercus suber) and holm oak (Quercus rotundifolia) are two Mediterranean species, with a strong presence in the Portuguese landscape. Natural hybrids between the two species (Q. × avellaniformis) are often frequent, but elusive. This study aimed to develop molecular and morphometric methods for the reliable characterization and identification of natural hybrids across Portugal.

The molecular analysis involved the collection of leaf samples from 30-40 individuals for each species and for putative hybrids. After genomic DNA extraction, eight previously reported microsatellite loci were used to genotype individuals. The data obtained were then subjected to a Bayesian clustering analysis using STRUCTURE software. The analysis shows a perfect distinction between the two species and demonstrates the reliability of the method for the molecular identification of hybrids.

The morphometric analysis considered the categorization of different phenotypic parameters related with leaf venation, which includes secondary nerves morphology and insertion angle of the two oaks. We used the program *tpsdig2* to define 27 landmarks to characterize individual leaf shape followed by a landmark comparison using the Geomorph R package. Different multivariate

methods have been evaluated in terms of performance to provide a valuable tool to distinguish the species and hybrids based on those leaf morphometric parameters and if those results correlate with the molecular data.

In conclusion, our study uses a dual and complementary approach to validate the cork oak- holm oak species and their natural hybrids recognition based on phenotype and genotype analysis.

Keywords: cork oak, holm oak, natural hybrids, phenotypic and genotypic characterization.

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20744 | Understanding molecular interactions between DE-ETIOLATED 1 (DET1) and CONSTITUTIVE PHOTOMORPHOGENIC 1 (COP1) in plant responsiveness to light

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Abstract

Light plays a key role in plant growth and development; however, extreme light conditions as very high or very low light intensity can constitute an abiotic stress to plants. Due to their plasticity, plants developed a wide range of molecular mechanisms that allow them to respond and adapt to these stress conditions.

CONSTITUTIVE PHOTOMORPHOGENIC 1 (COP1) and DE-ETIOLATED 1 (DET1) are two photomorphogenesis repressor proteins. In *Arabidopsis thaliana* these proteins conform a CULLIN-RING 4-based E3 ubiquitin ligase (CRL4) capable of degrading several light-responsive transcription factors, such as ELONGATED HYPOCOTYL 5 (HY5). Recently DET1 has been shown to be required for COP1 destabilization, yet the molecular details of this process and the mechanistic of the association between COP1-DET1 remains unknown.

Thus, this project aims to understand the molecular mechanisms controlling the activity and stability of COP1 protein, by characterizing the protein domains involved in the DET1-COP1 interaction. Moreover, we will explore if there's any external stimuli, such temperature, abiotic stress, sugar and hormones, that may affect DET1-mediated COP1 degradation.

To study and understand these molecular pathways is of great importance, because light responsiveness tightly regulates plant growth. Thus, the knowledge provided by this work can serve as a basis for biotechnological applications, to modulate plant responsiveness to light and increase crop quality and yield. Furthermore, in human cells, COP1 is a well conserved protein that has demonstrated a vital role in the regulation of tumor proliferation. To better understand this protein mode of action might generate a potential therapy for cancer treatment.

Keywords: Light signaling, protein degradation, photomorphogenesis, *Arabidopsis thaliana*, COP1, DET1.

20800 | Natural dyes for textile applications

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Abstract

Textile Industry is one of the biggest threats to the environment, consuming large amounts of water, and polluting aquatic resources. Particularly, the chemicals and dyes used during the wet process create the most polluted wastewater in this industry [1]. The traditionally used dyes in this industry are made from petrochemicals and are far more polluting than natural dyes due to the long process of extraction of fossil fuels and processing of petrol into the chemicals desired. In constant transformation, the Textile Industry seeks environmentally friendly solutions to transform its activity into a more sustainable one [2]. The interest in exploitation of natural pigments in textile dyeing has been growing and researchers are looking for new sources of natural dyes [3, 4] These eco-friendly dyes are a renewable source of colouring pigments and have been used for colouration of foods, medicine and in handicraft items. Natural dyes have several advantages, namely no health hazard, easy extraction and purification, no effluent generation, very high sustainability, and mild dyeing conditions.

Natural dyes have been applied in most of the natural fibres, such as, cotton, linen, wool and silk fibre, but also to synthetic fibres, namely nylon and polyester. However, the current natural dyes for textiles are difficult to reproduce, have low fastness to washing and light and do not have a standard application protocol. [5]

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In the present work, we investigated new sources of natural dyes, and we created a library of natural pigments that cover all the visible spectre and can be applied on different fabrics.

Keywords: textile, natural dyes, sustainability, natural pigments.

References

[1] Setiadi, T., Y. Andriani, and M. Erlania, *Treatment of textile wastewater by a combination of anaerobic and aerobic processes: A denim processing plant case*. Proceedings of the Southeast Asian Water Environment, 2006. **1**.

[2] Elsahida, K., et al. *Sustainability of the use of natural dyes in the textile industry*. in *IOP Conference Series: Earth and Environmental Science*. 2019. IOP Publishing.

[3] Koçak, Ö.F. and F. Yılmaz, Use of Alpinia officinarum rhizome in textile dyeing and gaining simultaneous antibacterial properties. Journal of Natural Fibers, 2022. **19**(5): p. 1925-1936.

[4] Samanta, A.K. and A. Konar, *Dyeing of textiles with natural dyes*. Natural dyes, 2011. 3(30-56).
[5] Gupta, V.K., *Fundamentals of natural dyes and its application on textile substrates*. Chemistry and technology of natural and synthetic dyes and pigments, 2019. 2019

20855 | The effects of inoculation with saline tolerant bacteria on the improvement of plant growth in salty soils

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Abstract

In this study, we made two different cultures of a consortium of rhizoplane and endophytic bacteria from two species of plants growing in salt water, Inula crithmoides and Sarcocornia perennis. The plants originated from the Aveiro Estuary, and were brought to grow in a floating island phytoremediation project in the Matosinhos marina. From each culture, five different bacteria species were selected and then each one was cultured in media of two varying salinities, to determine their tolerances to salty conditions. We expected to see significant salt tolerances, because the plants from which we obtained the bacteria were originally from a saltwater estuary, and are able to grow in the ocean water of the Matosinhos marina.

After identifying which species are most suitable to handle extreme saline conditions, we will then 545culture these species in a liquid nutritive medium to increase their population density. Afterwards, they will be inoculated in an horticultural plant species with low salt tolerance by soaking the roots of seedlings in the liquid culture before planting into a natural salinized agricultural soil. In this way, we will be able to see the effects which our selected bacteria have on enhancing the growth of these plants in the salty soil. We will record biomass data, and also visually record growth rate, and any visible signs of plant stress. We will also inoculate seeds by soaking them in the liquid culture before planting them in the soil. Through this procedure, we can also observe if the bacteria have a positive effect on plant germination in salty soil. We expect that these bacteria will have a positive effect on plant growth rate and biomass, and reduce signs of stress, compared to plants grown in the salty soil without inoculated roots. We also expect that the bacteria will have a positive effect on seed germination rate, compared to seeds which have not been inoculated.

20861 | Investigation of active microbial communities in the nitrogen cycle in two different soils

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Abstract

Soil bacteria play fundamental roles in biogeochemical cycles and strongly modulate the nitrogen transformations.

In this study, we investigated the presence of microbial communities active in the nitrogen cycle in two varying soils obtained from the Botanical Gardens of University of Porto. One soil sample was taken from a forested area, with large trees and leaf ground cover, while the other sample was taken from a garden area, in which grapevines were growing. From our microbial isolations, we were able to visually confirm the presence of two isolates of Actinobacteria, one from each soil. This phylum of bacteria is well known to be active in the nitrogen cycle. Furthermore, an API 20E test allowed us to get information of the metabolic profile of two other isolated bacteria.

Additionally, the two soils were tested for evidence of the processes of ammonification, the hydrolysis of urea, dissimilatory nitrate reduction, and denitrification. Our results indicated that bacteria present in both soils performed all of these processes.

To further investigate nitrogen cycle activity, we will perform an mRNA analysis on the soil samples, using quantitative PCR gene amplification. We will specifically amplify the nosZ gene that is responsible for the codification of the enzyme responsible for the reduction of nitrous oxide to dinitrogen. We expect to see positive results, based upon our experiments where we measured N₂O and N₂ rates in both soils by using the acetylene blockage method couple with Gas Chromatography (GC-ECD). Because we obtained positive results for N₂ gas production in our previous test, we expect that we will see positive results here. N₂O is a greenhouse gas of concern, so our experimental procedure to quantify the rate of N₂O gas production is significant to understanding to what levels this gas is being expelled to the environment by the soil in the botanical gardens, and identifying which type of soil may be producing N₂O at a faster rate.

21009 | Insights into the biochemical profile of *Arabidopsis* seedlings under combined abiotic stresses

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Abstract

The agricultural sector susceptibility to the current climate and social scenario, makes the concept of global food security a very distant reality. As such, the scientific community must strengthen its efforts into understanding the impacts of climate change on plant performance, as well as developing sustainable methods for crop resilience improvement. Thus, this work aimed to disclose the single and interactive effects of heat (42°C, 4 h) and salinity (100 mM NaCl) stresses on Arabidopsis thaliana seedlings (14 days old). Arabidopsis seedlings were subjected to several biometric and biochemical analysis in order to reveal the impacts of these stressors on the plants' growth and antioxidant status. So far, salt appears to be more harmful than heat, with seedlings exposed to a saline medium showing higher levels of hydrogen peroxide and lipid peroxidation, coupled with decreased growth, especially when both factors were applied simultaneously. This disruption in the antioxidant balance might be related to the modulation of ascorbate, proline and glutathione (GSH) levels, key antioxidant metabolites that were differently affected by salinity, heat and their combination. Taking this information into account, the focus of this work is now to develop strategies to counteract these negative impacts. More specifically, strigolactones (SLs) are phytohormones playing fundamental roles in regulating various physiological processes during plant development. In the framework of these roles, studies have been showing the positive interference of SLs during plants' adaptation to abiotic stresses. In this sense, the work herein described will be complemented by comparing the response of wild-type plants to these stressors with the response of SL-deficient Arabidopsis mutant lines.

Keywords: Climate change; Abiotic stress; Plant stress; Strigolactones.

21162 | Classic methods enhance modern analysis of Western Iberian Oak forests and predict species turn-over in face of climate change.

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Abstract

Knowing the floristic casts and associations of vegetation groups is an important tool to conserve and predict the demographic species turn-over of native Forests, especially when facing worsening climatic scenarios. In Portugal the native forests are mostly ruled by oaks (Quercus) and their distribution and species composition is predicted to change in the near future, due to climatic worsening (drought and extreme events), resulting in the urgency of foreseeing such changes.

This work envisages the compilation of all native Portuguese oak forest associations that were described in classic geobotanical works, from 1956 to the present. This was based in classic literature and herbaria review, encompassing 169 works of phytosociological characterization. In addition to the floristic matrices, all relevés sites were geographically referenced in a total of 687 locations. During this work, we also performed a full nomenclatural review and updated the species synonym list in the distinct works, which are highly susceptible for error prone related with species duplications, misidentifications and taxonomic rank attributions.

Results show that the western Iberian Forests encompasses 28 botanical families, dominated by Fabaceae, Asteraceae and Poaceae, and eleven biological types predominated by Hemicryptophytes, Phanerophytes and Geophytes.

This work envisages to be a solid basis for depicting a modern analysis of the Portuguese Potential Vegetation and will nourish future investigation works, based in the usage of statistical software analysis and niche ecological modeling. These tools will allow to predict demographic range-shifts and species turn-over of the Portuguese and Western Iberian Oak Forests, in accordance to predicted climate change.

Finally, this work will provide urgently needed answers to practitioners, about when and where each forest type association should be used in habitat restoration management programs at the national scale.

Keywords: Biodiversity; Forest modulation; Forest Conservation; Biogeography.

21188 | A new approach about the leaves of *Solanum betaceum* Cav: chemical composition and multimodal effect in the management of inflammatory events

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Abstract

Inflammation constitutes one of the first lines of defence against several stimuli that are perceived as harmful. While acute inflammatory processes may serve to protect the organism, deregulated or chronic inflammatory processes are the basis of several pathological conditions, including asthma, rheumatoid arthritis, cardiovascular diseases, among many others [1]. *Solanum betaceum* Cav., commonly known as tree tomato, belongs to the Solanaceae family. Studies involving this species focus on its fruit (tamarillo) [2]. Although being traditionally associated with healing properties, there are no scientific studies about the chemical compositions and the biological properties of tamarillo tree leaves. In this work, ethanolic extract from *S. betaceum* leaves was chemically characterized in terms of phenolic compounds and pigments (carotenoids and chlorophylls) by HPLC-DAD and of fatty acids by GD-FID. The anti-inflammatory potential of the extract was exploited in cell-free and cell-based assays.

Chemically, *S. betaceum* leaves ethanolic extract revealed a phenolic profile mainly composed by hydroxycinnamic acids, rosmarinic acid being the major one. In addition, five pigments, including xantophylls and chlorophylls were identified and quantified. A complex fatty acid profile, characterized mainly by the presence of medium and long fatty acyl chains, with different degrees of unsaturation was also established.

The extract was able to inhibit the activity of 5-lypoxigenase, an enzyme involved in inflammatory cascade, to scavenge physiologically relevant nitric oxide (*NO) and superoxide anion (O2*) radicals and to inhibit the first stages of lipid peroxidation induced by the Fe2*/ascorbate system. Moreover, a significantly capacity of the extract to decrease the NO levels in culture medium of activated macrophages was observed.

The multimodal effect exhibited by *S. betaceum* leaves ethanolic extract open doors for the use of this still unexplored material for the resolution of inflammatory frames.

Keywords: *S. betaceum* leaves, Phenolic profile, Carotenoid profile, Fatty acid profile, Inflammation, Oxidative stress.

Acknowledgments

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References

[1] [1] Martel-Pelletier, et al. (2003). Ann. Rheum. Dis. 62, 501-509.[2] Isla et al. (2022). Foods. 11, 3363.



Figure 1: 5-LOX inhibitory effect (A) and •NO and O2•- scavenging activity (B) of S. betaceum leaves ethanolic extract. Results are expressed as mean \pm SD of three independent experiments, each performed in triplicate.

21216 | Ecological Modelling of the Macaronesian-Mediterranean Junipers (*Juniperus* L. Sect. *Juniperus*) and conservation of the near endemic tree *Juniperus navicularis* Gand.

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Abstract

The Cupressaceae Juniperus navicularis Gand. is a dioecious dendroid shrub that grows in coastal sands. It is a near-endemic Portuguese species with two separated subpopulations in Southern Spain (Cádiz and Huelva), with a Near Threatened (NT) and Critically Endangered (CR) respective category in the two countries, following IUCN classification. J. navicularis grows in the understory of psammophyle Q. suber and other shrublands, regulating water and nutrients in the soil and providing critical habitats for various fauna and is severely threatened by the use of non-selective vegetation management techniques that jeopardizes new individuals' recruitment to the populations.

This study aims to create a database that will identify *J. navicularis*'s current and future distribution using species distribution models. Bioclimatic and topographic variables will be used to facilitate conservation efforts for this species in the Iberian Peninsula. Additionally, this study will expand to all Junipers in the same group to understand past and future demographic histories in both Mediterranean and Macaronesian subregions. The research team collected occurrence data for several focal Juniper species, including *J. badia*, *J. brevifolia*, *J. cedrus*, *J. deltoides*, *J. drupaceae*, *J. navicularis*, and *J. oxycedrus*, retrieved from the Global Biodiversity Information Facility, herbaria and literature review. The dataset encompassed almost 50,000 records and was filtered based on taxonomic-expert knowledge.

This study will unveil the Neogene biogeographic history of Mediterranean and Macaronesian Junipers and foster future questioning about the phylogeographic history and species delimitation of this significant group of conifers. Anticipating future range shifts of these forest dynamics alongside the neighboring Oak (*Quercus*) forests will be an important asset, to improve our knowledge about these species' responses to climatic worsening scenarios in an important biome for plant diversity.

Keywords: J. navicularis; Ecology modelling; Species distribution.

20812 | Atrazine impairs the nutritional support of spermatogenesis by suppressing glycolysis of mouse Sertoli cells

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Abstract

Atrazine (ATZ) is a pesticide used worldwide and a common contaminant in drinking water. ATZ is a potent endocrine disruptor responsible for several adverse health effects, such as altered hormonal activity and infertility. Within the testis, Sertoli cells (SCs) provide the mechanical and nutritional support for spermatogenesis. However, the impact of ATZ in SCs functions is still unknown. In this work, we aimed to elucidate the effects of ATZ on the nutritional support of spermatogenesis by studying the metabolic profile of ATZ-exposed SCs. For that purpose, mouse SCs (mSCs, TM4 cell line) were exposed to environmentally relevant concentrations of ATZ (0.3, 3, 30, 300 or 3000 μ g/L, n=10 for each condition). After 24 h, cytotoxicity was determined. Mitochondrial activity, ROS production and antioxidant potential of culture media were accessed by JC-1 dye, CM-H2DCFDA probe, and FRAP assay, respectively. Lactate dehydrogenase (LDH)

protein levels were analysed by Western Blot and glycolytic function was evaluated by Seahorse XF Glycolysis Stress Test Kit. Our results evidenced a decrease in the metabolic activity of mSCs exposed to 300 and 3000 µg/L, without causing cytotoxicity. Although ATZ does not affect mSCs mitochondrial function there was a tendency for increased ROS production and decreased antioxidant potential in the presence of the highest ATZ concentrations. Notably, exposure to ATZ significantly decreased glycolysis, glycolytic capacity, and non-glycolytic acidification of mSCs. LDH expression was also decreased in a dose-dependent manner. Overall, our data suggest that ATZ impairs the glycolytic metabolism of mSCs by reducing its glycolytic capability and LDH expression, potentially affecting lactate production. Since lactate is the preferred energy substrate for germ cells, ATZ exposure might impair the nutritional support of spermatogenesis and, consequently, compromise the male reproductive health.

Keywords: Endocrine disrupting chemicals; Atrazine; Male fertility; Glucose metabolism; Sertoli cells.

20396 | Humboldt Penguins (Spheniscus humboldti) living in the zoo: Effects of visitor's activity on penguin's behaviour

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Abstract

Zoos play an important role in the conservation of all animals in captivity, where it is imperative to guarantee that they have the best welfare possible. The presence of visitors is one of many elements that animals in zoos are daily exposed to, that may have an influence on their welfare. This influence can be seen as negative, since it can cause stress and lead to the performance of stereotyped behaviours; it can be seen as positive, since it can be considered a type of environmental enrichment, promoting an increase in behavioural diversity; or not have any influence at all. Thus, conducting animal behaviour studies in zoos is crucial to understand the influence that visitors can have on the animals, to ensure their welfare.

The Humboldt Penguins (Spheniscus humboldti), inhabitants of Zoo Santo Inácio, are the target of this study. Considered one of the main attractions of the Zoo, feeding sessions occur every day, attracting visitors. Therefore, this project aimed to study the behavioural responses of Humboldt Penguins to several visitor activities (proximity, levels of excitement, attempts to interact with the 554 animals). An ethogram of the penguins was elaborated, as well as a visitor behaviour scale (of 1-5 from passively observing to actively attempting to gain the animals' attention). Observations of the penguin's behaviour were made in the presence and absence of visitors and at the time of the feeding sessions. An instantaneous scan sampling of the penguin group was done once every 30 seconds and the zone of the enclosure used was registered, using the Boris software. Results seem to indicate that the nature and intensity of the visitor interactions, enclosure location influence the penguin's response to visitors. Comprehending the importance of these factors allows us to understand which visitors' behaviours have a negative or positive impact on the penguins-visitor interactions, enabling to refine the management of visitor-penguin interactions in zoos.

Keywords: Ethology, Zoos, Penguins, Welfare, Visitor effects.

20412 | Porcine Circovirus Type 2 prevalence in Wild Boars of Portugal - possible genotype shift

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Abstract

Porcine circovirus type 2 (PCV-2) is a non-enveloped DNA virus associated with several syndromes affecting swine. The genome of this virus is composed of a single strand of DNA, with two open reading frames: ORF1 (rep gene), encoding proteins linked to replication and ORF2 (capsid gene). Post-weaning multi-systemic wasting syndrome (PWMS), one of the syndromes associated with PCV-2, stands out due to its high economic impact on swine production. Recent data suggests the increasing circulation of the PCV-2d genotype, replacing other genotypes in circulation, particularly PCV-2b genotype.

To provide updated data on PCV-2 genotypes currently circulating in swine in Portugal, we 5555screened wild boar stools collected from several districts across Portugal, during the 2018–2020 hunting seasons, for PCV-2 and genetically characterized detected strains. From a total of 76 stool samples of wild boar tested by PCR for the partial PCV-2 ORF2 gene, a prevalence of 2.6% was found [2/76; 2.6%, 95% CI: 0.032-9.18]. Bidirectional sequencing showed that the sequences were 100% identical to each other and, after phylogenetic analysis, classified as PCV-2d genotype. This is the first report of the PCV-2d genotype in Portugal. This might be indicative that a shift in genotype is also occurring in Portugal, a trend that is being observed in developed countries. Vaccination for this virus exists, but all vaccines are based in PCV-2a and PCV-2b genotypes. As recent data shows cross protection of these vaccines for existing PCV-2 genotypes, circulation of PCV-2d, albeit of concern, should be controllable with already existing vaccines. However, novel genotypes are concerning as data shows that new genetic variants, with new tropisms, might evade vaccination and cause subclinical illness. Monitoring wild PCV-2 reservoirs is important for both veterinary public health and economic reasons, since PCV-2 infection has a strong economic impact on the swine industry.

Keywords: PCV-2; epidemiology; swine.

References

[1] de Sousa Moreira, A., Santos-Silva, S., Mega, J., Palmeira, J. D., Torres, R. T., & Mesquita, J. R. (2022). Epidemiology of Porcine Circovirus Type 2 Circulating in Wild Boars of Portugal during the 2018-2020 Hunting Seasons Suggests the Emergence of Genotype 2d. Animals: an open access journal from MDPI, 12(4), 451. https://doi.org/10.3390/ani12040451



Figure 1: Phylogenetic tree inferred using the MEGA X maximum likelihood method (Tamura 3-parameter model) and the Interactive Tree of Life (iTOL) based on 41 nucleotide PCV-2 sequences, including J315 sequence obtained in this study (PCV-2d, plus its accession number, is in bold and shaded in red) and 40 strains of different genotypes obtained from GenBank (PCV-2a to PCV-2h) (no bold or shading and identified with the accession number and country of origin).

20429 | Determination of bacterial cell concentration by optical density in the pathogen *Pseudomonas syringae* pv. *actinidae*

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Abstract

Kiwifruit bacterial canker (KBC) is a disease caused by Pseudomonas syringae pv. actinidae (Psa) which drastically affects kiwifruit production worldwide. In most studies, focused on understanding this disease, healthy kiwifruit plants (Actinidia chinensis) are inoculated with a given Psa inoculum concentration. However, conflicting information is found in the literature in what regards concentration being referred in some studies as colonies forming units (CFUs)/mL, whereas others rely on optical density (OD; measured at 600 nm) for its estimation. This inconsistency hampers to reproduce methodologies and interpret results, as OD reads may vary with different procedures and equipment. Despite the estimation of the bacterial concentration through determination of CFUs/mL being more accurate, it is a time-consuming procedure. Hence, this study aimed to stablish a consistent correlation between CFUs/mL and OD of Psa inoculum in our experimental conditions (equipment, buffer solution, etc.), which could assist inoculum preparation in future studies. For this end, an isolated colony from a Psa culture maintained in nutrient-sucrose agar (NSA) was firstly collected to be grown in Luria-Bertani (LB) liquid medium overnight (30 rpm, 26 $^{\circ}$ C). Cells were then centrifuged (30 min; 4000 g) and the pellet was resuspended three times in Ringer's solution to remove cell debris and LB medium remains. After that, the OD₆₀₀ was monitored spectrophotometrically (Thermo Scientific Multiskan SkyHigh) and adjusted to 0.1. Finally, three serial dilutions of 10⁻¹ were performed and 10 μ l, 20 μ l and 40 μ l were plated from a 10⁻³ dilution. The plates were incubated at room temperature for 72 h before determination of CFUs/mL. Our results revealed that an OD of 0.1 is comparable to 10⁷ CFUs/mL of Psa. This provides a reference for the conversion between OD and CFUs which could be utilized in KBC studies for better describing the inoculum characteristics.

Keywords: CFUs, inoculation procedures, kiwifruit, *Pseudomonas syringae* pv. Actinidae.

20466 | The role of oleate and oleoylethanolamide in the regulation of feed intake in European sea bass

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Abstract

The aquaculture sector has continuously grown over the years, contributing to 49% of fish produced worldwide in 2020 [1]. This growth is dependent on the use of aquafeeds, which represents about 70% of the total production costs. The optimization of feeding, as well as the enhancement of animal growth and body composition, emerges as an efficient strategy to reduce feed costs. Thereby, understanding the mechanisms underlying feed intake (FI) regulation and how it is affected by diet composition is extremely important. FI regulation relies on the interplay between orexigenic and anorexigenic factors produced and released by the peripheral system and which are integrated into the central nervous system, by nutrient-sensing mechanisms. Oleic acid (OA) and the derived fatty acid oleoylethanolamide (OEA) have been described as potent anorexigenics in fish [2, 3, 4, 5]. Thus, the present study aimed to evaluate the role of OA and OEA in the regulation of FI of European sea bass (Dicentrarchus labrax). For this purpose, an ex vivo trial was performed with liver tissue incubated for one hour either with 100 or 500 μ M of OA or OEA coupled or not with an increase in glucose concentration (5.5 or 10 mM). Thereafter, liver samples were collected and the expression of several genes involved in fatty acid (FA) and glucose sensing mechanisms was assessed. After OA (500 μ M) treatment, PPAR- α expression increased so, although no significant differences in FAS, SREBP1, LXR, and CPT1 expression were detected, FA-sensing mechanisms might have been activated after one hour of incubation. There was also a decrease in GK and GPase expression after both treatments suggesting that glucosensing mechanisms were activated, resulting in the inhibition of glycolysis and gluconeogenesis. In conclusion, these results indicate that further studies are necessary to unravel the role OA and OEA in FI regulation and in lipidic and glycolytic metabolism modulation.

Keywords: aquaculture, fish nutrition, *ex vivo*, oleate, oleoylethanolamide, feed intake regulation, lipid metabolism, fatty acid sensing mechanisms, glucose metabolism, glucose sensing mechanisms.

Acknowledgments

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References

[1] FAO Fisheries and Aquaculture, 2020. The State of World Fisheries and Aquaculture 2020. Sustainability in action. FAO, Rome. https://doi.org/10.4060/ca9229en

[2] Conde-Sieira, M., Bonacic, K., Velasco, C., Valente, L.M.P.P., Morais, S., Soengas, J.L., 2015. Hypothalamic fatty acid sensing in Senegalese sole (Solea senegalensis): Response to long-chain saturated, monounsaturated, and polyunsaturated (n-3) fatty acids. Am. J. Physiol. - Regul. Integr. Comp. Physiol. 309, R1521–R1531. https://doi.org/10.1152/ajpregu.00386.2015

[3] Librán-Pérez, M., López-Patiño, M.A., Míguez, J.M., Soengas, J.L., 2013. Oleic Acid and Octanoic Acid Sensing Capacity in Rainbow Trout Oncorhynchus mykiss Is Direct in Hypothalamus and Brockmann Bodies. PLoS One 8, e59507. https://doi.org/10.1371/journal.pone.0059507
[4] Tinoco, A.B., Armirotti, A., Isorna, E., Delgado, M.J., Piomelli, D., de Pedro, N., 2014. Role of oleoylethanolamide as a feeding regulator in goldfish. J. Exp. Biol. 217, 2761–2769. https://doi.org/10.1242/jeb.106161

[5] Velasco, C., Comesaña, S., Conde-Sieira, M., Míguez, J.M., Soengas, J.L., 2018. The short-term presence of oleate or octanoate alters the phosphorylation status of Akt, AMPK, mTOR, CREB, and FoxO1 in liver of rainbow trout (Oncorhynchus mykiss). Comp. Biochem. Physiol. Part - B Biochem. Mol. Biol. 219–220, 17–25. https://doi.org/10.1016/j.cbpb.2018.03.002

20609 | Balancing sociality and conflict: the role of redirected aggression in common waxbills

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Abstract

Individuals can balance the benefits and costs of sociality with information about their group members. Dominance hierarchies occur in many species and require knowledge of group members to predict future social interactions. In the context of social aggression, audience effects occur when individuals behave differently depending on the presence of bystanders. Additionally, effects on bystanders may occur if observing an interaction between two others influences the behaviour of the bystander. Empirical research is needed to understand the dynamics of dominance hierarchies, and the strategies for transferring information on aggressiveness. A recent descriptive study with common waxbills (Estrilda astrild) in a semi-natural setting found increased aggressiveness when less familiar individuals are present as bystanders in the audience, yet aggressive interactions were not directed at those unfamiliar individuals. This was interpreted as waxbills using aggression to show-off dominance to the unfamiliar bystanders. To complement this work, we used experiments in controlled conditions, manipulating the social and physical environment of waxbills in cages. It was found that, when in a novel cage, waxbills were more aggressive. We did not find evidence that waxbills showed-off aggressiveness in the presence of unfamiliar individuals, by directing aggression to familiar companions. Instead, we found an ${ extsf{-}}$ association between the amount of attacks waxbills received from unfamiliar individuals, and the amount of attacks they directed to familiar individuals, a pattern that can be interpreted as redirected aggression. Redirected aggression is a strategy that may occur in gregarious animals when an individual who has been attacked directs aggression to a bystander who was not involved in the provocation. We further discuss the impact of stress on aggression and the use of redirected aggression, as well as the putative adaptive advantages in the studied species.

Keywords: Sociality; *Estrilda astrild*; Dominance hierarchies; Displaced aggression; Behavioural Ecology.

20654 | Genetic characterization of Toll-Like receptor 7 gene in Chondrichthyans (sharks, rays, and chimaeras)

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Abstract

Chondrichthyans (sharks, rays, and chimaeras) represent the most ancient living basal-jawed vertebrate lineage and have wide variability in ecological traits such as habit (benthic, pelagic, or benthopelagic) and habitat (coastal, open ocean, or deepwater) [1]. Similar to mammals, they present an adaptive immune system and are thus considered a key taxon to understanding the evolution of vertebrates' adaptive immunity. Additionally, they are a good model for studying host-pathogen co-evolution since their biology and ecology allow them to interact with several different pathogens.

Toll-like receptors (TLRs) are an ancient family of genes that play an important role in the initial detection and response to pathogens. They recognize a wide range of pathogen-associated molecular patterns and perform biological functions in innate and adaptive immunity, inflammation, and cancer. Generally, these genes are under strong selective pressures and show marked variation in their number and diversity [2]. Although they are well characterized in various mammalian groups, little is known about their repertoire, genetic diversity, and structure in basal-jawed vertebrates [3]. Of note, the TLR7 gene is an innate immune receptor important for detecting single-stranded RNA viruses [4].

Here we conduct the first characterization of TLR7 genes in Cartilaginous taxa aiming at assessing their diversity among and within species, including taxa with distinct ecological traits (i.e., different habits and habitats). To do so, we performed bioinformatic searches (genomic and transcriptomic databases) and generated new data via DNA extraction, PCR amplification, and Sanger sequencing. The obtained data will be used for phylogenetic analysis and in estimating genetic diversity and divergence of the TLR7 gene among and within Chondrichthyans to allow reconstructing its evolutionary history and explore the patterns and processes shaping TLR7 diversity in this group.

Keywords: Chondrichthyans; toll-like receptor; TLR7.

Acknowledgments

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References

[1] Carrier, J.C., J.A. Musick, and M.R. Heithaus, Sharks and their relatives II : biodiversity, adaptive physiology, and conservation. CRC marine biology series. 2010, Boca Raton, FL: CRC Press/Taylor & Francis. xv, 713 p., 16 p. of plates.

[2] Nie, L., Cai, S. Y., Shao, J. Z., & Chen, J. (2018). Toll-like receptors, associated biological roles, and signaling networks in non-mammals. *Frontiers in immunology*, *9*, 1523.

[3] Liu, G., Zhang, H., Zhao, C., & Zhang, H. (2020). Evolutionary history of the Toll-like receptor gene family across vertebrates. *Genome biology and evolution*, *12*(1), 3615-3634.

[4] Neves, F., Marques, J. P., Areal, H., Pinto-Pinho, P., Colaço, B., Melo-Ferreira, J., ... & Esteves, P. J. (2022). TLR7 and TLR8 evolution in lagomorphs: different patterns in the different lineages. *Immunogenetics*, 74(5), 475-485.

20696 | Genetic structure of the red squirrel (Sciurus vulgaris) in Portugal

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Abstract

The red squirrel (Sciurus vulgaris) is a widespread species found in most of Eurasian coniferous forests. Although it has been extinct in Portugal for about four centuries, mainly due to habitat fragmentation and deforestation, it started recolonizing the country in the 80's. Natural dispersal from Spanish populations and reintroductions events in urban parks may have facilitated the recolonization of the Portuguese territory. In this study, we aim to investigate genetic structure and the potential origin of the red squirrels in Portugal, using mitochondrial molecular markers (mtDNA). A total of 51 roadkill samples and 23 pine swab samples were collected in north and central Portugal. DNA was extracted and two fragments of mtDNA, cytochrome b and D-Loop, were amplified. We were able to identify 6 and 10 haplotypes of cytochrome b and D-Loop, respectively, with diversity indices similar to other European populations. No genetic structure was observed in both markers, supporting a panmictic populations in Portugal. Further, to evaluate the potential source of the Portuguese population, we used available sequences from West and South Europe to reconstruct median-joining networks. No genetic structure was also observed among the European populations. Haplotype sharing between Portugal and Spain was detected in both mtDNA markers, supporting the recolonization from this neighbour country. In addition, haplotype sharing with France and, more surprisingly, with Italy was detected using D-Loop. Although natural dispersal from these countries cannot be completely ruled out, this haplotype sharing also highlights the potential role of reintroductions in the recent recolonization of Portugal. A more thorough investigation using fast-evolving markers or the whole genome is needed to uncover the origin of the Portuguese population.

20737 | The last of us: study and online access to the Fungi collection of Porto Herbarium (PO – MHNC-UP)

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Abstract

Fungi are the end and beginning of many nutrient cycles and the basis of several scientific studies in areas such as medicine, biology, nutrition, and agriculture. The Porto Herbarium (PO), currently part of the Museum of Natural History and Science of the University of Porto, contains cryptogamic specimens, such as Fungi, which are still very little known. The fungi collections of the PO currently include about 2300 national specimens, half of which were collected up to about 1950. These fungal specimens retain the original identification given by their collectors.

Since 2017, the addition of around 1000 specimens of macrofungi by the collector Vasco Fachada, and other specimens by collectors such as Carlos Vila-Viçosa and Paulo Oliveira, suggests a renewed interest in these historical specimens, which have much to offer the scientific community. It is therefore crucial to find a new, easier way to understand the vast collections that have yet to be digitised in a vast archive accessible to all curious minds.

Our main objective was to organise the herbarium inventory based on the taxonomic classification and historical information of these specimens. Thus, our working group created a digital database with the addition of visual aids in the form of photographs of each specimen to enrich the online viewing of the collection. We also made the connection between Gonçalo Sampaio's original collection of unnamed specimens and the current one, giving them the appropriate identification and order. Other collections and collectors were also recognized and studied, adding new value to these specimens.

In this way, we will be able to establish the more classical PO Fungi collection as an integral part of Portugal's scientific understanding and as a resource for worldwide access and study.

20774 | Searching for plastic degrading potential in marine microorganisms

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Abstract

Pollution from plastics fishing nets, traps and marine litter poses a serious threat to marine ecosystems. The biodegradation of these compounds by microorganisms is being studied nowadays. The objective of this work was to identify if some bacterial strains isolated from biofilm collected from plastic fishing nets (Net A: braided polyethylene (PE), Net B: braided nylon, Net C: fine nylon) presents potential for plastic degradation. For this, 8 strains isolated from the plastic biofilms after one month of growth in seawater, belonging to 5 different genera (*Rhodococcus*, Pseudomonas, Erythrobacter, Sulfitobacter and Pseudophaeobacter) were used. Screenning assays were performed to check the strains activity of esterase/lipase enzymes in TBA (tributyrin agar based) media (1% (v/v)), in TBA media supplemented with Ca^{2+} and TBA media supplemented with Mg²⁺. Escherichia coli ATCC 25922 was used as a negative control and Staphylococcus aureus ATCC 29213, Bacillus subtilis ATCC 6633, as a positive control. Positive results indicated by a formation of a halo around the colonies, after 48h of growth at 37ºC and 28ºC. In addition, growth assays were carried out on solid minimal media containing each one of these fishing nets as the sole carbon source, only for 3 strains, from 2 different genera (Rhodococcus and Pseudomonas), with inoculum prepared with an initial Optical Density of 0.1 and added to either discs (15 microliters) and wells (20 microliters).

This study was followed up for 1 month in which the diameters of the halos formed around discs were measured every week, and growth around the wells, seen under a stereoscope.

In activity assays for esterase/lipase enzymes, only CPN2, CPN3, 1.7L, N B19 and N B20 were positive. Regarding the growth in media with fishing nets, only CPN2 and 1.7L showed growth.

The next steps would be to carry out these screening tests for different strains and detect the presence of genes encoding for plastic-degrading enzymes, by PCR.

Keywords: Plastics; bacteria; biodegradation; fishing nets.

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20814 | Genomic analysis for forensic identification of predators in attacks on livestock

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Abstract

Humans and large carnivores have a long history of conflict due to direct competition on landscape and resources. In the Iberian Peninsula, the Iberian wolf (Canis lupus signatus) and the Cantabrian Brown bear (Ursus arctos) inhabit human-dominated landscapes, increasing the risk of potential conflict, namely livestock predation. In Asturias (North of Spain), the number of attacks to livestock has become more frequent since the XIV century, which has been triggering social discontent. As a way to recompense the local populations for the damage caused by these large carnivores, the local authorities developed a compensation mechanism to cover these cases. But, this compensation is only valid for livestock killed by wolves or bears, the same does not happen for livestock attacked by wild dogs. Therefore, it is crucial to correctly identify the predator involved in the conflict. In this study, we followed a forensic molecular approach to correctly identify the predator species. We started by extracting DNA from 20 samples from saliva swabs obtained from the prey's wounds. Then, two polymerase chain reactions (PCR) were performed: the first one to amplify two mitochondrial fragments (gene 12S and D-loop), and the second to add the indexes to the fragments present in the sample. The latter is a crucial step in DNA library preparation because it allows the identification of each sample. Finally, the samples were sequenced through high-throughput sequencing and will be analysed using bioinformatic analyses, leading to predator identification.

Keywords: *Canis lupus signatus; Ursus arctos;* livestock predation; Asturias; forensic molecular approach.

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References

[1] Llaneza L, López-Bao JV, Sazatornil V (2012). Insights into wolf presence in human-dominated landscapes: the relative role of food availability, humans and landscape attributes. *Diversity and Distributions*, 18(5), 459-469.

[2] Yravedra J, Maté-González MÁ, Courtenay LA, González-Aguilera D, Fernández MF (2019). The use

of canid tooth marks on bone for the identification of livestock predation. *Scientific Reports*, 9(1), 1-9.

20815 | Genetic evaluation of diet patterns in leopards from southern Angola

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Abstract

Understanding the diet of top predators, like leopards (Panthera pardus), including unravelling the dietary patterns and their variability in response to prey availability, is crucial to determine the ecology of such carnivores. Although widely distributed in the past, leopard populations have been decreasing throughout most of their range, due to habitat fragmentation, reduced prey availability and conflict with human activities. To implement global management and conservation programmes, it is urgent to understand how prey depletion impacts the patterns of predation or competition. Leopards are present in the Bicuar National Park, in the south of Angola, but are facing a reduced availability of prey, which has been promoted by the enormous social upheaval that the country has experienced for more than 40 years. This population has been monitored since 2017, including the number of individuals present in the park and their diet.

In this work, we aim to determine the diet of leopards from the Bicuar National Park using a DNA metabarcoding approach on non-invasive samples. Twenty scat samples were collected in the Bicuar National Park and subsequently submitted to DNA extraction using protocols optimized for non-invasive samples. To avoid potential errors due to scat misidentification in the field, we performed genetic confirmation of the species identification, through a two-step PCR approach. All samples were confirmed to belong to leopard, which were then subjected to an amplicon PCR and a PCR clean-up. These samples were individually indexed to perform the construction of DNA libraries for sequencing the mitochondrial 12S rRNA gene. The next step will be performing the bioinformatic analysis of genomic data for quality control and prey identification in each sample of the leopard. This will enable us to infer the diet patterns of the leopard at the Bicuar National Park in the south of Angola.

Keywords: *Panthera pardus*, DNA Metabarcoding, Diet Analyses, Non-invasive, Scat Analysis, Dietary Diversity, Dietary Niche, Carnivore.

20949 | The reshaping of Cetacea immunity: evolutionary tales of expansion and loss

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Abstract

Cetacea (whales, dolphins and porpoises) are among the most charismatic animals inhabiting the planet. Cetacea are exposed to a wide range of microbial pathogens, which occasionally cause significant populational declines. How these illusive aquatic mammals develop an immune response and the functional architecture of their immune system is largely unknown. Deciphering the genomic changes governing immune function is key to understand the evolution of these threatened species. Previous studies have shown the role of gene loss events (partial or total gene erosion). In effect, several genes coding for proteins responsible for the recognition of viruses and bacteria, as well as inflammatory factors, were shown to be lost within Cetacea. Here, we investigate some molecular components of the immune system in Cetacea and in other mammalian species to clarify variations in gene repertoires and mutational landscapes. We selected genes coding for proteins which are expressed on the surface of antigen-presenting cells: CD1 (cluster of differentiation 1), which allow the recognition of lipids, glycolipids and small molecules antigens, and MR1 (major histocompatibility complex class I-related gene protein) that recognises bacterial vitamin metabolites. Using a combination of synteny analysis, gene 🤳 annotation, and phylogeny, we uncovered a scenario of expansion and contraction in the CD1 gene cluster. While in human we find 5 CD1 genes (CD1A to E), ungulates exhibit major expansions (up to 14 copies); and, a striking gene contraction is observed in toothed whales (Odontoceti): yielding two genes in sperm whale (Physeter catodon) and a single copy in the remaining analysed Odontoceti. Baleen whales (Mysticeti), on the other hand, exhibited 3 to 4 CD1 genes. Additionally, the single copy MR1 appears pseudogenized in Cetacea. Together, these results expand and refine our vision the dynamic nature of mammalian genomes, as well as the role of gene duplication and loss as critical processes to comprehend Cetacea immunity.

Keywords: Cetacea, gene loss, immunity.

20964 | Reproductive genes in Pangolins: The role of gene loss

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Abstract

The reproduction of mammalian species in captivity is still a challenging task. In mammals, previous studies have shown differences in the physiology of these cell types in different lineages, specifically in the energetic pathways regulating the development of sperm cells (e.g., Cetacea). Thus, understanding the precise genetic program governing the development and maturation of the highly specialized reproductive cells is fundamental. Considering that the population of pangolins (order Pholidota) has been decreasing, captive breeding could be a valuable way to safeguard these species. Additionally, recent reports have pointed-out distinct molecular signatures (i.e., expression of a V-ATPase subunit isoform) with impacts on the pH regulation of pangolin sperm luminal microenvironment. Aiming to investigate the contribution of gene erosion, deletion, and duplication in the genetic architecture controlling the development and physiological maturation of sperm cells pangolin species, we used a combination of synteny analyses, gene annotations (i.e., Pseudochecker) and phylogeny. Target genes included genes involved in flagellated sperm motility (CABS1, CATSPER4, CATSPERB), protein folding, proteinprotein and protein-nucleic acid interaction (CCT8L2, GSG1 and RNF133). Our comparative approach revealed signs of gene erosion in pangolins. The obtained results support the essential role of secondary gene loss in the making of the reproductive traits in pangolins and the resourcefulness of genomic data towards the optimization of breeding protocols in captivity.

Keywords: Pangolins; Gene Loss; Reproduction; Sperm cells; Genomics.

20994 | First report of mites associated with *Rhynchophorus ferrugineus* (red palm weevil) in warmer regions of Portugal: Algarve and the Madeira Island

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Abstract

Rhynchophorus ferrugineus Olivier, 1790, or Red Palm Weevil (RPW) is native from southeast Asia and was first spotted in Portugal (Algarve) in 2007. This species is a pest of palm trees in Europe, especially of *Phoenix canariensis* L., RPW has been associated with multiple organisms, namely phoretic mites, which use the weevil to move from one place to another. Our objective is to report the different mite's species associated with the RPW and its distribution in Algarve and Madeira. The RPW were collected from the Algarve and the Madeira archipelago using aggregation pheromone traps. The specimens were stored in plastic bags in 70% ethanol and were dissected in order to register the number and species of mites in each body part of the host under a light microscope. We divided the RPW in five parts: head and antenna, thorax, abdomen, legs, and elytra and wings. Mites were mounted in microscopic slides in 90% lactic acid and identified based on morphological features.

In total, 33 weevils were observed (11 from Algarve and 22 from Madeira) with an average of 175 mites per weevil (mpw). The prevalence of mites in this species was 94.7%. Mites were found in association with all body parts, however, the highest average intensity was found in elytra and wings with 140 mpw. Seven mite species were found: *Centrouropoda* sp., *Curculanoetus* sp., *Acarus* sp., *Nenteria* sp., Mesostigmata and Astigmata type 1 and Astigmata type 2. In weevil samples from Madeira, mite eggs were also observed inside the weevil.

The high intensity of mites in the RPW shows that mites might have a negative impact on the weevil due to a significant added weight on its wings, potentially hindering its flight ability. This is the first study that reveals the presence of mite eggs inside the weevil. This may prove that mites establish a parasitic interaction with the weevil, instead of a phoretic interaction.

Keywords: Rhynchophorus ferrugineus; palm-tree; mite; invasive insect; phoresis.

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References

[1] Dembilio, Ó., and J. A. Jaques. 2015. Biology and management of red palm weevil. Sustainable pest management in date palm: Current status and emerging challenges: 13-36.

[2] Dilipkumar, M., A. Ahadiyat, P. Mašán, and T. S. Chuah. 2015. Mites (Acari) associated with Rhynchophorus ferrugineus (Coleoptera: Curculionidae) in Malaysia, with a revised list of the mites found on this weevil. Journal of Asia-Pacific Entomology 18: 169-174.



Figure 1: Mite collected from Rhynchophorus ferrugineus from Madeira archipelago with visible eggs. (Arrows – eggs)

20997 | Improving Synechocystis salt tolerance envisaging large-scale seawater cultivation

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Abstract

Compatible solutes are organic compounds of low molecular weight that are categorized into different chemical classes, such as polyols, carbohydrates, amino acids and their derivatives. These molecules can accumulate intracellularly in high amounts enabling the maintenance of the osmotic balance under stress conditions, namely salinity. One of these solutes, glycine betaine (GB), has a significant commercial value with applications in food/feed, pharmaceutical and cosmetics industries. The biosynthesis of GB using bacteria as cell factories is being pursued since the current production methods are too expensive, have low yields and/or are environmentally unfriendly. Therefore, cyanobacteria are emerging as chassis for the production of this CS, due to their photosynthetic metabolism/ability to sequester CO₂. Previously, the heterologous production of GB was implemented in several Synechocystis strains/chassis by introducing a synthetic device based on the biosynthetic pathway described for the halophilic cyanobacterium 🛁 Aphanothece halophytica [1], which involves the trimethylation of glycine. In this work, the optimization of GB yields is being attempted by increasing the availability of the GB precursor, glycine. For this purpose, several strains with or without the GB device are being cultivated in medium supplemented with different glycine concentrations. For the strains exhibiting improved growth, the compatible solutes, glycogen and extracellular polymeric substances (EPS) production will be measured, gaining an insight into the partition of carbon fluxes. By the end of this work, Synechocystis strains with improved halotolerance will be available foreseeing largescale cultivation in seawater.

Keywords: cyanobacteria, compatible solutes, glycine betaine, salt tolerance

Acknowledgments

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References

[1] Ferreira, E. A. et al. (2022) Front. Bioeng. Biotechnol. 9: doi: /10.3389/fbioe.2021.821075

21016 | Exploring the potential of algae-associated Actinobacteria as a source of antimycobacterial compounds

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Abstract

Resistance to antimicrobials is one of the biggest health challenges in the world, with projections indicating its association with 10 million deaths annually by 2050. The genus *Mycobacterium* is one important example. It includes two highly dangerous human pathogens, *M. tuberculosis* and *M. leprae*, with increasing resistance to available antibiotics. Additionally, the prevalence of non-tuberculous mycobacteria (NTM) is increasing around the globe. NTM are known for their exquisite resistance to all forms of antimicrobials, leading to a high demand for new and more effective drugs.

To solve this problem, multiple strategies can be employed, one of them being the search for new antimicrobials in Nature. Several microorganisms are known to produce a variety of bioactive compounds, in particular Actinobacteria. In this work, we tested 90 extracts derived from Actinobacteria living in symbiosis with two species of macroalgae, *Codium tomentosum* and *Chondrus crispus*, to investigate the presence of antimycobacterial agents.

The antimicrobial activity of the extracts was assessed against the pathogenic NTM species *M*. *abscessus* and *M*. *avium* in broth assays. We were able to identify the more active extracts against each of the species and test them at different concentrations (broth microdilution assay), to calculate their IC_{50} values. Our results enabled the identification of various extracts that significatnly inhibited the two mycobacterial species tested. To understand what type of compounds could be responsible for these activities, the extracts were subjected to dereplication based on reverse-phase liquid chromatography, with the resulting fractions being tested against in the NTM as above. In sum, this work disclosed macroalgae-associated Actinobacteria as a strong source for new antimycobacterial compounds. Future studies will aim at the identification of these compounds and their further characterization.

Keywords: Mycobacterium; Actinobacteria; crude extracts; drug susceptibility; antimicrobials.

Acknowledgments

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21113 | The dietary niche of the European otter in areas invaded and non-invaded by the signal crayfish in the NW of Portugal

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Abstract

Biological invasions may cause multiple effects on ecosystems, including changes in the food web network of entire communities. In this study, our aim was to understand how the signal crayfish (Pacifastacus leniusculus) invasion affects the abundance and trophic niche of a top predator, the European otter (Lutra lutra). We sampled four rivers (Tuela, Rabaçal, Baceiro, and Mente) in the NW of Portugal, and covered areas invaded (INV) and non-invaded (N-INV) by the signal crayfish. Thirty-two river stretches of approximately 600m were sampled in July 2021,19 in INV areas and 13 N-INV areas. GPS coordinates were recorded for all feces and used as a surrogate of otter abundance, while only fresh samples were collected for the dietary analysis. In total, 249 feces were recorded (214 in INV and 35 in N-INV areas), from which 197 were collected and stored in 96% ethanol. Yet, 100 feces were analysed following traditional approaches. Briefly, the feces were weighed, washed and the components separated by taxonomic group (amphibia, mammals, birds, fish, crustacea, reptiles, and insects). The frequency of occurrence (FO) was calculated by dividing the number of occurrences of a certain prey type by the number of total feces analysed. Differences in the FO of prey items and otter abundance between INV and N-INV areas were estimated using common statistical procedures. Our results showed that otter abundance was significantly higher in invaded (μ =11.26 and σ =7.45) when compared with non-invaded areas (μ =2.69 and σ =2.95), suggesting that they use more frequently the river stretches harboring the signal crayfish. The most frequent prey item in INV areas was the crustacean (FO=0.84), followed by insects (FO=0.28) and fish (FO=0.19), while in N-INV areas it was the fish and insects (both FO=0.50). Overall, in this study we provide one more evidence of the plasticity of the otter diet and the importance of the signal crayfish for its presence and abundance_in the river pristine habitats of NW Portugal.

Keywords: biological invasion; pristine habitats; top predator; Lutra lutra; diet analysis.

21127 | Life-history parameters of a laboratory colony of *Rhynchophorus ferrugineus* (Olivier, 1790) (Coleoptera: Curculionidae) for biotechnological applications

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Abstract

The red palm weevil (RPW), Rhynchophorus ferrugineus (Olivier, 1790), is an important pest of palms and an invasive exotic insect species in many countries of the Eastern Hemisphere, including Portugal. Here we present our results of studying the life history parameters of an RPW colony established in our laboratory at the Department of Biology of the FCUP for biotechnological applications. Characteristics of the RPW colony, such as the development time of each insect stage (egg-larva-pupa-adult), the average weight of larvae in each instar and the fecundity of eggs are going to be assessed. The colony started with twenty-four neonate larvae reared at 27±1°C, 0:24h (light:dark) and humidity of > 80% with a meridic diet developed in our laboratory, based on apple smoothie, wheat germ, maize flour and brewer's yeast as complete 🧉 ingredients. The apple smoothie was also added as a token stimulus as the RPW are known to prefer this fruit. To ensure adequate nutrition and survival of the insects, the diet also contained various chemically defined ingredients as additives, such as a vitamin/choline mixture, sorbic acid, ascorbic acid, methylparaben and a commercial mould inhibitor Fabco-I. Agar was used as the gelling agent. After 98 days and 7 instars, the RPW larvae weighed an average of 4.1 g and have a head capsule width of 7 mm. Throughout the process, we found that rearing space is a crucial factor for successful larval moulting and survival from the fifth instar onwards. The results of this work will provide new insight on the rearing of this insect species under laboratory conditions to better understand the biology of this pest. This colony will also serve as a source of high-quality insects for the evaluation of new insecticides and the isolation of insect molecules with biotechnological applications.

Keywords: Red palm weevil; invasive species; biological parameters; artificial diet; laboratory rearing; Yellow biotechnology.

Acknowledgments

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Head Capsule Width — Weight

21143 | Influence of temperature on Artemia franciscana mating and activity patterns

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Abstract

Climate change, escorted by increasingly higher temperatures, is affecting not only the physiology of many aquatic species but also their reproductive behaviour. Severe modifications of typical mating patterns, able to disrupt the expected action of selective forces such as sexual selection, could have severe implications for species adaptation. Recently, it was shown, in the microcrustacean *Artemia franciscana*, that increasing water temperatures are able to impact the species mating system (size assortative mating) by supporting random mating, thus reducing the intensity of sexual selection. Here, using a Locomotor Activity Monitor (LAM) system and the recently developed Rtivity software, we looked into behavioural biomarkers (e.g., swimming speed, rhythmic activity) to try and ascertain how temperature could potentially impact *A. franciscana* mating patterns.

We show that, diverging from what is observed at the species' optimal temperature (25 $^{\circ}$ C), where sex-specific velocities differ (males are faster than females), higher temperatures were translated by notably higher female swimming speeds. As mating pairs partially result from the male's ability to clasp and hold to a female, temperature-induced shifts in female swimming patterns can help justify the previously described random mating pattern occurring when *A*. *franciscana* is exposed to warmer waters. To the best of our knowledge, we also show, for the first time, that *A. franciscana* presents a clear circadian rhythmicity, seemingly unaffected by temperature.

Keywords: climate change; mating patterns; activity; reproduction.

21153 | Methodological optimization of scat extractions and non-invasive genetic identification of large consumers in Sahel

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Abstract

As of today, our knowledge of worldwide biodiversity is biased and scarce, and there is a great lack of information, especially regarding the biogeographic distribution of different species. This obstacle has been named "Wallacean Shortfall" and is one of the greatest challenges in the study of biodiversity since knowledge of a species distribution is the most basic data needed for proper management and conservation. This problem is worse the more elusive the species, and the more remote the geographic region.

West Africa is one of the major global biodiversity hotspots, but also one of the regions where the Wallacean shortfall is most pronounced, due to difficulties in accessibility and lack of infrastructure. As such the use of Non-Invasive samples like scats has been rising in popularity in the last few years as it is an incredible tool that allows gathering genetic information without capturing the animals and reducing the impact on their ecosystem. This presents a clear advantage for rare and elusive species that are more difficult to approach and study.

This work will focus on the methodological optimization of DNA barcoding of invasive (tissues) and non-invasive (faeces) samples of monkey (*Erithrocebus patas*), baboon (*Papio papio*), and crocodiles (*Crocodylus* sp., *Osteoalaemus* sp.), available at CIBIO. Sequences produced will then be blasted in BLAST and aligned with reference sequences available in online repositories (e.g., GeneBank) in order to identify the species or the genetic lineage/population of each sample. Lastly, the updated distribution of the species studied will be mapped using geographic information systems programs.

Keywords: Papio papio; Wallacean Shortfall; Erithrocebus patas; barcoding; Non-Invasive samples

References

[1] Costa et al. (2016). Improving DNA quality extracted from fecal samples — a method to improve DNA yield

[2] Brito, J. C., Sow, A. S., Vale, C. G., Pizzigalli, C., Hamidou, D., Gonçalves, D. V., ... & Álvares, F. (2022). Diversity, distribution and conservation of land mammals in Mauritania, North-West Africa. PloS one, 17(8), e0269870

21198 | Temperature influence on catch data and relative abundance of blue sharks in the North Atlantic

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Abstract

Climate-driven Ocean warming is one of the main factors that can affect marine life, leading to changes in species distribution, population declines, or local extinctions. Moreover, the reduction of ecologically important marine top predators such as sharks can lead to cascading effects across the marine ecosystem.

In this work, we evaluate the effect of temperature on catch rates of blue shark (*Prionace glauca*), the pelagic shark most commonly taken by commercial fisheries- by comparing daily water temperature and catch per unit effort (CPUE) index and building a thermal preference (i.e., abundance) curve. This was done based on a survey of data relating to blue sharks captured along the North Atlantic Ocean in expeditions from January 2013 to 2018. Consequently, data were evaluated using the RStudio software, and the average monthly and annual catch was plotted - the average catch was calculated based on weight values and the location where the capture occurred.

Our results showed that in the months of June over the years, there was a capture peak when compared with the other months suggesting a greater abundance of the species. When the annual average was accessed, it was possible to notice a higher abundance of the species during 2014 followed by a stabilization in blue sharks' abundance. However, much uncertainty still exists about the relation between the abundance in catch rates and water temperature fluctuation. Therefore, this offers some important insights related to increased fishing pressure among target species such as blue sharks and enables predictions about how they will respond to climate change, due to their rapid behavioural responses to warming.

Keywords: Climate change, Target species, Temperature, Thermal niche, Fishing.

21220 | Pollinators in the agroecosystems of São Tomé

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Abstract

One of the biggest threats to biodiversity is the fact that ecosystems are being simplified by agricultural practices, specially by monocultures. Pollinating arthropods can be particularly sensitive to agricultural practices as they can be specialized on a reduced number of plant taxa, often unavailable in agricultural fields, as well as suffer from heavy pesticide use.

The tropical island of São Tomé, located in the Gulf of Guinea, is inhabited by a large number of endemic animal and plant species. Although ¼ of the island is considered protected area, agriculture has historically been the economic base of the country. From sugar cane to cocoa and palm oil, São Tomé has seen its luxuriant rainforest been degraded since its human occupation. Still, little is known about the potential impacts of agroecosystems on arthropod pollinator loss in the island. To answer this question, we surveyed four different habitats (villages, oil palm plantations, cocoa plantations, and forests) with four sets of pan-traps across twelve sites. We used pan-traps to target pollinators since that they mimic flowers and function as colour baits. Each pan-trap was built with four differently coloured containers (yellow, white, blue, and orange) and was hang in trees at least 1m above ground for 24h. Each collected sample was then analysed and specimens were identified morphologically in the laboratory using a stereo microscope and adequate literature.

In this study we aimed to understand how pollinator biodiversity is distributed across habitats and how much of natural communities are still harboured in monocultures (both cocoa and palm oil). Specifically, we aimed to assess differences in a) taxa richness and b) taxa composition across an environmental gradient of human intervention. This study represents the first attempt to document arthropod pollinator communities in the island of São Tomé and can serve as a baseline for future biodiversity assessments. Keywords: Biodiversity, Pan-traps, Pollinators, Agricultural ecosystems.

Acknowledgments

This project was developed in the framework of the partnership agreement between BirdLife International and BIOPOLIS association to promote informed, evidence-based biodiversity conservation action in São Tomé and Príncipe, which is funded by the European Union through the 'Landscape Management in São Tomé and Príncipe' project (ENV/2020/420-182) and from the European Union's Horizon 2020 research and innovation programme under grant agreement No 854248. The team was also supported by TROPIBIO NORTE-01-0145-FEDER-000046, funded by Norte Portugal Regional Operational Programme (NORTE2020), under the PORTUGAL 2020 Partnership Agreement, through the European Regional Development Fund (ERDF).

21231 | Interactions among monk parakeets (*Myiopsitta monachus*) and other avian species in urban areas of Madrid (Spain) Fernández, Moreno, Estela, Sandra, CIBIO, Portugal

Abstract

The inclusion of the monk parakeet in the urban ecosystem is a scarcely studied topic. By collecting behavioural data when interacting with other species of urban birds we aim to understand better whether this invasive species is disrupting the dynamics and normal behaviour among native birds. Three parks with large colonies, in the north-western part of Madrid, were chosen to perform the sampling during the winter and spring season of 2021. Attending to behaviour, we observed that major proportion of interactions were with middle-sized species: rock dove, common wood pigeon, stock dove, common magpie, turtle dove and blackbird. This study documented for the first time, native species' agonistic interactions towards the monk parakeets related to nesting behaviour, trying to occupy their chambers and/or nests. Also, the correlation between the number of monk parakeets in a group and the likelihood of agonistic behaviour was demonstrated. In terms of nidotopy, we provide data to improve the knowledge about the expansion of this species in the Northwest part of Madrid, and the preferences of nesting support. One sampled park was found to be practically saturated, with a high density of nests, while the other two still had the capacity to grow. Therefore, monk parakeets seem to be completely adapted to the idiosyncrasy of urban areas in Madrid and expected to expand and establish more colonies in the outskirts.

Keywords: behavioural pattern, invasive species, monk parakeet, nidotopy, urban ecology.

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References

[1] Appelt, C. W.; Ward, L. C.; Bender, C. *et al.* 2016. Examining potential relationships between exotic monk parakeets (*Myiopsitta monachus*) and avian communities in an urban environment. *The Wilson Journal of Ornithology*, 128 (3): 556-56

[2] Área de Gobierno de Medio Ambiente y Movilidad. 2020. Informe sobre la necesidad, idoneidad y eficiencia del contrato de "Control y reducción de la cotorra argentina y cotorra de Kramer en el municipio de Madrid" (№ expediente: 300/2020/00726). Ayuntamiento de Madrid. Madrid.

[3] Escandell, V. y Escudero, E. 2020. Programa Sacre. En: Del Moral, J. C.; Molina, B.; Escandell, V.; Bermejo, A.; Leal, A.; De la Puente, J.; Escudero, E. y Nebreda, A. (eds.) *Programas de Seguimiento de Avifauna y Grupos de Trabajo de SEO/Birdlife 2019*: 6-9. SEO/Birdlife. Madrid.

[4] Hernández-Brito, D.; Carrete, M., y Tella, J. L. 2022. Annual censuses and citizen science data show rapid population increases and range expansion of invasive rose-ringed and monk parakeets in Seville, Spain. *Animals*, *12*(6): 677

[5] López-Ramírez, S. y Muñoz, A.-R. 2022. A Local Approach to Better Understand the Spread and Population Growth of the Monk Parakeet as an Invasive Species. *Birds*, 2022: 277-284.

[6] Martín Pajares, M. 2006. La cotorra argentina *(Myiopsitta monachus)* en la ciudad de Madrid: expansión y hábitos de nidificación. En: De la Puente, J.; Pérez-Tris, J.; Juan, M. y Bermejo, A. (ed.) *Anuario Ornitológico de Madrid 2005:* 76-95. SEO-Monticola. Madrid.

21255 | Studies of parasites in cartilaginous fishes from the Algarve coast

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Abstract:

Fish parasites can be dangerous to humans as they can cause various diseases, such as anisakiosis. Others cause damage to the fish themselves by debilitating them and preventing their normal 584development.

The objective of this work was to analyse cartilaginous fishes, that were accidentally caught, while fishing for crustaceans from the Algarve coast, in order to detect the presence of parasites. The fish analysed included the following species: Galeus melastomus (Rafinesque, 1810), Galeus atlanticus (Vaillant, 1888), Scymnodon ringens Barbosa du Bocage & de Brito Capello, 1864, Dalatias licha (Bonnaterre, 1788), Etmopterus spinax (Linnaeus, 1758), Deania profundorum (Smith & Radcliffe, 1912) and Oxynotus paradoxus Frade, 1929. Different organs were analysed, including the stomach, intestine, liver (under the microscope and stereoscope) and a piece of muscle (UV Press method to search for Anisakis sp.). Regarding the parasites studied, no Anisakis sp. were found in any specimen observed, but coccidia (Apicomplexa) were found in the intestine and liver off G. melastomus and G. atlanticus, with a prevalence of 71% and 100%, respectively.

Keywords: Parasites, Anisakis sp., Coccidia, UV Press

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References

[1] Compagno, L.J.V. (1984). FAO species catalogue. Vol. 4. Sharks of the world. An annotated and illustrated catalogue of sharks species known to date. Part 1. Hexanchiformes to Lamniformes. FAO Fisheries Synopsis, 4(125), 1-249.

[2] Compagno, L.J.V. (1984). FAO species catalogue. Vol. 4. Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Part 2. Carcharhiniformes. FAO Fisheries Synopsis, 4(125), 251-655.

[3] Compagno, L.J.V. (1999). Checklist of living elasmobranchs. In W.C. Hamlett (Eds.) *Sharks, skates, and rays. The biology of elasmobranch fishes* (pp. 471-498). John Hopkins University Press.
[4] Santos, M. J., Matos, M., Guardone, L., Golden, O., Armani, A., Caldeira, A. J. R., & Vieira-Pinto,
[5] M. (2022). Preliminary data on the occurrence of *Anisakis* spp. in European hake (*Merluccius merluccius*) caught off the Portuguese coast and on reports of human anisakiosis in Portugal. *Microorganisms*, *10*(2), 331. https://doi.org/10.3390/microorganisms10020331



Figure 1: Sample of mucus with coccidia collected from the intestine of Galeus atlanticus. A: Mature oocysts; B: immature oocyst.

20433 | An in vitro study on the role of viperin as an antiviral effector in rainbow trout (Oncorhynchus mykiss) cell line RTS11

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Abstract

Viperin (VIP) is a protein from the interferon family produced as an antiviral response that catalyse the conversion of CTP to ddhCTP, the modified nucleotide, when fused into the nascent chain of the viral RNA mechanism can inhibit viral replication. On the other hand, Viral hemorrhagic septicemia virus (VHSV) affects many fishes in aquaculture being responsible for major biologic and economic losses, affecting more than 50 species including freshwater and saltwater fishes.

To evaluate VIP role in fish antiviral response, gene knockdown was performed in an *in vitro* trial was designed in Rainbow trout (Oncorhynchus mykiss) macrophage cell lines (RTS11). VIP gene (vig1, XM_021582972.2) knockdown was first tested by using four different combinations of three distinct small interfering RNA (siRNAs) of 21–23 nucleotides in length. The VIP iRNA will silence the gene by the degradation of mRNA by homologous dsRNA and translational repression by non-specific (imperfect) binding of small RNAs to the 3' UTR of target mRNA.

The assays were performed applying 2 and 3 days of siRNA inoculation at three different amounts 5866 (10pmol 50pmol and 100pmol) is DTC11 (10pmol, 50pmol and 100pmol) in RTS11 cells at a concentration of 1-2x10⁶ cells.mL⁻¹. Afterwards, Poly I:C was used in a concentration of 25 mg/uL to induce cells antiviral mechanisms after siRNA inoculation. After 24 hours, RNA from each treatment was extracted and cDNA obtained to determinate the best set, amount and incubation period of siRNA, by Real-time PCR (RT-PCR). Subsequently, VIP-knockout cells and non-silencing siRNA cells (control) will be infected with inactivated VHSV to understand the pathways related to the transcriptional regulation of VIP expression and the pathways induced by VIP itself.

Ultimately, this study will allow a better understanding of VIP role in fish antiviral immune response and can help to create new prophylactics measures or treatments in the aquaculture environment.

Keywords: Viperin (VIP); Interferon; Viral hemorrhagic septicemia virus (VHSV); Gene knockdown; Rainbow trout; cell lines; Poly I:C; Small interfering RNA (siRNA); Aquaculture.

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20464 | Exploring the potential of marine bacteria as novel source of plant bioactive compounds

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Abstract

The increase in human population originated the need of a more efficient production of food supplies. Therefore, and to cope with the implementation of the One Health Concept, advancements in agricultural practices are necessary, which imply the use of novel and natural plant fertilizers and herbicides. A potential unexplored source of such compounds can be searched in bacteria. In this study, bacterial extracts from various marine bacteria belonging to Actinomycetota and Planctomycetota were tested in three model plants, Arabidopsis thaliana, Lactuca sativa and Lolium multiflorum. Bacteria were grown in three solid media (M600, M607 and M607 1/10) and secondary metabolites were extracted with ethyl acetate. Seeds were germinated in the presence of the bacterial extracts and plants growth was evaluated through root and aerial part lengths, number of leaves and plant fresh weight. Moreover, the levels of proline and lipide peroxidation were quantified for further detection of possible changes in the plant physiology. Based on the overall gathered information, the extracts used were classified as not presenting significant effects (NPSE), possible plant inhibitor (PPI) or possible plant stimulator (PPS). This study is innovative because the potential of marine bacteria in plant growth is an 587untapped field and may lead to the discovery of novel bioactive compounds with application in agriculture.

Keywords: Bacterial Extracts; Herbicides; Fertilizers; Plant Growth.

20571 | Deciphering the astrocytic and synaptic changes under chronic alcohol exposure using a self-administration paradigm

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Abstract

Drug abuse is characterized by a compulsive and persistent drug-seeking behaviour, despite the harmful emotional, physical and social consequences [1]. Our laboratory has previously found $\Box \check{O} \check{O} \check{C}$ that the neuronal-glial crosstalk is critical in relaying the changes caused by acute exposure to psychoactive drugs through neuroimmune mechanisms [2]. We have also reported that microglia can engulf postsynaptic components in the prefrontal cortex (PFC) of mice after repeated alcohol exposure and this led to increased anxiety in mice [3]. The adverse effects of alcohol on the central nervous system (CNS) are well described, with astrocytes becoming reactive and displaying changes in gene expression, activity and proliferation [4]. However, the mechanisms involved are not yet fully understood. We are currently characterizing the astrocytic response under chronic alcohol consumption, taking into account the crucial interaction between neuronal and glial cells in the development and maintenance of addiction. Using a well-established voluntary alcohol drinking paradigm [5], we are evaluating alcohol-associated changes in PFC astrocytes, synapses and their behavioural correlates. Our preliminary results indicate similar alcohol consumption patterns between males and females, however, males, but not females, present altered weight gain and experience a significant increase in inhibitory synapse density after chronic exposure to ethanol when compared to the control group. Our work is contributing to a better understanding of the impact of chronic alcohol intake and may lead to the development of new strategies for pharmacological intervention in drug addiction, based on the targets identified as critical for the neuronal-glial crosstalk.

Keywords: alcohol; astrocytes; neurons; synapses; CNS; addiction.

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References

[1] Witkiewitz, K., R.Z. Litten, and L. Leggio, Advances in the science and treatment of alcohol use disorder. Sci Adv, 2019. 5(9): p. eaax4043.

[2] Canedo, T., et al., Astrocyte-derived TNF and glutamate critically modulate microglia activation by methamphetamine. Neuropsychopharmacology, 2021. 46(13): p. 2358-2370.

[3] Socodato, R., et al., Daily alcohol intake triggers aberrant synaptic pruning leading to synapse loss and anxiety-like behaviour. Sci Signal, 2020. 13(650).

[4] Adermark, L. and M.S. Bowers, Disentangling the Role of Astrocytes in Alcohol Use Disorder.Alcohol Clin Exp Res, 2016. 40(9): p. 1802-16.

[5] Erickson, E.K., et al., Cortical astrocytes regulate ethanol consumption and intoxication in mice. Neuropsychopharmacology, 2021. 46(3): p. 500-508.

20583 | Disclosing biopharmaceutical applications of *Opuntia ficus-indica* (L.) and its role in circular economy

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Abstract

Opuntia ficus-indica (L.) Mill. is a tropical and subtropical plant that belongs to the Cactaceae family, which includes about 1500 species. It can grow in arid and semi-arid climates with a geographical distribution encompassing Mexico, Latin America, South Africa, and Mediterranean countries. In this work, to compile the main biopharmaceutical uses of the plant and its extracts, a prospective analysis was undertaken on Scopus database, using selected keywords. VOSviewer software was run to generate the bibliometric maps [1]. Several plant extracts can be obtained using a diversity of analytical methodologies, which govern the quality of the samples and their bioactivities. Given the high content of antioxidants (phenolic compounds and ascorbate), pigments (carotenoids, betalains), and vitamin E, several interesting biological activities are reported [2-4]. Besides the identified compounds, other phytochemicals based on bio-peptides and soluble fibers have also been reported to contribute for the biomedical properties of Opuntia ficus-indica. Its extracts were found to be effective against acne, arthrosis, dermatosis, diabetes, diarrhea, fever, high blood pressure, rheumatism, stomach ache, tumor, allergy, wound, colitis and inflammatory bowel disease, and some viral diseases [5-7]. Others, such as photoprotection [8], anti-obesity [9], and activity against metabolic syndrome [10], have also been reported. Although modern medicine is available in most countries for the control and treatment of many diseases, for historical and cultural reasons, phytomedicine continues to be popularly used in different regions of the globe. Phytochemicals-based treatments are of low cost and easily accessible, and are associated with limited adverse effects. In our work, we discuss the beneficial properties of the different parts of Opuntia ficus-indica and its extracts as a new source of nutraceuticals to promote circular economy.

Keywords: *Opuntia ficus-indica* (*L*.) *Mill.* extracts; biopharmaceutical applications; VOSviewer software; Scopus database; circular economy.

Acknowledgments

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References

- [1] N.J. van Eck, L. Waltman, Scientometrics 84 (2010) 523.
- [2] G. Al-Naqeb, L. Fiori, M. Ciolli, E. Aprea, Molecules 26 (2021) 5018.
- [3] C.E. Aruwa, S.O. Amoo, T. Kudanga, Food Res Int 112 (2018) 328.

[4] M.A. Silva, T.G. Albuquerque, P. Pereira, R. Ramalho, F. Vicente, M.B.P.P. Oliveira, H.S. Costa, Molecules 26 (2021) 951.

[5] R. Rasoulpour, A. Afsharifar, K. Izadpanah, M. Aminlari, Crop Protection 93 (2017) 33.

[6] I. Aboura, A. Nani, M. Belarbi, B. Murtaza, A. Fluckiger, A. Dumont, C. Benammar, M.S.

Tounsi, F. Ghiringhelli, M. Rialland, N.A. Khan, A. Hichami, Biomed Pharmacother 96 (2017) 1022.

[7] A.C. Maio, G. Basile, D. Iacopetta, A. Catalano, J. Ceramella, D. Cafaro, C. Saturnino, M.S. Sinicropi, Curr Med Chem 29 (2022) 4216.

[8] D. Skarupova, J. Vostalova, A. Rajnochova Svobodova, Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub 164 (2020) 1.

[9] K. Corona-Cervantes, A. Parra-Carriedo, F. Hernández-Quiroz, N. Martínez-Castro, J.M. Vélez-Ixta, D. Guajardo-López, J. García-Mena, C. Hernández-Guerrero, Nutrients 14 (2022).

[10] P.I. Angulo-Bejarano, M.D.R. Gómez-García, M.E. Valverde, O. Paredes-López, Curr Pharm Des 25 (2019) 3457.

20623 | Prevention of neurogenic detrusor overactivity after spinal cord injury. Effects of early combined treatment with resiniferatoxin and anticholinergics – darifenacin

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Abstract

Introduction: Spinal cord injury (SCI) typically leads to neurogenic detrusor overactivity (NDO) and detrusor-sphincter-dyssynergia (DSD), resulting in urinary incontinence. Antimuscarinics, resiniferatoxin (RTX) and botulinum toxin A (BTX-A) are the current mainstay therapies for this condition, with the latter being the gold standard for refractory patients. Treatment is only applied when bladder dysfunction is a chronic condition, but recent studies show that early administration of RTX or anticholinergics attenuated NDO emergence in SCI rats. Here, we are investigating if a combined early intervention with RTX and darifenacin, an antimuscarinic drug, can prevent NDO development.

Methods: Female Wistar rats (n=6/group) were submitted to spinal cord contusion (SCC) at T8/T9. They were divided in 4 experimental groups: intravesical vehicle for RTX (10% ethanol in sterile saline) and oral darifenacin vehicle (0,1 mL oil); intravesical RTX (50 nM), oral darifenacin (15mg/Kg) and RTX with darifenacin. Bladder function was weekly evaluated using the void spot assay. Four weeks post-SCC, animals underwent 1h cystometry under urethane anaesthesia before euthanasia and tissue collection. Bladder tissue is being evaluated by immunofluorescence for neuronal markers (β 3-tubulin, calcitonin gene related peptide (CGRP), vesicular acethylcoline transporter (VAChT) and M3 receptor.

Preliminary results: In vehicle-treated SCC animals, signs of spinal shock were evident 1 week after spinal lesion, with NDO being established at 4 weeks post-SCC. Analysis of VSAs and urodynamic recording suggest that early intervention with RTX or darifenacin attenuated NDO emergence, with results likely favouring darifenacin. Surprisingly, the combination of both drugs did not produce any beneficial effects.

Future work: Ongoing tissue analysis will document plastic changes in bladder innervation and M3 expression following treatment.

Keywords: Spinal cord injury, neurogenic detrusor overactivity, darifenacin, resiniferatoxin.

20650 | Development of high-order mutants for Arabinogalactan Proteins and further functional characterization

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Abstract

Angiosperms are plants that produce flowers, bearing their seeds inside fruits. They serve as a major source of food to humans and are a primary source of consumer goods, such as textile fibers and pharmaceuticals.

Angiosperms reproduction is a complex process that involves several signaling pathways. Among the various molecules involved in this process are Arabinogalactan Proteins (AGPs), glycoproteins rich in hydroxyproline, which are ubiquitous in the plant kingdom.

Seed production depends on successful fertilization. For these, a pollen grain lands on a pistil's stigma and germinates producing a pollen tube which transports two sperm cells into the embryo sac. Here, one pollen tube releases a pair of sperm cells to fuse with the female gametes, initiating seed development. The embryo sac bears two specialized cells – synergids – responsible for the production of pollen tube attractants, and these cells are immediately eliminated after successful fertilization, avoiding the attraction of extra pollen tubes.

AGP4 or *JAGGER* is important for pollen-pistil interactions, being essential for the death of the persistent synergid. *agp4* plants have a polytubey phenotype, that is, several pollen tubes growing towards a single embryo sac. *AGP3*, *AGP2*, *AGP5* and *AGP7* are phylogenetically related to *JAGGER*, but single mutants for these did not show visible phenotypes in the reproductive process. Thus, this work aimed to obtain double and triple mutants for these AGPs and analyse their reproductive phenotype.

Crosses between single mutants for AGP4, AGP3, AGP2, AGP5 and AGP7 were made, and double and triple mutants were already obtained. These high order mutants will be analysed regarding its phenotypes related to reproduction (pollen tube growth, seed set establishment and ovule and seed development). Also, constructs were obtained with the promoter or coding sequence for these AGPs, with the aim of analyzing these AGPs expression patterns and analyse its overexpression mutants.

Keywords: Plant reproduction; Arabidopsis; Arabinogalactan Proteins.

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20759 | Metabolite identification of a cyanobacteria with bioactivity towards obesity and intestinal lipid absorption

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Abstract

In Europe, overweight and obesity affect almost 60% of adults and nearly one in three children (WHO, 2022). This is due to a sedentary lifestyle and the greater availability and consumption of high-calorie foods that lead to a constant increase in average body weight and the consequent dramatic increase in the incidence of metabolic diseases in the population.

It is recognized that certain cyanobacteria and microalgae are producers of beneficial resources for human health. Our previous research identified a cyanobacterial strain with promising bioactivity in the reduction of intestinal lipases, which is one of the known mechanisms for obesity therapeutics. However, the responsible compound is not discovered yet. Consequently, this research seeks to identify the metabolites involved in the reduction of intestinal lipid absorption. The cyanobacterial strain LEGE 06118 from the Blue Biotechnology and Ecotoxicology Culture Collection (LEGE-CC) corresponds to a marine unidentified filamentous *Synechococcales*. This strain was distributed equally to 6 units of a photobioreactor, and grown for 2 weeks using different temperatures (10, 14, 18, 22, 26 and 30°C).

The manipulation of temperature was tested as parameter to increase the production of different metabolites, and subsequently verify their bioactivities. The metabolite profiles of extracts from each photobioreactor were characterized by mass spectrometry (LC-MS/MS) and associated with the observed bioactivities to identify the responsible metabolites. The biological effect was analysed by quantifying the intestinal lipase activity of PED6 in zebrafish larvae.

This work is ongoing and results will be presented on bioactivity in zebrafish larvae and metabolite profiling. Identifying these metabolites can play a crucial role in developing new nutraceuticals for future human health applications, especially in metabolic diseases.

Keywords: pharmaceutics; intestinal lipid uptake; fatty acids; obesity; zebrafish.

20817 | *In vitro* safety assessment of putative ecofriendly antifouling synthetic compounds

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Abstract

Marine biofouling is a worldwide problem with large economic implications, oftentimes fought with technologies considered harmful for human and environmental health. Therefore, developing new and eco-friendly alternatives to prevent this issue is critical. Nuclear receptors (NR) can be remarkable tools to evaluate the environmental risk associated with such promising ecofriendly antifouling compounds. NRs play a central role in the modulation of harmful effects resulting from exposure to chemicals and occupy a central role in OECD and EPA guidelines for testing and assessment of their toxic potential. In this work, a cell-based assay is used to evaluate the ability of novel antifouling compounds, synthesized at CIIMAR, as well as their transformation products, to induce NR transcriptional activity *in vitro*. The set of NRs tested covers distinct physiological processes (*e.g.*, steroid hormone, xenobiotic, retinoid acid, or fatty acid receptors). Also, vertebrate and invertebrate species were selected to improve the taxonomic sampling of the NRs responses towards the selected chemicals. Preliminary results indicate no apparent induction activity of two human and fish receptors by the tested compound or its transformation products. This work will allow a more accurate labelling of promising compounds developed in CIIMAR as true ecofriendly substances.

20917 | Exploring the neurotoxic effects of 2C-I and 25I-NBOMe

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Abstract

In the last decades, several new psychoactive substances (NPS) have emerged in illegal drug markets. Among NPS, psychedelic phenethylamines rank third in number of monitored substances by the EU Early Warning System [1]. Despite its popularity, there is limited information regarding their toxicological profiles. Hence, the aim of this study was to evaluate the cytotoxic profile of two phenethylamine derivatives, 2C-I and 25I-NBOMe, as well as the putative mechanistic pathways involved in their cytotoxicity, in differentiated SH-SY5Y cells, an *in vitro* 596 neuronal model.

The drugs cytotoxicity was evaluated by the neutral red (NR) uptake and the MTT reduction assays, 24 h after exposure. Their ability to induce oxidative stress (by ROS detection) and the influence of monoamine oxidase (MAO) inhibitors on their cytotoxicity (by the NR uptake assay) were also investigated. The drugs' effects on the intracellular levels of both glutathione (GSH) and adenosine triphosphate (ATP) were also assessed by the DTNB-reductase-recycling assay and by an ATP bioluminescence assay, respectively.

25I-NBOMe was remarkably more cytotoxic than 2C-I, with significant lower EC50 values for both cytotoxicity assays. No significant effects on the levels of ROS were observed, and the coincubation with MAO inhibitors did not significantly affected the drugs-induced cytotoxicity. However, the inhibition of glutathione synthesis (in the presence of BSO) significantly enhanced the cytotoxic effects of both drugs, suggesting that GSH plays a protective role against the cytotoxicity of these drugs. In addition, 2C-I and 25I-NBOMe significantly decreased intracellular GSH levels, and both drugs caused a concentration-dependent decrease in intracellular ATP levels, suggesting that they disrupted cell bioenergetics.

This study provides valuable information on the toxicological profile of 2C-I and 25I-NBOMe, highlighting that the presence of an N-benzyl moiety in 25I-NBOMe significantly increases all the observed cytotoxic effects.

Keywords: New Psychoactive Substances, Phenethylamines, Toxicological profile.

Acknowledgments

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References

[1] European Monitoring Centre for Drugs and Drug Addiction (2022), European Drug Report 2022: Trends and Developments, Publications Office of the European Union, Luxembourg.

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20918 | *In vitro* evaluation of peptides with potential antioxidant, anti-inflammatory and antihypertensive activities

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Abstract

Hypertension develops from genetic and environmental factors, and is exacerbated by disorders that increase systemic vascular resistance, like oxidative stress, inflammation and immune system dysfunction^{1,2}. The search for natural compounds as an alternative or a complement to the drugs used to treat hypertension and other chronic diseases has gained momentum in recent years¹. One example is that of food-derived peptides as nutraceuticals^{3,4,5}. In this context, we are exploring the antioxidant, anti-inflammatory, and antihypertensive potential of synthetic peptides derived from proteins found in milk (lactoferrins from different species of mammals) and in other food sources (e.g., jumbo squid - *Dosidicus gigas*).

Antioxidant activity *in vitro* was determined by both the DPPH radical scavenging activity and the Ferric Reducing Antioxidant Power (FRAP) assays. While none of the squid peptides was active, lactoferrin (LF) ones showed antioxidant potential: aLF-17-31, from donkey (*Equus africanus asinus*) LF, displayed the stronger radical scavenging activity (IC₅₀ 3.53 mol/mol DPPH), and nhLF-268-284, from human (Homo sapiens) LF, showed the stronger reducing power (1.26 ± 0.86 mM Fe2+ equivalents). The ABTS radical scavenging activity of LF peptides was further assessed, with bLF-1-11 from bovine (Bos taurus) LF standing out with a Total Antioxidant Status (TAS) of 5.68 ± 9.23 mM. The peptides' ability to inhibit the angiotensin converting enzyme 1 (ACE1) was also tested *in vitro*, as an indication of their antihypertensive potential; squid peptide RC7 inhibited ACE1 with an IC₅₀ of 908.6 μ M. Relevantly, none of the peptides was cytotoxic (MTT assay on macrophages), as only bLF1-11 showed some toxicity (IC₅₀ 417.6 μ g/mL).

In conclusion, new non-toxic food-derived peptides with antioxidant/antihypertensive activity were found. Ongoing studies will assess their anti-inflammatory activity (Griess method) as well as their effect of on the TAS in macrophages (superoxide anion production).

Keywords: Hypertension, nutraceuticals, bioactive peptides, antioxidant, anti-inflammatory, antihypertensive.

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References

- [1] https://doi.org/10.1177/1753944710368205
- [2] https://doi.org/10.1084/jem.2017177301022018c
- [3] https://doi.org/10.5851/kosfa.2015.35.6.831
- [4] https://doi.org/10.1111/bph.13608
- [5] https://doi.org/10.1080/10408398.2021.1964433

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20922 | Expanding the comprehension of Polycystic Kidney Disease (PKD) by employing organoids as a platform for individualized therapy.

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Abstract

Introduction: Tubuloids and kidney organoids have been recommended as promising substitute models for patient-focused therapy screening [1]. According to the expression of several proteins, ASC-derived human kidney tubuloids mimic the renewal of adult kidney epithelium by containing the proximal tubule, loop of Henle, distal tubules, and collecting duct [2]. In contrast to animal models, they offer a more precise representation of the *in vivo* nephron, allow high throughput investigations of human tissue, and can be efficiently grown from both healthy and diseased kidney epithelium, such as polycystic kidney disease (PKD) [3-4]. The availability of tissue is a significant barrier to executing patient-derived organoid cultures, particularly tubuloids. However, studies have demonstrated that urine can be a source of kidney epithelial cells [4], accurately recapitulating the genotype and phenotype of the donor [2].

Materials and Methods: We are developing tubuloids cultures from healthy donors using the Schutgens and colleagues [2] methodology. Urine samples are centrifuged, and multiple times cleaned with culture medium. Then after, domes are formed in plates by resuspending the pellet in Matrigel. The development of organoids is apparent after 14 days. After the characterisation is finished, we will proceed with the development of tubuloids from ADPKD patients to create a straightforward *in vitro* model of the condition.

Results: Confocal microscopy of the tubuloids allowed for the identification of tubular structures within the organoid and the presence of cells from the tubular epithelium. Further characterisation is presently being done, specifically by RT-PCR and immunofluorescence.

Discussion and Conclusions: After the characterisation is finished, we will proceed with the creation of tubuloids from ADPKD patients to create a straightforward *in vitro* model of the condition that will enable us to investigate the underlying cellular and molecular pathophysiology of the disorder.

Keywords: epithelium; PKD; tubuloids.

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REMODEL (857491 - H2020- WIDESPREAD-03-2018).

References

[1] Gupta, N., E. Dilmen, and R. Morizane, 3D kidney organoids for bench-to-bedside translation. J Mol Med (Berl), 2021. 99(4): p. 477-487.

[2] Schutgens, F., et al., Tubuloids derived from human adult kidney and urine for personalized disease modeling. Nat Biotechnol, 2019. 37(3): p. 303-313.

[3] Yousef Yengej, F.A., et al., Kidney Organoids and Tubuloids. Cells, 2020. 9(6).

[4] Calandrini, C. and J. Drost, Generation of Human Kidney Tubuloids from Tissue and Urine. J Vis Exp, 2021(170).

20951 | Isolation of endophytic *Lysinibacillus sphaericus* from the leaves of *Phoenix canariensis* (Chabaud) for biofertilizer and pest control applications

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Abstract

Plants are hosts for endophytic microbes (bacteria and fungi) that live in the living tissues of plants without harming them or causing disease symptoms. In addition, some endophytic bacteria have biological properties that can promote plant growth and increase resistance to stress. Some endophytic bacteria of the genus Bacillus spp. are known to secrete metabolites that promote plant growth, prevent pathogen infection and kill insect pests. The aim of this work is to isolate endophytic bacteria of the Bacillus cereus group from the palm Phoenix canariensis for their potential use as biofertilisers and for the biocontrol of the invasive exotic insect red palm weevil, Rhynchophorus ferrugineus (Olivier) (RPW), the main pest of palms around the world. The larval stage of this weevil destroys the plant by feeding on its fibers. Leaf samples were collected from P. canariensis in the city of Porto. To isolate endophytic bacteria from sampled leaves, we surface sterilized the samples, by washing them in water, followed by 70% ethanol, bleach, and deionized water. We then homogenized the leaf with Ringer's solution [1] and serial dilutions were plated on Bacillus cereus Selective Agar Base (MYP, Himedia) in the presence of polymyxin B antibiotic. Colonies using mannitol as main carbon source and showing lecithinase activity were isolated by serial plating on the same medium. For genetic identification, bacterial DNA was extracted with Chelex 10%. The 16S rRNA gene was amplified and DNA sequencing identified Lysinibacillus sphaericus among the isolates. The Bacillus genus is an important antagonist of many insect orders and has already been isolated from RPW cadavers. L. sphaericus is known to inhibit the hatching of RPW eggs. The latter suggests that the identified strain could have insecticidal activities against RPW that need to be verified. Our results have also contributed to a more detailed knowledge of the microbiome of palm plants.

Keywords: Endophytic bacteria; palms; biocontrol; red palm weevil.

Acknowledgments

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References

[1] Rashid S, Charles TC, Glick BR (2012) Isolation and characterization of new plant growthpromoting bacterial endophytes. Appl Soil Ecol 61:217–224



Figure 1: Phylogenetic tree with the bacterial strains isolated in this study. Samples from this study are highlighted in blue.

20971 | Studying the antiviral activity of synthetic compounds against SARS-CoV-2 infection

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Abstract

SARS-CoV-2 is a member of the viral *Coronaviridae* family, responsible for the most recent global pandemic known as coronavirus disease 19 (COVID-19), which has already caused millions of human deaths. The mechanism of SARS-CoV-2 entry into host cells involves the binding of the viral spike protein (S protein) to membrane angiotensin-converting enzyme 2 (ACE2), present in the host cell membranes. Importantly, both soluble and membrane ACE2 play important roles in the control of the body's blood pressure. [1]

The aim of this work is to evaluate the antiviral activity of analogues of synthetic compounds recently identified by us as inhibitors of the binding of the viral S protein to the host cellular ACE2 (unpublished results), in order to prevent SARS-CoV-2 viral infection.

The cytotoxicity of 8 selected compounds has been evaluated (by the Sulforhodamine B assay) in the Vero CCL-81 cell line (from African Green Monkey, ATCC) and will also be evaluated in the Calu-3 cell line (from human lung adenocarcinoma, CLS). The effect of the compounds on the expression levels of cellular total ACE2 protein will be measured by Western Blot. The ability of the compounds to reduce SARS-CoV-2 infection will be assessed in the same cell lines, following infection of cells with the SARS-CoV-2 virus [2], by immunofluorescence staining for the S protein. Our preliminary data demonstrated that 6 (from the 7 tested) compounds did not cause a cytotoxic effect in Vero CCL-81 cells, in the concentrations studied. Ongoing work will confirm their effect on ACE2 cellular levels, together with their effect on SARS-CoV-2 infection.

Keywords: SARS-CoV-2; ACE2 inhibitors; synthetic compounds.

References

[1] Wang, K., et al., *Angiotensin Converting Enzyme 2: A Double-Edged Sword*. Circulation, 2020. **142**, 426–428.

[2] Magalhães, A.C., et al., InfectionCMA: A Cell MicroArray Approach for Efficient Biomarker Screening in In Vitro Infection Assays. Pathogens, 2022. **11**(3).

20983 | Engineering the cyanobacterium *Synechocystis* for optimized production of glycine betaine

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Abstract

Compatible solutes (CS) are low-weight molecular compounds that are accumulated intracellularly to maintain cell homeostasis in unfavourable growth conditions like high salinity or temperature. CS form a hydration shell around key macromolecules such as proteins, leading to their stabilization and preventing denaturation and loss of function. These protective properties grant CS, such as glycine betaine (GB), high commercial value with applications in feed, cosmetic and pharmaceutical formulations. Currently, GB production methods are split into chemical synthesis, requiring hazardous chemicals and with a high carbon footprint, and biological that are greener and safer but have poor yields. Thus, GB production requires efficiency improvement that is being addressed by engineering microorganisms to produce this solute. Cyanobacteria, as photoautotrophic microbes, are sought for this purpose given their fast growth rate and high productivity (compared with plants), and simple nutritional requirements in comparison to heterotrophic bacteria, needing only light, carbon dioxide and water to grow. Among cyanobacteria, a promising candidate is the model cyanobacterium sp. PCC 6803 (Syn6803) due to its amenability to genetic engineering, fully sequenced genome and availability of genome scale metabolic models to perform behaviour simulations. A synthetic device for the production of GB was introduced into this cyanobacterium, enabling the synthesis of this CS and improving growth under salinity conditions [1]. The data also suggest that carbon is redirected from the glycogen sink to the production of CS and extracellular polymeric substances (EPS). Thus, in the proposed work, the optimization of GB production is being attempted by targeting potential competing pathways, namely EPS, to redirect metabolic fluxes towards the production of GB.

Keywords: cyanobacteria; compatible solutes; glycine betaine; EPS; metabolic fluxes.

References

[1] Ferreira, E. A. et al. (2022) Front. Bioeng. Biotechnol. 9: doi: /10.3389/fbioe.2021.821075

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21036 | In vitro antimicrobial activity of silver diaminofluoride against oral pathogens

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Abstract

Silver diamine fluoride (SDF), with the chemical formula Ag(NH₃)₂F, is an alkaline, colorless solution composed of fluoride and silver ions, which form a complex with ammonia. ⁽¹⁾ The use of SDF solutions has a long history in dentistry to treat hypersensitivity and caries control. ⁽²⁾ Numerous studies have evaluated the anti-cariogenic efficacy of different commercial SDF-based products; however, the use of different experimental set-ups makes it challenging to compare the efficacy of these products. Additionally, few studies have evaluated the potential of these products to be active against other oral pathogens, beside *Streptococcus mutans*, a cariogenic agent. Accordingly, the present work aims to evaluate and compare the antimicrobial activity of different commercial SDF products against various pathogens of the oral cavity, namely *Streptococcus mutans*, *Enterococcus faecalis*, and *Candida albicans*. For this, the agar diffusion test will be performed as well as the evaluation of the planktonic and sessile (biofilm) population after exposure to SDF. The results obtained will enhance current knowledge on the clinical applicability of SDF, identifying the commercial preparations with the greatest potential for antimicrobial action.

Keywords: SDF products; Streptococcus mutans; Enterococcus faecalis; Candida albicans; antimicrobial activity

References

[1] Greenwall-Cohen J, Greenwall L, Barry S. Silver diamine fluoride - an overview of the literature and current clinical techniques. British Dental Journal. 2020 Jun;228(11):831–8.

[2] Kim S, *et al.* The effect of reduced glutathione on the toxicity of silver diamine fluoride in rat pulpal cells. J Appl Oral Sci. 2021;29.

21108 | New insights into the anti-inflammatory potential of cyanobacteria bioactive metabolites

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Abstract

Cyanobacteria are prokaryotic microorganisms of huge biodiversity, constituting a promising resource for novel chemically and biologically active molecules of high commercial value. In this work, the antioxidant and anti-inflammatory potential of cyanobacteria was assessed, by exploring bioactive extracts of different polarities. Four filamentous strains of the Blue Biotechnology and Ecotoxicology Culture Collection of CIIMAR (LegeCC, http://lege.ciimar.up.pt) were selected: Leptolyngbya boryana LEGE 15486, Cephalothrix lacustris LEGE 15493, Leptolyngbya cf. ectocarpi LEGE 11479, and Nodosilinea nodulosa LEGE 06104 [1]. Acetone and water extracts obtained from the dry cyanobacteria biomass were chemically analysed for their total phenols and phycobiliproteins by colorimetric assays. The carotenoids profile of the acetone extracts was determined by high-performance liquid chromatography (HPLC-PDA). The aqueous extracts were mainly composed by phycobiliproteins, while the acetonic ones were rich in carotenoids, being characterized by the abundance in chlorophyll-a, zeaxanthin, and betacarotene (Figure 1). The extracts are being screened for their ability to scavenge the physiological free radicals superoxide anion radical (O_2^{\bullet}) and nitric oxide radical ($^{\circ}NO$), which are ever-present in the inflammatory framework. The anti-inflammatory potential of the extracts is also being accessed in vitro using the macrophages cell line RAW 264.7, stimulated with bacterial LPS, as model of inflammation. In a general way, both acetone and water extracts demonstrate ability to act in different mediators involved in the inflammatory process.

Keywords: Cyanobacteria, inflammation, oxidative stress, carotenoids, HPLC-PDA, RAW 264.7.

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Reference

[1] Favas, R.; Morone, J.; Martins, R.; Vasconcelos, V.; Lopes, G. Cyanobacteria Secondary Metabolites as Biotechnological Ingredients in Natural Anti-Aging Cosmetics: Potential to Overcome Hyperpigmentation, Loss of Skin Density and UV Radiation-Deleterious Effects. *Mar. Drugs* **2022**, *20*, 183.



Figure 1. Caretonoid and chlorophylls profile of the acetonic extract of the cyanobacteria Nodosilinea nodulosa LEGE 06104. HPLC-PDA recorded at 450 nm. Chlorophyll-a derivates (1, 6), Lutein (2), Chlorophyll-a (4), Zeaxanthin (5), β -carotene (8), unidentified carotenoids (3, 7, 9).

21112 | Exploring the toxicity of environmental and food contaminants on neuronal cells

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Abstract

Our diet contains unavoidable food contaminants such as heavy metals, pesticides, mycotoxins, food processing contaminants, and environmental pollutants that have been linked to neurological and neurodevelopmental disorders [1, 2, 3]. Exposure to these contaminants can induce neurotoxicity through various mechanisms, including oxidative stress, neuroinflammation, mitochondrial dysfunction, protein misfolding anomalies, and impairment of the blood-brain barrier, as demonstrated in both in vitro and in vivo models [1, 2, 3]. While the presence of multiple contaminants in our diet is a well-established fact, there remains a significant knowledge gap when it comes to the toxicological interactions between these substances. This study aimed to investigate the cytotoxicity of individual food contaminants on SH-SY5Y neuroblastoma human cells, as a point of departure to further analyse the interactions of contaminant combinations at relevant ratios and doses to human exposure. Contaminants were selected from different classes based on their known toxicity or greater prevalence in food. Cytotoxicity of acrylamide (ACR; 0,08-10 mM), aflatoxin B1 (AFB1; 0,8-100 μM), benzo[*a*]pyrene (BaP; 0,8-200 μM), cadmium (Cd; 0,8-100 μ M), and cypermethrin (CYP; 3,9-250 μ M) was evaluated using the MTT assay after 72 hours of exposure. Our findings indicate that individual exposure to these contaminants reduced cell viability in a concentration-dependent manner. While only high levels of BaP and CYP are cytotoxic to SH-SY5Y cells, exposure to low levels of ACR (0,08 mM) decrease cell viability to 85% (n=3), exhibiting an IC50 of 0,75±0,04 mM. Preliminary results show cadmium and AFB1 are the most cytotoxic, with IC50 around 7 μ M and 4 μ M, respectively. Further research is currently underway to investigate the toxicological interactions of these contaminants at realistic doses and ratios to human consumption, to better understand the potential health impacts of the combined exposure to mixtures of these substances.

Keywords: Food contaminants; Cytotoxicity; Neuronal cells; Combined exposure.

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References

[1] Mir RH, et al. Role of environmental pollutants in Alzheimer's disease: a review. Environ Sci Pollut Res Int. 2020;27(36):44724-42.

[2] Humphreys J, Valdés Hernández MdC. Impact of polycyclic aromatic hydrocarbon exposure on cognitive function and neurodegeneration in humans: A systematic review and meta-analysis. Frontiers in Neurology. 2023;13.

[3] Janik E, et al. Molecular Aspects of Mycotoxins—A Serious Problem for Human Health. International Journal of Molecular Sciences. 2020;21(21):8187.

21159 | Searching for neuroprotective compounds: Extraction of phenolic compounds from three *Lamiaceae* species

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Abstract

With the aging of the population and the Covid-19 pandemic, neurodegenerative and neuropsychiatric diseases have gained extreme relevance in Western societies. Unfortunately, there is no cure for those diseases, and the treatments that exist only control the symptoms. Therefore, it is important to find new alternatives, for example exploring medicinal plants that are rich in bioactive compounds. *Salvia officinalis L., Thymus vulgaris L.*, and *Lavandula angustifolia Miller* belong to the *Lamiaceae* Family. Species from this Family are well known for their antioxidant, anti-inflammatory, anti-obesity, and anti-cancer properties and because of these properties, the interest in their pharmacological uses has grown in recent years.

Therefore, with the aim of exploring the biological potential of these three species, decoctions were performed, and the total phenolic content (TPC) was determined. Values were found to be between 70.96 \pm 4.24 mg gallic acid equivalents (GAE)/g extract dry weight (for *Thymus vulgaris L*.) and 373.98 \pm 15.98 mgGAE/g extract dry weight (for *Salvia officinalis L*.).

The assessment of extracts' neuroprotective properties is currently under evaluation focusing on oxidative stress and inhibition of enzymes of the central nervous system.

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Keywords: Phenolic compounds; Lamiaceae.

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21233 | Revealing the biosynthetic potential of Leptothoe sp. through OSMaC strategies

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Abstract

Cyanobacteria are photosynthetic microorganisms known to produce a wide range of secondary metabolites, from toxins to other compounds with recognized biotechnological and pharmaceutical applications. Genomic studies have shown that cyanobacterial genomes encode for more biosynthetic gene clusters (BGCs) than the identified compounds so far, possibly because some are not expressed under standard laboratory conditions. Given that secondary metabolites are produced as a response to environmental stress conditions, employing the OSMaC (One Strain, Many Compounds) strategy might reveal cryptic or silent compounds [1]. The main goal of this work is to explore the biosynthetic capability of a cyanobacterium from the Blue Biotechnology and Ecotoxicology Culture Collection (LEGE-CC), using OSMaC. This strategy underlies that a single strain can produce different molecules when grown under different conditions.

Bioinformatics analysis of *Leptothoe* sp. genome pinpointed a BGC, to which a corresponding product has not yet been attributed. This BGC encodes for a putative hybrid non-ribosomal peptide/polyketide natural product. Genes encoding for a TonB-dependent transporter and an ABC-type transporter were also found among the BGC, suggesting this compound might be a siderophore, as these proteins are typically present in iron-uptake systems [2]. To uncover the production of this putative compound, the strain was cultivated in photobioreactors, under different lights (white, blue, and red) and photoperiods (16/8h light/dark cycle and 24h light). To explore the chemical profile in the different culture conditions, methanolic extracts of the biomass and culture media were analysed by LC-MS/MS. Herein, we will present the metabolomics analysis' results showing whether the various growth conditions affected the metabolome and if the silent/cryptic compound was discovered. Anticancer, anti-fouling, antiobesity, and antimicrobial bioactivities will also be presented and compared to the metabolomics profiles.

Keywords: cyanobacteria, natural products, biosynthetic gene cluster, siderophores.

Acknowledgments

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References

[1] Romano S, Jackson S, Patry S, Dobson A. Extending the "One strain many compounds" (OSMAC) principle to marine microorganisms. Marine Drugs. 2018;16(7):244.

[2] Qiu G-W, Koedooder C, Qiu B-S, Shaked Y, Keren N. Iron transport in cyanobacteria – from molecules to communities. Trends in Microbiology. 2022;30(3):229–40.
20506 | Can green synthesized ZnO nanoparticles using fruits extracts promote osteogenic differentiation of bone marrow mesenchymal cells?

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Abstract

Bone healing is a complex process of overlapping phases, including inflammation, repair, and remodeling that involves many intracellular pathways. Nowadays, there is growing interest in the application of osteoinductive and osteogenic growth factors and mesenchymal stem cells in order to improve bone repair and regeneration. Bone marrow mesenchymal stem cells (BMSC) are multipotent cells that can differentiate into a variety of cell types, such as pre-osteogenic chondroblasts and osteoblasts¹. It is known that zinc ion can promote BMSCs differentiation, with studies supporting zinc as a therapeutic agent to promote bone generation². There are many methods to produce zinc oxide nanoparticles (NPs), however NPs produced through green synthesis are typically biocompatible and more suitable for biomedical applications. Fruits or plants extracts contain natural compounds such as phytochemicals, that act as tailoring and capping agents producing NPs with unique physicochemical properties. Overall, the green synthesis of ZnO NPs is a promising method that offer several advantages over traditional methods, including environmental sustainability and scalability^{3,4}. The aim of this study is to evaluate if a culture medium enriched with zinc oxide NPs produced in the presence of tomato and passion fruit extracts can promote the differentiation of bone marrow mesenchymal stem cells into bone lineage cells in vitro, and to compare its differentiation ability to osteogenic culture medium. For that, bone marrow cells were exposed to different concentrations of ZnO NPs and to osteogenic medium. The cultures were evaluated in three different time points: days 3, 7 and 14 after adding the ZnO NPs, being analysed by immunofluorescence microscopy, cell viability and alkaline phosphatase activity as a marker of the differentiation into bone lineage cells. Ultimately, it is expected that the culture media with NPs show osteogenic differentiation ability similar to the osteogenic medium.

Keywords: bone marrow mesenchymal stem cells; zinc oxide; green synthesis; bone regeneration.

References

[1] Oryan A, Kamali A, Moshirib A, Eslaminejad MB. Role of Mesenchymal Stem Cells in Bone Regenerative Medicine: What Is the Evidence? Cells Tissues Organs. 2017;204(2):59-83. doi:10.1159/000469704

[2] Li H, Li M, Ran X, et al. The Role of Zinc in Bone Mesenchymal Stem Cell Differentiation. Cell Reprogram. 2022;24(2):80-94. doi:10.1089/cell.2021.0137

[3] Li Y, Yang Y, Qing Y, et al. Enhancing zno-np antibacterial and osteogenesis properties in orthopedic applications: A review. Int J Nanomedicine. 2020;15:6247-6262. doi:10.2147/IJN.S262876

[4] Alves MM, Andrade SM, Grenho L, Fernandes MH, Santos C, Montemor MF. Influence of apple phytochemicals in ZnO nanoparticles formation, photoluminescence and biocompatibility for biomedical applications. Mater Sci Eng C. 2019;101(March):76-87. doi:10.1016/j.msec.2019.03.084

20555 | Exploring the role of β3gnt7 during CNS axon regeneration

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Abstract

The inability of central nervous system (CNS) axons to regenerate is a significant obstacle to the treatment of injury and disease. Therefore, injury in adult mammals generally result in permanent neurological damage. The regenerative capacity of Acomys cahirinus, a rodent of the Muridae family, is an exception to this paradigm. Our group has been studying the reasons behind this rodent's extraordinary ability to regenerate after spinal cord injury (SCI). Acomys assemble a response which differs completely from a related rodent of the same family, *Mus*. Particularly, Acomys develop lower fibrosis at the injury site, which in Mus, creates a physical barrier and an inhibitory chemical environment for axon regrowth [1,2]. We recently discovered that Acomys express high amounts of the enzyme β 3gnt7 during the regenerative process, pointing it as a vital player in CNS regeneration [3]. To better understand the role of the β 3gnt7 during regeneration, we explored its temporal expression profile after SCI. We observed that, while in injured Mus β 3gnt7 levels remain low throughout time, *Acomys* overexpress β 3gnt7 during a critical period after injury. To further study the impact of β 3gnt7 overexpression on the neuronal growth, cortical neurons were plated on top of β 3gnt7-expressing astrocytes. The analysis of the neuronal morphology showed that this modified astrocytes seems to induce neuronal growth, including longer axons and higher arborization. Additionally, we explored which glial cell type is responsible for the expression of this enzyme. Using different cell type-specific markers, our preliminary results show that β 3gnt7 is expressed by a subset of CC1+ cells, indicating the involvement of the oligodendrocyte lineage in the regenerative process. Our work will give a better understanding of the role of this particular enzyme involved in the Keratan sulphate proteoglycans biosynthesis on enabling CNS regeneration in mammals.

Keywords: axon regeneration; proteoglycans; Acomys cahirinus.

References

[1] Dias, D. O., & Göritz, C. (2018). Fibrotic scarring following lesions to the central nervous system. Matrix Biology, 68-69, 561–570. https://doi.org/10.1016/j.matbio.2018.02.009
[2] Giger, R. J., Hollis, E. R., & Tuszynski, M. H. (2010). Guidance Molecules in Axon Regeneration. Cold Spring Harbor Perspectives in Biology, 2(7), a001867–a001867. https://doi.org/10.1101/cshperspect.a001867

[3] Nogueira-Rodrigues, J., Leite, S. C., Pinto-Costa, R., Sousa, S. C., Luz, L. L., Sintra, M. A., Oliveira, R., Monteiro, A. C., Pinheiro, G. G., Vitorino, M., Silva, J. A., Simão, S., Fernandes, V. E., Provazník, J., Benes, V., Cruz, C. D., Safronov, B. V., Magalhães, A., Reis, C. A., & Vieira, J. (2022). Rewired glycosylation activity promotes scarless regeneration and functional recovery in spiny mice after

complete spinal cord transection. Developmental Cell, 57(4), 440-450.e7. https://doi.org/10.1016/j.devcel.2021.12.008

20586 | Molecular mechanisms underlying robust MPS1/TTK activation

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Abstract

The fidelity of chromosome segregation in dividing cells is ensured by the Spindle Assembly Checkpoint (SAC), a conserved signaling pathway that delays anaphase until all chromosomes are correctly attached to spindle microtubules. The kinase MPS1 is the master regulator of the SAC but the molecular mechanism controlling MPS1 activation during mitosis is not yet fully understood. In this work, using recombinant purified proteins we show that Polo kinase/PLK1 promotes the trans-autophosphorylation of MPS1 T-loop. This is required for maximal MPS1 activation, as assessed by immunofluorescence in human RPE1 and *Drosophila* S2 cultured cells, where the inhibition of Polo/PLK1 with BI2536 led to a dramatic reduction of MPS1 T-loop phosphorylation at unattached kinetochores. Research is underway to map out Polo/PLK1 potentiates MPS1 auto-activation. By uncovering the mechanisms associated with MPS1 activation, we will have better insight into how diving cells prevent aneuploidy and use this knowledge to devise new strategies that can improve anti-cancer therapy.

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Keywords: MPS1; Polo/PLK1; SAC; chromosome segregation.

20657 | Revving Up Synechocystis: Boosting growth towards a more efficient cell factory

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Abstract

Cyanobacteria are emerging photoautotrophic chassis for the sustainable production of valueadded compounds, namely fatty acids, biofuels and therapeutic molecules. Synechocystis sp. PCC 6803 is a model cyanobacterium for which an extensive molecular/synthetic toolbox is available. The European consortium PhotoSynH₂ (https://photosynh2.org), aims at further engineering this strain to develop a more competitive chassis for the sustainable production of hydrogen using solar energy. However, Synechocystis has slower growth rates than heterotrophic bacteria and, therefore, the engineering of a fast-growing strain is desirable. In this work, we aim at developing such Synechocystis strain by targeting simultaneously genes which individual expression repression was previously shown to improve growth [1]. First, an inducible CRISPRi system to repress several targets at once will be developed. Then, crRNA arrays targeting one or several of the growth enhancing genes will be assembled in replicative plasmids that will be introduced into a Synechocystis strain constitutively expressing dCas9+tracrRNA. Subsequently, the strains generated will be evaluated under different conditions (e.g. temperature, light intensities/regimen), to assess which crRNA array further increases growth. With this work, we aim at developing a robust Synechocystis chassis with inducible fast growth, to decrease the time required to reach critical mass prior to production phase. This technology will be a step forward towards the sustainable production of value-added compounds using a photoautotrophic chassis.

Acknowledgments

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References

[1] L. Yao et al., Nat Commun 2020 11:1666, DOI: 10.1038/s41467-020-15491-7

20663 | A specific FMO5 gene duplication in Cetacea: Of history and function

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Abstract

The rapid human technological development in the Anthropocene is highly correlated with the accumulation of chemicals and xenobiotics in the environment. This constitutes a serious threat to wildlife fauna. Cetaceans, due to their life history, appear to be more susceptible to the bioaccumulation of these chemicals in their tissues, likely increasing the chances of disease development and risk of extinction. Here, we address mammalian genes with known roles in the protection against both exogenous and endogenous chemical insults, namely dimethylaniline monooxygenase [N-oxide-forming] 5 (FMO5). This enzyme plays a role in processing xenobiotics through its ability to perform Baeyer-Villiger oxidations. Using a combination of comparative genomics approaches, we deduced that cetaceans (i.e., Tursiops truncatus) appear to have a lineage-specific gene duplication, unlike most other mammal counterparts that are also adapted to marine environments. In addition, a third copy was also identified but displays a series of mutations suggestive of a pseudogenization event. Further studies will involve *in vitro* techniques to better analyse and characterize this genomic novelty in this particular mammalian clade. Overall, the main objective of this work is to better understand the mechanisms employed by cetaceans to help them adapt and deal with environmental chemicals.

Keywords: Cetaceans, chemical insults, Bioaccumulation, Baeyer-Villiger oxidations, lineage-specific gene duplication, pseudogenization.

20678 | Molecular and cellular asymmetries in Rat and Human sensory neurons

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Abstract

Somatosensory dorsal root ganglion (DRG) neurons present a pseudo-unipolar morphology, with a single stem axon that bifurcates into a peripheral and a central axon. These two axons exhibit distinct characteristics, with the peripheral axon displaying a large diameter, a more stable microtubule cytoskeleton and an increased axonal transport. Recently, our group developed a culture protocol for DRG neurons that allows us to study their pseudo-unipolar morphology in vitro [1]. We show that in vitro, these neurons can not only recapitulate the asymmetry in axon diameter, presenting a large and thin axon but also recapitulate the asymmetry in microtubule dynamics that we found in vivo. By infecting these cells with a lentivirus for EB3-GFP (that allows visualizing microtubule dynamics), we found that the thin "central-like" axon exhibits an increase in microtubule dynamics, while the large "peripheral-like" axon displays a stable microtubule cytoskeleton. Currently, our aim is to investigate if in a human sensory neuron model, the asymmetry of DRG axons is also recapitulated. For this, we started a collaboration with the lab of Dr Oliver Brüstle (University of Bonn, Germany), using human induced pluripotent stem cells derived in sensory neurons (idSN). We were able to pseudo-unpolarize these cells by co-culturing them with rat glial cells. We show that pseudo-unipolar idSN cells also display a large and thin axon. In the future, we want to evaluate if the asymmetry in microtubule dynamics and axonal transport that occurs in rat DRG neurons is recapitulated by idSN cells. If this holds true, idSN cells would be a fundamental model to study human diseases affecting somatosensory neurons.

Keywords: DRG Neurons; iPSC; Microtubule Dynamics; Axonal Transport.

Acknowledgments

We would like to thank to Pascal Roderer and Oliver Brustle for collaborating with us in this project.

References

[1] Nascimento AI, et al. Sensory neurons have an axon initial segment that initiates spontaneous activity in neuropathic pain. Brain. 2022 Jun 3;145(5):1632-1640

20685 | An automatic workflow to build a database of Cyanobacterial Bioactive Compounds with applications in Blue Biotechnology

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Abstract

The secondary metabolites found in cyanobacteria blooms have been reported in several studies. Considering that these cyanobacteria bioactive compounds have applications across different scientific fields, including anti-cancer therapeutic approaches and antibacterial activity, they can be used for developing new or improved biotechnological methods in these areas. For instance, Singh et al (2017), described the potential of cyanobacteria compounds as biofuels, biocides, its uses in medicine and cosmetics as well as food supplements. The currently available databases such as CyanoMetDB, NPAtlas, PubChem, ChEMBL are not standardised and curated taking in consideration the biochemical descriptors to be used in further computational validation of these compounds.

We have developed a workflow that automatically creates a cyanobacteria relational database of chemical compounds from different online databases. We merged the databases using as primary Key the Inchlkeys of these compounds, which are a hash of the Inchi (International Chemical Identifier). The methodology was accomplished by using Python algorithms, including the module pandas for data analysis, Octoparse and the APIs of the online databases. Currently the database contains cyanobacteria bioactive compounds with the respective SMILES (Simplified Molecular Input Line Entry System), InchiKeys, taxonomy, database original source, experimental bioassay, IC50, Ki, INH, MIC, and target. This data was validated using cross-validation between the different online sources. In the future, we expect to add new chemical descriptors calculated for each bioactive compound database record using the PaDEL-descriptor software and Mordred. Our main long-term objective is the search for compounds with relevant targets associated to human diseases, that have applications in blue biotechnology. This database will allow the determination of the most relevant cyanobacteria compounds for therapeutic purposes in humans.

Keywords: Cyanobacteria; Bioactive compounds; Blue biotechnology.

20693 | Cyanobacteria with bioactivity towards appetite reduction – growth conditions and metabolite identification

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Abstract

Obesity is a major public health challenge globally. According to the World Health Organization, by 2016, there were 1.9 billion overweight adults, of which 650 million were obese. This steady increase in body weight is correlated with a dramatic increase in the metabolic syndrome, leading to various comorbidities such as non-alcoholic fatty liver disease, cardiovascular, diabetes, musculoskeletal disorders, and the risk of some forms of cancer, all linked to increased mortality. As proven in recent studies, cyanobacteria are a source of many important bioactive and biotechnologically relevant compounds, including peptides, proteins, antioxidants, vitamins, polyunsaturated fatty acids, and pigments. Their enormous biodiversity, and the subsequent variability in the corresponding biochemical composition, make cyanobacteria cultivations a promising supply for new chemically and biologically molecules of high commercial value, such as pharmaceutical or nutraceuticals compounds. The nature of the metabolites produced can be controlled by altering the cultivation media or environmental conditions.

This work is focused on a cyanobacteria strain (*Nunduva sp*- LEGE 07159) with previous known bioactivity towards appetite reduction using zebrafish larvae. The manipulation of the light was tested for a boost in the production of different metabolites and their bioactivities, and the strain was grown for 2 weeks testing eight different light conditions in the multicultivator ranging from 400-700 nm. The metabolite profiles of extracts were characterized by mass spectrometry (LC-MS/MS). The bioactivity of extracts was analysed on appetite reduction in zebrafish larvae using fluorescent labelled liposomes. This work is ongoing, and results will be presented for the bioactivity analyses and metabolite profiling. The identification of responsible metabolites will be an important step to develop novel solutions to help lose weight and reduce obesity.

Keywords: overweight; cyanobacteria; zebrafish; bioactivities metabolites.

References

[1] W. H. O. WHO, WHO, World Health Organization, Factsheet obesity and overweight, updated June 2016. http://www.who.int/mediacentre/factsheets/fs311/en/(visited at 06/01/2017).

20715 | Understanding the role of the extracellular matrix component Perlecan on epithelial cytokinesis

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Abstract

Epithelia are highly proliferative tissues that play a fundamental role as the cohesive barrier that compartmentalize the organs, and whose disruption is tightly associated with several diseases. The multicellular organization and apical-basal polarity of this tissue demands coordination of cell-cell and cell-matrix adhesion in dividing cells, to ensure tissue functionality and faithful separation of daughter cells during cytokinesis. We recently performed an *in vivo* screen for cell adhesion molecules to assess their impact on cytokinesis efficiency in Drosophila melanogaster follicular epithelia. This screen revealed that the basal adhesion complex Dystroglycan-Dystrophin (Dg-Dys) promotes cytokinesis completion. Live imaging using GFP-tagged versions of this complex uncovered its accumulation in the basal side of the dividing cell and an enrichment in the cleavage furrow. Our more recent findings also suggest that the role of the Dg-Dys complex during epithelial cytokinesis is associated to its ability to bind to a specific component of the extracellular matrix, Perlecan. Thus, we are now combining high-resolution live imaging of Drosophila tissues with RNAi-mediated depletion of Perlecan to dissect its role in epithelial cytokinesis. By elucidating new mechanisms that coordinate adhesion to the extracellular matrix to prevent cytokinesis failure, we will pave the way to understand how to ensure the correct genetic ploidy of epithelial cells during growth and development.

Keywords: Epithelial Tissues; Cytokinesis; Perlecan; Drosophila melanogaster.

20728 | Discovery of ribosomally synthesized lipopeptides from Cyanobacteria

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Abstract

Cyanobacteria are a diverse group of photosynthetic microorganisms that have become a promising source of natural products with potential biotechnological applications. Among the various classes of cyanobacterial natural products, ribosomally synthesized and post-translationally modified peptides (RiPPs) are of particular interest due to their unique chemical structures and bioactivities. Cyanobactins, a subclass of RiPPs, are small cyclic and linear peptides that are produced by a diverse selection of cyanobacteria through post-translational modification of short precursor peptides. Recent advances in the understanding of cyanobacterial genetics and metabolism have facilitated the identification and characterization of novel enzymes. Furthermore, cyanobactins have shown a wide range of biological activities including antibacterial, antifungal, antiviral, and anticancer properties.

The aim of this project is to explore new enzymatic activities and uncover the bioactive and biotechnological potential of RiPPs. In this work, we focus on the detection, isolation, structural elucidation, and biological activity of a novel group of prenylated cyanobactins from Oscillatorialles cyanobacterium LEGE 16532. Herein we have identified eleven new metabolites including cyclic, mono and bis-prenylated cyanobactins where the forward prenylation occurs on the tyrosine residue. Through enzymology and analytical chemistry, we determined the structure of the final products and the prenyltransferase regioselectivity. This discovery has the potential to serve as a synthetic biological tool, providing drug-like properties to diverse small molecules. Overall, the study of RiPPs and cyanobactins represents an exciting area of research with promising applications in biotechnology.

Keywords: Cyanobacteria, Natural Products, RiPPs, Biotechnology, Bioactivity.

20747 | Dual Targeting function of GLN2-encoded Glutamine Synthetase

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Abstract

Glutamine Synthetase is a plant nitrogen assimilation pathway enzyme, that converts ammonium into glutamine. It exists in two forms: GS1 (cytosolic enzyme) and GS2 (plastidial enzyme), which intervenes in different ammonium forming processes. The GS2 assimilates the ammonium produced during the photorespiration and nitrite reduction. Initially, GS2 was classified as exclusively chloroplastidial, however, further studies in Arabidopsis thaliana pointed it as targeted to both chloroplast and mitochondria. In this work, the GS2 from A. thaliana and Medicago truncatula were studied and compared to better assess the dual targeting phenomenon and its physiological importance in these two species. Reporter genetic constructs were created and used to transiently transform Nicotiana tabacum leaves, for the study of the intracellular localization by confocal laser scanning microscopy and to stably transform A. thaliana wild type and *gln2;0* knockout mutants, assessing the physiological relevance of the dual targeting. The co-localization with either mitochondria or chloroplast was assessed in both species and compared. The transgenic A. thaliana grew in either normal or CO₂ saturated atmospheres and with different nitrogen sources (ammonium or nitrate), and the intracellular localization further studied under the different physiological conditions. This work will provide a better understanding of the GS2 dual targeting phenomenon and its effect on the plant physiology.

Keywords: photorespiration, mitochondria, chloroplast, nitrogen uptake.

Acknowledgments

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20762 | Recombinant expression and purification of trimeric autotransporter adhesins from *Photobacterium damselae* subsp. *piscicida*

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Abstract

Attachment to host tissues is a crucial step for colonization and infection by bacterial pathogens. Host adhesion is mediated by adhesins, molecules with high selectivity for specific targets in the host [1]. Trimeric autotransporter adhesins (TAA) are outer membrane proteins present in several Gram-negative bacteria that are involved in various functions, including binding to cells, biofilm formation, autoaggregation, and serum resistance [2]. TAA comprise head, neck, and stalk domains organized in a 'lollipop' or 'beads on a string' configuration [2]. The adhesin A of enteropathogenic Yersinia species (YadA) is the prototype of the lollipop-shaped TAA, and its structure and role in virulence are well described [2]. Photobacterium damselae subsp. piscicida (Phdp) is a Gram-negative bacterium that causes fish photobacteriosis, a disease with high mortality rate responsible for huge economic losses in aquaculture worldwide [3]. We found that Phdp field isolates express two putative TAA similar to YadA, which were named PadA and PadB (for *Photobacterium* adhesins A and B, respectively). In this work, we produced and purified recombinant versions of these TAA. For this, DNA sequences encoding different regions of PadA and PadB were cloned and expressed in E. coli in frame with C-terminal Histidine-tags and purified by affinity and size-exclusion chromatography. The recombinant proteins will be used for structural and functional characterization of PadA and PadB, to understand their role in virulence, and to perform vaccination trials in fish.

Keywords: adhesins, virulence, photobacteriosis

References

[1]Klemm, P. and M.A. Schembri, *Bacterial adhesins: function and structure*. Int J Med Microbiol, 2000. **290**(1): p. 27-35.

[2] Kiessling, A.R., A. Malik, and A. Goldman, *Recent advances in the understanding of trimeric autotransporter adhesins*. Med Microbiol Immunol, 2020. **209**(3): p. 233-242.

[3] Andreoni, F. and M. Magnani, *Photobacteriosis: prevention and diagnosis*. J Immunol Res, 2014. **2014**: p. 793817.

20781 | The utility of eDNA metabarcoding for assessing myxozoan presence and diversity in an estuarine environment

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Abstract

The development of effective approaches for monitoring parasites in aquatic habitats is essential considering the status of the world's biodiversity and the emergence of new illnesses. Myxozoans are important fish endoparasites with a spectacularly vast, although somewhat unexplored, diversity, due to the tiresome nature of the traditional methods used to detect the presence of these parasitic cnidarians [1-3]. Non-destructive sampling techniques, including eDNA metabarcoding, are presently being developed to avoid issues commonly associated with these traditional methods, while simultaneously producing useful data [3, 4]. Hartikainen et al. [3] conducted the only research to date that used eDNA metabarcoding to evaluate the diversity and abundance of myxozoans in freshwater and marine environments, focusing on analysing eDNA obtained from filtrands of water samples. This study aimed to evaluate and compare the diversity of myxozoans present in the different stretches of an estuarine environment, using the eDNA metabarcoding approach. Superficial water was monthly collected (June 2022 – February 2023) from three locations in the Minho River estuary: Caminha (lower estuary), Boega (middle estuary) and Morraceira (upper estuary), and sequentially filtered through different sized meshes (63, 20, 3 and 0.45 µm). eDNA was extracted from filtrands, and a nested PCR protocol targeting a variable region of the SSU rRNA gene (450-490 bp) was performed using previously developed metabarcoding primers [3]. PCR products of the correct size were obtained. The eDNA sequencing results were compared according to size, location, and month. The preliminary results of this work evidence the utility of eDNA metabarcoding for evaluating myxozoan presence and diversity at a faster rate than traditionally used methods.

Keywords: Myxosporea; eDNA; Minho River.

Acknowledgments

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References

[1] Bell, A.S. and L.C. Ranford-Cartwright, Real-time quantitative PCR in parasitology. Trends Parasitol, 2002. 18(8): p. 337-42.

[2] Okamura, B., et al., Myxozoan Evolution, Ecology and Development. 1st 2015. ed. 2015, Cham: Springer International Publishing: Imprint: Springer.

[3] Hartikainen, H., et al., Assessing myxozoan presence and diversity using environmental DNA. Int J Parasitol, 2016. 46(12): p. 781-792.

[4] Massana, R., et al., Marine protist diversity in European coastal waters and sediments as revealed by high-throughput sequencing. Environ Microbiol, 2015. 17(10): p. 4035-49.

20804 | Exploring the maternal genetic landscape of Andean Mestizos from Ecuador

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Abstract

South American human populations experienced a series of complex admixture events that shaped their genetic makeup. Ecuador retains the European and African genetic inheritances acquired during the colonial period, and Mestizos (individuals with Native, European, and African admixture) represent 72.3% of the population scattered across the country.

The present study focuses on assessing the maternal genetic contributions in the Mestizos from the Andean region of Ecuador, aiming to clarify the impact of post-conquest human migrations at a regional level. Maternal ancestry was obtained through complete mtDNA control region sequencing of 210 Andean Mestizos from Ecuador. Samples were divided into three subgroups according to their living place- North, Center, and South. High haplotype diversities were found in the three regions: North (0.9993 +/- 0.0023), Center (0.9981 +/- 0.0030), and South (0.9960 +/- 0.0036). These values are expected in admixed populations, although higher when compared to neighboring countries. Most of the mtDNA haplogroups found in our sample were of Native American origin (A2, B2, B4, C1, D1, D4). However, differences in the proportion of some native lineages were observed among the three Mestizo subgroups. African (L1, L2, L3) and Eurasian (U4c1, HV, R) haplogroups were encountered at low frequencies in North and South Andes, but none were present in Central Andes, where most Native American communities are established. Nonetheless, Pairwise FST genetic distance calculated using haplotype frequencies revealed no statistically significant differences between the three subgroups. Our results showed that despite some variation in haplogroup distribution between the three subgroups, there are no significant

differences in haplotype composition, demonstrating that under our geographic division criteria did not capture any significant mtDNA population structure.

Keywords: Ecuador; Andes; mtDNA, diversity, haplogroups.

20825 | MiT/TFE Family of Transcription Factors in Invertebrates: from nutrient sensing to environmental markers?

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Abstract

The microphthalmia/transcription factor E (MiT/TFE) family of transcription factors (TFs) serve to adapt cell responses to external and internal stimuli. Specifically, TFEB and TFE3 were shown to mediate a nutrient-dependent cross-talk between lysosomes, autophagy and the nucleus. Besides nutrients, such pathways were also recently shown to be activated by nanoparticle exposure, an increasingly common environmental contaminant of emerging concern. Thus, the present work aims to address the evolutionary distribution of MiT/TFE family in invertebrate species that could serve as sentinels of marine and/or fresh water environment. Using a combination of sequence mining and phylogeny, we identified the presence of a single copy of MiT/TFE, in invertebrates: namely, in Porifera, Cnidarians, Mollusca (e.g. Mytillus galloprovincialis), Annelida, Arthropoda, Rotifera, Nematoda, and Echinodermata. In vertebrates, events of gene duplication gave rise to the 4-fold TF gene collection: MITF, TFE3, TFEB and TFEC. The RT- qPCR expression profile in a mollusk species serving as environmental sentinel (*Mytilus* galloprovincialis), in basal conditions and upon nanoparticle challenge, will further clarify the expression and function of the single copy TF, notably regarding nanoparticle responses. The present work provides insight into evolutionary conservation of TFEB/TFE3-dependent processes, and predicts the suitability of such cellular processes as markers for nanoparticle exposure.

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Keywords: Transcription factors, lysosome biogenesis, invertebrates, nanoparticles.

20826 | Optimisation of new *in vivo* magnetic system to collect and eliminate circulating tumours cells

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Abstract

Cancer is among the scientific community's most well-known and investigated diseases due to its high incidence and mortality rate globally. Metastasis formation is one of the main factors for cancer mortality [1]. For metastasis to occur, cancer cells from the original tumour break free, enter the bloodstream, become circulating cancer cells (CTCs), and are carried to other locations in the body where they form new tumours [2]. The capture and elimination of these cells will prevent the formation of new metastases, thus increasing cancer patients' lifespan and quality of life. The major problem is that the primary devices developed for capturing these cells have several limitations, such as being unable to handle high volumes of whole blood, and the capture rate and purity of circulating cancer cells are far below what is desired.

The solution proposed in this work is to build an in *vivo* magnetic tubular system with a simple, inexpensive design capable of handling large volumes of whole blood. For this purpose, superparamagnetic particles functionalised with antibodies were used in the system. These bind to CTCs via the antibodies and, subsequently, are captured in the tubular system. Three cell counting techniques were used to calculate the capture rate of the CTCs (Neubauer Chamber, Flow Cytometry, and Image Flow Cytometry).

The present work obtained promising preliminary results regarding the capture rate of CTCs. However, further testing should be done to choose the best technique to count the cells captured by the system and optimise its various parameters to obtain reproducibility in the results. Furthermore, the next steps will be to start whole blood testing and *in vivo* assays in mice.

Keywords: Cancer; Circulating Tumor Cells; Magnetic Particles; Metastases.

Acknowledgments

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References

K. Ganesh and J. Massagué, "Targeting metastatic cancer," *Nature Medicine*, vol. 27, no. 1.
 Nature Research, pp. 34–44, Jan. 01, 2021. doi: 10.1038/s41591-020-01195-4.

[2] S. Ju *et al.*, "Detection of circulating tumor cells: opportunities and challenges," *Biomarker Research*, vol. 10, no. 1. BioMed Central Ltd, Dec. 01, 2022. doi: 10.1186/s40364-022-00403-2.

20831 | Inhibition of Mitochondrial Uncoupling Proteins (UCPs) impairs mouse Leydig cells mitochondrial function

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Abstract

Introduction: Metabolic diseases are closely related to hypogonadism due to impaired metabolism and decreased testosterone production in Leydig cells. Onset of metabolic diseases has also been linked with mitochondrial uncoupling proteins (UCPs) dysfunction. UCPs are transmembrane channels that transport protons and small substrates between the mitochondrial matrix and the intermembrane space. UCPs also act as key regulators of cell metabolism, mitochondrial activity, and reactive oxygen species production. We propose that UCPs dysfunction may play a role in the crosstalk between metabolic diseases and hypogonadism, yet their expression in Leydig cells and steroidogenesis remains unknown. Thus, we aimed to identify UCP1-3 expression and assess their role in mitochondrial function of mouse Leydig cells (mLCs). Materials and methods: Cultures of mLCs (BLTK-1 cell line) were used. RNA was extracted and UCP1-3 mRNA expression was determined by RT-PCR. UCP1-3 protein expression was also evaluated by Western Blot and immunofluorescence. UCPs function was assessed using genipin (0.5, 5, 50, 100 μ M, n=10 for each condition), a specific UCPs inhibitor. After 24h, cytotoxicity was appraised. Mitochondrial activity was assessed by Seahorse XF Cell Mito Stress assay.

Results: UCP1-3 mRNA and protein are expressed in mLCs. Their inhibition led to a decrease in cell proliferation and viability. Mitochondrial activity also declined in a dose-dependent manner, along with severely impaired respiratory capacity after UCP inhibition with the higher concentrations of genipin (50 and 100 μ M).

Conclusion: We identified for the first time the expression of UCP1, UCP2 and UCP3 in mLCs. UCPs inhibition severely compromises mitochondrial activity of mLCs. Future studies are needed to disclose a potential role of UCPs in steroidogenesis regulation. Overall, our results suggest that UCPs dysfunction may be involved in the interconnection between hypogonadism and metabolic diseases.

Keywords: UCPs, mitochondria, male fertility, Leydig cells, genipin.

20848 | *In vitro* bone cell behaviour and angiogenesis under static magnetic fields on magnetic bone implants

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Abstract

Using magnetic stimulation has demonstrated the potential for enhancing bone tissue regeneration by manipulating magnetic nanoparticles or scaffolds [1]. However, more research is needed to fully clarify the relationship between magnetism, bone cells and angiogenesis, leading to the development of new magnetic bone implants. In this work, porous hydroxyapatite granules were produced and coated with collagen containing various percentages of superparamagnetic iron-doped hydroxyapatite nanoparticles (FeHap2+/3+ NPs). MC3T3-E1 osteoblastic cells were seeded on the granules cultured for 7,14 and 21 days under static magnetic field effect. Resazurin, alkaline phosphatase, alizarin, osteocalcin, and osteopontin quantification assays were performed to assess cell growth, differentiation and mineralisation. Confocal laser scanning microscopy (CLSM) was also used to visualise the cell morphology and proliferation. The In vivo chicken embryo chorioallantoic membrane (CAM) assay was performed to assess the angiogenic and inflammation potentials of the magnetic granules. CLSM observations confirmed cell adhesion and migration into the pores' magnetic granules with the characteristic morphology. Resazurin assay indicates that cells remain metabolically active throughout the 21-day period. Alkaline phosphatase activity quantification assay confirmed that cells could differentiate in the cell culture time. The Alizarin, osteocalcin and osteopontin assays showed that the cells began mineralisation after day 14. The CAM assays showed the formation of new blood vessels in the presence of magnetic granules without signs of inflammation. The study demonstrated that osteoblastic cells could proliferate, differentiate, and initiate the mineralisation phase when exposed to external magnetic stimulation and granules. Further investigations are needed for a more comprehensive understanding of the angiogenic potential for the magnetic granules, by a combination of in vivo CAM and in vitro assays with endothelial cells.

Keywords: Angiogenesis; Bone regeneration; Magnetic bone implants; Magnetic stimulation.

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References

[1] Ribeiro TP, *et al.*, Magnetic bone tissue engineering: Reviewing the effects of magnetic stimulation on bone regeneration and angiogenesis, *Pharmaceutics*, (2023)

20884 | Human Disease - Gene Expression Network

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Abstract

Diseases are often caused by a dysfunction in one or multiple genes. While in some cases it is possible to identify a causal relation between the genotype and phenotype, understanding the mechanisms and the biological dysregulation that leads to disease, is still a challenge. It is likely that beyond known disease genes, many other genes play a role in human diseases. Understanding pleiotropic relationships is essential to develop novel therapeutic actions.

Taking advantage of the Genotype-Tissue Expression (GTEx) dataset, we set to investigate the relation of >22,000 genes, across 46 different tissues from 781 individuals, to 4 demographic and 17 clinical traits, including several diseases such as Diabetes or Hypertension.

We propose a network-based framework to systematically investigate the relation between genes and phenotypes in the tissues of origin where they are differentially expressed. We established a bipartite network, that we called Human Phenotype – Gene Expression Network, to mine 7,804 differential expressed instances, from 2305 genes across 20 tissues in a combined, gene-centric or phenotype-centric view. In addition to the general properties of the networks, we identified peripheral and central genes, specific or shared by multiple diseases. Community finding algorithms reveal the association and organisation of phenotypes and genes.

Through a network science analysis of transcriptomic data we aim to provide novel insights on or expression regulation and the underlying mechanisms of health and disease.



Keywords: networks science; systems biology; transcriptomics; genotype-tissue expression project; genetic interactions.

Figure 2: Network development workflow. On the left side we describe the dataset. On the centre and right side, we display preliminary graphs that showcase the organisation and association of genes and phenotypes in the context of differential expression.

Phenotype Projection 20885 | Pharmacodynamic evaluation of novel Catechol-O-methyltransferase inhibitors

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Abstract

Catechol-O-methyltransferase (COMT) inhibitors are clinically relevant in the therapy of Parkinson's disease and potentially in various neuropsychiatric disorders. Currently available COMT inhibitors are however associated with adverse reactions, low bioavailability and short elimination half-lives. The development of new selective COMT inhibitors is, therefore, of paramount importance. The aim of this study was to obtain *in vitro* pharmacodynamic data of novel COMT inhibitors and compare them to the standard inhibitor, tolcapone. The activity of 🔾 🔵 soluble (S) and membrane bound (MB) COMT from rat liver and brain was evaluated under a saturating concentration of adrenaline in the presence of each inhibitor. The reaction product, metanephrine, was measured by HPLC-ED. Tested COMT inhibitors produced concentrationdependent decreases in the O-methylation of adrenaline by liver S- and MB-COMT and brain MB-COMT. The COMT inhibitor SB9 was found to be the most potent inhibitor against liver and brain isoforms. SB9 displayed higher inhibitory activity towards brain (IC₅₀=14 nM) and liver MB-COMT (IC₅₀=20 nM) than liver S-COMT (IC₅₀=1 μ M), suggesting a higher selectivity against MB-COMT. Cell viability assays in human cells and in vivo pharmacokinetic studies are in progress. In conclusion, these results suggest that SB9 may have a potential therapeutic role as a brain COMT inhibitor, the main form of which is MB-COMT.

Keywords: Catechol-O-methyltransferase; Liver; Brain; Parkinson's disease; L-DOPA.

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References

[1] Silva TB et al. (2020) Drug Discov Today 25(10):1846–1854, doi: 10.1016/j.drudis.2020.07.015.

[2] Pinheiro SD et al. (2019) Eur J Pharmacol 847:53–60, doi: 10.1016/j.ejphar.2019.01.027.

[3] Chavarria D et al. (2022) Eur J Med Chem 243:114740, doi: 10.1016/j.ejmech.2022.114740.

20886 | Morphological and genetic characterization of the PRRXL1 S119A phosphodefective mouse

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Abstract

The heterogeneity of the nervous system relies on distinct neuronal cell fates, which are specified in the early development through the combinatorial action of several transcription factors. One of these is the paired related homeobox protein-like 1 (Prrxl1). In late embryonic development, Prrxl1 null mice exhibit an ablation of most of the glutamatergic neurons in the dorsal horn spinal neurons, which implies a role in the differentiation and maintenance of the nociceptive circuitry. It is known that phosphorylation is one a putative mechanism of transcription factor regulation to control neuronal differentiation. By combining immunoprecipitation with mass spectrometry analysis, it was possible to identify multiple phosphorylation sites and, among those, Ser119 was considered to be relevant for the activity and conformation of Prrxl1. To determine the functional role of phospho-Ser119 *in vivo*, a phospho-defective knockin (KI) mouse model, the Prrxl1914

To uncover the effect of this particular phospho-mutation on the genetic program under the control of Prrxl1, we are evaluating Prrxl1 target genes expression, by qPCR, in spinal cords obtained from wild type and KI embryos at different developmental ages. By histological staining and labelling we are identifying spinal morphological abnormalities and impairments in neuronal differentiation of embryos at distinct stages of development.

In addition, we gained insight on the biochemical impact of pS119 on the interaction between Prrxl1 and its molecular partner Tlx3, taking advantage of co-immunoprecipitation approaches. Along with that, we have studied the putative role of kinase HipK2 in the modulation of phosphorylation on Prrxl1S119 and its impact on the expression of Prrxl1 target genes in ND7/23 neuronal cell lines.

With these results, we were able to deepen our insight into the mechanisms that control nociceptive neuron differentiation.

Keywords: Prrxl1, phosphorylation, TLX3, kinase HipK2, S119A, phospho-mutant, neurodevelopment, spinal cord.

21027 | Unconventional vacuolar trafficking pathways in tobacco BY-2 cells

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Abstract

The correct sorting of proteins is essential in the development and functioning of organisms because of their major roles in different subcellular mechanisms. Currently, in plant cells, two pathways are known for directing proteins through the endomembrane system to the vacuole. The conventional route, which involves the passage through the endoplasmic reticulum (ER), the Golgi apparatus, the trans-Golgi network and pre-vacuolar compartments towards the vacuole, and an unconventional route, where the proteins are transported directly from the ER to the vacuole, bypassing the Golgi. While the conventional pathway is well described and the main molecular machinery already known, the mechanisms behind the unconventional vacuolar pathway are still unclear. The Plant Specific Insert (PSI) and C-terminal peptide are two domains found in cardosins, characterized as vacuolar sorting determinants, that mediate protein trafficking through these two different pathways. The *Nicotiana tabacum* plant cell culture Bright Yellow-2 (BY-2) cell line, is a suitable system for studying endomembrane protein trafficking because of its advantages compared to whole-plant systems. Our aim is to characterize and depict the mechanisms underlying the unconventional protein trafficking route in BY-2 cells and check for the presence of the newly characterized ERMEC/EMAC compartment. To accomplish this, BY-2 suspension cultures were established and stably transformed with known vacuolar markers, following either the conventional or unconventional routes. Our preliminary results on the expression and localization of cardosins PSIs (PSIA and PSIB) in BY-2 cells revealed that both predominantly accumulate in the vacuole, as previously observed in Nicotiana tabacum leaf cells. In the future, inducible transgene expression together with drug treatments and specific markers will allow controlled detection and tracking of PSIs in BY-2 cells, along with immunolocalization for a complete overview.

Keywords: Unconventional routes, Bright Yellow-2, *Nicotiana tabacum*, Plant Specific Insert, Protein trafficking, Vacuolar Sorting Determinant (VSD).

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21064 | Tension-driven axon elongation triggers cytoskeleton remodelling

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Abstract

Axon elongation during development is guided by the growth cone, a highly motile structure at the tip of the axon. The growth cone can generate forces in response to chemotactic cues, leading the way to synaptic targets. However, after birth, the organism's growth must be accompanied by the extension of the neuronal network, which occurs through a growth cone-independent mechanism. This project aims to uncover the molecular mechanisms of neurons in response to tension-driven elongation, a process that remains poorly understood in the field.

To achieve this goal, we developed a microfluidic stretcher system for culturing dorsal root ganglia (DRG) neuron explants from embryonic mice. This system allows for a uniformly distributed stretch, whose rate can be computer-controlled to mimic physiological conditions through firmware and software built specifically for this purpose. The microfluidic platform also enables the growth of DRG explants on top of a flexible silicone substrate, making it compatible for live imaging.

Our study focuses on the axonal cytoskeletal dynamics in response to externally applied controlled forces. Our findings reveal a decrease in the density of dynamic microtubules and an increase in the axonal microtubule growth velocity. Axons under stretch also exhibit a tendency to decrease neurofilament density, while the nearest neighbour distance between neurofilaments increases. Future studies will evaluate the effects of stretch on axonal actin dynamics.

Overall, this work sheds light on the mechanisms of cytoskeleton adaptation during tensiondriven axon elongation. Additionally, it introduces a bioengineering-based approach that can provide new relevant insights to the field.

Keywords: tension, axon, microfluidics, cytoskeleton, microtubules, neurofilaments.

Acknowledgments

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21089 | Development of NAM-FISH for the study of biofilms formed in an advanced 3D substrate

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Abstract

The fraction of microorganisms that can be cultivated in the laboratory is undesirably low. Thus, there is a need to seek and develop new substrates that overcomes such limitation. In addition, it is essential to develop techniques that allow researchers to identify and locate such microorganisms and their colonies. Bac3Gel is a startup pioneering the development of advanced substrates that mimic the microenvironments in which microorganisms are found in nature. These substrates combine a 3D architecture with an oxygen gradient, structure, and penetration of molecules, and replicate key features of the human mucus where vast microbial communities reside. In fact, Bac3Gel has been able to reproduce the way in which pathogens organize themselves in the human body, and show resistance to microbial treatments that are closer to what is reported in the literature. Fluorescence in situ hybridization (FISH) is a powerful tool to identify microorganisms. The use of nucleic acid mimics (NAM-FISH) has improved the performance of FISH methods for the detection and location of microorganisms within biofilms. The aim of this study is to test the performance of NAM-FISH in spatially locating biofilm cells cultured in the advanced 3D substrates – Universal-Bac3Gel®. As a case study, P. aeruginosa, the most commonly isolated bacteria from chronic wounds, was selected. A specific NAM probe for this species was used in biofilm experiments.

Preliminary results have shown that the probe can successfully penetrate the hydrogel and accomplish hybridization with the specific nucleic acid sequence in *P. aeruginosa* for which it was designed. This method demonstrates great potential for observing the 3D structure of the biofilm within the hydrogel.

Keywords: nucleic acid mimics, fluorescence *in situ* hybridization, biofilms, chronic wounds, Bac3Gel

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References

[1] Azevedo AS, Fernandes RM, Faria AR, Silvestre OF, Nieder JB, Lou C, Wengel J, Almeida C and Azevedo NF (2022) Spectral imaging and nucleic acid mimics fluorescence in situ hybridization (SI-NAM-FISH) for multiplex detection of clinical pathogens. Frontiers in Microbiology. 13:976639. doi: 10.3389/fmicb.2022.976639

[2] Pedersoli L, Zhang S, Briatico-Vangosa F, Petrini P, Cardinaels R, den Toonder J, & Peneda Pacheco D (2021). Engineered modular microphysiological models of the human airway clearance phenomena. *Biotechnology and Bioengineering*, 118, 3898–3913.
 doi: 10.1002/bit.27866

[3] Peneda Pacheco D, Bertoglio F, Butnarasu C, Suarez Vargas N, Guagliano G, Ziccarelli A,
 Briatico-Vangosa F, Ruzzi V, Buzzaccaro S, Piazza R, van Uden S, Crotti E, Visentin S, Visai L, Petrini
 P, Modelling the heterogeneity of microbial ecosystems in vitro. [submitted]



Figure 1: Results achieved by implementing the FISH protocol within the gel and subsequent microscopy analysis using both (A) the fluorescence probe to specifically detect P. aeruginosa and (B) DAPI.

21204 | Establishment of a CRISPR/Cas9 activation (CRISPRa) methodology to study Sialyl Lewis X role in malignant features of gastrointestinal cancer

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Abstract

644 Cancer is a severe global health issue, with millions of associated deaths every year and the number of new cases continually rising [1]. To assist the development of more efficient therapies and earlier stage biomarkers, the study of the molecular mechanisms underlying this disease is of the utmost importance.

One of the cancer hallmarks is the abnormal expression of glycans due to alteration in the glycosylation process. Glycosylation consists in the enzymatic addition of glycans to other biomolecules, like proteins or lipids, essential for their function. Thus, alterations in glycosylation have an active role in several molecular mechanisms, including cell invasion and metastization [2]. Among the major glycan alterations reported in gastrointestinal cancers, the overexpression of Sialyl Lewis X antigen (SLeX) is a feature and is associated with more aggressive tumours and worse patient prognosis [3, 4]. Thus, the study of its role in cancer is essential.

This project aims to develop a genetic engineering tool based on CRISPR/Cas9 technology, the CRISPR activation (CRISPRa) [5, 6], to establish glycoengineered cell models overexpressing a key sialyltransferase in SLeX biosynthesis, the ST3GallV [7].

Specifically, lentiviral plasmids containing single-guide RNAs targeting distinct ST3GAL4 promoter regions and a plasmid encoding a dCas9 protein coupled to activation factors were designed and are being used to genetically engineer gastrointestinal cancer cell lines. In parallel, the characterization of the ST3GAL4 promoter methylation status in these cells is being performed to deduce the performance of the adopted CRISPRa system. Further, the expression levels of ST3GAL4 gene will be assessed by RT-qPCR, and SLeX expression will be screened through several techniques, mainly flow cytometry, immunofluorescence and western blot. Finally, we will evaluate malignant characteristics, including proliferation and invasion, in successfully glycoengineered cell lines overexpressing SLeX.

Keywords: Gastrointestinal cancer, Glycosylation, Sialyl-Lewis X, ST3GallV, CRISPR activation

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References

[1] Sung, H., et al., Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin, 2021. 71[8]: p. 209-249.

[2] Pinho, S.S. and C.A. Reis, Glycosylation in cancer: mechanisms and clinical implications. Nat Rev Cancer, 2015. 15(9): p. 540-55.

[3] Gomes, C., et al., Carcinoembryonic antigen carrying SLe(X) as a new biomarker of more aggressive gastric carcinomas. Theranostics, 2019. 9(24): p. 7431-7446.

[4] Amado, M., et al., Dimeric sialyl-Le(x) expression in gastric carcinoma correlates with venous invasion and poor outcome. Gastroenterology, 1998. 114[8]: p. 462-70.

[5] Kampmann, M., CRISPRi and CRISPRa Screens in Mammalian Cells for Precision Biology and Medicine. ACS Chem Biol, 2018. 13(2): p. 406-416.

[6] Dominguez, A.A., W.A. Lim, and L.S. Qi, Beyond editing: repurposing CRISPR-Cas9 for precision genome regulation and interrogation. Nat Rev Mol Cell Biol, 2016. 17(1): p. 5-15.

[7] Costa, A.F., et al., ST3GallV drives SLeX biosynthesis in gastrointestinal cancer cells and associates with cancer cell motility. 2022, Research Square.

21238 | Regulation of CD47 expression by interferon-gamma under chronic Methamphetamine exposureTitle

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Abstract

Exposure to methamphetamine (Meth), a highly addictive widely used psychostimulant, is classically associated with damage to neuronal terminals, but its neurotoxicity can also be mediated via activation of the neuroinflammatory response. Microglia, the resident immune cells of the brain, become highly activated and increase the release of proinflammatory mediators upon exposure to Meth. However, their role in Meth-associated neurotoxicity is still not sufficiently understood. Data from our lab shows that, in the hippocampus, chronic Meth administration leads to microglia homeostasis dysregulation, synapse dysregulation, and downregulation of cluster-differentiation 47 protein (CD47). The crosstalk between CD47 and its receptor, signal regulatory protein α (SIRP α), is an important "don't eat me signal" that inhibits phagocytosis. CD47 has been shown to protect synapses from excessive microglia-mediated pruning during development and neurodegeneration. Of note, in cancer cells CD47 expression is modulated by interferon-gamma (IFN-y). Consistently, after chronic Meth, we observed a significant decrease of meningeal T cells, and a decrease in the production of IFN-y by these cells. Here we aim to clarify if IFNy is regulating CD47 in the brain after chronic Meth administration, and consequently regulating synaptic pruning, using IFNyKO mice and wild-type mice injected with recombinant IFNy via stereotaxic surgery. Preliminary results indicate that IFNy/CD47 does not modulate microglia morphology and number after chronic Meth in the hippocampus. Currently we are evaluating synapses and phagocytosis, and we further expect to clarify the impact of IFNy /CD47 in the chronic Meth conditioning and in memory.

Keywords: Methamphetamine, Microglia, Neuron, Neuorinflammation, hippocampus.

20768 | Tutti frutti: Taxonomic revision and online access of the PO Herbarium Carpotheque (PO – MHNC-UP)

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Abstract

The term "*tutti frutti*" was coined in 1834 by the Italians and means "all the fruits", which sums up what the Carpotheque has. In the Porto Herbarium, we can find one, defined as a botanical collection consisting of preserved fruits and seeds, which usually subsidies an herbarium. Although this collection has a considerable size, it lacks common and exotic species and has incomplete meta-information.

We started with the standard curatorial work of numbering and creating a database of metadata for each specimen, while mounting and arranging them in jars (with alcohol for the fleshy ones). We then carried out a taxonomic and ecological revision, listing and checking their current taxonomic name, extracting data from the labels in the jars and tabulating them in a Microsoft Excel database.

This Carpothec contains plants from all over the world, from Angola to China and back to Portugal. New specimens were added during visits to botanical gardens, walks in the city, research projects and in our own gardens. The newly collected fruits were dried and then placed in an anoxia chamber (which artificially changes the atmosphere by releasing nitrogen, preventing the growth of oxygen-dependent organisms). The final step was to photograph the specimens in a light box to create a catalogue for everyone to consult.

Statistical analysis of specimen data revealed 340 species, distributed in 164 Families, with a predominance of Fabaceae (indehiscent, polyspermic fruits with zoochoric dispersal syndromes). The specimens were divided into two groups: the historical (1905 to 1975) and the contemporary collection (2010 to 2023).

This carpotheque supports taxonomic, ecological and physiological studies in the fields of economic botany, ethnobotany and conservation of local floras. Therefore, the discussion of these results is an important contribute to scientific research and perseverance.

Keywords: Fruits; Carpotheque; Cataloguing.



CHEMISTRY


20505 | Amperometric immunosensor targeting soybean Gly m TI allergen in foods

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Abstract

Soybean is a very versatile food, presenting several functional properties and contributing to its numerous applications in food industry. Soybean protein flours, concentrates/isolates are widely used as technological ingredients in food formulations, namely in meat and bakery products. However, soybean is known to cause allergic reactions in children/adults and its trypsin inhibitor is classified as a minor allergen inducing severe and life-threatening immunological responses. Therefore, it is crucial to develop highly sensitive and specific devices for their incorporation into food allergen monitoring systems.

For this purpose, an amperometric immunosensor was advanced to quantify soybean in model foods based on the immunorecognition of Gly m TI allergen using the anti-Gly m TI IgG, followed by electrochemical detection (square wave voltammetry). The immunosensor allowed a detection limit of 0,00001% (0,1 mg kg⁻¹) of soybean protein isolate in biscuits, sausage and hams. The immunosensor performance was not affected by different food processing methods (baking, autoclaving or oven-cooking) or by distinct matrices, as the LOD was the same for unprocessed and processed model foods (dough/biscuits, raw/autoclaved sausages or raw/cooked hams). The anti-Gly m TI IgG/ Gly m TI amperometric immunosensor allowed to detect soybean proteins below 0,1 mg kg⁻¹ in all tested matrices, confirming its suitability to quantify soybean at trace amounts in both unprocessed/processed foods, thus allowing the protection of 99% of soybean allergic patients.

Keywords: soybean, allergy, electrochemistry, immunosensor

Acknowledgments

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20524 | G protein-oriented immobilization of antibodies onto gold screen-printed electrodes - a promising improvement for human chorionic gonadotropin biosensor

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Abstract

Detection and quantification of Human Chorionic Gonadotropin (hCG) can be used to confirm pregnancy and can provide clinicians with valuable information regarding the progress of a pregnancy and the health of a foetus. In certain cases, hCG is used as a tumour marker (e.g., in seminoma, choriocarcinoma, germ cell tumours, and hydatidiform mole).

Electrochemical detection using fabricated biosensors suggests affordable real-time point-ofcare hCG monitoring. In the present work, a biosensor was developed where recombinant G protein is immobilized onto the gold screen-printed electrodes using a self-assembled monolayer of DTSP (Lomant's reagent). DTSP molecule significantly simplifies biosensor fabrication as it has succinimidyl groups and does not require further usage of the NHS/EDC binding mechanism. Additionally, recombinant G protein allows oriented capture of anti-hCG monoclonal antibodies via its Fc domains. Biosensing platforms with correctly oriented antibodies possess higher selectivity, better accuracy, and demonstrate lower detection limits.

The studies carried out so far include the optimisation of biosensor fabrication steps: 1 - bare electrode, 2 - self-assembled monolayer, 3 - binding of recombinant G protein, 4 - oriented antibody capture, and 5 - coupling of antibodies to hCG. PalmSens 4 Potentiostat was used for signal detection using electrochemical impedance spectroscopy and cyclic voltammetry techniques.

The results obtained (i.e., increase in charge transfer resistance) are consistent with those predicted and confirm successful and reproducible immobilization of antibodies onto GSPEs using mentioned above technique. Further experiments will include the preparation of calibration curves and the determination of hCG concentration in real samples.

Keywords: hCG; biosensors; electrochemistry; screen-printed electrodes; recombinant G protein.

References

[1] Neubert, Hendrik, et al. "Enhanced affinity capture MALDI-TOF MS: orientation of an immunoglobulin G using recombinant protein G." *Analytical chemistry* 74.15 (2002): 3677-3683.



Figure 1: 1 – Gold screen-printed electrode, 2 – Schematic representation of the preparation of the biosensor, 3 – Nyquist plot of electrochemical impedance spectroscopy experiments

20573 | Chemical control of acrylamide in the food industry

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Abstract

Acrylamide is an organic compound and a food contaminant known for its carcinogenicity (Group 2A of the IARC classification) and toxicity. Throughout the years, several studies have been conducted about its effect in the population's health and there is scientific consensus regarding its formation: the Maillard reaction [1, 2].

Some of the most significant factors that contribute to its formation are: (i) the ingredients, as the presence of amino acids, mostly asparagine, and reducing sugars with free carbonyl groups that enhances the Maillard reaction; and, (ii) the processing conditions, namely pH (in acidic conditions), water activity, temperature and baking time [1, 3-6].

In the European Union, Regulation 2017/2158 of November 20th of 2017 defines mitigation measures for acrylamide content in foodstuff, including focus on the product development regarding its chemical composition (use of asparaginase to reduce asparagine in flour), assessing raw materials (control of the ingredients' origin), or quality assurance through risk assessment (HACCP methodology). There are only maximum reference levels, but the absence of clear maximum values does not make food testing any less demanding when it comes to acrylamide content [7].

Though it is mandatory to perform acrylamide analysis in a laboratory with accredited methods at least yearly, where there is a demonstrable association between the concentration of acrylamide in a foodstuff and an organoleptic parameter, as colour, evaluation of this parameter replaces exhaustive laboratory analysis [7].

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This is why, though common instrumental methods of analysis to quantify acrylamide content in food matrices include chromatographic techniques, one may resort to colorimetric methods, which are faster, of low cost and maintenance, and simpler, not demanding high specialized personnel.

This work aims to be a review of the methodologies described in the scientific literature and the official ones for acrylamide determination.

Keywords: acrylamide, Regulation 2017/2158, chromatographic techniques, colorimetric techniques

Acknowledgments

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References

[1] Saez-Hernandez, R., et al., *Determination of acrylamide in toasts using digital image colorimetry by smartphone*. Food Control, 2022. **141**: p. 8.

[2] International Agency for Research on Cancer, *IARC Monographs On The Evaluation Of Carcinogenic Risks To Humans*. 1994. p. 389-433.

[3] Baharinikoo, L., M.J. Chaichi, and M.R. Ganjali, *Fluorescence Determination of Acrylamide in Potato Chips Based on P540 and P503 Fluorescent Reagents.* Iranian Journal of Chemistry & Chemical Engineering-International English Edition, 2022. **41**(1): p. 121-134.

[4] Sarion, C., G.G. Codină, and A. Dabija, *Acrylamide in Bakery Products: A Review on Health Risks, Legal Regulations and Strategies to Reduce Its Formation.* International Journal of Environmental Research and Public Health, 2021. **18**(8): p. 4332.

[5] Andačić, I.M., et al., *Exposure of the Croatian adult population to acrylamide through bread and bakery products.* Food Chemistry, 2020. **322**: p. 126771.

[6] Keramat, J., et al., *Acrylamide in Baking Products: A Review Article*. Food and Bioprocess Technology, 2011. **4**(4): p. 530-543.

[7] REGULAMENTO (UE) 2017/2158 DA COMISSÃO de 20 de novembro de 2017 que estabelece medidas de mitigação e níveis de referência para a redução da presença de acrilamida em géneros alimentícios. <u>https://eur-lex.europa.eu/legal-content/PT/TXT/?uri=CELEX%3A32017R2158</u>.

20576 | Electrochemical biosensing of ANP using MIPs as receptors

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Abstract

Molecularly imprinted polymers (MIPs) have been widely used in various fields, such as biomedicine, chemical separation and biosensing. [1] The higher stability and low production costs are some of the advantages of MIPs over natural antibodies making these biomimetic materials very promising in the biosensing field. Generally speaking, MIPs can be synthesized using different simple approaches, namely by i) surface electrochemical polymerization of redox monomer or ii) prepared by polymerization in solution containing functional monomer(s) and template, along with cross-linking agents. [1, 2]

Over recent years, the advances in nanotechnology have allowed to produce these materials in different sizes and configurations. That is the case of MIP nanoparticles, also called nanoMIPs, which present great advantages when compared to bulk MIPs, i.e., one binding site per nanoparticle, faster binding kinetics and more homogeneous binding sites, resembling monoclonal antibodies. [3]

The development of new electrochemical biosensors has exponentially increased over the past decade due to the unique characteristics of electrochemical methods (potentiometry, amperometry, impedance), such as high sensitivity, fast response time, and low cost analysis. Furthermore, the miniaturization of electrochemical devices, using screen-printed electrodes (SPEs) for example, allowed the portability of this type of sensors for point-of-care (POC) analysis or *in situ* monitoring of target analyte. [2]

In our work, we aim to develop an amperometric biosensor using a MIP receptor film prepared in a SPE by electropolymerization of dopamine biomonomer, for the quantification of atrial natriuretic peptide (ANP), a biomarker and therapeutic agent with relevance in cardiovascular diseases, in particular, myocardial infarction [4]. Later, the obtained results will be compared with the ones obtained using nanoMIPs as receptors, covalently immobilized on the surface of SPEs, for the detection of ANP.

Keywords: MIPs; nanoMIPs; atrial natriuretic peptide; biosensing; electrochemical; electropolymerization.

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References

[1] J.J. BelBruno, Molecularly Imprinted Polymers, Chemical Reviews 119(1) (2019) 94-119.

[2] E. Mazzotta, T. Di Giulio, C. Malitesta, Electrochemical sensing of macromolecules based on molecularly imprinted polymers: challenges, successful strategies, and opportunities, Analytical and Bioanalytical Chemistry 414(18) (2022) 5165-5200.

[3] J. Wackerlig, P.A. Lieberzeit, Molecularly imprinted polymer nanoparticles in chemical sensing – Synthesis, characterisation and application, Sensors and Actuators B: Chemical 207 (2015) 144-157.

[4] C. Nagai-Okatani, K. Kangawa, N. Minamino, Three molecular forms of atrial natriuretic peptides: quantitative analysis and biological characterization, JOURNAL OF PEPTIDE SCIENCE 23(7-8) (2017) 486-495.

20578 | Synthesis and structure elucidation of building blocks for marine cyclic peptide analogues as promising antimicrobial agents

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Abstract

Marine cyclic peptides are a group of metabolites with pivotal relevance due to their unique structures, chemical properties, and interesting biological activities, such as antimicrobial [1,2]. There are many examples of marine cyclic peptides with antimicrobial activity, including against drug-resistant bacteria and fungi [3], which makes these molecules as promising for the development of new antimicrobial agents.

Unnarmicins A and C, produced by marine bacteria Photobacterium sp., are outstanding examples. They can inhibit the fungal ABC transporters whose overexpression is the cause of the highest levels of multi-drug resistance of pathogenic fungi. Structurally, they comprise four amino acid residues and a 3-hydroxy fatty acid chain. They only differ in the size of the aliphatic fatty acid chain [4].

One of the aims of our group is to synthetize new unnarmicin analogues for evaluation of antimicrobial activity and further structure-activity relationship studies. In this study, the first steps of the synthetic pathway adopted for these molecules and their analogues are described.

Herein, all the steps for the synthesis of a series of building blocks comprising the hydroxy fatty acid chain linked by an ester bond to an amino acid residue are described. The synthetic strategy for their synthesis includes: a) protection reaction of aliphatic hydroxy acids, b) coupling reaction with an amino acid residue comprising the amino group protected, and c) selective deprotection of aliphatic hydroxy acid. The structures of all synthetized compounds were established by IR and NMR spectral analysis.

Keywords: Marine cyclic peptides; Antimicrobial activity; Chemical synthesis

Acknowledgments

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References

- [1] Phyo, Y. Z. et al. (2018), Molecules, 23, 306.
- [2] Fernandes, C. et al., Molecules, 2023, 28, 615.
- [3] Ribeiro, R. et al. (2022), Mar Drugs, 20, 397.
- [4] Tanabe, K. et al. (2007) Biochem. Biophys. Res. Commun., 364, 990-995.

20584 | Determination of patulin in apple products by high performance liquid chromatography with ultraviolet detection

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Abstract

Mycotoxins are natural, low molecular weight products produced by filamentous fungi and molds as secondary metabolites and are a diverse group of chemicals.

Patulin is one of these mycotoxins, produced by several fungi common to fruit and vegetable products, especially apples, such as fungi belonging to the genera *Penicillium, Aspergillus, Paecilomyces* and *Byssochlamys*. Acute exposure to patulin can cause gastrointestinal symptoms, including nausea, vomiting, ulcers, intestinal bleeding, and damage to the duodenum.

The objective of this work is the implementation and validation of a method for the determination of patulin in apple products by high performance liquid chromatography with an ultraviolet detector.

First, it is necessary to extract patulin from apple juice and apple puree by a mixture of ethyl acetate and hexane in the presence of sodium sulfate, sodium hydrogen carbonate and sand, followed by solid phase extraction, evaporation and redissolution in water at pH=4. Finally, the patulin present in the sample is quantified by reversed phase high performance liquid chromatography with ultraviolet detection, at the wavelength of 276 nm.

Keywords: mycotoxins; patulin; implementation; validation; high performance liquid chromatography; ultraviolet detection.

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20592 | Synthesis of a series of building blocks to obtain nitro derivatives

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Abstract

Over the years, compounds containing nitro groups have been widely studied and valuable bioactive compounds are used in therapeutics [1]. Most nitro drugs exhibit antimicrobial activity because the nitro group triggers redox reactions within cells causing toxicity and the posterior death of microorganisms, not only bacteria but also multicellular organisms such as parasites [2]. Currently, renewed interest in nitro drugs is noted by efforts to develop new bioactive compounds as clinical candidates. Moreover, previously failed nitro drugs are being reinvestigated in detail as part of a drug repurposing program [3].

Herein, the total synthesis of a series of suitable functionalized compounds as building blocks to further obtain nitro derivatives is described. The structure elucidation of the synthetized compounds was established by spectroscopic methods (1H NMR, 13C NMR, and IR).

Future work will include the evaluation of the antimicrobial activity and structure activity relationship studies.

Keywords: Nitro derivatives; building blocks; structure activity relationship.

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References

[1] Noriega, S. et al. Pharmaceuticals 2022, 15(6), 717.

- [2] Paula, F. R. et al. Quim Nova 2009, 32(4), 1013-1020.
- [3] Nepali, K et al. J Med Chem 2019, 62, 2851-2893.

20598 | Bacterial Siderophores - Iron thievery weapons in environmental research: synthesis, characterization and applications as bioremediation and chelating agents

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Abstract

Iron is an essential trace metal for most organisms, including microorganisms that need iron as an enzyme cofactor to catalyze vital biological reactions [1]. Siderophores are small molecules of organic nature, released by bacteria to chelate iron from the surrounding environment and subsequently incorporate it into the cytoplasm [1]. Beyond iron, these molecules can complex with a wide variety of metals, and for this reason, they are widely investigated in the environment field [2]. The pollution caused by heavy metals is increasing, so it is urgent to find economic and sustainable solutions for remediation. Siderophore-assisted remediation is one of the innovative and advantageous strategies for various environmental applications [3].

In this work, we present the synthesis of a natural siderophore and a siderophore analog and the structural elucidation of the obtained compounds by ¹H-NMR spectroscopy. Complexation tests of these siderophores with various metals, including Fe³⁺, will also be addressed. These studies are performed by an analytical reversed-phase HPLC protocol, which approximately indicates the amount of complex formed (siderophore-ion metal) and the affinities of the different siderophores for the metals. The overarching goal of this work is to apply these molecules in the environment in order to reduce heavy metals rates.

Keywords: siderophores; environment; heavy metals; pollution.

Acknowledgments

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References

[1] Almeida, M et al. J. Med. Chem. 2023, 66, 32-70.

- [2] Wang, Y. et al. Environ. Sci. Pollut. Res. 2022, 29 (3), 3888-3899.
- [3] Williamson, A. J. et al. Miner. Eng. 2021, 163, 106774.

20628 | Identification of xanthene derivatives inhibitors of mutant G2019S of Leucine Rich Repeat Kinase 2 (LRRK2) in yeast

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Abstract

Parkinson's Disease (PD) is the second most prevalent neurodegenerative disease among the elderly population [1]. Mutations in the PARK8 locus, leucine-rich repeat kinase 2 (LRRK2), are the most common monogenetic cause of PD, responsible for 5-10% of the familial PD. The most frequent LRRK2 mutation associated with PD is G2019S, found in the kinase domain. As such, inhibitors of G2019S reveals to be promising for PD's treatment [2].

For long, the yeast model has been used to study human proteins and search for their 661pharmacological modulators [3]. To identify selective small-molecule inhibitors of human G2019S LRRK2, this protein and wild-type (wt) were individually expressed in the yeast Saccharomyces cerevisiae. The G2019S mutation was obtained by site-directed mutagenesis from wt LRRK2. High copy expression of human wt or mutant LRRK2 in yeast caused significant growth inhibition, more pronounced for the PD-causing mutant G2019S [4].

Xanthenes are tricyclic compounds with an incorporated oxygen, which have already been associated with neuroprotective activity in vivo [5]. As such, several xanthene derivatives were tested in S. cerevisiae to verify if these neuroprotective compounds would inhibit G2019S LRRK2. Using the yeast assay, we identified the compounds MS1, MS20 and MM42B, which were able to inhibit the G2019S variant around 15 and 30 %. In a future work, a docking analysis will be conducted to evaluate potential interactions between xanthene derivatives and the biological target.

Keywords: Parkinson's Disease, LRRK2, yeast, inhibitors, xanthenes.

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References

[1] Thomas, B. and M.F. Beal. Hum Mol Genet, 2007. 16 Spec No. 2: p. R183-94.

[2] West, A.B. Experimental Neurology, 2017. 298: p. 236-245.

[3] Barberis, A., et al. Drug Discov Today Technol, 2005. 2(2): p. 187-92.

[4] Pereira, C., et al. Biochimica et Biophysica Acta (BBA) - General Subjects, 2014. 1840(6): p. 2025-2031.

[5] Maia, M., et al. Eur J Med Chem, 2021. 210: p. 113085.

20662 | Chitosan-flavylium conjugates towards construction of pH-responsive membranes for food spoilage detection

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Abstract

Nowadays, food safety and quality have concerned most of the consumers worldwide: people tend to be more interested in the expiry dates and quality of the products at the time of purchase. To ensure that, scientists have been developing efforts to create smart packaging technologies in order to visually inform the consumer's freshness state of a given product at real-time. For this purpose, (bio)films containing anthocyanins as pH-sensitive dyes incorporated in biopolymers have been widely studied as pH-freshness indicators. Actually, pH can be directly correlated with food freshness since the spoilage process promotes the formation of organic acids and volatile amine-based compounds which will decrease or increase the pH of perishable foods such as dairy products, meat, fish, among others. On the other hand, anthocyanin-based films are mainly obtained through classic solvent casting techniques without control of thickness and architecture which could compromise their properties and efficiency. ^{1,2}

Bearing this, the main goal of this work is to build up biodegradable and sustainable thin films based on flavylium pH-sensitive dyes and marine-origin biopolymers for the detection of food spoilage. Firstly, a flavylium-type dye was rationally designed to contain an azide group for further functionalization onto chitosan-alkyne derivative through copper-catalyzed azide-alkyne cycloaddition (CuAAC), also known as "click chemistry". The obtained conjugate was exhaustively characterized by different techniques namely, FTIR, NMR (¹H, NOESY), and *zeta*-potential. The chitosan-flavylium conjugate will constitute a building block for the further construction of highly ordered nanostructured polymeric multilayer free-standing pH-responsive membranes with tailored thickness, composition, structure, properties, and functions via Layer-by-Layer (LbL) assembly methodology. ³

Keywords: Flavylium, biofilms, smart packaging.

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References

[1] Pires, A. S. *et al.* Colorimetric pH-Responsive Biomaterials Based on Pyranoflavylium-Biopolymer Hybrid Conjugates. *ACS Appl. Polym. Mater.* **2022,** 4, 4961–4971. https://doi.org/10.1021/acsapm.2c00514.

[2] Cruz, L., Basílio, N., Mateus, N., de Freitas, V. & Pina, F. Natural and Synthetic Flavylium-Based Dyes: The Chemistry behind the Color. *Chem. Rev.* **2022**, *122*, 1416–1481. https://doi.org/10.1021/acs.chemrev.1c00399.

[3] Monteiro, L.P.G.; Borges, J.; Rodrigues, J.M.M.; Mano, J.F. Unveiling the Assembly of Neutral Marine Polysaccharides into Electrostatic-Driven Layer-by-Layer Bioassemblies by Chemical Functionalization. *Mar. Drugs* **2023**, *21*, 92. https://doi.org/10.3390/md21020092.

20669 | Exploring the assembly of aminopyrazine acrylamides for application in cancer treatment: optimization of the reactional conditions

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Abstract

Cancer is one of the leading causes of death worldwide, and its treatment is still complex and known to cause secondary side effects to patients. Photodynamic therapy (PDT) emerges in this context as a good alternative for the treatment of the disease, since it has great benefits, such as being low invasive and highly selective. [1] This therapy combines a photosensitizer (PS), light of specific wavelength, and molecular oxygen (${}^{3}O_{2}$). Recent studies show that coelenterazine (Clz) analogues have demonstrated relevant toxicity in different cancer cell lines (such as breast, liver, prostate, and neuroblastoma), while having no appreciable toxicity toward noncancer cells. [2,3,4]

Based on these results, this work describes the synthesis and optimization of the reactional conditions for the assembly of new aminopyrazine-based acrylamides. The development of this optimized method represents a contribution to the preparation of new analogues, based on the Clz system, with potential applications in PDT.

Keywords: Acrylamide; aminopyrazine; photosensitizer.

Acknowledgments

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References

 S. Wang, Y. Liu, Y. Feng, J. Zhang, J. Swinnen, Y. Li, Y. Ni. Cancers 11 (2019) E1782.
 C.M. Magalhães, J.C.G. Esteves da Silva, L. Pinto da Silva. ChemPhysChem 17 (2016) 2286.
 K.A.D.F. Castro, J.A. Prandini, J.C. Biazzotto, J.P.C. Tomé, R.S. da Silva, L.M.O. Lourenço. Front. Chem. 10 (2022) 825716.

[4] L.P. Silva, C.M. Magalhães, A.N. Montenegro, P.J.O. Ferreira, D. Duarte, J.E. Rodríguez-Borges, N. Vale, J.C.G.E. Silva. Biomolecules 9 (2019) 384.

20674 | Development of smart labels to reduce food waste

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Abstract

Food waste and the shelf-life extension of a product are fundamental concerns in today's society, not only because of its economic reasons but also because of its environmental impact. Changes at this level can benefit the world of today and tomorrow. On the other hand, more aware and informed consumers with purchasing power, demand faster and friendlier methods of food control, which provides real-time information on food safety since the manufacturing process to the supermarket. Along these lines, smart packaging is a value proposition, for real-time monitorization of the packaged food, providing updated information to the consumer about relevant changes in the food quality. Biogenic amines are one of the indicators of food deterioration, being obtained from the decarboxylation of amino acids present in protein-rich foods, such as fish, meat, or dairy products. A food safety criterion in the EU Regulation 2073/2005 requires the determination of histamine by its danger potential among all biogenic amines. Therefore, in this work, we intend to develop a smart tag that changes color when in contact with histamine. For that, a polymeric membrane will be used as a sensor matrix where the recognition molecule, a metalloporphyrin derivative, is dispersed. Several metalloporphyrin derivatives were evaluated, taking into account their interaction with histamine, by UV/VIS spectrophotometry. Two of them, the Ga-TPFC and Co(II)-TPP, showed significant changes on the UV-VIS spectroscopic profile in the presence of histamine. Throughout this work, we will aim to develop a label that incorporates metalloporphyrin derivatives such as Co-TPP as recognition molecules.

Keywords: food waste, food safety, metalloporphyrins, histamine, smart labels

20683 | Synthesis of aminopyrazine-based acrylamides as precursors of new photosensitizers for application in cancer treatment

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Abstract

Effective and selective cancer treatments are still a challenge in contemporary medicine, being thus an unmet medical need. Traditional methods are invasive and known to cause serious side-effects to patients. In this context, photodynamic therapy (PDT) emerges as an alternative for cancer treatment due to its high selectivity and minimal invasiveness. [1] This therapy combines a photosensitizer (PS), light of a specific wavelength, and molecular oxygen (³O₂). Research shows that coelenterazine (Clz) analogues have shown relevant toxicity in different cancer cell lines such as breast, liver, prostate, and neuroblastoma, without appreciable toxicity toward noncancer cells. [2,3,4]

Inspired by these results, in this work, a new series of acrylamides obtained from aminopyrazine, a common precursor in the synthesis of Clz analogues, is presented. A small library of aminopyrazine-based acrylamides was synthesized in high overall yield and these scaffolds will be used as precursors in the synthesis of new PS.

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Keywords: Aminopyrazine; acrylamide; cancer treatment.

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References

 S. Wang, Y. Liu, Y. Feng, J. Zhang, J. Swinnen, Y. Li, Y. Ni. Cancers 11 (2019) E1782.
 C.M. Magalhães, J.C.G. Esteves da Silva, L. Pinto da Silva. ChemPhysChem 17 (2016) 2286.
 K.A.D.F. Castro, J.A. Prandini, J.C. Biazzotto, J.P.C. Tomé, R.S. da Silva, L.M.O. Lourenço. Front. Chem. 10 (2022) 825716.

[4] L.P. Silva, C.M. Magalhães, A.N. Montenegro, P.J.O. Ferreira, D. Duarte, J.E. Rodríguez-Borges, N. Vale, J.C.G.E. Silva. Biomolecules 9 (2019) 384.

20686 | Application of aza-proline-based scaffolds for the assembly of Glypromate analogues

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Abstract

Glypromate is an endogenous neuropeptide derived from the insulin-like factor-1. Biologically, this neuropeptide displays neuroprotective activity with the potential to treat neurodegenerative diseases and other neurological conditions. [1] However, due to its peptide nature, Glypromate exhibits low permeability across biological membranes and a short biological half-life. [1]

The incorporation of aza-amino acid residues into biologically active peptides is known to be an efficient strategy to increase both stability and bioavailability of peptide-based drugs by improving the resistance towards hydrolysis promoted by peptidases.[2,3] The replacement of α -carbons with nitrogen atoms has been shown to increase the acidity of the amino group, allowing for stronger hydrogen bonds than the ones formed by regular amino acids,[3] which, in some cases, may result in enhanced activity and selectivity.[4] Moreover, the nitrogen atom at the α -position can interchange between planar and pyramidal geometries in a dynamic manner, adopting either pseudo-*R* and *S* configurations.[5] It has been demonstrated that, because of this feature, aza-amino acids are very useful for the design of secondary structures in peptides and proteins. [3,5]

In this work, the incorporation of aza-proline and aza-pipecolic acid is explored in Glypromate neuropeptide as proline surrogates. The main goal is to study the influence of these aza-amino acids on the biological activity of this neuropeptide. These aza-peptides will be biologically evaluated to study their toxicological and neuroprotective profiles. This project is expected to further push forward the knowledge about this neuropeptide, paving the way for the development of novel hits for neurological diseases.

Keywords: Aza-peptides; Glypromate; Neuroprotection.

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References

[1] Silva-Reis, S. C.; Sampaio-Dias, I. E.; Costa, V. M.; Correia, X. C.; Costa-Almeida, H. F.; García-Mera, X.; Rodríguez-Borges, J. E. *ACS Chem. Neurosci.* 2023, *14*, 554-572.

[2] Begum, A.; Sujatha, D.; Prasad, K. V. S. R. G.; Bharathi, K. Asian J. Chem. 2017, 29, 1879-1887.

[3] Zega, A. Current Med. Chem. 2005, 12, 589-597.

[4] Proulx, C., Sabatino, D., Hopewell, R., Spiegel, J., Ramos, Y.G. & Lubell, W. D. *Future Med. Chem*. 2011, *3*, 1139-1164.

[5] Thormann, M. & Hofmann, H. J. J. Mol. Structure 1999, 469, 63-76.

20690 | Determination of volatile thiols in coffee by liquid chromatography with fluorescence detection

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Abstract

Volatile thiols constitute a group of compounds that, despite their low content in coffee, contribute significantly to the organoleptic profile of the coffee beverage. Examples of volatile thiols, such as 2-furfurylthiol, methional or 2-methyl-3-furantiol, are considered key odour compounds of coffee.

The determination of these compounds is usually performed by methodologies based on gas chromatography or high performance liquid chromatography (HPLC). The gas chromatographybased methodologies, although with better performance in terms of chromatographic separation than liquid chromatography, require more demanding sample treatment. Therefore, the development of high performance liquid chromatography-based methodologies is encouraged. In this research work, an analytical methodology for the determination of volatile thiols in coffee by HPLC-fluorescence detection after fan-assisted extraction was developed. The experimental procedure was focused on: (i) the study of the conditions of the derivatization reaction of volatile thiols with o-phthaldialdehyde, in the presence of an amine, for indirect determination of these analytes, by fluorescence; (ii) the study of the conditions that allow to maximize the extraction of the analytes derivatized and; (iii) the study of the conditions that allow to maximize the extraction of these volatile compounds, based on a fan-assisted extraction system [1].

Keywords: volatile thiols; coffee; derivatization; liquid chromatography; fluorescence detection.

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References

[1] S. L. Teixeira, J. R. Santos, P. J. Almeida, J. A. Rodrigues, Food Control, 138, 109014, 2022

20692 | Exploring the synthesis of activated aza-proline and aza-pipecolic acid and their structural analysis by X-ray crystallography

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Abstract

Aza-peptides, a particular class of peptide derivatives, are formed by the replacement of one or more α -carbon atoms of a peptide by nitrogen atoms.[1] This type of modification provides peptides with a diversified set of pharmacokinetic and pharmacodynamic properties.[1] The incorporation of aza-amino acid residues into biologically active peptides enhances resistance against degradation by peptidases,[2] thus increasing the stability and bioavailability of peptide drugs.[1,2] In some cases, aza-peptides may also benefit from improved activity and selectivity.[3] The replacement of α -carbons with nitrogen atoms has been shown to increase the acidity of the amino group, providing stronger hydrogen bonds than the ones formed by proteinogenic amino acids.[2] Not only that, but the α -nitrogen atom can dynamically change between pyramidal geometries, alternating between pseudo-*S* and *R* configurations.[4] Additionally, it has been demonstrated that, because of these properties, aza-amino acids are very useful for the design of secondary structures in peptides and proteins.[2,4]

Therefore, the development of aza-peptides is considered to be a very effective and promising methodology in the field of medicinal chemistry for the design of peptide-based pharmaceuticals with improved pharmacological and biological activities.

In this work, two synthetic routes for *C*-activated aza-proline and aza-pipecolic acid are explored. The synthetic methodology relies on *N*-alkylation and *N*-carbonylation from hydrazine derivatives. Moreover, the X-ray structures of these compounds are disclosed. These protocols are expected to be useful for the assembly of bioactive aza-peptides.

Keywords: Aza-amino acids; Peptidomimetics; Proline surrogates.

Acknowledgements: This work received financial support from PT national funds (FCT/MCTES, Fundação para a Ciência e Tecnologia and Ministério da Ciência, Tecnologia e Ensino Superior) through the project 2022.01175.PTDC. I.E.S.-D. and S.C.S.-R. thank FCT for funding through the Individual Call to Scientific Employment Stimulus (Ref: 2020.02311.CEECIND/CP1596/CT0004) and Ph.D. grant SFRH/BD/147463/2019, respectively. X.C.C. thanks FCT for the research grant through the project 2022.01175.PTDC. FCT is also acknowledged for supporting the LAQV-REQUIMTE research unit (UIDB/50006/2020).

References

Begum, A.; Sujatha, D.; Prasad, K. V. S. R. G.; Bharathi, K. Asian J. Chem. 2017, 29, 1879-1887.
 Zega, A. Current Med. Chem. 2005, 12, 589-597.

[3] Proulx, C., Sabatino, D., Hopewell, R., Spiegel, J., Ramos, Y.G. & Lubell, W. D. *Future Med. Chem.* 2011, *3*, 1139-1164.

[4] Thormann, M. & Hofmann, H. J. J. Mol. Structure 1999, 469, 63-76.

20718 | Extraction of gallic acid from winery wastes using green techniques

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Abstract

Conventional treatments of winery waste are becoming increasingly expensive, demanding significant amounts of effort, resources, and energy for safe waste discharge. Therefore, the need to recycle, reuse and recover energy and valuable chemicals from winery waste and wastewater become apparent. Valorization of winery waste is possible when introducing the concept of biorefinery, i.e. the use of winery waste as bioconversions feedstock to produce platform chemicals, biofuels, heat, and energy. This work aims to recovery gallic acid (GA) from winery wastes by green techniques. GA has a strong antioxidant activity, and therefore has several health benefits, such as antiradical, anticancer, anti-fungal, and antiviral properties [1]. In the first stage of this work, grape pomace (seeds, skins, and stalks) was treated, and grape seeds were milled with a knife mill and sieved with a sieve shaker. The fractions with particle size 500-355 μ m were selected for the following studies. These fractions were after extracted with water, the greenest of solvents (ratio S/L 1:5, pH 4), at room temperature with stirring during 60 minutes [2]. Following, factorial planning was applied to optimize the extraction of GA by changing three parameters: ratio S/L, pH and stirring period. In this regard, the Total Phenolic Content (TPC) was evaluated for each sample optimized, in order to calculate the total phenolics expressed as gallic acid equivalents (GAE). HPLC analysis of samples obtained with pH 9 and 7 was also performed, in order to selected the best conditions to obtain the highest content of gallic acid.

Keywords: Gallic acid, winery wastes, and green chemistry.

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References

[1] Badhani, B.; Sharma, N.; Kakkar, R. Gallic acid: a versatile antioxidant with promising therapeutic and industrial applications. RSC Advances 2015.

[2] Jara-Palacios, M. J.; Gonçalves, S.; Heredia, F. J.; Hernanz, D.; Romano, A. Extraction of antioxidants from winemaking byproducts: Effect of the solvent on phenolic composition, antioxidant and anti-cholinesterase activities, and electrochemical behaviour. Antioxidants 2020.

20731 | Design and synthesis of proline mimetic amphiphiles as potential transdermal drug delivery systems

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Abstract

Transdermal drug delivery offers numerous advantages compared to oral or parenteral routes, such as avoidance of hepatic metabolism, sustained drug release, as well as improved patient compliance, and is thus of great interest to pharmaceutical research. The administration of drugs through the skin is, however, hampered by the natural barrier properties of the skin, which results in poor permeation of most drugs. One strategy used to improve transdermal permeation consists in the use of chemical permeation enhancers, compounds able to induce a temporary, reversible increase in skin permeability.¹

Amino acid derivatives show a great potential as permeation enhancers, as they exhibit high biodegradability and low toxicity.^{2,3} In this context, our research group has been engaged in the design and evaluation of the physicochemical and biological properties of a library of novel potential CPEs, based on amphiphilic molecules derived from 4-hydroxyproline and cyclic unnatural β -amino acids (proline mimetics), to be used in transdermal delivery approaches. Herein, the synthetic methodologies followed for the obtention of monomeric/dimeric precursors of proline-mimetic derivatives will be presented.

Keywords: amino acids; amphiphiles; chemical permeation enhancers

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Acknowledgments

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References

[1] Ramadon D, McCrudden MTC, Courtenay AJ, Donnelly RF. *Drug Deliv Transl Res*. 2022; 12(4): 758-791. doi:10.1007/s13346-021-00909-6

[2] Pereira R, Silva SG, Pinheiro M, Reis S, do Vale ML. *Membranes (Basel)*. 2021;11(5). doi:10.3390/membranes11050343

[3] Kopečná M, Macháček M, Roh J, Vávrová K. *Sci Rep.* Published online 2022:1-10. doi:10.1038/s41598-022-24108-6



Figure 1: Permeation of a drug through intercellular pathway

20732 | "Artificial" antibody targeting Gly m TI soybean allergen for food MIP-sensor application

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Abstract

Soybean is an allergenic food with technological interest, being applied to different processed foods, representing a potential hidden hazard for the allergic population. Minimizing the risk of accidental exposure of allergic individuals is dependent on the progress of allergen monitoring programs that include the implementation of efficient methodologies for the detection/quantification of allergens in foods.

In this work, a MIP-sensor for the quantification of soybean was developed, targeting the trypsin inhibitor protein (Gly m TI allergen) in processed foods. The biorecognition element was built using the molecular imprinting polymer (MIP) technique to produce a "plastic antibody" that mimics the anti-Gly m TI IgG. The MIP-sensor stability/analytical performance was evaluated through electrochemical techniques. The analytic performance of the artificial antibody was compared and validated with the immunosensor using the anti-STI IgG. The MIP-sensor was tested in complex food matrices containing soybean protein isolate in biscuits, sausages, and hams. The MIP-sensor enabled detecting Gly m TI up to 0.1 mg kg⁻¹ of soybean in all tested matrices, revealing adequate specificity/sensitivity for monitoring soybean, with high operability for complex food matrices. The MIP-sensor allows protection of a fraction >99% of the soybean allergic population.

Keywords: allergen; MIP; trypsin inhibitor protein; biosensor.

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20778 | A solvent-free reaction in the green synthesis of a new eco-friendly antifouling agent

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Abstract

The development of eco-friendly synthetic pathways can be achieved by a sustainable way using green chemistry as an inspiration, designing less toxic and inherently safer chemicals, selecting alternative solvents and reaction conditions. The ideal green chemical synthesis is safe, sustainable, non-polluting and consuming minimum amounts of materials and energy and giving little or no waste material, promoting innovation while protecting the environment and human health [1].

The aim of this work was the optimization of the synthesis of a new antifouling compound (GBA26) [2] [3] towards green chemistry. In the current synthetic route, the last reaction step is solvent-free leading to the cleavage of the *tert*-butyl carbamate (*N*-Boc) protecting group, being a sustainable and green alternative related to standard methods in the last years, which does not require post-cleavage manipulations (quenching, removal of solvents and purification steps). Using a two-chamber reactor, the HCl gas is released from available precursor molecules (NaCl and H_2SO_4) in chamber A and diffused subsequently to chamber B where it enables the deprotection reaction. Furthermore, the by products are gaseous, and this solvent-free reaction allowed to obtain our antifouling agent in a quantitative yield without consuming any solvent [4].

Keywords: solvent-free; green chemistry; atom economy.

Acknowledgments

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References

[1] Tiwari, S. and A. Brahmpurkar, Green Chemistry: A New Trend in the Chemical Synthesis to Prevent Our Earth. Acta Scientific Pharmaceutical Sciences, 2021. 5(6): p. 39-52.

[2] Rita Neves, A., et al., Gallic acid derivatives as inhibitors of mussel (Mytilus galloprovincialis) larval settlement: Lead optimization, biological evaluation and use in antifouling coatings. Bioorganic Chemistry, 2022. 126.

[3] Neves, A.R., et al., Antifouling Marine Coatings with a Potentially Safer and Sustainable Synthetic Polyphenolic Derivative. Marine Drugs, 2022. 20(8).

[4] Verschueren, R.H., et al., Solvent-free N-Boc deprotection by ex situ generation of hydrogen chloride gas. Organic & Biomolecular Chemistry, 2021. 19(26): p. 5782-5787.



Figure 1: Solvent-free reaction for *N*-boc deprotection. Adapted from [4]

20803 | Synthesis of aminopyrazine derivatives with potential application in cancer treatment

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Abstract

Cancer is the leading cause of death worldwide, and its treatment is still quite challenging nowadays. This is because traditional methods are usually invasive and cause serious side effects to patients. In this sense, photodynamic therapy (PDT) emerges as an efficient alternative for the treatment of different forms of cancer.[1] This therapy combines a photosensitizing drug, light of specific wavelength, and molecular oxygen (${}^{3}O_{2}$) to generate reactive oxygen species (ROS), mainly as singlet oxygen (${}^{1}O_{2}$), which is highly cytotoxic. [2,3]

Ongoing work from our research team showed that Coelenterazine (Clz) analogues display cytotoxicity to different cancer cell lines, while not showing toxicity toward noncancer cells.[4] The Clz analogues are obtained by using aminopyrazine as starting material. In this work, different aminopyrazine analogues were obtained in high yield through conventional synthesis and characterized by NMR. These aminopyrazine scaffolds will be used as precursors in the synthesis of new Clz analogues with potential application in PDT.

Keywords: Aminopyrazine; Coelenterazine; PDT.

Acknowledgments

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References

 S. Wang, Y. Liu, Y. Feng, J. Zhang, J. Swinnen, Y. Li, Y. Ni. Cancers 11 (2019) E1782.
 C.M. Magalhães, J.C.G. Esteves da Silva, L. Pinto da Silva. ChemPhysChem 17 (2016) 2286.
 K.A.D.F. Castro, J.A. Prandini, J.C. Biazzotto, J.P.C. Tomé, R.S. da Silva, L.M.O. Lourenço. Front. Chem. 10 (2022) 825716.

[4] L.P. Silva, C.M. Magalhães, A.N. Montenegro, P.J.O. Ferreira, D. Duarte, J.E. Rodríguez-Borges, N. Vale, J.C.G.E. Silva. Biomolecules 9 (2019) 384.

20809 | Chromatographic and computational lipophilicity assessment of antifouling biocides

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Abstract

Biofouling is a serious problem because this unwanted accumulation of micro- and macroorganisms triggers the degradation of submerged structures, such as ships or water pipes. Antifouling paints containing biocides are an important method of preventing biofouling. However, the ecotoxicity of antifouling biocides has raised some concerns as they can harm marine species and may even persist in the environment and bioaccumulate in aquatic organisms [1].

Lipophilicity is the most important physical-chemical property for predicting bioaccumulation [1]. Usually presented as the logarithm of the partition coefficient (log P), lipophilicity can be assessed using different methods [2].

In this work, we evaluated the lipophilicity of anti-fouling biocides using *in silico* and experimental methods. The dataset was composed of six commercial biocides, eight biocides synthesized by our research group [3-5], and nine reference substances with known log P values. Seven software were also used to predict the log P of these compounds. The results obtained for each compound with the different computational methods were compared and the most accurate method was identified.

The experimental log P values were measured using the reverse-phase high-performance liquid chromatography (RP-HPLC) method. For each compound, the log P value was obtained from the retention factors (k) in mobile phases with different volume fractions of methanol:water. Linear correlations between log k values and the volume fraction of methanol in the mobile phase were found, with R^2 values greater than 0.99. The experimentally obtained values differ from the in silico calculated values. The obtained results raise the need for the experimental determination of lipophilicity for evaluating the bioaccumulation potential of biocides.

Keywords: antifouling biocides; bioaccumulation; lipophilicity; partition coefficient; reversed-phase high-performance liquid chromatography

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References

[1] Vilas-Boas, C., et al., Beyond the marine antifouling activity: the environmental fate of commercial biocides and other antifouling agents under development. Advances in Nanotechnology for Marine Antifouling, 2023.

[2] Soares, J.X., et al. *Liquid Chromatography on the Different Methods for the Determination of Lipophilicity: An Essential Analytical Tool in Medicinal Chemistry*. Chemosensors, 2022. 10, DOI: 10.3390/chemosensors10080340.

[3] Rita Neves, A., et al., *Gallic acid derivatives as inhibitors of mussel (Mytilus galloprovincialis) larval settlement: Lead optimization, biological evaluation and use in antifouling coatings.* Bioorganic Chemistry, 2022. 126, DOI: 10.1016/j.bioorg.2022.105911.

[4] Resende, D.I.S.P., et al. From Natural Xanthones to Synthetic C-1 Aminated 3,4-Dioxygenated Xanthones as Optimized Antifouling Agents. Marine Drugs, 2021. 19, DOI: 10.3390/md19110638.
[5] Almeida, J.R., et al. Structure-Antifouling Activity Relationship and Molecular Targets of Bio-Inspired(thio)xanthones. Biomolecules, 2020. 10, DOI: 10.3390/biom10081126.

20824 | New hybrid metal sulfide/oxide@MWCNT nanomaterials for the photocatalytic removal of emerging pollutants

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Abstract

In recent years, the presence of emerging pollutants (industrial dyes and pharmaceutical products) in consumable and residual water is a global environmental problem, mainly because of the severe effects that they can cause on ecosystems and in human and animal health [1]. Photocatalysis is a known advanced oxidation process, very promising for the oxidative degradation of organic pollutants in wastewater, since it is more energetically efficient and less expensive than conventional wastewater treatment methods [2-4].

In this work, new nanomaterials based on multiwalled carbon nanotubes (MWCNTs) and their hybrids with metal oxides and/or sulfides were developed and applied as photocatalysts for the degradation of the organic pollutant Rhodamine B (RhB) dye. The MWCNTs were previously oxidized with HNO₃ and then, MnFe₂O₄ and/or Bi₂S₃ nanoparticles were *in situ* grown onto the oxidized MWCNTs (ox-MWCNTs) by coprecipitation and hydrothermal routes, respectively. The composition and structure of the as-prepared nanomaterials were characterized by several techniques, namely X-Ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy coupled with energy dispersive X-ray spectroscopy (SEM/EDS). The adsorption (in the dark) and photocatalytic performance of the obtained Bi₂S₃@ox-MWCNTs, MnFe₂O₄@ox-MWCNTs and Bi₂S₃@MnFe₂O₄@ox-MWCNTs hybrid materials and of their individual counterparts were evaluated for the removal of RhB from water under UV-A (low power 15 W) and visible light (halogen lamp, 150 W).

Keywords: Hybrid nanomaterials; carbon nanotubes; photocatalysis; emerging pollutants; wastewater treatment.

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References

A. Alsbaiee, B.J. Smith, L. Xiao, Y. Ling, D.E. Helbling, W.R. Dichtel, *Nature*, **2016**, *529*, 190-194.
 R. Matos, M.S. Nunes, I. Kuzniarska-Biernacka, M.A. Guedes, A.C. Estrada, J.L. Lopes, T. Trindade, C.Freire, *Eur. J. Inorg. Chem.*, **2021**, *47*, 4915–4928.

[3] R. Das, C.D. Vecitis, A. Schulze, B. Cao, A.F. Ismail, X. Lu, J. Chen, S. Ramakrishna, *Chem. Soc. Rev.*, **2017**, *46*, 6946–7020.

[4] F. Dalto, et al., Nanomaterials, 2021, 11, 3016-3040.



Figure 1: Metal sulfide/oxide@MWCNTs nanomaterials for the photocatalytic removal of organic pollutants.
20842 | Vitamin D₃: Synthesis of promising new analogues for cancer treatment

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Abstract

Vitamin D₃ can be acquired through diet and/or produced in the skin when exposed to sunlight. Its active form – calcitriol (1,25D) – regulates mineral metabolism, is fundamental in controlling the cell cycle, modulating cell proliferation and differentiation and inducing cell apoptosis, and is essential to the immune system.[1] Due to its pharmacological activity, calcitriol is used in the treatment of osteoporosis, psoriasis and renal osteodystrophy. The inhibition of proliferation of certain cancerous cells conferred by calcitriol has aroused greater interest in the scientific community for application as a treatment for different types of cancer. However, one of the biggest obstacles in the use of this drug is due to its strong calcemic action, when used in supraphysiological concentrations, causing calcium deposition in the kidneys, intestine and vessels.[2]

In order to develop more selective drugs with less calcemic effect, the aim of this work is the synthesis of new analogues of calcitriol. To acquire information of the interaction of these new vitamins with the Vitamin D Receptor (VDR), docking studies were conducted.[3] Subsequently, the precursors with higher affinity were synthesised. The synthesis was then optimized employing the *Dess-Martin* oxidation reaction and reductive amination.

Keywords: Calcitriol analogues; Cancer treatment; Vitamin D₃; Vitamin D Receptor; Organic synthesis.

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References

[1] Binderup, L., et al., 20-EPI-vitamin D3 analogues: A novel class of potent regulators of cell growth and immune responses. Biochemical Pharmacology, 1991. **42**(8): p. 1569-1575.

[2] Lieben, L., G. Carmeliet, and R. Masuyama, *Calcemic actions of vitamin D: effects on the intestine, kidney and bone.* Best Practice & Research Clinical Endocrinology & Metabolism, 2011. **25**(4): p. 561-72.

[3] Rochel, N., et al., *The crystal structure of the nuclear receptor for vitamin D bound to its natural ligand*. Molecular Cell, 2000. **5**(1): p. 173-9.

20850 | Development of new antimicrobial compounds to fight infectious disease

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Abstract

The infectious diseases caused by microorganisms with pathogenic capacity such as bacteria, fungi, virus and parasites are easily transmissible. They are still responsible for a high mortality and morbidity rate worldwide. In 2017, the World Health Organization (WHO) released a global priority pathogen list to guide efforts to find new antibiotics against the current public health threats [1]. In fact, the Gram-positive bacteria strains are one of the greatest threats to public health, being Staphylococcus aureus, Streptococcus pneumoniae and Enterococcus faecium responsible for community-acquired and hospital-associated infections [2]. In this context, finding new safe and efficient antimicrobial and therapeutic strategies are urgently needed to deal with antimicrobial resistance in constant evolution.

Bacteria, like any other organism, require iron as an enzyme cofactor to catalyse vital biological 686reactions. The uptake of iron by these unicellular organisms is accomplished through several mechanisms, including the production of small organic iron chelating molecules, called siderophores. These metabolites are released by bacteria in order to sequester surrounding iron through specific receptors and incorporate it into their cytoplasm.

Therefore, the aim of this work has been focused on the design and synthesis of innovative compounds as antibiotics. To achieve this goal, 3-hydroxy-pyridin-4(1H)-one scaffold, which display a great iron chelating capacity, was structurally modified with different substituents in order to carry out not only the iron chelation, but also the recognition and incorporation of the conjugates in the bacterial cell. Structural characterization of the newly synthesized compounds will be carried out by NMR (1H, 13C and DEPT) spectroscopy. Then, the physicochemical properties, in vitro iron chelation activity and antibacterial capacity of the novel antibiotics will be evaluated. The results obtained so far will be presented in this communication.

Keywords: Antibiotic resistance, antimicrobial activity, gram-positive bacteria, 3-Hydroxy-pyridin-4(1H)-one scaffold.

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References

[1] Antibiotic Resistance, (n.d). https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance (accessed February 28, 2023).

[2] Abbina, S., Gill, A., Mathew, S., Abbasi, U., & Kizhakkedathu, J. N. (2020). Polyglycerol-Based Macromolecular Iron Chelator Adjuvants for Antibiotics to Treat Drug-Resistant Bacteria. ACS Appl. Mater. Interfaces, 12(34), 37834–37844. Doi:10.1021/acsami.0c06501.

20873 | Amino-acid-conjugated flavonoids with potential antitumor activity: synthesis and structure elucidation

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Abstract

Cancer is a pathology characterized by an abnormal cellular growth and which jeopardizes severely the welfare of numerous people worldwide. According to Global Cancer Observatory (GCO) data, in 2020 were diagnosed more than 19 million new cases of cancer¹, therefore it urges the need for the development of novel compounds with antitumor activity. Flavonoids are natural products associated with a wide range of therapeutical activities, namely anticancer². Many flavonoids with antitumor activity are chiral. As a consequence of the chirality impact on the pharmacokinetic properties and medicinal effect of these polyphenolic molecules, many efforts have been made to ameliorate antitumor profile of flavonoids through synthetic methodologies^{2,3}, including the insertion of natural chiral molecules, such as amino acids. In the light of the previously mentioned, this project aims to enlarge a library of chiral derivatives of flavones with amino esters and the respective amino acids, proceed to their structure elucidation by NMR, IR and MS and further screening of their potential antitumor activity.

Keywords: flavonoids; chiral; antitumor.

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References

 Global Cancer Observatory Home Page. <u>https://gco.iarc.fr/</u> (accessed 2023-03-09).
 Pinto, C.; Cidade, H.; Pinto, M.; Tiritan, M. E. Chiral Flavonoids as Antitumor Agents. *Pharmaceuticals* 2021, *14* (12), 1267.

[3] Pereira, A. M.; Cidade, H.; Tiritan, M. E. Stereoselective Synthesis of Flavonoids: A Brief Overview. *Molecules* 2023, *28* (1), 426.

20911 | Nanostructured anthocyanins - natural and sustainable solutions to improve food quality

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Abstract

Anthocyanins (ANCs) are polyphenolic pigments that belong to the class of flavonoids and are responsible for the attractive colours of fruits and flowers. They also have beneficial health properties, including obesity prevention, antioxidant and antidiabetic activities¹. Thus, their application in the food industry as natural colorants and functional ingredients is highly required. However, after extraction from plant material, ANCs physicochemical stability is reduced. The formation of polyelectronic complexes (PECs) with biopolymers, such as polysaccharides, may be an approach to stabilize these pigments². The main objective of this work was to study the impact of PEC formation using I-carrageenan (I-CRG), a sulphated polysaccharide, in the physicochemical behaviour of a blackberry ANC (BbE). Firstly, the BbE was characterized, showing that 557 mg.g $^{-1}$ corresponded to ANCs, with the major ANC detected being cyanidin-3-O-glucoside. The preparation of ANC- λ -CARG complexes showed the formation of soluble and insoluble complexes. Then, the reaction was followed at different pHs by turbidimetry. The optimum conditions of formation of the insoluble complexes occurred when the mass ratio of BbE/I-CRG was 1/0.05, using pH=3. Under these conditions, $12.26 \pm 1.68\%$ of the ANCs in the extract were incorporated in λ -CRG, forming insoluble PECs. The morphology analysis of these complexes, showed a compact and porous surface, and a hydrogel-like morphology was verified prior to freeze-drying, using cryo-SEM. The complexation was confirmed by FTIR-ATR, where wavenumber shifts were shown to occur, in the spectrum of the insoluble PECs, for the bands referring to the sulfite groups of I-CRG, and the C=O group of the benzopyran ring. The thermal behaviour showed that the complexation with I-CRG increased the stability of the BbE pigments. In this work, insoluble complexes of ANCs-I-CRG were produced that could be applied in the food industry as insoluble dyes or production of biofilms to form new packaging.

Keywords: anthocyanins, biopolymers, polyelectronic complexes, morphology, thermal stability.

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References

[1] Durazzo, A., Lucarini, M., Souto, E. B., Cicala, C., Caiazzo, E., Izzo, A. A., & Santini, A. (2019). Phytother Res, 33(9), 2221-2243.

[2] Meka, V. S., Sing, M. K., Pichika, M. R., Nali, S. R., Kolapalli, V. R., & Kesharwani, P. (2017). Drug Discov, 22(11), 1697-1706.

20961 | Degradation studies applied to new antifouling compounds: Biodegradation, abiotic degradation and photodegradation

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Abstract

Biofouling is a natural phenomenon that occurs in the marine environment and is characterised by a continuous accumulation of microorganisms, algae and/or animals on submerged surfaces. This biological process has several negative impacts on the economy, environment and health. One of the examples with great impact is in maritime transport where the fixation of fouling organisms causes a decrease in speed, a significant increase in fuel consumption, which consequently leads to environmental problems.^{1,2}

In order to control this phenomenon toxic and bioaccumulative anti-fouling (AF) agents are applied on coatings.^{1–3} Therefore, nowadays the focus has been on developing equally effective but eco-friendly AF agents. In the research group of the Laboratory of Organic and Pharmaceutical Chemistry of Faculty of Pharmacy of the University of Porto, several promising compounds with potential AF activity have been synthesized.⁴

In this work, the main objective was to perform various types of degradation tests on several promising compounds synthesized by the group, namely, biodegradation, abiotic degradation in accelerate conditions and photodegradation in several aqueous matrices, in particular natural seawater (NSW).^{5,6} The main purpose of these tests is to predict the persistence and stability of these compounds in the aquatic environment and to check whether or not transformation products are formed. The monitoring of these assays were carried out by High Performance Liquid Chromatography (HPLC) methodology, previously validated and suitable for the quantification and detection of the various compounds. Furthermore, the presence of new transformation products resulting from the studies, will be identified by liquid chromatography (LC) with high-resolution mass spectrometry (HRMS).

Keywords: Eco-friendly Anti-fouling agents; Biodegradation; Abiotic Degradation; HPLC.

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References

[1] Neves, A. R.; Almeida, J. R.; Carvalhal, F.; Câmara, A.; Pereira, S.; Antunes, J.; Vasconcelos, V.; Pinto, M.; Silva, E. R.; Sousa, E.; Correia-da-Silva, M., *Ecotoxicol. Environ. Saf.* **2020**, *187*, 109812. https://doi.org/10.1016/j.ecoenv.2019.109812.

[2] Neves, A. R.; Pereira, D.; Gonçalves, C.; Cardoso, J.; Pinto, E.; Vasconcelos, V.; Pinto, M.; Sousa,
E.; Almeida, J. R.; Cidade, H.; Correia-da-Silva, M., *Mar. Drugs* 2021, *19* (12), 682.
https://doi.org/10.3390/md19120682.

[3] Jung, S. M.; Bae, J. S.; Kang, S. G.; Son, J. S.; Jeon, J. H.; Lee, H. J.; Jeon, J. Y.; Sidharthan, M.;
Ryu, S. H.; Shin, H. W., *Mar. Pollut. Bull.* 2017, 124 (2), 811–818.
https://doi.org/10.1016/j.marpolbul.2016.11.047.

[4] Pereira, D.; Gonçalves, C.; Martins, B. T.; Palmeira, A.; Vasconcelos, V.; Pinto, M.; Almeida, J.
R.; Correia-da-Silva, M.; Cidade, H., *Mar. Drugs* 2020, 19 (1), 5. https://doi.org/10.3390/md19010005.

[5] Vilas-Boas, C.; Gonçalves, V.; Marco, P. D.; Sousa, E.; Pinto, M.; Silva, E. R.; Tiritan, M. E.; Correia-da-Silva, M., *Mar. Drugs* **2022**, *20* (9), 548. https://doi.org/10.3390/md20090548.

[6] Vilas-Boas, C.; Neves, A. R.; Carvalhal, F.; Pereira, S.; Calhorda, M. J.; Vasconcelos, V.; Pinto, M.; Sousa, E.; Almeida, J. R.; Silva, E. R.; Correia-da-Silva, M., *Ecotoxicol. Environ. Saf.* 2021, 228, 112970. https://doi.org/10.1016/j.ecoenv.2021.112970.

20987 | Initial steps into the synthesis of a catecholamide siderophore mimetic

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Abstract

Iron is one of the most essential micronutrients for microorganism's survival since it is involved in several biological processes like electron transport and metabolic processes. Despite the abundance of this element in the Earth's crust, there is a low bioavailability in the aerobics environment and microorganisms overcome this difficulty, for example, by producing siderophores. These low-molecular-weight compounds have a high affinity to chelate Fe(III) since they have negatively charged oxygen atoms. There is an enormous structural diversity of siderophores, being the most common catecholates, hydroxamates, carboxylates, and mixed, in which two or more of these moieties are present in their structure. Siderophores are used in diverse applications, such as in antibiotic conjugates against resistance, in metalloenzymes inhibitors and in the bioremediation of contaminated ecosystems. [1, 2, 3]

In this work, the synthesis of a potential catecholamide siderophore mimetic (1) through a coupling reaction between 2,3-bis(benzyloxy)benzoic acid (2), *N*-hydroxysuccinimide (NHS), *N*,*N*'-dicyclohexylcarbodiimide (DCC) and 4-amino butanoic acid is presented. Synthetic details and structural characterization (by 1D and 2D NMR studies) of the synthesized compound will be presented and discussed.[4]

Keywords: siderophores; iron; antibiotics.

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References

Ahmed E, Holmström SJM. *Microbial Biotechnology*. 2014;7(3):196-208.
 Almeida MC, da Costa PM, Sousa E, Resende DISP. *Journal of Medicinal Chemistry*. 2023;66(1):32-70.
 Kurth C, Kage H, Nett M. *Organic & Biomolecular Chemistry*. 2016;14(35):8212-27.

[4] Bergeron RJ, Singh S, Bharti N. Tetrahedron. 2011;67(18):3163-9.



Figure 1: Synthesis of the catecholamide siderophore mimetic (1).

20991 | MIP nanoparticles for specific recognition of BSA

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Abstract

The scientific community is currently making efforts to coming up with alternatives to biological antibodies. In this context, molecularly imprinted polymers (MIPs) have the potential to be a highly promising alternative to their biological counterparts, since these synthetic biomimetic materials ("plastic antibodies") are expected to have a high ability to recognize the target analyte, although they have higher stability and much lower production cost [1]. Moreover, over recent years, the preparation of nanoscale imprinted materials, specifically molecularly imprinted polymer nanoparticles (MIP NPs, also known as nanoMIPs), has found many innovative practical applications, including in the biosensing field [2].

This work consists on the synthesis and characterization of nano sized molecularly imprinted polymers (MIP NPs) for the selective recognition of bovine serum albumin (BSA). Two methods were considered, for MIP nanoparticles synthesis, namely by (i) precipitation polymerization [3] and by (ii) solid-phase approach [4]. In order to characterize the MIPs, different techniques were used, such as DLS, for size estimation, zeta potential to evaluate the colloidal stability of NPs and SPR to measure specific molecular interactions in real time and evaluate nanoMIPs performance. Then, the MIP NPs obtained by the different synthesis methods were compared in order to select the most appropriate biomimetic materials for incorporation into optical transduction devices for detection of BSA in environmental samples with high selectivity and sensitivity.

Keywords: molecularly imprinted polymers; nanoparticles; MIPs NPs; nanoMIPs; biosensor; BSA; optical detection.

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References

[1] A.M. Mostafa, S.J. Barton, S.P. Wren, J. Barker, TrAC - Trends in Analytical Chemistry. 144 (2021).

[2] J. Wackerlig, R. Schirhagl, Anal Chem. 88 (2016) 250–261.

[3] K. Yoshimatsu, H. Koide, Y. Hoshino, K.J. Shea, Nat Protoc. 10 (2015) 595–604.

[4] F. Canfarotta, A. Poma, A. Guerreiro, S. Piletsky, Nat Protoc. 11 (2016) 443–455.

21005 | New antidotes for *Bothrops asper* venom: study of PLA2 protein

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Abstract

Nowadays, it's estimated that 1.8 to 2.7 million people develop clinical illnesses, and 81-138 thousand die from venom from snakebite complications. So, it's urgent to find a therapy that acts quickly and effectively [1]. Snake venoms are complex mixtures of small molecules, peptides, and proteins, that display significant bioactivity. One of the most common toxins is secreted phospholipase A2 (PLA2), which can cause local and systemic effects, mostly myotoxicity. The presence of calcium is essential for PLA2 activity [2]. The project focuses on understanding the reaction mechanism of PLA2 of Bothrops asper using a chromogenic substrate, NOBA, and obtaining compounds that can inhibit this enzyme. Molecular docking was the first methodology to be applied to predict the ideal pose of NOBA. For that, GOLD was used to perform 50 runs with a radius of 10 Å, using four different scoring functions of Gold. After this, a 4-step minimization of the complex was applied, using an octahedral box of water molecules with 15 Å beyond the protein extremities. Molecular dynamics simulations were also made with an NPT ensemble at 310.15 K. Then, molecular docking was validated: the results were compared with several structures of PLA2 that have a substrate, ligand, or inhibitor, using the four scoring functions of GOLD. GoldScore was the scoring function that had better results. Several MD simulations were made to see the stability of the protein, especially the residues that coordinate the calcium. Using the protocol of frozen atoms or distance restraints, releasing the restraints causes modifications in the coordination, especially the interaction NOBA-Calcium. With those results, it's possible to see that the coordination is very labile. Future work involves further molecular dynamics simulation, a QM/MM study on the enzyme, and applying machine learning in the drug discovery process.

Keywords: Bothrops asper; PLA2; Computational chemistry; Machine Learning.

References

[1] J. M. Gutiérrez, J. J. Calvete, A. G. Habib, R. A. Harrison, D. J. Williams, and D. A. Warrell, "Snakebite envenoming," *Nat. Rev.*, 2017.

[2] A. L. Oliveira, M. F. Viegas, S. L. da Silva, A. M. Soares, M. J. Ramos, and P. A. Fernandes, "The chemistry of snake venom and its medicinal potential," *Nat. Rev. Chem.*, vol. 6, no. 7, pp. 451–469, 2022, doi: 10.1038/s41570-022-00393-7.

21012 | Development of analytical methods for the fluorescence characterization of a photocatalysis mechanism

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Abstract

Nowadays, there is an ever-growing concern over protecting human, animal and environmental health from discharges of polluted industrial effluents. In light of this, the application of photocatalytic processes for the treatment of polluted waters is an emerging research field. Thus, the synthesis of metal-free catalysts, and in particular graphitic carbon nitride (GCN), has been the subject of great attention by the scientific community owing to the promising potential of GCN related to its intrinsic conductivity and photoactivity [1].

In this work, we aimed to assess the effectiveness of GCN to photodegrade a model pollutant (phenol) under different conditions in the presence of coumarin (COU) as scavenger of hydroxyl radicals (HO[•]). The photocatalytic reactions were carried out using light-emitting diodes as an irradiation source and the generated or consumed species were analysed by fluorescence coupled to high-performance liquid chromatography (HPLC). Umbelliferone (UMB) is the specific product of the reaction between COU and HO[•] [2], and this by-product was followed by the same analytical method. In addition, the generation of HO[•] from the activation of hydrogen peroxide (H_2O_2) via GCN, was also analysed.

The obtained results showed a higher formation of HO[•] in the presence of H_2O_2 (70% removal of COU) than in the absence of this oxidant agent (27% removal of COU). In addition, the reactions with argon and air bubbling showed that dissolved oxygen has an important role in the formation of HO[•], as there is a smaller conversion of COU into UMB under anoxic conditions.

Keywords: photocatalysis, graphitic carbon nitride, fluorescence, advanced oxidation processes, reactive oxygen species.

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References

 Rani, B., A.K. Nayak, and N.K. Sahu, Degradation of mixed cationic dye pollutant by metal free melem derivatives and graphitic carbon nitride. Chemosphere, 2022. 298: p. 134249.
 Nasaka, Y. and A.Y. Nasaka, Constantian and Detection of Basetive Overgen Species in

[2] Nosaka, Y. and A.Y. Nosaka, Generation and Detection of Reactive Oxygen Species in Photocatalysis. Chemical Reviews, 2017. 117(17): p. 11302-11336.

21024 | An automatic flow-based method for expedite analysis of enzymatic activity

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Abstract

Enzymes are catalysts of (bio)chemical reactions that are involved in the regulation of diverse biological processes. The high specificity and sensitivity of these biomolecules have prompted their use as biosensors to detect and/or quantify a variety of analytes, as well as their application in pharmaceutical, food and biotechnology industries¹. In this context, the set of reliable and fast methods to quantify enzymatic activity is highly relevant namely for the diagnosis and monitoring of health conditions, for drug discovery and development, for optimizing biotechnology processes, and for analytical detection/quantification of specific entities^{2,3}.

In this work, the development of an automatic method for assessing the enzymatic activity was pursued. This was set in a conventional high-performance liquid chromatography (HPLC) equipment, without requiring a stationary phase. This setup allowed a strict control of the sampling steps and reaction time, affording reproducible sampling and delivery of the reaction product into a fluorescence detector. Moreover, minimal use of sample and reagents (< 100 μ L in total) was feasible, with their introduction in a rection coil for reaction development. Also, as operations are performed automatically, the processing of the next sample (in the autosampler) while the previous is still being quantified is viable, as required for high-throughput analysis.

The proposed setup was applied to quantify the enzymatic activity of β -galactosidase, an enzyme that plays an important role in human body wellbeing³ and frequently used as reporter in bioassays. Reaction parameters such as the volumes of reagent and sample, mixing conditions, and implementation of continuous *vs.* stopped flow were studied, towards increased sensitivity determinations within 2 min. Therefore, a throughput of 30 samples h⁻¹ with low operator intervention and operation cost (0.1 \in per analysis) were achieved. Future studies applying the proposed setup to other enzymatic studies are envisioned.

Keywords: enzymatic activity, automation, miniaturization, high-throughput analysis

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References

[1] Robinson, P.K., Enzymes: principles and biotechnological applications, in Understanding Biochemistry: Enzymes and Membranes. 2015, Portland Press Ltd: London. p. 1-41.

[2] Ornelas-Gonzalez, A., et al., Enzymatic Methods for Salivary Biomarkers Detection: Overview and Current Challenges. Molecules, 2021. 26(22): p. 15.

[3] Skoczek, J., et al., A multi-pumping flow analysis system for beta-galactosidase activity assays. Food Chemistry, 2019. 294: p. 231-237.

21063 | Shrimp shell waste valorisation as sustainable catalysts for bioproducts and biofuels

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Abstract

The environmental problems of society in the 21st century have encouraged the industry to look for alternatives to the conventional raw-materials obtained from fossil sources, and used in the production of common chemicals. Biomass has emerged as excellent alternative renewable source for the production of biofuels and bioderived chemicals in the context of a biorefinery [1]. Shrimp shells (CC) and other crustaceans are mostly composed by protein (20-40 %), calcium carbonate (20-50 %) and chitin (15-40 %) and are currently left in landfills without any recovery [2]. Chitin that already contains nitrogen atoms provides an excellent opportunity for the synthesis of N-bioderivative chemical compounds and materials.

In this work, new SS-biochar (activated carbon obtained from the pyrolysis of shrimp shells) based catalysts were prepared and applied in catalytic processes for the production of ethyl levulinate (EL) and Y-valerolactone (VL) from 5-hydroxymethylfurfural (HMF), a well-known platform molecule. The SS-biochar was functionalized with sulfonic acid groups, Figure 1.[3] Different thermal, physical and functionalization methodologies were tested. The catalysts were characterized by different characterization techniques such as nitrogen adsorption isotherms, FTIR, TGA and SEM. The SS-biochar-propane-SO₃H catalyst proved to be the most active in the conversion of 5-HMF into EL with 90 % yield, at 130 °C, 6h. The reusability tests will also be presented and discussed.

Keywords: Heterogeneous and sustainable catalytic processes, waste valorisation; biochar; ethyl levulinate.

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References

 V. Froidevaux, C. Negrell, S. Caillol, J. P. Pascault, and B. Boutevin, "Biobased Amines: From Synthesis to Polymers; Present and Future," Chem. Rev., **2016**, 116(22) 14181.
 N. Yan, Y. Chen, "Sustainability Dep't waste seafeed waste", Nature **2015**, 524(7564), 155.

[2] N. Yan, X. Chen, "Sustainability Don't waste seafood waste", Nature, **2015**, 524(7564), 155-157.

[3] A. F. Peixoto, R. Ramos^a, M. M. Moreira, O. Salomé G. P. Soares, L. S. Ribeiro, M. F. R. Pereira, C. Delerue-Matos, C. Freire, "Production of ethyl levulinate fuel bioadditive from 5-hydroxymethylfurfural over sulfonic acid functionalized biochar catalysts," Fuel, **2021**, 303, 121227.



Figure 1: general scheme of the preparation of sulfonic acid-functionalized biochar based catalysts using ball milling assisted methodology.

21071 | Development of green solvents for the pharmaceutical industry

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Abstract

Nowadays, one of the biggest challenges that pharmaceutical industry faces is the poor solubility of active pharmaceutical ingredients (API), which, consequently, will decrease their bioavailability and subsequent efficacy. To overcome this problem in a more sustainable approach, the industry is trying to develop new delivery systems resorting to green chemistry principles¹. In this context, deep eutectic solvents (DES) are gaining substantial interest. DES are a mixture of a hydrogen bond donor (HBD) and a hydrogen bond acceptor (HBA) that form a liquid mixture at room temperature. They are a very promising type of solvents, due to their remarkable properties, such as, biodegradability, biocompatibility, low-cost, non-volatility, non-toxic, high solubility, tunability and thermal stability. They have a wide range of applications in the pharmaceutical field and are being used to increase permeability, stability and solubility of APIs, and to develop controlled release systems². In this work, the goal is to improve chlorpropamide and tolbutamide solubility, both oral antidiabetic drugs, which have very low solubility. For that, each API was dissolved in a tri-component system DES. The DES and DES+API were characterized by differential scanning calorimetry (DSC) and mid-infrared spectroscopy (MIR). The DES rheological behaviour was also studied. The solubility of APIs incorporated in the DES was determined using a HPLC system and compared with the solubility of the crystalline APIs. Results showed a decrease in solubility in both APIs when incorporated in DES, reenforcing the need to study new DES.

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References

[1] Rodrigues, M.; Baptista, B.; Lopes, J. A.; Sarraguça, M. C., Pharmaceutical cocrystallization techniques. Advances and challenges. Int. J. Pharm. 2018, 547, (1-2), 404-420.

[2] Sarraguça, M. C.; Ribeiro, P. R. S.; Nunes, C.; Seabra, C. L., Solids Turn into Liquids-Liquid Eutectic Systems of Pharmaceutics to Improve Drug Solubility. Pharmaceuticals 2022, 15, (3), 279.

21090 | Aminoxanthones as building blocks for bioconjugation with aminoacids

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Abstract

Xanthones derivatives (XDs) are associated to a large spectrum of important pharmacological and biological activities, such as antibacterial, anticancer, antiviral, anti-inflammatory, and antifungal activities [1]. In order to develop new XDs as potential antimicrobial agents, a series of XDs were synthesized using the 2,7-diaminoxanthone (XNH2) as building block and the coupling reagent (1-cyano-2-ethoxy-2-oxoethylidenaminooxy)dimethylamino-morpholino-carbenium

hexafluorophosphate (COMU) to bond XNH2 to a variety of commercial amino acids. The method of synthesis of XNH2 consisted in two steps: the nitration reaction of xanthone with potassium nitrate in the presence of sulphuric acid followed by the reduction with stannous chloride in concentrated hydrochloric acid [2]. The final product was recrystallized in ethanol. Afterwards, the coupling reaction with several BOC-protected amino acids was carried out to obtain new derivatives. The structure elucidation and determination of the enantiomeric purity of the synthesized XDs are ongoing.

Keywords: xanthone; chiral; antimicrobial.

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References

[1] Fernandes C, Masawang K, Tiritan ME, Sousa E, de Lima V, Afonso C, Bousbaa H, Sudprasert W, Pedro M, Pinto MM. New chiral derivatives of xanthones: synthesis and investigation of

enantioselectivity as inhibitors of growth of human tumor cell lines. *Bioorg. Med. Chem.* 2014 Feb 1;22(3):1049-62. doi: 10.1016/j.bmc.2013.12.042

[2] Grzelakowska A, Kolińska J, Zakłos-Szyda M, Sokołowska J Novel Fluorescent Probes for L-Cysteine Based on the Xanthone Skeleton. *J. Photochem. Photobiol. A: Chem.*, vol. 387, Jan. 2020, p. 112153, doi: https://doi.org/10.1016/j.jphotochem.2019.112153

21110 | Light-activated sulfonamides for antimicrobial photodynamic therapy

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Abstract

Sulfonamides are the oldest class of conventional antimicrobials to combat infections. Sulpha drugs are dihydropteroate synthase competitive inhibitor, mimetizing *p*-aminobenzoic acid and consequent inhibiting tetrahydrofolic acid synthesis which is essential to the formation of nucleic acids precursors in bacteria [1]. Light-activated porphyrin sulfonamides have shown promising results as a new class of antimicrobial agents [2]. These molecules are capable of producing reactive oxygen species (ROS) upon irradiation with light, which can damage the cell wall and other cellular components of bacteria. This makes them a potential alternative to traditional antibiotics, which are facing increasing resistance from microbial populations. Once the combination of different therapeutic approaches may improve the biological activity, the aim of this work was to combine a porphyrin with a sulpha moiety by an amide bond that could be cleaved by amidases naturally present in bacteria. Thus, the present work describes the synthetic access and strategy for the preparation of porphyrin-sulfonamide bioconjugates containing enzymatically cleaved amide groups. The structure elucidation of the intermediates was achieved by spectroscopic methods and will also be presented.

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Keywords: porphyrins, sulfonamides, photodynamic therapy, antimicrobial resistance.

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References

Patrick, G. (2017). An introduction to medicinal chemistry (6th ed.). Oxford University Press.
 Sarabando, S. N. et al., Molecules 2023, 28 (5), 2067. DOI: 10.3390/molecules28052067

21117 | Chemical and physical characterization of commercial biodegradable pots for plant production

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Abstract

This project arises to analyse if the available biodegradable pots are a viable alternative to plastic pots conventionally used in agriculture and associated with many environmental problems.

Today, plastic waste, such as pots and bags, which are widely used in the agricultural sector, generates major environmental problems due to the difficulty of its degradation by natural process, due to the emission of substances harmful to the environment, the need for special recycling in the case of contact with pesticides, low yields after recycling and not allowing their direct planting in soils, and in some cases they are discarded, without reuse.

Biodegradable pots are made of natural polymers, susceptible to rapid degradation by enzymatic reactions of micro-organisms such as bacteria, fungi or algae present in soil or water. They serve as a source of substrate for the development of crops during their degradation, making the agricultural production process more efficient. The characterization of biodegradable materials is based on analysing the chemical, physical, microbiological and mechanical characteristics. These characterizations allow evaluation of the potential of these materials to replace conventional plastic pots in agriculture. The mineral composition, total organic content, water retention capacity and tensile strength were evaluated for different materials (e.g., paper, coconut fiber, etc.). The results show that biodegradable materials, such as cellulose paste, are the weakest materials considering their tensile strength but are rich in carbon and minerals, contributing to the enrichment of soil and thus to the growth of the plains, making them a potential substitute for plastics.

Keywords: plastics, biodegradable pots, characterization, properties, sustainability.

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21140 | Hydroponic agriculture substrates as biosorbents for adsorption of metals in contaminated soils

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Abstract

Remediation of metal contaminated soils remains a global challenge. The historical mining activities and current anthropogenic activities have led to a significant increase of metals in soils. The removal of metals by efficient and cost-effective technologies from soils has been a challenge. This preliminary study aimed to use substrates from hydroponic agriculture as an economical and efficient adsorbent for metals such as Hg, As, Sb, Pb, Cu, Cd and Cr. Nanoparticles of zero valent iron (nZVI) were also used in order to determine if their presence would promote the adsorption efficiency of the substrates.

For that purpose, two substrates (coconut and a mixture of pine + coconut) from hydroponic agriculture were digested in a microwave using aqua regia to evaluate metal contamination and were characterized by Fourier-transform infrared spectroscopy and Scanning electron microscope. To access the adsorption capacity and efficiency of the substrates, adsorption tests were carried out. In a tube, 200 mg of the substrate was added and made up to 50 mL with a multielement buffer solution containing Hg, As, Sb, Pb, Cu, Cd, and Cr with a concentration ranging from 0.1 to 4 μ g g⁻¹. For assays using nZVI, 300 μ l of a solution containing nZVI were used along with the multielement buffer solution. After 24h, the supernatant was analysed by Inductively Coupled Plasma Mass Spectrometry. The Langmuir adsorption isotherm model was applied to the data. Results showed, except for As, that the substrates in the absence of nZVI had the maximum absorption capacity of 862 (Cu), 448 (Cd), 326 (Sb), 629 (Hg), 918 (Pb) and 750 (Cr) μ g g⁻¹. In the presence of nZVI, the element that showed maximum absorption capacity was Hg with 965 μ g g⁻¹. These substrates, upon their use in the hydroponic agriculture, present a cost-effective, efficient, and environmentally friendly approach with potential for metal remediation in contaminated soils.

Keywords: Biosorbents; Metals; Contaminated soils; Inductively Coupled Plasma Mass Spectrometry; Nanoparticles.

Acknowledgements

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21164 | New chalcone-kojic acid hybrids with potential antityrosinase activity

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Abstract

Melanogenesis is the process of melanin synthesis, the pigment of human skin, eyes, and hair, that promotes photoprotection and homeostasis. However, abnormal overproduction of this pigment results in dermatological pathologies such as melasma, postinflammatory melanoderma, solar lentigines, and cancer.^{1,2} Among several enzymatic reactions involved in melanogenesis, the rate-limiting step catalysed by the tyrosinase stands out.³ Kojic acid is a natural product widely used as skin whitening agent in cosmetic products, since it acts as an inhibitor of tyrosinase, exhibiting depigmenting activity. However, this compound has some disadvantages, such as low efficacy and poor stability. To circumvent these inconvenients, this acid should be used in concentrations above 1%, but in that case, adverse effects are also revealed.⁴ Therefore, several alternatives to kojic acid have been developed. Chalcones are a group of natural products that have demonstrated a wide array of biological activities, such as antioxidant and antiinflammatory, revealing also skin health promoting effect.^{5,6} Taking these into account, the synthesis of new kojic acid-chalcone hybrids by click chemistry (CC) reaction could result in the discovery of new tyrosinase inhibitors. Herein, some kojic acid-chalcone hybrids with a 1,2,3triazol linker by CC were synthesized and their structures were elucidated by nuclear magnetic resonance. These structure-related kojic acid-chalcone hybrids will allow structure-activity relationship studies and therefore their anti-tyrosinase activity will be evaluated by a spectrophotometric assay.

Keywords: melanogenesis; kojic acid; chalcone; click chemistry; antityrosinase.

Acknowledgments

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References

[1] Pillaiyar, T.; Manickam, M.; Namasivayam, V. Skin whitening agents: medicinal chemistry perspective of tyrosinase inhibitors. *J Enzyme Inhib Med Chem* **2017**, *32* (1), 403-425.

[2] Maranduca, M. A.; Branisteanu, D.; Serban, D. N.; Branisteanu, D. C.; Stoleriu, G.; Manolache,

N.; Serban, I. L. Synthesis and physiological implications of melanic pigments. *Oncol Lett* **2019**, *17* (5), 4183-4187.

[3] Obaid, R. J.; Mughal, E. U.; Naeem, N.; Sadiq, A.; Alsantali, R. I.; Jassas, R. S.; Moussa, Z.; Ahmed, S. A. Natural and synthetic flavonoid derivatives as new potential tyrosinase inhibitors: a systematic review. *RSC Adv* **2021**, *11* (36), 22159-22198.

[4] Phasha, V.; Senabe, J.; Ndzotoyi, P.; Okole, B.; Fouche, G.; Chuturgoon, A. Review on the Use of Kojic Acid—A Skin-Lightening Ingredient. *Cosmetics* **2022**, *9* (3).

[5] Singh, L. R.; Chen, Y. L.; Xie, Y. Y.; Xia, W.; Gong, X. W.; Hider, R. C.; Zhou, T. Functionality study of chalcone-hydroxypyridinone hybrids as tyrosinase inhibitors and influence on anti-tyrosinase activity. *J Enzyme Inhib Med Chem* **2020**, *35* (1), 1562-1567.

[6] Salehi, B.; Quispe, C.; Chamkhi, I.; El Omari, N.; Balahbib, A.; Sharifi-Rad, J.; Bouyahya, A.; Akram, M.; Iqbal, M.; Docea, A. O.; et al. Pharmacological Properties of Chalcones: A Review of Preclinical Including Molecular Mechanisms and Clinical Evidence. *Front Pharmacol* **2020**, *11*, 592654.

21210 | Synthesis and characterization of organic compounds with high electron correlation

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Abstract

Naphthalene and anthracene derivatives have found a wide range of applications in organic electronics, such as OLEDs, photovoltaics, and sensors, due to their electronic, optical properties, and high charge mobility. In this work, we study the energetic and structural properties of some phenylnaphthalenes and phenylanthracenes. Some of these compounds have already been shown to possess unexpectedly extensive π -conjugation and this leads to a significant energetic stabilization, among other effects.[1]

In this work, we present the synthesis, purification, and characterization, through NMR and UV-Vis spectroscopies, of the compounds studied. Moreover, we study the phase equilibrium (fusion and sublimation) and analyse molecular energetics with the help of combustion calorimetry. As main objective, we want to understand the influence of molecular size and the presence and position of substituents on the electronic conjugation. Additionally, through the comparison of experimental results with the theoretical predictions, the nature of this conjugation will be evaluated in terms of electron correlation energy (static vs dynamic). With these results, we intend to explore the relation between electron correlation and quantum entanglement in molecules.[2]

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Keywords: Electron correlation, π conjugation, organic semiconductors.

References

 C.F.R.A.C. Lima, M.A.A. Rocha, B. Schröder, L.R. Gomes, J.N. Low, L.M.N.B.F. Santos, J. Phys. Chem. B, Vol.116, 3557, 2012.
 H. Wang, S. Kais, Isr. J. Chem., Vol.47, 59, 2007.

21262 | Preparation and characterization of biopolymer-based composites for environmental applications

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Abstract

Biomass valorisation to produce value-added biochemicals via catalytic processes nurture the growth of a sustainable bioeconomy. The use of new green catalysts based on cheap and abundant raw materials is under especial interest.

The fly ash is the main waste from coal combustion (CFA) composed mainly with oxides (Fe₃O₄, Al₂O₃, and SiO₂) and char[1]. Magnetic separation of CFA lead to Fe-rich fraction (FeCFA) with 40 wt.% of iron oxides which could be used as magnetic core in catalysts preparation [2]. Also, chitosan (CS) a naturally abundant polysaccharide, extracted from shrimp shells (purity of 60 - 90% [3]) can be easily cross-linking with tripolyphosphate (TPP). This process reformed CS structurally into more resistant derivatives even at low pH. Additionally, Mn_3O_4 is an easy prepared semiconductor (hydrothermal, 160 °C) with a band gap of 2.07 eV [4] which can be applied in photooxidation reactions under visible light. The conjunction of these three components (FeCFA, CS and Mn_3O_4) may lead to a promising magnetically separable, and stable photocatalyst.

In the present study three component material FeCFA@CS@Mn₃O₄, (FeCFA (magnetic core), biopolymer (chitosan commercial/extracted from shrimp shell) linker and Mn₃O₄ nanoparticles (active centre)), was synthetised using environmentally friendly approach (Scheme 1).

The morphology, elemental and chemical analysis of FeCFA@CS@Mn₃O₄, as well as FeCFA, FeCFA@CS; Mn₃O₄ and CS were studied by following techniques: SEM-EDS, XRD, XRF, Raman and FTIR. The FTIR spectrum of FeCFA@CS@Mn₃O₄ shows a band at 1415 cm⁻¹ (C–H stretching) and between 700 to 400 cm⁻¹ (M-O stretching, M= Fe and Mn) confirmed the presence of CS and Mn₃O₄ in the fabricated material. EDS analysis confirms the presence of all elements expected (Fe, Mn, and O) which confirms a successful preparation of the three-component composite.

It's expected that FeCFA@CS@Mn₃O₄ could be used as a high performance, selective and stable catalyst in the oxidation of 5-hydroxymethyl-2-furfural (HMF) under visible light.

Keywords: coal fly ash; Mn_3O_4 ; biopolymer-based materials; hydrothermal synthesis; ionic gelation

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References

[1] Nunes, M.S., et al., *Assessment of coal fly ash char as a substituting material of graphite with electrocatalytic activity for the oxygen reduction reaction.* Sustainable Chemistry and Pharmacy, 2022. 27: p. 100705.

[2] Kuźniarska-Biernacka, I., et al., *Application of Fe-rich coal fly ashes to enhanced reduction of 4-nitrophenol.* Cleaner Chemical Engineering, 2022. 2: p. 100019.

[3] Hisham, F., et al., *Facile extraction of chitin and chitosan from shrimp shell*. Materials Today: Proceedings, 2021. 42: p. 2369-2373.

[4] Jha, A., R. Thapa, and K.K. Chattopadhyay, *Structural transformation from* Mn_3O_4 *nanorods to nanoparticles and band gap tuning via Zn doping*. Materials Research Bulletin, 2012. 47(3): p. 813-819.



Figure 1: The FeCFA@CS@Mn₃O₄ composite preparation and application in HMF photooxidation.



CRIMINOLOGY AND LAW



20579 | Political-Administrative decentralization of the Portuguese state

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Abstract

The present work analyses the political-administrative decentralization of the Portuguese State, with the intention of examining the State's center of administrative decisions, as well as its single legal-constitutional order, verifying the organization and functioning of a country inserted in a context of Democratic Rule of Law. Therefore, it must follow from constitutional principles such as the autonomy of the local authorities, the insular autonomous regime and the democratic decentralization of the Public Administration, which involves mostly the country's economy. Through hypothetical-deductive analysis, with a theoretical character, adhering to the methodology of bibliographic review, articles, national and international legislative research, it is found that the allocation of authority and initiatives cover the three traditional functional areas of decentralization: political, financial and administrative. Once these were jointly established, protected by law and effectively applied, they should surely act for the economic development of Portuguese society, as well as to contribute to the advancement of the European Union. However, several controversies are presented regarding the implementation of a decentralized government that seeks in its great actions to bring better conditions of dignified life to citizens. The Portuguese government continues to work to promote the decentralization of the economy in a sustainable manner, through its policies, initiatives and with a strong legal framework in place, such as the Constitution of the Portuguese Republic, as well as by the Local Finance laws and even by the Treaty on the Functioning of the European Union. However, while the decentralization of Portugal's economy has the potential to promote more balanced economic growth and greater efficiency in the delivery of public services, there are also potential risks that must be addressed.

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Keywords: Decentralization, Public Administration, Economy, Constitution

References

Camões, P. (2005). Análise da Evolução Finanças Locais Portuguesas. Lisboa: Escolar Editora. Coletânea de direito fiscal / supervisão Glória Teixeira. - 5ª ed., atualizada. - Porto: AEFDUP-Associação de Estudantes da Faculdade de Direito da Universidade do Porto, 2021.

Commission Européenne (2016). Soutenir décentralisation, gouvernance locale et 231-252 développement local au travers d'une approche territoriale. Bruxelles: Direction générale de la coopération internationale et du développement - Commission Européenne Constituição da República Portuguesa [CRP], 2021

Duarte, B. (2016). *Descentralização Administrativa: Novos Caminhos, Novas Realidades*. Lisboa: UL.

Lei 73/2013, *Regime Financeiro das Autarquias e das Entidades Intermunicipais*, Diário da República n.º 169/2013, Série I de 2013-09-03

21244 | Affective abandonment and its implications on Law

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Abstract

Considering the importance of a family not only in the life of children, but also in their development, it is up to the Law, a social science, to take special attention in the content of its norms.

Regarding filiation, it can be said that currently in Portugal, the husband of the mother is presumed to be the father. In this sense, the Law gives added value to biology as a general criterion to define the parenthood, in respect to the right to personal identity, from the perspective of knowledge of our own genetic heritage.

Without prejudice to some exceptions, such as adoption, affiliation, and medically assisted procreation; as a rule, parenthood is established by a presumption of biological descent, and to be rebutted, it must be proven that that person does not actually ascend that child.

However, a family is (or at least should be) recognized by love from the parents, care, attention, security, and protection. Following a biological criterion, there may be cases in which the child has not even met his father because he has not assumed his paternal responsibilities, yet he is legally recognized as their father.

Nevertheless, we can think and point out other ways of establishing legal parentage that seem to embrace more readily these structural values of a family, such as a socio-affective criterion, which has been developed by the courts in Brazil. Is has been possible to have cases in which a man may be recognized as the child's legitimate father, not because he is the biological father, but he cares for that child as his own.

This project seeks to what the dominant social understanding in Portugal is, to comprehend whether it is (or is not) legitimate for the law to be revised someday in the future.

Keywords: Family Law; Parenthood; Filiation.

20431 | The influence of parenting styles on children and youth's externalizing and internalizing: the mediational role of self-control

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Abstract

Over the last decades, children and youth's externalizing and internalizing behaviours have become major concerns, drawing attention from academics, practitioners and the society as whole. In fact, it is widely recognized that these behaviours have the potential to negatively affect the development and later adjustment of children and youth and that research is needed in order to understand the factors underlying its emergence and development, so that prevention efforts could be drawn [1] [2] [3].

Thus, using a sample of Portuguese 7th, 8th and 9th graders, the current study seeks to explore the influence that family variables, namely parenting styles (i.e. authoritarian, permissive and authoritative) might exert in the development of children and youth externalizing and internalizing behaviours. Furthermore, this research aims at exploring the indirect effect that self-control might play in this relationship. In order to do so, a quantitative and multi-informant approach was adopted, using questionnaires aimed at both children and youth and their legal guardians, comprising internationally recognized and validated instruments and scales.

Considering previous studies, and the hypothesis posed, it is expected that authoritarian and permissive parenting styles would be associated with higher levels of externalizing and internalizing behaviours, as opposed to the authoritative parenting style, regardless of the child's gender. Furthermore, it is anticipated that self-control would mediate the relationship between parenting styles and these kinds of behaviours.

Ultimately, this study aims to enhance the scientific knowledge on this domain, by exploring data based on the Portuguese context, and to contribute for raising awareness for the need to develop scientifically based prevention and intervention strategies. Thus, this paper seeks to present and discuss the research goals and methodology adopted in this study, in order to deepen the subsequent data analysis and interpretation.

Keywords: children, youth, externalizing behaviours, internalizing behaviours, parenting styles, self-control.

References

[1] Achenbach, T. M. (1991). Manual for the Child Behaviour Checklist/4-18 and 1991 profile. *University of Vermont, Department of Psychiatry*, 1-135.

[2] Lier, P. A., Vitaro, F., Barker, E. D., Brendgen, M., Tremblay, R. E., & Boivin, M. (2012). Peer victimization, poor academic achievement, and the link between childhood externalizing and internalizing problems. *Child development*, *83*(5), 1775-1788.

[3] Rinaldi, C. M., & Howe, N. (2012). Mothers' and fathers' parenting styles and associations with toddlers' externalizing, internalizing, and adaptive behaviours. *Early Childhood Research Quarterly*, *27*(2), 266-273.

20497 | The influence of prison architecture and design on inmates' behaviour

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Abstract

Prison architecture and design have been extremely diverse, which has to do with the belief that architecture and design matters to inmates' behaviour, their experiences and goals attributed to prison sentences. This architectonic variety has consequences, since it is believed that it can affect, for example, future crime commission and the number of infractions committed by inmates during their sentence. This originates broader social and economic costs. However, there is not enough evidence on the effect that prison architecture and design have on the inmates' success in adapting to prison and avoiding recidivism, as studies on the subject are too scarce (e.g., Beijersbergen, Dirkzwager, Van der Laan and Nieuwbeerta, 2016; Moran, Jewkes and Turner, 2016; Nadel and Mears, 2018).

The current investigation aims to understand the relationship between prison architecture/design and inmate behaviour. More specifically, it intends to explore how prison architecture and design (cells, sound, size and location) influence the inmates' adaptation to prison.

To do so, the current study employed a qualitative methodology and used a random sample of inmates from several Portuguese prisons, which were selected through a convenience sampling and that show particular architectural/design characteristics regarding cells, prison size and location. A semi-structured and in-depth interview was specifically designed for this study in order to collect detailed and in-depth experiences, exploring the inmates' perception about prison architecture and design and its influence on their behaviour. This includes collecting their perceptions about how prison architecture and design influence the interaction between inmates; between them and prison officers; and on infractions committed. Inmates' subjective perceptions about particular architectonic elements and prison places will also be explored. Data analysis will be done through a narrative analysis.

The presentation will offer some preliminary results.

Keywords: Prison Architecture/Design; Inmates Behaviour; Prison Adaptation.

References

Beijersbergen, K. A., Dirkzwager, A. J., Van der Laan, P. H., & Nieuwbeerta, P. (2016). A Social Building? Prison Architecture and Staff-Prisoner Relationships. *Crime & Delinquency*, *62*(7), 843-874. doi:10.1177/0011128714530657

Moran, D., Jewkes, Y., & Turner, J. (2016). Prison design and carceral space. Em Y. Jewkes, B. Crewe, & J. Bennett (Eds.), *Handbook on Prisons* (2º ed., pp. 114-130). Routledge.

Nadel, M. R., & Mears, D. P. (2018). Building with no end in sight: the theory and effects of prison architecture. *Corrections: Policy, Practice and Research,* 2377-4665. doi:10.1080/23774657.2018.1461036

20501 | What difficulties do sex offenders face when reentering society after serving a prison sentence? An exploratory study with Portuguese sexual offenders on probation *Cardoso, Ana Rita, Faculdade de Direito, Portugal Santos, Gilda, Faculdade de Direito, Portugal*

Abstract

After completing a prison sentence, the former inmate embarks in a significant adaptation process, commonly known as society re-entry or community reintegration, which implies the reconnection with different societal structures. A successful re-entry process is considered to be highly important for preventing recidivism [1] [2] [3]. However, the ex-inmates usually face several barriers (e.g., reuniting with family, friends and neighbours, finding stable housing and employment, compliance with social and legal norms), that might negatively affect a successful reintegration process [2] [4] [5]. Previous studies have demonstrated that these difficulties are even greater when it comes to sexual offenders [6].

Thus, based on the experiences and perceptions of individuals who are on probation for having committed a sexual offense, the current study seeks to explore the difficulties faced by these individuals concerning reintegration process after serving a prison sentence. Specifically, this research aims at exploring community reintegration dimensions such as housing, employment, familial and romantic relations, parenting, institutional support or perceived social stigma. In order to do so, this study follows a qualitative approach, using semi-structured interviews as the privileged method for data gathering.

Ultimately, this study aims at enhancing the scientific knowledge on this domain, by exploring data based on a Portuguese sample, and to contribute for raising awareness for the need to properly accompany and integrate these individuals upon society reentry, as a way of preventing recidivism. This paper mainly seeks to discuss the study's methodology and preliminary results, in order to deepen the subsequent data analysis.

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Keywords: sexual offenders; inmate re-entry; community reintegration; barriers; probation

References

[1] Laub, J. H., & Sampson, R. J. (2001). Understanding desistance from crime. *Crime and justice*, *28*, 1-69

[2] Visher, C. A., & Travis, J. (2003). Transitions from prison to community: Understanding individual pathways. *Annual review of sociology*, *29*, 89-113

[3] Anderson-Facile, D. (2009). Basic challenges to prisoner reentry. *Sociology Compass*, *3*(2), 183-195

[4] Graffam, J., Shinkfield, A., Lavelle, B., & McPherson, W. (2004). Variables affecting successful reintegration as perceived by offenders and professionals. *Journal of offender rehabilitation*, 40(1-2), 147-171

[5] Cnaan, R. A., Draine, J., Frazier, B., & Sinha, J. W. (2008). Ex-prisoners' re-entry: An emerging frontier and a social work challenge. *Journal of Policy Practice*, 7(2-3), 178-198

[6] Brown, K., Spencer, J., & Deakin, J. (2007). The reintegration of sex offenders: Barriers and opportunities for employment. *The Howard Journal of Criminal Justice*, *46*(1), 32-42
20551 | Cyberbullying and Cybervictimization: The role of gender, parenting styles and empathy

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Abstract

The increasing and frequent use of the internet and digital resources has changed the patterns of perpetration and victimization of antisocial behaviour, creating opportunities and additional means for these phenomena to occur in the cyber space[1].

In this context, cyberbullying, defined as any behaviour carried out through electronic or digital means by an individual or group of individuals who repeatedly communicate through hostile/aggressive messages with the intention of inflict damage/discomfort on others, is increasingly problematized in today's societies[2].

Despite the studies focused on the risk and protective factors of cyberbullying, including individual, interpersonal and community factors [3], the literature concerning these factors in the explanation of both victimization and perpetration of cyberbullying is still scarce. Therefore, this ongoing study explores the relationship between cyberbullying victimization and perpetration, parenting styles and empathy. Additionally, the potential moderator role of gender and socio-economic status will be analysed.

Data will be collected through a self-report questionnaire applied in schools to students aged between 13-15-year-old. Perpetration and victimization of cyberbullying will be assessed with the Portuguese version of the CBQ and CBQ-V scales, respectively. Empathy will be measured with BES-A scale, and the short version of the PSDQ will be used to measure parenting styles.

Regarding the results, it is expected that aggressors and victims will have a higher socio-economic status. Low levels of empathy are expected to be related to the perpetration of cyberbullying. It is expected that higher levels of aggression and victimization are reported by adolescents with authoritarian or permissive parents. Finally, considering mixed results founded in previous literature, there is no specific expected result regarding gender.

Keywords: cyberbullying; cybervictimization; parenting styles; empathy; gender; socio-economic status.

References

[1] Patchin, J. W., & Hinduja, S. (2006). Bullies Move Beyond the Schoolyard: A Preliminary Look at Cyberbullying. Youth Violence and Juvenile Justice, 4 (2), 148-169

[2] Tokunaga, R. S. (2010). Following you home from school: A critical review and synthesis of research on cyberbullying victimization. Computers in Human Behaviour, 26(3), 277–287. http://dx.doi.org/10.1016/j.chb.2009.11.014.

[3] Baldry, A., Farrington, D., & Sorrentino, A. (2015). "Am I at risk of cyberbullying"? A narrative review and conceptual framework for research on risk of cyberbullying and cybervictimization: The risk and needs assessment approach. Aggression and Violent Behaviour, 23, 36-51

20605 | The influence of chronotype on eyewitness memory performance

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Abstract

People can be classified according to their chronotype, which is their preference in terms of sleeping patterns and task performance, being divided into three categories: morning-type, evening-type and neither-type. The literature suggests that the synchrony between time-of-day and chronotype could potentially result in better performance and productivity, known as the "synchrony effect". In this study we aimed to analyse a possible interaction between chronotype (morning-type/evening-type) and time-of-day (morning/end of day) and how this interaction could influence the eyewitnesses' memory performance. To this end, 44 participants (24 evening-types and 20 morning-types) were recruited to perform two memory tasks that took place in two online sessions, at different times of the day: one in the morning and another at the end of the day. In each session, it was requested to each participant to visualise two videos, one of a crime scene and another of a neutral situation, answer questions related to the videos and complete questionnaires to collect additional variables that influence memory (e.g., stress, depression and anxiety). The order of the sessions (synchrony/asynchrony) and the presentation of the videos were counterbalanced across participants.

The results indicated that the participants' memory performance was better in the synchrony moment when compared to the asynchrony moment. It was also found that the type of chronotype did not influence the obtained results, which means that what explains the differences is just the fact that the chronotype is in synchrony or asynchrony. Finally, it was found that the influence of stress, anxiety and depression was more pronounced in neutral videos.

These results could have important implications for research and interrogation practices, however further studies will be necessary to consolidate the knowledge about the influence of the chronotype and synchrony effect on eyewitness memory performance.

Keywords: chronotype; time-of-day; synchrony/asynchrony effect; memory; eyewitness testimony.

20805 | Experiences of imprisonment by LGBT inmates

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Abstract

According to Meyer et al. (2017), little is known about sexual minorities serving prison time. Early research discussing the incarceration of sexual minorities assumed that these were offenders or deviants. It was from the 1970s onward that research began to look at these minorities through an anti-discrimination lens, integrating them into the target groups of hate crimes and other forms of prejudice.

However, research on the lived experiences of the LGBT prison community is still minuscule and those that exist have mainly been conducted with transgender women and in the North American context, which limits the understanding of the phenomenon of LGBT incarceration internationally and makes it impossible to generalize findings (Bromdal et al, 2019). Moreover, research addressing the LGBT prison community is dominated by health-related issues, public policy analyses, concerns about gender-based distribution, and victimization enhanced by vulnerability associated with sexual orientation and gender identity (Meyer et al, 2017; Maycock, 2020). In this sense, supported by a literature review of scientific publications, the present research has the general objective of describing the experiences of imprisonment of the LGBT prison community, from the realization of semi-structured interviews with LGBT inmates of the Provisional Detention Center II in the State of São Paulo. This qualitative study also aims to understand how the process of adaptation of LGBT inmates to prison takes place; to understand if there are conditions in the prison that respect the inmates' LGBT identity; to understand the distribution and organization of LGBT inmates in the prison space; to describe the experiences of victimization of LGBT inmates; and to understand the consequences of victimization on LGBT inmates. For data analysis, content analysis is used to identify the themes present in the interviewee's speeches. In the presentation the first results of this qualitative work will be revealed.

Keywords: imprisonment; LGBT; adaptation; allocation; victimization.

References

[1] Brömdal, A., Clark, K. A., Hughto, J. M., Debattista, J., Phillips, T. M., Mullens, A. B., ... & Daken, K. (2019). Whole-incarceration-setting approaches to supporting and upholding the rights and health of incarcerated transgender people.

[2] Maycock, M. (2020). 'I want the male and the female wings. I don't want a special trans wing for people.': Transgender people in custody in Scotland's views about transgender specific facilities within prisons. *Prison Service Journal*, (251), 31-37.

[3] Meyer, I. H., Flores, A. R., Stemple, L., Romero, A. P., Wilson, B. D., & Herman, J. L. (2017). Incarceration rates and traits of sexual minorities in the United States: National Inmate Survey, 2011–2012. *American Journal of Public Health*, *107*(2), 267-273.

20822 | Life trajectories in drug dealing: foreign and gypsy ethnicity women prisoners

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Abstract

The exponential increase of female incarceration around the globe is, nowadays, a cause of great concern in the contemporary society. In fact, in recent years, empirical research focused on understanding this phenomenon has expanded notably, suggesting that, both at the national and international level, the number of women behind bars is growing faster than the male one. Portugal is not an exception to this trend. Moreover, official data show an increase in the imprisonment of foreign women, the majority convicted for drug related crimes, which is also the most frequent crime in the convictions of women of gypsy ethnicity. Although these groups are phenotypically and culturally distinct, they are both subject of the same false perception, spread by the mass media and in political discourses, that they are more dangerous and responsible for more crimes than the Portuguese female population (Gomes, 2011). Using an intersectional approach, the main goal of this ongoing research is to analyse the life trajectories of foreign women from Portuguese-speaking countries and gypsy ethnicity women who are currently imprisoned for committing related drug crimes in Portuguese female prisons. The research will adopt a qualitative methodology, conducted through semi-structured interviews. More specifically, the study aims: a) to trace the life trajectories of these groups of women, focusing on the transition events, the context of life before and during imprisonment; b) to understand the different motivations and/or life events related with drug dealing offences; c) to explore and discuss issues related to the role of being a "delinquent women", within and outside the prison walls; d) and to explore the potential processes of stigmatization, social exclusion and racism experienced or witnessed by the participants during imprisonment.

Keywords: female incarceration; foreign women; women of gypsy ethnicity; drug dealing.

References

[1] Cunha, M. I. (2010), "Race, Crime and Criminal Justice in Portugal." In A. Kalunta-Crumpton (ed.), Race, Crime and Criminal Justice: International Perspectives, New York, Palgrave MacMillan, pp. 144-161.

[2] Gomes, S. (2014) Caminhos para a prisão: uma análise do fenómeno da criminalidade associada a grupos estrangeiros e étnicos em Portugal, Famalicão, Ed. Húmus.

[3] Gomes, S. (2011) Criminalidade, Etnicidade e Desigualdades: O crime nos reclusos dos PALOP, Leste Europeu e de etnia cigana e as percepções dos guardas prisionais e dos elementos da direcção acerca deles. Universidade do Minho – Instituto de ciências sociais, Braga.

[4] Matos, R., Cunha, M.I & Santos, J. (in press). Foreign National Women Arrested for Drug Trafficking: A Dynamic Socio-penal Portrait. In M. J. Guia e S. Gomes (eds.), Prison, State and Violence, Springer Books, pp. 61-70.

21101 | Media, Medo do Crime e Punitividade – uma relação de mediação

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Abstract

The literature on the effects of media on fear of crime dates to Gerbner and Gross (1976), when the authors decided to assess the relationship between watching television and fear of violence. Indeed, the authors concluded that violence is over-represented on television when compared to the real world, and also that individuals who watch more television are more likely to not trust others and to believe that they are at high risk of becoming victims of violence. Furthermore, literature has been showing that increased support for harsh criminal policies stems from rational responses to crime (Jennings et al, 2017). The increasing blurring of the lines between entertainment and news that leads to the development of a culture of fear (Simon, 2007), and this culture of fear generates a demand for punitive responses from the justice system (Garland, 2001). The The literature on the relationship between media consumption, fear of crime, and punitiveness is scarce. An exception is the study by Dolliver and colleagues (2018), which showed that individuals tend to transform crime news into fear, and this fear increases support for more punitive policies. Building on this premise, the present work poses a proposal for quantitative research on the relationship between media consumption and punitiveness, through the mediation of fear of crime. Furthermore, it aims to understand how variables such as political orientation, gender, age, or socioeconomic status moderate the relationship between media consumption, punitiveness and fear of crime. To achieve these objectives, a survey will be built and administered to a sample of individuals. Expected results and limitations will be outlined.

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Keywords: media; punitiveness; fear of crime.

References

[1] Garland, D. (2001). The culture of control: Crime and social order in contemporary society. Chicago, IL: The University of Chicago Press.

[2] Gerbner, G., & Gross, L. (1976). Living with television: The violence profile. Journal of communication, 26(2), 172-199.

[3] Jennings, W., Farrall, S., Gray, E., & Hay, C. (2017). Penal populism and the public thermostat: Crime, public punitiveness, and public policy. Governance, 30(3), 463481.

[4] Simon, J. (2007). Governing through crime: How the war on crime transformed American democracy and created a culture of fear. New York, NY: Oxford University Press.

21173 | Exploring Portuguese cannabis cultivation: An analysis of growers' legal perception

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Abstract

According to the World Health Organization, Cannabis is the most grown, trafficked, and used illicit substance in the world. Moreover, Cannabis' entry in national markets has shifted in the past 30 years from importations to small-scale domestic cultivation (Decorte, 2010). It also serves diverse purposes, such as medical and recreational use (Newton-Howes & McBride, 2016).

In Portugal, cannabis use is illegal, but it is not criminalized. However, its cultivation is a crime (Art. 40 of DL 18/2009). This unusual situation justifies the importance of understanding how growers perceive the law and its consequences. To study cannabis cultivation characteristics, the Global Cultivation Research Consortium conducted a 2nd wave of the International Cannabis Cultivation Questionnaire online in 18 countries, including Portugal, which aimed to collect data on cannabis cultivation, usage patterns, and related legal and social concerns.

Results show that, in Portugal, respondents (N=115), who admitted to growing cannabis, were mostly men with an average age of 33.24 years, having begun growing at an age of 24.84 years, and grown an average of 9.62 crops (1.40 crops in the year prior). It was also shown that participants believed that this activity is legal or thought it to be punishable only by civil sanction: 28.1% stated that growing cannabis is legal even if regulated; 2.1% thought it was legal without restrictions; and 9.4% considered it to be punishable by civil sanction. Regarding recreational cultivation, the values decrease (1.9%; 0.9%; 9.3% respectively). These and other results will be discussed.

Participants were more aware of laws regulating cannabis cultivation for recreational purposes than for medical purposes, although some were still unaware of the legal stipulations, and this is not negligible. Results will be discussed in the context of deterrence theory, which argues that crime deterrence occurs when individuals know the law and believe detection and sanction will be effective and speedy.

Keywords: small-scale domestic cannabis cultivation, legal perception, deterrence theory

References

[1] Decorte, T. (2010). The case for small-scale domestic cannabis cultivation. *International Journal of Drug Policy*, *21*(4), 271–275. doi:10.1016/j.drugpo.2010.01.009

[2] Newton-Howes, G.; McBride, S. (2016) Medicinal cannabis: moving the debate forward. *New Zealand Medical Journal, 124*, 103-109.

EDUCATION SCIENCES





20495 | The importance of epistemological reflection in the pedagogical act: Pedagogical paradigms in light of the UNESCO report on the Futures of Education

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Abstract

This essay aims to reiterate the importance of epistemological reflection in the pedagogical act, particularly in light of the 2022 report by the International Commission on the Futures of Education (ICFE), appointed by UNESCO, titled "Reimagining Our Futures Together: A New Social Contract for Education." I make this argument in two ways. Firstly, I assert that the best way to develop students' skills is through qualified teachers as interlocutors, based on the pedagogical paradigms developed by Trindade and Cosme (2016). To demonstrate this, I present these paradigms and show how they are not only present in the ICFE report but also necessary for comprehending and applying its recommendations.

Secondly, I draw attention to potential epistemological misunderstandings in some popular trends in education, specifically post-critical theories in the curriculum field and methodological "innovations" linked or unlinked to technology in the pedagogical field. These trends, significant because they appear in the ICFE report, are examined in their own subsections.

Through dialogue and communication, as recommended by Freire (2014), the essay advocates for a balanced approach that prioritizes common knowledge, promotes active citizenship, digital and scientific literacy, and ethical care. Although the references mainly focus on the school context, throughout the essay, I choose not to refer to students exclusively as children since I recognize that the issue presented here can apply to other situations. Therefore, while I write this essay primarily for teachers, I hope that it can be beneficial for anyone involved in pedagogical activities.

Keywords: Epistemological reflection; Common Knowledge; Pedagogical act; Pedagogical paradigms.

References

[1] Bruner, Jerome. (1996). The culture of education. Harvard University Press.

[2] Comissão Internacional sobre os Futuros da Educação, UNESCO. (2022). *Reimaginar nossos futuros juntos: um novo contrato social para a educação*. Disponível em: https://unesdoc.unesco.org/ark:/48223/pf0000381115

[3] Canário, Rui. (1999). Educação de adultos: um campo e uma problemática (Vol. 7). Educa.

[4] Cosme, Ariana., & Trindade, Rui. (2013). Organização e gestão do trabalho pedagógico: perspetivas, questões, desafios e respostas. *Mais Leitura*.

[5] Freire, Paulo. (2014). Extensão ou comunicação? Paz e Terra.

[6] Lopes, Alice C. (2013). Teorias pós-críticas, política e currículo. *Educação, sociedade & culturas, (39),* 7-23.

[7] Lopes, Alice C., & Macedo, Elisabeth. (2021). Apresentação: Uma alternativa às políticas curriculares centralizadas. *Roteiro, 46(1),* 101-110. https://doi.org/10.18593/r.v46i.27181

[8] Macedo, Elisabeth. (2012). Currículo e conhecimento: aproximações entre educação e ensino. *Cadernos de pesquisa, 42,* 716-737.

[9] Santos, Lucíola L. (2007). Currículo em tempos difíceis. Educação em Revista, 291-306.

[10] Trindade, Rui, & Cosme, Ariana. (2016). Instruir, aprender ou comunicar: Reflexão sobre os fundamentos das opções pedagógicas perspetivadas a partir do ato de ensinar. *Revista Diálogo Educacional, 16(50),* 1031-1051.

[11] Young, M. (2007). Para que servem as escolas? *Educação & sociedade, 28*, 1287-1302.

20779 | Study of the drama-based pedagogy impact on astronomy teaching in the 7th Grade

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Abstract

Currently, there is a growing need to innovate the pedagogical strategies used for science teaching in Portugal - Astronomy being no exception -, in order to engage and promote a wider range of students' socio-emotional skills.

Drama-Based Pedagogy (DBP) is thus presented as a potential ally for an educational practice guided by sociocultural and humanist learning perspectives. The present case study accompanies the implementation of DBP strategies in the teaching of Astronomy to a group of students in the 7th grade in a public school from north of Portugal. An attempt is made to identify and anticipate potential challenges that can be expected in similar future applications of this type of activities. For the proposed analysis, observations were registered, a questionnaire was collected and semistructured interviews were carried out with the participating students. Particular attention was driven to students' opinion and reactions to classes, as well as to occurring challenges and opportunities for teachers.

Keywords: drama-based pedagogy, astronomy, education, science teaching



Figure 1: Drama-based pedagogy focuses on academic, affective, and aesthetic outcomes.



ENGINEERING



20422 | Exploring technologies for simulating assisted childbirth

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Abstract

Parturition is a natural and highly complex physiological process influenced by fetal size. Sometimes it can be accomplished with the assistance of instruments, like the vacuum-cup. However, for this process to succeed, the vacuum-cup must be correctly positioned [1]. There is currently a defined point where it should be placed, yet there are various head formats and sizes, so the point considered ideal for a standard head may not be appropriate for an asymmetric one. This project aimed to create different fetal heads with asymmetries (craniosynostoses) to then simulate the impact of the vacuum-cup on the maternal pelvis. It was used MATLAB to create an algorithm that allowed the morphing for each craniosynostosis. To ensure that the morphed head is suitable for simulation purposes, an analysis was performed on the new meshes created in ABAQUS. This analysis can help identify any potential problems with the new geometry, like areas of high stress concentration or with insufficient mesh resolution. Qualitatively all heads presented the desired shape, still the morphing had a high relative error for brachycephaly. In general, the meshes had a good quality and the elements did not deviate much from their ideal shape. The size of the sutures and fontanelles was also evaluated, having decreased in the situations of plagiocephaly and scaphocephaly. In brachycephaly, the size of the sutures and anterior fontanelle increased, and the posterior fontanelle disappeared, contrary to what was expected.

Keywords: Craniosynostosis, Finite Element Method, Computational Modelling, Morphing.

Acknowledgments

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References

[1] A. Estevão, "Vacuum-Assisted Vaginal Delivery: a Biomechanical Study," Porto, Jul 2021.

20461 | Plants as sensors: First studies and prototype models

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Abstract

Plants, despite not having a brain and being unable to move, can respond effectively to various stimuli. They gather and process information about their surroundings to make decisions that prioritize their well-being, while considering the environment. These decisions are communicated through electrical signals within and between cells, mainly in the form of action and variation potentials, in response to stimuli such as mechanical vibrations, changes in temperature, light intensity, and humidity. Although the ability of plants to react to environmental stimuli is well accepted, the way plants process information remains not fully understood. Hence, this study addresses plants as computational resources and explores the possibility of using plants as environmental sensors. By collecting and storing extracted signals from *Mimosa pudica* over long periods of time, under different stimuli, and consequently presenting these data in a real-time dashboard, the analysis of a potential relationship between the signals observed in the plant and some environmental conditions is facilitated.

Furthermore, after testifying this relationship, we have developed a prototype model that reports temperature variations through the signals acquired from the plants.

Utilizing information about physiological plant conditions and incorporating it into control systems has the potential to not only supplement or replace electronic sensors, but also to enable the development of highly autonomous plant systems capable of performing tasks such as climate control, irrigation, and soil treatment.

Keywords: Plant Signalling, Plant Behaviour, Sensors, IoT, Environment

20462 | Biomechanical impact of a subsequent childbirth on female pelvic floor

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Abstract

More than a third of women will experience pelvic floor dysfunction (PFD) throughout their lives, and these constitute one of the major problems affecting public health, in terms of prevalence, cost and impact on quality of life [1]. In recent years, PFD have been widely studied, particularly regarding the effect of childbirth and pregnancy itself [2]. Computational modelling is a key step in understanding the influence of obstetric factors on the risk of injury to pelvic floor muscles (PFM). Model simulation of the pelvic cavity allows the study of PFD, as well as the analysis of stresses and deformations to which these structures are subjected when forces are involved, such as in childbirth [3]. The aim of this work is the parameterization of a simplified delivery model regarding dimensions and material parameters of the fetal head and PFM. The results obtained showed that the larger the diameter of the fetal head the greater the stress on the PFM. Furthermore, since these are simplified models, a balanced distribution of stresses was verified at the base of the PFM, the area of greatest stress. The script created allows the simulations to be performed with different conditions in a faster and more practical way.

Keywords: Numeric Simulation, Parameterization, Python, Abaqus, Finite Element Method

Acknowledgments

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References

[1] Torrisi, G., et al. "A prospective study of pelvic floor dysfunctions related to delivery." Eur J Obstet Gynecol Reprod Biol 160.1 (2012): 110-115.

[2] Parente, M., et al. "Deformation of the pelvic floor muscles during a vaginal delivery." Int Urogynecol J 19.1 (2008): 65-71.

[3] Silva, A. "Estudo biomecânico da cavidade pélvica da mulher." (2012).

20477 | SHS - Soil Health surrounding former mining areas: Characterization, risk analysis, and intervention I

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Abstract

The waste resulting from mineral exploration and processing can result in compounds that when emitted, released, and leached can contaminate the surrounding natural systems. Thus, the project "SHS - Soil health surrounding former mining areas: characterization, risk analysis, and intervention" has the overall objective of identifying and characterizing the environmental impacts resulting from the mobilization processes of the harmful elements originating from the Ribeiro da Serra mine activities.

The study site was sampled for physical (Moisture and Particle Size Analysis), chemical and environmental (Total Organic Carbon, Natural Leaching and Acid Net Generation) characterization. Twenty-seven samples were collected.

The analysed samples consisted mostly of gravel and their moisture content varied between 2 % and 10 %, approximately. From the chemical analysis it was found that the most abundant element was Fe, with a maximum of 8.5 %. The concentration of Cu, Zn, As, Sb and Pb was 0.0195 %, 0.0185, 0.1407 %, 2.5436 % and 0.0814 %, respectively. The total organic carbon varied between 0.86 % and 13.05 %. From the acid generation tests it was found that 23 out of the 27 samples showed acid generating behaviour with maximum NAG pH of 4.5 and NAG pH of 7 equal to 0.2 and 14.3 kg H2SO4/ton, respectively.

Keywords: Antimony, gold, environmental characterization, environmental contamination, heap, mining legacy, mine wastes

Acknowledgments

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20535 | Development of a drug-delivery system based on chlorhexidine-loaded porous composite hydrogel for bone tissue engineering

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Abstract

The emergence of bacterial infections following the implantation of biomaterial-based bone implants has substantially impacted patients' quality of life and placed a strain on healthcare systems ^[1,2]. Biomaterials loaded with antibiotics have been used as vehicles for the local delivery of antimicrobial agents to prevent, control and treat implant-related infections (IRIs) [3-5]. However, antibiotic resistance is an acute concern to the global community, being required an alternative antimicrobial agent to control and treat IRIs, particularly those caused by antibioticresistant bacteria. Chlorhexidine (CHX) has been described as a good candidate for the development of multifunctional approaches based on anti-infective biomaterials and drugdelivery systems that do not encourage microbial evolution, similar to antibiotic resistance ^[5-7]. This antiseptic has a wide-spectrum antibacterial activity, acting against Gram-negative and Gram-positive bacteria, bacterial spores, lipophilic viruses, yeast, and dermatophytes ^[8]. In addition to low drug resistance, CHX presents good soft tissue tolerability, hence being used in biomedical applications like controlled drug delivery in dental medicine ^[1]. Therefore, the present work intends to develop CHX-loaded alginate-nanohydroxyapatite composite hydrogels to prevent local tissue infections and, simultaneously, to promote bone tissue regeneration. A physicochemical (swelling, FTIR, SEM) and biological (halo of inhibition test) characterization of the materials was performed. The obtained results showed that the materials have a porous structure with good swelling behaviour and their functional groups were identified; the halo of inhibition test showed that the process of production did not affect the CHX's bioactivity. At the end of this work, a multifunctional biomaterial integrating osteogenic and antibacterial functions is expected to support bone cells' osteogenic functions and prevent bacterial colonization.

Keywords: Biomaterial; Chlorhexidine; Hydrogel; Implant-related infections.

References

[1] Zhao, C., Liu, W., Zhu, M., Wu, C., & Zhu, Y. (2022). Bioceramic-based scaffolds with antibacterial function for bone tissue engineering: A review. Bioactive Materials.

[2] Ribeiro, M., Monteiro, F. J., & Ferraz, M. P. (2012). Infection of orthopedic implants with emphasis on bacterial adhesion process and techniques used in studying bacterial-material interactions. Biomatter, 2(4), 176-194.

[3] Benedini, L., Laiuppa, J., Santillán, G., Baldini, M., & Messina, P. (2020). Antibacterial alginate/nano-hydroxyapatite composites for bone tissue engineering: Assessment of their bioactivity, biocompatibility, and antibacterial activity. Materials Science and Engineering: C, 115, 111101. 1

[4] Barros, J. A. R., de Melo, L. D. R., da Silva, R. A. R., Ferraz, M. P., de Rodrigues Azeredo, J. C. V., de Carvalho Pinheiro, V. M., ... & Monteiro, F. J. (2020). Encapsulated bacteriophages in alginate-

nanohydroxyapatite hydrogel as a novel delivery system to prevent orthopedic implantassociated infections. Nanomedicine: Nanotechnology, Biology and Medicine, 24, 102145.

[5] Riool, M., Dirks, A. J., Jaspers, V., de Boer, L., Loontjens, T. J., van der Loos, C. M., ... & Zaat, S.
A. (2017). A chlorhexidine-releasing epoxy-based coating on titanium implants prevents
Staphylococcus aureus experimental biomaterial-associated infection. Eur Cell Mater, 33, 143-157.

[6] Wang S, Yang Y, Li W, Wu Z, Li J, Xu K, et al. Study of the Relationship Between Chlorhexidine-Grafted Amount and Biological Performances of Micro/Nanoporous Titanium Surfaces. ACS Omega. 2019;4:18370-80.

[7] Barros J, Grenho L, Fontenente S, Manuel CM, Nunes OC, Melo LF, et al. Staphylococcus aureus and Escherichia coli dual-species biofilms on nanohydroxyapatite loaded with CHX or ZnO nanoparticles. Journal of biomedical materials research Part A. 2017;105:491-7.

[8] Barros, J., Grenho, L., Fernandes, M. H., Manuel, C. M., Melo, L. F., Nunes, O. C., ... & Ferraz,
 M. P. (2015). Anti-sessile bacterial and cytocompatibility properties of CHX-loaded
 nanohydroxyapatite. Colloids and Surfaces B: Biointerfaces, 130, 305-314.

20603 | Assessing OPEX costs at hydropower plants: A path for efficiency and decarbonization

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Abstract

The European Union has set several targets for renewable energy as part of its efforts to address climate change and the transition to a more sustainable and low-carbon economy. These targets include increasing the share of renewable energy in final consumption, having hydropower plants as one of the main paths to decarbonization due to their potential and flexibility in a context of increasing and uncertain energy demand.

The current research focus on analysing the operational expenditure costs at two different types of hydropower plants - Pumped Storage (PHS) and Water Reservoir (WR); in order to provide robust guidelines for plants to optimize their operations and asset management, becoming more able to meet environmental goals.

For this study, an OPEX cost model was developed - and 61 variables and 21 parameters governing these costs were identified. The model was then tested on three Portuguese hydropower plants, which were selected based on their transparency.

From the European Network of Transmission System Operators (ENTSO-E) and the Oak Ridge National Laboratory (ORNL) platforms, data was collected, cleaned and analysed to feed the model. A Monte Carlo simulation was performed for each plant followed by a sensitivity analysis, allowing the identification of the most important parameters and their effect on OPEX costs. Finally, the results were then analysed and compared to the few existing literature.

The study revealed which are the parameters who impact the most the plants, such as the time taken to make a new attempt to start up the turbine after a failed start, the electrical and pumping equipment maintenance, among others. Based on these results, a heat map was created to facilitate the identification of the impact of each parameter on costs, helping plants to optimize their operations for improved efficiency, flexibility and sustainability.

Keywords: hydropower; renewable energy; operational expenditure; sustainability; environmental goals; Monte Carlo simulation; cost modelling.

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20620 | Analysis of the reaction parameters of palmitic acid deoxygenation for sustainable jet fuel production

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Abstract

Due to the need to decrease greenhouse gas emissions in the aviation industry, there is a great demand for sustainable fuel options. One of the alternatives is to explore the catalytic conversion of microalgae biomass into hydrocarbons in the jet fuel range, considering the high lipid content of this feedstock [1]. Palmitic acid is a long-chain fatty acid used as a model molecule to investigate deoxygenation reactions to produce the desired products for this purpose [2].

In this context, the focus of this study is to assess the deoxygenation reactions of palmitic acid using a commercial catalyst (Co-Mo/Al₂O₃) in a high-pressure and high-temperature batch reactor. The temperature, pressure, catalyst loading and stirring rate of the reactor will be adjusted to pinpoint the best conditions for an effective, cost-efficient, and sustainable process. Thus, the conversion of palmitic acid and the yield of hexadecane (C16) and pentadecane (C15) were measured using a gas chromatography-flame ionization detector (GC-FID).

The non-noble metal catalyst tends to promote the hydrodeoxygenation (HDO) route of removing oxygen over the hydrodecarbonylation and hydrodecarboxylation reactions. This was observed through the greater production of hexadecane and water. With increased temperature conditions (350 °C), it was also possible to remark that the deoxygenation was fully carried out, having no intermediary compounds such as aldehydes and alcohols being formed. Moreover, at this temperature, the yield and conversion rates were higher than those in lower temperatures. For instance, whilst maintaining all other reaction conditions among all tests, it was found that the reaction at 350 °C holds a conversion of 76 % with a yield of C16 of 52 %, whereas for 300 °C both the conversion rate and the yield of C16 formation were around 26 % and for 220 °C both values were 0 %. The yield of C15 formation was 0.3 %, 0.04 % and 0 %, respectively. Other reaction parameters are still being evaluated.

Keywords: Palmitic acid; catalytic deoxygenation; jet fuel hydrocarbons; optimisation.

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References

 Magalhães, I. B.; Pereira, A. S. A. de P.; Silva, T. A.; Renato, N. dos S. Predicting the Higher Heating Value of Microalgae Biomass Based on Proximate and Ultimate Analysis. Algal Research, 2022, 64,102677. <u>https://doi.org/10.1016/j.algal.2022.102677</u>.

[2] Cao, Y.; Shi, Y.; Bi, Y.; Wu, K.; Hu, S.; Wu, Y.; Huang, S. Hydrodeoxygenation and Hydroisomerization of Palmitic Acid over Bi-Functional Co/H-ZSM-22 Catalysts. Fuel Processing Technology, **2018**, 172, 29–35. <u>https://doi.org/10.1016/j.fuproc.2017.09.020</u>.

20625 | Adsorbent regeneration and antimony recuperation techniques using saturated adsorbents

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Abstract

Antimony is a semi-metallic element with great value and versatility in today's rapidly expanding industry. It's also very toxic for human consumption, and the need to extract it from polluted waters, whether it be to decontaminate those waters or to recover the antimony and use it in the industry, is in high demand [1].

Cork granulates are a very common byproducts in the cork industry [2], making them affordable and environmentally safe, and when combined with iron hydroxides, they produce an adsorbent capable of successfully adsorbing antimony and other oxyanions from contaminated waters [3]. In this study, antimony adsorption and desorption from iron-coated cork granulates in continuous mode was investigated. Ascorbic acid 0.1M was chosen as eluent from previous studies in batch mode. The amount of iron on the eluent after the desorption cycle was also measured to assess

mode. The amount of iron on the eluent after the desorption cycle was also measured to assess changes to the integrity of the adsorbent. Adsorption cycles were carried out with adsorbent after desorption as well as after another iron coating to evaluate its adsorption capacity.

The adsorbent proved to be efficient in decontaminating the water and recuperating the antimony, resulting in 8.0 mg g⁻¹ of adsorption capacity when the iron-coated cork granulates were new. Antimony desorption efficiency was also achieved, as we were able to retrieve 83 % of the metalloid. However, the desorption with ascorbic acid damaged the adsorbent's capability to retain antimony, resulting in 1.4 mg g⁻¹ of adsorption capacity when the granulates had already been through a desorption cycle. This was also verified by the large amount of iron present in the eluent after the desorption cycle, since 87 % of the iron in the iron-coated cork granulates was leached. Furthermore, the attempt to regenerate the cork granulates by recoating them with iron proved to be ineffective, resulting in 1.9 mg g⁻¹ of adsorption capacity, making the regeneration of this adsorbent not advantageous in the conditions investigated in this work.

Keywords: Antimony; Cork; Iron; Adsorption; Desorption

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References

[1] G. Ungureanu, S. Santos, R. Boaventura, C. Botelho, (2015). Arsenic and antimony in water and wastewater: Overview of removal techniques with special reference to latest advances in adsorption, Journal of Environmental Management 151 326-342

[2] A. Pintor, C. Ferreira, J. Pereira, P. Correia, S. Silva, V. Vilar, C. Botelho, R. Boaventura, (2012). Use of cork powder and granules for the adsorption of pollutants: A review, Water Research 46(10) 3152-3166.

[3] A. Pintor, B. Vieira, R. Boaventura, C. Botelho (2020). Removal of antimony from water by ironcoated cork granulates, Separation and Purification Technology, 233 116020.

20638 | Recycled construction and demolition waste in landfill cover systems: inclined plane shear resistance of interfaces with geosynthetics

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Abstract

The building and construction sector create more than a third of the waste generated in the European Union. To achieve a more sustainable construction, applications for the waste generated should be developed, making it a valuable raw material. Over the last years, many applications have been found for construction and demotion waste (CDW). Examples include the use of CDW in the manufacture of binders, mortars and concrete, in base layers of transportation infrastructures, as well as its application as filling material of structural embankments. This work focuses on the viability of using fine-grained recycled aggregates coming from CDW in final cover systems of waste landfills. These systems, which are normally formed by geosynthetics covered by soil, are used to, for example, avoid direct exposure of the surrounding ecosystem to waste, control gaseous emissions and odors, or prevent water infiltration into the landfill. Geosynthetics used in landfill cover systems often include a geomembrane (fluid barrier) and, over it, a drainage geocomposite (a geonet with geotextiles). This work evaluated the potential replacement of the soil layer placed over the geosynthetics by fine-grained recycled aggregates from CDW.

The behaviour of the interface between a fine-grained recycled aggregate from CDW and two distinct geosynthetics (a geomembrane and a drainage geocomposite) was studied. Shear tests were conducted on an inclined plane considering two interfaces: (1) interface drainage geocomposite-CDW and (2) interface geomembrane-drainage geocomposite. The behaviour of the CDW under inclined plane shear mode was also characterised. The shear tests considered different vertical confinement stresses and different CDW compaction conditions (degree of compaction and moisture content).

Keywords: construction and demolition waste; geosynthetics; landfill cover systems; inclined plane shear tests.

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20641 | Microencapsulation and valorisation of bioactive compounds present in plants, with applicability in the food, pharmaceutical and cosmetic industry

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Abstract

Polyphenols are bioactive compounds that can be extracted from vascular plants and have numerous health benefits given their anticarcinogenic, anti-inflammatory and antiallergic functions and their preventive action on cardiovascular, autoimmune and neurodegenerative diseases. Their integration in medicines, food and cosmetic products increases their therapeutic, nutritional and economic value, however, their chemical instability and low bioavailability makes this implementation complicated since the compounds suffer degradation during their production and storage. Microencapsulation is a way of protecting these compounds from external conditions and of controlling their release by creating a matrix of a coating agent around the active compound.

On this study two methods were used: spray drying and electrospinning. The core material was quercetin and pullulan was the chosen coating agent. To analyse the viability of this combination, for each method, controlled release studies were conducted, the efficiency of the encapsulation was calculated and the microstructures were characterized in terms of morphology by scanning electron microscopy.

The total release of quercetin from the samples was achieved after 6270 s and 3130 s for the spray drying and electrospinning methods, respectively, while the encapsulation efficiency of the spray drying samples was 86 % and 100 % on the electrospinning samples, making it the most efficient method. The spray drying method produced microparticles of irregular shapes and with a large polydispersity of sizes, while a film was produced by electrospinning. Comparing the particles with and without quercetin it was observed that its presence does not influence the microstructures formed.

This study made it possible to conclude that microencapsulation of quercetin with pullulan, using these two methods, is a viable solution that allows the production of different microstructures for future applications in the food, pharmaceutical and cosmetic industry.

Keywords: Electrospinning; Microencapsulation; Pullulan; Quercetin; Spray Drying

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20665 | Glucose concentration monitoring with advanced surface plasmon resonance optical fibre sensor technology

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Abstract

Glucose concentration detection is crucial in disease diagnosis, clinical analysis, and food quality monitoring [1, 2]. Fluorescent sensing methods are commonly used, but their limitations, such as the short lifetime of fluorescent agents and the high cost of enzymes have limited their further development and application in biosensing [3], leading to a need for low-cost and robust alternatives.

In this work, a sensor that utilizes a transmission scheme for measuring glucose aqueous solutions based on surface plasmon resonance is proposed. A comparison between the performance of two sensors with similar lengths and different diameters is performed.

The first sensor comprises a multimode optical fiber with a diameter of 400 μ m and a 1 cm section of the cladding removed. A 50 nm-thick gold thin film was sputtered onto the fiber. The second sensor is similar, except that the fiber has a diameter of 600 μ m. The sensors were evaluated for their performance in measuring glucose concentrations ranging from 0.0001 to 0.5000 g/mL.

The first sensor proposed with a diameter of 400 μ m demonstrated high sensitivity, with a total wavelength red shift of 117.3 nm. This sensor achieved a maximum sensitivity of 312.0 nm/(g/mL) for the highest concentration. On the other hand, the sensor with a diameter of 600 μ m obtained a wavelength red shift of 127.4 nm and achieved a maximum sensitivity of 322.0 nm/(g/mL).

The resolutions and stabilities of both sensors (400 μ m and 600 μ m) were also studied. The 400 μ m sensor achieved a resolution of 0.027 g/mL, and the standard deviation for the stability study was 0.018 nm/(g/mL). Meanwhile, the 600 μ m sensor obtained a resolution of 0.028 g/mL, and the standard deviation was 0.022 nm/(g/mL), indicating that both sensors have good stability. In conclusion, the sensors showed similar stability and resolution. However, 600 μ m sensor demonstrated better wavelength sensitivity and a larger red shift, making it the greater choice for monitoring and measuring glucose concentrations.

Keywords: Surface plasmonic resonance, optical fiber sensor, transmissive sensor, glucose monitoring.

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References

Y. Li, H. Ma, G. Lin, Q. Liu, Z. Yan, D. Liu, O. Sun, "Immobilized optical fiber microprobe for selective and high sensitive glucose detection", Sens. Actuators: B, Vol. 255, pp. 3004-3010, 2018.
 R. Ballerstadt, A. Polak, A. Beuhler, J. Frye, "In vitro long-term performance study of a near-infrared fluorescence affinity sensor for glucose monitoring," Biosens. Bioelectron, Vol. 19, pp. 905-914, 2004.

[3] R. Esposito, B.D. Ventura, S.D. Nicola, C. Altucci, R. Velotta, D.G. Mita, M. Lepore, "Glucose sensing by time-resolved fluorescence of sol–gel immobilized glucose oxidase," Sensors, Vol. 11, pp. 3483, 2011.

20705 | Folate-functionalized PLGA nanoparticles: A promising approach to target methicillin-resistant *Staphylococcus aureus*

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Abstract

Antimicrobial resistance (AMR) is considered one of the top 10 threats to human health worldwide by the World Health Organization (WHO). In the past, bacterial infections were considered minor or manageable illnesses. However, nowadays, due to antibiotics' resistance, pathogenic bacteria are now linked with severe diseases and sometimes with death. Particularly, methicillin-resistant Staphylococcus aureus (MRSA) is one of the most common antibioticresistant bacteria [1]. Thus, it is crucial to develop new and effective therapeutic strategies capable of treating MRSA infections. A promising approach is using functionalized drug-loaded nanoparticles (NPs) to specifically target MRSA and deliver antibacterial agents directly to their site of action [2]. In this work, poly(lactic-co-glycolic acid) (PLGA) NPs were produced by the single emulsion-solvent evaporation technique. The NPs' surface was functionalized with folate as folate receptors are overexpressed in MRSA-infected tissues, making it a target for drug delivery (Figure 1). The covalent coupling of PLGA with the folate's amino group was achieved by a carbodiimidecoupling reaction with the PLGA's carboxyl groups. The obtained folate-functionalized PLGA NPs exhibited mean diameters of 185 \pm 10 nm, a polydispersity index of 0.08 \pm 0.02, and a zeta potential of -17 \pm 2 mV. The conjugation efficiency obtained was 42 \pm 6%, which corresponds to 423 ± 56 molecules of folate per NP. According to their physicochemical properties, folatefunctionalized PLGA NPs remained stable for at least 14 days under storage conditions (4 °C). Further studies aim to evaluate the in vitro and in vivo targeting ability of the developed smart NPs.

Keywords: MRSA; antibiotic resistance; targeted delivery, nanoparticles functionalization; drug delivery

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Stimulus - Individual Call – (CEEC-IND/01741/2021); and Santa Casa da Misericórdia (MB-35-2021).

References

[1] Hulme, J., Application of nanomaterials in the prevention, detection, and treatment of methicillin-resistant staphylococcus aureus (mrsa), Pharmaceutics 2022, 14, 805.

[2] Vanamala, K., et al., Folate functionalized lipid nanoparticles for targeted therapy of methicillin-resistant staphylococcus aureus, Pharmaceutics 2021, 13, 1791.



Figure 1: Schematic representation of folate-functionalized PLGA NPs.

20734 | Recovery of burnt soils using Technosols - case study

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Abstract

In Portugal, as in other places in the world, forest fires with high intensity frequently occur, they affect significant areas of the territory with a negative impact on the different environmental compartments; in the soils, changes in their physicochemical and biological characteristics are, several times, detected. To study these alterations and, also, the effect of a tailor-made Technosol on its recovery, a pilot area was implemented in Trás-os-Montes in which monitoring has been conducted. In this area, soil samples were collected over four different moments: before the prescribed fire; after the prescribed fire; before the Technosol application and after the Technosol placement. The soil samples were used to laboratory characterization; texture, electrical conductivity, and nitrogen content were determined, among others. The test methodologies used followed the standard norms and procedures.

Tailor-Made Technosols are artificial soils whose manufacture is carried out considering the characteristics of the natural soil on which they will be deposited and the intended objectives of their use; in this study, an andic and eutrophic technosol was applied.

The results obtained showed that there is an increase in the values of electrical conductivity after a fire, with a significant emphasis after the application of Technosol. However, in the study period, a tendency for a progressive decrease after a few months was detected. In the case of nitrogen, as in the electrical conductivity, an increase in its concentration is noted after the Technosol deposition and, later, its decrease. Regarding the texture, at the beginning the soils were silt loam and, in most cases, they stay so, although there was an increase in the sandy fraction. Comparing the results with those obtained from samples collected in areas without Technosol application, it is possible to verify that the increases in electrical conductivity and nitrogen content were much smaller. In texture, in this case, there was a significant decrease in sand content and an increase in clay and silt contents. Thus, it is possible to conclude that the application of Technosol promotes improvements in soil characteristics, helping their recovery.

Keywords: Soils, Technosols, Soil Remediation

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20745 | Dual photocatalytic activity of nonmetal doped carbon nitride

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Abstract

In the field of semiconductor photocatalysis, the development of carbon-based materials, such as graphitic carbon nitride (GCN), has attracted increasing attention for research. This is especially due to its possible application under visible light to produce hydrogen peroxide (H_2O_2), which has shown potential in the field of fuel cells, as an energy carrier [1]. In addition, H_2O_2 is a chemical oxidiser widely used in different applications such as disinfection, fine chemistry and wastewater treatment. Hence, GCN-based photocatalysis has emerged as a promising technology in the field of H_2O_2 production, replacing those that are not as environmentally sustainable as the world currently demands [1, 2].

Due to the low specific surface area, fast charge carrier recombination rates and relatively low photocatalytic efficiency of bulk GCN materials, various modifications have been reported (e.g., thermal treatments, metal doping) [3]. In this context, nonmetal atoms (*e.g.*, P, B, O and S), at different dosages (0.2, 1.0, 5.0wt.%), were doped in the GCN matrix during the thermal polymerisation of urea, a metal-free carbon/nitrogen rich precursor. The use of metal-free atoms was important to reinforce the overall sustainability of the process [1-3].

To explore the efficiency of the photocatalysts, experiments with simultaneous production of H_2O_2 and degradation of three contaminants of emerging concern (CEC) were performed under visible light. In addition, selected photocatalytic reactions were carried out using 10% (v/v) of methanol, ethanol, and isopropanol aqueous solutions as sacrificial agents to investigate the H_2O_2 production. The 1wt.% P-doped photocatalysts presented a higher production of H_2O_2 , compared to bare GCN, after 2 hours of reaction using a 10% (v/v) of methanol aqueous solution. Moreover, when the 1wt.%. P-doped GCN photocatalyst was used for the degradation of a mixture of CECs (Fig. 1), a faster degradation and increased H_2O_2 formation (6-fold) were observed in comparison with bulk GCN.

Keywords: carbon nitride, doping, hydrogen peroxide, photocatalysis, pharmaceuticals.

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References

[1] Torres-Pinto, A., et al., Recent Strategies for Hydrogen Peroxide Production by Metal-Free Carbon Nitride Photocatalysts. Catalysts, 2019. 9(12).

[2] Chen, J., et al., Carbon nitride for photocatalytic water splitting to produce hydrogen and hydrogen peroxide. Materials Today Chemistry, 2022. 26.

[3] Jiang, L., et al., Doping of graphitic carbon nitride for photocatalysis: A reveiw. Applied Catalysis B: Environmental, 2017. 217: p. 388-406.



Figure 1: Degradation of organic contaminants (VEN – venlafaxine, MTP – metoprolol and DCF – diclofenac) with 1.0%wt. P-doped GCN (closed symbols) compared to bare GCN (open symbols).

20750 | A route to commercialization of perovskite solar cells: the upscaling challenge

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Abstract

In the last decade, perovskite solar cells (PSCs) have been one of the most promising technologies for photovoltaic (PV) applications, showing a record power conversion efficiency evolution from 3.8 % to nearly 26 % in only 13 years.1 The high absorption coefficient, low cost, easy-to-process and abundant precursors, tunable composition and strong diffuse light harvesting are some of the factors attracting attention to this thin-film technology, which is also suitable for building integrated photovoltaics and flexible substrates.2 Different PSC device architectures have been reported, being the regular and inverted structures the most used. In the regular structure, the perovskite layer is deposited on top of the electron transport layer (ETL) and then a hole transport layer (HTL) is deposited. In the inverted architecture, the charge transport layers' order is inversed. Despite, regular architecture presenting the highest efficiency, inverted structure is attracting increasing attention due to its low-temperature fabrication process and stability.3 Nevertheless, to make PSCs available on a commercial scale, efficient and robust photovoltaic large area devices and/or modules must be built. At the laboratory scale, spin-coating is the most used deposition technique. However, for larger areas, it does not guarantee a uniform layer, besides being not suitable for flexible substrates or continuous roll-to-roll processes.4 For this reason, many other deposition techniques have been investigated for the fabrication of large area PSC devices, such as the blade-coating and slot-die coating.

In this work, the upscaling process of an inverted PSC was engaged. For that, large-area PSC devices were fabricated under ambient conditions, using slot-die coating for the deposition of the active layers (HTL, ETL and perovskite layers). The deposition parameters for each layer were optimized to achieve high-performance devices. A PSC device with 5 cm² active area was fabricated with a power conversion efficiency of 8 %.

Keywords: Perovskite solar cells; upscaling; commercialization.

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References

[1] NREL, Research Cell Record Efficiency Chart, 2022, <u>https://www.nrel.gov/pv/assets/pdfs/cell-pv-eff-emergingpv.pdf</u> (accessed on 09/03/2023).

[2] P. C. Reshmi Varma, Chapter 7 - Low-Dimensional Perovskites, Editor(s): Sabu Thomas, Aparna Thankappan, Perovskite Photovoltaics, Academic Press, 2018, 197-229.

[3] J. Príncipe, V. C. M. Duarte, L. Andrade, Inverted Perovskite Solar Cells: the emergence of a highly stable and efficient architecture. Energy Technology 2022, 10, 2100952.

[4] R. Swartwout, M. T. Hoerantner, V. Bulović, Scalable Deposition Methods for Large-area Production of Perovskite Thin Films. Energy Environ. Mater. 2019, 2, 119-145.

20761 | Role of Lactic Acid Bacteria (LAB) in displacing biofilms in the food industry

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Abstract

In food processing facilities, microorganisms tend to adhere to food contact surfaces and form biofilms, which are reservoirs of bacteria that may contaminate food. As part of a biofilm, bacteria are protected from the stressful conditions found during food processing and become resistant to antimicrobials, including traditional sanitizers and disinfectants. Several studies in the food industry have shown that probiotics, essentially LAB, can prevent and control biofilm formation by spoilage and pathogenic microorganisms. In this context, the ability of *Lactiplantibacillus plantarum* (LP) and *Lacticaseibacillus rhamnosus* (LR) to disperse pre-formed biofilms of Escherichia coli, Pseudomonas putida, and Pseudomonas aeruginosa was evaluated.

The antibiofilm assays followed a displacement strategy that consisted of the disruption of 24hour single-species biofilms through the addition of LP or LR. The contact between pathogen biofilms and the probiotic cell suspension lasted 24 h. The number of total and culturable biofilm cells with or without LAB treatment (control) was determined by flow cytometry and colonyforming unit (CFU) counts, respectively.

Reductions of about 40-55% in the number of total *E. coli* cells, and 25-35% in the number of culturable cells were obtained after 24 h of probiotic treatment. The antibiofilm activity could be due to competition for nutrients and/or by release of antimicrobial metabolites, that may have compromised the integrity of pathogen cells. In contrast, the culturability of *Pseudomonas* species was not reduced when pre-formed biofilms were exposed to LP or LR.

These preliminary results demonstrate the antibiofilm potential of LP and LR against *E. coli* biofilms, suggesting that LAB are a promising approach to control biofilm formation in the food industry. However, further studies are needed to unravel the cellular processes underlying such a different probiotic behaviour against foodborne biofilms.

Keywords: probiotic; lactic acid bacteria; biofilm displacement; foodborne pathogen.

Acknowledgments

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20766 | Biomechanical study of the anal sphincters

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Abstract

The anal canal is made up of a complex arrangement of sphincters, which can be divided into an inner and outer group of muscles. Anal sphincter injury during vaginal delivery represents the most important risk factor for the development of fecal incontinence in women, which can occur after delivery or a few years later. In the last decades there has been a serious focus on research linked to the study and analysis of biological tissues, which have a strongly non-linear behaviour and are difficult to characterize. By obtaining accurate and reliable results of the anal canal through computational models, we can estimate specific properties of patients with fecal incontinence. Knowing these characteristics can, in turn, help health care professionals to prevent the onset of injury to these structures. The goal of this work was then to create a 3D geometric model of the anal canal using MRI images and the Slicer 3D program for segmentation. The MRI images belong to a 35-year-old woman without pelvic symptoms. The model obtained was smoothed and adjusted to be 30 mm long and 10.40 mm wide, to be in accordance with the literature [1]. Three main partitions were created in Inventor software, corresponding to the anal canal, the internal sphincter, and the external sphincter, respectively. The external sphincter was divided into three fascicles: deep, superficial and subcutaneous. The 3D geometric model is now ready to be meshed using an 8-node hexahedral elements, hybrid formulation and constant pressure (C3D8H). To characterize the mechanical behaviour of this region, tensile tests will be performed on anal sphincters from sheep without pathology of the pelvic region. Then, a comparison of experimentally obtained data with literature data will be made for the external sphincter [2].

Keywords: Biomechanics of Tissues; Fecal Incontinence; Finite Element Method; Hyperelastic Tissue.

References

 Shon et al. (2022). Assessment of normal anal sphincter anatomy using transanal ultrasonography in healthy Korean volunteers: a retrospective observational study. Journal of Yeungnam Medical Science, 39(3), 230–234. https://doi.org/10.12701/yujm.2021.01515
 Rios Ataxca et al., "A PASSIVE STATE SIMULATION OF AN ANAL SPHINCTER USING SIMMECHANICS," J Mech Med Biol, vol. 18, no. 6, Sep. 2018, doi: 10.1142/S0219519418500598



Figure 1: Representation of the anatomical model with the respective dimensions.

20898 | Characterization of new biosurfactants for textile applications

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Abstract

Surfactants are compounds capable of lowering surface tension of water, making it easier to remove oil and grease from materials and surfaces [1]. Nowadays, the major feed in the production of surfactants are petrochemical sources. Due to their low biodegradability, petrochemicals represent a risk factor for native living beings and their diversity [2]. During the last years, microbial surface-active compounds have emerged as potential alternatives [3]. Owing to their amphipathic nature, simple glycolipids are natural surfactants, which are biodegradable and have low ecotoxicity while remaining active under extreme conditions of temperatures, pH and salinity. A number of these lipids are major products of certain microorganisms, and they can be produced through fermentation technologies. The most promising are rhamnolipids and sophorolipids [3]. Recently, biosurfactants have been used as main active ingredients or additives for personal care and cleaning products, such as shampoos and laundry detergents [4]. However, the potential of their application for the textile industry has not been explored.

Herein, we evaluate different biosurfactants, provided by NGC partner companies, for textile applications, namely scouring, bleaching, dyeing and soaping. For that, we tested the foaming capacity, hydrophilicity, degree of whiteness, and capacity to remove oil stains. From the different surfactants evaluated, rhamnolipids presented the best performance in the hydrophilicity and foaming tests. Regarding whiteness and cleaning tests, both rhamnolipids and sophorolipids presented a good performance. These results are the first steps for the development of new bioproducts for textile industry.

Keywords: biosurfactant; sustainability; textile industry; glycolipids.

References

[1] Tadros, T., *Surfactants*, in *Encyclopedia of Colloid and Interface Science*, T. Tadros, Editor. Berlin Heidelberg, Springer 2013. p. 1242-1290.

[2] Badmus, S.O., et al., Environmental risks and toxicity of surfactants: overview of analysis, assessment, and remediation techniques. Environmental Science and Pollution Research, 2021.
28 (44): p. 62085-62104.

[3] Pardhi, D.S., et al., *Microbial surfactants: A journey from fundamentals to recent advances.* Frontiers in Microbiology, 2022. **13**.

[4] El-Khordagui, L., Badawey, S. E., Heikal, L. A., 'Chapter 3 Application of biosurfactants in the production of personal care products, and household detergents and industrial and institutional cleaners', *Green Sustainable Process for Chemical and Environmental Engineering and Science*, Elsevier, 2021. p. 61.

20906 | Recycling polyurethane and thermoplastic urethane waste from external prostheses for the manufacture of filaments for 3D printing

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Abstract

Polyurethane (PU) is applied in a wide variety of applications, such as automotive industry, civil construction, footwear or even mattresses. Recycling processes of this material are still underdeveloped, being that at the end of life, PU products go to landfill, are mechanically or chemically recycled, or used in Energy Recovery or Biological Degradation. Preliminary work carried out with shredding Thermoplastic Polyurethane (TPU) defective cosmetic prosthetics, mixed with PU machining residues of limb models that are industrial waste of a Prosthetics and Orthotics company, allowed to create a 100 % recycled material able to be injection moulded. TPU formulations with 10, 20, 30 and 60% PU were injected in an industrial machine (Battenfeld BA 400/125 CDC) to produce the parts shown in Figure 1 a). From each set of the parts obtained, 4 tensile specimens of each lot were removed to determine the mechanical properties (MultiTestdV Mecmesin equipment (UK), Fig. 1b)). The best formulation (10 % PU with 90 % TPU), in terms of mechanical properties, extrudability and surface quality, was selected to produce pellets (Fig. 1c)). PU and TPU were mixed in gravimetric dispensers, and a twin-screw, corotating and modular extruder, model Coperion ZSK 26, was used to manufacture the pellets at PIEP (Innovation in Polymer Engineering). A study was conducted to determine the best parameters to process the pellets and extrude (210°C, 5rpm and 90% cooling), in a 3Devo Composer machine, a 3D printing filament (Fig. 2). The material was very sensitive to any changes and the final configuration are temperatures around 210°C, 5rpm and 90% cooling. The main advantages shown in the printing tests are for example color similar to the skin tone and good flexibility like TPU filament but with more rigidity. A mechanical hand prosthesis was then designed and printed for a 10-year-old girl through the E-Nable project community.

Keywords: Polyurethane, Recycling, 3D Printing, Prosthetics

Acknowledgments

The authors acknowledge the support provided by *Padrão Ortopédico*, External Prostheses company that provided the wasted material and the internship during the master thesis. The support from *Maitools, Injection and Mold Engineering, Lda.*, with the injection tests and material shredding, is also extremely appreciated. Also, by *PIEP – Innovation in Polymer Engineering* with the manufacturing of pellets for filament extrusion. The extrusion of the filament at Department of Metallurgical and Materials Engineering of *FEUP*. Finally the connection with a real case to design a mechanical hand provided by *3d Printing for Health, E-Nable*.

References

[1] Sheppard, D. T., Jin, K., Hamachi, L. S., Dean, W., Fortman, D. J., Ellison, C. J., & Dichtel, W. R. (2020). Reprocessing Postconsumer Polyurethane Foam Using Carbamate Exchange Catalysis and Twin-Screw Extrusion. ACS Central Science, 6(6), 921–927.

[2] Kemona, A., & Piotrowska, M. (2020). Polyurethane Recycling and Disposal: Methods and Prospects. Polymers, 12(8), 1752



Figure 1: Injected samples to evaluate the processability of the mixtures



Figure 2: Tensile tests



Figure 3: PU, TPU and pellets from the mixture



Figure 4: Tests for filament extrusion



Figure 5: 3D filament

20938 | Photo-assisted production of hydrogen using graphitic carbon nitride immobilized on a 3D printed structure

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Abstract

The future requires clean energy solutions using natural renewable resources to face the increasing demand and the depletion of fossil fuels (petroleum and natural gas). In this context, photocatalytic reforming of biomass is an effective strategy to produce sustainable hydrogen (H_2) as an energy carrier. Among the optical semiconductors applied in the field of photocatalysis, graphitic carbon nitride (g-C₃N₄) has revealed significant potential for water splitting using methanol as sacrificial agent [1].

In the present study, a g-C₃N₄ photocatalyst (here labeled as GCN-T) was synthesized by thermal polymerization of dicyandiamide. The GCN-T was impregnated with a platinum (Pt), which works as co-catalyst for photocatalytic H₂ production. Aiming at a technological approach, the Pt/GCN-T photocatalyst was immobilized on a 3D printed structure and tested to produce H₂ under visible light irradiation. The efficiency of the Pt/GCN-T photocatalyst (powder and immobilized) was investigated using methanol and glucose as sacrificial agents.

An increased performance for photocatalytic production of H_2 was observed using glucose as sacrificial agent, comparing with the results when methanol was employed (Fig. 1). In addition, the use of immobilized Pt/GCN-T photocatalyst showed comparable efficiency with the results obtained using slurry reactions. This result appears as a good solution to avoid the need for additional reaction separation steps. In addition, the possibility of using photocatalytic reforming of biomass makes this reaction system a promising solution for H_2 production.

Keywords: photocatalysis; graphitic carbon nitrite; hydrogen; biomass; immobilized photocatalyst.

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References

[1] Tan, Hao et al., Catalyst Communications, ChemSusChem 55 (2019) 12503-12506.



Figure 1: Total photocatalytic H_2 production from 0.02 M solutions of methanol and glucose using powder and immobilized Pt/GCN-T.

20980 | Vulnerability of biopolymer-matrix composites to environmental factors

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Abstract

As our society moves towards more sustainable material solutions, we see a shift towards the growing use of biopolymer-matrix composites. These are vulnerable to several environmental factors which act differently according to the type of matrix. This study, based on the published studies in the last ten years on Scopus, verses on the most relevant biopolymers today: poly-lactic acid, thermoplastic starch and polyhydroxyalkanoates. Herein we analyse the effects of water uptake on the macromolecular level, stiffening the matrix, if below the freezing temperature, and plasticising it, if above the glass transition temperature, eventually resulting in hydrolysis, which occurs at the filler-matrix interface for composites, e.g., in PLA/TiO2 composites tested at 37 ºC over one year. Seawater is shown to induce complex effects beyond simple hydrolysis, particularly for PHB samples, mostly degraded due to surface erosion with a weight loss of up to 60% after 35 days in tropical waters. Another study indicates, for PLA, a negligible mass loss in fresh and seawater over 365 days and reports a mass loss of PHB as much as 8% over the same period in the same testing conditions. The microbial and enzymatic degradation are responsible for metabolising some polymers and natural fillers, leading to a change in their structure/composition. The obtained products accelerate the loss of integrity, which is particularly relevant for natural fibres and/or biodegradable composites, e.g., those with PLA and TPS matrices, especially under tensile fatigue/creep loads, that increase the exposed area. Specifically, TPS is reported to fully disintegrate over 30 days of soil burial at 30 °C; however contrasting results are found in the literature. Driven by sustainability concerns, biopolymers have been gaining relevance in engineering applications, and further work is still required to assess the effects of the environmental factors discussed.

Keywords: polymer-matrix composites, environmental fatigue, creep, water absorption, seawater, microbial degradation, enzymatic degradation, UV damage, temperature, PLA, PHA, PHB, TPS, starch

20998 | Life cycle assessment of a seamless piece of clothing from a Portuguese textile company

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Abstract

The need to move towards more sustainable development requires advances in improved production methods, with lower environmental impacts on a Life Cycle Thinking, LCT, perspective. Due to its relevance to human life and global economic importance, especially on a Portuguese scale, the textiles industry has an important role to play in the transition to more sustainable forms of production. Yet, the sector still has a long way to go to improve its sustainability performance.

An evaluation of the current state of affairs is necessary, in order to identify what is the best course of action. Hence, in the framework of an IJUP 2021 project, the environmental impacts of a seamless textile piece of clothing were evaluated using the Life Cycle Assessment, LCA, methodology. Seamless textile clothing are innovative articles, easier to produce when compared to existing pieces, as they do not have seams, requiring less materials and less process operations. A "cradle-to-gate" was done, following the guidelines defined in the ISO 14040 and 14044 standards. Data from the industrial operation were used as much as possible, complemented with data from the literature and life cycle inventory databases, as far as possible for the Portuguese and European conditions. The Higg index webtool was used in this work, for the environmental impact assessment, and the results were compared with those obtained using the SimaPro software V8.5.2. The same environmental impact categories and calculation methodologies were used to allow for the comparison of both tools. The results allowed the identification of main environmental hotspots, and to suggest measures to improve the process environmental performance, and to conclude about the Higg index accuracy.

Keywords: Environmental Impacts; Higg Index; Life Cycle Assessment; LCA; Seamless textile.

21002 | Life cycle assessment of a nightwear apparel

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Abstract

The textile and fashion sector are among the most relevant industrial sectors in the EU in terms of employment and added value created. Due to its intensive consumption of materials, chemicals and energy, and the generation of significant amounts of waste and emissions throughout the supply chain, significant environmental impacts result from the activities of the textile industry. Thus, the European Union has defined a specific strategy to improve this sector sustainability, considering all the steps of the supply chain and the life cycle of the products manufactured by the sector.

At the company level this implies the need to assess the environmental impacts of their products on a Life Cycle Thinking, LCT, perspective. Hence, in the framework of an IJUP 2021 project the environmental impacts of a nightwear apparel were evaluated using the Life Cycle Assessment, LCA, methodology. The framework defined in the ISO 14040 and 14044 standards was used, on a "cradle-to-gate" approach. Inventory data was obtained from the company, complemented with data from the literature and life cycle inventory databases, for Portuguese and European conditions as much as possible. In this work the Higg index webtool was used for the environmental impact assessment, and the results were compared with those obtained using the SimaPro software V8.5.2. The same environmental impact categories and calculation methodologies were used to allow for the comparison of both tools. The results allowed to identify the main environmental critical points, and to suggest measures to improve the environmental performance of the process and conclude on the accuracy of the Higg index.

Keywords: Environmental Impacts; Higg Index; Life Cycle Assessment; LCA; Nightwear clothing.

21017 | 3D-printing of magnetic particles containing hydrogels for smart drug release combined with cancer phototherapy

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Abstract

Skin cancer represents the most common form of malignancy in Caucasians and its global burden continues to rise. Conventional techniques include surgery and chemo or radiation therapy. While surgery may not be able to completely remove all cancer cells in the human body, chemotherapy and radiation therapy suffer from limited specificity to cancer cells causing severe toxic side effects to normal tissues.

Phototherapy induces either chemical or thermal damage to a localized target region, when in the presence of light, through photodynamic or photothermal therapy, respectively. Phototherapy is a minimal invasive technique that avoids damages to the surrounding tissues, usually present in conventional cancer treatments. Nanoparticles have been widely studied as drug delivery vehicles and their characteristics including unique radiation absorbance, high surface area, and conductivity properties, contribute to their high potential in the biomedical field.

Graphene nanoparticles (G) were magnetized with iron, producing magnetic graphene (@G) with an average particle size of 379.5 nm, and a saturation magnetization of 59.6 emu/g. @G particles were incorporated in a hydrogel - H, and scaffolds were produced. Printed @G-H scaffolds present magnetic properties and ability of NIR light-heat conversion. Preliminary cytotoxicity tests give an indication that the material is not cytotoxic.

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Keywords: Cancer; Bioprinting; Nanoparticles; Hydrogels; Phototherapy; Drug delivery.

References

[1] Amaral SI et al. Carbon nanomaterials for phototherapy of cancer and microbial infections. Carbon 2022, 190, 244.

21053 | Optimization of dissimilar single-lap joints bonding multimaterial adherends with thermal residual stresses

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Abstract

Adhesive bonding is increasingly popular in aeronautics for its flexibility in design, vibration damping, and ability to join dissimilar materials. Composite materials are widely used due to their strength, stiffness-to-density ratios, and superior properties. However, delamination is a common failure in carbon-fibre-reinforced polymer (CFRP) single lap joints due to high peel stresses. To address this issue, Fibre Metal Laminates (FML) are often used in order to prevent delamination and increase peel strength in CFRP joints. In particular, incorporating aluminium layers in symmetric and asymmetric configurations has been studied to yield a 35% increase in joint strength relative to conventional CFRP joints [1]

This study investigates the effects of residual stresses resulting from coefficients of thermal expansion mismatch on bonded joints, particularly in multimaterial adherends. It seeks to leverage these stresses to improve joint performance, taking into account geometry, thickness, and material selection through numerical simulations, finite element analysis, and experimental validation. The study proposes using FMLs with CFRP and aluminium substrates to enhance joint strength and failure mode. Curved aluminium substrates with a gradual increase in adhesive thickness towards the overlap region were assessed, yielding a noticeable increase in ductility and joint energy compared to the planar configuration. Hence, this approach was extended to encompass both CFRP and dissimilar CFRP-AI materials, with the expectation of a similar trend. Hybrid joints employing curved adherends can benefit from the homogenization of stresses facilitated by the inclusion of aluminium sheets and the compressive thermal stress state induced by the curing process. The combination of both effects is expected to prevent joint delamination and confer greater joint strength.

Keywords: Adhesive Bounding, Fibre Metal Laminates, Residual Thermal Stresses

Acknowledgments

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References

[1] Simões, B.D.; Nunes, P.D.P.; Ramezani, F.; Carbas, R.J.C.; Marques, E.A.S.; da Silva, L.F.M. Experimental and Numerical Study of Thermal Residual Stresses on Multimaterial Adherends in Single-Lap Joints. Materials 2022, 15, 8541. https://doi.org/10.3390/ma15238541

21054 | Mechanical characterization of a novel silane based polyurethane hybrid flexible adhesive

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Abstract

The need for a more sustainable adhesive formulations has enabled the use of silane-based adhesives in different sectors, such as the automotive industry. In this work, a novel 2K adhesive which joins silylated polyurethane resin (SPUR) with standard epoxy resin was mechanically characterized. The novel structural adhesive allows for composite and plastic bonding. The characterization process was started with tensile bulk tests, conducted to determine the stress-strain curve data which provided the Young's modulus, ultimate tensile strength and maximum strain to failure. The results displayed a 45% of elongation and a maximum tensile strength of 4.2 [MPa]. This was followed by the thick adherent shear test (TAST) which allowed to determine the shear stiffness and strength. It was reached a shear value of about 1.4 times of the tensile strength. The adhesive showed adequate shear properties when benchmarked to other polyurethanes, joining a lower tensile and shear elongation. Both tests were support by digital image correlation (DIC) approach, allowing to withdraw the bidimensional strain field.

For the fracture mechanics approach, the double-cantilever beam (DCB) and the end-notched flexure (ENF) tests were performed to respectively acquire the value of the first and second fracture toughness pure modes. A relatively low critical energy release rate was withdrawn for the first mode test. Final characterization results were benchmarked with other semi-structural adhesives as well as silicones and polyurethanes in the market in order to analyse the feasibility of introducing the novel adhesive into a suitable industry.

Keywords: SPUR; Silane Adhesive; Polyurethane; Adhesive characterization.

Acknowledgments

The authors gratefully acknowledge the Portuguese Foundation for Science and Technology (FCT) for supporting the work presented.

21062 | Characterisation of the antibacterial behaviour of Cu-alloyed cast stainless steels with ageing treatment

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Abstract

One of the best materials for situations where general corrosion resistance is crucial to service performance is austenitic stainless steel (ASS). This distinctive property, together with other exceptional qualities, including mechanical strength, toughness, conformability, and weldability, have encouraged the widespread usage of this material in a wide range of industrial sectors like the medical and food processing industries. A need for materials with antibacterial behaviour has arisen because of growing health, safety, and sanitation concerns. Due to their high strength, good creep, and corrosion resistance, Cu-bearing antibacterial stainless steels have drawn growingly attention in recent years. The right amount of Cu addition and the adequate heat treatment result in outstanding antibacterial characteristics. Cu precipitates on the ASS passive film, and the precipitates produce ions that capture electrons from bacteria, resulting in their killing [1-3].

In this study, AISI 304 ASS with 3.5% Cu and AISI 316L ASS with 2.0% Cu were subjected to a solution heat treatment followed by an ageing treatment at 750 °C for 0.5, 1 and 2 hours, respectively. Furthermore, assessed was the antibacterial activity of specimens not aged. S. aureus ATCC 49230 was chosen for the bacterial testing, and before each experiment, bacteria were grown in TSB for 24 hours at 37 °C and 150 rpm. Fresh TSB was used to prepare the initial suspensions, containing 1 105 Colony-Forming Units (CFU) mL⁻¹. The growth of planktonic bacteria was examined after 1, 3, and 6 hours of incubation, and the adhesion and proliferation of bacteria (sessile populations) after 6 and 24 hours.

The findings demonstrated that the 304 ASS and 316L ASS alloyed with Cu had an ageing treatment that improved their antibacterial resistance, which is explained by Cu precipitation. For 304 ASS and 316L ASS, respectively, antibacterial rates of 99.67% and 99.99% were reached after 0.5 hours of ageing and 6 hours of incubation.

References

[1] I.T. Hong; C.H. Koo; *Materials Science and Engineering A*, **2021**, 805, 140571.
[2] T. Xi; M.B. Shahzad; D. Xu; Z. Sun; J. Zhao; C. Yang; M. Qi; K. Yang; *Materials Science and Engineering C*, **2017**, 71, 1079-1085

[3] L. Ren; L. Nan; K. Yang; Materials and Design, 2011, 32, 2374-2379

21095 | Mitigation and treatment of acid mine drainage using GEOTUBE® technology

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Abstract

Acid Mine Drainage (AMD), present in many mining areas (both active and abandoned mines), especially in sulphidic metallogenic provinces, constitutes a serious environmental hazard. This type of liquid effluents requires an effective treatment, capable of neutralizing its low pH, precipitating the content of dissolved heavy metals and then retaining and dewatering the precipitates. In order to reduce the volume of sludge produced and the costs associated with its management, it is necessary to remove the water from the solid material in suspension. This process will be done by dewatering geotextile tubes, namely the Geotube[®].

The present study aims to investigate efficient, economic and eco-friendly solutions for the treatment of AMD. To achieve this goal, two geologically and geographically distinct sites were selected for collecting AMD samples, one from the Neves Corvo copper and zinc mine, and another from the deactivated Midões coal mine, located in the south and north of Portugal, respectively.

As neutralizing solution, it was selected sodium hydroxide (1M and 2M). Preliminary results for the Neves Corvo drainage increased pH level from 2.9 to 4.9. The neutralization tests results caused the precipitation of metallic ions in the solution (Fe, Zn, and Cu). It was also possible to recover the precipitated metals after dewatering process by Geotube[®], which totalled 8.42 g in 500 mL of AMD neutralized by 50 mL of NaOH (2M) solution. In the case of Midões neutralizing tests, pH level went from 3.7 to 12.9 with the same conditions, denoting this drainage requires a lower consumption of neutralizing agent.

The experimental work is still ongoing testing alternative neutralizing agents, such as lime and steel slag, which are more economical, and in line with the principles of circular economy and waste valorisation.

Keywords: Acid Mine Drainage, neutralization, Mine, precipitation, pH, heavy metals, cooper, zinc Iron, Geotube[®], sludge, dewatering, geotextile tubes,

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The authors would like to thank Geosin for their collaboration and for making available samples of geosynthetic materials.

21099 | Production of composite coatings by laser cladding using WC Powder and Inconel 625 Wire: Response surface methodology optimization

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Abstract

Many engineering components require the improvement of surface properties to achieve specific application requirements: wear and corrosion protection, electrical insulation, thermal insulation, etc. One common approach to improving surface properties is the addition of coatings to the component's surface. Laser cladding (LC) is an advanced technology for surface modification where substrate and coating (typically powder or wire used as coating feedstock material) are bonded metallurgically. It is an industrial technology recognized and widely applied to coat.

In this work, specimens with claddings resulting from the simultaneous feeding of Inconel 625 wire and WC powder were produced. The simultaneous processing of powder and wire aims to combine the high deposition rates associated with high-power cladding with the net 100% deposition efficiency characteristic of wire deposition. This system allows *in situ* metal matrix composite production without employing cored wires. The influence of selected LC process parameters (inputs: laser power and feed rate) and in the track geometry and dilution (outputs) were evaluated via Response Surface Plots and regression analysis equations. Mechanical and microstructural characterization was accessed for the optimal condition: Optical Microscopy, SEM/EDS analysis, and Vickers hardness. The clads microstructure consists of a matrix of Inconel with dispersed tungsten carbides (WC). The distribution of WC on the Inconel matrix depends on LC parameters; increasing energy input leads to more tungsten carbide dissolution. Secondary carbides and hard phases were identified by SEM/EDS analysis: Cr₂₃C₆, WC₂, and TCP phase. The average hardness reached on clad samples was (758±94) HV10. This is the first in-depth metallurgical evaluation of a simultaneous wire/powder deposition. Further optimization loops and tests (specially wear test) are planned.

Keywords: laser cladding; coating; metal matrix composites; optimization.

21114 | Data reconstruction for fisheries analysis

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Abstract

Fishery analysis plays a critical role in maintaining the long-term sustainability of fisheries, which is important not only for the health of fish populations, but also for the livelihoods of millions of people who depend on fishing for their food and income. Specially, the metier used in fishing can have a significant impact on the evolution of the species since different fishing techniques can selectively target specific species or populations of fish, which can lead to changes in the genetic makeup of the targeted population over time.

The current project focuses on reconstructing information about metier used for fishery that lacks in surveys collected by OKEANOS, over the years, in order to have a complete information for fishery analysis.

For this study, a model was developed considering the 13955 fishing discharges in the data set and the 12 variables considered relevant. The data was cleaned, analysed, and prepared to test different machine learning models and parameters together with feature engineering, allied to time windows methods. Also, a study of the model's probability was made, and a combination of models was performed.

The study resulted in two principal models: one with a better general accuracy and the other one with better accuracy per classification. Both models showed to represent the data well and the results were consistent over the time. Furthermore, it was possible to understand how the species are distributed between the metiers over the years and which ones become more relevant to the fishery.

Keywords: machine learning; fishery; data analysis.

Acknowledgments

The author thanks the support given by INESCTEC during the initial part of the project.

21121 | Imbalanced multi class classification with concept drift

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Abstract

As our digital universe grows so does the amount of data. This data can arrive in a constant stream, making it unrealistic to fit it all into a machine's memory. To avoid this problem, machine learning (ML) models are trained incrementally through continuous updates or using only the most recent batches of data.

However, data may be more prevalent towards a particular class, hindering the predictive potential of ML models. The characteristics of the data may also change over time which means that the models become increasingly inappropriate as these changes occur.

These problems have been thoroughly studied in binary class scenarios. However, only a few studies tackle them in a multiclass setting which we will focus and try to improve.

To achieve this, we propose a system that employs a Dynamic Ensemble Selection method alongside the state of the art for each of the aforementioned problems. Some of these methods will be adapted through binarization into a multiclass method, since they are only suitable for binary class scenarios.

The system first checks for the presence of a concept drift whenever a new data batch *i* arrives. If a concept drift occurred, it checks if this is the first time a drift with these characteristics has occurred. If it is, it trains all models with data batch *i*-1 and selects the best one, storing the drift's characteristics in case a similar drift occurs again. After all these steps, or in case no drift is detected, the model selected by the system is used to predict on data batch *i*. Therefore, the proposed system provides mechanisms to continuously adapt to the characteristics of the data, ensuring the best overall performance for the different multiclass ML tasks.

Keywords: concept drift, dynamic classifier selection, imbalance classification, multiclass classification.



Figure 1: Proposed methodology

21122 | The effect of graphene-based composites on the inhibition of single- and multispecies biofilms by uropathogenic bacteria

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Abstract

Urinary catheters (UCs) are the most common medical devices used in hospitals and healthcare facilities to treat and mitigate several clinical conditions. However, their use is associated with serious complications, including the occurrence of urinary tract infections, which are mainly caused by bacterial adhesion and biofilm formation on UCs surfaces. Due to their physicochemical properties and antimicrobial activity, graphene has been broadly applied in the biomedical field. Therefore, this study aimed to investigate the antibiofilm performance of nitrogen-functionalized graphene nanoplatelets (GNP) composites for application as coatings for urinary catheters. For this purpose, GNP were functionalized with nitrogen groups (N-GNP) using melamine as a nitrogen precursor and incorporated at 1 wt % into a polydimethylsiloxane (PDMS) matrix. The performance of the N-GNP/PDMS composites was tested against single- and multi-species biofilms of Staphylococcus aureus (SH1000 expressing GFP), Pseudomonas aeruginosa (PO1 expressing mCherry), and Klebsiella pneumoniae (ATCC 13883) (the most common causative agents of UTIs) under conditions prevailing in urinary tract devices. Biofilm formation was assessed by determining the number of total cells through flow cytometry, and by counting the number of colony-forming units (CFU) using selective culture media. Biofilm analysis revealed that, in single-species biofilms, the 1 wt % N-GNP/PDMS composite was able to reduce the number of S. aureus, P. aeruginosa, and K. pneumoniae cells by 65, 42, and 36%, respectively. Also, this composite decreased the biofilm culturability by up to 50%. In contrast, tri-species biofilms seemed to be less susceptible to the antimicrobial activity of the synthesized composite. Overall, N-GNP/PDMS composites inhibited biofilm development by uropathogenic bacteria, showing the potential of these carbon materials as coatings for urinary catheters.

Keywords: Urinary catheters; Carbon materials; Antibiofilm activity; Engineered surfaces.

Acknowledgments

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21161 | Analysis of cardiac and respiratory signals in the detection of neonatal sepsis

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Abstract

Neonatal sepsis is a generalized infection that affects around 3,000,000 newborns annually, with a high mortality rate. Neonatal sepsis manifests in several nonspecific symptoms, making it harder to diagnose, sometimes resulting in a late inefficient, and ineffective treatment. Therefore, neonatal sepsis is a significant concern to the World Health Organization due to its high mortality rate and increased antibiotic resistance when the prevention antibiotics are administrated.

An early diagnosis is crucial for effective treatment. However, the currently used methods lack specificity, are invasive, and are time-consuming. Artificial intelligence-based algorithms have been recently explored as a method of diagnosis. In particular, Digi-NewB, a European project, collected and used data regarding physiological signals, video, and clinical observations of newborns to create a monitoring system for sepsis risk analysis.

The main goal of this work is to explore and study the dynamics of two physiological signals: heart (HR) and respiratory rate (RR), in neonatal sepsis detection. This study probes complexity measures like entropy, compression, mutual information (MI), and normalized compression distance (NCD). The data used belongs to the Digi-NewB project.

The Bubble, Distribution, and Permutation entropies for the traces of the infected babies showed some decreases near the diagnostic in the complexity of both HR and RR. The Fuzzy and Conditional entropy of the HR had clearer complexity increases close to the diagnosis time for some subjects. The results for the compression rate were better for the RR, presenting a sharp decrease for some babies.

Furthermore, in the bivariate measures, such as MI and NCD, several subjects had evident shifts in complexity.

Future studies should compare these results with the values obtained using traces from healthy babies.

Keywords: complexity measures, heart rate, respiratory rate, classification, neonatal sepsis.

21257 | Magnetic hyperthermia studies in tumour cell applications

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Abstract

The case under study involves the use of magnetic nanoparticles in magnetic hyperthermia, which is the application of an alternating magnetic field to particles that produce heat that could be used, for example, to remove cancer cells. This is a promising method in medical tumour research as, in addition to being non-toxic, it has the advantage that the particles target only the tumour cells and don't damage the surrounding healthy cells. ^[1] One of the goals of this work is to produce magnetic nanoparticles (MNPs) that are viable for use in a medical treatment context. ^[2]

The method used to obtain magnetic nanoparticles was the coprecipitation method, which consists in the reaction of Fe²⁺ and Fe³⁺ salts in the presence of an alkaline solution, under an inert atmosphere. One advantage of this method is the ability to produce a high number of MNPs. On the other hand, the size control during the synthesis is extremely limited and the fact that they agglomerate easily due to the magnetic forces between them, makes their production difficult. ^[3] The use of surfactants, such as PEG and citric acid, may prevent their agglomeration as they surround the nanoparticles, creating a film.

To quantitatively evaluate the synthesized MNPs, a magnetic hyperthermia system was used that creates an alternating magnetic field through a resonant circuit, which causes the nanoparticles to heat up. This heating is then measured and acquired by a data acquisition program that registers the variation of the temperature over time.

One parameter evaluated is the specific absorption rate (SAR), which measures the power dissipated per gram of nanoparticle.

More specifically, we can analyse through all the data obtained that the use of citric acid in the coprecipitation as a coating led to an increase in the performance of the particles, not only because it solved the problem of agglomeration, but also because they reach the desirable temperature and optimal SAR values, which didn't happen with the PEG coated particles.

Keywords: Magnetic hyperthermia, Magnetic nanoparticles, Coprecipitation, Cubic nanoparticles, Heating rate

Acknowledgments

I would like to thank all the people who helped me carry out this internship and this report, in particular Professor Domingos Barbosa and Eng. Teresa Castelo-Grande for all the help provided throughout the execution of work. Also, to Professor Paulo Augusto and Lobinho Gomes for helping in the work when needed.

References

[1] Liu X, Zhang Y, Wang Y, et al. Comprehensive understanding of magnetic hyperthermia for improving antitumor therapeutic efficacy. Theranostics. 2020;10(8):3793-3815. Published 2020 Feb 19. doi:10.7150/thno.40805

[2] Dimitri Stanicki, Luce Vander Elst, Robert N Muller, Sophie Laurent, Synthesis and processing of magnetic nanoparticles, Current Opinion in Chemical Engineering, Volume 8,2015

[3] Emir Baki Denkbaş, Cem Bayram, in Nanobiomaterials in Drug Delivery, 2016



ENVIRONMENTAL SCIENCES



20395 | Life cycle assessment of a product from the textile industry

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Abstract

The textile industry is one of the oldest and currently among the largest and most polluting industries in the world. Therefore, it's relevant to assess the environmental consequences inherent of the textile production, in order to improve its environmental performance. When it comes to Life Cycle Assessment (LCA), there are few studies related with textile products, especially underwear. Hence, the present study contributes to fill this gap, by carrying out a LCA of a men's boxer, made in Portugal.

A "cradle-to-gate" approach was considered and the environmental impact assessment was done using the SimaPro software V8.5.2, with five environmental impact categories being studied: climate change (CC), eutrophication (ET), abiotic depletion - fossil fuels (AD), water use (WU) and freshwater ecotoxicity (FE). The results obtained with SimaPro were compared with those obtained using the webtool Higg Index. The environmental impact assessment results show that production and spinning of organic cotton are the most significant stages of boxer's production, followed by the dyeing process. The Higg Index presented results three times higher than those obtained with SimaPro in the CC and AD categories. Then, three scenarios were analysed considering different percentages of renewable energy.

Results show that a large percentage (45%) of the product's environmental impacts is related with processes that occur upstream of production itself, in this case the organic cotton production. Regarding the Higg Index, results show that the webtool is helpful in providing textile companies with reasonable estimates of the environmental impacts, but it is not the most accurate tool for developing an LCA study of a textile product.

Keywords: Environmental Impacts; Higg Index; Life Cycle Assessment; LCA; Men's boxer short.

20459 | Physical and chemical characterization of the calcium difluoride sludge heap from a phosphate processing plant (NORM site)

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Abstract

The site under study, the NORM site, is a deposition site for calcium fluoride sludge derived from phosphate processing and partially covered by vegetation. The site was contaminated between 1930 and 1979, making it a key site for studying the mobility of specific radionuclides (U238, Ra226, Po210, Pb210) and their effects on vegetation.

The planned characterization work was based on i) particle size analysis; ii) elemental chemical composition by X-ray fluorescence; iii) concentration for K40, Th232 and Ra226. Acid generation prediction tests (NAG test), natural leaching tests, and pH determination of the waste were performed. Distribution coefficients for K40, Th232 and Ra226 were also determined. The results show clear differences between contaminated and non-contaminated samples. There are also evidences of radionuclides mobility with the depth.

Keywords: NORM, radionuclides, calcium fluoride, sludge, phosphate processing, soil contamination

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20472 | Ecotoxicological evaluation of bioinsecticide spinosad in a non-target species *Danio rerio*

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Abstract

Synthetic pesticides might be responsible for negative impacts on ecosystems, eventually causing insecticide resistance, soil and water contamination, and potential impacts on non-target organisms. Thus, it is necessary to search for more environmentally friendly alternatives to replace synthetic pesticides. Biopesticides are biologically based pesticides, made from natural resources. Spinosad, is a natural product originated from the fermentation of an actinomyces bacterium Saccharopolyspora spinose, and is the active substance of a bioinsecticide (commercial formulation: Spintor[®]), already implemented on the market for fruit pest control, as a sustainable alternative to conventional pesticides. This study aims to evaluate the ecotoxicological effects of spinosad on the model organism zebrafish. For that purpose, zebrafish were acutely exposed to a range of spinosad concentrations (0.07 - 1.00 mg/L), based on already determined acute toxicity values (e.g. mortality), environmentally predicted concentrations, and recommended dosage (500 μ g/L) for field interventions against the insect development. The evaluation of the effects of the biopesticide was conducted through quantified of the biomarkers of oxidative stress, lipid peroxidation, energetic reserves, and neurotransmission, in the exposed organisms. Significant alterations were observed in the antioxidant enzymes (increase in SOD activity and decrease in CAT and GRed activities), lipids reserves (decrease in lipids content), neurotransmission (inhibition of AChE activity), and enzymatic pathways of energy production (increase in LDH activity). The here-presented biochemical results showed significant perturbations (oxidative stress, disruption in the energy pathways, and neurotoxicity) can occur due to Spinosad exposure, showing potential risks for non-target organisms. In conclusion, spinosad revealed high toxicity risk to non-target species even at the recommended dosage in field applications.

20482 | Study of the effectiveness of two amendments in mitigating the availability of Cu in viticulture soil

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Abstract

Copper-based fungicides have been used in grapevines for decades, for the treatment and control of downy mildew. This resulted in an emerging concern about soil contamination with this metal through vines phytosanitary treatments and the contamination of adjacent ecosystems.

This study was carried to test the effectiveness of two soil amendments, in reducing the concentration of available Cu in a vineyard soil, as well in improving the physicochemical properties of the soil.

For this purpose, it was selected a vineyard from the "Região dos Vinhos Verdes" (Barcelos, Portugal). The soil was collected, dried and sieved (<4 mm) and then incubated with Cu for four weeks, using the Bordeaux mixture as the source.

The Cu concentrations used for laboratory contamination of the soil were based on previous studies conducted by our research team: 72, 111, 173, 268 and 416 mg/kg.

After the incubation, the amendments, crushed pine bark and mussel shell, were added at a concentration of 3g/kg each and left for incubation for four weeks. The amendments were tested separately, to evaluate the role of each one in the sequestration of Cu. Previous studies have shown that both amendments have the potential of being an effective Cu biosorbent.

Four ecotoxicological tests were carried, following standard protocols. Two of them were direct toxicity tests with terrestrial organisms, the reproduction test with oligochaetes (*Eisenia fetida*) and the plant emergence and growth test using the *Medicago sativa* plant.

The other two were performed with aquatic species, to evaluate soil elutriates, obtained for each sample. These were the growth inhibition of *Lemna minor* and the bioluminescence inhibition assays with the bacterium *Allivibrio fischeri*, the *Microtox*TM assay.

The possible positive results in decreasing the vulnerability of this soil to Cu, is related with the amendments in changing important characteristics of the soil (pH and organic matter content) that may account to decrease Cu mobility.

Keywords: Copper-based fungicides, Ecotoxicological assays, soil amendments.

20483 | Impact of deadwood structures on the biodiversity of forest areas

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Abstract

Forests are one of the most distributed ecosystems in the world, occupying about 30.6% of the earth's surface, and are one of the terrestrial ecosystems that harbor a greater number of species. The importance of studying the influence of dead wood in forest areas is based on the functions that these ecological features assume in ecosystems, namely as a refuge for endless species, for feeding, reproduction, and nesting, but also for maintaining nutrient cycles, carbon fixation, and soil preservation.

Deadwood corresponds to dead trees, dry branches, and decaying roots. Saproxylic organisms are those that need deadwood at some point in the life cycle, and comprise mainly fungi and insects, corresponding to about 30% of the world's forest biodiversity. During decay, dead wood changes physically and chemically, undergoing changes in its structure and quality. It is therefore colonized by different species throughout its decay. With the biodiversity decline in forest areas, and with a dominant economic and commercial forest management focus in Portugal, there is an increased need to study and better understand the role of deadwood in forest ecosystems. This is more relevant in Portugal, since it is the second European country with less dead wood in its forests.

The first objective of this study is to develop a methodology for the selection of data, considering the most important microhabitats, species of flora and fauna. This data set will include the dimensions, the predominant species, the cause of their death, their state of decomposition, the solar exposure and the microhabitats present. The second objective will be to analyse the data collected in the field, to understand how the different characteristics of different types of deadwood structures influence the amount and type of biodiversity we can find. The work will be developed from February to May in forest areas in the of Lousada, in cooperation with VERDE, an Association for the Integrated Conservation of Nature.

Keywords: Deadwood; biodiversity; Conservation.

20488 | SHS - Soil health surrounding former mining areas: characterization, risk analysis, and intervention II

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Abstract

The SHS (Soil Health Surrounding Former Mining Areas: Characterization, Risk Analysis and Intervention) research project's main objective is to identify the environmental impacts resulting from mining, focusing on the Ribeiro da Serra mine, in Gondomar.

The waste resulting from the exploration and extraction of gold (Au) and antimony (Sb) was deposited in open-air, in heaps near the mine, raising the probability of possible contamination of the surrounding environment, mainly for soil and water bodies.

In order to find an environment remediation solution, a physical, chemical and environmental characterization of the soil collected in the mine was conducted. The characterization tasks included: the soil pH measurement, soil density, moisture, soil porosity and particle size analysis by sieving and laser X-ray diffraction. The soil pH values were within the acid values, between 4 and 5. The soil, in most samples, consisted mainly of gravel, having a percentage between 50 % and 70 %, and the percentage of clay was approximately 0%. Soil density was on average 800 kg/m3, porosity was approximately 0.33 and, finally, humidity was 4.42%.

Keywords: Antimony, gold, environmental characterization, environmental contamination, heap, mining legacy, mine wastes

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20509 | Marine micro-debris ingestion and biological effects in wild fish (*Trisopterus luscus*) from the North East Atlantic Ocean

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Abstract

The contamination of wild fish populations by marine microplastics and other micro-debris with no nutritional value are of high concern. The goals of this study were to investigate the contamination of wild fish specimens (Trisopterus luscus) from Portuguese waters of the North East (NE) Atlantic Ocean by marine micro-debris (MMDs) and potential biomarker alterations. Fish (n = 53), obtained from the commercial fleet shortly after landing in the Matosinhos Port and aimed at human food consumption, were immediately transported to the laboratory, where they were measured and weighted. From each fish the whole gastrointestinal tract (GT) was isolated for MMD analysis, and a portion of the liver was isolated for biomarkers' determination. The MMDs recovered from GT samples were primary characterized (size, shape and colour) and quantified. The biomarkers determined in the liver were the lipid peroxidation (LPO) levels, and the activities of glutathione S-transferases (GST) and catalase (CAT). From the total number of fish, 51 % had MMDs in the GT, with sizes ranging from 29 to 3118 µm. The most common shape was fibre-like but fragments, pellet-like and film-like MMDs were also found. A variety of colours was found with brown and orange being the most common. Fish with MMDs in the GT had a significantly ($p \le 0.05$) higher activity of the hepatic enzymes CAT and GST compared to fish where no MMDs in the GT were found, and no significant differences (p > 0.05) in LPO levels between the two groups of fish were observed. These findings indicate that T. luscus specimens from Portuguese waters of the NE Atlantic Ocean ingest a variety of MMDs and suggest that the particles and/or the other chemicals that they generally contain are likely inducing hepatic oxidative stress. These findings also highlight the potential risks posed by MMDs to the sustainability of wild fish populations, marine biodiversity and ecosystem function, and human consumers of seafood, thus to 'One Health'.

Keywords: wild fish; marine litter; biomarkers; oxidative stress

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20520 | Valorisation of incinerator bottom ash and construction and demolition waste in geotechnical applications with geosynthetics

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Abstract

The transition to a circular economy requires the development of procedures for valuing the waste that is generated. When there are no recovery options available, waste is normally forwarded to incineration and/or landfill. Incineration is a process commonly used for the treatment of municipal solid waste. This process generates, in large quantities, a residue known as incinerator bottom ash (IBA). Another area responsible for the generation of waste in large quantities is construction and demolition activities. Construction and demolition waste (CDW) can have many different components, including concrete and mortar, glass, metals, ceramics, wood or plastics. These must be duly sorted and forwarded to different recovery actions.

One possibility for the valorisation of IBA and CDW is their use, as filling material, in geotechnical applications, e.g., in road infrastructure. In these applications, IBA and CDW may be in contact with geosynthetics (polymeric materials extensively used in civil engineering works for drainage, filtration, separation, protection, reinforcement or waterproofing). For the use of IBA and CDW in geotechnical works with geosynthetics, many requirements must be fulfilled, including: (1) IBA and CDW must have physical, mechanical and geotechnical properties compatible with those required for use as filling material; (2) IBA and CDW must not release harmful substances into the environment; and (3) IBA and CDW should not affect the short and long-term behaviour of geosynthetics. This work focused on evaluating the environmental impact of IBA and CDW through leachate chemical analysis, as well as the effect that IBA and CDW have on geosynthetics.

Keywords: Waste valorisation; incinerator bottom ash; construction and demolition waste; geosynthetics.

Acknowledgments

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20523 | Tannin extraction optimization: adding value to eucalyptus bark

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Abstract

Coagulation/flocculation is one of the most common methods used for chemical treatment of water/wastewater and industrial effluents. Conventional coagulants such as metal salts and synthetic polymers are typically employed, but research and practice associate their use with the production of a large volume of potentially toxic sludge, performance strongly affected by pH and high operating costs. To overcome these disadvantages, natural coagulants have been extensively researched as alternatives [1]. Tannin coagulants are attracting attention due to the precursor availability in a wide range of plant species and residues. Tannins are natural polyphenolic compounds with the potential to be converted into effective coagulants/flocculants [2]. In the present work, Eucalyptus globulus bark, a common residue from pulp and paper, and furniture industries, was used as a tannin source. Tannin extraction is the first step for coagulant production. Solid-liquid extraction (SLE) using water as solvent was optimized using Response Surface Methodology (RSM) coupled with Box-Behnken design. This methodology provides accurate information on the effect of variables on responses and enables to determine optimum conditions, while minimizing the required number of experimental trials [3]. RSM was used to determine how the extraction time, water-to-bark ratio, and temperature affect extraction performance. The extraction yield and extract quality (total phenolic content) were modeled as functions of the referred extraction conditions. Multi-response optimization was used to find the overall conditions that maximize combined responses. The optimum SLE conditions were determined as 20 min contact time, a liquid-to-solid ratio of 50 mL/g, and 90 °C. Using these operating variables, the model predicted an extraction yield of 13% and a total phenolic content of 163 mg of gallic acid equivalents per gram of extract.

Keywords: Tannin-based coagulants; water and wastewater treatment; sustainability; Response Surface Methodology.

Acknowledgments

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References

[1] I. T. Tomasi, C. A. Machado, R. A. R. Boaventura, C. M. S. Botelho, and S. C. R. Santos, "Tanninbased coagulants: Current development and prospects on synthesis and uses," *Science of the Total Environment*, 2022, doi: https://doi.org/10.1016/j.scitotenv.2022.153454.

[2] M. Fraga-Corral *et al.*, "Technological Application of Tannin-Based Extracts," *Molecules*, 2020, doi: <u>https://doi.org/10.3390/molecules25030614</u>.

[3] NIST/SEMATECH, *e-Handbook of Statistical Methods*. NIST/SEMATECH, 2012.

20588 | Major climate changes during key glacial terminations in the North Atlantic Region

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Abstract

Global warming and unprecedented increase in CO2 predicted for 2100 urgently calls for improved understanding of the climate system. Dry regions are becoming drier with high fire risk and prolonged fire seasons, while storms and floods are becoming more severe in regions exposed to extreme weather events. Glacial terminations are punctuated by abrupt climate shifts which occurred on time scales of millennial to a few centuries, and for that considered exceptional periods for testing the forecasted climate of next decades. The Hydroshifts project explores abrupt hydroclimate changes and aim to document the severity of these changes in highly vulnerable regions, in the North Atlantic, trying to understand the causes and mechanisms that lead to these climatic instabilities. This work aims to detect and document long-term trends and short-lived shifts in sea surface temperatures (SST) changes in the North Atlantic region during the last and previous glacial terminations (TI, TV and TVII). We propose the identification of the major cold episodes associated with meltwater pulses, and explore thermal contrast between key sites: mid-latitudes of the North Atlantic (SW Europe: D13882; IODP U1385, and the high latitudes of the North Atlantic (IODP U1314 and IODP U1308)). To reach these objectives, we plan to do a detailed characterization of temperature and circulation in the study area using current satellite images. The sea surface temperature (SST) profiles were reconstructed based on the relative composition of C37 unsaturated alkenones using a calibration equation obtained from sediment samples and annual average temperature of surface waters (Uk'37=0.033*SST+0.044; r2=0.96; n=370). The relative abundance of the C37:4 will be used to track episodes of massive cold freshwater input, allowing the detection of extreme cold episodes within TI, TV and TVII. This information allows policymakers to develop better strategies to mitigate future climate changes and abrupt hydroclimate shifts in the mid-latitudes of the North Atlantic.

Keywords: North Atlantic, Hydroclimate shifts, Sea Surface Temperature, Glacial terminations.
20656 | Phytotechnology implementation in marine and freshwater environments: case study of floating wetlands

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Abstract

Phytotechnologies are plant-based approaches that solve or complement the solution of environmental problems, by remediating soil, water, and air or restoring ecosystem services in managed landscapes. Floating treatment wetlands (FWIs) are examples of a phytotechnology, also named nature-based solution, that provides water treatment and management with low capital costs, high success rate, low maintenance requirement, and aesthetic nature when compared to conventional solutions. They also promote biodiversity and ecosystem establishment, enabling creation of habitat, nursery spot or as stepping stone. FWIs comprise a floating platform, colonized by selected plants and an anchoring system. The selection of the plant species is very important for the success of a full coverage system and also to assure a full development of a rooting system for phytoremediation purposes. In the present study 4 FWIs were implemented (with different floating materials: 2 of cork and 2 of hand-assembled recycled material), in order to compare the performance and their establishment in two environments: saline and freshwater. The saline environment was associated to a port marina and the freshwater environment to a pond. Selected plant species were considered for each environment. Monitoring of the system is being carried out along time concerning the associated biodiversity, plant establishment and floatability evaluation of the floating platforms. Based on the analysis of these results, this work hopes that these nature-based solutions can contribute to better water management, in order to involve the conservation and rehabilitation of natural ecosystems.

Keywords: Biotechnology; Ecosystem services; nature-based solutions.

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20660 | A Microview inside Leça's River

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Abstract

The presence of microplastics in aquatic ecosystems has been rising increasing in the last decades with a tendency to increase their accumulation. It's estimated that 80% of plastic pollution is transported by rivers to the sea, and the origin of this material is diverse and may originate from the degradation of larger plastic objects such as bottles, fishing nets, tire wear, synthetic clothing washing or even personal care products like exfoliants. The main impact of these particles on aquatic ecosystems is due to the fact that microplastics can accumulate persistent organic pollutants, which are harmful to the environment by interacting with organisms, as well as altering the abiotic characteristics of the aquatic ecosystems. Although microplastics have been recognized as an emerging pollutant, there is still no standardized protocol for the sampling, extraction, quantification, or treatment of an ecosystem affected by this type of pollution. This project aims to evaluate and categorize the presence of microplastics in the sediments and in the water column at the final section of the Leça's river. Four sampling sites were selected in the downstream area of the river: Lionesa (P1), Goimil (P2), Gatões (P3), and Guifões (P4). Sediment and water samples (1L) were collected at each sampling site. The sample collection will be carried out monthly for a year starting in January 2023. Microplastics were extracted from the water and sediment samples using two approaches: density difference by stirring with 36 g/L NaCl, and 10% KOH digestion followed by the density difference by stirring with 36 g/L NaCl. The microplastics will be classified in terms of size, color, shape, and chemical constitution applying the protocols of the OSPAR convention. From the data obtained, it will be possible to categorize the abundance of microplastics according to time and sampling sites, subsequently evaluating possible sources of this type of pollution in the hydrographic basin of Leça's river.

Keywords: microplastics, pollution, digestion, Leça's river, aquatic, sediment.

20714 | Integrated system for wastewater treatment: microalgae and constructed wetland

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Abstract

The use of microalgae and constructed wetlands in wastewater treatment has become an example of Nature-based solutions (NBS) applied to environmental sanitation. This study aims to obtain integrated and cohesive knowledge through the 1) evaluation of the performance of an integrated effluent treatment system, that combines microalgae with a horizontal subsurface flow constructed wetland, having an anaerobic pre-treatment, 2) evaluation of the macroinvertebrates associated to the constructed wetland in order to support the understanding of its functioning, and 3) energy recovery through biomass generated by microalgae and aquatic macrophytes in the production of bioenergy (Biogas) during the treatment process. The collection and identification of microalgae, as well as the macrophytes present in the substrate of the constructed wetland unit, during a defined period, will be carried out to analyse the system development such as technology features and sustainability in terms of operation. The expected results refer to the evaluation of the performance of the integrated microalgae system and constructed wetland unit in terms of pollutant removal; conversion of biomass generated into bioenergy, to verify the existing differences between conventional urban effluent treatment technologies and alternatives such as constructed wetlands. The innovative contributions of this project will increase the knowledge for the application of the integrated microalgae and wetland system built to wastewater, as well as its technological and economic potential for full-scale application. Poster presentation method.

Keywords: Water pollution, constructed wetland, microalgae, wastewater, biogas.

Acknowledgments

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20742 | Assessment of post-wildfire recovery of vegetation in soils inoculated with native microalgae and cyanobacteria

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Abstract

Fire regimes in southern European countries such as Portugal are changing, and the wildfires that naturally affect these ecosystems are increasing in severity and frequency. Therefore, developing possible solutions to mitigate the damages caused by wildfires in Portuguese forests is paramount. This was addressed in project GreenRehab, which aimed to identify, isolate, and test biocrusts composed of native microorganisms (microalgae and cyanobacteria) from a burnt area in Mortágua (Viseu, Portugal), with the potential to promote post-fire recovery.

In this study, we present results from the final phase of the project, aiming to evaluate vegetation recovery in the macrocosmos (*in situ*), especially when compared with the results obtained in microcosmos experiments (in the laboratory).

After applying prescribed fire, vegetation recovery was assessed in a 1.1 hectares area. Spectral readings were collected in 4 dates using a handheld spectrometer to assess 20 plots ($0.5m \times 0.5m$) – 10 of which were inoculated with the selected consortium of microorganisms. The remaining 10 were not inoculated, as controls. Furthermore, images were collected using a multispectral camera onboard an Unoccupied Aerial Vehicle (UAV). Spectral indices from both sources were used to evaluate fire severity in the study area and test for significant differences in vegetation and soil recovery between the inoculated and control groups.

Results highlight the ability of spectral measurements from the portable spectrometer and UAV to assess the effectiveness of post-fire soil rehabilitation treatments based on native microalgae and cyanobacteria. As well as contributions to post-fire soil stabilization and recovery are expected from the GreenRehab project.

Keywords: Vegetation recovery; native microorganisms.

Acknowledgments

The Project GreenRehab (ref. nº.: PCIF/RPG/0077/2017) was supported by national funds through the Foundation for Science and Technology (FCT).

20770 | Characterisation and inventory of the small water bodies in urban green areas of Vila Nova de Gaia Municipality

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Abstract

The global population growth and associated urban development promotes the destruction of natural areas, which are important habitats for numerous species. One solution to minimise the damage caused by the destruction of natural areas is the creation of green areas inside the cities. These areas provide multiple benefits such as, habitat for biodiversity, provisioning of ecosystem services and contributing to human physical and mental well-being. Many of these urban green areas have freshwater water bodies such as lakes, water tanks, ponds, puddles or fountains. Despite the different levels of relevance, they all contribute to the preservation of aquatic and water-dependent species. However, these habitats are highly threatened by anthropogenic activities and its biodiversity is unknown in many locations. Therefore, this project aims to map and characterise the water bodies located in urban gardens in Vila Nova de Gaia (Porto district) and catalogue the different species that are dependent on these types of habitats, such as aquatic plants, invertebrates and amphibians. In the end, the data collected about the species and the number, quality and threats of the water bodies, will be analysed to develop an action plan for the conservation of aquatic biodiversity in urban areas.

Keywords: Urban biodiversity; Conservation; anthropogenic impacts, freshwater bodies

20785 | Contamination of wild European hakes (*Merluccius merluccius*) from the North East Atlantic Ocean with marine micro-debris and biological responses

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Abstract

A diversity of wild marine fish has been found to be contaminated with microplastics and other micro-debris, together hereafter indicated as MMDs, but the knowledge on the biological effects that they may cause in real scenarios is still limited. This study investigates the potential biological responses in relation to MMDs contamination in wild fish (Merluccius merluccius) from the Portuguese waters of the North East (NE) Atlantic Ocean. Fifty fish were obtained from the commercial fishery fleet shortly after being landed at the Matosinhos Port. In the laboratory, from each fish, the whole gastrointestinal tract (GT) was isolated for MMDs analyses, and samples of gills and liver were collected for MMDs and biomarkers' analyses, namely lipid peroxidation (LPO) levels, and the activity of the anti-oxidant enzymes glutathione peroxidase (GPx) and catalase (CAT). Of the fish sampled, 50% had MMDs present in their GT, 50% in their liver and 46% in their gills. The size ranges of the MMDs were from 32 to 4784 μ m, 11 to 3212 μ m and 87 to 4011 μ m, respectively. Significant differences ($p \le 0.05$) in enzyme activities were found between fish with MMDS and fish without MMDs in both tissues for CAT, and only in the gills for GPx. No significant differences were observed in LPO levels between the two groups of fish. The findings of this study suggest oxidative stress in liver and gills of wild fish in relation to MMDS exposure, highlighting the importance of further research on this topic to increase 'One Health' protection.

Keywords: wild fish; biomarkers; marine litter; oxidative stress, European hake

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20813 | Assembly of a bacterial consortium for the biodegradation of PFAS and related subproducts

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Abstract

Per- and polyfluoroalkyl substances (PFAS) are man-made chemicals with wide application in consumer products since the 1950s. A recent revision of the PFAS definition has also introduced several polyfluorinated pharmaceuticals and agrochemicals into this class, further exacerbating the urgency of any PFAS-related pollution scenario. Their many favourable properties, including improved persistence and lipophilicity, has caused PFAS to be considered mobile pollutants with the capacity to accumulate in the environment for various decades. In fact, their increased presence in the aquatic environment has negative effects on the environment and human health, so it is of great importance to develop and improve remediation techniques to remove PFAS and other related subproducts from aquatic matrices.

This work aims to create a synthetic bacterial consortium and study its capacity to degrade different PFAS and/or their subproducts. To achieve this, different fluoroorganic-degrading bacterial strains are currently being screened. Among them, a fluoroaliphatic (*Delftia acidovorans* MFA5) and a fluoroaromatic-degrading strains (*Labrys portucalensis* F11) have already been preselected to be included in the consortium. Soon, when a final selection of prospective fluoroorganic-degrading strains is achieved, their co-cultivation compatibility will be investigated through growth inhibition tests (cross-streak and diffusion disc activity assays). Strains with favourable co-cultivation dynamics will then be assembled in a synthetic bacterial consortium and tested for its ability to degrade different PFAS (individually) and related subproducts, based on bacterial growth analysis and on defluorination efficiency.

This work will contribute to the ongoing effort of designing an efficient PFAS bioremediation unit to outfit a novel hybrid water treatment technology that combines nanophotocatalysis and bioremediation for the mitigation of PFAS aquatic pollution.

Keywords: Biodegradation, PFAS, Bacterial Consortium, Defluorination.

Acknowledgments

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20854 | A review study on microplastic and plastic-related chemicals in food and health impacts.

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Abstract

Microplastics (MPs) are formed by the disintegration of plastic fragments which can be through a combination of physical abrasion, UV-radiation, and microbiological degradation of the environment [1]. Plastic fragments <5mm are considered MPs, while <100nm are called nanoplastics (NPs). MPs and NPs together are referred to as micro(nano)plastics-MNPs [2].

Food safety is a growing concern given the rising MNPs contamination in the environment. They can be found in beverages, food additives, honey, drinks, and plastic food packaging. MPs have been already detected in human blood [3], the placenta [4], and breastmilk [5].

Studies with mammals and human cells or organoids have given perspective about the potential impact of MNPs on human health, affecting lungs, kidneys, heart, DNA, and neurological systems. Additionally, as plastics often contain additives or other substances, the potentially harmful effects of exposure to these must be also carefully studied before any conclusion can be drawn[6]. A review study was carried out about the state of the art of MNPs and plastic related chemicals in food and their potential impacts on human health. The expected impacts on human health are wide considering the reported studies. MPs can cause problems in organs, such as the lungs, kidneys, and heart, or even in more complex components such as DNA and the neurological 8011 system [7]. The most common affects are also be as a system [7]. system [7]. The most common effects are related to cell toxicity, inhibition in cell production, cell apoptosis, metabolism disorders, and organ malfunction. Microplastic exposure has also been responsible for modifying animal behaviour such as an increase in anxiety rates. The effects of MNPs on health are dependent on size, exposure time, and concentration [8]. Scientific evidence includes the existence of MPs in biological samples and even in our diet. Some negative consequences are reported by several research, but the information in this field is still quite limited. Promising studies are being held in human cells and organoids, but still, no papers on human beings have been published.

Keywords: Microplastics; Nanoplastics; Chemical pollutants; Health.

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References

[1] Ivleva, N.P., A.C. Wiesheu, and R. Niessner, Microplastic in Aquatic Ecosystems. Angewandte Chemie International Edition, 2017. 56(7): p. 1720-1739.

[2] Gao, D., et al., Toxicological impacts of micro(nano)plastics in the benthic environment. Science of The Total Environment, 2022. 836: p. 155620.

[3] Leslie, H.A., et al., Discovery and quantification of plastic particle pollution in human blood. Environment International, 2022. 163: p. 107199.

[4] Ragusa, A., et al., Plasticenta: First evidence of microplastics in human placenta. Environment International, 2021. 146: p. 106274.

[5] Ragusa, A., et al., Raman Microspectroscopy Detection and Characterisation of Microplastics in Human Breastmilk. Polymers, 2022. 14(13): p. 2700.

[6] Martinho, S.D., et al., Microplastic Pollution Focused on Sources, Distribution, Contaminant Interactions, Analytical Methods, and Wastewater Removal Strategies: A Review. International Journal of Environmental Research and Public Health, 2022. 19(9): p. 5610.

[7] Yang, Y.-F., et al., Toxicity-based toxicokinetic/toxicodynamic assessment for bioaccumulation of polystyrene microplastics in mice. Journal of Hazardous Materials, 2019. 366: p. 703-713.

[8] Stock, V., et al., Uptake and cellular effects of PE, PP, PET and PVC microplastic particles. Toxicology in Vitro, 2021. 70: p. 105021.

20859 | Microplastics in the atmosphere of Porto

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Abstract

Microplastic (MP) particles have been observed in most environments, and concentrations are expected to increase over the coming decades, given the continued and increased production of synthetic polymer products. This increase may elevate the risk these particles pose to the environment and human health¹. Microplastics are particles of plastic that are less than 5 mm in diameter and are of two main categories: the primary microplastics, which are directly released into the air, such as from road markings and synthetic manufacturing, and the secondary microplastics, that are formed from the degradation of larger plastic items, such as plastic bags or bottles².

For this work, air samples were collected from August 2022 to January 2023. Two types of passive collectors were used: NILU Precipitation Collector for the wet atmospheric particulate fallout and Atmospheric Microplastic Collector for the microplastic dry deposition. To achieve a similar result as the active collectors using a series of filters, a size-fractioning filtration was adopted involving different types of sieves and filters with various porosities to separate particles of different sizes. Sieves with mesh sizes of 125, 63, and 25 µm were used to retain larger particles, while filters with pore sizes of 12, 0.45, and 0.22 µm were used to retain smaller particles, which includes the respirable fraction of microplastic with size PM₁₀ and PM_{2,5}. After filtration, microplastics were quantified through optical microscopy. This analysis revealed more than 200 MP/m²/day of microplastics in the atmosphere of Porto.

Acknowledgements

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References

[1] Petersen, F., & Hubbart, J. A. (2021). The occurrence and transport of microplastics: The state of the science. *Science of the Total Environment*, 758, 143936. https://doi.org/10.1016/j.scitotenv.2020.143936

[2] Loganathan, Y., & Kizhakedathil, M. P. J. (2023). A Review on Microplastics - An Indelible Ubiquitous Pollutant. Biointerface Research in Applied Chemistry, 13 (2): 126. https://doi.org/10.33263/BRIAC132.126

20862 | Development of a bioremediation system for the removal of PFAS from aquatic environments

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Abstract

Among the many pollutants that afflict aquatic ecosystems, PFAS (per- and polyfluoroalkyl substances) stand out due to their distribution, environmental persistence and ecotoxicity. Currently, there are no suitable remediation technologies capable of mitigating PFAS-related pollution in these ecosystems. Yet, the combination of nanophotocatalysis (NPC) and bioremediation (BRMD) may prove useful in combating PFAS aquatic pollution. NPC has shown promising results for the breakdown of persistent pollutants, while BRMD processes can benefit from the high degree of redundancy and promiscuity of bacterial catabolism to efficiently degrade various pollutants and their sub-products. As such, this work aims to develop an efficient BRMD unit, based on a synthetic bacterial consortium with orthogonal defluorination capacity, and explore its potential to act as a secondary water treatment step in tandem with a TiO₂-based NPC treatment, to remove PFAS from aquatic matrices.

The first development step, currently ongoing, is set on screening different bacterial strains enriched with fluorinated pollutants, petroleum hydrocarbons or cyanotoxins. This sorting is being achieved by validating the degradative capabilities of the strains based on their bacterial growth and defluorination performances. So far, these preliminary tests led to the selection of two prospective consortium members, *Delftia acidovorans* MFA5 and *Labrys portucalensis* F11, based on their capacity to defluorinate 50 mgL⁻¹ of fluoroacetate and fluorobenzene in 8 days, respectively.

Once all strains are selected and their co-cultivation dynamics are ascertained, a synthetic bacterial consortium will be assembled and tested as a BRMD step coupled to a primary NPC treatment against two different PFAS in quasi-real aquatic matrices.

Keywords: Environmental pollution, PFAS, defluorination, nanophotocatalysis, bioremediation

Acknowledgements

This research was conducted in the scope of the project Xenohybrid, funded by Fundação Amélia da Silva de Mello. This work was also supported by the Strategic Funding UIDB/04423/2020 and UIDP/04423/2020, through national funds provided by Fundação para a Ciência e Tecnologia and European Regional Development Fund.

20869 | Metal resistance and plant growth potential of *Panicum virgatum* rhizosphere bacteria for phytoremediation of digestate amended soil

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Abstract

Anaerobic digestate (AD) can be employed as an organic amendment and fertilizer for soil, being an alternative method for land restoration [1]. However, the use of AD may introduce pollutants in the amended soils, including trace metals (TMs), posing a potential threat to the receiving environments. To mitigate these risks, phytoremediation can be employed as a green and costeffective technology to immobilize or remove TMs in soils, and concomitantly, improve soil properties and health. The role of bacterial communities associated with the plant and resulting plant/microbe interactions in the rhizosphere can play a crucial role in the modulation of phytoremediation in TMs contaminated soil, through the regulation of plant growth and TMs resistance. Thus, the aim of this work is to identify the bacterial strains associated with the rhizosphere of Panicum virgatum (switchgrass), that are relevant in the phytoremediation process. For that, culture-dependent approaches will be used to identify and describe previously isolated plant-associated bacteria from *Panicum virgatum* rhizosphere, as well as for the 806 evaluation of their TM-resistance and plant growth promoting rhizobacteria (PGPR) traits. TMresistance will be determined by culturing and exposing the strains to increasing concentrations of Pb, Zn, Cu, and Cr. The results will provide more knowledge on the culturable microbial bacteria inhabiting the plants rhizosphere that can be used to develop biological bioinoculants to improve the uptake of metals and the growth of plants that have ecological relevance to recover TMs contaminated environments.

Keywords: Anaerobic digestion; phytoremediation; rhizosphere bacterial community; trace metals.

Acknowledgments

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References

[1] Zhang, Z., Chen, Y., & Gray, K. A (2014). Anaerobic digestion of lignocellulosic biomass: challenges and opportunities. Bioresource technology, 169, 324-331

20874 | Environmental implications of the use of tungsten oxide nanoparticles for clean energy production

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Abstract

The energy demand is increasing globally due to the population growth and to the high dependency of the society on this resource. Thus, the development of sustainable energetic systems is a relevant topic not only for general public, but also for the scientific community and industrial sector.

In this sense, nanotechnology can offer materials at nanoscale making the hydrogen production 807 a viable and cost-effective process through a fill a viable and cost-effective process through of the application of transition metal-based catalysts, such as tungsten oxide nanoparticles (WNP) to separate water for generation of clean energy from hydrogen. However, there are no toxicological studies regarding the effect of these compounds on the environment.

In this context, this work aimed at performing a comparative evaluation of the environmental safety of the commercial compounds - tungsten oxide (W) (Alfa Aesar) and WNP (nanopowder < 100 nm, Sigma-Aldrich) on agriculture crops (Avena sativa and Zea mays) and on soil invertebrates (Folsomia candida). The tests were conducted on natural soil from Estarreja (Aveiro, North of Portugal - 40°45'17" N, 8°34'9" W), testing twelve concentrations (0 to 1000 mg W/kg soil) with three replicates per treatment and five for the control group, with duration of 28 days for reproduction with F. candida and 14 days for plants (after germination of 50% of seeds in the control), respectively, following standard OECD guidelines.

Since there no studies about the effect of WNP on the ecosystems, at the end of the assays, the data obtained will be essential to demonstrate if WNP are safer in comparison with its corresponding tungsten oxide for the selected species.

Keywords: Sustainable energy; nanotechnology; environmental safety; toxicological studies

Acknowledgments

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20905 | Microbial community characterization of enriched cultures with potential to degrade pharmaceuticals: culture-dependent and independent approaches

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Abstract

Pharmaceuticals, along with their active metabolites, are being continuously released into the environment mainly through wastewater treatment plants effluents, but also due to their manufacture or their improper use and disposal. Several technologies have been developed to remove pharmaceuticals; however, they are not suitable to be applied in natural environments. To fulfil this increasing need, bioremediation approaches using autochthonous microorganisms with metabolic capacity to degrade pollutants is becoming a promising technology to recover these areas. Thus, this study aimed to unveil the biodegradation potential of autochthonous microorganisms to remove paroxetine and bezafibrate, combining culture-dependent and independent methods. To select the key organisms for the remediation process, an enrichment process was carried out for 20 weeks (10 cycles), using sediment from the Lima River Estuary as inoculum, doped with 1 mg L^{-1} of paroxetine or bezafibrate. At the end cultures were plated in PCA and Mineral-salts media, being the latter doped with the respective pharmaceutical. Bacterial isolates were purified and preserved at -80°C and all bacterial strains were taxonomic identified through 16S rRNA gene sequencing. Samples were collected at the end of each cycle for the evaluation of bezafibrate and paroxetine removal using liquid chromatography analysis and to perform a characterization of the enriched microbial community through next-generation sequencing (V4-V5 hypervariable region of the 16S rRNA gene). Until the 6th cycle, a removal efficiency higher than 80% was observed for both pharmaceuticals. Data on removal efficiency of cycles 7 through 10, taxonomic identification of culture isolates, and microbial community characterization is being conducted. These results will contribute to develop efficient remediation tools by providing crucial insight regarding the microbial communities involved in the degradation of these two pharmaceuticals.

Keywords: Bioremediation, pharmaceuticals, enriched cultures, microbial community dynamics.

Acknowledgments

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20910 | Marine litter monitoring on Matosinhos Beach

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Abstract

Marine litter is defined by any solid material that has been deliberately discarded, unintentionally lost or transported by the wind, rivers or draining systems to marine and coastal environments. It is a global concern as it impacts a wide spectrum of environmental, economic, safety and cultural problems. Plastic has a particularly problematic role in this matter as it represents up to 90% of this litter. The CMIA (Centro de Monitorização e Interpretação Ambiental) of Matosinhos has been dedicating part of its awareness programs to marine litter, doing monthly surveys to monitor the litter of the Matosinhos beach. This monitoring program has been done in collaboration with Agência Portuguesa do Ambiente, and following the OSPAR protocol "Guideline for marine litter monitoring on the Beaches in the OSPAR Maritime Area". So, monthly surveys have been conducted to collect and characterized all the litter items presented in three transects perpendicular to the coastline. Several high schools' students from different ages have Matosinhos beach, since November 2021, it was shown that the most abundant debris found 809 been participating in the surveys. From the data collected in the monitoring program in were plastic fragments (ID OSPAR 1171), lollypop sticks (ID OSPAR 192) and cigarette butts (ID OSPAR 64). These results differ from the other OSPAR beaches, were the most frequent litter found are plastic fragments, fishing gear and packaging. Such differences can result from the characteristics of the Matosinhos beach, an urban beach that is subject to mitigation actions as clean-ups and sand nourishments made by the local authorities.

20939 | Kelp forests in the north of Portugal: characterization of ecosystem services and its importance for coastal management

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Abstract

Marine ecosystems have been going through momentum during the last decades, with a diverse range of international initiatives recognizing their profound importance for human well-being. Regarding coastal zones, kelp forests represent an essential habitat supplying several Ecosystem Services (ESs) fundamental to the society and impact the economy and the environment. However, such importance is only sometimes reflected in the decision-making and management and conservation strategies. In Portugal, little is still known about the importance of kelp forest, indicating a need for more public awareness and informed management policies. The present work aims to solve this knowledge gap by characterizing the ESs provided by the kelp forests of the Northern coast of Portugal. For that, the Ecosystem Service Cascade (ESC) approach was used to identify the ecological functions, ESs and ultimately the social benefits and goods provided by kelp forests. A global list of all the potential ESs provided by kelp forests was produced, following the recent classification from the Common International Classification of Ecosystem Services (CICES), and from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Then, this list was adapted to the kelp forests of Portugal, based on expert judgment and literature research, to identify indicators/data of each class of ESs. Overall, a total of 12 potential ESs were identified by kelp forests in general, including 6 provisioning services, 4 regulating and maintenance services, and 2 cultural services. The list of the ESs provided by the kelp forests of the NW Portugal is still being analysed, and results will be discussed focusing the need to integrate this new information in the current protection and management programmes of the northern Coast of Portugal.

Acknowledgments

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20942 | Monitorization of air quality in the Natural Park of Montesinho

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Abstract

Montesinho Natural Park (MNP) is a protected nature reserve, inserted in the Natura 2020 network, located in the northeast of Portugal. Covering about 75,000 hectares, it is the home of many species of local fauna and flora. Beekeeping is considered a crucial activity for the future of the rural world, especially, for agriculture, as a source of income and employment. Bees are very sensitive insects that produce honey and during honey production, they collect pollen from different plants in the surrounding areas and the deposition and/or absorption of airborne air pollutants might influence their well-being and even be incorporated in the honey and beehive products [1]. Information on bees' exposure to airborne pollutants has been slowly emerging [1-3]. This work characterizes the air levels of particulate matter, carbon monoxide, nitrogen dioxide, and volatile organic compounds in different beehives from MNP. Different sampling campaigns are being performed between March and May 2023 with air quality sampling devices. Preliminary results allow quantifying the concentrations of particulate matter with an aerodynamic diameter of 10 and 2.5 microns (PM₁₀ and PM_{2.5}, respectively) and nitrogen dioxide in some beehives. These findings suggest the influence of local populations in the air quality of beehives' surrounding area.

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Keywords: Air quality, Natural Park, environmental quality, Bees.

Acknowledgments

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References

- [1] Badiou-Bénéteau, A, et al. (2013) Environment International, 60, 31-41.
- [2] Cochard, P, et al. (2021) Science of the Total Environment, 751, 141831.
- [3] Lambert, O. et al. (2012) Chemosphere, 86(1), 98-104.

20992 | Restoration of marine forests seaweed species as a Nature-Based Solution to mitigate climate change

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Abstract

Seaweeds are organisms that play an essential role in marine habitats, increasing the associate biodiversity (Harley et al, 2012).. They also provide oxygen along with many other ecological services vital to the aquatic trophic web (Wernberg et al, 2019). Marine forests are habitats formed by several orders of large macroalgae (e.g., Laminariales and Fucales). These very diverse habitats have been exposed to the effects of climate change such as the rise of sea temperature and the acidification of the ocean, which are endangering their survival and affecting their distribution. In this study, three key species forming marine forests have been investigated: Himanthalia elongata, Ascophyllum nodosum and Laminaria hyperborea. These are cold water species, presenting their southern limit of distribution in the North of Portugal (Stagnol et al, 2016).Their life cycle is already known, being similar to other fucoid and kelp, but their reproduction in laboratory is still poorly studied. In this work, methods to cultivate germlings in laboratory have been optimized to be used in reforestation projects. The influence of light intensity (40μ molm⁻²s⁻¹ and 80μ molm⁻²s⁻¹) and three different temperatures (12, 15 and 18°C) on egg and spore germination is being assessed. *H. elongata* gametes were released with no significant differences for different temperatures. All treatments resulted in cultures with a lot of debris. A washing method was tested to try to obtain cultures with less residues, but this led to a decrease in gamete release. Considering A. nodosum, the receptacles were collected, and the gametes released in the laboratory were placed at the different temperatures and light. Preliminary results showed a higher percentage of germination at 15°C. Germlings growth was followed by measuring their length and area. The same procedure will be applied to L. hyperborea, to study a way to optimize spore release and germination in laboratory, to be seeded in recruitment disks and then deployed in the field.

Keywords: seaweeds; marine forests; germination.

References

Harley, C. D. G., Anderson, K. M., Demes, K. W., Jorve, J. P., Kordas, R. L., Coyle, T. A., & Graham, M. H. (2012). EFFECTS OF CLIMATE CHANGE ON GLOBAL SEAWEED COMMUNITIES. *Journal of Phycology*, *48*(5), 1064–1078. https://doi.org/10.1111/j.1529-8817.2012.01224.x

Stagnol, D., Michel, R., & Davoult, D. (2016). Population dynamics of the brown alga Himanthalia elongata under harvesting pressure. *Estuarine Coastal and Shelf Science*, *174*, 65–70. https://doi.org/10.1016/j.ecss.2016.03.014

Wernberg, T., Krumhansl, K., Filbee-Dexter, K., & Pedersen, M. F. (2019). Chapter 3—Status and Trends for the World's Kelp Forests. In C. Sheppard (Ed.), *World Seas: An Environmental*

Evaluation (Second Edition) (pp. 57–78). Academic Press. https://doi.org/10.1016/B978-0-12-805052-1.00003-6

21047 Assessment of the pollen allergenic potential in indoor air

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Abstract

Pollen is a ubiquitous and seasonal bioaerosol since it is related to the life cycle of flowering plants and its concentrations in the atmosphere are higher during spring. From a biological perspective, pollen is indispensable, but from a human health point of view, pollen can be responsible for allergic respiratory diseases [1].

Pollen can enter the indoor environment through open windows and doors or ventilation systems without filtration [2, 3].

Our study aimed to assess indoor air pollen allergenic potential and the outdoor environment influence on its concentration. A daily sampling of the pollen content in the indoor air was conducted at the atrium of the central services building of FCUP using a cyclone-type sampler. For each sample, soluble protein content was quantified as a proxy for the allergological potential 814present, followed by the qualification and quantification of the pollen grains. These results were compared with the atmospheric pollen concentration recorded outside the building using the same sampling methodology.

Different potentially allergenic pollen types were identified in the indoor environment: Cupressaceae, Quercus, Betula, Platanus, Acer, Urticaceae and Poaceae, and their concentrations were correlated with the results obtained for the outdoor environment. The total indoor pollen concentrations and the soluble protein content in each sample followed the same trends.

It was also observed that the indoor air was significantly influenced by ventilation since during the weekend (closing of the building) and school breaks (less circulation of individuals) a decrease in both the protein content and the amount of pollen sampled in the indoor air was observed.

Thus, the presence of pollen inside the building with allergenic potential was demonstrated, which could contribute to the exacerbation of allergic disease in its occupants. Regularly monitoring this bioaerosol in the indoor air is considered important.

Keywords: pollen, proteins, allergies.

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References

Joubert, I. A., M. Geppert, L. Johnson, R. Mills-Goodlet, S. Michelini, E. Korotchenko, A. Duschl,
 R. Weiss, J. Horejs-Höck and M. Himly (2020). "Mechanisms of Particles in Sensitization, Effector
 Function and Therapy of Allergic Disease." <u>Frontiers in Immunology</u> 11.

[2] Menzel, A., M. Matiu, R. Michaelis and S. Jochner (2017). "Indoor birch pollen concentrations differ with ventilation scheme, room location, and meteorological factors." <u>Indoor Air</u> 27(3): 539-550.

[3] Pelliccioni, A., V. Ciardini, A. Lancia, S. Di Renzi, M. A. Brighetti, A. Travaglini, P. Capone and M.
C. D'Ovidio (2021). "Intercomparison of Indoor and Outdoor Pollen Concentrations in Rural and Suburban Research Workplaces." <u>Sustainability</u> 13(16): 8776.

21059 | Assessment of soil health in the vicinity of a Au/Sb Mine

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Abstract

Produced mine wastes from mining activities typically contain high concentrations of heavy metals and hold acid-forming properties. Mine wastes should be carefully deposited and treated to minimize potential environmental impacts. In past mining explorations, there was a lack of environmental concerns. In this sense, mine waste deposits from abandoned mines are typically contaminant sources, affecting local populations and ecosystems.

In the mineral belt of Valongo, Portugal, it was found the mineralization of valuable metals, including gold–antimony. Many of these deposits were already explored during the Roman occupation of the Iberian Peninsula. The presented case study is the former mine of Montalto, located in the municipality of Gondomar, Porto district. Montalto mine was opened in 1864, and the activity ceased in 1906.

For the assessment of soil health, 21 soil samples were collected in the vicinity of the Montalto mine facilities. Multiple parameters were measured, including heavy metal concentration, static net acid generation, soil texture, and organic carbon concentration.

Regarding grain size, samples were mainly composed of sand, resulting in a soil texture classified as sandy clay loam, sandy loam, or loamy sand. However, in some sites, it was visibly detected fragments of waste rock from mining exploitation.

The concentration of heavy metals was measured through X-ray Fluorescence, allowing to perceive that part of the area is contaminated with heavy metals. The highest detected concentration of arsenic is 747 ppm, and for antimony 2017 ppm.

In the vicinity of the mine, there are residential areas, landfarming fields, livestock production, and areas for leisure. By comparing the measured values of heavy metals with the Portuguese Environmental Agency guideline for soils, it is concluded that some sites in the vicinity of the mine are contaminated, and so there is risk of exposure. Therefore, future studies should aim for the remediation of the site.

Keywords: Antimony, gold, arsenic, environmental characterization, environmental contamination, mining legacy, mine wastes

Acknowledgments

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21074 | Acute ecotoxicological effects of metformin on Daphnia magna

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Abstract

In recent years several studies showed the importance of the continuous monitoring programs of pharmaceuticals and their metabolites in water bodies. Due to their difficult removal during wastewater treatments, they are discharged into surface waters putting aquatic organisms at risk. One of these pharmaceuticals is metformin, commonly used for the treatment of type 2 diabetes and as an anticancer agent. Metformin is frequently found in wastewater treatment plants' influents, effluents, and surface waters. Because of the potential hazard it poses, it has been included in the 4th Watch List of substances to monitor under the Water Framework Directive, which reinforces the necessity to assess the impacts of metformin on aquatic ecosystems.

This study aimed to perform the acute evaluation of the effects of metformin for Daphnia magna, in order to understand at what levels this model organism is affected. An acute assay of 48h was carried out to assess swimming alterations and lethality of the drug, after 24h and 48h of exposure. The surviving daphnids were kept to characterize the sub-individual toxicity of metformin, using quantification of biomarkers of oxidative stress (such as catalase, CAT), lipid peroxidation (thiobarbituric acid reactive substances, TBARS levels) and neurotoxicity (acetylcholinesterase, AChE).

D. magna showed acute toxicity with significant effects and lethal concentrations: EC50 (24h) = 81841.0 mg/L, LC50 (24h) = 89.7 mg/L and LC50 (48h) = 61.2 mg/L. Preliminary results indicated that metformin can cause oxidative stress and neurotoxicity to aquatic organisms after acute exposure. In order to assess the effects of metformin in D. magna life-history parameters a subchronic exposure (10 days) will be conducted.

The here-obtained results and previous works suggest that metformin presents a risk to nontarget aquatic species and can be classified as hazardous to the aquatic environment.

Keywords: ecotoxicity, pharmaceutical, oxidative stress, neurotoxicity

21196 | Micro-debris in shore water samples from the Northwest Portuguese Atlantic Coast

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Abstract

The contamination of seawater by microplastics and other micro-debris (particles < 5 mm), hereafter together indicated as marine micro-debris (MMDs) is a global treat to biodiversity. The main goal of this study was to investigate the types of MMDs present in shore surface water samples from the Northwest (NW) Portuguese Atlantic coast. Water samples were collected in four sampling sites located in the the shore of 4 beaches: Vila Praia de Âncora (S1), Cabedelo (S2), São Bartolomeu do Mar (S3), and Boa Nova (S4). In the laboratory, samples were filtered, and the filters were dried. The MMDs retained in the filters were analysed using a stereomicroscope, pictures of each MMD were obtained, and each MMD was further analysed using an image analysis software. MMDs were primary characterized and quantified by size, shape and colour. The chemical characterization of the MMDs is ongoing. All the water samples contained MMDs. A total of 496 MMDs were recovered from the analysed water samples, with the following number per sampling site: 152 in S1, 52 in S2, 110 in S3 and 182 in S4. The size of the MMDs ranged from less than 100 μ m up to 5000 μ m, most of the MMDs had fibre-like shape and blue colour but other shapes and colours were also found. These findings indicate the presence of a variety of MMDs in shore surface water of the NW Portuguese Atlantic, which may be up taken by shore organisms potentially leading to adverse effects. Therefore, is very important to continue the ongoing monitoring on the NW Portuguese Atlantic shore to increase the knowledge on the contamination of shore water and organisms by MMDs and its potential biological and ecological effects.

Keywords: microplastics; micro-debris; water; primary characterization.

Acknowledgments

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(NORTE-01-0145-FEDER-000040), funded by NORTE 2020, under the Portugal 2020 Partnership Agreement, through the European regional Development Fund.

21202 | The influence of culture and artistic manifestations in the promotion of environmental education and communication

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Abstract

Environmental education and sensitization are essential to address environmental challenges. One of the factors that can increase its effectiveness is the use of methodologies that appeal to personal and community experience, duly adapted to the target audience and its context [1], [2]. It has been proven that arts and culture are powerful tools for sustainability and education. Arts and cultural participation empower people to face many challenges, including environmental issues. Creative expression makes it possible to find different points of view of the same topic, which is particularly relevant when talking about education and the promotion of a critical spirit. Furthermore, creative expression creates a more personal connection, increasing the effectiveness of education.

There are already several environmental education projects implemented with this premise, in several countries, with positive results [3].

Digitalization and globalization have enabled new forms of culture and artistic manifestations (e.g. podcasts) and are able to bring people close to the topic of the environment and environmental sustainability, as they allow broad and easy access to information.

To understand the influence of culture and artistic manifestations in the promotion of environmental education and communication, this work is divided in 4 parts: mapping cultural and artistic projects in which the environment is addressed; accessing environmental education projects that interconnect arts and culture; understanding how the environment is seen and connected in arts and culture; evaluate in which way arts and culture can improve environmental education and their effective impact in the society, through the implementation of art-based activities and surveys.

Keywords: environmental education; art; culture; environmental communication.

References

[1] M. J. Hortas and J. Campos, "EDUCAÇÃO FORMAL E NÃO FORMAL: ENTRE A FORMAÇÃO E A INTERVENÇÃO," 2014. [Online]. Available: http://www.eses.pt/interaccoes

[2] C. Khasnabis et al., "Non-formal education," 2010, Accessed: Jan. 19, 2023. [Online]. Available: https://www.ncbi.nlm.nih.gov/books/NBK310920/

[3] UNESCO, "Advancing sustainability education through art, expression and culture," 2023. https://www.unesco.org/en/articles/advancing-sustainability-education-through-art-expression-and-culture (accessed Mar. 02, 2023).

21259 | Inorganic wastes from pulp paper mills - recycling alternatives for water remediation

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Abstract

The paper pulp industry is constantly growing and is one of the largest in the world, with the main raw material being pulp obtained from trees.[1,2] This growth has led to an exponential generation of inorganic wastes such as slaker grits (SG), green liquor (GL) and lime mud (LM) which can have harmful effect on the environmental and still no effective utilization has been projected.[1]

The rapid industrialization, continuous growth of world population and modernization of developing countries has also led to unprecedented levels of water pollutants (organic dyes, pesticides, pharmaceuticals) threatening the sustainability of our planet.[3] Methylene blue (MB), for instance, is an organic dye widely used in the textile industry and is one of the main causes of surface water contamination.[4] Another major class of water pollutants are antibiotics, such as levofloxacin (LVX), which can treat various infections being extensively used in the livestock industry, ultimately leading to contamination of groundwater.

This work aims at the valorization of inorganic wastes from paper pulp production as potential adsorbents for the removal of typical water pollutants, namely MB and LVX. The inorganic wastes will be processed by thermal activation, specifically by pyrolysis under inert atmosphere in order to increase their porosity and therefore to enhance the adsorption efficiency. The materials were analysed by a myriad of characterization techniques, including FTIR-ATR spectroscopy, zeta potential (PZ) as a function of pH, SEM and EDX. The adsorption studies were monitored by UV-Vis spectroscopy (MB) or fluorescence spectroscopy (LVX). Optimization of the experimental parameters, namely contact time, pH control and adsorbent dosage, as well as recyclability and stability tests have been performed.

Keywords: inorganic wastes; sustainability; water pollutants; methylene blue; levofloxacin.

References

- [1] L. Simão, et al, Cerâmica vol. 64, pp. 443–453, 2018.
- [2] J.A. Silva, A.L.C.L. Lourenço, Rev. Economia Ensaios, pp. 159–188, 2017.
- [3] S. Rojas, P. Horcajada, Chem. Rev., vol. 120 pp. 8378-8415, 2020.
- [4] J.S.M. Júnior, Research, Soc. and Development, vol. 10, n.6, 2021.



Figure 1: Generated waste: green liquor, lime mud and slaker grits.



GEOLOGY



20908 | About a dwarf fauna of likely Silurian age, related to Upper Ordovician glaciation, S. Pedro da Cova (inverse limb of Valongo Anticline), Gondomar, NW Portugal

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Abstract

The Palaeozoic (Cambrian to Carboniferous) is well exemplified in S. Pedro da Cova (Gondomar, NW Portugal). The studied area is located in the inverse limb of the Valongo Anticline. A dwarf fossil fauna concerned our attention. This fauna occurs in a succession of green-red slates underlying impure yellow quartzites. The latter form a kind of reef mounds. Green-red slates are in contact with the Upper Ordovician Hirnantian diamictites [1] and the impure yellow guarzites, sometimes friable, contact with Silurian laminated light grey slates bearing Monograptus interbedded with quartzites and phtanites indicating Llandovery [2]. Locally a black lenticular Silurian quartzite, equivalent to Rhuddanian Parteira quartzite [1] occur in the base of the greenred slates. The Devonian dominantly represented by yellow-grey slates with interbedded centimetric light quartzites, overlie the Silurian. In green-red slates, the dwarf fauna is very diversified with trilobites, corals, gastropods, brachiopods, bivalves, echinoderms (cystoids?, crinoids), sponges?, tentaculites and ostracods. In impure quartzites several rugose corals, one gastropod, echinoderms (crinoids and an edrioasteroid?) have been recognized. All the species are of small size, evidencing the "Lilliput Effect" [3] due to the mass extinction event that occurred in relation with the Hirnantian glaciation (Upper Ordovician). The identification of the species is ongoing, but so far fossils don't allow to date. The stratigraphic position of the succession points to an Early Silurian age. Till now dwarf faunas recognised in other places are not so diversified. Cooper & Jin [4] refer to a Silurian (early Rhuddanian) low diversity brachiopod dwarfed fauna, in the Becscie Formation (eastern Canada). Kaljo [5] observed that the Early Silurian dwarf corals from the Porkuni quarry (Estonia) are particularly significant as they contrast with some rather usual enormous rugose and tabulate corals of the Upper Ordovician.

Keywords: dwarf fauna; high diversity; Silurian; Rhuddanian; Hirnantian glaciation; "Lilliput Effect".

References

[1] Couto, H., Knight, J, & Lourenço, A, 2013. Late Ordovician ice-marginal processes and sea-level change from the north Gondwana platform: Evidence from the Valongo Anticline (northern Portugal). Palaeogeography, Palaeoclimatology, Palaeoecology 375, 1–15.

https://doi.org/10.1016/j.palaeo.2013.02.006

[2] Romariz, C., 1962. Graptolitos do Silúrico português. Revista Faculdade Ciências de Lisboa, 2aSéries C, Ciências Naturais 10, 115–312.

[3] Harries, P. & Knorr, P., 2009. What does the 'Lilliput Effect' mean?. Palaeogeography, Palaeoclimatology, Palaeoecology 284, 4–10.

https://doi.org/10.1016/j.palaeo.2009.08.021

[4] Cooper, P. & Jin, J., 2014. The revised Lower Silurian (Rhuddanian) Becscie Formation, Anticosti Island, eastern Canada records the tropical marine faunal recovery from the end-Ordovician Mass Extinction. Newsletters on Stratigraphy, Vol. 47/1 (2014), 61–83 https:// DOI: 10.1127/0078-0421/2014/0040

[5] Kaljo, D., 1996. Diachronous recovery patterns in Early Silurian corals, graptolites and acritarchs. Geological Society, London, Special Publications, 102, 127 – 133. https://doi.org/10.1144/GSL.SP.1996.001.01.10



HEALTH SCIENCES



20680 | Establishment of a 3D multi-layered intestinal inflammation model

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Abstract

Inflammatory bowel disease (IBD) is highly debilitating, and a definitive cure is not available in clinics. The establishment of reliable and useful *in vitro* models of the inflamed intestinal barrier to validate the development of therapies for IBD is of utmost relevance. Our research group has previously established a three-dimensional (3D) model of a healthy intestine, that comprises an endothelial barrier, a collagen-based layer embedding human intestinal fibroblasts (HIFs), and lastly, an epithelial layer, composed of enterocytes and mucus-producing cells (1, 2). Seeing the flaws in the *in vitro* representation of the inflammatory environment, we propose to improve this 3D model by adding THP-1 cells in the lamina propria to better recapitulate the inflammatory environment.

To establish a 3D intestinal inflammation model to be used as a platform for drug screening, the differentiation of THP-1 monocytes to macrophages was primarily performed. Following that, a collagen layer with embedded HIFs and macrophages was optimized to mimic the intestinal lamina propria. The metabolic activity of the cells inside the gels along the time in culture was assessed, as well as the cell layer formation. Our results showed that the fibroblasts and macrophages are active inside the gels, indicating they are healthy and proliferating. Upon successful establishment of the 3D collagen layer with HIF and macrophages, inflammation was induced with lipopolysaccharide (LPS). The transepithelial electrical resistance values were maintained upon induction of inflammation. In the inflamed 3D model, the secretion of pro-inflammatory cytokines was significantly increased, compared to the 3D model without LPS. This 3D intestinal inflammation model has the potential to help bridge the gap between *in vitro*

and *in vivo* testing, which could have a major impact in the drug development field and, thus, contributes to the replacement, reduction, and refinement (3Rs) policy, mainly by reducing the number of animal experiments.

Keywords: inflammatory bowel disease; intestinal 3D in vitro models; inflammation

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References

- [1] Macedo M. H. et al., Front. Bioeng Biotechnol. 8-524018 (2020)
- [2] Macedo M. H. et al., J Control Release. 414-30 (2022)


Figure 1: Scheme of the configuration of the 3D multi-layered intestinal inflammation model.

20700 | Generation of ex-vivo 3D organoid culture from surgically-derived tissue of paediatric brain tumours

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Abstract

Despite significant improvements in cancer care and diagnosis, paediatric brain tumours (PBT) remain a leading cause of death in children¹. The current clinical approach to these rare tumours, a combination of surgery, chemotherapy, and radiotherapy led to enhanced survival rates. However, these improvements are followed by considerable long-term sequelae². Our team has been active in contributing to the molecular characterisation of PBT cases, through a nationwide study, the PRECISEKIDS project, where paediatric solid tumours are being submitted to nextgeneration-sequencing (NGS) studies, offering clinicians important molecular insight into each PBT case. While we are having remarkable advances in understanding the molecular biology behind these heterogenous tumours, the translation of all this knowledge is still a huge challenge³. Our main aim is to generate ex-vivo 3D organoid cultures from surgically derived tumour tissue of PBT as a molecular tool capable of guiding precision medicine in the paediatric cancer context. Regarding methodology, our key tasks are the collection of surgical material of PBT for organoid generation, and the genomic characterization of both PBT and respective organoids through an NGS panel specially dedicated to paediatric cancer. Since November 2022, in collaboration with Centro Hospitalar Universitário São João, we have collected surgical material from eight PBT: three pilocytic astrocytomas, a pleomorphic xanthoastrocytoma, a pineoblastoma, an ependymoma, and two high-grade diffuse gliomas. We are following an already-reported protocol⁴. So far, two of the pilocytic astrocytomas and the pleomorphic xanthoastrocytoma tissue samples developed organoid-like structures. Additionally, the genomic profile of these structures matched with their corresponding primary tumour. We are now performing other techniques to molecularly characterise these structures such as immunohistochemistry, immunofluorescence analysis using confocal microscopy, and proteomic studies.

Keywords: paediatric brain tumours, molecular biology, patient-derived organoids, precision medicine.

Acknowledgements

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References

[1] Siegel, R. L., Miller, K. D., Fuchs, H. E. & Jemal, A. Cancer statistics, 2022. *CA Cancer J Clin* **72**, 7-33, doi:10.3322/caac.21708 (2022).

[2] Suh, E. *et al.* Late mortality and chronic health conditions in long-term survivors of earlyadolescent and young adult cancers: a retrospective cohort analysis from the Childhood Cancer Survivor Study. *Lancet Oncol* **21**, 421-435, doi:10.1016/s1470-2045(19)30800-9 (2020).

[3] Blattner-Johnson, M., Jones, D. T. W. & Pfaff, E. Precision medicine in pediatric solid cancers. *Semin Cancer Biol* **84**, 214-227, doi:10.1016/j.semcancer.2021.06.008 (2022).

[4] Jacob, F. *et al.* A Patient-Derived Glioblastoma Organoid Model and Biobank Recapitulates Inter- and Intra-tumoral Heterogeneity. *Cell* **180**, 188-204.e122, doi:10.1016/j.cell.2019.11.036 (2020).

20702 | Targeting mitochondrial TERT to overcome therapeutic resistance

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Abstract

Reactivation of telomerase is a common process in most human tumours [1, 2], usually due to reexpression of its catalytic subunit, the telomerase reverse transcriptase (TERT), contributing to cell immortalization [3]. In thyroid cancer (TC), it was demonstrated that TERT reactivation is often associated with distant metastases, therapy resistance and shorter survival rates of patients [4], however TERTs' canonical functions are not enough to explain these clinical associations. Some works have been proposing a possible non-canonical function of TERT, specifically in 83 mitochondria, as it can translocate into this organelle due to the presence of a N-terminal target mitochondrial sequence (MTS) [1]. In mitochondria, TERT seems to contribute to: protection of mtDNA under oxidative stress; decrease in the production of ROS and apoptosis; increase in mitochondrial membrane potential; and improvement of cellular respiration [5].

Our hypothesis is that the translocation of TERT into mitochondria, in TC cells, may indicate a mechanism of response to oxidative stress caused by cancer therapeutics. Therefore, in this project we are evaluating TERTs' impact in mitochondria in a CRISPR-Cas9 altered TC cell line which lacks the MTS region of TERT (preventing its translocation into this organelle) in comparison with control cells. Currently, we are characterizing the altered cells regarding cell growth and viability (Trypan Blue Exclusion and PrestoBlue Assays), cell cycle profile and proliferation (Flow Cytometry with PI, BrdU Incorporation Asssay). We will further evaluate the effects of these alterations in mitochondrial functions, namely oxidative stress (specific dyes), apoptosis (Flow Cytometry with Annexin V/PI), and metabolism (Seahorse Analyser) as well as in the cellular response to therapeutic drugs.

Overall, this study will allow to evaluate the relevance of mitochondrial TERT-related functions as they might contribute to the discovery of novel targets and therapeutic opportunities for TC patients.

Keywords: thyroid cancer; TERT; therapy resistance; non-canonical functions; mitochondria.

Acknowledgments

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References

[1] Zheng, Q., J. Huang, and G. Wang, Mitochondria, Telomeres and Telomerase Subunits. Front Cell Dev Biol, 2019. 7: p. 274.

[2] Kim, N.W., et al., Specific association of human telomerase activity with immortal cells and cancer. Science, 1994. 266(5193): p. 2011-5.

[3] McKelvey, B.A., C.B. Umbricht, and M.A. Zeiger, Telomerase Reverse Transcriptase (TERT) Regulation in Thyroid Cancer: A Review. Front Endocrinol (Lausanne), 2020. 11: p. 485.

[4] Vinagre, J., et al., Frequency of TERT promoter mutations in human cancers. Nat Commun, 2013. **4**: p.2185.

[5] Rosen, J., et al., Non-canonical functions of Telomerase Reverse Transcriptase - Impact on 833 *redox homeostasis.* Redox Biol, 2020. **34**: p. 101543.

20707 | The role of UPR-glycosylation axis in innate immune activation

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Abstract

Systemic lupus erythematosus (SLE) is a chronic autoimmune disease that affects several organs and occurs primarily in women of active age. The immunopathogenesis remains elusive but it is known that plasmacytoid dendritic cells (pDCs) play a key role in the pro-inflammatory response in SLE [1].

pDCs are a subset of dendritic cells that produce type I interferon (IFN-I) upon TLR7 or TLR9 activation, thus displaying a large endoplasmic reticulum (ER) and Golgi [2]. The unfolded protein response (UPR) is an important protein quality checkpoint in pDCs, for the following synthesis and secretion of cytokines. Moreover, N-glycosylation is a post-translational modification required for adequate protein folding and subsequent function, being crucial for immune cell recognition and communication [3]. Deficiencies in PERK (an ER sensor of the UPR) have been reported in some SLE patients [4]. However, the role of PERK in pDC function remains unknown.

Thus, we aim to unravel the dynamics in the UPR-PERK axis and glycosylation in the functional effector phenotype of pDCs. For that, we used CAL-1 cells, a pDC cell line, to establish a PERK 834knockout (KO) cell line. With these cells, we found that PERK deficiency impacts on TLR7 activation. More specifically, activation of TLR7 with the agonist CL307 in the absence of PERK leads to reduced production of type I IFN mRNA. We are currently evaluating the role of PERK in the glycophenotype and C-type lectin expression in pDCs.

Understanding protein synthesis regulation and glycosylation mechanisms can represent a great opportunity to target TLR7 signaling in pDCs and control the "IFN signature" that contributes to systemic inflammation and autoimmunity.

Keywords: systemic lupus erythematosus; plasmacytoid dendritic cells; unfolded protein response; glycosylation.

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References

[1] A. Kaul et al., Nat Rev Dis Primers, vol. 2, Jun. 2016, doi: 10.1038/nrdp.2016.39. [2] D. Mitchell, S. Chintala, and M. Dey, Journal of Neuroimmunology, vol. 322. Elsevier B.V., pp. 63-73, Sep. 15, 2018. doi: 10.1016/j.jneuroim.2018.06.012.

[3] I. Alves, Â. Fernandes, B. Santos-Pereira, C. M. Azevedo, and S. S. Pinho, *FEBS Letters*, vol. 596, no. 12. John Wiley and Sons Inc, pp. 1485–1502, Jun. 01, 2022. doi: 10.1002/1873-3468.14347.
[4] J. Wang *et al.*, *The American Journal of the Medical Sciences*, vol. 348, no. 6, pp. 465–473, 2014.

20719 | Characterization of cell proliferation, angiogenesis, inflammation and browning profile of the adipose tissue of women with endometriosis

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Abstract

Endometriosis is a gynecological inflammatory disease with systemic manifestations characterized by estrogen-dependent ectopic growth of endometrium. Endometriosis patients present low body mass index, which we hypothesize is associated with pathological browning of the adipose tissue (AT). In this study, we characterize the expression of molecules associated with cell proliferation (PCNA), angiogenesis (VEGF), estrogen secretion (CYP17A), inflammation (F480 and Galectin-3) and browning of AT (PGC1- α and UCP-1) by dual immunolabeling fluorescence microscopy in visceral and subcutaneous AT of endometriosis patients.

Visceral (VAT) and subcutaneous (SAT) AT samples were collected during surgeries of women with endometriosis or uterine myoma excision (controls) at Centro Hospitalar Universitário S.João–Porto (n=6/adipose tissue type/group). Dual immunolabelling of F4/80, Galectin-3, PCNA, α -actin (marker of smooth muscle cells), VEGF, CYP17A, PGC1- α and UCP-1 was performed in tissue sections. Quantification of PGC1- α and UCP-1 expression was carried out by western blotting.

All the studied proteins were identified in the AT sections by immunofluorescence, although no marked differences were found in endometriosis patients relatively to controls, neither between SAT and VAT. However, UCP-1 expression was apparently more intense in VAT of the endometriosis group, which could relate with browning of adipose tissue. Bands corresponding to PGC1- α and UCP-1 were detected by western blotting, in a preliminary assessment. A profuse labelling of Galectin-3 was observed in all samples, which co-localizes with F4/80 in macrophages in VAT of endometriosis patients. Cell proliferation evidenced by PCNA labelling and blood vessels marked after α -actin and VEGF detection were also observed in AT.

Quantitative morphometric analysis to further determine the adipocyte areas and molecular studies to support the presence of inflammation and browning of AT in endometriosis are ongoing.

Keywords: Adipose tissue; Browning; Endometriosis; Inflammation.

20739 | Evaluation of RRAS2 and TTP1 promoter mutations in thyroid tumours

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Abstract

Thyroid cancer is the most frequent endocrine neoplasm, being the tenth most prevalent in both genders and it presenting an overall good prognosis [1]. Ras related 2 (R-Ras2), also known as TC21, is a GTP-binding protein that together with R-Ras1 and R-Ras3, is part of the R-Ras GTPase subfamily. Mutations in *RRAS2* gene in the long-tailed hotspot Q72L/H block the hydrolysis of guanosine triphosphate (GTP) in Ras superfamily proteins, generating constitutively active proteins that will preferentially bound to GTP [2]. This gene is composed by five exons encoding a member of the Ras superfamily that participates in the RAS-MAPK pathway [3]. The tripeptidyl peptidase 1 promoter (TPP1p) encodes the telomere-binding protein TPP1 that recruits telomerase to the telomeres. This process plays a key role in the telomere stability and length regulation. Mutations in this promoter were reported to create novel transcription factor binding sites as previously presented for telomerase promoter (TERTp) [4]. Co-expression of these two promoters lead to telomere elongation, indicating that mutations in the *TPP1* and *TERT* promoter cooperate for the immortalisation of cancer cells [5].

Our project aimed to evaluate mutations in the Q72L hotspot of the *RRAS2* gene and in the *TPP1p* in thyroid tumours. Upon genotyping of *RRas2* and *TPP1p*, we conclude that the presence of mutations in the Q72L hotspot may not represent an oncogenic event, as we did not detect them. For *TPP1p*, still under study, although already presented in the literature, at the moment we have not detected them in our series, pointing that they may be a rare event in thyroid tumours.

Keywords: Thyroid cancer; Tumours; *R-Ras2* gene; Q72L hotspot; Telomerase promoter (TERTp); TPP1 promotor (TPP1p).

Acknowledgments

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References

[1] Wright, K., et al., The clinical significance of the American College of Radiology (ACR)Thyroid Imaging Reporting and Data System (TI-RADS) category 5 thyroid nodules: Not as risky as we think? Surgery, 2023. 173(1): p. 239-245.

[2] Fernández-Pisonero, I., et al., A hotspot mutation targeting the R-RAS2 GTPase acts as a potent oncogenic driver in a wide spectrum of tumors. Cell Rep, 2022. 38(11): p. 110522.

[3] Yu, C., et al., Clinical analysis of Noonan syndrome caused by RRAS2 mutations and literature review. European Journal of Medical Genetics, 2023. 66(1): p. 104675.

[4] Goldstein, A.M., et al., Association of germline variants in telomere maintenance genes (POT1, TERF2IP, ACD, and TERT) with spitzoid morphology in familial melanoma: A multi-center case series. JAAD International, 2023. 11: p. 43-51.

[5] Chun-on, P., et al., TPP1 promoter mutations cooperate with TERT promoter mutations to lengthen telomeres in melanoma. 2022. 378(6620): p. 664-668.

20852 | Characterization of carbon-dots and its impact in a breast cancer cell line

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Abstract

Carbon dots (CD) have emerged as a novel promising alternative to metal-based nanoparticles. These fluorescence carbon materials have been the subject of research since 2004 and exhibit excellent chemical and physical properties such as hydrophilicity¹, good biocompatibility and reduced toxicity, which allows a good interaction with biological systems. Taking this in consideration it is not surprising that CD have been introduced for the study/therapeutics of breast cancer¹, especially, in drug delivery system, bioimaging, biosensor, microbial therapy, photodynamic and photothermal therapy². Breast cancer is the most prevalent cancer with a high morbidity rate in the female population worldwide³.

In this study, we considered the use of fructose derived CD for breast cancer therapy. CD were produced from D-fructose via microwave irradiation by the bottom-up method. Following purification, particles were characterized using TEM, FTIR, DLS and fluorescence microscopy. As expected, fructose derived CD consist of carbon, oxygen and hydrogen. As characteristic of CD, they are fluorescent with an absorption maximum at 360 nm that when irradiated at 360 nm have an emission maximum at 520 and a broad emission band (maximum 520 nm).

In what concern cell-based assays, our results using breast cancer cell line BT474 and MCF-10A breast epithelial cells show CD are able to penetrate the cell membrane and display cytotoxicity towards tumor cell lines. In still preliminary results, it appears that they have reduced toxicity versus non tumor cell line, suggesting that they can be used as anti-tumoral agents for therapeutic purposes.

Keywords: Carbon dots; nanoparticles; breast cancer; cell culture.

Acknowledgments

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References

[1] Nocito, G. *et al.* Carbon dots as promising tools for cancer diagnosis and therapy. *Cancers* (*Basel*). **13**, 1–14 (2021).

[2] Sharma, A. & Das, J. Small molecules derived carbon dots: synthesis and applications in sensing, catalysis, imaging, and biomedicine. *J. Nanobiotechnology 2019 171* 17, 1–24 (2019).
[3] Deo, S. V. S., Sharma, J. & Kumar, S. GLOBOCAN 2020 Report on Global Cancer Burden: Challenges and Opportunities for Surgical Oncologists. *Ann. Surg. Oncol.* 29, 6497–6500 (2022).

20879 | The impact of IFNy-mediated endothelial cell activation for the progression of the mycobacterial granuloma

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Abstract

Granulomas are hallmark lesions of mycobacterial infections, consisting of well-structured masses of macrophages surrounded by lymphocytes. These structures can provide protection by physically containing the bacteria but can also evolve in ways often causing tissue destruction and allowing bacteria to spread. IFNy is a key cytokine for granuloma assembly as its absence impairs the formation of such structures leading to mycobacterial growth. In our previous work we have shown that IFNy-mediated macrophage activation is surprisingly dispensable for granuloma formation, suggesting that other cell type is responding to this cytokine and enabling the assembly of the granuloma. IFNy signalling on endothelial cells has been shown to contribute for the local recruitment of inflammatory cells in other disease models. We thus postulate that in mycobacterial infections, endothelial cells are responding to IFNy contributing to granuloma formation by allowing cellular extravasation to the infected organ. To address this hypothesis, we used an inducible endothelial cell–specific IFNyR1-KO mouse model (VE-Cadherin-creERT2 x 841IFNgR1fl/fl). Mice were infected either with a high dose of M. tuberculosis HN878 (leading to large inflammatory lesions culminating with animal death), or with a low dose of M. avium 25291 (a strain known to induce well-structured granulomas which develop central necrosis, mimicking the human granuloma). Our preliminary data suggest that IFNy signalling on endothelial cells is important to regulate cellular recruitment during mycobacterial infections. In future studies we aim at exploring which molecular signalling in these cells is required to control cellular inflammation.

Keywords: Mycobacterium tuberculosis; Mycobacterium avium; Granuloma; Inflammation; IFNY; Endothelial cells

20882 | The role of macrophage-epithelial transition for mycobacterial granuloma progression and disease outcome

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Abstract

Tuberculosis (TB) is caused by the infectious agent Mycobacterium tuberculosis (Mtb), a pathogen that evolved with the human race and developed elaborated strategies to both evade and persist within the host immune response. One of such strategies is the ability to persist in granulomas. A core of macrophages and other innate cells, surrounded by a lymphocytic cuff, composes these inflammatory lesions. Granulomas physically restrain the bacteria, but can evolve in ways often causing tissue damage, allowing bacteria to disseminate in the body and transmit to other hosts. Thus, the granuloma is a central piece in dictating TB outcomes. Understanding the molecular principles driving granuloma organization and dynamics are crucial to predict TB progression, and devise new therapies capable of both restricting bacterial growth and prevent tissue pathology. Within the granuloma, macrophages undergo a genetic epithelioid transition (MET), acquiring features of epithelial cells with expression of E-cadherin and other epithelial markers. This 842 reprograming leads to the formation of cell junctions between adjacent macrophages contributing to a more cohesive granuloma structure. Whether a cohesive granuloma benefits the host or the bacteria remains elusive. To understand the impact of MET in different types of granuloma architecture (from small well-structured granulomas to highly inflammatory necrotic lesions), mice deficient for E-cadherin expression in the myeloid lineage (Cdh1 floxed x Lyz2Cre) were infected with different strains of Mycobacterium avium (2447 or 25291) or with Mycobacterium tuberculosis HN878. Our preliminary data suggest that in well-structured granulomas, epithelial macrophages are responsible for placing lymphocytes in the periphery of the granuloma, impairing protective immunity and benefiting the bacterium. In the future, we aim to unveil the mechanisms leading to granuloma-MET, offering amenable molecular targets to manipulate the granuloma architecture to benefit the host.

Keywords: Mycobacterium tuberculosis; Mycobacterium avium; granuloma; macrophageepithelial transition; E- cadherin.

20904 | The subcutaneous adipose tissue from HFE-knockout mice accumulates high levels of iron and develops a pro-inflammatory phenotype

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Abstract

The Hemochromatosis protein (HFE) plays a crucial role in controlling cellular iron homeostasis by regulating iron absorption and systemic iron balance. Iron homeostasis plays a vital role in the metabolism and development of adipose tissue (AT), as it is essential for adipogenesis. However, an increased accumulation of iron in adipocytes is associated with obesity, in which adipogenesis is impaired favouring adipose tissue expansion through hypertrophy, a key driver for several metabolic disorders[1]. Iron overload is also known to stimulate senescence of cells that become resistant to apoptosis but very active in secreting pro-inflammatory molecules, which aggravate organ dysfunction [2].

The mechanisms underlying iron overload and adipocyte senescence are however unknown and 843constitute the basis of the present work. We therefore aim to evaluate the expression of inflammatory and cell senescence markers in subcutaneous adipose tissue (SAT) samples from wild-type (WT) and HFE-knockout mice.

Iron accumulation in adipose tissue was confirmed by Perls' Prussian blue staining of SAT sections. Then, a molecular-based analysis was performed to evaluate the expression of cell senescence markers (P21) by western-blot and of senescence-associated secretory phenotype (SASP) genes (IL-6,TNF α) by qPCR. Moreover, proteins (F4/80,Galactin3) and genes (MCP1,TGF β) related to inflammation and fibrotic pathways (FN-1,Col6a3) were also analysed. It was possible to observe that SAT samples from HFE-knockout mice accumulate higher levels of iron than SAT from WT animals with a concomitant upregulation of IL-6 and MCP-1 genes. This suggests that increased deposition of iron in AT induces the recruitment of MCP-1-positive macrophages. These are proinflammatory M1 macrophages, which may explain the increments of IL-6 observed in SAT from HFE animals. However, IL-6 is also a SASP component, so further studies will be necessary to understand the role of iron in adipocyte senescence.

Keywords: Adipose tissue, Senescence, Inflammation

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References

[1] Ma, W., Jia, L., Xiong, Q., Feng, Y., & Du, H., (2021). The role of iron homeostasis in adipocyte metabolism. Food & function, 12(10), 4246–4253. https://doi.org/10.1039/d0fo03442h
[2] Chen WJ, Kung GP, Gnana-Prakasam JP. Role of Iron in Aging Related Diseases. Antioxidants (Basel). 2022 Apr 28;11(5):865. doi: 10.3390/antiox11050865. PMID: 35624729; PMCID: PMC9137504.

21228 | Paediatric oncology: main recommendations and nutritional guidelines

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Abstract

Introduction: Paediatric cancer aetiology is multifactorial and the symptoms depend on its location or affected system. The physiological changes, resulting from the cancer or its treatments, can increase the risk of malnutrition. Thus, it is urgent to understand the current nutritional care guidelines.

Aim: To review the most common nutritional concerns in paediatric oncology, the main recommendations and guidelines published in scientific databases.

Methodology: A review was conducted from October to December 2022, through PubMED and Google Scholar, using the keywords "paediatric," "cancer" and "nutrition", searching papers published in the last 10 years, in English or Portuguese.

Results: Paediatric cancer is the main cause of death in children and young people, with a higher prevalence of leukaemia (42%), lymphomas (24%), tumours of other epithelial tissues and melanomas (8%), CNS tumours (7%) and kidney (7%). The treatment depends on the type of cancer, representing a 5-year survival rate average around 80% in developed countries. The main physiological changes associated with cancer or its treatment (anorexia, gastrointestinal disorders, mucositis, esophagitis, dysphagia, xerostomia, dysgeusia or dysosmia) can increase the risk of malnutrition and affect treatment's response. Thus, the nutritional status can be assessed using a variety of screening tools, for example the Nutrition Screening Tool for Childhood Cancer (SCAN). The recommendations issued by ESPEN aren't child specific, the existing child recommendations aren't cancer specific, only some national paediatric associations have reached a consensus.

Conclusions: Nutritional assessment is of essential importance to signal risk situations, and although there is no single measure of nutritional intervention, when this is carried out early, it allows maintaining an adequate nutritional status, before and after treatments, improving quality of life.

Keywords: Paediatric oncology; Paediatric nutrition; Guidelines.

20503 | Research on antibiotic resistance in isolates from environmental waters of Douro

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Abstract

Public health has been affected in the last years more and more by infections caused by antibiotic resistant bacteria due to the ability that bacteria present to create new resistances to antibiotics. This work was based in the research developed for the initiation to investigation program at the Faculty of Pharmacy of University of Porto. This is an exploratory work that is just in the beginning. With the aim of detecting antibiotic resistant bacteria in environmental waters, we searched for fecal contamination indicators, especially lactose fermenting Enterobacterales. The water samples were collected from a region near the natural reserve of "Estuário do Douro", a resting, feeding, and sheltering place for many species of migratory birds, in 18th November 2022. The first step to this study was inoculation of culture media bymembrane filtration of different volumes of river water (100 mL; 10 mL; 1mL of the samples in) and culture in MacConkey agar, MacConkey agar with ampicillin, cefotaxime and meropenem and also spread of 100 µL of water samples in those same culture media.

Characterization of the isolates selected from the culture media with meropenem and cefotaxime. For those isolates, we proceeded to antimicrobial susceptibility testing by agar diffusion method according to EUCAST. AMPc beta-lactamases and extended-spectrum betalactamases (ESBL) producers were presumptively identified. The resistance mechanism of AMPc 846 producers was confirmed by phenotypic test with inhibitors and the ESBL producers were confirmed by the double-disk-synergy-test.

Our results are few, but we are confident in the path we are following because till now we already were able to detect two ESBL producers, an AMPc producer and some isolates that showed a high level of resistance to the antimicrobial agents.

The detection of this kind of multidrug resistant bacteria, especially in a location like the one from these samples, is important because a healthy aquatic environment affects a lot of ecosystems that are the base of a "one health" approach of antimicrobial resistance spread.

Keywords: antibiotic resistance; one health; multidrug resistant bacteria

20408 | Risk of eating disorders and social desirability among higher education students: comparison of nutrition students with other courses

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Abstract

Introduction The transition to university is a period of high risk for the development of eating disorders, with nutrition science students representing a group with particular vulnerability. In research involving self-administered questionnaires, we should consider potential sources of bias, including social desirability.

Objectives To compare the risk of eating disorders between students of nutrition/dietetics and other courses and to analyse the effect of social desirability.

Methodology Data from 475 higher education students (79.8% female) with ages between 18 and 27 years were analysed. All participants completed a questionnaire assessing the risk of eating disorders (EAT-26) and social desirability.

Results Of the respondents, 11.2% (n = 53) had a high risk for eating disorders, being that proportion higher among females (12,7% vs. 5,2%, p = 0.045). No differences were found in the EAT-26 scores between nutrition/dietetics students and students from other areas nor in the risk of eating disorders. Social desirability correlated negatively with "Dieting" (r = -0,144; p = 0,003) and "Bulimia and food preoccupation" EAT-26 subscales (r = -0,275; p < 0,001) and showed a positive correlation with "Oral control" (r = 0,151; p = 0,002). The overall EAT-26 score was negatively associated with social desirability (r = -0,115; p = 0,016).

Conclusion In this sample, nutrition/dietetics students did not differ from those attending other courses regarding the risk of eating disorders. Overall, the risk of eating disorders is higher in women. A potential social desirability bias should be considered when interpreting results from the different EAT-26 subscales, especially regarding bulimic behaviour and related symptoms.

Keywords: risk of eating disorders; EAT-26; social desirability; nutrition students; higher education students.

20479 | Patterns of eating behaviour among 13-year-old adolescents and associated factors: findings from the Generation XXI birth cohort

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Abstract

Lifestyles, such as eating behaviour, learned and adopted during adolescence, may persist into adulthood. However, the literature exploring patterns of eating behaviour and its determinants among adolescents remains limited. The aims of this study were to identify groups of individuals with similar patterns of eating behaviour in a sample of Portuguese adolescents and to explore whether the identified groups differ in terms of early life characteristics, family environment, severity of depressive symptoms and Body mass index (BMI) z-score. Participants were 3601 13year-olds enrolled in Generation XXI, a population-based birth cohort. Adolescent eating behaviour was assessed using the Adult Eating Behaviour Questionnaire (AEBQ), a self-reported questionnaire previously validated in this sample. The severity of depressive symptoms was measured using the BDI-II and data on sociodemographic and anthropometric characteristics were collected at birth and the 13-year-old follow-up. Latent class analysis (a person-centred approach) was conducted and associations were estimated using univariate and multivariable multinomial logistic regression models. Five patterns of individuals were identified: "Picky eating", "Disinterest towards food", "Food neophilia", "Emotional eating" and "Food attractiveness". Some patterns, such as "Picky eating", "Food neophilia" and, especially, "Emotional eating" and "Food attractiveness" included mainly girls. Adolescents whose mothers had higher educational level were less likely to be in the latent class of "Food attractiveness" and those with higher BMI z-score were more likely to belong to the "Food neophilia" pattern. Individuals with more severe depressive symptoms had higher odds of belonging to the "Picky eating" and, especially, "Emotional eating" and "Food attractiveness" patterns. These findings suggest a starting point for the development and planning of targeted public health interventions.

Keywords: eating behaviour; adolescents; depression; latent class analysis; environmental influences; weight

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20730 | Brewer's yeast as a clean label ingredient for replacement of phosphates in hams

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Abstract

Phosphates are common additives in the meat industry. They are used to increase the water retention capacity. They act in buffering, emulsification, colour stability, inhibition of lipid oxidation, antibacterial activity and protein dispersing properties. Excessive consumption inhibits absorption of minerals, causes kidney diseases and colorectal cancer.

Brewer's yeasts are sets of strains responsible for beer fermentation. Often Saccharomyces 849 cerevisiae, which consume sucrose, maltose and maltotriose, producing ethanol and CO². Studies show that brewer's yeast as a meat food ingredient may produce the same functions as phosphate.

In this study we evaluated the potential use of brewer's yeast to substitute phosphate in meat products. Hams with brewer's yeasts extracts were evaluated for appearance and texture properties. Comparing with control samples, with and without phosphates, and three commercial phosphate substitutes. The impact of different treatments on colour was evaluated by the difference (Delta E test) between two colours in a L*a*b* colour space. The texture properties: hardness, cohesiveness, elasticity, gumminess, chewiness and resilience were evaluated by the TPA test (Texture Profile Analysis) of double compression.

Extracts were obtained through hydrothermal treatment at high temperatures, using an autohydrolysis reactor in different temperatures and extraction times (i) only with water and solvent and (ii) with sodium hydroxide as a solvent at two concentrations.

They were tested at 6.5 g/kg, the phosphate concentration in the model matrix, and 13.3 g/kg, the maximum concentration indicated to be added of the commercial phosphate substitutes tested.

Hams produced with brewer's yeasts extracted with NaOH 1M showed no significant differences (p<0.05) to the controls with phosphates and commercial substitutes. Providing similar colour, cohesiveness, elasticity, hardness, gumminess and chewiness. Concluding that these extracts could be an alternative for replacing phosphates in hams.

20820 | Neurobehavioural effects on offspring due to Ketogenic diet

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Abstract

A multitude of therapeutic effects has been attributed to ketogenic diets, including weight loss, cardiovascular health, microbiome disruption, diabetes and cancer. Likewise, there is evidence for the importance of maternal nutrition during pregnancy and lactation on individual's development and health. In fact, maternal lifestyle before conception is one of the long-lasting factors affecting foetal programming and neurodevelopmental outcomes. The aim of the present study was to evaluate how maternal nutrition, ketogenic diet intake, influences neurobehavioural development of offspring. Two-months-old male and female Wistar rats were randomly allocated to either a control chow or a ketogenic diet. Rats had free access to standard rat chow (4RF21/C Mucedola) or ketogenic chow (AIN-76A Bio-serv) and water ad libitum. Dams were randomly allocated in standard and ketogenic groups. All animals were monitored. Offspring were postnatally observed considering several neurodevelopmental reflex parameters to assess nervous system maturation. In some behaviours studied (rooting, ear twitch, eye opening, auditory startle, air righting) we identified the "first day of performance" while in others (surface righting, cliff aversion, negative geotaxis, forelimb grasp, olfactory discrimination and openfield) a measure of performance (time in seconds) was recorded. Pups fed with ketogenic diet presented a reduced evolution in body weight compared with their counterparts. No differences were found in air righting between groups, but tactile sensitivity was achieved earlier in pups fed with standard chow. Maternal nest exploration activity in ketogenic pups appears to be increased. Locomotor activity increased with age in both groups. After weaning, offspring received the same diet as their dams for five months. At the end of the experimental period, behavioural studies were performed to evaluate changes in learning and memory, anxiety and social behaviour.

21123 | Sociodemographic, lifestyle and anthropometric profile of vegetarian and omnivorous adults: preliminary data from the VEGGIENUTRI project

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Abstract

Data on characterization of vegetarian individuals in Portugal is currently unavailable. This work aimed to compare sociodemographic, lifestyle and anthropometric characteristics among vegetarian and non-vegetarian populations. This was a cross-sectional study from the VeggieNutri project which invited healthy adults following an omnivorous (OMNI), lacto-ovovegetarian (LOV) or vegan (VEG) dietary pattern for 1 year minimum. Weight, height, waist circumference (WC), body composition (eg. visceral fat (VF), muscle mass (MM), total body water (TBW)), blood pressure (BP) and handgrip strength (HGS) were measured. Participants completed a sociodemographic and lifestyle questionnaire. 422 individuals (72% females) were included, of whom 58%, 25% and 17% were OMNI, LOV and VEG, respectively. Global median (IQR) age was 34 (26-44) years, with LOV and VEG being younger compared to OMNI, p=0.004. Distribution of

males by dietary patterns was: OMNI (64%)>VEG (20%)>LOV (16%), while distribution of females by dietary pattern followed a different trend: OMNI (56%)>LOV (29%)>VEG (16%) (p=0.026). Education, monthly income, smoking, physical activity, HGS or BP were not different between groups. Among VEG, the proportion using nutritional supplements was the highest (86%), followed by LOV (54%) and OMNI (29%) (p=0.001). BMI was adequate in all groups, being the lowest in VEG group (median (IQR) BMI of 22.4 (20.4-25.6) kg/m2, p=0.024). WC and VF were the lowest in LOV group (median (IQR) WC in LOV of 79.3 (71.9-86.7) cm, p=0.001; median (IQR) VF in LOV of 3.0 (1.5-5.0), p=0.012). OMNI individuals tended to have higher MM (median (IQR) in kg: 45.5 (40.5-55.0), 43.7 (40.3-48.3) and 43.0 (39.3-53.4) for OMNI, LOV and VEG, respectively, p=0.077). TBW was adequate in all groups, being the highest in VEG group (median (IQR) of 53.1 (50.6-57.0)%, p=0.032). In conclusion, anthropometric characteristics differed between dietary patterns, with lower values of BMI, WC, VF and MM and higher TBW in plant-based dietary groups.

Keywords: dietary pattern; omnivorous; lactoovovegetarian; vegan; body mass index; waist circumference; body composition

Acknowledgments

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21229 | Eating behaviour and risk of eating disorders in higher education students

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Abstract

Eating behaviour suffers unique and integrated interferences from nutritional, psychological, cultural, social, demographic and economic factors, requiring a multifactorial understanding of its dimensions. Our aim was to determine the risk of eating disorders (ED) among Portuguese higher education students and to relate it to different dimensions of eating behaviour. A sample of 338 higher education students (83.1% women) with a mean age of 21.5 years (SD=2.5) was assessed in terms of risk of ED (EAT-26), dimensions of eating behaviour (uncontrolled eating, restraint, emotional eating, binge eating, flexible and rigid control and eating self-efficacy) and Body Mass Index (BMI). The risk for the development of ED was higher among females (14,6%) when compared to men (7,0%, p = 0,14). Among women, BMI, uncontrolled eating, restraint, emotional eating, binge eating, flexible control and rigid control were predictors of ED risk. Among men, the risk of ED was associated with higher restraint and eating self-efficacy. For women, multivariate analysis on the EAT-26 subscales (Diet, Bulimia and Oral Control) with BMI and dimensions of eating behaviour as independent variables revealed statistical significance, explaining about half of the variance for Diet (adjusted R2 = 0.551; p < 0.001), one-third for Bulimia (adjusted R2 = 0.326; p < 0.001) and one-seventh of risk variance for Oral Control (adjusted R2 = 0.145; p < 0.001). In men, the model was significant (p < 0.001), explaining about half of the variance for Diet (adjusted R2 = 0.525; p < 0.001), a fifth for Bulimia (adjusted R2 = 0.233; p = 0.006) and a fifth of the variance risk for Oral Control (adjusted R2 = 0.236; p = 0.003). In conclusion, higher education students are a risk group for ED, especially women. The risk of ED among males is associated with restrictive behaviours and eating self-efficacy, while among females BMI and most eating behaviour are related with the risk of ED.

Keywords: eating behaviour, eating behaviour dimensions, EAT-26, university students.

21239 | Adherence to the Mediterranean dietary pattern

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Abstract

The Mediterranean Dietary Pattern (MDP) is internationally recognized as one of the healthiest diets, since lots of benefits have been associated with it, such as less cardiovascular and other chronic diseases. This study aimed to study sociodemographic and lifestyle characteristics of Portuguese adults associated with the adherence to the MDP. A sample of Portuguese adults (≥18 years) was assessed by questionnaire: socio-demographics (sex, age, education); lifestyles (physical activity, screen time and sleeping hours) and adherence to the MDP (Portuguese version of the Prevention with Mediterranean Diet tool; PREDIMED). The sample comprised 332 participants (63.4% females) with mean age of 48 years (range: 18 to 98). About one third (34.7%) had higher education and 22.2% reported less than high school educational level. Half of the sample (48.9%) reported practicing physical activity weekly and the average daily time of sleeping was 7 hours and 15 minutes. About two thirds (68.2%) reported to know what MDP is, but only 35.7% revealed a good adherence to it. Females and males didn't differ significantly regarding PREDIMED's score (mean = 8.6 vs. 8.4, p = 0.303). A higher level of adherence to the MDP was associated with older age (r =0.212, p<0.001) and less time dedicated to sedentary activities with technology (r=-0.130, p=0.018). A higher proportion of the participants who reported knowing what the MDP is had good adherence to it (43.2% vs. 19.8%, p>0.001). No significant associations were found between the adherence to the MDP and education (r=0.091, p=0.098), physical activity level (r=-0.027, p=0.737) or sleeping hours (r=-0.082, p=0.137). However, higher age, knowing what the MDP is and screen time were associated with the adherence to the MDP. This work intends to contribute towards target interventions to increase the adherence to MD in Portugal.

21243 | Does gestational diabetes induce changes in neurobehaviour in early postnatal and in young adult offspring?

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Abstract

Maternal lifestyle before conception is one of the long-lasting factors affecting foetal programming and neurodevelopmental outcomes. In fact, gestational diabetes mellitus is the most common complication of pregnancy, affecting 10% of expectant mothers. Both human cohort studies and experimental research has demonstrated that diabetes during pregnancy has varying effects on fetal development and affects health outcomes in the offspring. The aim of the present study was to evaluate how maternal diabetes influences early postnatal neurobehavioural development of offspring and after weaning their locomotor activity, anxiety and learning and memory abilities. Dams were randomly allocated in non-diabetic, diabetic and diabetic-treated with insulin groups. Gestational diabetes was induced with Streptozotocin at 856 gestational day 5 (GD5) of pregnancy. Half of the diabetic pregnant females were randomly assigned to receive insulin pellets subcutaneously at GD9. Offspring were postnatally observed considering body weight and several neurodevelopmental reflex parameters to assess nervous system maturation. In some behaviours studied (rooting, ear twitch, eye opening, auditory startle, air righting) we identified the "first day of performance" while in others (surface righting, cliff aversion, negative geotaxis, forelimb grasp and openfield) a measure of performance (time in seconds) was recorded. Pups born from diabetic dams presented a reduced evolution in body weight compared with their counterparts. No differences were found in air righting between groups, but tactile sensitivity was achieved earlier in pups born from diabetic and diabetic-treated with insulin dams. Locomotor activity increased with age in all groups. After weaning, offspring were maintained for two months and behavioural studies were performed to evaluate changes in locomotor activity, learning and memory, anxiety and aggressive behaviours.

Keywords: Gestational diabetes, Neurodevelopmental behaviour, Offspring, locomotor activity, learning and memory, anxiety.

21254 | Ethics and artificial nutrition and hydration on the terminal patient

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Abstract

Given the lack of scientific evidence, decisions regarding the administration of artificial nutrition and hydration in terminally ill patients constitute an important ethical dilemma, existing a conflict between "treat" and "care" perspectives, varying also its usage depending on the legal and cultural background in the various countries.

This study aims to clarify whether this practice is a basic care intervention or a futile medical treatment. Therefore, we review the national guidelines and codes of ethics of different European countries.

In countries such as Portugal, Italy and Poland, it is viewed as a basic care intervention, while in countries namely France, England, Norway, Ireland, Germany, Finland, Netherlands, Belgium and Switzerland it is viewed as a medical treatment. Moreover, in countries such as Romania, Croatia and Hungary there is a lacking legal framework.

The different approaches of the terminally ill patient's care can reflect differences on cultural perspectives.

Keywords: Artificial nutrition; Artificial hydration; End of life; Medical Ethics; Persistent Vegetative State; Medical Code of Ethics

21267 | Dietary supplements for travellers' diarrhoea

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Abstract

The human intestinal microbiota plays a fundamental role in our well-being because, in addition to its digestive functions, it has a crucial function in the body's defence, containing an abundant flora that are beneficial to humans.

A diet with pre- and probiotics ensures the balance of this microbiota, allowing the multiplication of beneficial microorganisms and hindering the entry of pathogens. Prebiotics are substances that feed beneficial microorganisms, positively influencing their multiplication and activity. On the other hand, probiotics are live microorganisms, present in some foods, supplements, or manipulated foods, that when administered in adequate doses can balance the intestinal microbiome. Finally, postbiotics are products of the metabolism of probiotics that, due to their bioactivity, can reproduce their beneficial effects. Thus, a symbiotic relationship between all of them is essential to ensure an intestinal ecosystem that favours the growth of beneficial flora and hinders the proliferation of infectious bacteria. When it's not possible to guarantee an adequate amount of these microorganisms through food, it may be necessary to resort to supplements. Some supplements help maintaining the good condition of the intestinal flora, especially when traveling to other countries and there are changes in the eating habits/routines. It prevents "travellers' diarrhoea. This is a self-limited infectious gastrointestinal disease whose origin is 858 mostly bacterial (enterotoxigenic Escherichia coli). The risk of transmission is greater in warmer and more humid seasons, as these favour the proliferation of microorganisms, and its impact can range from mild to severe depending on the person.

Do such products effectively have any influence on the prevention of travellers' diarrhoea? What other actions will it have on the individual's health? This paper aims to discuss facts that allow consumers to decide on the acquisition of this type of supplements.

Keywords: travellers' diarrhoea; prebiotics; probiotics; postbiotics; microbiota; supplement.

References

[1] GOTRIED, Jonathan. (2021). MSD Manuals. Travellers' diarrhoea. Accessed on 08/03/2023 https://www.msdmanuals.com/pt-

pt/profissional/distúrbiosgastrointestinais/gastroenterite/diarreia-do-viajante.

[2] Scarpellini E, Rinninella E, Basilico M, Colomier E, Rasetti C, Larussa T, Santori P, Abenavoli L. From Pre- and Probiotics to Post-Biotics: A Narrative Review. Int J Environ Res Public Health. 2021 Dec 21;19(1):37. doi: 10.3390/ijerph19010037. PMID: 35010297; PMCID: PMC8750841.

20514 | Analysis of the implementation of an Integrated Responsibility Unit to improve the treatment of obesity in Portugal

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Abstract

Background: In 2018, the largest hospital in the North of Portugal, Centro Hospitalar Universitário de São João (CHUSJ), faced a high waiting time for outpatient clinic and surgery of obese patients, creating the need to innovate and redesign the way hospitals were organized to better respond to patients. For that reason, in 2019, a new model of healthcare delivery, Integrated Responsibility Units (IRU), with larger autonomy, patients centred, and pay-for-performance was introduced in CHUSJ.

Methods: To analyse the results of IRU a retrospective study was designed, comparing the triennium 2016 to 2018, when obesity treatment was incorporated into the General Surgery Department, to the triennium 2019 to 2021, as an Integrated Responsibility Unit. The areas of study were access, production, efficiency, quality, and economic-financial performance. Additionally, to obtain the view of IRU's professionals was performed a survey to determine the evolution of motivation, satisfaction and how the model can be improved in the future.

A reduction of 66 % in the waiting time for appointments and 34 % for surgery, was observed. In terms of production stands out a 127 % Results: Access to obesity treatment increased over the triennium of implementation of the IRU. terms of production, stands out a 127 % increase in the number of appointments and 29 % in surgeries. On the financial side, there was a reduction of 83 % in the losses between trienniums. IRU health workers had an increase of 33 % in motivation to a rate of 84%.

Conclusions: The constrain in access and lack of efficiency existed in 2018. The IRU model surpassed the objectives proposed. Controlling access, efficiency, improving quality and financial balance. Concurrently, the motivation of health professionals increased. It was demonstrated that Integrated Responsibility Units have the potential to revolutionize medical services with constraints and increase focus on the patient.

Keywords: Health Management, Efficiency, Access, Performance, Autonomy, Portugal, Portuguese National Health Service (SNS).

20689 | Transgenerational high-fat diet mouse model shows elevated expression of obesity-related genes and impaired mitochondrial performance in seminal vesicles

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6U

Abstract

The combination of genetic background and lifestyle factors have transgenerational effects, heightening the risk of obesity and related health problems. We aimed to evaluate the effects of a high-fat diet (HFD)-induced obesity on the expression of obesity-related genes (ORGs) in seminal vesicles (SV) over 3 generations. We further analysed how this condition affected mitochondrial performance, by the activity of citrate synthase (CS) and mitochondrial complexes I (CI) and II (CII). We employed a transgenerational mice model, generation FO was split into 3 groups (n=6): Control (standard chow 200 days), HFD (HFD 200 days), and HFDt (HFD 60 days plus standard chow 140 days). The sons (F1) and grandsons (F2) of the F0 generation were fed the standard chow (200 days). The transcripts of selected ORGs (MC4R, FTO, GNPDA2, TMEM18) in SV of each mouse were quantified by RT-qPCR. We further isolated the SV mitochondria of FO mice (n=3), and evaluated the CS, CI, and CII activities. Expression of MC4R and GNPDA2 in SV increased within the FO generation, from the control to the HFD, and from HFD to HFDt. This effect appears to fade in the following generations. TMEM18 presented increased transgenerational expression for the HFDt across the 3 generations. We observed that SV of FO mice maintained CS activity in all conditions, while CI had higher activity in the HFDt group (compared to the HFD) and CII followed a reversed trend. HFDs can have an impact on the genetic expression of ORGs in SV for up to two generations. This effect appears partially reversed in the F2 generation for MC4R and GNPDA2, important regulators of energy homeostasis. Thus, reversing the diet can bring long-term beneficial effects in SV. Assessment of CS activity in generation FO mice suggests that the Krebs cycle may not be damaged. The decrease observed in CII activity suggests a detrimental effect on mitochondrial performance, which can lead to oxidative stress, often associated with obesity.

Keywords: Obesity, Obesity-related genes, Oxidative Stress

20796 | Compliance of established food/nutritional therapy in a group of overweight patients followed in nutrition consultations

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Abstract

Introduction: It is known that it is often difficult to people comply diets for weight control, even if they are properly individualized.¹

Aim: Compare the dietary intake reported by a group of overweight patients with the prescription made in the first nutrition appointment, 2 months after starting dietary/nutritional therapy with an individualized food plan (IFP).

Methods: Sociodemographic and anthropometric data and physical exercise habits were collected in a group of 21 overweight patients. Data on food intake were collected (usual food day + extra food) and compared with the individualized food plan prescription and self-perception of compliance of the food plan was evaluated with a Lickert scale (1-none compliance and 10 extreme compliance).

Results: The sample consists of 21 overweight individuals of both sexes (mean BMI 32.1kg/m2) with a mean age of 48 years. Compared to the IFP, a lower energy intake (-20.3%), lower contribution of fat (-25.1%) and lower contribution of carbohydrates (-27.7%) to the total energy value were found, with statistical significance.

There was also a lower intake of vegetables (-0.85), fruit (-1.35), cereal equivalents (-2.84) and fat (-3.71). Individuals self-report being compliant, since the median for self-perceived compliance is 6.00, but no associations were found between the differences in intake and self-perceived compliance with the IFP.

Conclusion: There are differences between self-reported dietary intake and IFP. It is crucial to understand the reasons that lead to this gap and to highlight the importance of transmitting information to patients so that they can adequately comply the IFP and achieve consistent and healthy weight loss.

Keywords: overweight, food therapy, nutritional therapy, compliance, food plan

References

[1] Lemstra, M., Y. Bird, C. Nwankwo, M. Rogers and J. Moraros (2016). "Weight loss intervention adherence and factors promoting adherence: a meta-analysis."<u>Patient Prefer Adherence</u>10: 1547-1559.

20937 | Lipid metabolism in iron overloaded mice adipose tissue

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Abstract

Iron is an essential regulator of adipogenesis, a crucial process for the adipose tissue (AT) development. In obesity and aging, for example, adipogenesis is impaired, favoring AT expansion through adipocyte hypertrophy instead of hyperplasia. This occurs in parallel with a high inflammatory, fibrotic and hypoxic environment, ultimately leading to metabolic dysfunction. Recent data shows that a high-iron diet decreases fat accumulation by downregulating adipogenesis and upregulating lipolysis in AT [1]. Consistent with this hypermetabolic response is the induction of browning phenotype that turns white into beige adipocytes, in which iron demands are higher than in white adipocytes to maintain the thermogenic mitochondrial capacity [2].

Nevertheless, data are scarce on the mechanisms underlying iron modulation of AT function. Therefore, the aim of this study is to elucidate the crosstalk between iron overload and adipocyte browning and metabolism. To this end, subcutaneous AT (SAT) samples were obtained from wild-type (WT) and Hemochromatosis Protein (HFE)-knockout mice at different ages (3, 6 and 9 months) for histological examination (Perls' Prussian blue) and for a qPCR analysis of genes related with browning (Ucp1, Pgc1 α , Dio2, Cidea, Prdm16) and lipid metabolism (Fabp4, Lpl).

WT animals showed a general decrease with age in the expression of all the genes analysed in this study. Similarly, a decrease expression of these genes was also found in HFE when compared to WT, suggesting impaired browning and lipid metabolism in HFE-knockout animals. Through Perls staining, iron deposits were only observed in older HFE-knockout mice (9m). Moreover, a decrease in the mRNA expression of Ucp1 and Pgc1 α , essential for the thermogenic potential, was observed in these animals.

In conclusion, our results show that both aging and iron deposits in adipose tissue influence negatively adipocyte metabolic pathways and browning mechanisms.

Keywords: Adipose tissue; Browning; Lipid metabolism.

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References

[1] Xiong Q, Zhao J, Tian C, Ma W, Miao L, Liang L, Zhang K, Du H. Regulation of a High-Iron Diet on Lipid Metabolism and Gut Microbiota in Mice. Animals (Basel). 2022 Aug 13;12(16):2063. doi: 10.3390/ani12162063. PMID: 36009656; PMCID: PMC9405328.

[2] Yook JS, You M, Kim Y, Zhou M, Liu Z, Kim YC, Lee J, Chung S. The thermogenic characteristics of adipocytes are dependent on the regulation of iron homeostasis. J Biol Chem. 2021 Jan-Jun;296:100452. doi: 10.1016/j.jbc.2021.100452. Epub 2021 Feb 23. PMID: 33631196; PMCID: PMC8010711
20416 | Quantification of antidepressant drugs in patients with suspected psychotropic drug intoxication

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Abstract

Antidepressant drugs (ATD) are the second cause of drug intoxication in Portugal. As the prescription of highly toxic ATD has been replaced by newer and safer drugs, the associated mortality has considerably declined. However, for polymedicated patients, patients with reduced hepatic and kidney function, and patients with drug metabolism genetic vulnerability, the risk of intoxication may be significant. Therefore, the availability of toxicological analyses for the broad spectrum of ATD in clinical use, at healthcare facilities, is of great importance.

The purpose of this study was to implement in the clinical practice of Centro Hospitalar Universitário de Santo António a complementary method for the diagnosis and monitoring of patients suspected for ATD intoxication or toxicity, through the blood quantification of the extensive variety of ATD available in the market. First, the study received the Hospital approval of the Board and Ethics Committee. Then, the medical and nursing teams were briefed on the project. Afterwards, method verification was performed to confirm the fitness of the proposed method for its intended use. Finally, quantification of the various ATD and active metabolites was performed in real patient samples using the verified commercially available kits.

The method proved to be suitable for the analysis, for most analytes (33), having adequate precision, accuracy and measuring range. However, for the hospital's LC-MS equipment, the results for a few analytes (5) did not meet the standards required and, for that reason, some analytical parameters require further optimization. Among the 20 patient samples, suspected ATD were found in 16 (4 with toxic levels) and not suspected ATD were found in 4. The method proved to be valuable for the diagnosis and monitoring of patients suspected for ATD intoxication or toxicity, since it allowed the detection of ATD that were overlooked by the screening tests already used in the clinical routine of the hospital.

Keywords: antidepressants intoxication; toxicological analysis; LC-MS/MS; method verification.

20444 | The role of biotics as a therapeutic strategy for oral mucositis - a systematic review

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Abstract

Objectives: Oral mucositis is an acute and highly prevalent side effect of cancer treatments. Currently, there is no effective strategy for its prevention or treatment. This systematic review aimed to assess the effectiveness of biotics used as a therapeutic strategy for the management of oral mucositis.

Materials and Methods: The PRISMA checklist was followed and PubMed, Web of Science, and Scopus were screened for clinical and pre-clinical studies assessing the potential effects of biotics in oral mucositis.

Results: From a total of 1250 articles retrieved, the authors included 9 in this systematic review. Four clinical studies reported positive clinical outcomes with Lactobacillus species (*Lactobacillus casei* and *Lactobacillus brevis* CD2) and *Bacillus clausii* UBBC07. In pre-clinical studies, there were promising results with *Lactococcus lactis* genetically modified, *Streptococcus salivarius K12*, and *Lactobacillus reuteri*.

Conclusion: The findings of this systematic review suggest that probiotic supplementation could potentially reduce the incidence of therapy-induced oral mucositis or alleviate its symptoms in chemotherapy or radiotherapy patients. However, the available evidence is narrow and marred by significant heterogeneity across studies.

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Keywords: Oral mucositis, probiotics, prebiotics, oral cancer, head and neck cancer.

20445 | Contamination by antibiotic resistant bacteria of a water stream and a water drainage reaching Matosinhos beach

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Abstract

Antibiotic resistant bacteria have been a major global public health issue, concerning specially the medical care centres and hospitals, questioning the effectiveness of current infections treatment regimens. The emergence and persistence of antimicrobial resistance in the environment has been thoroughly researched, as the aquatic environment can be a reservoir of these bacteria in areas with anthropogenic contamination.

Having this in mind, this work aims at investigating water streams of Ribeira da Riguinha and Rua de Brito Capelo, which both flow into Matosinhos beach, testing the possibility of faecal contamination.

Several samples were collected and analysed within twenty-four hours from these two water streams. It was performed a phenotypic characterisation followed by a genotypic detection.

Firstly, a membrane filtration was performed with various volumes: 100 mL, 10 mL, 1 mL (with a 1/20 dilution using sterile water) and 100 μ L (by spread). Each one of the membranes were placed in MacConkey agar and MacConkey agar with ampicillin (100 μ g/mL), cefotaxime (1 μ g/mL) and meropenem (0.5 μ g/mL) and incubated overnight at 37 °C.

Secondly, mostly lactose fermenting, gram negative bacteria were chosen, at random, from MacConkey agar with cefotaxime and meropenem for further phenotypic characterization.

Antimicrobial susceptibility tests were carried out, for all the isolates of interest, by agar diffusion method according to EUCAST, including β -lactams and non β -lactams. In addition, bacteria isolates were identified presumptively by their colour in Chromagar Orientation medium. Regarding the mechanism of resistance, AMPc producers were confirmed by phenotypic tests with inhibitors, ESBL producers by double disk-synergy-test and carbapenemase producers by the Carbapenem Inactivation Method (CIM).

Finally, the isolates were analysed through a molecular biology method, Polymerase chain reaction (PCR) and the reaction products were visualized using agarose gel electrophoresis.

On the water samples were found *Enterobacteriaceae*, including *Escherichia coli*, KESC and *Pseudomonas* exhibiting extended-spectrum β -lactamases (ESBL), AMPc β -lactamases and carbapenemases. This indicates faecal contamination with relevant antimicrobial resistant threats (EUCAST, 2022; van der Zwaluw et al., 2015).

Keywords: Antimicrobial resistance; water stream contamination; Enterobacteriaceae.

Acknowledgments

This project could not have been accomplished without the encouragement, support, and guidance from the following people, and for that, I would like to express my appreciation.

First, I would like to thank my supervisor Professor Helena Ferreira for receiving me at Laboratório de Microbiologia (FFUP), proposing me this exciting work and for the opportunity to develop skills in the field of investigation. Beyond that, for the permanent support and valuable advice given throughout this year.

I could not fail to thank my co-supervisor, Dr Josman Palmeira, for all the patience and the constructive suggestions during this research.

Also, acknowledge to all the staff, especially Cristina for her kindness and assistance.

In addition, this study would have been more challenging without the help and participation of my committed colleagues, Catarina Mota and Tiago Peixoto.

Lastly, and most significantly, a big thank you to my family and friends, specifically to my father for encouraging me to enrol on this project, my mother for the incredible support and my friend Ana Basto for accompanying me on this journey.

References

EUCAST. (2022). Antimicrobial susceptibility testing. EUCAST disk diffusion method. European society of clinical microbiology and infectious diseases. Retrieved Jun 27 2022 from https://www.eucast.org/ast_of_bacteria/disk_diffusion_methodology/

van der Zwaluw, K., de Haan, A., Pluister, G. N., Bootsma, H. J., de Neeling, A. J., & Schouls, L. M. (2015). The Carbapenem Inactivation Method (CIM), a Simple and Low-Cost Alternative for the Carba NP Test to Assess Phenotypic Carbapenemase Activity in Gram-Negative Rods. PLOS ONE, 10(3), e0123690. https://doi.org/10.1371/journal.pone.0123690

20478 | CBD for the treatment of sleep disorders

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Abstract

This literature review evaluates the effectiveness of CBD in treating sleep disorders based on previous research. The study involved a systematic review of scientific literature and included studies in animals and humans, as well as randomised clinical trials.

The cannabinoids are a group of chemical compounds that are found in the cannabis plant or synthesised. These compounds interact with the body's endocannabinoid system (ECS), which is involved in regulating a wide range of physiological processes [1] and has been shown to play a role in regulating the circadian rhythm, making it a potential target for sleep disorders.

While animal studies have shown promising results, human studies on the effects of CBD on sleep are still limited [2]. CBD is a non-psychoactive compound found in this plant that is believed to have various potential health benefits [3].

One study found that a high dose of CBD led to an increase in the total percentage of sleep in rats, while another found that a low dose increased wakefulness in humans. However, two studies showed that a dose of 160mg/day increased sleep time in insomnia patients and decreased nightly arousals [2].

In another study on healthy volunteers, it was verified that 300 mg of CBD did not disrupt their normal sleep cycle or architecture [4]. Moreover, in patients with Parkinson's disease, CBD has also been shown to improve symptoms of sleep behaviour disorder, which can lead to poor sleep quality and nightmares [5], as shown by a study from 2014 examined in four patients [6]. It's worth noting that the sedative effects of CBD appear to be dose-dependent, with lower doses 869

being more stimulating and higher doses having a sedating effect. Additionally, chronic use of CBD for insomnia may increase the risk of dependence [2].

Overall, while CBD may be a potential therapeutic option for sleep disorders, more research is needed to fully understand its effects on sleep and the potential risks of long-term use.

Keywords: Cannabinoid; CBD; Sleep disorder; Endocannabinoid system; RBD; Parkinson.

Acknowledgments

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References

[1] Abyadeh, M., et al., A Proteomic View of Cellular and Molecular Effects of Cannabis. Biomolecules, 2021. **11**(10): p. 1411.

[2] Oberbarnscheidt, T. and N.S. Miller, The Impact of Cannabidiol on Psychiatric and Medical Conditions. Journal of Clinical Medicine Research, 2020. 12(7): p. 393-403.

[3] DiLonardo, M.J. CBD vs. THC: What's the Difference? 2019 2019/08/14; Available from: https://www.webmd.com/pain-management/cbd-thc-difference.

[4] Crippa, J.A., et al., Translational Investigation of the Therapeutic Potential of Cannabidiol (CBD): Toward a New Age. Frontiers in Immunology, 2018. 9.

[5] Marshall, L. *REM Sleep Behaviour Disorder (RBD): Clues About Brain Diseases.* 2022 2022/12/08; Available from: <u>https://www.webmd.com/sleep-disorders/story/REM-sleep-behaviour-disorder-RBD</u>.

[6] Chagas, M.H.N., et al., *Cannabidiol can improve complex sleep-related behaviours associated with rapid eye movement sleep behaviour disorder in Parkinson's disease patients: a case series.* Journal of Clinical Pharmacy and Therapeutics, 2014. **39**(5): p. 564-566.

20492 Predictors of psychotherapy dropout in patients with borderline personality disorder: A systematic review

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Abstract

Introduction: Borderline Personality Disorder (BPD) is a highly debilitating psychiatric condition. Despite the expansion of new BPD specific forms of psychotherapy in the last few decades, high dropout rates in these treatments have been reported. Treatment discontinuation is associated with poor patient outcomes, inefficient utilization of resources and the demoralization of healthcare providers.

Method: In order to identify predictors of psychotherapy dropout among patients with BPD, a systematic search of Medline, the Cochrane Library, PsycInfo and PsycArticles was conducted. Studies included were randomized-controlled trials with patients diagnosed with BPD, in which the therapeutic intervention consisted of an evidence-based psychotherapy. The quality of evidence in the studies was assessed through the use of Revised Cochrane risk of bias tool for randomized trials.

Results: Six articles, incorporating four types of treatment (Dialectical Behaviour Therapy, Schema Therapy, Transference Focused Psychotherapy and Systems Training for Emotional Predictability and Problem Solving), were included. The dropout rates range from 31% to 69%. High hostility and a weak therapeutic alliance were consistently predictive of dropout. In contrast, better 871 mindfulness skills and better performance in specific neuropsychological domains such as memory and executive control were identified as predictive of lower risk of dropout. Sociodemographic variables and comorbidity did not influence treatment retention.

Conclusion: Factors that influence discontinuation should be taken into consideration in future treatment programs, in an effort to optimize retention. Qualitative assessments of patients' reasons for dropping out may also help guide adjustments.

Keywords: borderline personality disorder; treatment dropout; psychotherapy; therapeutic alliance; systematic review.

20518 | Tunnelling nanotubes as pharmacological targets of tubulin targeting drugs

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Abstract

Tunnelling nanotubes (TNTs) are thin intercellular structures, containing actin and tubulin, with largely unknown functions. TNTs may be involved in intra and intercellular communication. Recently they were reported to play important roles in cancer[1]. Taxanes and vinca alkaloids are anti-cancer drugs known as anti-mitotic drugs due to their action on tubulin polymerization and impairment of mitosis. Their putative role in the production of TNTs is not known because of the absence of experimental models to study drug effects on TNTs. This shortage also slowed the discovery of new drugs.

This work aimed at developing a TNT quantification method in 2D cell cultures and validating it by investigating the effects of established and of non-oncological drugs that potentially may affect TNTs formation (such as flubendazole). MDA-MB-231 cells (initial density 1.4×10^4 cells/ml) were treated either with solvent (0.1%DMSO; control) or drugs: paclitaxel (5-40nM), flubendazole (0.1-0.8µM) and vinblastine (50 nM-5µM) for 24h. At this point, cells were labelled Hoechst 33342 or DAPI filter (cell counting). TNTs were counted manually by two independent operators using a 872 (5µg/mL; for nuclei staining) and imaged using Lionheart FX using phase contrast (TNTs counting) set of literature-found criteria[2, 3]. Results are expressed as number of TNTs/cell (mean±SD) from 4 independent experiments. Cohen's d and Student's t-test were used to detect significant differences. Cell viability was assessed in parallel assays using Presto BlueTM reagent. Results show that paclitaxel (40nM), flubendazole (0.8µM) and vinblastine (50nM-5µM) caused a reduction in the number of TNTs/cell and that the method is appropriate for drug research. In conclusion, TNTs can be a target for both anti-mitotic drugs (as expected) and to nononcological drugs (such as flubendazole) and this method may be useful in the drug discovery of

Keywords: Tunnelling nanotubes; drug repurposing; cancer.

Acknowledgments

"anti-mitotic" oncological drugs.

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References

[1] Ottonelli, I., et al., Tunneling Nanotubes: A New Target for Nanomedicine? Int J Mol Sci, 2022. 23(4).

[2] Carter, K.P., J.E. Segall, and D. Cox, Microscopic Methods for Analysis of Macrophage-Induced Tunneling Nanotubes. Methods Mol Biol, 2020. 2108: p. 273-279.

[3] Abounit, S., E. Delage, and C. Zurzolo, Identification and Characterization of Tunneling Nanotubes for Intercellular Trafficking. Curr Protoc Cell Biol, 2015. 67: p. 12 10 1-12 10 21 [1]

20526 | Novel compounds for lymphoma treatment

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Abstract

We have developed a series of novel N-1,2,3-triazole–isatin hybrids that are promising as tumour antiproliferative agents [1]. Our triazole-isatin hybrids present high cytotoxic activity against solid tumour cells such as colon cancer, lung adenocarcinoma, and breast cancer. In addition, in breast cancer, some of these compounds alter the expression of genes encoding the epigenetic regulators p-300 (Histone Acetyltransferase P300) and ATP-2 (Acyl-Protein Thioesterase 2). These results suggest an effect of these compounds in gene expression in particular oncological contexts.

This work aims to test the effect of these novel compounds in a particular lymphoma type lacking targeted therapies: diffuse large B-cell lymphoma (DLBCL). This lymphoma is a type of fast-growing, aggressive form of non-Hodgkin lymphoma (NHL), that develops when the human body starts to produce abnormal B lymphocytes [2]. Currently, the available treatments for this oncological disease are inefficient for one-third of the patients

We conducted MTT assays using a cell line representative of this lymphoma type (SU-DHL-4) to measure cellular metabolic activity as an indicator of cell viability, proliferation, and cytotoxicity. This technique allowed us to calculate the IC50 value for each compound tested (n=4), a measure of drug potency [3]. Taking into consideration these results, we choose the best treatment concentration to use in cell cultures with higher volumes to successfully obtain RNA extracts for cDNA synthesis. Then, the cDNA was used to evaluate by real-time q-PCR the expression levels of p-300 and ATP-2, among other targets. Our data, suggests that these compounds are promising new therapies for DLBCL treatment.

Keywords: Lymphoma; cell lines; triazole-isatin hybrids; MTT assays.

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References

[1] Busto N., Leitão-Castro J., García-Sosa A.T., Cadete F., Marques C.S., Freitas R., Burke A.J. N-1,2,3-Triazole-Isatin Derivatives: Anti-proliferation effects and target identification in solid tumour cell lines. **RSC Medicinal Chemistry**. 2022. 13(8): 970-977; doi.org/10.1039/d2md00044j

[2] Goldfinger M., Cooper D.L. *Refractory DLBCL: Challenges and Treatment. Clin Lymphoma Myeloma Leuk.* 2022. 22(3):140-148. doi: 10.1016/j.clml.2021.09.011.

[3] Sargent J. M. *The use of the MTT assay to study drug resistance in fresh tumour samples. Recent Results Cancer Res.* 2003. 161:13-25. doi: 10.1007/978-3-642-19022-3_2.



Figure 1: Workflow for obtaining preliminary results regarding the modes of the action of the N-1,2,3-Triazole-Isatin derivate collection

20548 | The role of lactoferrin in age-related neurodegenerative diseases

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Abstract

Lactoferrin is a glycoprotein, and the main protein in the human milk. It is present in colostrum and plays a pivotal role in brain development [1]. The protein exhibits outstanding bioactivities from birth to elderly; evidence exists that lactoferrin protects the brain from neuronal injury, enhances brain connectivity and neurotrophin production, besides being instrumental in the prevention of neuropsychiatric diseases over time while promoting cognitive development. Recent data demonstrating that astrocytic lactoferrin may have an active role in the cholesterol synthesis have also been published, highlighting its role in neurodevelopment and several neurological diseases [2]. In this work, we discuss the latest evidence of the role of certain nutrients during neurodevelopment from neonatology to elderly, highlighting the added value of lactoferrin in anti-inflammatory and immunomodulatory processes in the brain. A special focus is given to Parkinson's Disease and Alzheimer's Disease. A search using a combination of terms (i.e., lactoferrin, neurodegenerative diseases, Parkinson's Disease, Alzheimer's Disease) was run in Scopus, to generate the bibliometric map using the VOSviewer software [3]. The generated clusters highlight a range of different studies on the application of lactoferrin, including the development of delivery platforms for the glycoprotein.

Keywords: Lactoferrin; neurodegenerative diseases; Parkinson's Disease; Alzheimer's Disease; VOSviewer.

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References

G.H. Schirmbeck, S. Sizonenko, E.F. Sanches, Nutrients 14 (2022).
S.F. Xu, Z.Q. Pang, Y.G. Fan, Y.H. Zhang, Y.H. Meng, C.Y. Bai, M.Y. Jia, Y.H. Chen, Z.Y. Wang, C. Guo, Glia 70 (2022) 2392.
N.J. van Edv. J. Waltman, Scientematrics 84 (2010) 522.

[3] N.J. van Eck, L. Waltman, Scientometrics 84 (2010) 523.

20553 | Finding a link between S100B and Transthyretin, two proteins with antiaggregation properties against AB peptide

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Abstract

Alzheimer's disease (AD) is a complex neurodegenerative disorder and involves multiple proteins, such as Transthyretin (TTR) and S100. S100B is the most abundant member of the Ca^{2+} -binding S100 family, known to play an important role in early inflammatory responses as an intra and extracellular holdase-type chaperone that prevents Amyloid- β peptide (A β) and tau aggregation and neurotoxicity, typical features of AD. S100B is secreted by glial cells (mainly astrocytes), and also by neurons, but at lower levels. TTR is also a protein with protective functions in the central and peripheral nervous systems. Several independent studies showed TTR decreased and S100B increased levels in AD patients, but the link between them is still unknown. In this work we asked whether A β_{42} peptide can increase S100B expression in neurons, using the human neuroblastoma cell line SH-SY5Y. Analyses of the mRNA by RT-qPCR, and of protein by immunocytochemistry, and slot blot in conditioned media, showed that A β oligomers led to increased levels of S100B, indicating that S100B responds to extracellular Aβ.

To explore a possible link between TTR and S100B, we used an AD transgenic mouse model established in different TTR genetic backgrounds, and S100B levels were analysed by immunohistochemistry. In animals with normal TTR (AD/TTR+/+), no differences were found $\frac{8}{7}$ between ages (3 and 7 months). However, when studying animals with reduced TTR (AD/TTR+/-) and without TTR (AD/TTR -/-), we found significantly elevated levels of S100B in 7-month-old mice, compared to 3-month-old mice.

Our results suggest that S100B expression by neurons is triggered by AB oligomers, demonstrating its active role in AD. Furthermore, TTR reduction might act as a signal for increased S100B expression, in advanced AD. TTR and S100B may act through similar mechanisms, and the insufficiency of one can be compensated by increasing the other.

Keywords: Alzheimer's Disease; Aβ peptide; S100B; Transthyretin

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20572 | Comparative study of the effect of IQOS[®] aerosols and cigarette smoke on the functional activity of human gingival fibroblastic cells

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Abstract

In addition to the association with several systemic pathological conditions, tobacco usage is one of the major causes of periodontal diseases, which results in bone loss, tooth mobility and, on more severe situations, teeth loss(1). To provide smokers with a potentially less dangerous alternative to traditional tobacco, IQOS® cigarettes were created. This tobacco is heated to a high temperature, which results in the production of an inhalable vapor without burning the tobacco(2). *In vitro* experiments using human cells are very helpful for determining the potential toxicity of compounds, with a high translationality to human health(3). In addition, fibroblasts, the most common cell type within the periodontium, are crucial for maintaining and modifying the extracellular matrix and gingival structure(4). Therefore, this study aims to compare the effect of conventional cigarette smoke with IQOS® aerosols on the functionality of human gingival fibroblastic cell cultures.

Traditional tobacco will be used to create the smoke solutions, and two different IQOS® devicesthe Iluma and the traditional IQOS® - will be used to create the aerosols. To produce the culture medium enriched with the aerosol/smoke a smoking machine and the ISO 20778:2018 smoking protocol will be used. The fibroblastic cell cultures will be established and characterized for several functional parameters at distinct time points. Aerosol/smoke extracts will be used undiluted, and serially diluted with the culture medium. The cell proliferation and metabolic activity of the cultures will be evaluated to access potential cytotoxicity while cell morphology will be accessed using fluorescence microscopy upon staining of relevant cellular structures.

The findings will support the development of hypotheses on the influence of IQOS[®] aerosols on periodontium physiology, as well as the effects of switching from conventional tobacco to IQOS[®] devices on periodontal disorders.

Keywords: heated tobacco products, IQOS®, conventional tobacco, periodontal disease.

References

[1] Chaffee BW, Couch ET, Vora MV, Holliday RS. Oral and periodontal implications of tobacco and nicotine products. Periodontology 2000. 2021;87(1):241-53.

[2] Simonavicius E, McNeill A, Shahab L, Brose LS. Heat-not-burn tobacco products: a systematic literature review. Tobacco Control. 2019;28(5):582.

[3] Gohlsch K, Mückter H, Steinritz D, Aufderheide M, Hoffmann S, Gudermann T, et al. Exposure of 19 substances to lung A549 cells at the air liquid interface or under submerged conditions reveals high correlation between cytotoxicity in vitro and CLP classifications for acute lung toxicity. Toxicol Lett. 2019;316:119-26.

[4] Smith PC, Cáceres M, Martínez C, Oyarzún A, Martínez J. Gingival wound healing: an essential response disturbed by aging? J Dent Res. 2015;94(3):395-402.

20577 | Synthesis of hydroxyacids required for the formation of new anti-virulent agents

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Abstract

Staphylococcus aureus is a gram-positive bacterium found in the skin and nasal cavities that causes a wide variety of clinical diseases. As these microorganisms show resistance to existing antibiotics, it is necessary to develop new drugs active against *S. aureus* through non-bactericidal mechanisms with anti-virulence approaches.¹⁻³ Promising anti-virulent compounds are depsipeptides (peptides in which one or more of the amino groups, -C(O)NHR-, are replaced by the corresponding ester group, -C(O)OR-), which are mainly found in marine natural products and have shown to inhibit *S. aureus* virulence by interfering with quorum sensing (QS). To enable the formation of these depsipeptides, hydroxy-acids were synthesized by stereoselective aldol reactions with butanal and hexanal as critical building blocks.¹

In this work, we present the synthesis of hydroxy acids with *R*-configuration and the structural elucidation of the obtained compounds by ¹H-NMR spectroscopy. Initially, the starting material, D-phenylalaninol is refluxed with CS_2 under basic aqueous conditions to give (R)-4-benzylthiazolidine-2-thione who suffers acetylation to give the compound **2**. Followed by an aldol reaction with butanal or hexanal and final hydrolysis, the (*R*)-3-hydroxyhexanoic acid was obtained (Figure 1).

Keywords: anti-virulent agents, depsipeptides, natural products, hydroxyacids.

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References

[1] Betül Kitir, M. B., Hanne Ingmer, Christian A. Olsen, Total synthesis and structural validation of cyclodepsipeptides solonamide A and B. *Tetrahedron* **2014**, *70* (42), 7721-7732.

[2] O'Connell, K. M.; Hodgkinson, J. T.; Sore, H. F.; Welch, M.; Salmond, G. P.; Spring, D. R., Combating multidrug-resistant bacteria: current strategies for the discovery of novel antibacterials. *Angew Chem Int Ed Engl* **2013**, *52* (41), 10706-33.

[3] Rasko, D. A.; Sperandio, V., Anti-virulence strategies to combat bacteria-mediated disease. *Nat Rev Drug Discov* **2010**, *9* (2), 117-28.



(a) KOH (3M, H₂O), CS₂ (5 eq), AcCl (1.5 eq), DMAP (0.1 eq), NEt₃ (1.5 eq), CH₂Cl₂; (b) Butanal or hexanal (1 eq), TiCl₄ (1.8 eq), iPrEtN (1.8 eq), CH₂Cl₂ (c) THF (0.2 M), LiOH (4 eq, 1M, H₂O).

Figure 1: Synthesis of hydroxy acids with R-configuration.

20587 | New P-glycoprotein activators as potential small molecules for the treatment of Alzheimer's disease

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Abstract

Alzheimer's disease (AD), whose true aetiology remains unknown, is a neurodegenerative disease characterized by a progressive decline in the cognitive function with the currently approved therapy remaining only symptomatic, lacking effects on disease progression. AD presents a multifactorial nature, with oxidative stress, metal ion dyshomeostasis and mitochondrial dysfunction emerging as possible causes, in addition to the well-established hyperphosphorylation of Tau protein and aggregation of amyloid-beta (A β) [1, 2].

In this work, 19 new synthetic tricyclic compounds were screened in a cholinergic-differentiation neuronal model using the human neuroblastoma SH-SY5Y cell line [3, 4]. The developed compounds were screened in distinct neuroprotective assays mimicking disease-related hallmarks, namely 1) iron overload, 2) ferroptosis and 3) impairments in A β clearance. The results revealed outstanding neuroprotective effects of the majority of the compounds against iron (III)and erastin-induced cytotoxicity and their ability to modulate P-glycoprotein (P-gp) activity. Moreover, in a cellular model of AD-like pathology of A β -induced cytotoxicity, the most promising compounds were able to protect the differentiated cells against the toxic stimulus, implicating the energy-dependent efflux pump - P-gp - in the clearance of A β peptides.

The overall results of this study highlight the neuroprotective effects of the bioactive compounds, thus empowering the rational strategy for the design of P-gp activators as a solution to counteract the severally interrelated features underlying the pathogenesis of AD.

Keywords: Alzheimer's disease; amyloid-beta; neuroprotection; cholinergic-differentiation model; P-glycoprotein.

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References

[1] Du X, Wang X, Geng M (2018) Alzheimer's disease hypothesis and related therapies. Transl Neurodegener 7:1–7

[2] Savelieff MG, Nam G, Kang J, Lee HJ, Lee M, Lim MH (2019) Development of multifunctional molecules as potential therapeutic candidates for Alzheimer's disease, Parkinson's disease, and amyotrophic lateral sclerosis in the last decade. Chem Rev 119:1221–1322

[3] Zhang YP, Brown RE, Zhang PC, Zhao YT, Ju XH, Song C (2018) DHA, EPA and their combination at various ratios differently modulated A β 25-35-induced neurotoxicity in SH-SY5Y cells. Prostaglandins Leukot Essent Fat Acids 136:85–94

[4] Teppola H, Sarkanen JR, Jalonen TO, Linne ML (2016) Morphological Differentiation Towards Neuronal Phenotype of SH-SY5Y Neuroblastoma Cells by Estradiol, Retinoic Acid and Cholesterol. Neurochem Res 41:731–747

20608 | Osteosarcoma multicellular spheroids: A tool to screen new therapeutical strategies

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Abstract

Osteosarcoma (OS) is a common primary bone cancer that affects mainly children/young adults ^[1]. The available treatment, surgery and chemotherapy, has been unimproved for decades, which explains the stagnant 5-year rate survival (60% for patients with localized tumour and 20% for metastatic cases) ^[2]. The lack of knowledge about OS etiology and pathophysiology has hampered the development of innovative therapies ^[3]. The establishment of representative *in vitro* models is a promising alternative to surpass this problem ^[4].

We aimed to establish a 3D *in vitro* model using tumour, stromal and immune cells, to address the potential of immunomodulatory nanomedicines in OS treatment. Tumour-associated macrophages play an important role in signalling and OS progression, making them a potential treatment target ^[5]. We are particularly interested in the role of M1/M2 polarization on the tumour microenvironment (TME), and how the modulation of these phenotypes can hinder or aid tumour growth and metastasis formation ^[6]. Mesenchymal stem cells (MSCs) are another important player as they are known for interacting with tumour cells and modulating the TME, favouring disease progression^[7,8].

We have successfully established spheroids using two OS cell lines (143b and MG63): mono (tumour cells), double (tumour cells and macrophages) and triple (tumour, macrophages and MCSs) culture up to 14 days (Figure 1). Viability, size/morphology and cell population were monitored at different time points. Spheroids remained viable during the time in culture, maintaining a spheric morphology. Characterization of these microtissues is on-going: morphology (histology) and cell distribution (by FlowCytometry (FC) and immunohistochemistry). FC analysis showed a percentage of 30-50% of macrophages for double spheroids and 20-40% for triple spheroids. When fully characterized, spheroids will be integrated in a microchip, under dynamic flow, where the administration of nanoparticles carrying an immunomodulatory drug will be tested.

Keywords: 3D culture; in vitro model; tumour spheroids; drug screening; cancer.

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References

[1] Ottaviani, G., & Jaffe, N., The epidemiology of osteosarcoma. Pediatric and adolescent osteossarcoma. 2009, 3-13.

[2] Horner, M. J., SEER cancer statistics review. 2009, 1975-2006. http://seer. cancer.«gov/csr/1975_2006/.

[3] Saraf, A. J., Fenger, J. M., & Roberts, R. D., Osteosarcoma: accelerating progress makes for a hopeful future. Frontiers in oncology. 2018, 8, 4.

[4] Rodrigues, J., Sarmento, B., & Pereira, C. L. Osteosarcoma tumor microenvironment: the key for the successful development of biologically relevant 3D in vitro models. In vitro models. 2022, 1-23.

[5] Duan, Z., & Luo, Y., Targeting macrophages in cancer immunotherapy. Signal transduction and targeted therapy. 2021, 1-21.

[6] Buddingh, E. P., Kuijjer, M. L., Duim, R. A., Bürger, H., Agelopoulos, K., Myklebost, O., Serra, M., Mertens, F., Hogendoorn, P. C. W., Lankester, A. C. & Cleton-Jansen, A. M. Tumor-Infiltrating Macrophages Are Associated with Metastasis Suppression in High-Grade Osteosarcoma: A Rationale for Treatment with Macrophage Activating AgentsImpact of Macrophages on Osteosarcoma Metastases. Clinical Cancer Research. 2011, 2110-2119.

[7] Tsukamoto, S., Honoki, K., Fujii, H., Tohma, Y., Kido, A., Mori, T., Tsujiuchi, T. & Tanaka, Y. Mesenchymal stem cells promote tumor engraftment and metastatic colonization in rat osteosarcoma model. International journal of oncology. 2012, 163-169.

[8] Bonuccelli, G., Avnet, S., Grisendi, G., Salerno, M., Granchi, D., Dominici, M., Kusuzaki, K. & Baldini, N. Role of mesenchymal stem cells in osteosarcoma and metabolic reprogramming of tumor cells. Oncotarget. 2014, 7575.



Figure 1: Representative images of a) 143b spheroids, b) MG63 spheroids, c) MG63 and macrophages double culture spheroids and d) MG63, MSCs and macrophages triple culture spheroids at day 7.

20626 | Reactivation of mutant p53 to prevent ultraviolet radiation-induced skin damage Carvalho, João, Departamento de Química e Bioquímica, Faculdade de Ciências, Universidade do Porto, Porto, Portugal; Instituto de Ciências Biomédicas Abel Salazar, Porto, Portugal; Laboratório de Microbiologia, Faculdade de Farmácia, Universidade do Porto, Porto, Portugal

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Abstract

Introduction: Skin cancer (SC) is a major public health issue. As a highly preventable cancer type, it has been the focus of intensive research to explore additional protective strategies for sunscreens, in which mutant p53 (mutp53) represents a promising target due to its key role in ultraviolet radiation (UVR)-induced SC. Indeed, the reactivation of mutp53 represents a promising approach to SC prevention [1]. Recently, our group has identified the compound MANIO as a mutp55 reactivator [2]. Herein, we aimed to study the potential of MANIO as a chemopreventive agent against UVR-induced skin carcinogenesis [3]. Material & Methods: Normal human keratinocyte HaCaT cells were pre-treated with MANIO for 24h, followed by UVB exposure to 20 mJ/cm² and further analysis. The effect on p53 DNA-binding ability was evaluated using the TransAM p53 Transcription Factor Assay Kit. Cell viability was assessed by trypan blue and cell cycle, apoptosis and intracellular reactdamage specific DNA binding protein-2 (DDB-2) were detected by immunofluorescence staining. Results: Pre-treatment of HaCaT cells with MANIO, before UVB-exposure, increased the p53 DNA-binging ability when compared to vehicle. It also enhanced cell survival in response to UVB by promoting cell cycle arrest at the G2/M phase and reduced UVB-induced apoptosis. MANIO also protected cells from UVB-induced ROS generation and subsequent oxidative damage. MANIO depleted UVB-induced DNA damage, as evidenced by a reduction of DNA in comet tails and CPD levels in the DNA. Futhermore, it increased the DDB-2 levels, which is a component of the nucleotide excision repair (NER) pathway transcriptionally regulated by p53. Conclusions: Collectively, these results support a promising chemopreventive activity of MANIO against UVB-induced skin damage.

Keywords: Skin cancer, UV radiation, DNA lesions; Mutant p53, Reactivation

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References

Loureiro, J., et al., *P53 in skin cancer: From a master player to a privileged target for prevention and therapy.* Biochimica et Biophysica Acta (BBA)-Reviews on Cancer, 2020. 1874(2): p. 188438.
Ramos, H., et al., *A selective p53 activator and anticancer agent to improve colorectal cancer therapy.* Cell Reports, 2021. 35(2): p. 108982.

[3] Loureiro, J.B., et al., *Mutant p53 reactivator SLMP53-2 hinders ultraviolet B radiation-induced skin carcinogenesis.* Pharmacological Research, 2022. 175: p. 106026.

20666 | Liraglutide impacts mitochondrial performance of mouse Leydig cells in conditions of normoglycemia and hyperglycaemia

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Abstract

Male fertility has been decreasing through the years and is affected by various illnesses (i.e obesity and type 2 diabetes mellitus). These metabolic disorders alter cellular metabolism, cause oxidative stress (OS) and decrease testosterone secretion. Antidiabetics are used to control those dysfunctions but although testicular cells metabolism is essential for spermatogenesis, the effect of most antidiabetics on male reproduction remains unknown. Leydig cells (LCs) are essential since they produce testosterone, a key male hormone for male reproduction. Glucagon-like peptide 1 receptor agonists, such as liraglutide, have been used in diabetic patients and for body weight reduction in obese patients (with and without hyperglycaemia). We aimed to evaluate the effect of liraglutide on LCs function under normoglycaemia and hyperglycaemia conditions. We exposed LC cultures (BLTK1 cell line) to subpharmacological, pharmacological and suprapharmacological concentrations of liraglutide (25, 50, 100 nM, respectively) under normoglycaemia (5 mM glucose) and hyperglycaemia (22 mM glucose) for 48h. We then assessed the metabolic viability and proliferation, LDH release and ROS production. Mitochondrial performance was evaluated by the Seahorse XF Cell Mito Stress assay. Liraglutide (50, 100 nM) increased the metabolic viability of LCs and induced an increase in ROS production, at all concentrations, in normoglycaemic conditions compared with control group. In hyperglycaemia conditions, liraglutide (25, 50 nM) shows a tendency to restore the mitochondrial parameters to the control condition: basal respiration rate, maximal respiration rate, proton leak, and ATPproduction coupled respiration rate. Liraglutide modulates ROS production, cell viability and mitochondrial function in LCs cultures. Since LCs bioenergetics and steroidogenesis are dependent on mitochondria functioning, our data suggests that liraglutide may have an impact on steroidogenesis. Future studies are needed to support this hypothesis.

Keywords: Diabetes Mellitus, Liraglutide, Male Infertility, Oxidative Stress.

20697 | Bleomycin's effects on human sperm motility and vitality in vitro

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Abstract

Cancer incidence in adolescents and young adults (AYAs) has increased over the years [1]. Fortunately, more than 80% of these AYAs live for more than 5 years, with testicular cancer, the most common malignant neoplasm at this age, having a survival rate of more than 90% [1], [2]. These statistics emphasize the importance of quality of life after cancer. In this regard, learning more about therapeutic side effects is critical in order to minimize them. More than 85% of AYAs cancer survivors want to be fathers in the future [3], but most therapies target rapidly dividing cells, making spermatogenesis a potential target [4]. Combination chemotherapy with bleomycin, etoposide, and cisplatin (BEP) was one of the main contributors to testicular cancer survival rates [5], but it often came at the expense of side effects, particularly on men's reproductive capacity. These drugs are used in combination as well as alone; however, bleomycin has received the least amount of research on its effect on human fertility. In light of this, the aim of this study is to investigate how bleomycin affects human sperm vitality and motility, two key factors in sperm quality and fertilizing ability.

Sperm samples (n = 45) were cultured *in vitro* for two hours at 37°C in sperm preparation medium with and without (control) physiological concentrations of bleomycin. The aforementioned parameters were evaluated further in accordance with World Health Organization recommendations [6], and statistical analysis was used to compare experimental and control groups.

Bleomycin significantly reduced sperm vitality (P<0,001; t-student test) and motility (P<0,001; Wilcoxon signed-ranks test), with motility being significantly impaired at the expense of progressive motility, the first sign of impending infertility.

In summary, this study found that bleomycin has a negative effect on human spermatozoa, and thus on men's fertility, providing patients and clinicians more tools for discussion and making fertility preservation decisions.

Keywords: Bleomycin; Cancer; Human Sperm; Sperm Vitality; Sperm Motility

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References

[1] S. H. M. Janssen, W. T. A. van der Graaf, D. J. van der Meer, E. Manten-Horst, and O. Husson, "Adolescent and Young Adult (AYA) Cancer Survivorship Practices: An Overview," *Cancers (Basel)*, vol. 13, no. 19, Oct. 2021, doi: 10.3390/CANCERS13194847.

[2] R. D. Barr, "Adolescents, young adults, and cancer—the international challenge," *Cancer*, vol. 117, no. S10, pp. 2245–2249, May 2011, doi: 10.1002/CNCR.26052.

[3] J. Xie *et al.*, "Reproductive concerns among adolescent and young adult cancer survivors: A scoping review of current research situations," *Cancer Med*, vol. 11, no. 18, pp. 3508–3517, Sep. 2022, doi: 10.1002/CAM4.4708.

[4] W. H. B. Wallace, R. A. Anderson, and D. S. Irvine, "Fertility preservation for young patients with cancer: who is at risk and what can be offered?," *Lancet Oncol*, vol. 6, no. 4, pp. 209–218, Apr. 2005, doi: 10.1016/S1470-2045(05)70092-9.

[5] J. Maselli, B. F. Hales, and B. Robaire, "The effects of chemotherapy with bleomycin, etoposide, and cis-platinum (BEP) on rat sperm chromatin remodeling, fecundity and testicular gene expression in the progeny," *Biol Reprod*, vol. 89, no. 4, pp. 85–86, Oct. 2013, doi: 10.1095/BIOLREPROD.113.110759/2514069.

[6] WHO, WHO laboratory manual for the examination and processing of human semen, 6th ed. Geneva, Switzerland: WHO Press, 2021.

20753 | Dual *in situ* drug delivery system for enhanced bone regeneration: association of bisphosphonates and bone morphogenic protein with bone substitutes

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Abstract

Bone critical defects encompass conditions in which tissue loss or damage exceeds the innate capability of the bone tissue for spontaneous repair, as significant traumas, infections, and oncologic surgeries. Aiming for an improved outcome for these conditions, the newer generation of bone substitutes have been developed to induce osteogenesis, in addition to the necessary framework for cell colonization. Among drug candidates, bisphosphonates (BPs) and bone morphogenic proteins (BMPs) have the potential to prevent further bone loss and induce bone neoformation in critical defects, respectively.

BPs are approved for clinical use in several indications including osteoporosis and bone metastatic tumors. They have a long half-life due to their high affinity for hydroxyapatite crystals, being quickly incorporated. Regarding their activity, BPs inhibit osteoclastic activity, either by apoptosis of mature osteoclasts or prevention of precursors' differentiation.

BMPs belong to the transforming growth factor-beta superfamily and are potent osteoinductive molecules, being involved in the recruitment and differentiation of mesenchymal progenitor cells into functional osteoblasts, resulting in significant bone neoformation. However, it has been documented that BMPs also contribute to osteoclast's differentiation and survival, hampering their overall osteogenic activity.

Thus, this scoping review addresses the current advances in the development of bone substitutes capable of a dual local delivery of BPs and BMPs for enhanced bone regeneration, including studies set on *in vivo* pre-clinical models and clinical trials. Relevant mesh terms were employed in two databases, Web of Science and PubMed. Studies that fill the inclusion criteria were included in the review.

Keywords: BMP; Bisphosphonates; Osteoclastogenesis; tissue-engineering; drug-delivery.

20771 | Design of biomimetic nanoplatforms derived from fibroblasts' membranes

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Abstract

Cytoplasmic membranes are highly dynamic and multifactorial structures that coordinate a plethora of interactions between the cells and their surroundings. Thus, understanding and weaponizing their in vivo attributes is becoming a key point in nanomedicine development. Biomimetic is an emerging field that enables the development of models that replicate components of the human organism, which allows the reproduction of what happens in vivo in greater detail. This concept encompasses the usage of cell membrane components in the development of efficient drug delivery systems [1] as well as mimetic models that enable the studying of membrane interactions. Research around the therapeutic possibilities in which these nanoplatforms may be employed has mostly been focused on cells from the immune system and erythrocytes, which has resulted in a limited view of how other cell types, namely fibroblasts, can be useful in the production of nanoplatforms for different immunomodulatory purposes in disease [2]. Hence, this work initiates the framework in which fibroblast cell membranes can be both studied without the contribution of intracellular events and consequently utilized in the production of superiorly biocompatible and bioactive drug delivery systems. Regarding the first aim, the cytosol of fibroblasts was hydrogelated with a hydrophilic polymer, allowing them to retain the fluid and functional cell membrane interfaces that enable biological interactions. Meanwhile, the latter objective was achieved by producing liposomes of extracted lipids via thinfilm hydration and consecutive extrusion, which were then characterized in terms of size dispersion, stability, cell viability and entrapment efficiency of a bioactive compound. Henceforth, these techniques lay the foundation for the development of superiorly competent and specific devices for biomembrane studies and nanoscaled biomedical devices.

Keywords: Biomimetic, nanoplatform, liposome, hydrogelation

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References

 T. Li *et al.*, "Cell Membrane Coated-Biomimetic Nanoplatforms Toward Cancer Theranostics," *Front. Bioeng. Biotechnol.*, vol. 8, Apr. 2020, doi: 10.3389/fbioe.2020.00371.
S. Davidson *et al.*, "Fibroblasts as immune regulators in infection, inflammation and cancer," *Nat. Rev. Immunol.*, vol. 21, no. 11, pp. 704–717, Nov. 2021, doi: 10.1038/s41577-021-00540-z.



Figure 1: Structure of gelated cells was observed with fluorescein-diacrylate (green) for hydrogel labelling and DiD dye (red) for membrane staining.

20838 | Design and optimization of Edaravone loaded PLGA-based nanoparticles

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Abstract

Poly (lactic-co-glycolic acid) (PLGA) is one of the most employed polymers for the formulation of nanoparticles (NPs) for drug delivery as it possesses an ability to encapsulate both hydrophilic and hydrophobic compounds¹. Edaravone is a free radical scavenger used for the treatment of Amyotrophic Lateral Sclerosis (ALS). However, its clinical application is limited by its poor water solubility, short half-life, and low bioavailability². In this sense, Edaravone loaded PLGA-based NPs were prepared by nanoprecipitation method in order to enhance the drug delivery and, consequently, increase its bioavailability³. Nonetheless, at neutral pH, it was verified that the encapsulation's efficiency presented low values (3.51±0.72%) and the resulting NPs presented a particle size of 136.8±8.7nm and surface charge of -34.41±1.69 mV. The synthesis of the NPs was optimized by changing the type of polymers, synthetic solvents used and the pH of the aqueous solution. In that way it was possible to improve the encapsulation's efficiency 13-fold (46.94±4.23%) and decrease the NPs size to 75.7±2.2nm. Also, it is known that Edaravone has a greater radical-scavenging activity at higher pH², so this optimization process holds great promise for the enhancement of the drug's therapeutic efficacy.

Keywords: Poly(lactic-co-glycolic) acid nanoparticles; Edaravone; drug delivery; Amyotrophic Lateral Sclerosis.

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References

[1] Pinto, M.; Silva, V.; Barreiro, S.; Silva, R.; Remião, F.; Borges, F.; Fernandes, C. Brain DrugDelivery and Neurodegenerative Diseases: Polymeric PLGA-Based Nanoparticles as a ForefrontPlatform.AgeingResearchReviews2022,79,101658.

[2] Watanabe, K., Tanaka, M., Yuki, S., Hirai, M., & Yamamoto, Y. How is edaravone effective against acute ischemic stroke and amyotrophic lateral sclerosis? *Journal of Clinical Biochemistry and Nutrition* **2018**, *62* (1), 20–38. https://doi.org/10.3164/jcbn.17-62.

[3] Fernandes, C.; Martins, C.; Fonseca, A.; Nunes, R.; Matos, M. J.; Silva, R.; Garrido, J.; Sarmento, B.; Remião, F.; Otero-Espinar, F. J.; Uriarte, E.; Borges, F. PEGylated PLGA Nanoparticles As a Smart Carrier to Increase the Cellular Uptake of a Coumarin-Based Monoamine Oxidase B Inhibitor. ACS Applied Materials & Interfaces 2018, 10 (46), 39557-39569. https://doi.org/10.1021/acsami.8b17224.

21086 | From farm-to-fork: occurrence of persistent multidrug-resistant and coppertolerant *Klebsiella pneumoniae* clones in poultry farms

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Abstract

BACKGROUND: *Klebsiella pneumoniae*-Kp is a clinically-relevant but neglected multidrugresistant-MDR bacteria at the One Health interface. Studies on poultry production to depict factors contributing to Kp selection/persistence remain scarce. Here we evaluated Kp occurrence and diversity among chicken flocks, its environment and derived meat produced in 7 intensive farms-FA where copper-supplemented feeds are widely used.

METHODS: Fourteen flocks-FL were sampled in 3 stages (2022): P0=one-day-old chicks and P1=clean poultry-houses, P2=pre-slaughter chickens and P3=meat/slaughterhouse. Samples (before/after enrichment were plated in SCAI. After identification-PCR, the isolates were screened for Cu tolerance-CuT (MICCuSO4-0.25-36mM/anaerobiosis), CuT silA gene and antibiotic (disk-diffusion/microdilution) susceptibility. Clonality was assessed by FTIR spectroscopy/wzi sequencing and whole-genome sequencing to infer MLST+cgMLST (Pathogenwatch).

RESULTS: Kp (n=99) was detected in 43%-n=24/56 of samples, most from P2 (n=11FL/6FA) compared to P0 (n=1FL), P1 (n=5FL/4FA) and P3 (n=7 meat batches/7FA). The K-types most dispersed were KL111 (n=16; P2/P3; 4FL/3FA), KL10 (n=11; P0/P1/P2; 4FL/4FA), KL19 (n=9; P2; 2FL/1FA) and KL109 (n=7; P1/P2; 2FL/2FA). WGS (n=21) assigned Kp to 16 STs, including global successful clones as ST11, ST15, ST147, ST280 and ST307. cgMLST analysis confirmed the presence of genetically-related clones in P1+P2 or P2+P3. More than 50% of the samples contained Kp-MDR and Kp-silA+ (MICCuSO4>16mM).

CONCLUSIONS: Poultry production are a source of a high diversity of Kp clones, including MDR+CuT ones that persist variably between farms and stages. CuT associated with MDR may contribute to the selection of certain strains/clones at pre-slaughter stage, whose impact for food safety needs to be further explored.

Keywords: Antimicrobial resistance, food safety, environment, poultry-production.

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21106 | Evaluation of anti-gene oligonucleotide strategy for targeted shutdown of activated telomerase: a novel therapeutic approach in cancer

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Abstract

Telomerase re-expression, detected in 80 to 90% of all human cancers, is the favored mechanism for cancer cells to achieve immortalization [1, 2]. Telomerase reverse transcriptase promoter (*TERTp*) mutations, the main mechanism for upregulation of *TERT* expression, are relatively frequent in specific types of human cancers [3]. The hotspot *TERTp* mutations in human cancers are at the positions -124 and -146 bp (C>T or G>A in the reverse strand), and enhance *TERTp* activity by creating a consensus binding site (GGAA) for E-Twenty-six (ETS) transcription factors [4, 5].

Our project aims to create innovative and specific therapeutic strategies to *TERTp* mutated cancers using oligonucleotide-based drugs (LNA modified anti-gene oligonucleotides (agONs), containing a triplex forming region linked to a DNA duplex invasion region). To achieve this, we started with the expansion and purification of plasmids from recombinant *E.Coli* using mini or maxi prep systems. The plasmids were based on the pGL3 backbone system where different versions of the *TERTp* were inserted to drive expression of the luciferase gene (TERTp Vazio/pGl3 and TERTp Mut -124/pGl3). Purity of obtained plasmids was confirmed by absorbance measurements and agarose gel electrophoresis. Plasmids were also validated by sanger sequencing to confirm the presence of the point mutations in the *TERTp* region. Subsequently, the binding of different agON to the plasmids was tested in an *in vitro* (test tube) system. The plasmids were thus incubated with different agONs, at different concentrations, in low salt phosphate buffer and intranuclear buffer, to investigate the binding/hybridization capacity of agONs to the mutation sites of the *TERTp*.

By developing a precision medicine approach directed specifically at the *TERTp* mutation mechanism of activation, we expect to have an impact on cancer therapy and be able to cover a large burden of malignant tumours that frequently harbour these genetic alterations (e.g. thyroid, skin, CNS cancers).

Keywords: Telomerase, TERT promoter mutations, Oligonucleotide Therapeutics, Precision medicine approach, Cancer therapy

Acknowledgments

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References

[1] Pestana, A., et al., *TERT biology and function in cancer: beyond immortalisation*. J Mol Endocrinol, 2017. 58(2): p. R129-R146.

[2] Hanahan, D. and R.A. Weinberg, *Hallmarks of cancer: the next generation.* Cell, 2011. 144(5): p. 646-74.

[3] Vinagre, J., et al., *Frequency of TERT promoter mutations in human cancers*. Nat Commun, 2013. 4: p. 2185.

[4] Huang, F.W., et al., *Highly recurrent TERT promoter mutations in human melanoma*. Science, 2013. 339(6122): p. 957-9.

[5] Bell, R.J., et al., *Cancer. The transcription factor GABP selectively binds and activates the mutant TERT promoter in cancer.* Science, 2015. 348(6238): p. 1036-9.

21149 | Assessment of antimicrobial resistance spread in surface aquatic systems: a study of four rivers in North Portugal

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Abstract

Background: Antimicrobial resistance (AMR) spread in surface water systems, providing water for drinking or for recreational activities, can have serious implications to human, animal and environmental health. The standard criteria to assess water quality are based in the absence of specific bacteria, and do not include AMR study. Here we evaluate the spread of AMR bacteria in rivers of North Portugal under diverse anthropogenic activities.

Methods: Samples from four rivers (8 water+7 sediments) were collected (Dec-2022/Jan-2023). The fecal indicators Enterococcus and Escherichia coli as well as the pathogen Salmonella enterica were recovered using standard methodologies to assess water quality. Salmonella, Enterococcus species or E. coli phylogenetic groups (PhG) were identified by PCR, and Salmonella serogroups by serologic reactions. Antibiotic susceptibility (n=26) was studied by disk diffusion (EUCAST/CLSI guidelines).

Results: Enterococcus (n=46; 19-E.hirae, 13-E.faecalis, 4-E.faecium, 3-E.lactis, 3-E.durans, 4-other species), E. coli (n=43; PhG: 16-A/C; 13-B2; 1-B1; 3-E; 2-D/E; 3-A; 5-other) and Salmonella (n=16; C2 serogroup) were recovered from 87%, 80% or 20% of the samples, respectively. Multidrugresistant (MDR) bacteria were found in 53% of samples, including E.coli in 58% (most from PhG A/C and B2) and Enterococcus in 31% (E.faecalis, E faecium, E.hirae). AMR among E.coli and Enterococcus were very diverse, including to the clinically relevant beta-lactams, quinolones or aminoglycosides.

Conclusions: Diverse fecal indicators/pathogens with/without AMR are present among a high number of water/sediments samples, including to antibiotics of clinical relevance. More studies are needed to assess if such bacteria also have tolerance to other antimicrobials sustaining their presence in the aquatic environment, as these rivers are under multiple pollution types.

Keywords: Antimicrobial resistance; Environment; Public health; One Health; Surface waters

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21249 | Population pharmacokinetic study involving different Salbutamol formulations

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Abstract

Asthma is a chronic inflammatory disease of the lower airways. The prevalence of asthma is increasing worldwide, and the tendency is for the number of asthma sufferers to soar in the coming years. Salbutamol is a short-acting β 2-agonist, recommended for the symptomatic relief and prevention of bronchospasm caused by asthma events. Its therapeutic effect is based on its potent smooth muscle relaxant properties, which allow the inhibition of bronchial smooth muscle contraction and subsequent bronchodilation. Salbutamol can be administered in an inhaler, dry powder, or nebulizer form, resulting in highly diverse pharmacokinetic (PK) parameters and, consequently, different efficacy and adverse effects. Likewise, other asthma drugs, salbutamol has adherence-related problems, due to the devaluation of the disease by the world's population. As a result, there are severe clinical implications, explaining the impactful number of deaths. Precision Medicine has been increasingly important as it identifies the best treatment for the patient. Pharmacological simulation studies have contributed greatly to the advancement in this area and, in particular, to extend the knowledge of the PK profile of a drug. In silico studies of the PK profile of salbutamol have not been yet reported. Therefore, we aim to develop a physiological based pharmacokinetic (PBPK) model of salbutamol, using data from previously published clinical studies, in order to understand which characteristics (age, gender, comorbidities) are the most favourable to the therapeutic regimen currently prescribed to asthma patients. With this, we will also explore new drug regimens to minimize adverse effects and, consequently, to increase adherence to asthma therapy. Additionally, drug interactions, one of the most causes of adverse effects in patients undergoing polytherapy, will also be considered in this PK profile study, as it is frequently paired with other drugs, in particular, inhaled corticosteroids.

21268 | Multiple-element exposure in a population of school-aged Portuguese children: from health outcomes to preventive tools

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Abstract

Introduction: Chemical elements have an important role in the human body's function. However, homeostasis dysregulation might have adverse health effects. Because of their presence in the environment, food has also been contaminated with potentially toxic elements, exposing people to their potential effects, something even more concerning during developing phases of life.

Aim: This study aimed to explore the effects of multiple-element exposure, in a population of school-aged children by evaluating their exposure and its relationship with food intake.

Methodology: We evaluated urine samples from 556 participants from the IoGeneration@Lisboa project, using a properly validated inductively coupled plasma mass-spectrometry analytical procedure. Sociodemographic, lifestyle and dietary information was evaluated through an online questionnaire answered by the parents. Data were subjected to descriptive statistical analysis.

Nonparametric Mann-Whitney test or the Kruskal-Wallis test for comparison of more than two groups for variables with non-normal distribution. Statistical significance level was set at 0.05. Results: Preliminary results show an association between the concentration Lit, Rb, Cs, Ba and Tl and sex (p=0.009;p<0.001;p=0.005;p=0.05;p=0.005 respectively). B, Al, Mn, Zn, As, Se, Sr, Mo, Sb, Cs, and Pb have association with Ba seem to an age (p=0,029;p=0,005;p<0.001;p=0.016;p=0.021;p=0.059;p=0.009;p<0.001;p=0.003;p=0.002; p=0.02 respectively). There is also an association between element concentration and the consumption of fish (Sn:p=0.004; Hg:p=0.006), fatty fish (As:p=0.045), lean fish (Ni:p=0.036; Hg=0.013), white meat (Mo:p=0.16), milk (Co:p=0.02;Bi:p=0.013), mollusks (Li:p=0.009; Mo:p=0.045;Cd:p=0.052;Pb:p=0.003) and shellfish (Se:p=0.021;Tl:0.025;Bi: p=0.018). Conclusion: These results might be important to define new public health politics and translating to clinical practice. To assess the existence of patterns of interaction between elements and determinants of exposure, a principal component analysis will be performed.

Keywords: Endocrine disruptors, children, elements, metals, heavy metals.

Acknowledgments

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References

Zoroddu MA, Aaseth J, Crisponi G, Medici S, Peana M, Nurchi VM. The essential metals for humans: a brief overview. J Inorg Biochem. 2019;195(February):120–9.

FAO; WHO. Trace elements in human nutrition and health World Health Organization. World Heal Organ [Internet]. 1996;1–343. Available from: https://apps.who.int/iris/handle/10665/37931. Sargis RM, Heindel JJ, Padmanabhan V. Interventions to address environmental metabolism-disrupting chemicals: Changing the narrative to empower action to restore metabolic health. Front Endocrinol (Lausanne). 2019;10(FEB).

20667 | High-fat diet during early life alters expression of HOXB13 in prostate which imposes a risk for prostate cancer development in the offspring

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Abstract

Excess of weight is associated with hormonal/metabolic dysregulation, oxidative stress, and chronic inflammation. These alterations provide an ideal environment for tumour development. Individuals with overweight/obesity are at a higher risk of developing Prostate Cancer (PCa). These individuals can be wrongly diagnosed through traditional methods, which highlights the need for new PCa tissue biomarkers. Homeobox B13 (HOXB13) has recently emerged as a possible biomarker. Concurrently, new evidence suggest that overweight/obesity imprints epigenetic cues that can be transgenerationally inherited. This hypothesis implies that the offspring of individuals with obesity have an increased risk for developing PCa. To test this, a transgenerational animal model (Mus musculus) was established, where F0 mice were exposed to three different diets: standard, high-fat (HFD), and diet correction ([DC], 60 days HFD, plus 120 days standard diet), ad libitum for 200 days post wearing. Males were mated with lean females to generate F1, and the same for F2. PCa biomarkers expression on the prostates was evaluated by quantitative polymerase chain reaction. The expression of AR remained unaltered between groups and generations, suggesting that diet does not impact the expression of this PCa biomarker. Meanwhile, in F0, prostates from the DC group presented a tendency for increased HOXB13 expression in comparison to the other groups. Curiously, in F1, HOXB13 expression was decreased in comparison to the F1 control group. No differences were found in F2 regarding the expression of this biomarker. Altered HOXB13 is reported as an important carcinogenesis hallmark. We propose that altered HOXB13 expression is due to altered HOXB13 promoter methylation, which could explain the altered expression of this PCa biomarker in F1. Our results suggest that high-fat diet during early life impacts *HOXB13* expression on the prostate, increasing the risk for PCa in the offspring.

Keywords: High-fat diet, HOXB13, Prostate Cancer.

20567 | Potential impact of mites on public health: Distribution and identification of mites associated with invasive insect red palm weevil (*Rhynchophorus ferrugineus*) in Northern Portugal

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Abstract

The red palm weevil (RPW) is a destructive pest found globally. RPW is associated with several mite species, whose by-products can cause allergic reactions in sensitive individuals. RPW is frequently found in palm trees, which are a common sight in public gardens. This puts people at risk of coming into contact with mites and other potential disease vectors, which can cause poorly understood diseases like acariasis, which is brought on by mites that can enter and parasitize human tissues.

The objective of this study was to investigate the diversity and distribution of mites associated with RPW in northern Portugal for their potential impact on public health. In 4 districts of northern Portugal, RPW specimens were sampled using pheromone traps. Under a magnifying glass, the collected weevils were dissected, and mites were identified with the use of a microscope. To provide a molecular approach for mite species identification, the 18S rRNA gene was isolated and amplified.

All of the collected RPW specimens were found to be mite associated, with an average of 400 mites per individual. In total, seven mite species were identified: *Curculanoetus rhynchophorus, Uroobovella* sp., *Dendrolaelaps* sp., Mesostigmata; *Acarus* sp.; *Nenteria extremica; Centrouropoda* sp. Moreover, 5 new DNA sequences from 4 different mite species were published in this work. These sequences could be exploited to create new medical diagnostic tools.

This study highlights the variety and prevalence of mites associated with RPW in northern Portugal, which can cause diseases. Further research is required to fully understand the impact of mite infestation on public health and the parasitic relationship between mites and RPW. Future studies should explore the new DNA sequences discovered in this study and their potential for medical diagnosis.

Keywords: medical diagnostic tools; mites; palm trees; parasites; public health; weevils.

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References

[1] Abe, F., Hata, K., & Sone, K. (2009). Life history of the red palm weevil, *Rhynchophorus ferrugineus* (Coleoptera: Dryophtoridae), in Southern Japan. Florida Entomologist, 92(3), 421-425.

[2] Al-Ayedh, H. (2011). Evaluating a semi-synthetic diet for rearing the red palm weevil *Rhynchophorus ferrugineus* (Coleoptera: Curculionidae). International Journal of Tropical Insect Science, 31(1-2), 20-28.

[3] Arlian, L. G. (2002). Biology, host relations, and epidemiology of Sarcoptes scabiei. Annual review of entomology, 47(1), 457-486.

[4] Choudhary, S., Kumar, S., & Narasimhan, B. (2020). Tick-borne rickettsial infections: A review of clinical practice guidelines and diagnostic challenges in the acute phase. Tropical doctor, 50(4), 279-285.

[5] Ferry, M. (2019). Review Paper (Control: Insects) The world situation and the main lessons of 30 years of fight against the red palm weevil.

[6] Li, Chao-Pin, et al. "Acaroid mite, intestinal and urinary acariasis." World Journal of Gastroenterology: WJG 9.4 (2003): 874.

[7] Nutanson, I., & Steen, C. J. (2014). Diseases carried by arthropods and skin infestations. Clinics in dermatology, 32(4), 579-586.

[8] Matos, I. Mites and fungi associated with Rhynchophorus ferrugineus (Coleoptera: Curculionidae): first report in northern Portugal. Thesis (Master's Degree in Biochemistry)– Faculty of Sciences of University of Aveiro.



Figure 1: Pictures of RPW in association with hundreds of mites (photos by Oliveira, João & Matos, Inês).

20647 | Covid-19 mitigation measures in primary schools: a description and impact evaluation

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Abstract

Introduction: During Sars-Cov-2 pandemic primary schools adopted mitigation measures to stop the spread of the infection. These measures generate low intensity and distorted speech and eliminate mouth visual cues. This has impact on non-verbal communication, intelligibility, learning and social interaction.

Objective: The main goal of this investigation is to evaluate primary school's students and teachers self-perceived impact of the mitigation measures on classroom's communication processes. Methods: A mixed method design was adopted for collecting data from 4th grade students and primary school teachers from preselected schools of Oporto. Online questionnaires were applied to identify the measures implemented and to evaluate the self-perception of their impact. Teachers' questionnaire further measured the impact on their voice health. A total of 81 students and 21 primary school teachers responded. A focus group with the teachers was held.

Results: Implementation of mitigation measures decreased with time. While students practiced social distance (63%) and wore surgical masks (51,9%), teachers kept classroom windows (100%) and doors opened (90,5%), while also wearing surgical masks (80,9%). Institutional measures such as social bubbles and hand's hygiene met 100% compliance.

Students perceive loss of intelligibility in teachers when they wore KN95 masks and while classroom doors were opened. Teachers reported greater vocal effort (80,9%) and abuse (57,2%). Teachers believe learning was negatively impacted (57,1%). Students emphasize socioemotional aspects, such as a negative impact in their peer relationships (44,4%), but also a decrease of feelings of shame and agitation, as participation and autonomy levels increased.

Conclusion: The main mitigation measures adopted were masks, social distancing, and improved classroom ventilation. Perceived impact on student's socioemotional development is high.

Keywords: Covid-19; Mitigation measures; Primary school; Communication.

20721 | The role of pro-resolving mediators in the decidual reaction and pregnancy

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Abstract

Endometrial remodelling is complex and relies on early pro-inflammatory and hormonal cues. It involves the differentiation of endometrial stromal cells (ESCs) into decidual cells, immune cell recruitment and production of essential factors preparing the uterus for implantation^[1]. However, post-implantation anti-inflammatory responses sustain pregnancy and reduce tissue damage. Thus, an imbalance in the inflammatory environment of the uterus can influence reproductive function and ultimately, lead to implantation failure and miscarriage^{[2], [3]}. This work focuses on pro-resolving lipid mediators (A4 and B4 lipoxins, D1 and E2 resolvins) and investigates their effect on implantation, as well as their role in uterine decidualization. We first evaluated their metabolic enzymes (12-LOX, 15-LOX, 5-LOX, COX-2) mRNA and protein expression, through Western Blot, immunohistochemistry in first-trimester decidua (gestational age, 5–12 weeks) derived from women with elective pregnancy termination (n=8) and women who suffered miscarriage (n=18). Furthermore, we analysed the in vitro effects of LXA4, LXB4, RvD1 and RvE2 $(0.01-1 \,\mu\text{M})$ on ESCs using the St-T1b cell line. We determined its impact on decidualization by measuring markers of endometrial differentiation, prolactin (PRL) and insulin-like growth factor binding protein-1 (IGFBP1), by qRT-PCR, as well as morphology by Giemsa staining. Our current findings show no difference in mRNA expression of LOX enzymes; however, protein levels were significantly higher in miscarriage (12-LOX P=0.005; 15-LOX P=0.028). Unlike E2 (P=0.015), cell viability assays did not show inhibitory effects on ESCs. Based on our preliminary data for decidualization with four experiments, we observed a tendency for E2 to reduce IGFBP-1 mRNA expression and affect ESCs morphology, which together may result in the impairment of decidual reaction. Altogether, our data suggest that these lipid mediators may have an effect on ESCs differentiation and pregnancy.

Keywords: decidualization, inflammation, lipid mediators, miscarriage

References

[1] B. Gellersen and J. J. Brosens, 'Cyclic Decidualization of the Human Endometrium in Reproductive Health and Failure', *Endocrine Reviews*, vol. 35, no. 6, pp. 851–905, Dec. 2014, doi: 10.1210/er.2014-1045.

[2] G. O. Canny and B. A. Lessey, 'The role of Lipoxin A4 in endometrial biology and endometriosis', *Mucosal Immunol*, vol. 6, no. 3, pp. 439–450, May 2013, doi: 10.1038/mi.2013.9.

[3] M. Szczuko, J. Palma, J. Kikut, N. Komorniak, and M. Ziętek, 'Changes of lipoxin levels during pregnancy and the monthly-cycle, condition the normal course of pregnancy or pathology', *Inflamm. Res.*, vol. 69, no. 9, pp. 869–881, Sep. 2020, doi: 10.1007/s00011-020-01358-6.

20777 | Addressing a Gut-Skin Axis that underlies the mechanism associated with the pathogenicity of Crohn's Disease and Hidradenitis suppurativa

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Abstract

Hidradenitis suppurativa (HS) is a chronic inflammatory skin disorder, affecting 0.5-4% of the worldwide population, being manifested by subcutaneous painful nodules in apocrine glands enriched areas, pus secretion, abscess and fistula formation.¹ HS is one of the extraintestinal manifestations of Crohn's disease (CD), characterized by a transmural inflammation of the gastrointestinal tract.² Although the association between these IMIDs (Immune-Mediated Inflammatory Diseases) is not yet clarified, previous studies have demonstrated a shared accumulation of anti-*Saccharomyces cerevisiae* (ASCA) antibodies in the serum of these patients, which is routinely used as a biomarker of CD.³

Glycans are complex and diverse structures that decorate the surface of all cell types, being important to protein folding, cell-cell adhesion and immune recognition. In fact, glycans are a fundamental part of the identity of microorganisms, allowing the immune system to recognize and eliminate them to avoid infection. However, since ASCA antibodies usually recognize glycan epitopes of *Saccharomyces cerevisiae*, we hypothesize that high titters of ASCA in HS and CD may be associated with the accumulation of abnormal *N*-glycosylation, leading to the loss of immune tolerance by a mechanism called Glycan mimicry.⁴

Thus, we want to tackle the existence of a potential common glycan-based mechanisms between HS and CD and to evaluate the effects of high titters of ASCA, pinpointing a novel Gut-Skin axis that may be involved in the immunopathogenesis of autoimmune disorders. We have characterized the glycoprofile of skin and colon from patients' paraffin samples by histochemistry and at the transcriptional level by Real-time qPCR. Our preliminary results indicates that HS and CD patients share a common abnormal glycosignature, mainly throughout the exposure of abnormal glycoantigens.

Keywords: Hidradenitis suppurativa, Crohn's disease, Autoimmunity, Glycosylation, ASCA antibodies.

References

[1] Costas A Constantinou GEF and EN. Hidradenitis suppurativa : infection , autoimmunity , or both ? *Ther Adv Musculoskelet Dis*. 2019;11:1-14. doi:10.1177/1759720X19895488
 [2] Meng Zhang, Qun-De Chen, Hai-Xia Xu, Yu-Meng Xu, Hong-Jin Chen B-LY. Association of hidradenitis suppurativa with Crohn's disease. *Clin Cases*. 2021;8960(15).

doi:10.12998/wjcc.v9.i15.3506

[3] Torres J, Petralia F, Sato T, et al. Serum Biomarkers Identify Patients Who Will Develop Inflammatory Bowel Diseases Up to 5 Years Before Diagnosis. *Gastroenterology*. 2020;159(1):96-104. doi:10.1053/j.gastro.2020.03.007

[4] Alves I, Fernandes Â, Santos-Pereira B, Azevedo CM, Pinho SS. Glycans as a key factor in self and nonself discrimination: impact on the breach of immune tolerance. *FEBS Lett*. 2022;596(12):1485-1502. doi:10.1002/1873-3468.14347

20836 | Development of a Tetraplet-Primed PCR (TTP-PCR) assay for Myotonic Dystrophy type 2

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Abstract

Myotonic dystrophy type 2 (DM2; MIM #602668) is an autosomal dominant degenerative disorder that affects muscles in multiple systems. The cause of this disorder is the increase in (CCTG)_n repeat number in motif complex [TG]_n[TCTG]_n[CCTG]_n of *CNBP* gene, located in the 3q21 chromosomal region. Normal CNBP alleles have up to 30 repeats, and pathogenic alleles contain from 75 to up to 11 000 repeats. Due to clinical similarities with other dystrophic muscular diseases, DM2 diagnosis remains a challenge. The most common diagnostic methods for DM2 are Southern blotting assays and long-range PCR assays since they allow us to quantify expansions. However, these are time-consuming techniques with a low sensitivity for somatic mosaicism situations. Triplet Repeat-Primed PCR (TP-PCR) is a quick, easy and precise assay for repeat disorders. In this technique, three different primers are used: a universal marked primer, a primer that will pair outside the repeat and another that will pair inside the repeat. The third primer has a tail sequence complementary to the universal primer. In this study, a Tetraplet-Primed PCR (TTP-PCR) assay was carried out targeting the (CCTG)_n repeat in the CNBP gene. In TTP-PCR, the primer sequence which pairs with the repeat region is a tetraplet, instead of a triplet as in TP-PCR. PCR products of several lengths are formed according to the number of repeats, resulting in the detection of expansions. We intended to ascertain if this technique could be used as a robust molecular diagnostic method for DM2. This method does not indicate the absolute number of (CCTG)_n repeats; however, this is not relevant at a diagnostic level since no correlation between repeat number and symptom severity has been established. This study aimed to implement and validate the use of TTP-PCR for the diagnosis of DM2 and to simplify the testing procedure.

Keywords: CNBP; (CCTG), expansion; myotonic dystrophy type 2

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20986 | Microtubule dynamics and axonal transport are impaired in Transthyretin Amyloid Polyneuropathy

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Abstract

Transthyretin Amyloid Polyneuropathy (ATTR-PN) is a rare and fatal neurodegenerative disease, characterized by the deposition of aggregates of mutant TTR, particularly in the peripheral nervous system (PNS), leading to dying-back sensory axonopathy. While some therapeutic strategies exist, there are still none that target the irreversible neurodegeneration characteristic of the disease, highlighting the need for further characterization of cellular and molecular pathways and identification of novel drugs involved in ATTR-PN.

Disruption of microtubules and axonal transport have been identified as key players in the pathogenesis of several peripheral neuropathies. However, despite the importance of these mechanisms in other similar pathologies, their role in ATTR-PN remains unknown. In this work, we investigated the impact of mutant TTR in microtubule dynamics and mitochondrial axonal transport using an ATTR-PN mouse model that expresses the human TTR A97S mutation and exhibits sensory impairment (hTTR^{A97S}). Ex-vivo live imaging using advanced confocal microscopy of sural nerves from hTTR^{A97S} mice uncovered defects in axonal mitochondria trafficking and microtubule dynamics. In particular, impaired axonal transport was observed with defects in the percentile of motile mitochondria. Furthermore, alterations in microtubule dynamics were found, including a decrease in the velocity of microtubule polymerization and an increase in the comet density. Importantly, these defects were present at an age preceding axonal loss *in vivo*. To unravel the molecular mechanism, we are currently employing proteomic approaches to identify differentially expressed proteins and pathways in hTTR^{A975} sural nerves.

This data suggests a dysfunction of the axonal cytoskeleton in an ATTR-PN mouse model. Ultimately, our work will contribute to unravelling novel mechanisms of axonal degeneration in ATTR-PN which might impact the development of new therapeutic strategies for the disease.

Keywords: transthyretin; axonopathy; Transthyretin Amyloid Polyneuropathy; cytoskeleton; microtubule dynamics; axonal transport; peripheral nervous system.

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This work was financed by the 2021 Transthyretin Amyloid Polyneuropathy (ATTR-PN) Research Competitive Grant Program from PFIZER Inc. Thy1-EB3-YFP and Thy1-Mito-CFP mice were provided by Dr. Thomas Misgeld (Technical University of Munich, Germany).

References

Kan, H. W., Chiang, H., Lin, W. M., Yu, I. S., Lin, S. W. & Hsieh, S. T. (2018). Sensory nerve degeneration in a mouse model mimicking early manifestations of familial

amyloid polyneuropathy due to transthyretin Ala97Ser. Neuropathology and Applied Neurobiology 44(7): 673-686.

Magalhães, J., Eira, J. & Liz, M. A. (2021). The role of transthyretin in cell biology: impact on human pathophysiology. Cellular and Molecular Life Sciences 78(17): 6105-6117.

Planté-Bordeneuve, V. & Said, G. (2011). Familial amyloid polyneuropathy. Lancet Neurol 10(12): 1086-1097.

21028 | ATP-sensitive P2X4 shift towards P2X7 ionotropic receptor to control cholinergic neurotransmission in post-inflammatory rat ileitis

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Abstract

Purines control cholinergic neurotransmission in the gastrointestinal tract, which is dampened in inflammatory bowel diseases (IBDs). Tonic activation of the ionotropic P2X7R by ATP released from proliferating glial cells keeps acetylcholine (ACh) overflow by surviving neurons after an inflammatory insult [1,2]. Besides the P2X7R, ATP activating the P2X4R mediates neuroimmune interactions in IBDs [3]. This prompted us to investigate the interplay between P2X7 and P2X4 receptors on [³H]ACh release from the myenteric plexus of the ileum of rats with postinflammatory ileitis 7 days after the intraluminal injection of 2,4,6-trinitrobenzenesulfonic acid (TNBS). The P2X7R antagonist, A-438079 (3 μ M, 15 min before S2), decreased [³H]ACh release from stimulated (EFS: S1 and S2; 5 Hz, 200 pulses, 1 ms) myenteric neurons of TNBS-treated rats (S2/S1: 0.48±0.12, n=4), but not that of control animals (S2/S1: 0.90±0.04, n=4). Conversely, blockage of the P2X4R with 5'-BDBD (10 μ M) inhibited evoked [³H]ACh release in control animals (S2/S1: 0.48±0.04, n=12 vs 0.83±0.06, n=4), but enhanced the transmitter release in TNBS-treated rats (S2/S1: 1.19±0.12, n=6 vs 0.71±0.13, n=5). Co-application of A-438079 (3 μM) and 5'-BDBD (10 μ M) did not modify the effect of each drug alone in healthy rats, but blockage of the P2X7R with A-438079 (3 μ M) prevented 5'-BDBD (10 μ M)-induced facilitation of [³H]ACh release in TNBS-treated animals (S2/S1: 0.52±0.17, n=5 vs 1.19±0.12, n=7). Confocal microscopy studies showed that P2X4R and P2X7R co-localize in VAChT-positive cholinergic nerves, as well as in S100 β -positive enteric glial cells. Data suggest that inflammation shifts the P2X4R-mediated facilitation of ACh outflow by releasing the break controlling the lower affinity P2X7R on cholinergic nerves.

Keywords: post-inflammatory ileitis; myenteric plexus; purinergic receptors; cholinergic neurotransmission.

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References

[1] Vieira, C., Magalhães-Cardoso, M. T., Ferreirinha, F., Silva, I., Dias, A. S., Pelletier, J., ... Correia-De-Sá, P. (2014). Feed-Forward Inhibition of CD73 and Upregulation of Adenosine Deaminase Contribute to the Loss of Adenosine Neuromodulation in Postinflammatory Ileitis. Mediators of Inflammation, 2014, 1-19. doi:10.1155/2014/254640

[2] Vieira, C., Ferreirinha, F., Magalhães-Cardoso, M. T., Silva, I., Marques, P., & Correia-de-Sá, P. (2017). Post-inflammatory lleitis Induces Non-neuronal Purinergic Signaling Adjustments of Cholinergic Neurotransmission in the Myenteric Plexus. Frontiers in Pharmacology, 8 doi:10.3389/fphar.2017.00811

[3] Williams, W. A., Linley, J. E., Jones, C. A., Shibata, Y., Snijder, A., Button, J., ... Chessell, I. (2019). Antibodies binding the head domain of P2X4 inhibit channel function and reverse neuropathic pain. PAIN, 160(9), 1989-2003. doi:10.1097/j.pain.000000000001587

21042 | Unveiling common molecular pathways linked to ILDs with progressive fibrosing phenotype: The role of MUC5B promoter variant

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Abstract

Progressive fibrosing ILDs (PF-ILDs) comprise a heterogeneous group of lung disorders associated with high morbidity and mortality, that exhibit a continuous worsening phenotype despite standard treatment. The MUC5B promoter variant rs35705950 is the common genetic variant associated with the greatest risk of developing idiopathic pulmonary fibrosis (IPF). As IPF and fibrotic hypersensitivity pneumonitis (fHP) present phenotypic resemblances, we aimed to analyse the role of rs35705950 MUC5B single nucleotide polymorphism (SNP) in common molecular pathways linked to PF-ILDs.

Herein, taking advantage of our extensive ILD patients' cohort, we found that the frequency of MUC5B rs35705950 GT and TT genotypes was dramatically increased in IPF and fHP, as compared to healthy controls (GT: 57,6% versus 63,3% versus 20,7%; TT: 15,3% versus 10,3% versus 0,9%).

Furthermore, the distribution of cellular populations in bronchoalveolar lavage (BAL) is comparable between IPF and fHP patients, highlighting the hypothesis that PF-ILDs may share common fibroproliferative pathways. Interestingly, when stratifying the fHP patients according to the MUC5B rs35705950 genotype, we observed an increased percentage of macrophages in BAL fluid in individuals carrying the minor allele together with a slight decrease in neutrophils, eosinophils, and lymphocytes.

Further studies related to MUC5B protein expression, localization and function in fHP patients are ongoing. With this approach, we expect to shed light into pathways shared between IPF and HP, with potential use in early stratification of disease risk and survival.

Keywords: Interstitial lung disease; hypersensitivity pneumonitis; MUC5B; single nucleotide polymorphism; bronchoalveolar lavage.

21072 | Impact of high-fat and high-fat-high-sugar diets in neurogenesis and neuropeptide Y in aged rats

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Abstract

The consumption of high-caloric diets in human populations has deleterious effects on the human body, including the brain, leading to an increase in neuropsychological disorders. However, these effects are underreported in the literature, particularly in the elderly population. This study aimed to better understand the alterations induced by two high-caloric diets, high-fat (HF) and high-fat high-sugar (HFHS) in the hippocampus, a region important for cognition and emotions. In particular, we aimed to analyse the effects of these diets on the neurogenic process and their impact on the GABAergic system in the hippocampus. Therefore,18-month-old male Wistar rats were randomly divided into three groups: control, HF, and HFHS. After 12 weeks of diet treatment, animals were euthanized and processed for immunohistochemistry for doublecortin (DCX) and neuropeptide Y (NPY).

Our results revealed that in aged rats the HFHS diet decreased the density of DCX-positive cells and NPY-positive cells in the hippocampus. Interestingly, the effects of the HF diet were lighter, associated with a reduction in the DCX-positive cells but without impact in the NPY-positive cells. Thus, our results suggest that aged rats are highly susceptible to high-caloric diets, even if they only start later in their lifetime, with an impact on neurogenesis and GABAergic system. Furthermore, diets rich in saturated fats and sugar are more detrimental to aged rats than highfat diets are.

Keywords: High-Fat, High-sugar, Neuroinflammation, Aged Rats, Hippocampus

21133 | Characterization of invariant Natural Killer T cell phenotype and function in Fabry disease patients

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Abstract

Fabry disease is a rare genetic condition caused by deficiency of the enzyme alpha-Galactosidase A (α -Gal A) which leads to the accumulation of the lipid globotriosylceramide (Gb3). The clinical outcome of Fabry disease is related to the α -Gal A activity, with more severe cases presenting no activity.

Cell frequency of Invariant Natural Killer T (iNKT), which are CD1d-restricted T cells, is decreased in α -Gal A KO mice vs WT. Contrary to conventional NKT cells, iNKT express a semi-invariant TCR and rapidly produce cytokines when stimulated. It is possible that the nature and abundance of different lipids in different organs impacts the presence and/or function of iNKT cells.

Our goal is to determine if the accumulation of lipids in Fabry disease leads to iNKT cell frequency, phenotypic and functional alterations and if these alterations could be disease biomarkers. In order to achieve this, flow cytometry analyses of peripheral blood iNKT cells will be carried out from a diverse group of Fabry disease patients and subjects who are apparently healthy. The first task is to construct a flow cytometry panel and define/optimise the required experimental conditions. iNKT cells are identified using Anti-CD3 and a lipid loaded CD1d tetramer. Cell phenotype is unravelled by using Anti-CD3, Anti-CD4, Anti-CD8 α and Anti-CD8 β as well as activation (ICOS) and exhaustion (PD-1 and TIM-3) markers. Titrations are being done for each antibody/reagent. PD-1 and TIM-3 expression is low and we are still trying to improve the detection method of these markers. We are also attempting to use Anti-CXCR6 and Anti-CD244 to identify a subpopulation of circulating iNKTs, described in the literature. Surprisingly, from our preliminary data, we weren't able to identify this population. Thus, more optimisations are being done to take conclusions.

This is an ongoing study and there are still optimisations to tackle before proceeding with the patients and healthy subjects.

Keywords: Fabry disease; invariant Natural Killer T cells; Lipids; Flow Cytometry;

21155 | Uncovering the microglia response during neonatal Group B *Streptococcus* meningitis

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Abstract

Group B Streptococcus (GBS) remains the most common bacterial cause of meningitis in neonates. Microglia, the brain resident immune cells, have a critical role in the development of neural circuits. However, the role of GBS infection on microglia activation and neurological sequelae remains poorly characterised. Here, we aimed to evaluate whether GBS induces changes in microglia profile during the acute phase of infection, using a mouse model that mimics key steps of GBS pathophysiology in humans. Female C57BL/6 mice were intra-vaginally inoculated with GBS during gestation, and CFU analysis was performed on postnatal days (P) 1, 3 and 5. Bacterial colonisation was found at all ages, peaking at P3. When analysing the status of microglia by flow cytometry in the whole brain of male pups at P3, an overall activation was observed in the infected group. Mainly, we found a significant increase in microglia frequency, as well as the mean fluorescence intensities (MFIs) of CD45, CD11b and F4/80. Additionally, we also analysed some microglial receptors that are important neuro-immune regulators with relevant functions during development. We observed increased CX3CR1 expression in microglia, whereas Sirp α and CD200r were not altered. Moreover, analysing the cortex and hippocampus, relevant regions for cognition, we found similar numbers in Iba1⁺ cells, a known microglia marker, in the hippocampus of infected pups. In contrast, a significant decrease was observed in the cortex, suggesting altered migration of these cells. Furthermore, microglia phagocytosis was increased in the cortex of infected pups but not in the hippocampus. Interestingly, quantification of neurons revealed a significant decrease in the hippocampus of infected pups while being increased in the cortex, compared with age-match controls. Altogether, our results show that GBS meningitis alters the neonatal microglia profile. Further studies will be necessary to better understand the microglia inflammatory state after GBS infection.

Keywords: Group B Streptococcus; neonatal meningitis; microglia.

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21175 | The role of novel clinical digital tools in the screening and diagnosis of Obstructive Sleep Apnea - A systematic review

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Abstract

Background: Clinical digital tools are an up-and-coming new technology that can be used in the screening and diagnosis of obstructive sleep apnea (OSA) patients, notwithstanding the crucial role of polysomnography (PSG) – the gold standard.

Objective: The aim of our study was to identify, gather, and analyse existing digital tools and smartphone-based health platforms that are being used for this disease's screening or diagnosis in the adult population.

Methods: We performed a comprehensive literature search in MEDLINE, Scopus, and ISI databases for studies evaluating the validity of digital tools in OSA screening or diagnosis until November 2022. The risk of bias was assessed using JBI Critical Appraisal Tool for Diagnostic Test Accuracy Studies. Sensitivity, specificity, and area under the receiver-operating curve (AUC) were used as discrimination measures. This systematic review was registered in PROSPERO under reference CRD42023387748.

Results: We retrieved 1714 articles, 41 of which were included. We found 7 smartphone-based tools, 10 wearables, 11 bed/mattress sensors, 5 nasal airflow devices, and 8 other sensors that did not fit the previous categories. Only 8 (20%) studies performed external validation after testing their developed tool. Considering the studies that only internally validated their models, the work that arose as the best showed an AUC, sensitivity, and specificity values of 98%, 95%, and 100%, respectively, for a clinical cutoff of AHI \geq 15. It uses a mattress sensor with multiple pressure points that detect pressure variation caused by heart rate, respiratory, and other body movements. Among studies that externally validated the proposed tools, the highest measures were 99%, 96%, and 92%, respectively, for a clinical cutoff of AHI \geq 30, and correspond to a noncontact audio recorder that records sleep sounds, which are then analysed by a deep learning technique that automatically detects sleep apnea events, calculates the apnea-hypopnea index (AHI), and identifies OSA.

Conclusions: These clinical tools presented promising results, showing high discrimination measures. However, there is still a need for quality studies, comparing the developed tools with the gold standard and validating them in external populations and other environments before they can be used in a clinical setting.

Keywords: obstructive sleep apnea; diagnosis; mHealth; digital tools; smartphone; wearables; sensor; polysomnography, systematic review.

21205 | Exposure to naturally occurring metals during early-pregnancy and pregnancy outcomes: results from the IoMum cohort

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Abstract

This work aimed to characterize exposure to Aluminium (Al), Lithium (Li), Barium (Ba), and Strontium (Sr) and their association with sociodemographic and lifestyle factors, anthropometric parameters of the newborn and pregnancy complications.

Spot urine samples (n=349) of eligible pregnant women attending the routine 1st-trimester ultrasound scan from April 2018 to April 2019 at Centro Hospitalar Universitário de S. João were analysed through ICP-MS to quantify the metals' urinary concentrations (MUC). Inclusion criteria were: gestational age between 10 weeks and 13 weeks plus 6 days with confirmed foetal vitality and signature of the informed consent. MUCs are presented through median (IQR) in $\mu g/L$ or $\mu g/g$ creatinine.

MUCs were: Al 8.3 (4.7-14.7), Li 18.5 (10.3-34-3), Ba 1.7 (1.0-3.0), and Sr 100.7 (70.3-166.7), which are within the levels previously described in the literature.

Increased excretion of Al was found in healthcare (HCP) (12.76 (7.41-23.23) vs 10.05 (5.05-20.63) μ g/g in other occupations; p=0.048) and in hairdressing professionals (HDP) (18.73 (13.25-31.24) versus 10.33 (5.52-20.82) μ g/g in other occupations; p=0.039). Urinary Al decreased from normal weight (12.34 (7.12-23.36) μ g/g) to obese women (5.91 (3.45-14.66) μ g/g (p=0.002). Urinary Sr decreased as the ingestion of milk increased (from 160.32 (98.27-228.88) μ g/g in the group consuming 1 cup of milk < 3 times a month to 109.66 (66.51-182.64) μ g/g in the group consuming 1 cup of milk < 4 times a week; p=0.000). Finally, mothers of appropriate for gestational age (AGA) newborns consistently presented higher urinary Ba or Sr in comparison to small (SGA) and large for gestational age (LGA) newborns, whereas mothers of SGA newborns (weight or head circumference) had higher excretion of Al or Li in comparison with AGA or LGA.

In conclusion, Al excretion may result from occupational exposure of pregnant women. For the observed levels of exposure, Ba and Sr were innocuous while Al or Li were potentially toxic to the newborn.

Acknowledgments

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Work performed according to the protocol approved by the Ethics Committee of Centro Hospitalar e Universitário de São João/FMUP.

21221 | Does allergic rhinitis induce structural and behavioural changes in the male rat brain?

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Abstract

Background: Allergic Rhinitis (AR) is known to be a cause of olfactory dysfunction. In addition to the classic symptoms, AR has also been liked to other problems, such as sleep pattern disturbances, a decrease in cognitive performance, depression and anxiety. It has been theorized that the olfactory pathway is the link between nasal inflammation and central nervous system (CNS) modifications. The aim of this study is to investigate the functional and behavioural changes in the olfactory pathway and related areas in an animal model of AR.

Methods: AR was induced in adult Wistar rats by ovalbumin sensitization and challenge. Following the aggressive behaviour test and the buried food test, we investigated the synaptic structure of the olfactory bulb (OB), by immunofluorescence detection of synaptophysin (Syn) and glutamatergic and GABAergic neuronal markers.

Results: The AR rats spent significantly less cumulative time in offensive behaviours and more time in defensive behaviours than controls. It was also found that the latency to locate the hidden cookie in the buried food test was significantly higher in rats from the AR group. Additionally, we detected a significant decrease in Syn in the glomerular layer (GL) of OB. The expression of GAD67 and VGLUT2 was also reduced in the OB, compared to the control group.

Conclusions: There was evidence of olfactory dysfunction in the rats of the AR group, as expected. We also identified significant structural changes in glutamatergic and GABAergic activity in essential components of the olfactory pathway.

Keywords: allergic rhinitis; olfaction; anxiety; depression; olfactory bulb.

21223 | Role of oats in celiac disease: an update

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Abstract

Introduction: Celiac disease is an autoimmune enteropathy triggered by a triad – genetic susceptibility (HLA class II DQ2 and/or DQ8); loss of immune tolerance to gluten; and gluten ingestion – with a global prevalence of approximately 1%. Despite being phylogenetically more distant from wheat, rye and barley, studies have found some negative effects of oat consumption in celiac patients, and hence its safety has been a hot topic of discussion for the past 20 years. Aim: To analyse the effects of oat consumption in celiac children and discuss the theoretical causes for these results.

Methodology: In this narrative review, we searched for articles published between 2020 and 2022 927in PubMed and Scopus, using the terms "celiac disease", "oats", "using oat", "gluten contamination", "gluten-free products" and "safety".

Results: Currently, some authors emphasize the nutritional and organoleptic benefits of oats in a gluten-free diet and question its toxicity, while others highlight the negative effects found in some studies that used pure oats. Most articles evaluating the effect of oat consumption in celiac children concluded that it is generally well tolerated and it is currently recommended by several countries. Some authors attribute the negative effects found in some studies not to interindividual variability but either to cross-contamination in products not labelled as "glutenfree" or to the variable immunoreactivity of different species of oats (identified by the ELISA AbG12 tests). The distinct immunoreactivity results from a combination of various factors – e.g. epitope types, percentage of avenins, etc. - leading to some varieties being considered potentially toxic while others are probably safe.

Conclusion: Oat consumption is generally considered as safe for celiac children, however the use of oats labelled as "gluten-free" is recommended. Both consumers and oat producers should prioritize the less immunoreactive species.

Keywords: celiac disease, coeliac disease, children, oats, oat consumption, cross-contamination, immunoreactivity, gluten-free, safety

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References

[1] Spector Cohen I, Day AS, Shaoul R. To Be Oats or Not to Be? An Update on the Ongoing Debate on Oats for Patients With Celiac Disease. Front Pediatr. 2019; 7:384.

[2] Kosová K, Leišová-Svobodová L, Dvořáček V. Oats as a Safe Alternative to Triticeae Cereals for People Suffering from Celiac Disease? A Review. Plant Foods Hum Nutr. 2020; 75(2):131-41.

[3] Gell G, Bugyi Z, Florides CG, Birinyi Z, Réder D, Szegő Z, et al. Investigation of Protein and Epitope Characteristics of Oats and Its Implications for Celiac Disease. Front Nutr. 2021; 8:702352.
[4] Dvořáček V, Kotrbová-Kozak A, Kozová-Doležalová J, Jágr M, Hlásná Čepková P, Vítámvás P, et al. Specific Avenin Cross-Reactivity with G12 Antibody in a Wide Range of Current Oat Cultivars. Foods. 2022; 11(4).

[5] Ahola HG, Sontag-Strohm TS, Schulman AH, Tanhuanpää P, Viitala S, Huang X. Immunochemical analysis of oat avenins in an oat cultivar and landrace collection. Journal of Cereal Science. 2020; 95:103053.

21232 | Improving clinical severity assessment and outcome prediction in a mouse model of neonatal Group B Streptococcal diseases

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Abstract

Invasive disease due to Group B Streptococcus (GBS) infection subsists as the main source of morbidity and mortality in neonates. The gap observed between effective therapeutics strategies obtained during the preclinical stages and benefits in human trials is mainly due to the absence of scoring systems in animal models to evaluate the degree of critical illness and provide prognostic clarity like the ones used in human patients. outcomes. In this context, we used a non-invasive neonatal scoring system reflecting the metrics used in human neonates, to identify the main predictors of clinical severity and survival of pups born from Balb/c pregnant dams intravaginally inoculated with 8×10^4 CFU of GBS. The evaluation was based on observational parameters, including skin color, spontaneous behaviour/movement, milk spot visibility and head posture. The physical examination-based parameters examining provoked behaviour and pain. The capillary refill time and skin turgor assessed the circulatory status and dehydration grade, respectively.

At 24h after birth infected pups had significantly higher (*P*<0.005) neonatal clinical scores comparatively to uninfected neonates. The area under the curve (AUC) (95% CI: 0,88-0,99) for the clinical score was 0,93 (*P*<0.0001) indicating that this scoring system was excellent for discriminating between GBS diseased newborns from healthy ones. The clinical score of 3,5 (95% CI: 0,77-0,96) was selected as the best cutoff value for newborns developing GBS disease – the sensitivity and specificity of the clinical score were 90% and 67%, respectively. The observational parameters in parallel with gain weight and capillary refill time were shown to be main predictors of neonatal survival within the infected pups (AUC: 0,84; 95% CI: 0,61-1,00).

Adoption of this scoring system will provide a robust metric to assess health of newborn mice and therapeutics outcomes.

21281 | Assessment of exposure to plastic additives in Portuguese pregnant women: the role of dietary consumption and associated health effects

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Abstract

Context: Plastics are widely used in a variety of aspects of daily life. This study focused on the evaluation of Brominated Flame Retardants and Phosphorous Flame Retardants contaminants, known additives of plastics. Prolonged exposure to these chemicals, by humans, and its accumulation appears to lead to several adverse health effects. Also, pregnancy is a period of susceptibility to environmental toxicants, both for women and fetuses.(1–3)

Objective: This study aimed to assess the relationship between the levels of plastic additives in blood samples of pregnant women with dietary consumption and putative associated health effects.

Design and Participants: We evaluated blood samples of a sub-sample of 153 pregnant women from the IoMum cohort. The extraction of plastic additives from blood samples was performed by SPE method followed by gas chromatography with a photometric flame detector and electron

capture detector analysis. Descriptive statistics were performed and Mann-Whitney and Kruskal-Wallis tests were used. Differences were considered statistically significant whenever P <0.05. Results: Preliminary results show that there is a positive association of contaminants with pregnancy complications, namely gestational diabetes(p=0.039 for BDE100), pre-eclampsia (p=0.046 for BDE99), pre-term delivery(p=0.016 for TToPTCP; p=0,001 for BDE47) and other complications (p=0,004 for BDE154); determinants of exposure such as smoking habits (p=0.026 for the contaminant BDE154); and dietary consumption, namely milk(p=0,046 for TToPTCP), cheese(p=0,011 for BDE153), vegetable drinks(p=0,044 for BDE28; p=0,034 for BDE154), fish (p=0,002 for BDE47), soy and soy products (p=0,011 for TBEP; p=0,038 for BDE153) and viscera (p=0,037 for TBEP; p=0,032 for TToPTCP; p=0,048 for BDE100).

Conclusions: Principal Component Analysis test will be applied to better explore exposure patterns. We believe that the results of this study will be very useful for the creation of future clinical and public health guidelines.

Keywords: Biomonitoring; Plastic additives; Pregnant women; Health effects

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References

[1] Guimar J, Bracchi I, Pinheiro C, Moreira NX, Pestana D, Prucha C, et al. Association of 3-Phenoxybenzoic Acid Exposure during Pregnancy with Maternal Outcomes and Newborn Anthropometric Measures: Results from the IoMum Cohort Study. Toxics. 2023;11(125).

[2] Cruz Fernandes V, Pestana D. Environmental Chemicals: Integrative Approach to Human Biomonitoring and Health Effects. Toxics. 2022;10(314).

[3] Basak S, Das MK, Duttaroy AK. Plastics derived endocrine-disrupting compounds and their effects on early development. Birth Defects Res. 2020;112(17):1308–25.

20564 | Polyvascular disease influences long-term cardiovascular morbidity in carotid endarterectomy

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Abstract

Introduction: Carotid stenosis (CS) is an important cause of ischemic stroke. Secondary prevention lies in performing a carotid endarterectomy (CEA) procedure, the recommended treatment in most cases. When two or more vascular regions are simultaneously affected by atherosclerosis, mainly the carotid, coronary, or limb arteries, a multivessel disease polyvascular disease (PVD) is present. This study aims to assess the potential role of PVD as a long-term predictor of major adverse cardiovascular events (MACE) and all-cause mortality in patients submitted to CEA.

Methods: From January 2012 to December 2021, patients submitted to CEA for carotid stenosis in a tertiary care and referral center were eligible from a prospective database. A *post hoc survival* analysis was performed, and survival analysis was performed by the Kaplan-Meier method. The primary outcome was the incidence of long-term MACE and all-cause mortality. Secondary outcomes included acute myocardial infarction (AMI), major adverse limb events (MALE), stroke, and acute heart failure (AHF).

Results: A total of 207 patients were enrolled, with a median follow-up of 63 months. The mean age was 70.4 \pm 8.9, and 163 (78.7%) were male. There were 65 (31.4%) patients that had two arterial vascular territories affected, and 29 (14.0%) patients had PVD in 3 arterial beds. On multivariable analysis, both MACE and all-cause mortality had as independent risk factors age (aHR 1.039, P=0.003; aHR 1.041, P=0.019), chronic kidney disease (aHR 2.524, P=0.003; aHR 3.377, P<0.001) and PVD2 (aHR 3.381, P<0.001; aHR 2.665, P=0.013). PVD1 was only associated with MACE as a statistically significant risk factor (aHR 2.531, 1.439-4.450, P<0.001). Conclusions: PVD in patients with cerebrovascular disease (CVD) was revealed to carry a two-fold

increased risk for all-cause mortality and MACE during long-term follow-up. PVD may be a simple yet valuable tool in predicting all-cause mortality, MACE, AMI, and MALE after CEA.

Keywords: cardiovascular disease; survival analysis; carotid stenosis; peripheral vascular disease; major adverse cardiovascular events, major adverse limb events.

20687 | Study of proteins associated with sexual dimorphism in aortic valve stenosis

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Abstract

Aortic valve (AV) stenosis (AVS) is the most common acquired heart valve disease[1]. Male sex is a known independent risk factor for AVS[2] and for the same level of hemodynamic severity, women present a lower degree of calcification and a higher degree of fibrosis[3]. Doppler echocardiography remains the gold standard for diagnosis confirmation[4]. Therefore, plasmamonitorable biomarkers of severe AVS would be of extreme value. Yet, these should be personalized according to sex, due to the relevant differences in disease progression.

In a previous proteomics study of our group, >70 AV proteins were found dysregulated by sex and some showed significant associations with disease severity: CD163 (AV area r=0.29, p<0.05, n=50), NADPH oxidase 2 (valve weight r=0.51, p<0.05, n=20), CD74 (velocity ratio r=0.50, p<0.01, n=33), oxysterol-binding protein 1 (OSBP1) (indexed AV area r=0.40, p<0.01, n=44). In turn, glutathione peroxidase (GPX1) occupied a central position in a protein-protein interaction network. Therefore, this work's goal is to validate the differential expression of such proteins in both sexes and evaluate their biomarker value for AVS.

Our cohort included 50 patients undergoing AV replacement (Table 1). Men's AVs were ca. 1.8x heavier than women's, reflecting higher calcium levels[5]. Histochemistry with Alizarin Red staining revealed no differences in valve calcification between sexes, probably due to the decalcification step. An alternative method for calcium assessment is in place. Red Sirius staining for fibrosis quantification is ongoing and is expected to be greater in women. Western blot was first used to validate the differential expression of all proteins; however, all proteins except GPX1 fell below the detection limit. GPX1 immunoblot did not reproduce proteomics findings. The proteins OSBP1, CD74, and CD163 are currently being evaluated by immunohistochemistry. The most promising proteins will be assessed in plasma and their correlation with disease severity evaluated.

Keywords: aortic valve stenosis; sex differences; biomarkers.

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References

[1] Goody, P.R., et al., Aortic Valve Stenosis: From Basic Mechanisms to Novel Therapeutic Targets. Arterioscler Thromb Vasc Biol, 2020. 40(4): p. 885-900.

[2] Saeed, S., M.R. Dweck, and J. Chambers, Sex differences in aortic stenosis: from pathophysiology to treatment. Expert Rev Cardiovasc Ther, 2020. 18(2): p. 65-76.

[3] Hervault, M. and M.-A. Clavel, Sex-related Differences in Calcific Aortic Valve Stenosis: Pathophysiology, Epidemiology, Etiology, Diagnosis, Presentation, and Outcomes. Structural Heart, 2018. 2(2): p. 102-113.

[4] Ahn, Y., et al., Classification of severe aortic stenosis and outcomes after aortic valve replacement. Sci Rep, 2022. 12(1): p. 7506.

[5] Thaden, J.J., et al., Sex-related differences in calcific aortic stenosis: correlating clinical and echocardiographic characteristics and computed tomography aortic valve calcium score to excised aortic valve weight. Eur Heart J, 2016. 37(8): p. 693-9.

Table 1: Clinical	characteristics	of severe AVS	patients; n=50) (25 men/25	women); n.s.	- non-
significant.						

	Men (n=25)	Women (n=25)	p-value	
Clinical data				
Maximal transvalvular pressure			nc	
gradient [mmHg] (n)	74.4 ± 15.5 (25)	78.5 ± 18.6 (24)	11.5.	
Mean transvalvular pressure gradient [mmHg] (n)	46.4 ± 11.4 (25)	49.9 ± 12.2 (25)	n.s.	
Indexed aortic valve area [cm ² /m ²] (n)	0.47 ± 0.1 (25)	0.47 ± 0.12 (25)	n.s.	
Velocity ratio (n)	0.23 ± 0.05 (21)	0.23 ± 0.03 (12)	n.s.	
Excised valve weight [g] (n)	4.0 ± 1.5 (11)	2.2 ± 0.3 (9)	**	

** p-value < 0.01 (p = 0.0012)

21085 | Recommendations for the management of cardiomyopathy mutation carriers: Evidence and/or doubts/intentions

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Abstract

Some cardiomyopathies are hereditary or, at least, have been associated with a familial predilection. Morbidity and mortality can be caused by heart failure, sudden death, or arrhythmias. Sometimes these events are the first manifestations of cardiovascular disease. Hypertrophic Cardiomyopathy and Arrhythmogenic Right Ventricular Cardiomyopathy are perhaps most thoroughly studied in that context. Dilated Cardiomyopathy, although most frequently, of secondary etiology, has a significant familial cluster. Noncompaction of the left ventricle can sometimes be seen in healthy individuals and, in other instances cause severe LV dysfunction.

Genetic testing is of utmost importance since it might allow us to identify individuals carrying a mutation predisposing to these diseases. Also, certain variants may benefit from tailored therapeutic regimens and thus, searching for a causal mutation can impact clinical practice. It is recommended for all first-degree family members and patients with HCM, or ARVC. Patients with DCM and positive family history should be included as well. Regular follow-ups are advised, even in those with negative phenotypes, because these disorders are often age-dependent. During pregnancy and in the case of athletes' special consideration should be made as well. We intend to summarize the most current evidence regarding their management.

Keywords: Hypertrophic cardiomyopathy; Dilated cardiomyopathy; Arrhythmogenic cardiomyopathy; Noncompaction.
21125 | The heart at our hands: Utilizing multicellular spheroids as innovative vascularization units for advanced tissue engineering

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Abstract

To this day, cardiovascular diseases remain the leading cause of death worldwide. Myocardium infarction (MI) results in extensive and permanent destruction of the cardiac muscle, which commonly results in heart failure (HF). Modern methods to deal with MI and chronic HF have major drawbacks and are insufficient to meet demands and novel therapies are urgently needed. Cardiac tissue engineering (TE) approaches are promising alternatives to restore the damaged myocardium, but present solutions do not promote correct graft integration. One critical aspect is the poor inosculation with the host's microvasculature, leading to insufficient reperfusion of the scaffold. Multicellular spheroids of endothelial and mural cells are potential candidates to surpass such problems by promoting neo-vasculature sprouting [1] at the patch-host interface. Our strategy aims to generate relevant cardiac vascularizing units made of induced pluripotent stem cells (iPSC)-derived cardiac fibroblasts (CF) and endothelial cells (EC). These spheroids will then be fused with an iPSC-cardiomyocyte construct, to further generate biologically relevant vessel networks once implanted after MI, and study their role in promoting graft viability and functionality. Herein, we detail the differentiation of EC and CF from iPSC as described in Zhang, H et al., [2], and Giacomelli, E. et al., [3] as well as generation of different formulations of EC-CF spheroids. The 3D cellular assembly, extracellular matrix production and their capacity to generate vessel-like structures when embedded in fibrin, will be further presented. These data constitute the first steps towards the generation of a promising vascularization strategy to overcome the current limitation of cardiac TE and ease their bench to bedside progression.

Keywords: Heart failure, Cardiac Patch, Spheroids, Vascularization Units, Cardiomyocyte, Endothelial Cell, Cardiac Fibroblast, Induced Pluripotent Stem Cell, Tissue Engineering

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References

[1] D. T. O. Carvalho, T. Feijão, M. I. Neves, R. M. P. Da Silva, and C. C. Barrias, "Directed selfassembly of spheroids into modular vascular beds for engineering large tissue constructs," *Biofabrication*, vol. 13, no. 3, Jul. 2021, doi: 10.1088/1758-5090/ABC790.

[2] H. Zhang et al., "Generation of Quiescent Cardiac Fibroblasts From Human Induced Pluripotent

Stem Cells for In Vitro Modeling of Cardiac Fibrosis," *Circ. Res.*, vol. 125, no. 5, pp. 552–566, Aug. 2019, doi: 10.1161/CIRCRESAHA.119.315491.

[3] E. Giacomelli *et al.*, "Three-dimensional cardiac microtissues composed of cardiomyocytes and endothelial cells co-differentiated from human pluripotent stem cells," *Development*, vol. 144, no. 6, pp. 1008–1017, Mar. 2017, doi: 10.1242/DEV.143438.

21168 | Urinary proteomics study in heart failure with preserved ejection fraction

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Abstract

Heart failure with preserved ejection fraction (HFpEF) includes around 50% of the HF cases and presents a high mortality rate (30-60% at 5 years) [1,2]. Its prevalence is increasing with population aging and comorbidities accumulation [2,3]. Although HFpEF pathophysiology is not completely understood, systemic low-grade inflammation as a consequence of comorbidities associated with cardiac microvascular endothelial dysfunction, oxidative stress, and fibrosis are considered to be key players [4]. The complexity of this condition associated with the presence of one or more co-morbidities, which often occur in patients, can contribute to the particularly difficult diagnosis and limited effective therapy. The discovery of novel biomarkers that can help in the diagnosis and understanding of disease pathophysiology is of utmost importance, especially if measured in a non-invasive way and if cost-and time-effective for patients and clinicians. In this work, urine samples were collected from individuals with HFpEF and control individuals without HF and matched for body mass index, diabetes mellitus, and dyslipidemia, for proteome characterization using a mass spectrometry-based approach. Urine proteomics allowed the identification of 808 distinct proteins, mainly associated with immunity and metabolic processes. Five proteins (AMBP (alpha-1-microglobulin), RBP4 (retinol binding protein 4) SERPINA1 (alpha-1-antitrypsin), SERPINA3 (alpha-1-antichymotrypsin), and GSN (gelsolin)), present in all samples, and found in higher levels in HFpEF patients in comparison with control individuals, were selected to validation by western and slot-blot (based on the association with HF and the location in a protein-protein interactions network). Immunoblot analysis showed that SERPINA1 and RBP4 levels were significantly increased in HFpEF individuals in comparison with the control group. Future work includes the validation of these results in an independent clinical cohort.

Keywords: urine; proteomics; heart failure.

Acknowledgments

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References

[1] Upadhya, B. and D.W. Kitzman, Heart failure with preserved ejection fraction: New approaches to diagnosis and management. Clin Cardiol, 2020. 43(2): 145-155.

[2] Lourenco, A.P., et al., An integrative translational approach to study heart failure with preserved ejection fraction: a position paper from the Working Group on Myocardial Function of the European Society of Cardiology. Eur J Heart Fail, 2018. 20(2): 216-227.

[3] Dunlay, S.M., V.L. Roger, and M.M. Redfield, Epidemiology of heart failure with preserved ejection fraction. Nat Rev Cardiol, 2017. 14(10): 591-602.

[4] Adamczak, D.M., Oduah, MT., Kiebalo, T., et al., Heart Failure with Preserved Ejection Fraction—a Concise Review. Curr Cardiol Rep, 2020. 22: 82.

21194 | In vitro study of the effects of aggregated TTR in cardiac cells

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Abstract

Transthyretin (TTR) amyloidosis is a disease associated with extracellular deposition of insoluble amyloid fibrils in tissues, originating polyneuropathy and cardiomyopathy [1]. The protein aggregates are composed by wild type (TTR wt) in the forms associated with aging and mainly involving the heart or, by TTR variants due to mutations in TTR gene, the most severe forms. The two main mechanisms involved in TTR amyloid formation are: i) TTR destabilization, provoked by mutations or environmental conditions, causing tetramer dissociation into partially folded monomers, aggregation and fibril formation and ii) TTR proteolysis, triggering also aggregation and amyloid formation [2].

Previously, in our group, *in vitro* studies have already been made using HL-1 cardiomyocytes to characterize aggregation of TTR wt and TTR variants under proteolytic conditions and the toxicity on the cellular line. No evident effects were detected suggesting that this cell line may not be sensitive enough to the aggregates. Recent studies indicated that cardiac fibroblast are affected by TTR deposits, presenting increased proliferation and upregulation of inflammatory genes, revealing progression in TTR-based disease [3].

The objective of this project is to contribute towards the knowledge of the process and mechanisms of amyloid formation through *in vitro* studies using mice cardiac fibroblast activated into myofibroblasts. The studies involve cell viability assays and investigating apoptosis through caspase activation and evaluation of biomarkers by Western Blot. Also, for this work we produced and purified recombinant TTRs, transforming *E. coli* with plasmids encoding the variant proteins and purifying it by ion exchange chromatography. The results obtained should contribute to elucidate the mechanism of TTR proteolysis and aggregation in the cardiac cells.

Keywords: Transthyretin amyloidosis; cardiac fibroblast; proteolysis

References

[1] Bezerra, F., M.J. Saraiva, and M.R. Almeida, *Modulation of the Mechanisms Driving Transthyretin Amyloidosis.* Front Mol Neurosci, 2020. **13**: p. 592644.

[2] Mangione, P.P., et al., *Plasminogen activation triggers transthyretin amyloidogenesis in vitro*. J Biol Chem, 2018. **293**(37): p. 14192-14199.

[3] Dittloff, K.T., et al., *Transthyretin amyloid fibrils alter primary fibroblast structure, function, and inflammatory gene expression.* Am J Physiol Heart Circ Physiol, 2021. **321**(1): p. H149-h160.

20627 | Minimally invasive surgery for Pilonidal disease: Outcomes of Gips technique - a systematic review and meta-analysis

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Abstract

Aim: Pilonidal disease is a common inflammatory condition with significant impact in the quality of life. Currently, there is a tendency to favour minimally invasive procedures. The present review aims to summarize evidence and assess the outcomes of the Gips procedure.

Methods: A systematic review was conducted on MEDLINE/Pubmed, Scopus, Web of Science and Cochrane Library databases until December 2022. Eligible studies included patients with pilonidal disease submitted to the Gips procedure, reporting at least one of the following outcomes: wound complications, wound healing time, time to resume daily activities and recurrence (PROSPERO protocol: CRD42023389269). The National Institutes of Health assessment tool was used for risk of bias evaluation. Meta-analysis was performed using OpenMeta[Analyst]and R softwares and a subgroup analysis was performed, when applicable.

Results: Thirteen observational studies with a total of 4,286 patients submitted to Gips were included. The pooled wound complications rate was 7.8% (95% CI: 5.1–10.6), median time to resume daily activities was 1 day (95% CI: 1-2) and mean wound healing time was 4.7 weeks (95% CI: 3.0– 6.4). Subgroup analysis showed pooled recurrence rate was 6.5% (95% CI: 5.2-7.8) up to 2 years and 38.9% (95% CI: 27.1-50.7) after more than 2 years of surgery. Most results showed substantial heterogeneity across studies.

Conclusion: Despite apparent favourable outcomes of the Gips procedure, there is a high recurrence rate overtime. Since included studies had an observational nature and unstandardized methodologies, comparative randomized controlled trials with longer follow-up are needed for high level evidence regarding these outcomes.

Keywords: pilonidal disease; sinusectomy; *gips*; minimally invasive surgery.

20880 | Characterization of white adipose tissue used in distinct breast reconstruction surgical approaches

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Abstract

Mastectomy with breast reconstruction is one of the general first-line treatments for breast cancer, the most prevalent cancer in women worldwide [1]. Current surgical strategies for breast reconstruction after mastectomy use autologous abdominal subcutaneous white adipose tissue (aWAT) flap transfer, which implicates some donor site morbidity and deformity. To circumvent this problem, it was implemented a different surgical procedure- a laparoscopic flap harvest of the omental visceral WAT (oWAT)- that implies smaller surgical scars in the donor area [2]. It is the aim of the current project the characterization of the human WAT samples from different anatomical locations used in breast reconstruction and the evaluation of the impact of donor location in the transferred WAT.

For this, aWAT- deep and superficial, thigh subcutaneous WAT, oWAT and breast subcutaneous WAT- bWAT were collected during the two different breast reconstruction surgeries (using aWAT, n=10, or oWAT, n=10). Additionally, 6 months after the procedures, original bWAT and transferred aWAT or oWAT were also collected from the same patients (n= 20). All WAT samples were histologically evaluated (H&E and Sirius red staining). Preliminary western-blotting results revealed different expression levels, among the subcutaneous samples, of the macrophage markers arginase and CD206 and of the inflammatory crown-like structure marker Galactin3. Studies are ongoing with the quantification of inflammatory cytokines (IL-6, IL-1 β , TNF α , IL-10, TGFb) and extracellular matrix components (collagen and fibronectin) by western-blotting and Real-time PCR.

With this project we expect to provide strong molecular evidence on the use of oWAT flaps for breast reconstruction in patients with breast cancer. As well, the better understanding of the cellular communication pattern between WAT and recipient tissue will be essential for the short and long-term treatment of breast cancer patients.

Keywords: Breast Cancer; Adipose tissue, Breast reconstruction

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References

[1] Kronowitz, S. J. (2015). State of the art and science in postmastectomy breast reconstruction. Plastic and Reconstructive Surgery, 135(4).

[2] Shash, H., Al-halabi, B., Aldekhayel, S., & Dionisopoulos, T. (2017). Laparoscopic harvesting of omental flaps for breast reconstruction—a review of the literature and outcome analysis. Plastic Surgery, 26(2), 126–133.

20923 | Anatomical and radiological study of the extracranial portion of the hypoglossal nerve: Importance for anterior surgical approaches to the cervical spine

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Abstract

Introduction: Anterior surgical approaches to the cervical spine are common procedures for orthopedic and neurosurgeons, and the knowledge of the complex cervical anatomy is critical to avoid iatrogenic damage to local structures such as the hypoglossal nerve (from now on referred to as HN). Therefore, in this study, we focused on the detailed description of the HN extracranial trajectory and its relations in the cervical region.

trajectory and its relations in the cervical region. Materials, methods and results: Seven embalmed adult human cadavers (derived from body donation, Portuguese Decreto-Lei nº 274/99) were carefully dissected in order to preserve the normal anatomy of the cervical region. After bilateral dissection of the HN, its extracranial trajectory was marked with a thin radiopaque wire, along with the bifurcation of the common carotid artery (a prominent structure in this region), which was marked with a lead sphere. Cervical X-ray imaging of the cadavers was performed in anteroposterior and lateral views. The following reference points were bilaterally evaluated in relation to the vertebral levels as seen

the X-ray images:1. Bifurcation of the common carotid artery;

- Furthest point from the median plane of the HN;
- Most inferior observable point of the HN trajectory.

The vertical distance parallel to the median plane between the bifurcation of the common carotid artery and the HN was also measured bilaterally.

Presently, we are overseeing the statistical analysis of the resulting data.

Discussion/Conclusion: This study strived to increase the knowledge of extracranial HN trajectory anatomy, and its relation with the cervical spine. Damage to the HN, along with one or more adjacent nerves could lead to difficulty in swallowing and articulating words and to respiratory problems due to airway obstruction. Thus, given that the HN is at risk in anterior approaches of the cervical spine, understanding its trajectory and relations in detail is of surgical importance and a relevant topic of research.

Keywords: Hypoglossal Nerve; Dissection; Anatomy; Anterior cervical approaches; latrogenic injury.

20954 | Surgical anatomy of the proximal part of the musculocutaneous nerve: A cadaver study

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Abstract

Introduction: The musculocutaneous nerve (MCN) is one of the two terminal branches of the lateral cord of the brachial plexus. In this study, we aim to describe its course until perforating the coracobrachialis muscle and its anatomical relations with relevant muscular and bony landmarks, as it is important to have a thorough understanding of these topics when performing shoulder and arm surgery.

Materials and methods: We dissected and measured 10 cadavers, 6 male and 4 female (derived from body donation, Portuguese Decreto-Lei nº 274/99). However, 2 of the 20 upper limbs were excluded due to anatomical variants and/or dissections that altered the appropriate anatomy. After dissection, several morphometric measurements were taken to characterise the course of the MCN and its anatomical relations with the surrounding structures. We also took measurements that allow us to estimate the size of the arm. These measurements were taken with the upper limb in various degrees of abduction (0°, 45° and 90°). All variations of the normal anatomy that were found were documented. Going forward we intend to perform a statistical analysis to correlate the measurements we took of the MCN with the dimensions of the arm.

Conclusion: Overall, with this study we intended to describe several aspects related to the origin, course, and relations of the MCN, and thus increase and solidify the anatomical knowledge in this field. Iatrogenic nerve damage, which includes injury of the MCN, is one of the main dangers associated with orthopaedic surgery. Despite advancements in diagnostic and surgical techniques, detailed knowledge of anatomy continues to be of pivotal relevance to clinicians in both diagnostics and surgical and non-surgical treatment of lesions.

Keywords: Anatomy; Dissection; Cadaveric Study; Coracoid Process; Coracobrachialis Muscle; Musculocutaneous Nerve; Shoulder and arm surgery.

20969 | Anatomical and radiologic study of the internal branch of the superior laryngeal nerve: Importance for anterior surgical approaches to the cervical spine

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Abstract

Introduction: Orthopedic and neurosurgical surgeries involving an anterior approach to the cervical spine are common procedures. Considering the variety of structures in the cervical region, knowledge of the local anatomy becomes relevant in order to avoid iatrogenic damage and comorbidities. Because one of the vulnerable structures is the internal branch of the superior laryngeal nerve (from now on referred to as ibSLN), in this study we aimed to describe and detail its origin and trajectory.

948

Materials and Methods: Seven embalmed adult human cadavers (derived from body donation, Portuguese Decreto-Lei nº 274/99) were carefully dissected in order to preserve the normal anatomy of the cervical region. After dissection of the right and left ibSLN, their trajectory was marked with a thin radiopaque wire. Another relevant anatomical landmark, the bifurcation of the common carotid artery, was also marked with a lead sphere. Cervical X-Ray imaging of the cadavers was performed in anteroposterior and lateral views. The following reference points were evaluated in relation to the vertebral levels seen in the X-Ray images:

- 1. Bifurcation of the common carotid artery
- 2. Origin of the ibSLN
- 3. Furthest point from the median plane of the ibSLN
- 4. Most inferior observable point of the ibSLN

Currently we are conducting a statistical analysis of the obtained results.

Discussion/Conclusion: This study worked on improving knowledge of the anatomy of the ibSLN, a structure often at risk in anterior cervical surgical approaches. This branch is sensory to the laryngeal mucosa down to the vocal folds and, therefore, damage to this structure can lead to sequelae such as foreign body sensation in the throat or abolition of the laryngeal cough reflex, which can lead to aspiration. As so, knowing the nerve's trajectory and its relations becomes crucial and in need of further research.

20981 | Anatomical, radiological and surgical study focused on the human skeletal pelvis and lumbosacral plexus: Relevance for pelvic ring fractures management

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Abstract

Introduction: Although fractures of the pelvic ring are relatively uncommon, they are challenging for orthopaedic surgeons [1]. Depending on the fracture type, lesions of the lumbosacral plexus and/or its branches may be present [2-4]. Thus, with this study we intend to increase the knowledge of the pelvic anatomy, namely the topographical relationships of its bony and nervous components.

Materials and methods: Eleven embalmed adult human cadavers, eight female and three male, (derived from body donation, Portuguese Decreto-Lei nº 274/99) were dissected, preserving the anatomy of the abdominopelvic region [5-7]. After dissection, several morphometric measurements were taken. The next step of our work was, using the same cadavers, to mark the nervous structures with radiopaque material and perform the instrumentation of the pelvis simulating the surgical treatment of certain fractures, and finally make accurate measurements using fluoroscopy.

Conclusion: The study of the bony structures and the morphology of nervous structures analysed in this work are of utmost importance in the diagnosis and treatment of pelvic ring fractures. The results obtained so far represent an important part of the study and will be even more valuable with additional instrumentation procedures and imagiological studies that we intend to carry out. Our study will contribute to increase the detailed knowledge of pelvic anatomy and will certainly help surgeons in the management of pelvic trauma patients.

Keywords: Anatomy; Dissection; Radiology; Skeletal pelvis; Lumbosacral plexus; Pelvic fracture management

References

[1] Artoni C, Francesco F, Guardoli L, Lasagni F, Leigheb M, Fontanesi F, Calderazzi F, Pompili M,
Vaienti E, Ceccarelli F. Pelvic ring fractures: what about timing? Acta Biomedica.
2019;90(Supplement 12): 76-81.

[2] Kutsy RI, Robinson LR, Routt ML Jr. Lumbosacral plexopathy in pelvic trauma. Muscle Nerve. 2000:23(11): 1757-1760.

[3] Rodrigues-Pinto R, Kurd MF, Schroeder GD, Kepler CK, Krieg JC, Holstein JH, Bellabarba C, Firoozabadi R, Oner FC, Kandziora F, Dvorak MF, Kleweno CP, Vialle LR, Rajasekaran S, Schnake KJ, Vaccaro AR. Sacral Fractures and Associated Injuries. Global Spine Journal. 2017;7(7): 609-616.

[4] Tipton JS. Obturator neuropathy. Current Reviews in Musculoskeletal Medicine. 2008;1(3-4): 234-237.

[5] Esperança Pina JA, Bensabat Rendas A, Correia M, Goyri O`Neill J, Pais D. Anatomia Geral e Dissecação Humana. Lidel; 1995.

[6] Loukas M, Shane Tubbs R, Benninger B. Gray's Clinical Photographic Dissector of the Human Body. 2nd Edition. Elsevier; 2019.

[7] Standring S (ed.). Gray's Anatomy - the Anatomical Basis of Clinical Practice. 42nd edition. Elsevier; 2021.

21199 | Impact of Enhanced Recovery After Surgery (ERAS) guidelines implementation in cesarean delivery: a systematic review and meta-analysis

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Abstract

Background: Cesarean delivery rate is increasing, with no prediction of this rate to drop. Implementation of Early Recovery After Surgery (ERAS) program adapted to this high prevalent obstetrical surgical procedure proposes better peri-operative care achievement with improved maternal medical care, namely reduced morbidity, faster return to normal daily activities and improved impact on quality of life. Our aim was to analyse the outcomes of ERAS guidelines implementation in cesarean sections (CS).

Material and methods: A systematic review was performed across 3 databases (MEDLINE (Pubmed), Scopus and Web of Science), with no time or language filters, for articles comparing outcomes on pregnant women who delivered via CS with ERAS guidelines implementation versus the traditional approach without ERAS implementation. Outcomes established: primary – hospital length of stay; secondary - opioid consumption, readmission rates and maternal complications (overall, surgical site infection and emetic morbidity). Statistical analyses were conducted using Review Manager 5.4 and its results were expressed as mean difference, standardized mean difference and odds ratio, with 95% of confidence intervals. This systematic review was reported according to the PRISMA statement.

Results: This systematic review included 16 studies (3 randomized controlled trials (RCT), 4 prospective cohorts and 9 retrospective cohorts), with a pool analysis of 19001 women (9752 with the traditional approach and 9249 following ERAS guidelines). Our results showed a significative decrease in length of hospital stay (MD: -13.78h; CI 95% -19.28 to -8.28; p<0.00001) and opioid consumption (SMD: -0.91; CI 95% -1.51 to -0.32; p=0.003), with similar readmission rates (OR: 0.85; CI 95% 0.50 to 1.44; p=0.53) and maternal complications, namely: overall (OR: 0.87; CI 95% 0.56 to 1.35; p=0.53); surgical site infection (OR: 1.13; CI 95% 0.72 to 1.77; p=0.60) and emetic morbidity (OR: 0.78; CI 95% 0.31 to 1.96; p=0.60).

Conclusions: ERAS guidelines applied at CS management are associated with decreased length of stay and opioid consumption, without negatively impact on readmission rates and overall maternal complications, including surgical site infection and emetic morbidity. The reduced number of RCT studies and the heterogeneity of the studies (heterogeneous inter-study protocols) constitutes the major limitation of the evidence found. Still, these findings may be a foremost help to confirm the beneficial impact of an ERAS approach during peri-cesarean management.

Conclusion: ERAS guidelines applied at CS management are associated with decreased length of stay and opioid consumption, without negatively impact on readmission rates and overall maternal complications, including surgical site infection and emetic morbidity. The reduced number of RCT studies and the heterogeneity of the studies (heterogeneous inter-study protocols) constitutes the major limitation of the evidence found. Still, these findings may be a foremost help to confirm the beneficial impact of an ERAS approach during the peri-cesarean management.

Keywords: ERAS; Enhanced Recovery After Surgery; Cesarean Section; Maternal Outcomes

21276 | Comparison between the open and the laparoscopic approach in the primary ventral hernia repair: A systematic review and meta-analysis

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Abstract

Background: Ventral hernia repair has suffered various changes in the previous decade and new techniques have started to be used. Laparoscopic primary ventral hernia repair may be an alternative to open repair since it prevents large abdominal incisions and may reduce recurrence, pain, and hospital stay. However, whether the laparoscopic approach may improve clinical outcomes has not been systematically assessed.

Objectives: The aim of this systematic review is to compare the clinical outcomes of the laparoscopic versus open approach of primary ventral hernias (epigastric, umbilical, and paraumbilical hernias).

Methods: A systematic search of MEDLINE (PubMed), Scopus, Web of Science, and Cochrane Central Register of Controlled Trials was conducted in February 2023. All randomized controlled trials comparing the laparoscopic with the open approach in patients with a primary ventral hernia (epigastric, umbilical, and paraumbilical hernias) were included. The quality of included studies was evaluated according to the Cochrane risk of bias tool. A random effects meta-analysis of risk ratios was performed for hernia recurrence, local infection, wound dehiscence, and local seroma. Meta-analysis for weighted mean differences was performed for postoperative pain, duration of surgery, length of hospital stay, and time until return to work. Heterogeneity being assessed by I² statistic.

Results: A total of nine studies were included in the systematic review and meta-analysis. The overall hernia recurrence was twice less likely to occur in the laparoscopic approach (RR=0.49; 95%CI=0.27-0.89; p=0.020; I²=29%). Local infection (RR=0.32; 95%CI=0.20-0.51; p<0.001; I²=0%), wound dehiscence (RR=0.08; 95%CI=0.02-0.34; p<0.001; I²=0%) and local seroma (RR=0.43; 95%CI=0.22-0.86; p=0.020; I²=14%) were also significantly less likely to be present in patients undergoing laparoscopic surgery. Severe heterogeneity was obtained when pooling data on postoperative pain, duration of surgery, length of hospital stay, and time until return to work.

Discussion: Results should be analysed cautiously given the detected heterogeneity and the limitations of included primary studies. Nevertheless, the laparoscopic approach of the primary ventral hernia repair appeared to be associated with a lower frequency of hernia recurrence, local infection, wound dehiscence, and local seroma.

Disclosure: This systematic review and meta-analysis was not registered. The authors declared no potential conflicts of interest or financial support respecting the research, authorship, or publication of this article.

Keywords: Ventral hernia, Umbilical hernia, Paraumbilical hernia, Epigastric hernia, Laparoscopic repair, Open repair, Systematic review, Meta-analysis.

20435 | Effects of steam sterilization on the properties of stimuli-responsive polymerbased hydrogels

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Abstract

In recent decades, there has been an increase in the development of polymeric biomaterials, including hydrogels, which have been widely used in pharmaceutical preparations due to their hydrophilicity, biocompatibility, and good mechanical properties.

Hydrogels based on stimuli-responsive polymers can change their characteristics in response to small variations in environmental conditions, such as pH, temperature, and ionic strength, among others.

In the case of some routes of administration, such as ocular and parenteral, the formulations must meet specific requirements, namely sterility. Therefore, it is essential to study the effect of the sterilization method on the integrity of pharmaceutical forms based on hydrogels sensitive to external stimuli.

Thus, the main objective of this work was to study the effect of sterilization by moist heat under pressure (121°C) on the properties of hydrogels based on the following stimuli-responsive polymers: Carbopol[®] 940, Pluronic[®] F-127, and sodium alginate. The properties of the prepared hydrogels – texture properties, rheological behaviour, and sol-gel phase transition – were evaluated to compare and identify the differences between sterilized and non-sterilized hydrogels.

The results of this study showed that the Carbopol[®] 940 hydrogel was the one that suffered fewer changes in its properties after sterilization. On the other hand, sterilization was found to cause slight changes in the Pluronic[®] F-127 hydrogel, regarding gelation temperature and gelation time, as well as a considerable decrease in the viscosity of the sodium alginate hydrogel.

In summary, it is possible to conclude that sterilization by moist heat under pressure is suitable for Carbopol[®] 940 hydrogels. Contrarily, this technique does not seem adequate for sterilization of alginate hydrogels or Pluronic[®] F-127 hydrogels, as it considerably alters their properties.

Keywords: hydrogels, smart polymers, sterilization.

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20547 | Polymeric nanocomposites for biomedical applications: A focus on drug delivery and imaging analysis

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Abstract

Polymeric nanocomposites have recently become one of the most instrumental tools for biomedical applications ranging from implants to hydrogels and other drug delivery systems, besides imaging analysis. Nanocomposites consist of a polymeric matrix that can also be combined with metal nanoparticles to depict several attractive properties such as mechanical, electrical and optical properties that can also be exploited as nanophotonics. Their unique biological and mechanical properties offer them also the capacity to be tailored for a specific biomedical application, provided that they are biodegradable and do not induce any significant immune response. These nanocomposites can also be designed to exhibit three-dimensional extracellular matrices that can closely mimic the human tissues and be used in regenerative medicine, besides their well-known applications also in wound and skin healing [1-3]. Polymers can be selected from natural, semisynthetic and/or synthetic nature, to create unique microenvironments to promote cell growth and differentiation [4, 5]. In this work, we discuss the different types of polymers and their assemblies used in the production of nanocomposites for biomedical applications and imaging analyses, and provide a bibliography search to outline the state of the art on several relevant applications, namely, for drug delivery, tissue engineering, biotechnology and imaging analysis. From the search done on the Web of Science and Scopus engines, the bibliometric maps have been generated to correlate the different keywords and highlight the innovative and multidisciplinary character of polymeric nanocomposites in biomedical research.

Keywords: Polymeric nanocomposites; metal nanoparticles; Web-of-Science database; Scopus database; biomedical applications.

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References

[1] B.M. de Almeida, I.D.D. Dos Santos, F.M.A. de Carvalho, L.C. Correa, J.L.S. Cunha, C. Dariva, P. Severino, J.C. Cardoso, E.B. Souto, R.L.C. de Albuquerque-Junior, Int J Mol Sci 23 (2022).

[2] B.P. Genesi, R. de Melo Barbosa, P. Severino, A.C.D. Rodas, C.M.P. Yoshida, M.B. Mathor, P.S. Lopes, C. Viseras, E.B. Souto, C. Ferreira da Silva, Int J Pharm 634 (2023) 122648.

[3] E.B. Souto, C.M.P. Yoshida, G.R. Leonardi, A. Cano, E. Sanchez-Lopez, A. Zielinska, C. Viseras, P. Severino, C.F.D. Silva, R.M. Barbosa, Pharmaceutics 13 (2021).

[4] C.M.P. Yoshida, M.S. Pacheco, M.A. de Moraes, P.S. Lopes, P. Severino, E.B. Souto, C.F. da Silva, Polymers (Basel) 13 (2021).

[5] E.B. Souto, A.F. Ribeiro, M.I. Ferreira, M.C. Teixeira, A.A.M. Shimojo, J.L. Soriano, B.C. Naveros, A. Durazzo, M. Lucarini, S.B. Souto, A. Santini, Int J Mol Sci 21 (2020).

20642 | Variation of urinary creatinine levels in firefighter trainees during a controlled urban fire event

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Abstract

Occupational exposure as a firefighter causes bladder cancer [1]. Creatinine can be used in the diagnosis of acute kidney injury (AKI) [2]. Firefighting activities expose firefighters to dehydration, heat, and physical stress, which can contribute to the development of AKI [3]. The characterization of urinary creatinine levels in firefighters after their active participation in fire combat remains poorly characterized. The urinary creatinine levels in 12 firefighters' trainees were determined during a controlled urban fire. Overall, the urinary creatinine concentrations were higher in the day after firefighting (61.00 – 308.03 mg/dL) than pre-fire conditions (31.36 – 243.78 mg/dL). A total of 17% firefighters presented an increase of, at least, 1.5 times in the urinary creatinine levels after the firefighting activity. The urinary levels of creatinine of 8.3% of participants exceeded the recommended guidelines defined by the World Health Organization (30-300 mg/dL) [4]. The results of this study emphasize the need to explore the association between urinary creatinine and early detection of AKI in firefighters. Further studies, with a superior number of individuals and other biomarkers of early kidney damage, should be addressed.

Keywords: Kidney injury, Creatinine, Firefighters, Controlled fires.

Acknowledgments

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References

[1] Demers, PA, et al. (2022) Lancet Oncol., 23 (8), 985-986.

[2] Lousa, I, et al. (2021) Int. J. Mol.Sci., 22 (1), 43-83.

- [3] Schlader, ZJ, et al. (2019) Nutrients, 11, 9 34.
- [4] World Health Organization (1996) WHO/HPR/OCH 96.1.

20644 | Increased production levels universal sequence in non-small cell lung cancer (NSCLC) vaccines

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Abstract

mRNA vaccines present a high potential for the treatment of several diseases, including therapeutic vaccination regarding numerous cancers. However, the instability of the mRNA molecule is still a shortcoming when it comes to the application of mRNA to the vaccines technology. A short, pyrimidine-rich, noncoding sequence, capable of increasing mRNA stability and protein levels was discovered and patented by our group. iPLUS, which stands for increase Protein Levels Universal Sequence (WO/2020/076174), is a 28-nucleotide long sequence initially found in Drosophila Melanogaster's polo gene that plays an important role in mRNA 3' end formation. When subcloned downstream of a gene, this sequence is able to increase the respective protein production in zebrafish, yeast and mammalian cell lines. We hypothesize that the iPLUS technology may be applied to mRNA cancer vaccines, in particular for non-small cell lung cancer (NSCLC), whose mRNA vaccine is currently being developed by CureVac. By subcloning iPLUS downstream of the cDNA of two antigens used in CureVac's CV9202 vaccine for NSCLC, it is anticipated an increase in antigen production and in mRNA stability. These two factors are important, not only for the effectiveness of the vaccine itself, but also for the vaccine producing industry. To understand if iPLUS can actually promote an increase in mRNA stability, as well as in its protein production, iPLUS and iPLUSv2, a variant of this sequence, will be subcloned downstream of MAGEC2 and BIRC5 cDNAs and compared with the plasmids without iPLUS. To evaluate iPLUS performance, two types of studies will be performed: in vitro transcription to evaluate mRNA stability and transient transfection in ExpiCHO cell line, to evaluate the yield of protein production.

Keywords: mRNA vaccine; 3'UTR; iPLUS; Non-Small Cell Lung Cancer.

20902 | Evaluation of age-associated cellular and molecular changes on human uterine samples

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Abstract

In developed countries, the number of women delaying childbirth to their late 30s/early 40s has been increasing. Advanced age increases the risk of infertility, pregnancy complications and the need for assisted reproductive techniques. As a growing problem with a relevant socioeconomic impact, it is urgent to gather knowledge on the mechanisms underlying female reproductive ageing. In this setting, we are convinced that the occurrence of uterine senescence-related alterations is a major contributor. Indeed, it is the uterus that provides the environment for early embryonic development, implantation, placentation, and fetal development. Previous results on mice showed uterine changes associated with age, such as dilatation and increased expression of oxidative stress markers [1]. Using human uterine samples, we reported an age-related increase in albumin carbonylation [2] and have preliminary data showing alterations on uterine extracellular matrix protein composition and oxidation status from older women. This work aims at characterizing senescence-related uterine alterations during reproductive ageing. Uterine biopsies from term-pregnant women with 20 to 41 years old were used. Hematoxylin and Eosin staining and immunohistochemical detection of vimentin, a frequently used marker for uterine stroma, allowed the identification of both decidua and myometrium in all uterine samples. Sudan black B (SBB) staining is often used to identify cells containing lipofuscin aggregates. Herein, we were not able to identify SBB positive cells in the analysed sections. Uterine homogenates are being submitted to western-blotting to quantify proteins whose expression is typically altered during senescence, such as Lamin B1, p21 and phospho-Histone H2AX, among others. The complete characterization of age-associated alterations occurring in the uterus during reproductive ageing may contribute to improve pregnancy outcomes at advanced age.

Keywords: uterine senescence; reproductive ageing; female fertility.

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References

- [1] Silva E, et al. Biol Reprod, 2015, Sep;93(3):56
- [2] Mendes S, et al. Free Radic Biol Med, 2020, May;152:313

20907 | Valorization of *Fucus vesiculosus* and brewer's spent yeast biomass to produce an efficient iodine nutraceutical

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Abstract

lodine deficiency disease (IDD) affects nearly 1.9 million people worldwide, being the most prevalent cause of brain damage [1]. Although universal salt iodization is an efficient way to treat IDD, it presents chemical disadvantages, which argues the development of efficient natural iodine-food-carriers. Brown seaweeds are naturally high iodine-enriched foods, but its direct consumption can lead to hyperthyroidism, and frequently there is consumption resistance to its taste, smell, and texture. Thus, this work evaluated the potential of brewer's spent yeast (BSY) – the second major by-product of brewing process, to adsorbe the iodine of the brown seaweed specie *Fucus vesiculosus*.

The seaweed extract was prepared by Subcritical Water Extraction (90 °C, 100 bar, flow rate of 10 mL/min) and kinetic and equilibrium experiments were performed using non-living (lyophilized) BSY biomass, at pH 4, room temperature and at predefined initial concentrations of seaweed extract and mass of BSY. The quantification of iodine was made by the Sandell-Kolthoff method. The BSY, before and after iodine uptake, was characterized by the determination of the point of zero charge (pHPZC), Fourier transform infrared (FT-IR) analysis, and scanning electron microscopy with energy dispersive spectroscopy (SEM/EDS).

Results showed that the Elovich's, pseudo-first-order's, and pseudo-second-order's models were fitted to the experimental kinetic results. The equilibrium was achieved in 5 min and the kinetic constant was 0.45 \pm 0.08 gBSY/µgiodine.min. The maximum biosorption capacity of *Fucus vesiculosus* iodine extract by the BSY biomass was 26 \pm 4 µgiodine/gBSY. Overall, these findings suggest the potential of the iodine-enriched BSY as an efficient iodine-carrier nutraceutical for the treatment/prevention of IDD. The mean ingestion of 5.0 g/day of iodine-enriched BSY could satisfy between 35-60% of iodine RDA for adults and around 22-35% of iodine RDA for pregnant women.

Keywords: Iodine deficiency disease, iodine nutraceutical, brewer's spent yeast, Fucus vesiculosus

Acknowledgments

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References

[1] Rami, A., Saeid, N., El Mzibri, M. et al. Prevalence of iodine deficiency among Moroccan women of reproductive age. Arch Public Health 80, 147 (2022).

21007 | Pharmaceutical formulations based on 2D-nanomaterials for phototherapy

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Abstract

Skin cancer is one the most common forms of cancer reported around the world, with 9500 people being diagnosed with some form of skin cancer every day in the USA. Regardless of its low mortality especially in the early stages of the disease, the increasing incidence strains the resources of the various healthcare systems, increasing the cost associated with the treatments used. The therapies used today, like chemotherapy, radiotherapy, and surgery have numerous side effects, which have an active influence in decreasing the quality of life of the patient.

Phototherapy is a medical treatment that requires the incidence of light on a predetermined target surface, this technique has been used and studied for the treatment of various diseases, such as skin cancer. Photothermal therapy, a branch of phototherapy, is based on the incidence of near-infrared light or visible light on the surface on the surface of nanoparticles which can efficiently convert the irradiated light into heat, the subsequent temperature increase will lead to thermal ablation of the surrounding cells. Since cancer cells present increased sensitivity to higher temperatures, photothermal therapy shows great potential to either, directly destroy the tumor tissues, or improve the efficiency of chemotherapy and immunotherapy. Photothermal therapy has various beneficial properties, including low invasiveness and toxicity for healthy cells. The work to be presented includes the study of the production methods of new 2Dnanomaterials, their photothermal conversion capabilities, and ability to induce tumor ablation by converting the incident light into heat. Also, pharmaceutical formulations will be developed by incorporating new 2D-nanomaterials and an anti-cancer drug into a hydrogel matrix of Carbopol. The anticancer effect on skin cancer cells in presence and absence of near-infrared radiation, and the synergetic effect between phototherapy and chemotherapy, as well as the biocompatibility of the treatment will be also studied.

Keywords: Cancer; 2D-Nanomaterials; Hydrogels; Phototherapy; Drug delivery; Biocompatibility.

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21019 | Operational and Systematic Coworker Acquiring Robotics (OSCAR) in the Laboratory

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Abstract

The concept of Operational and Systematic Coworker Acquiring Robotics (OSCAR) refers to the use of robotic systems to assist human workers in various operational and systematic tasks. These are designed to work alongside human workers to perform tasks such as material handling, assembly, and quality control. The main objective is to improve productivity and efficiency by automating repetitive, dangerous tasks, while at the same time keeping human workers in the loop.

Developing this robot requires a thorough understanding of specific tasks and requirements of the laboratory, as well as the safety protocols that need to be followed. For this propose is necessary to identify the specific tasks that the robot needs to perform, such as handling samples or moving equipment; to develop a prototype that incorporates the necessary sensors, actuators, and software to perform the identified tasks and meet safety requirements; test the robot in a controlled environment; integration of the robot into the laboratory workflow, including connecting it to other equipment and systems, and providing appropriate training for laboratory personnel.

In this project it is intended to develop a robotic arm capable of performing routine laboratory tasks, being easy to build and control. Therefore, a robot arm was built using a design made in CAD, after which the different parts were obtained by 3D printing. As a control system, a MEGA 2560 associated with a RAMPS interface was used, avoiding the use of specific circuits not commercially available.

The firmware was developed using C++ intended for controlling the actuating elements and acquisition of signal from sensors. The software for routine tasks was developed using Gambas3 using Qt4, due to the simplicity of the language in the implementation of graphical interfaces with good performance.

OSCAR has the potential to improve automation and productivity in various industries as well as to contribute to the advancement and dissemination of robotics in the laboratories.

Keywords: robotics, laboratory, automatization, low-cost.

21166 | Engineering a Red-Shifted Luciferase expressing Plasmodium berghei line

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Abstract

Malaria is a vector-borne infectious disease caused by parasites of the *Plasmodium* genus. In mammals, the infection starts with the deposition of sporozoites in the skin by the bite of an infected female Anopheline mosquito. Sporozoites migrate to the liver, where they infect hepatocytes and transform into thousands of red blood cells infective forms. Deciphering the molecular mechanisms involved in the sporozoite's journey to the liver will contribute to the development of more effective immune interventions. Significant advances have been done in malaria using rodent models combined with live imaging techniques, including whole-mouse bioluminescence imaging ^[1]. In rodent malaria models, this is typically performed using transgenic parasites expressing a firefly luciferase ^[2]. However, improved sensitivity has been described in other models using a red-shifted version of this reporter (PpyRE9H) for ultrabright bioluminescence with less tissue attenuation in living subjects ^[3]. Thus, the goal of this work is to engineer a Plasmodium berghei line expressing a red-shifted firefly luciferase and evaluate whether sensitivity to detect sporozoites increases. First, we modified the available pL1720 plasmid, which allows integration of the reporter in the genome by double cross-over homologous recombination in the 230p locus^[4], replacing the firefly luciferase LucIAV ORF by the PpyRE9H. This gene's expression will be controlled by pbeef1a promoter and stabilized by the 3' region of pbdhfr/ts. The newly engineered plasmid pL1720_PpyRE9H and the pL1720 were then linearized upon enzymatic digestion. P. berghei ANKA parasites were transfected with 10 µg of each construct and the transgenic parasites are being selected by fluorescence-activated cell sorting (FACS)^[4,5], as these plasmids also encode the red fluorescent reporter mCherry^[4]. Upon selection, parasites will be cloned by limiting dilution in mice, genotyped and their infectivity will be evaluated.

Keywords: Malaria; Live imaging; Red-shifted luciferase.

Acknowledgments

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References

[1] De Niz, M., Spadin, F., Marti, M., Stein, J. V., Frenz, M., & Frischknecht, F. (2019). Toolbox for In Vivo Imaging of Host-Parasite Interactions at Multiple Scales. Trends in Parasitology, 35(3), 193–212. https://doi.org/10.1016/j.pt.2019.01.002

[2] Sá M, Costa DM, Tavares J. Imaging Infection by Vector-Borne Protozoan Parasites Using Whole-Mouse Bioluminescence. Methods Mol Biol. 2022;2524:353-367. doi: 10.1007/978-1-0716-2453-1_29. PMID: 35821487.

[3] McLatchie, A. P., Burrell-Saward, H., Myburgh, E., Lewis, M. D., Ward, T. H., Mottram, J. C., Croft, S. L., Kelly, J. M., & Taylor, M. C. (2013). Highly Sensitive In Vivo Imaging of Trypanosoma brucei Expressing "Red-Shifted" Luciferase. PLoS Neglected Tropical Diseases, 7(11), e2571. https://doi.org/10.1371/journal.pntd.0002571

[4] Prado, M., Eickel, N., De Niz, M., Heitmann, A., Agop-Nersesian, C., Wacker, R., Schmuckli-Maurer, J., Caldelari, R., Janse, C. J., Khan, S. M., May, J., Meyer, C. G., & Heussler, V. T. (2015). Long-term live imaging reveals cytosolic immune responses of host hepatocytes against Plasmodium infection and parasite escape mechanisms. Autophagy, 11(9), 1561–1579. https://doi.org/10.1080/15548627.2015.1067361

[5] Janse, C. J., Franke-Fayard, B., Mair, G. R., Ramesar, J., Thiel, C., Engelmann, S., Matuschewski, K., Gemert, G. J. van, Sauerwein, R. W., & Waters, A. P. (2006). High efficiency transfection of Plasmodium berghei facilitates novel selection procedures. Molecular and Biochemical Parasitology, 145(1), 60–70. https://doi.org/10.1016/j.molbiopara.2005.09.007

21186 | Importance of climate change manifestations and urban green areas on the potential expansion of ixodid vectors

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Abstract

Urban development combined with climate change can trigger negative effects in the ecosystems. Although the recognized environmental benefits, the implementation of urban green areas can increase the number of habitats favorable to the spread of ixodid vectors, as well as to increase its contact with humans and animals, which may constitute a public health problem. Nowadays, to increase the effectiveness of health services intervention, is necessary to create multidisciplinary teams. In this context, geography, through Geographic Information Systems (GIS), plays a crucial role. This software contributes to operate and export geographic alphanumeric information in a global, regional, or local scale.

The aim of this study was to conjecture the potential vulnerabilities of climate change and the expansion of urban green areas on the occurrence of ixodid vectors in urban environments. Besides, it is intended to demonstrate the application of GIS methodology in delimiting higher risk zones and to propose new locations for ixodid vectors surveillance.

The study area was composed by four municipalities of Porto metropolitan zone (Northern Portugal). The study was divided into three topics: characterization of local climate conditions, climate forecasts as well as green areas, surveillance data of ixodid vectors in the study area, identification of susceptible and risk areas of ixodid vectors expansion.

The expansion of vectors in urban area was confirmed, evidencing that climate change combined with urban green areas can result in an increased dissemination of ixodid vectors in urban environments, consequently, may increase the incidence of diseases transmitted by them. This study shows that GIS constitute a profitable tool for a more fruitful site demarcation of ixodid vectors monitoring, increasing the success of its capture in the free-living phase. The more active identification of risk areas will allow health services to take more effective measures.

Keywords: Climate Change; Urban Green Areas, Public Health; Ixodid Vectors; Geographic Information Systems (GIS)

21226 | Fit accuracy qualitative assessment of Co-Cr and PEEK frameworks

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Abstract

A correct fit of the framework to the supporting structures is crucial for the clinical success of a removal partial denture (RPD) providing support, stability and retention. RPD frameworks are often fabricated from cobalt chromium (Co-Cr). However, for aesthetic and biocompatibility reasons, alternative materials such as Polyether-ether-keton (PEEK) are currently being search. The objectives of the present investigation were to evaluate and compare the fit accuracy of Co-Cr and PEEK frameworks, produced by digital technologies, in Kennedy class I and III situations. In this context, two study models (Kavo^{*}, Germany) of a mandibular Kennedy class I and III modification 1 previously prepared were digitized and frameworks were digitally designed. For each study model two frameworks were produced, one in Co-Cr and other in PEEK, using an additive (Selective Laser Melting) and a subtractive (milling) technique, respectively. A qualitative assessment of the frameworks to the respective model was made on the occlusal and cingular rests, minor and major connectors, using three methods: M1) simple visual inspection; M2) clinical inspection with a Periodontal Williams probe; M3) clinical inspection with image amplification and an Endodontic Kerr file nr.50 (evaluation of the major connector) or an endodontic plugger nr.35 (evaluation of another components). Measurements were classified as absence or presence of a maladjustment according to the visualization of the space between the surfaces (M1) or the entry of the instrument into the space (M2 and M3). This evaluation showed that Co-Cr frameworks presented a better fit than PEEK on both Classes, being this difference more evident on Class III. In literature there are a few articles on this subject, but some report better fit of PEEK frameworks compared to Co-Cr, contrary to the results obtained. Although PEEK constitutes an aesthetic material that could be an alternative to Co-Cr, further studies are needed for its adequate clinical application.

Keywords: Removable Partial Denture; Framework; CAD-CAM; Digital; PEEK; Co-Cr; Fit accuracy.

References

[1] Soltanzadeh P, Suprono MS, Kattadiyil MT, Goodacre C, Gregorius W. An In Vitro Investigation of Accuracy and Fit of Conventional and CAD/CAM Removable Partial Denture Frameworks. J Prosthodont. 2019; 28(5):547-555. doi: 10.1111/jopr.12997.

[2] Harb IE, Abdel-Khalek EA, Hegazy SA. CAD/CAM Constructed Poly(etheretherketone) (PEEK) Framework of Kennedy Class I Removable Partial Denture: A Clinical Report. J Prosthodont. 2019;28(2):e595-e598. doi: 10.1111/jopr.12968.

[3] Barraclough O, Gray D, Ali Z, Nattress B. Modern partial dentures - part 1: novel manufacturing techniques. Br Dent J. 2021; 230(10):651-657. doi: 10.1038/s41415-021-3070-4.

[4] Tasaka A, Shimizu T, Kato Y, Okano H, Ida Y, Yamashita S. Accuracy of removable partial denture framework fabricated by casting with a 3D printed pattern and selective laser sintering. J Prosthodont Res. 2020; 64(2): 224-230. doi: 10.1016/j.jpor.2019.07.009.

[5] Vaicelyte, A.; Janssen, C.; Le Borgne, M.; Grosgogeat, B. Cobalt–Chromium Dental Alloys: Metal Exposures, Toxicological Risks, CMR Classification, and EU Regulatory Framework. Crystals 2020, 10, 1151. https://doi.org/10.3390/cryst10121151

[6] Ye H, Li X, Wang G, Kang J, Liu Y, Sun Y, Zhou Y. A Novel Computer-Aided Design/Computer-Assisted Manufacture Method for One-Piece Removable Partial Denture and Evaluation of Fit. Int J Prosthodont. 2018; 31(2):149–151. doi: 10.11607/ijp.5508.

[7] Arnold C, Hey J, Schweyen R, Setz JM. Accuracy of CAD-CAM-fabricated removable partial dentures. J Prosthet Dent. 2018;119(4):586-592. doi: 10.1016/j.prosdent.2017.04.017.

20754 | Development of lipid nanoparticles with nystatin for an antifungal action

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Abstract

Fungal diseases in especial, caused by *Candida albicans* have been described as a significant concern to public health. The spectrum of clinical diseases caused by this fungi species range between oral or vulvovaginal candidiasis and candidemia. The emergence of resistance mechanisms towards antifungal therapy greatly hampers successful management of illness and patient outcome. Nystatin, an antifungal drug, presenting low aqueous solubility and low intestinal permeability. Nowadays, the emerging platform of nanotechnology, notably solid lipid nanoparticles (SLN), has been subject to growing attention over recent past, owing to the promising properties of vectorization among a substantial variety of pharmaceutical drugs. Due to its hydrophobic proprieties, nystatin was encapsulated in SLN, thus aiming to understand the relationship between the use of nanosystems and the improvement of your therapeutic effect. The aim of this work was to formulate SLN with nystatin by different methods (high speed homogenization and ultrasonication) with optimization of several parameters and formulation of 2 gels (one of them containing nanoparticles).

Initially, 3 lipids were used: Compritol 888 ATO, cetyl palmitate and Precirol ATO 5 and, after the study of several parameters (size, encapsulation efficiency (EE), polymorphic behaviour of the lipids), Precirol ATO 5 was chosen as the lipid with the most satisfactory results. The results of the present work showed that the dosage of nystatin is linear, specific and presents repeatability. The average diameter of empty nanoparticles and with drug was, respectively, 306 nm and 260 nm and an EE of 67.8%. Regarding stability, SLN with drug proved to be more stable than SLN without drug. The polymer used for formulation of gels was the polymer commonly known by the trade name carbopol 940. The yield of 0.5% carbopol gel preparations and 0.5% carbopol gel + 10% Precirol-Nis NPs were 87.2% and 91.39%, respectively.

Keywords: Candida; nystatin; stability

Acknowledgments

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HUMANITIES AND SOCIAL SCIENCES



20919 | Thematic routes as an institutional science communication strategy: The GreenUPorto's case study

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Abstract

Science communication has an important role in society. In fact, a population with increased scientific literacy is one more capable of making informed decisions. Being that the majority of research facilities are financed by public funds, citizens have the right to know how their capital is spent for research purposes. In more recent times, research centers have started investing in science communication for the public. However, according to several studies, this is still not a high priority investment, both in terms of funds and human resources. As such, the present work intends to assess whether the creation of thematic routes within research centers is a costeffective alternative to the more traditional science communication activities developed at these facilities. The first step will be to implement dedicated workshops for GreenUPorto's researchers in order to gather their contributions on: what are their most relevant findings to communicate to the public, and what are the most important locations for their research. Subsequently, the different thematic routes will be conceptualized and produced. Each thematic route will be constituted by several stations widespread through GreenUPorto's and FCUP's infrastructures, including indoor and outdoor locations. Each station will act as a puzzle piece of the overall storyline. After the implementation of thematic routes, guided visits to these routes will be promoted with three sets of audiences: general public, schools, and GreenUPorto's researchers. After these guided visits, participants will be requested to fill a short questionnaire in order to assess their experience regarding their understanding of the research portrayed and enjoyment of these routes. The costs associated with this strategy will also be compared with the funding necessary for the implementation of other science communication activities in the center.

Keywords: science communication; science dissemination; co-creation.

References

 Entradas, M. (2015). Envolvimento societal pelos centros de I&D, in Maria de Lurdes Rodrigues e Manuel Heitor (org.) "40 Anos de Políticas de Ciência e de Ensino Superior", Almedina, Portugal.
Entradas, M., Bauer, M.W., O'Muircheartaigh, C., Marcinkowski, F., Okamura, A., Pellegrini, G., et al. (2020). Public communication by research institutes compared across countries and sciences: Building capacity for engagement or competing for visibility? PLoS ONE 15(7): e0235191. https://doi.org/10.1371/journal.pone.0235191
20415 | Changing or not the timbre of the stressed vowel in metaphorical plurals in EP Almeida, Andreia, Faculty of letters of the University of Porto, Portugal

Abstract

The present work focuses on the study of (non) alteration of the tone of the tonic vowel in metaphonic plurals in Contemporary European Portuguese. Despite having previously been the object of study of several scientific articles, we propose a rigorous descriptive analysis of this variation phenomenon, taking as a starting point one of William Labov's methods, the word list, in order to understand if we are witnessing, or not, a current change regarding metaphonic plurals.

Keywords: metaphonic plurals; linguistic variation; dependent and independent variable; change in progress.

References

[1] Andrade, Ernesto. d'. (1992), "Histórias de O" in Temas de Fonologia. Lisboa: Colibri

[2] Cunha, C.; Cintra, L. (2005) *Nova Gramática do Português Contemporâneo*. Lisboa: João Sá da Costa, 18.ª edição

[3] Cunha, Viviane (2000), "A questão da origem da metafonia no português" *in Script* vol. 4, nº7, pp. 37 − 43.

Disponível em <u>http://periodicos.pucminas.br/index.php/scripta/article/view/10373</u> (última visualização: 15 de dezembro de 2020)

[4] Labov, William. (2008), Padrões Sociolinguísticos. São Paulo: Parábola Editora

[5] Ribeiro, Mariana (2018), "Um singular, dois plurais" in *Revista Eletrónica de Linguística dos estudantes da Universidade do Porto*, vol. 7, nº1, pp. 10 – 28. Disponível em <u>https://ojs.letras.up.pt/index.php/elingUP/issue/view/372</u> (última visualização: 15 de dezembro de 2020)

20427 | Explicit teaching of the lexicon in pre-reading stage and textual comprehension: a didactic experience

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Abstract

This presentation details the empirical study carried out in the context of the pedagogical internship of Portuguese, at Ermesinde Secondary School, which was part of the master's degree in Portuguese Teaching in the 3rd cycle of Basic Education and in Secondary Education, concluded in 2021. The project, in the light of the methodological principles of action research, had as its object the teaching-learning process oriented to the improvement of lexical knowledge and textual comprehension of 7th grade students. The identification of this area is based on contextual knowledge obtained through direct observation of the class and records in the investigator's journal. Considering the theoretical framework related to the importance of lexical knowledge in reading comprehension and its determining role in school success, an action plan was drawn up, whose schedule included two cycles of action-research focused on the explicit teaching of the lexicon in the pre-reading stage. The data collected were mobilized for readjustments in subsequent plans, with a view to ensure meaningful learning by students and measure the impact of the intervention. The reuse of lexical items taught in pre-reading stage had positive effects on their integration into the students' mental lexicon, allowing to conclude the effectiveness of the activities and the need for further investigations that adopt this framework.

Keywords: Portuguese Teaching; lexical competence; pre-reading; textual comprehension.

21046 | "Europeaness" in the Eurovision song contest: the new standard of 'Civilization'? Ramos, Pedro M., Faculdade de Letras da Universidade do Porto, Portugal

Abstract

The European Song Contest (ESC) is a major music festival that is celebrated in Europe every year. Having been created with the purpose of uniting the continent after the Second World War, the contest quickly became the perfect stage where countries could express their culture and their belonging to Europe. With the increasing number of countries participating in the ESC after the fall of the Iron Curtain, the event took a step up regarding to whether this diversity could affect the concept of 'Europeaness'. In this paper, I draw on the ESC literature about cultural performances in the show and analyse it through the English School (ES) theory of International Relations. I argue that, in the context of the show, the concept that enables international societies to be formed and maintained - 'Civilization' - takes shape in the concept of 'Europeaness' and it is an important institution in its attempt to unite Europe. The paper contributes to the emerging literature that explains high politics through what seem to be ordinary events and shows that the ES provides an adequate framework for thinking about less 'high politics-centred' issues.

Keywords: Eurovision; Europeaness; English School; Civilization; International Relations.

21183 | Satire, information and campaign: a historical and visual analysis of Russian posters from 1917

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Abstract

It is a delicate moment to discuss Russian culture due to the conflict between Russia and Ukraine. At the same time, it is crucial to know the history of a country that has been active in international and European politics over the years. In this sense, Russian culture is relevant on the world stage. This paper analyses posters produced in 1917 in the context of Pre-Revolutionary Russia. There are few academic materials produced in Portuguese investigating these objects of study, despite the importance of this moment for the construction of Russian history and identity

Throughout the research were gathered posters produced in the period from February to October 1917 [1]. The images were collected from the Digital Museum of Contemporary History of Russia's digital archive. Despite language difficulties, Russian posters provide a vast and rich field for study. The availability of online sources at the Digital Museum of Contemporary History of Russia facilitates the research by cataloging satirical, informative, and campaign posters in its platform 'Российский политический плакат 1917 г.',. Moreover, the translation was done by consulting dictionaries and reviewed by native Russian speakers.

As for the state of art, most literature was in English. However, it is in Russian databases, such as cyberleninka, with scientific publications or the Russian State Library (Электронная библиотека РГБ) that allows one to find more detailed questions about posters.

There were selected posters that 1) enabled a deeper exploration of their message and context of production, since language and culture, in some cases, presented a difficulty for the research, and 2) those that answered the guiding question "what do posters have to say about the year of 1917?"

Keywords: political posters, Russian revolution, 1917.

References

[1] According to the Julian calendar, used at the time and has thirteen days of difference to the Gregorian calendar, in use in the West.

20617 | The importance of public green spaces for recreation and leisure in the health and well-being of children and the elderly

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Abstract

Public green spaces for recreation and leisure are of great importance for the quality of life of populations [1]. In this work, we address the accessibility conditions to gardens for the Union of Parishes of Matosinhos and Leça da Palmeira, as well as their qualities and shortcomings always bearing in mind the multiple benefits, that these spaces produce in the health and well-being of children and the elderly.

The world's population has grown very intensively over the last two centuries, especially in cities, causing green areas to decrease [2]. Green spaces, if seen as an infrastructure, can ensure benefits at various levels: social, environmental and economic [3]. However, in this work, we highlight the social functions and benefits for children and the elderly. As several studies indicate, physical and/or visual contact with green spaces are associated with better mental health conditions in the population [4]. These spaces promote physical activity and social interactions, combating the isolation of the elderly [5]. In children, some of the benefits of green areas in urban environments include stress reduction, reduction of interactive behaviours, and increased self-esteem [6].

The target population of our study corresponds to about 36% of the total population of the parish. In our territorial analysis, one of the problems that stands out in the spatial distribution of gardens is that the northernmost area of the parish has a deficit of gardens in terms of quantity and accessibility (Figure 1). In the surveys we conducted with the elderly population in the gardens of the parish, we understood that they should be improved. Based of the identification of these problems, we suggest three intervention strategies: 1- creation of four new gardens in the parish (Figure 2); 2- identifying weaknesses and threats in the gardens, we propose improvement actions, assuming one of the gardens as a "model garden" (Figure 3); 3- promotion of urban agriculture in two of the gardens.

Keywords: Green spaces; accessibility; benefits; children; elderly

References

[1] de Paula Maia, I., Almeida dos Santos, A., & de Souza Santos, R. (2020). 61.A IMPORTÂNCIA DAS ÁREAS VERDES EM ESPAÇOS URBANOS: reflexões sobre qualidade de vida e marcos legais THE IMPORTANCE OF GREEN AREAS IN URBAN SPACES: reflections on quality of life and legal frameworks.

[2] United Nations (2018). World Urbanization Prospects The 2018 Revision

[3] Madureira, H., Nunes, F., Vidal, J., Cormier, L., & Madureira, T. (2015). Urban Forestry & Urban Greening. Urban residents beliefs concerning green space benefits in four cities in France and Portugal. Urban Forestry & Urban Greening, 14(1), 56–64.

[4]Tendais, I., & Ribeiro, A. I. (2020). Urban Green Spaces and Mental Health During the Lockdown Caused By Covid-19. Finisterra, 55(115), 183–188

[5] Ali J. M., Rahaman M., Hossain I. S. (2022). Urban green spaces for elderly human health: A planning model for healthy city living. Vol. 114. pp 1-11

[6] Dockx, Y., Bijnens, E. M., Luyten, L., Peusens, M., Provost, E., Rasking, L., Sleurs, H., Hogervorst, J., Plusquin, M., Casas, L., & Nawrot, T. S. (2022). Early life exposure to residential green space impacts cognitive functioning in children aged 4 to 6 years. Environment International, 161.



Figure 1A – Population density, by statistical subsection, in the Union of Parishes of Matosinhos and Leça da Palmeira (2021)



Figure 1B – Accessibility by foot (within 10 minutes) to the public parks and gardens of the Union of Parishes of Matosinhos and Leça da Palmeira



Figure 2 – Location of proposed new gardens in the Union of Parishes of Matosinhos and Leça da Palmeira



Figure 3 – Strengths of Jardim Basílio Teles – SWOT analysis

21004 | Difficulty in accessing housing in the parish of São Mamede de Infesta and Senhora Hora

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Abstract

The low housing supply, especially for rental, is a current issue, particularly visible in metropolitan areas. The study area of this work is the parish of São Mamede de Infesta and Senhora da Hora (Matosinhos municipality), where there is a high housing pressure due to Porto proximity, good supply of services, public transport, and accessibility, combined with low supply of housing, mainly for rental.

This work presents the following objectives: (i) to analyse the supply, distribution, and characteristics of the housing market; (ii) to represent the housing market cartographically; (iii) to analyse the measures adopted and suggest possible solutions.

We consulted the PNPOT, the new generation of housing policies, the Master Plan of Matosinhos, the MatosinhosHabit and the Local Housing Strategy - "1º Direito" for the framework of the measures adopted in recent years.

Then whe collected data from the "Idealista" website (Oct 10-16, 2022) regarding the housing supply by building typology, state of conservation, average prices, prices per m2, and purpose for purchase and rental. The gathered information was organized in a database and represented by building and subsection in GIS. Finally, fieldwork was carried out to validate the results.

The average price of housing for purchase is $330,460 \in$ and for rental is $1,188 \in$, while the average salary in Portugal in 2021 was $1,326 \in$, and the minimum national wage is $760 \in$ this year. It is observed that MatosinhosHabit has been ineffective in countering the pressure in the real estate sector, leading to economic segregation and gentrification.

To combat the difficulty in accessing housing, we propose: (i) promoting the renting of vacant homes to increase supply and decrease rental prices; (ii) urban rehabilitation; (iii) strengthening MatosinhosHabit to promote renting, rehabilitation, and dissemination of national rental and financing programs and plans.

Keywords: Habitation, difficulty, União das Freguesias de São Mamede de Infesta e Senhora da Hora, solutions



Housing offer, to buy, by price in São Mamede de Infesta e Senhora da Hora

Source: Idealista, collected between 10th and 16th of October

Figura 1: Housing offer, to buy



Housing offer, to rent, by price in São Mamede de Infesta e Senhora da Hora

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Source: Idealista, collected between 10th and 16th of October

Figura 2: Housing offer, to rent

20596 | The perspective of prostitution in the 19th century in Portugal

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Abstract

Women and their history is a historiographical movement that gained strength in the 60s/70s of the 20th century. Within this thematic, the figure of the woman as a sex worker proves to be a complex and multifaceted field of study.

The projects developed within this theme focus mainly on administrative studies, in the field of guardianship and regulation or prohibition of this activity, as the sources for this are more direct and abundant. Nevertheless, we have sought a systematic study of the theme with different approaches, being social, cultural, economic, administrative, among others.

In order to observe the perspective of prostitution in the 19th century, our research must go through a historiographic analysis of the studies about women and sexuality, as essential fields to the understanding of the prostitutional world of the 19th century. In this way, we aim to understand in which way prostitution was seen, both internationally and nationally, and, if possible, to understand if the changes that occurred at a social level in the 19th century, in the domain of the public/private spheres had an influence on the female experience. In order to complement the exhibition, we will observe some essential works of this century, such as the works of Eça de Queirós, entitled "Os Maias" and "A tragédia da rua das Flores" and Fialho d'Almeida, with the works "A Ruiva" and "Três Cadáveres". By this we want to understand how individual beliefs, markedly religious, the foreign influence and the growing possibility of education of the population of the time influenced the way prostitution was seen and lived.

Keywords: Prostitution, women, morality.

References

[1] GUINOTE, Paulo; OLIVEIRA, Rosa – Prostituição, boémia e galanteria no quotidiano da cidade, In REIS, António - Portugal contemporâneo. Lisboa : Publicações Alfa, 1990. p. 339 – 382.

[2] MARTINS, Nathália Leite Rodrigues - Prostituição e marginalidade feminina na ficção de Eça de Queirós e Fialho de Almeida - Os Maias, A tragédia da rua das Flores, "A ruiva" e "Três cadáveres". Rio de Janeiro: Universidade do Estado do Rio de Janeiro (Dissertação de Mestrado), 2016

[3] WEEKS, Jeffrey – Sex, Politcs and Society: The regulation of Sexuality since 1800. Inglaterra: Routledge, 2017. ISBN 978-113-896-318-4

20599 | Alexandre Rodrigues Ferreira's scientific expedition to Brazil (1783-1792): perception and analysis of local communities

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Abstract

In the late 18th century, Portugal tried to keep up with European scientific developments. The knowledge and exploration of resources were factors that motivated the Portuguese State to promote a set of scientific expeditions to its overseas domains, including Brazil. The preparations for the trip were primarily influenced by Domenico Vandelli (1735-1816), professor of Natural History and Chemistry at the University of Coimbra, who had a close academic relationship with Alexandre Rodrigues Ferreira (1756-1815), a Brazilian student who attended the same university. Later on, Ferreira became responsible for leading the expedition to Brazil between 1783 and 1792, promoted by the Secretary of State for the Marine and Overseas Domains. For nine years, Alexandre and his team collected information on Botany, Zoology, Geography and Anthropology. It is in this last area that the interest of the present project lies. The study of local communities in Amazon, the place travelled by the expedition in question, presents itself as an observatory for understanding how these people were perceived by the figures previously mentioned concerning issues such as their physiognomy and their daily lives. Based on this analysis, carried out by crossreferencing written and iconographic documentation produced during the expedition, this project aims to contribute to the knowledge of local Amazonian communities marginalised by Portuguese historiography. Knowing these communities, and understanding how they were interpreted in the eighteenth century by people who represented the Portuguese state, is an essential piece for the History of Brazil and to understanding that History should not only be made by the vision of the coloniser before the colonised. Understanding roles and behaviours is essential to understand the colonial system of the 18th century.

Keywords: Alexandre Rodrigues Ferreira; Brazil; Scientific Expedition

References

[1] DOMINGUES, Ângela – Viagens e exploração geográfica na Amazónia em finais do século XVIII: política, ciência e aventura. Lisboa: Instituto de História de Além-Mar, 1991. (Analecta transmarina.). ISBN 972-648-052-3

[2] HORCH, Rosemarie Erika – Alexandre Rodrigues Ferreira, um cientista brasileiro do século XVIII. Revista do Instituto de Estudos Brasileiros [Em linha]. Nº30 (1989), p. 149-159 [Consult. 8 Novembro 2021]. Disponível na Internet: na Internet: utama Internet: na Internet: na Internet: na Internet:
 URL:https://www.revistas.usp.br/rieb/article/view/70489>. ISSN 2316-901X

[3] SIMON, William Joel - Scientific expeditions in the portuguese overseas territories (1783-1808) and the role of Lisbon in the intellectual-scientific community of the late eighteenth century. Lisboa: Instituto de Investigação Científica Tropical, 1983. (Centro de estudos de cartografia antiga)

20694 | The royal entry of D. Manuel I in Lisbon, in 1521, as a space for sociability and the construction of a common imaginary

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Abstract

In the modern period, ceremonial practice constituted itself as an instrument for the transmission of values, transmitted through a protocol that used a common grammar, building processes of identity among those attending and participating. With this project, we propose to study the royal entry of D. Manuel I (1469-1521) in Lisbon, in 1521, regarding his marriage with Leonor of Austria (1498-1558), as a ceremonial practice that takes on a complex artistic dimension and transmit a set of principles and values, through an imaginary of common references.

The aim of this work is to analyse the event as a space of sociability, where ephemeral art is instrumentalized by power. Through the understanding of the presence of sounds, images, smells, tastes and other sensations, we seek to understand the stimuli to the imaginary of the population, drawing the mental picture and the set of experiences that contributed to the development of a common identity.

About the methodology used, we followed the crossing of sources of information. We worked with a chronicle of the time, by Gaspar Correia (1492-1563), which describes the procession and the artistic representations, and we studied correspondence exchanged between the Câmara de Lisboa, the organizer of the event, and D. Manuel I, the commissioner. Finally, we consider the description of the city of Lisbon by João Brandão de Buarcos (c. 1450 - c. 1562), a few years away from the event, in order to understand the connection between the geographical reality of the spaces and the artistic content presented. What message was conveyed? What perception did the population have of the event, how did they live and experience it?

984

Keywords: royal entrance, ceremonial, ephemeral art.

References

[1] BUESCU, Ana Isabel – <u>Na corte dos reis de Portugal: saberes, ritos e memórias. Estudos sobre o século XVI</u>. Lisboa: Colibri, 2010. ISBN 978-989-689-023-0.

[2] MACHADO, João Nuno Sales - <u>1521: Per Ordenança de Gil Vicente</u>. In Gil Vicente 500 Anos Depois. Lisboa: INCM, 2002.ISBN: 972-27-1246-2. Vol. 1. p. 475-497.

[3] GODINHO, André Filipe Claro - <u>A invenção do triunfo: memória, saberes e sensibilidades nas</u> <u>entradas régias portuguesas (séculos XVI e XVII)</u>. Lisboa: Faculdade de Ciências Sociais e Humanas da Universidade Nova de Lisboa, 2020. 188 f. Dissertação de Mestrado em História Moderna e Contemporânea.

20751 | Malagueira as a 20th-century heritage: Reflections on the process of classification of the neighbourhood in Évora

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Abstract

Designed by the Portuguese architect Álvaro Siza, the Malagueira neighbourhood is the result of an order by the City Government in the late seventies in an attempt to supply the huge housing deficit in the locality. After decades, for still being a reference for its exceptional artistic, aesthetic, urbanistic, and memory values, its indication as cultural heritage on an international scale justified its safeguard as a national monument. When creating the global strategy for valuing world heritage, UNESCO advocated the creation of a list of material and immaterial assets that was representative, balanced, and diversified, as some countries had an imbalance in some categories. In Portugal was possible to observe this deficit in the area of 20th-century heritage, and given the typological, temporal, geographic diversity and the representativeness of the architect Álvaro Siza, a set of works, among them, Malagueira was selected to compose these gaps. As this is a top-down example in which it is clear that there is no rigid hierarchy of scales, it demonstrates that only after its worldwide indication is it possible to realize a mobilization for its preservation and protection as a national monument. If it is to be classified by UNESCO, Évora will be one of the few examples of a city that has in a small radius two centers considered world heritage, one of them being a historic center founded in 700 BC. and the other modern of the 20th century. The research aims to understand and reflect on how this process is taking place on an international and national scale from the historical context of the neighbourhood located on the outskirts of the city of Évora, bringing the questions that lead to the inscription of a property on the Tentative List of World Heritage by UNESCO, ending up demonstrating a fine example of an initiative whose purpose is to safeguard and disseminate heritage.

Keywords: Malagueira; Évora; Álvaro Siza; Nacional Monument, Modern Heritage; Architecture.

20467 | O Homem Duplicado and "Quem Porfia Mata Caça": Interartistic relations within Saramago's novel

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Abstract

O Homem Duplicado (José Saramago, 2002) tells the story of Tertuliano Máximo Afonso, who, after watching a film titled "Quem Porfia Mata Caça", discovers an individual that is identical to him. From this moment on, it is impossible to separate the narrative's course and the viewing of said cinematographic work.

Through an interartistic perspective, the main objective of this paper is to show the existing dialogues between the eminently literary diegesis and the filmic element, which only exists within the universe of the former. In order to do so, it necessarily reflects upon the reasons behind choosing such artistic form as the catalysing medium of the plot, as well as analyses the nature, construction and development of the relation between the novel and the film.

Since the (apparently) chaotic environment is one of this book's cornerstones, this proposal also explores in what ways the written narrative and the one relative to "Quem Porfia Mata Caça" intertwine, not only to question the idea of a mandatory and natural hierarchical organization of the arts- with literature being, in the traditional perception, always more valuable than cinemabut also to highlight the problematics around the theme of identity in a digitally (post-)modern world. The role of António Claro as an actor and as the character he portrays in the said film is, in the proposed work, addressed, explained and connected to the lines of thought, feeling and action of Tertuliano himself.

Finally, by detecting the existence of two different spheres of reality that cannot be dissociated without compromising the original form and content of each other and pondering on their importance in the context of O Homem Duplicado, this paper empowers the hypothesis of distinct artistic manifestations sharing common elements that work in cooperative ways to the point of bilaterally merging themselves and giving rise to a complex but vivid derived narrative.

Keywords: Literature; Cinema; Interarts.

Acknowledgments

I would like to thank Dr. David Pinho Barros, professor of Literature and Literary Studies (MELCI Master's Degree) at the Faculty of Arts and Humanities of the University of Porto for reviewing the Portuguese version of the proposed work.

References

[1] Almeida, T. F. (2018). Literatura e seus reflexos: O cinema em "O Homem Duplicado", de José Saramago. In M. C. Ribas & S. F. Amaral (Ed.), *Interconexões: mídias, saberes e linguagens* (pp. 33-47). ABRALIC. https://www.abralic.org.br/downloads/e-books/e-book13.pdf#page=34.

[2] Alves, F. C. J. (2010). *A Construção Duplicada em "O Homem Duplicado"* [Master's Thesis, University of Paulo].

https://pdfs.semanticscholar.org/c701/4db0bb3e3e46faf1267c69a971ff2fa2bd89.pdf .

[3] Beraldo, J. P. (2017). "O Homem Duplicado" e Seus Outros: intertextualidades em José Saramago e Denis Villeneuve [Master's Thesis, University of Brasília]. http://dx.doi.org/10.26512/2017.03.D.24282.

[4] Elleström, L. (2019). *Transmedial Narration- Narratives and Stories in Different Media*. Palgrave Macmillan.

[5] Hernandes, T. R. (2010). O homem duplicado: reminiscências e intertextualidades. Nau *Literária*, 5(2). <u>https://doi.org/10.22456/1981-4526.11137</u>.

[6] Nunes, E. (2019). Personagens em migração nas adaptações de literatura para o cinema: reflexões a partir de O Homem Duplicado e de Enemy. *Cadernos de Literatura Comparada*, 41(12), 237-259. <u>https://doi.org/10.21747/21832242/litcomp41a11</u>.

[7] Saramago, J. (2002). O Homem Duplicado. Caminho.

[8] Villeneuve, D. (Director). (2013). Enemy [Film]. Entertainment One.

20604 | Unravelling the unique features of Japanese travel literature through Matsuo Bashô`s haikus: A comparative perspective

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Abstract

The present work analyses the book "O Eremita Viajante [haikus - obra completa]" (2016), a collection of 1002 haikus, versed by the Portuguese writer Joaquim M. Palma, which compiled the life's work of the famous Japanese haiku poet Matsuo Bashô, who consolidated the traditional Japanese haiku form. The study focuses on two aspects of the work: the relationship between the text and the spatial movement it reflects, and the differential character of Bashô's haiku in comparison to Western travel literature from the late 19th century onwards. The book allows the reader to follow Bashô's life journey through his haikus and accompanying notes, mirroring his joy and need for travel, and homage to places visited by renowned Japanese literary figures while incorporating a dialogue between the self and the locale, employing cultural and literary references, personal experiences, and literary memory to create a reencounter with the past, which dialogues with Western travel writing from the last two centuries. However, while Western literature tends to focus on outside beauty, Japanese travel literature focuses on national beauty. Furthermore, the kikôbungaku style, typically written in poetry format (waka), differs from Western conventions and may be perceived as unconventional. The distinct aesthetics of Japanese and Western travel literature may explain why travel literature has been a legitimate genre in Japan since ancient times, while often being dismissed in the West as non-literary journalism or reportage until the 19th century [1]. Therefore, this study contributes to the understanding of travel literature as a genre and highlights the unique features of Japanese travel literature from a comparative perspective, inviting to reflect on alternative forms of travel literature beyond Western literary centrism.

Keywords: travel literature; Matsuo Bashô; haiku; comparative analysis.

References

[1] Fessler, S. (2004). Musashino in Tuscany: Japanese overseas travel literature, 1860-1912. University Of Michigan, Center For Japanese Studies.

21084 | Jane Austen and the forgotten hybrid genre: Pride and Prejudice in photonovel *Meireles, Ana, Faculdade de Letras, Portugal*

Abstract

The relationships between two or more different artistic media are one of the interests of the intermedial studies. In this area, we can talk about medial transposition, medial constellation and medial references, those being some of the models of intermedial relationships, according to the literary approach by Irina Rajewsky. Furthermore, to study these relationships, it is necessary to analyse the methodologic processes through which an object passes, including the degrees of influence attributed to the elements of a certain artistic media, like their materiality and their resistance to a new media, considering not all elements cannot be represented in its original form when going through an intermedial change. In order to explore the ways two different artistic practices dialogue, approach and depart, this study has for object the literary novel Pride and Prejudice by Jane Austen (1813), and its adaptation to a photonovel, also called Pride and Prejudice (originally Orgulho e Preconceito), published in 1965, by a Brazilian magazine. The photonovel, studied by Jan Baetens, and well-conceived as a forgotten genre that some claim being (or always been) out of season, is the result of a medial constellation – thus, in this hybrid environment characteristics of different other genres are present, among which the serial, photography, melodrama and comics. It is therefore a mixed narrative, in which plays with the non-verbal text, through photograms, and the verbal text, in the form of caption, speech bubbles and paratext.

Some of the matters that will be discussed in this study concern to the way the verbal text remains and in what way is it altered, how physical materiality preserves itself when confronted with other artistic practices, like photography, what linguistic barriers can be encountered and how these induce the literary work, what does the difference in media add to the artistic value of the object, *Pride and Prejudice*, and finally, what is the scope and demand of this transformation?

Keywords: intermedial studies, medial constellation, medial transposition, photonovel, hybrid genres, Jane Austen, *Pride and Prejudice*

References

[1] Austen, Jane. (1813). *Pride and prejudice*; ed. ut.: *Orgulho e Preconceito* (J. N. Gaspar, Trad.). Lisboa: Círculo de Leitores, 1972.

[2] Baetens, Jan. (2012). "The photo-novel, a minor medium?" *In NECSUS, European Journal of Media Studies*, no 1, pp. 54-66.

[3] Pour le roman-photo. Bruxelles: Les Impressions Nouvelles (2017).

[4] *A fotonovela: o estereótipo como surpresa*. (D. P. Barros, Trad. e Prefácio). Porto: Edições Afrontamento, Instituto de Literatura Comparada Margarida Losa (2022).

[5] Biajoli, Maria Clara Pivato. (2022). "Pride and Prejudice in Brazil 's Popular Culture: A Photonovel and a Soap Opera". *Humanities* 11, no 75.

[6] Civita, Victor (ed. e dir.). (1965). *Orgulho e Preconceito. A história de um amor inesquecível*. In *Supernovelas Capricho* 8. São Paulo: Editora Abril.

[7] Duarte, Joana Isabel Fernandes. (2018). *Se não se podem ver filmes, leiam-se as revistas. Uma abordagem da imprensa cinematográfica em Portugal (1930-1960).* [Dissertação de mestrado]. Faculdade de Letras da Universidade do Porto.

[8] Elleström, Lars. (2014). *Media Transformation: The Transfer of Media Characteristics Among Media*. Londres: Palgrave Macmillan.

[9] Forster, E. M. (1927). Aspects of the Novel. United States of America: Harcourt, Inc.

Hutcheon, Linda. (2011). Uma teoria da adaptação. (A. Cechinel Trad.). Santa Catarina: Editora UFSC

[10] Joanilho, André Luiz, & Joanilho, Mariângela Peccioli Galali. (2008). "Sombras literárias: a fotonovela e a produção cultural". In *Revista Brasileira de História*, vol 28, no56, pp. 529-548. São Paulo: Universidade Estadual Londrina.

[11] Kooistra, Lorraine Janzen. (1995). "Two texts, two hands, two looks". In *The artist as Critic: Bitextuality Fin-de-siècle Illustrated Books*, pp. 1-39. Aldershot: Scolar Press

[12] Patrucco, Anna Maria. (2018). "Orgoglio e Pregiudizio: dal romanzo alla graphic novel". *Cahiers d'études romanes* 37, pp. 133-146.

[13] Rajewsky, Irina O. (2012). "A fronteira em discussão: o status problemático das fronteiras midiáticas no debate contemporâneo sobre intermidialidade". In A. S. Vieira & T. F. N. Diniz (Org.), *Intermidialidade e Estudos Interartes: Desafios da Arte Contemporânea 2*, pp. 51-75. Belo Horizonte: Editora UFMG

[14] Sampaio, Isabel Silva. (2008). *Para uma memória da leitura: a fotonovela e seus leitores*. [Tese de doutoramento]. Universidade Estadual de Campinas, Faculdade de Educação.



Figura 3: First page of the Pride and Prejudice photonovel (emphasis on the Italian actors)



82 - SUPERNOVELAS CAPRICHO

Figura 4: Page 82 of the Pride and Prejudice photonovel (emphasis on the linguistic differences and its impact at the end of the narrative)

21120 | Women and authorship in 17th Century Portugal: D. Feliciana de Milão's "Carta de Refutação" as an important piece of the puzzle

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Abstract

The category of authorship as it pertains to female writers is, in the context of 17th century Portugal, a very problematic one. The current investigation aims to present an analysis of the content and implications of D. Feliciana de Milão's female empowering discourse in the titular "Carta de Refutação", a letter produced for self-defense in these geographical and chronological circumstances. Through a stylistic, thematic, and rhetorical analysis, I identify the letter's political motivations as well as its functioning mechanisms, which allowed Feliciana, a woman with notable social influence, to explore an extremely taboo, transgressive, incisive, and jocular criticism of male dominance in several substrata of cultural expression. Situating the obtained results in the historical and biographical context preceding the text's production, I conclude that, due to vicissitudes associated with the process of press publication, the characterization of Feliciana as an author would constitute an evident anachronism. However, moving from this analysis, I present an historical cross-reading of the category, further inquiring into the current canonical knowledge of women writers of this time, and defending a revisitation of female Portuguese writers of the 17th century, due to her impressive writing proficiency and the evident widespread circulation of her written production.

Keywords: authorship; female writers; Portugal

Acknowledgments

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References

[1] Campos, A. M. (2013). Ilíada. UNIVESP TV. São Paulo: Univesp TV

[2] Campos, F. (2022). FELICIANA MARIA DE MILÃO (1629 - 1705) NA MARCA DE POSSE O LEMA DE VIDA. Ponto de Acesso v. 16 n. 3, 2022: EDIÇÃO ESPECIAL - AS MARCAS DE PROVENIÊNCIA: TEORIA & PRÁXIS

[3] Fernandes, M. d. (1995). Espelhos, cartas e guias: casamento e espiritualidade na Península Ibérica, 1450-1700. Porto: Instituto de Cultura Portuguesa, Faculdade de Letras da Universidade do Porto

[4] Jerónimo, S. (Séc. IV). De viris illustribus

[5] Morujão, I. (2012). IMAGES DE LA FEMME-AUTEUR DANS LES PARATEXTES DES ŒUVRES NARRATIVES FEMININES PORTUGAISES À L'AGE MODERNE. VS 19, 145-167.

[6] Morujão, I. (2013). Por trás da grade:poesia conventual feminina em Portugal (sécs. XVII – XVIII). Lisboa: Imprensa Nacional: Casa da Moeda

[7] Ribeiro, M. d. (1938). Estudos de Crítica Histórica I, 1667 - 1668, A destronação de el-Rei D. Afonso VI e a anulação de seu matrimónio. Lisboa

[8] Sena-Lino, P. A. (2012). Estratégias por Correspondência: Uma leitura da obra de Feliciana de Milão. Lisboa: Universidade de Lisboa, Departamento de Literaturas Românicas

[9] Sena-Lino, P. A. (2012). Estratégias por Correspondência: Uma leitura da obra de Feliciana de Milão. Anexos. Lisboa: Faculdade de Letras, Departamento de Literaturas Românicas
[10] Vieira, P. A. (1668). Sermão Histórico Panegírico nos Anos da Raínha D. Maria Francisca de Sabóia. NEAD – NÚCLEO DE EDUCAÇÃO A DISTÂNCIA da Universidade da Amazónia

21215 | Jorge de Sena and Björk: The delimations of erotic speech in the arts Jofilsan Victor, Faculdade de Letras da Universidade do Porto, Portugal

Abstract

Jorge de Sena and Björk are artists separated by medium, space and by time. One is a Portuguese poet of the XXth Century and the other is an Icelandic singer-producer of avant-garde electronic music. But there is a thread that unites them even in their differences and that is the expression and exploration of erotic craving in the arts. Björk explores the limits of language as a pure melodic element in the speech of desire, articulating her longing through rich and detailed musical landscapes and vocal run improvisations, meanwhile Sena searches for a way to utilize language almost as a material for the construction of a visual and phonetic sculpture conveying no exact and concrete meaning, but rather a limitless number of associations between significant and signified. Sena reinvents language as a pure libidinal discourse free from conventions and delimitations of meaning through the combination of old archaisms of the classical languages and neologisms invented by himself. The want to recreate the act of voicing desire in erotic context is what was observed and perceived as their mutual point. The works of Björk that were analysed, songs from the albums Debut (1993), Vespertine (2001) and Medúlla (2004), try to recontextualize the desire of the women in society, subverting the typical image of venus as a passive woman that exists to be desired and transforming it into a boy, thus causing a resignification of gender roles in the complex net of desire. Jorge de Sena goes on the other way, utilizing language to create his famous and experimental "Quatro sonetos a Afrodite Anadiómena", in which he corrupts language to express his jubilee of entering in contact with his muse - an object that is silent and incapable of expressing her own point of view in the myriad of wants that is proper to Eros.

Keywords: Interarts; Erotism; Experimentalism; Semiotic; Poetry; Music.



PHYSICS



20612 | Production of a thermal switch with a Galinstan based ferromagnetic fluid

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Abstract

The urge for miniaturization is associated to heat dissipation issues that shift smaller-scale systems' working temperature from optimal values. At room temperature, fluidic thermal switches' design and adaptability make them a promising solution to mitigate this problem [1].

The thermal switch developed considers a magnetic fluid which combines Galinstan's heat conduction properties with Ni's ferromagnetism. This way, we can control the heat flux between a source and a sink through application of a magnetic field.

The ferromagnetic fluids fabricated used Galinstan batches produced according to the protocol reported in Ref. [2]. The mix of the Ni particles into the Galinstan liquid was made inside a glove bag with an inert Ar atmosphere. Before the mix, four purges were performed with this gas. The magnetic material was mixed in and alloyed into the liquid metal using an agate mortar and pestle until achieving homogeneity [3].

The incorporated Ni microparticles were synthesized through mechanical grinding with a steel file and posterior orbital ball milling. Through SEM visualization we determined an average particle size of 18 μ m for the resulting powder.

In the experimental setup – see Fig. 1 (a) –, the magnetic field variations are induced by the vertical periodic movement of NdFeB magnets aided by an electric motor. The device operation is automated by home-made Python and Arduino programs.

In our tests, we considered a mixture with Ni (4) wt.% and different occupation levels of a cylindrical loading with 1 cm height and diameter. For frequency values ranging from 0.01 Hz to 1 Hz we were able to achieve a maximum temperature span of 20% between heat source and sink which, combined with Fig. 1 (c), proves our device ability to lessen heat losses from the source.

Our next steps are to experimentally measure the mixture's specific heat and the ON and OFF states thermal conductivities, whilst simulating the setup's heat transfers, using COMSOL Multiphysics software.

Keywords: heat management; ferromagnetism; Galinstan.

References

[1] Joel B. Puga, et al. Novel thermal switch based on magnetic nanofluids with remote activation. Nano Energy, 31:278_285, jan 2017.

[2] Filipa Furriel (2021). Magnetocaloric Ferrofluids. Faculdade de Ciências da Universidade do Porto, Porto, Portugal.

[3] Isabela A. de Castro, et al. A gallium-based magnetocaloric liquid metal ferrofluid. Nano Letters, 17(12):7831_7838, nov 2017.



Figure 1: (a) Thermal switch setup considered [1]. (b) Fluid shape in operating states. (c) Exemplification of the temperature difference between heat source and sink during the switch actuation for the case of a 65 % loading and a 0.05 Hz frequency.

20791 | Flexible topological insulator in Sb2Te3

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Abstract

Understanding these novel materials, known as topological insulators, which are both metals and insulators at the same time, was one of quantum mechanics' greatest achievements in the 20th century. Despite its relatively short history, the area has already achieved progress in both theoretical comprehension and experimental realization. Topological insulators (TI) are quantum materials that have an electrically conductive surface and an insulative core as a result of their distinct electronic band structure, which has a band gap in the center and a gapless energy dispersion at the edge. Time-reversal symmetry prevents the surface states from being scattered or backscattered by impurities or structural flaws in the material. [1] TIs offer qualities that permit high efficiency, since no energy is lost as heat, and have lower power consumption than current technologies, which bodes well for the creation of new electrical and spintronic devices. The main issue is to create a flexible topological insulator (FTI) with improved topological protection while preserving mechanical flexibility, providing innovative devices a new trait. The optimization of Sb2Te3 thin films on a Kapton substrate will be described and thoroughly explored in the current work. Using DC magnetron sputtering, this material will be produced under several crucial deposition parameters, such as gas flux, current deposition, and thickness. [2]

Keywords: Condensed Matter; Topological Insulators; Sb2Te3; DC Sputtering; Flexible Devices.

References

[1] "Topological insulators in Bi2Se3, Bi2Te3 and Sb2Te3 with a single Dirac cone on the surface", Haijun Zhang et al., *Nature Phys* 5, 438–442 (2009).

[2] "Electronic Conduction Channels Engineered in Topological Insulator Sputtered Thin Films", Sofia Ferreira Teixeira et al., ACS Applied Electronic Materials 4(12), 2022.

20819 | Optimizing thermal expansion in 3D-printed cements

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Abstract

The number of reports detailing negative thermal expansion (NTE) materials, which exhibit a contraction in response to heat and an expansion when cooled, has substantially risen over the past few years. These materials play a crucial role in the production of composites with zero thermal expansion (ZTE) when combined with the conventional positive thermal expansion (PTE) materials that have the opposite effect, and find practical application in various fields, including space telescopes, micro-electronic components, and dental fillings [1]. Moreover, NTE materials could potentially benefit the construction sector by optimizing the thermal expansion of mortars to minimize micro-fissures and cracks induced by natural cooling and heating cycles. As the development and optimization of ZTE composites for construction purposes is in a preliminary state, this work aims to fill the gap in the literature, while also improving the thermal behaviour of 3D printed structures [2].

Amongst the materials that exhibit isotropic NTE behaviour, this work has been focused on La-Fe-Si based materials. Tailoring their thermal expansion by tunning their particle size and strain via ball milling, as well as changing their chemical composition allows them to be used in roomtemperature ZTE applications [3]. Complementary and considering lower-cost solutions, studies were also made with materials with low PTE, such as silica powder. All their properties were characterized using various methods, including Scanning Electron Microscopy (SEM), Energy Dispersive Spectroscopy (EDS), X-ray Diffraction (XRD), and SQUID magnetometry.

To optimize the ZTE of the composite, analytical and numerical [4] models were used to determine the optimal concentration and particle size of the compensator in the final composite, as well as the effects of its distribution in the composite's matrix.

Finally, the mechanical properties and thermal expansion of the final composites will be studied.

Keywords: negative thermal expansion; zero thermal expansion; composites; thermal expansion compensator.

References

[1] Takenaka, K. (2012). Negative thermal expansion materials: technological key for control of thermal expansion. Science and technology of advanced materials.

[2] Pessoa, S., et al., 3D printing in the construction industry-A systematic review of the thermal performance in buildings. Renewable and Sustainable Energy Reviews, 2021. 141: p. 110794.

[3] Fleming, R. O., Gonçalves, S., Davarpanah, A., Radulov, I., Pfeuffer, L., Beckmann, B., ... & Belo,
 J. H. (2022). Tailoring Negative Thermal Expansion via Tunable Induced Strain in La–Fe–Si-Based
 Multifunctional Material. ACS Applied Materials & Interfaces, 14(38), 43498-43507.

[4] Karch, C. (2014). Micromechanical analysis of thermal expansion coefficients. Modeling and Numerical Simulation of Material Science, 2014.

20913 | Physical nonlinear system for neuromorphic computing

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Abstract

As technology continues to advance, the need for faster and more efficient computational hardware becomes increasingly pressing. Yet, the physical constraints of nano-electronics place a restriction on conventional Von Neumann-based approaches to computing. To overcome these limitations and achieve higher levels of performance, a new paradigm in computing is emerging in the form of neuromorphic computing. In short, neuromorphic computing inspires on the structure and function of the human brain to create machines that can learn, adapt, and make decisions in ways that are similar to biological neurons. Still the degree of parameter optimization involved in typical neural networks is nor versatile for general purpose compute. In this context, Extreme Learning Machines (ELMs) stand out as a promising architecture that aim to ease this requirement. An ELM is a single-layer feedforward neural network that utilizes a non-linear mapping of input data into a high-dimensional feature space, where the training is performed. Bypassing the need of tuning weights at the intermediate layers simplifies the training and deployment procedure, making the architecture appealing. In this work we will explore the application of this paradigm to deploy an ELM using a nonlinear oscillator chain described by the Toda Lattice Equation. We start by showcasing the system capacity to carry out classification and regression operations on datasets with nonlinear separability. The performance of the neural network is then examined in relation to the chaoticity of the system. 1001

Keywords: extreme learning machines, neural network, toda lattice, chaotic, neuromorphic computing

21048 | The magnetocaloric effect studies on the NiMnGa/PDMS composite

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Abstract

Optimization of multi-phase materials under varied conditions can enhance their properties aiming for modern applications, addressing major global challenges [1]. One may reduce the particle size and improve the area surface contact for heat transfer purposes or mix it with polymeric matrices to reduce oxidation and expand possible applications [2]. Considering the last approach, homogeneity on particle size distribution in polymer-based composites is desirable for "applications" [3]. Heusler alloys have a wide range of multifunctional properties, including magnetocaloric and magneto-optical [4].

We have introduced Ni2MnGa Heusler compound powder obtained through ball milling with ~30 μ m of average particle size into Polydimethylsiloxane (PDMS) using the solvent-casting technique [1]. A single composite of 30 wt.% of Ni2MnGa was produced (15 mm of diameter), where the 8 hours of curation at 80°C lead to a nonuniform distribution of the powder along the height. To evaluate the properties of the composite, we have cut the sample into 3 equal pieces (2 cm in height). From both magnetization saturation (Msat) and magnetic entropy change (Δ S) evaluation (Figure 1), we have obtained that around 3 wt.% of powder was retained at the top of the composite, 6 wt.% in the middle, and 18 wt.% at the bottom. Considering the 20% error from the magnetization measurements, the weight fraction distribution is in good agreement with the calculated for the sample preparation.

Furthermore, although the maximum on the MCE for Ni2MnGa at the microscale is found to occur above 350 K [5], the agreement between Msat and Δ S can be used to infer inhomogeneity in composites produced through the solvent casting technique. Further investigations should be performed to develop a model to predict the particle distribution during the matrix curation process and to optimize and improve the polymer-based composites preparation process towards homogeneity, desirable for the practical use of multi-phase systems.

Keywords: magnetocaloric effect; magnetocaloric materials; magnetic properties.

Acknowledgments

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References

[1] V. M. Andrade, N. B. Barroca and A. L. Pires., Materials & Design. 186, 108354 (2020).

[2] J. Y. Law and V. Franco., Encyclopedia of Materials: Composites. 2, 461-472 (2021).

[3] W. Imamura, A. A. Coelho and V. L. Kupfer., Journal of Magnetism and Magnetic Materials. 425, 65-71 (2017).

[4] T. Graf, C. Felser and S. S. Parkin., Progress in Solid State Chemistry. 39, 1-50 (2011).

[5] M. Qian, X. Zhang and L.Wei., Sci Rep. 8, 16574 (2018).



21111 | Optical gas sensors based on porous materials

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Abstract

Monitoring gases in a given environment is increasingly important not only to assess its toxicity levels, but also to control the presence of impurities, contaminants or leak detection in pipes or storage facilities. With most gases are odourless and are undetected by the human senses, the need for sensor systems able to monitor its levels in the atmosphere, capable of protecting human health and safety and preventing explosions and other catastrophic events is increasing. Metal-Organic Frameworks (MOFs) which exhibit high porosity, high degree of crystallinity and exceptional chemical activity combined with Optical Fiber Sensors (OFS) allow the measurement of concentrations of gases. The porosity of the MOFs allows the capture of specific molecules, originating changes in optical properties, either through emission of fluorescence or displacement of the absorption band.

A preliminary experimental investigation is presented on the detection of different gases using special optical fiber configurations, based either on plasmonic effects or in waveguide coupling between the fundamental mode and higher order cladding modes, and coated with the developed MOFs dissolved in PVA, Hidrogel and cellulose.

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21203 | Optical pH sensors based on self-assembled nanofilm coated long-period fiber gratings

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Abstract

Long-period Fibre Gratings (LPFGs) are periodic perturbations of the refractive index (RI) of an optical fibre core along its propagation axis with periods of hundreds of micrometres and a length 30 mm which can be fabricated through the induced electric-arc technique. This type of perturbation promotes the coupling between the guided modes and the higher order cladding modes of specific wavelengths, which strongly depends on the modulation period and on the RI of the cladding mode. Changes in these properties result in a spectral shift of the resonant band, enabling sensing applications. Since the latter depends on the RI of the external medium, coating the LPFG section with a material whose RI changes with a parameter to be detected (such as pH) can result in a highly sensitive optical sensor.

Multiple materials, mostly polymers and hydrogels, have a pH-induced change in the RI due to swelling and deswelling phenomena, and a few of them were already implemented in optical sensors [1]. In this work LPFGs coated with some of these materials, such as chitosan and polyacrylic acid [2], are studied and presented, using a Layer-by-Layer (LbL) Self-Assembly technique, which consists in depositing alternating layers of materials with opposing electrical charge by immersing the fibre in prepared solutions.

An experimental set-up allowed the real-time monitoring of several LPFGs simultaneously during the deposition process, confirming and comparing the number of fabricated bilayers. It was possible to observe the spectral response as a function of the pH of the surrounding liquid solution, laying the groundwork for the future implementation of LBL deposited coatings for pH detection not only using LPFGs, but also in other structures such as surface plasmon resonance-based devices.

Keywords: optical fiber sensor; long-period fiber gratings; pH sensing; layer-by-layer self-assembly

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References

[1] Andreas Steinegger, Otto S. Wolfbeis, and Sergey M. Borisov, "Optical Sensing and Imaging of pH Values: Spectroscopies, Materials, and Applications", in Chemical Reviews 2020 120 (22), 12357-12489

[2] L. Li and Y. -N. Zhang, "Fiber-Optic SPR pH Sensor Based on MMF–NCF–MMF Structure and Self-Assembled Nanofilm," in IEEE Transactions on Instrumentation and Measurement, vol. 70, pp. 1-9, 2021, Art no. 9502509

21207 | Sputter deposition of thin films of gold and titanium dioxide for sensing: Fabrication and characterization

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Abstract

Fibre optic technology has been positioning itself at the forefront in an extremely important situation in several areas beyond communication, namely in sensing due to its many well-known advantages. An optical fibre sensor is presented based on surface plasmon resonance (SPR) excitation in a conventional single mode fibre at the infrared wavelength aiming external refractive index monitoring with high sensitivity. The sensing element has been fabricated by unilaterally removing a section of the fibre cladding to expose the core, through a polishing method, followed by deposition of thin layers of gold (a highly reflecting metal) and titanium dioxide (a dielectric with high refractive index which allows tunning of the SPR excitation to the infrared – the main goal of this study) onto the fibre core using sputtering technology.

The thickness of each layer was previously calculated using a simulation software based on the matrix transfer technique, which was developed at INESC TEC to work with a wide range of materials and different configurations.

A broadband white-light source is used to introduce a wide range of wavelengths into the fibre core and the transmitted signal is collected with an optical spectrum analyser.

Changes in the refractive index external to the sensing structure result in a wavelength shift of the corresponding attenuation band with high sensitivity. Experimental results of sensitivity and dynamic range in the measurement of refractive indexes of aqueous solutions are compared with the theoretical model of the sensor and with planar substrates manufactured for this purpose and characterized with the prism coupling technique.

Keywords: Optical fibre; Surface plasmon resonance; Refractive index sensor; Sputtering technology; Thin films.

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21245 | Water-Evaporation-Induced Generator with bio-waste activated carbon

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Abstract

In the last decade, resource scarcity and environmental issues have threatened our planet. Finding alternatives for resource management and energy production is essential. Energy is a major necessity for economic growth and human comfort. However, fossil fuels still represent around 84% of total energy production, which is damaging to the environment. Therefore, alternative sustainable energy sources are essential. Water is the largest energy carrier on Earth, covering 71% of the planet and consuming around 35% of total solar energy [1]. Water-Evaporation-Induced Generators (WEIGs) generate electricity from materials interacting with water [2], using mechanisms like streaming, waving, drawing potentials, and evaporation-induced electricity. This technology can collect energy from flowing, dropping, condensing, and evaporating water. In fact, 1% efficiency with 1% of absorbed water energy could provide nearly 1/3 of global energy consumption [3].

In 2017 it was firstly reported that water evaporating through a carbon black film is able to produce a sustainable potential difference of over 1V and electrical current up to 100 nA [4]. Since then WEIGs have increasingly driven attention to a deeper understanding of the electrode materials and processes. This technology has the potential to be part of our daily energy consumption, making its research and development essential for a sustainable future. In this work a carbon porous membrane, prepared from a low carbon footprint bio-waste, is examined, in terms of energy generation, for different materials and experimental conditions. The obtained results are promising and open the way for a sustainable WEIG to eventually harvest ocean Blue energy.

Keywords: Energy harvesting; Bio Activated Carbon; Water evaporation.

References

- [1] Zhang et al, Nature Nanotech 13, 1109–1119 (2018)
- [2] Stephens et al, Nature Geosci 5, 691-696 (2012)
- [3] Yin et al, Joule 4, 1852–1855 (2020)
- [4] Xue et al, Nature Nanotech 12, 317–321 (2017)
21253 | Electric transport properties of MXene composite films

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Abstract

MXenes, a transition metal carbide and nitrides with 2D graphene-like structure, have been extensively researched since they were synthesized in 2011¹ owing to their physical and chemical properties. The variety of compositions, structures, functionalized surfaces and a unique combination of electrical, optical², thermal and mechanical properties have led to many applications in fields like energy storage, biomedical, electromagnetic shielding, sensing and others.

Polymer materials are widely used in our daily life. However, the performance of single polymers do not meet the performance require in several applications. MXene-based fillers in polymer matrices can enrich the properties of MXenes to achieve multi-functional hybrid materials, avoiding the aggregation of MXene nanosheets and obtain high-performance composites³.

Mxenes embedded in polymer matrices have very complex electric transport mechanisms. In this work, we are investigating $Ti_3C_2T_x$ and $Ti_2C_1T_x$ MXene composites to better understand the electron–ion conduction channels and the interaction sites in MXene-polymer composites to improve their performances.

Keywords: MXenes; composite.

References

- [1] M. Naguib et. al, Adv. Mater., 2011, 23, 4248.
- [2] Yury Gogotsi et. Al, Adv. Mater. 2018, 30, 1804779.
- [3] Kaili Gong et. al, *Composites Part B*, 2021, 217, 108867.

21266 | Fabrication and characterization of sputter thin films of silver and titanium dioxide for sensing

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Abstract

Optical fibres are a technology that have revolutionized communications by being an excellent method for transmitting information in long distances. Even so, new developments have started to position optical fibre technology in a great option for sensing applications, due to its range of advantages and great sensitivity.

In this work, an optical fibre sensor is presented, based on surface plasmon resonance (SPR) excitation. For the manifestation of this effect a sensing element was fabricated using a single mode fibre. Through polishing, the fibre cladding was removed in a "D" geometry, exposing the core. Then, using sputter coating, a thin layer of silver and a dielectric with high refractive index, titanium dioxide, which protects the silver from oxidation, were deposited. This metal/dielectric structure allows SPE excitation in the near infrared (NIR).

To get an insight of the band's properties in the NIR, a simulation study was previously accomplished using a software based on the matrix transfer technique (MTT), with the goal of optimizing the layer's thicknesses. The MTT implementation developed at INESC TEC allows a wide range of materials and different configurations.

To examine the SPR excitation, the sensing element is exposed to a broadband light source, and the transmitted signal is observed with an Optical Spectrum Analyser. The changes in the external refractive index results in a wavelength shift of the corresponding SPR band with high sensitivity. The sensitivity and dynamic range of refractive index measurements of aqueous solutions were assessed through an experimental study, where the findings were matched against the theoretical model of the sensor and planar substrates, characterized with the prism coupling technique, that were manufactured for this purpose.

Keywords: Plasmonics; Optical fibres; Refractive index sensor; Sputtering deposition; Thin films; Surface plasmon resonance.

Acknowledgments

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21269 | Improving ionic conductivity of NASICON solid electrolyte with PVA-based polymers

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Abstract

As the world faces an unprecedented energy crisis, the need for reliable, sustainable, and safe energy storage solutions has never been more urgent. Typically, these devices employ conventional liquid electrolytes that possess inherent safety and long-term stability concerns. Solid-state electrolytes have emerged as promising alternatives, as they overcome these safety concerns while exhibiting high energy density and stability. Sodium-ion solid-state electrolytes are especially attractive for their abundance, low cost, and sustainability ¹. The main challenges currently hindering widespread use of Na-ion solid-state batteries and supercapacitors are low ionic conductivity and high interfacial resistance between the electrodes and the solid electrolyte ². PVA-based electrolytes exhibit superior capacity for charge carrier storage, excellent dielectric permittivity and ionic conductivity, as well as ideal mechanical properties, making them an environmentally friendly and biodegradable solution to these challenges ³.

In this work, Polyvinyl alcohol (PVA)-based polymers are used to enhance the performance of the sodium (Na) super ionic conductor NASICON (Na₃Zr₂Si₂PO₁₂) solid electrolyte, by reducing the interfacial resistance and increasing the overall ionic conductivity of the cell. Several symmetric

cells were manufactured using both powder and pellet forms of NASICON, with different PVA-

based polymer types and concentrations. Electrochemical impedance spectroscopy (EIS) was used to analyse the internal resistance of the cells under different temperature and pressure conditions.

Our results demonstrate that the use of PVA-based polymers significantly reduces the interfacial resistance of NASICON, both in powder and pellet form. These results provide insight into the use of PVA-based polymers in the development of high-performance Na-ion solid-state batteries and supercapacitors.

Keywords: Solid-state Batteries; Na-ion; supercapacitors; PVA; polymer electrolyte; ionic conductivity; interfacial resistance; EIS

References

[1] Qiangqiang Zhang et. al, Modification of NASICON electrolyte and its application in real Na-ion cells, Engineering, Volume 8, 101016, 2022

[2] Lixiao Zhang et. Al, NASICONs-type solid-state electrolytes: The history, physicochemical properties, and challenges; interdisciplinary materials, 101002, 2022

[3] Jacky Ing Wong et. Al, Development of poly(vinyl alcohol) (PVA)-based sodium ion conductors for electric double-layer capacitors application, Materials Science and Engineering B 263, 114804, 2021



PSYCHOLOGY



20439 | Zoom Fatigue: visual image self-perception and other aspects of video calls

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Abstract

Due to the COVID-19 pandemic and related lockdowns, videoconferencing software became widespread in work and educational settings. However, a new phenomenon of increased fatigue associated with the use of videoconferencing software started to be discussed. In 2022, Riedl compiled several definitions and defined Zoom Fatigue "as a somatic and cognitive exhaustion that is caused by the intensive and/or inappropriate use of videoconferencing tools, frequently accompanied by related symptoms such as tired-ness, worry, anxiety, burnout, discomfort, and stress, as well as other bodily symptoms such as headaches" [1].

Our main objective was to study if body, self-image, and other factors influence people's attitudes towards videoconferencing and if they experience fatigue during videoconferences. A 37-question questionnaire was developed by compiling opinions and evidence about stress-inducing factors in videoconferences. The questionnaire was divided into five sections: sociodemographic characteristics (questions (Q) 1–5); use of videoconferences (Q 6–8), use of camera, self-view, and appearance aspects (Q 9–20), other aspects of videoconference (Q 21–30), teamwork (Q 31–33), overall videoconference satisfaction and fatigue (Q 34-37). Quantitative statistical methods were used to analyse the questionnaire responses.

Most respondents (60.3%) agreed that video calls are more tiring and demanding than face-toface conversations. The feeling that one's appearance degrades in videoconferences is associated with Zoom Fatigue (68.5% vs 50.6%, p < 0.001). Notwithstanding, there was no link between the usage of video in a videoconference and the feeling of having a worse appearance or a higher feeling of fatigue (63.3% vs 72.8%, p = 0.06). Believing that one's appearance worsens in videoconferences leads to a higher rate of body image self-care (22.9% - vs 12.7%, p < 0.001) and an increased wish to have cosmetic surgeries, especially within the female gender (9.5% in the female gender vs 4.1% in the male gender, p = 0.003). Participants who believe that their appearance worsens in videoconferences tend to think that the images of their peers differ in videoconferencing (56.0% vs 38.6%, p < 0.001).

Our study entails that the so-called Zoom Fatigue is a real phenomenon and alerts for the potential body image issues that videoconferencing may cause.

Keywords: Zoom Fatigue, Video call, Videoconference, Fatigue, Videoconference Fatigue

Acknowledgments

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References

[1] Riedl, R., On the stress potential of videoconferencing: definition and root causes of Zoom fatigue. Electronic Markets, 2022. 32(1): p. 153-177.

[2] Bennett, A., et al., Videoconference fatigue? Exploring changes in fatigue after videoconference meetings during COVID-19. Journal of Applied Psychology, 2021. 106: p. 330-344.

20772 | On the birth of a mother in a migratory context: Brazilian experiences

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Abstract

Initiation into motherhood is a unique process for each woman, but equally challenging due to the adaptations inherent to the new scenario experienced. Social support, which performs essential functions in the care of the baby to support the mother, can be a facilitating element in the face of these women adapting to new roles and attitudes towards motherhood.

Thus, to understand the psychological implications of social support in the transition to motherhood in a migratory context, the thesis project aims to develop a qualitative study of Brazilian women residing in Portugal, migrants, and who became mothers of the first child, including the impact generated by migration in the context of becoming a mother. The literature describes this period as the second adolescence due to the biopsychosocial effects. Therefore, this transition is even harder for those women due to the lack of social support from separation from family, friends, and culture.

In conclusion, the present study mentioned aims to understand the impacts of the transition to motherhood on Brazilian migrant women in Portugal, applying a questionnaire and, subsequently, conducting a semi-structured interview to allow free speech and a better understanding of important points to be considered about the experiences of these women. Furthermore, the discussions will be conducted online, in the most comfortable context for the interviewee, allowing for more significant space for speech.

Keywords: Motherhood; Social Support; psychological Impacts; Brazil; Migration.

21134 | Online narrative group intervention with caregivers of people with hereditary ataxia: evaluation of participants' experience and impact on family functioning

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Abstract

People living with hereditary ataxias (HA) commonly need help from an informal caregiver due to the disease's neurodegenerative and severely incapacitating symptoms. Informal caregiving is psychologically challenging, yet specific support interventions are still scarce. The Portuguese HA Association approached the CGPP stating a need for a support intervention for caregivers. A narrative-based group intervention (Tree of Life exercise) was adapted and remotely (3 online sessions) delivered with caregivers, facilitated by a clinical psychologist and a genetic counsellour. This study aimed to explore the caregivers' experience (5 women, age 40-54y) with the intervention and its impact on their family functioning. The Portuguese version of the Systemic Clinical Outcome and Routine Evaluation (SCORE-15) was used at baseline (T1), post-intervention (T2), and follow-up (T3) to evaluate family functioning in the domains family strengths, family communication and family difficulties. An opinion form and individual semi-structured interviews with the participants were used to explore experience with the intervention. Data were analysed thematically (interviews) and through descriptive statistics (SCORE-15 scores' differences). Preliminary results show the participants' satisfaction with the narrative exercise. The group format and the role of the facilitators were highly valued in fostering personal narratives and social embeddedness. Was reported a positive impact of the intervention on well-being, through the sharing of experiences, and an improved sense of self-care. The scarcity of support interventions was clearly highlighted. With the SCORE-15 results was observed an improvement in family functioning in relation to family strengths and family communication, while family difficulties oscillated and aggravated. This intervention could provide follow-up support in genetic counselling protocols, and may potentially be adapted to support caregivers of people with other serious inherited conditions.

Keywords: Hereditary Ataxias; Informal Caregivers; Narrative Intervention; Family functioning.

L015

21225 | Transition to a leadership position: Phases, challenges and its impact on wellbeing

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Abstract

The transitioning process to a leadership position is a challenging process, in part due to the specificities of the new role and in part due to the importance of these transitions in adult life, resulting in an impact on the leader's well-being. This study intends to explore this transition, its impact on the leader's well-being, and understand how leaders experience a challenging stage in their life, to identify how to support them through it. This study will opt for a qualitative methodology, through the application of a semi-structured interview and CIT (Critical Incident Technique) for data collection and the content analysis as a data analysis method.

Keywords: Transitioning process to a leadership, Challenges of leadership positions, Well-being

Acknowledgments

I would like to thank my professor Dr. Catarina do Vale Brandão for all help and guidance in the writing and development of this investigation. I would also like to thank my friends and family for the support during the ups and downs of this process.

21271 | The use of social networking sites and non-suicidal self-injury among children and adolescents: A systematic review

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Abstract

Non-suicidal self-injury (NSSI) consists of the deliberate, self-inflicted destruction of body tissue without suicidal intent and is a major public health problem in adolescents. Over the past few decades, an increase in the prevalence of NSSI has been noted and NSSI behaviours appear to be developing at younger ages. Simultaneously, the use of Social Networking Sites (SNS) has steadily increased over recent years. Youths are the most frequent users of SNS, spending a significant part of their day connected to SNS. SNS are also being increasingly used earlier by children. The coincident rise in the widespread use of SNS and NSSI has led researchers to consider a possible link between these two aspects. However, this phenomenon is still not fully understood. A systematic review was conducted with the purpose of clarifying the link between SNS and NSSI behaviours among young populations, specifically focusing on the effect of SNS exposure on NSSI behaviours. Searches in the electronic databases PsycINFO, PubMed, and Web of Science were performed using search terms related to the variables of interest (social networks, non-suicidal self-injury, and children/adolescents). The database search produced an initial number of 626 records. The study selection process resulted in a total of six studies eligible for inclusion in the review. In studies dealing with samples of children and adolescents from psychiatric contexts, significant associations were found between SNS exposure and increased risk of NSSI, whereas in studies dealing with community contexts, the association was non-significant for all studies except for one. Because the studies all followed a cross-sectional design, it was not possible to establish whether SNS exposure resulted in NSSI or whether NSSI resulted in SNS. Future longitudinal studies and research using qualitative methodology can contribute to a better understanding of the role of SNS exposure and NSSI.

Keywords: Non-suicidal self-injury; NSSI; Social Networking Sites; Children; Adolescents; Contagion.

20473 | Why do you think their family is poor? Exploring the causal attributions of poverty in middle childhood

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Abstract

This study explored upper elementary school children's perspectives on the causes of poverty. Participants were 248 fourth grade children (51% female, M age = 9.52, SD = 0.43) from Porto District. Children participated in an individual interview with a stimulus situation describing a child and family living in poverty, based on previous research [1], and an open-ended question: "Why do you think Pedro/Jessica's family is poor?". Each interview was recorded and subject to verbatim transcription. Answers were analysed following thematic analysis [2] in an iterative process with categories emerging from the data and informed by previous research [1,3]. Three independent researchers double coded 20% of the interviews with a master coder (k = .85 for 31 interviews; k = .81 for 10 interviews; k = .82 for 10 interviews).

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Children attributed poverty to four types of causes: naïf/fatalistic (mentioned by 19% of children); individualistic (58%); contextual (41%); and unspecific (59%). Naïf/fatalistic causes involved attributing it to chance or unreasonable events (e.g., "some people were born without luck"). Individualistic causes included causes related to poor money management, not working enough, or lacking effort and abilities (e.g., "they spent a lot of money"; "they didn't get a job because maybe they don't want one"). Contextual causes involved interpersonal factors such as lack of social support from family/friends, lack or restricted access and conditions to work (e.g., discrimination, low-paid jobs), or country-level conditions (e.g., "they don't want poor people in jobs"; "they may live in a country where there is not so much work"). Unspecific causes included general aspects that cannot be attributed to individual or contextual causes, without further explanation (e.g., "they lost their job").

These results allow to further understand the causal attributions of poverty in middle childhood among Portuguese children, shedding light on this developmental phase.

Keywords: causal attribution; middle childhood; poverty.

Acknowledgments

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References

[1] Mistry, R. S., Nenadal, L., Griffin, K. M., Zimmerman, F. J., Cochran, H. A., Thomas, C. A., & Wilson, C. (2016). Children's reasoning about poverty, economic mobility, and helping behaviour: Results of a curriculum intervention in the early school years. *Journal of Social Issues, 72*(4), 760-788. <u>https://doi.org/10.1111/josi.12193</u>

[2] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101. <u>https://doi.org/10.1191/1478088706qp063oa</u>

[3] Flanagan, C. A., Kim, T., Pykett, A., Finlay, A., Gallay, E. E., & Pancer, M. (2014). Adolescents' theories about economic inequality: Why are some people poor while others are rich? *Developmental Psychology*, *50*(11), 2512. <u>https://doi.org/10.1037/a0037934</u>



SPORT SCIENCES



20792 | Exploring young athletes' perceptions about their talent development environment: The relative importance of contextual factors

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Abstract

Understanding the talent development environment is crucial for improving the learning process of young athletes and enhancing effective talent development. Athletes' perspectives on talent factors are important for developing effective talent identification and development strategies. The objective of this study was to investigate the perceptions of team sport players regarding their talent development environment and compare differences across age groups (10-12, 13-14, and +15) and sport types (basketball, football, handball, volleyball, and water polo). A total of 721 Portuguese players (10-16y) completed the Talent Development Environment Questionnaire. The results revealed significant positive intercorrelations among most factors, except for quality preparation and long-term development fundamentals, which had a negative correlation, and quality of life and communication, which were uncorrelated. Additionally, older players (+15) perceived that their sport and social context placed greater emphasis on their long-term development focus and long-term development fundamentals compared to younger players (10-12, 13-14); accordingly, they also rated the communication and support network more favorably than their younger peers (+15>13-14). Furthermore, significant differences in players' perceptions were observed across sports, particularly in quality preparation (handball > basketball), long-term development focus (handball > football, volleyball), understanding the player (handball > volleyball), and long-term development fundamentals (handball > football). The study's implications suggest that coaches, teachers, and parents should consider the athletes' perceptions when developing talent development environments that facilitate successful development for young athletes. This information can help athletes from different sports and ages to create a supportive environment that enhances athletes' long-term development and well-being.

Keywords: sport phycology; contextual factors; talent development environment.

20894 | Parental influences throughout the long-term development of highly skilled and less skilled volleyball players

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Abstract

Sport is a privileged social context that provides rich opportunities for interpersonal interaction. The social network established throughout athlete's sport participation plays an important role in how they experience sport, with a special emphasis in the influence that parents had throughout this process. The purpose of this study was to understand the perceptions of highly skilled and less skilled volleyball players about the influences that parents had on their long-term sport development and performance achievement. A qualitative descriptive approach was considered in this study. Semi-structured interviews were conducted with 30 highly skilled and 30 less skilled volleyball players to gain an in-depth understanding of the influence of parents in players' sport development. Content analysis was used to analyse the data. Results suggested that parents played an important role in players' development, but this role differed according to players' expertise level. The tangible support was a kind of behaviour observed during the early years and was provided by parents of highly skilled and less skilled players. It was perceived as a positive influence that facilitated their development. However, the level of parental involvement was differently perceived between skilled and less skilled players. The former emphasized the importance of a moderate level of parental involvement and the autonomy provided by parents throughout their development. On the contrary, less skilled players reported excessive parental involvement, translating their negative influence on their sporting development and performance. Despite the importance of these findings, further studies are needed to examine the specific parental behaviours that may facilitate (or not) healthy sport experiences throughout players development. Further studies should also explore different sporting and cultural contexts to provide a deeper understanding of parental influences in sport.

Keywords: social influences; talent development; athlete development; expertise level; volleyball

20897 | From parents' reflected appraisals and significant others support behaviours to perceived competence and sport values: A multi-sport study

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Abstract

Expectancy-value theory (EVT), a widely accepted model of motivation, posits that expectations of success on a learning task and the individual value placed on the task are central determinants of motivation to learn. Expectancy refers to an individual's perceived ability and expectations for success, while value refers to the extent to which an individual values or enjoys the activity. Theoretical contributors to expectancies and values include parents' appraisals of their child's competence, which is thought to be mediated by parents' reflected appraisals (i.e., the child's perceptions of their parents' evaluations of their abilities); other contributors include the perceptions of support from parents, and other role models. Drawing on the EVT, we examined the relationships between the theory's components (perceived competency and task value), parents' reflected appraisals, and significant others' praise and criticism behaviours. Additionally, since the EVT suggests that adolescents' social world also influences their expectancies and task values, differences between sports in the variables were also assessed. A total of 682 players from various team sports, aged 10-16, completed a multi-section questionnaire tapping the targeted variables. Regression analyses revealed that the father's and mother reflected appraisals, as well as significant others' praise behaviours, predicted the players' perceptions of competence (beta = .31, .26,.13, respectively). Additionally, the father's and mother's reflected appraisals predicted the players' perceptions of sports value (beta = .25, .19, respectively). Finally, a MANOVA showed significant differences between sports in perceived competence (football > handball, water polo; basketball > water polo) and sports value (football, basketball > handball, water polo, volleyball). Results were discussed in terms of the influence of reflected appraisal and significant others' behaviours on athletes' self-perceptions and sport values.

Keywords: perceived competence, reflected appraisals, sport value, parental influence, team sports

L023

20950 | Examining the relationship between achievement goals, perceived motivational climate, and emotional outcomes in adolescent team sports players

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Abstract

Youth sports can provide a sense of well-being for adolescents, but their experiences can differ significantly depending on various factors. While some thrive in sports, others may struggle with the pressure to perform and the intense focus on winning, leading to high levels of sport anxiety and fear of failure. Research has shown that athletes' achievement goals and the perceived motivational climate can affect their emotional outcomes. However, there are limited studies examining those motivational correlates in relation to different dimensions of discrete negative emotions, which could provide interesting directions for intervention. This study aimed to examine the relationship between achievement goals (task/ego) and perceived motivational climate (task, performance, mistakes) to emotions (fear of failure and anxiety) among male adolescents participating in team sports. Six hundred and eighty-five male team sport players, aged 10-16 years old, completed a multi-section questionnaire that measured the targeted variables. Correlational, regression, and canonical analyses revealed that, overall, task orientation and a perceived task-involving climate were negatively related to most dimensions of fear of failure and/or anxiety. Additionally, ego orientation and a perceived performance-involving climate (either performance-oriented or mistakes-oriented) were positively associated with most of the emotional dimensions analysed. The findings highlight the importance of studying motivational conditions in youth sports. Specifically, an examination of team sports players' achievement goals, together with the analysis and monitoring of variations in the perceived motivational climate, may provide further insight into whether sports participation can promote or potentially generate a positive or negative emotional experience in young athletes.

Keywords: achievement goals; motivational climate; anxiety; fear of failure; team sports.

20962 | Does age is associated with a poor cognitive function, attention, and reaction time in older adults with dementia?

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Abstract

Background: Dementia is a highly prevalent condition amongst older adults which worsens with the advance of age. Nonetheless, the scientific literature concerning reaction time, attention, and cognitive function according to age is lacking. The symptoms of dementia can compromise the autonomy and independence of the elderly in their daily lives, with changes in cognition, function and behaviour. Aim: To compare reaction time, attention, and cognitive function according to age in older adults with suggestive dementia who are users of day care settings. Methods: 53 elders (mean age: 78.42 ± 8.49 years old; 67.9% women) were assessed for cognitive function (Portuguese version of the Montreal Cognitive Assessment - MoCA), attention (Trail Making Test - TMT parts A and B) and reaction time (top-down and bottom-up preferred and non-preferred hands using two apps, Reaction Time and Lights Out Reaction Time[®], respectively). Age was categorized as 65-79 and 80-95 years old. Between groups comparison were ascertain using independent-t test and paired sample t-test. Results: Age groups were not different according to sex (p>0.05). Between group comparisons showed that the oldest in comparison with the youngest age group had a worse bottom-up reaction time of the preferred hand (1359.75 \pm \checkmark 860.78 older; 893.52 ± 621.32 younger, respectively; p=0.027), trail making test part A (200.59 \pm 65.56 older; 150.73 \pm 45.28 younger, respectively; p=0.008) and MoCA score (7.79 \pm 4.48 older; 10.48 \pm 4.60 younger, respectively; p=0.036). In the youngest elders, thirteen variables were significantly correlated, while in the oldest group, the number of correlated variables were eleven. Conclusion: As elders with dementia get older, the worse the cognitive function, the attention and simple reaction time.

Keywords: dementia; cognitive function; attention; reaction time

21011 | The reaction time of football goalkeepers measured through tasks in and out the pitch

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Abstract

Football is one of the sports that has given more importance to scientific research, because it considers that only through scientific knowledge it is possible to develop with efficiency and rigor both the athletes and the game tactics. Given the known effect of training specificity, it is considered that tests to evaluate motor skills close to the context of the sport played are more appropriate to understand the effects of these skills on athletes. However, studies still diverge on the use of laboratory and *in-situ* tests to assess athletes. Therefore, this study aims to investigate the relationship of simple reaction time, choice reaction time and goalkeeper performance when using laboratory or in-situ reaction tests. Participated 10 male goalkeepers, aged between 13 and 18 years old (14.60±1.51 years) with a federated practice time of 6.80±2.04 years. The online "Simple and choice reaction time tasks" tests (https://www.psytoolkit.org/lessons/experiment simple choice rts.html) and a practical field test were used as instruments, which aimed to understand how a sudden change in the ball direction, caused by a rail (placed on the ground 2 m from the goalkeeper and 9 m from the penalty mark), would influence the reaction time of goalkeepers, and consequently the goals conceded during the task. Spearman correlation was used for data analysis. The results show: (i) significant positive correlation between simple reaction time (SRT) and choice reaction time (CRT) (r=.842; p<0.01); (ii) significant negative correlation between SRT and goals conceded (GC) (r=-.920; p<0.01); significant negative correlation between CRT and GC (r=-.759; p<0.05). We conclude that there is a significant association between the two reaction times (SRT and CRT) and that the shorter is the time that the athlete takes to react, the fewer goals he suffers. This study constitutes a starting point for future studies related to simple and choice reaction time in different situations (laboratory or *in-situ*).

Keywords: soccer, simple reaction time, choice reaction time, goalkeeper performance

21018 | Weightlifting: aesthetic vision on morphotype

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Abstract

The aesthetics of sport considers and presents a relevant focus on morphotype, and multiple body types can be included as factor to be analysed. The pronouncement of all sorts of bodies entails the association of distinctive sports¹, resulting from natural selection, and mainly as an outcome from training. Nowadays, in sports fields, images are offered as a valid intermediary of defining targets and dissemination². Current hermeneutic study aims to contribute to illuminate the aesthetics of weightlifting based on the morphotype by analyzing images. Four weightlifting related images were selected from sport photographers web page, newspapers and online museums. The selection addressed different mediums, like painting, sculpture, photography, and stamp. Using qualitative and interpretative analysis, the different images showed the most frequent morphotype characteristic of weightlifters: the large muscular volume. Their shape seems to deeply contribute to the aesthetic value of this sport³. In the Figure 1, is possible to understand the astonishing capacity to lift and maintain heavy weights due to hypertrophied and voluminous body presented since ancient beliefs. Atlas personifies endurance, power and overcoming, important characteristics for the weightlifter. Despite of confident and calm facial expression of athlete, the contracted muscles of limbs exhibit an excellent body control in Figure a 2. The virtuosity conveyed by the control over his body leads us to perfection and excellence. There is also the affirmation of strong and well-defined physical structure in stamps (Figure 3) and sculpture (Figure 4), meanwhile the ability to raise the bar can be seen as a form of divine ascension, reaching the level of the gods and differentiating from the earthlings. It was possible to understand that voluminous and well-defined muscles prevail from the various components associated to body morphotype of weightlift practitioners, reaching us with the weightlifters' mastery.

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Keywords: aesthetics; morphotype; weightlifting; hermeneutics.

References

[1] Schatz, H. (2002). Athlete. New York: Harper Collins.

- [2] Huyghe, R. (1998). O poder da imagem. Lisboa: Edições 70, Lda.
- [3] Gumbrecht, H.U. (2007). Elogio da beleza atlética. São Paulo: Companhia das Letras.



Figure 1: Guercino's painting 'Atlas holding up the celestial globe', 1646. On exhibition at Museo Mozzi Bardini and available on:

https://brunelleschi.imss.fi.it/galileopalazzostrozzi/object/GiovanniFrancescoBarbieriKnownAsGuercinoAtlasHoldingUpTheCelestialGlobe.html



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Figure 2: Weightlifter Charles Jean Rigoulot in 1924 France Olympic Games. Available on: https://www.thevintagenews.com/2018/04/19/strongman-nazi/?chrome=1.



Figure 3 Franciszek Winiarski Polish stamp from Olympic appeal series, 1967. Available on: https://www.allnumis.com/stamps-catalog/poland/sport/90-groszy-1967-weight-lifter-28812



Figure 4: Sculpture of Pepe Amigo in honour of Lydia Valentín weightlift achievement, 2016. Available on: https://as.com/masdeporte/2021/09/30/polideportivo/1633021366_447539.html.

21033 | Can an inter-task verbal feedback change breaststroke kinematics and efficiency at a sprint pace?

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Abstract

One of the daily tasks in swimming coaching is the capacity to deliver fast feedbacks looking for skill development and performance improvements. The value of verbal feedback was already studied at front-crawl¹, or in isolated tasks like the glide action². As the complexity differs in the different swimming techniques, it remains unknown if verbal cueing can promote similar effects in kinematics and efficiency. The aim of the current study was to verify if verbal feedback promotes changes in breaststroke kinematics and efficiency at a sprint pace. Sixteen trained swimmers were randomly assigned to an experimental and control group (n=8 each) to perform 2x25m maximal breaststroke. Verbal feedback to increase the stroke length and to boost the lower limbs action was provided to the experimental group between trials. The time of the 25m (in s) and the stroke rate (in Hz) were manually assessed by an expert researcher, and mechanical speedometer retrieved the instantaneous velocity data (in m·s⁻¹) allowing later the stroke length (in m) and stroke index (in $(m^2 \cdot s^{-1})$ estimations. An independent-sample t-test was computed to assess differences between trials ($p \le 5\%$). Cohen's d was selected as an effect size (d) measure. While both groups showed unchanged values in the kinematics or in the time to cover the 25m distance, the stroke index increased in the experimental group (2.00±0.40 m²·s⁻¹ vs 2.10±0.36 $m^{2} \cdot s^{-1}$, p=0.02, d=0.26) and decreased in the control group (2.07±0.33 $m^{2} \cdot s^{-1}$ vs 1.98±0.28 $m^{2} \cdot s^{-1}$, p=0.03, d=0.29). Although the inter-task verbal feedback did not change the assessed breaststroke kinematic variables, it proved to increase swimming efficiency at a sprint pace. Future studies should try to understand the effectiveness of verbal feedback across the different swimming techniques using a broad range of swimming velocities.

Keywords: swimming, biomechanics, coaching, training

References

[1] Zatoń, K., & Szczepan, S. (2014). The impact of immediate verbal feedback on the improvement of swimming technique. *Journal of Human Kinetics*, 28(41): 143–154. doi: 10.2478/hukin-2014-0042

[2] Papic, C., Andersen, J., Naemi, R., Hodierne, R., & Sanders, R. (2021). Augmented feedback can change body shape to improve glide efficiency in swimming. Sports Biomechanics.
 doi: 10.1080/14763141.2021.1900355

L030

21056 | Age- and sex-differences in musculoskeletal fitness in 6-to-10 years old children: the RUSH study

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Abstract

Background: Musculoskeletal fitness (MSF) is considered a health indicator in children [1]. Moreover, it has been shown that boys and girls tend to increase their motor performance across time during their primary school years [2].

Aims: To test for age- and sex-differences in primary school children MSF controlling for body fat percentage.

Material and methods: Data comes from the RUSH study [3]. The sample comprises 1522 children (765 girls) aged 6-to-10 years. Percentage body fat (%BF) was assessed with a bioimpedance scale, whilst MSF was assessed with the standing long jump and handgrip strength using standard protocols [1]. A standardized score (z-score) was computed for each test and then summed to obtain an overall muscular fitness z-score (zMSF). A two-way ANOVA model was used to test for mean differences in boys and girls zMSF across age. Then, we relied on an ANCOVA model with %BF as covariate. Further, mean estimates for sex and age, and contrasts of marginal linear predictions were computed in STATA v.14. Effect sizes were also calculated (partial eta square: η_P^2).

Results: Results showed age (F=198.51, p<0.001, η_p^2 =0.35) and sex (F=40.78, p<0.001, η_p^2 =0.03) significant differences. However, no age-by-sex significant interaction was found in zMSF (F=1.78, p=0.1305). After controlling for %BF, the same mean trend emerged as in the ANOVA model (Figure 1), so much for age (F=204.24, p<0,001, η_p^2 =0.35) and sex (F=25.56, p<0,001, η_p^2 =0.02). More specifically, children tend to systematically increase their performance from 6 years onwards. Differences between boys and girls were mostly evident from 6 to 8 years (p<0.05) favoring boys. Yet, no significant differences were observed at 9 and 10 years (p>0.05).

Conclusions: Our findings showed that boys consistently outperformed girls in their MSF (except in 9 and 10 years). Also, both boys and girls improved their MSF from 6 to 10 years, even when controlling for their %BF.

Keywords: Musculoskeletal fitness; body fat percentage; children.

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References

[1] Fitness Measures and Health Outcomes in Youth. (2012). https://doi.org/10.17226/13483

[2] Maia, J., Reyes, A., Tani, G., Vasconcelos, M. O., & Chaves, R. (2018). Ativo III. A Magia do Crescimento e do Desenvolvimento das Crianças Vouzelenses. Porto: FADE-UP e Câmara Municipal de Vouzela.

[3] Maia, J., Pereira, S., Guimarães, E., Santos, C., Garganta, R., Vasconcelos, O., Farias, C., Garbeloto, F., Tani, G. & Katzmarzyk, P. (2022). Rush: Return-to-school after COVID-19. Disponível em https://rush.fade.up.pt/news/



Figure 1. Muscular fitness z-score mean trends by sex and age adjusted for %body fat.

21083 | Changing physical education curriculum into the development of an individual understanding of "being Fit"

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Abstract

Self-imaging is highly associated with the individual's sense of well-being (Carvalho & Spamer, 2022). It represents the image and the idea of how each person sees themselves, and usually, a positive vision of their physical appearance may boost self-esteem and improve confidence. Therefore, as Physical Education is the only subject in school that attends corporeality as a pedagogical subject, PE teachers can have an essential role in developing body concept. In fact, school is a privileged place to promote healthy habits and construct an idea of "fit" adjusted to each individual (Harris et al., 2018) . This study aimed to capture students' opinions, from a seventh-grade class, concerning the idea of "What's being Fit?" and "How they see himself/herself bodies". The participants were 21 students, aged between 12 and 14 years old (10 boys and 11 girls), from a school near the Porto city centre. Students were required to fill out a questionnaire entitled "How do you see your body?", to analyse the level of satisfaction with their own body and physical appearance, and to draw or write, on a plain sheet, the idea of "What's being Fit?". The images and texts, and questionnaire answers were analysed using thematic analysis. The preliminary results showed that: 1) the images and texts created by the students are in line with a healthy lifestyle, referring to a healthy diet, defined/athletic bodies and regular sports practice; 2) being fit is not a consensual concept, and some of them defined it as "having a well-defined, strong and muscular body; being in shape; having a healthy diet, drinking water and with sleep"; 3) 23,8% of the students mentioned they were not happy with their appearance and 71,4% said they instead change something (to be skinnier and muscled and/or to adopt healthier habits). The idea of "being Fit" needs to be considered at school, namely in PE, to help students to adjust it to their own needs throughout life.

Keywords: Physical Education; Physical Activity; Student; Self-image.

Acknowledgments

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References

Carvalho, R., & Spamer, F. (2022). Impacto das mídias sociais sobre autoimagem e autoestima de jovens.

Harris, J., Cale, L., Duncombe, R., & Musson, H. (2018). Young people's knowledge and understanding of health, fitness and physical activity: issues, divides and dilemmas. *Sport, Education and Society, 23*(5), 407-420.

21097 | Differences in force profile between Big blades with and without Randall foils

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Abstract

The type and shape of the rowing oar blade have a significant impact on performance, since the force developed by the rower is transmitted to the blades influencing the boat velocity. A recent addition of a strip of plastic (Randall Foils) attached to the Big blade has shown to have a positive effect on performance (Cardoso et al., 2022) but there is still a lack of information to fully understand its impact on performance. The aim of this study was to compare the force profile between Big blades with and without Randall foils. Twenty rowers (13 men), with 9 ± 6 years of competition experience at national and international levels, performed two 90 s tethered rowing at maximum intensity in a 25 m indoor swimming pool (24 h apart) using Big blades with and without foils. The force exerted was measured using a load cell connected to the stern of the boat by a 5 m steel cable. Statistical parametric mapping was used to compare the force profile along the test between the two experimental conditions ($p \le 0.05$). Figure 1 displays the force and the T-test profile curve (upper and lower panels, respectively), being not observed differences between Big blades with and without foils. Force is an important rowing performance determinant and, although studies on the impact of these foils are scarce, higher values for Big blades with and without Randall foils (160.3 ± 49.0 N vs 150.4 ± 53.7 N, respectively) were recently reported (Cardoso et al., 2022). In addition, in the same study was reported an increased load during the propulsive phase of the rowing cycle when using the foil, provoking higher muscle fatigue and a potential change in the rowing technique, explaining the results observed between experimental conditions. Future studies should be conducted in on-water free rowing aiming to analyse the impact of Randall foils.

Keywords: Rowing, rowing; performance; blades; Randall foils, force

Acknowledgments

The authors acknowledge the Portuguese Foundation for Science and Technology, I.P. (FCT) and the European Social Fund (ESF) for the PhD individual grant to Ricardo Cardoso (2021. 04976.BD). The authors would like to thank all rowers and clubs involved in this study.

References

[1] Cardoso, R., Rios, M., Carvalho, D. D., Monteiro, A. S., Soares, S., Abraldes, J. A., Gomes, B. B., Vilas Boas, J. P., & Fernandes, R. J. (2022). Mechanics and energetic analysis of rowing with Big blades with Randall foils. *International Journal of Sports Medicine*. <u>https://doi.org/10.1055/a-1990-9787</u>



Figure 1. Force mean ± SD values of Big blades with and without Randall foils (upper panel) and statistical parametric mapping T-test profile curve (with the limits of significance identified by the red dashed lines; lower panel) along the tethered rowing test.

21128 | Evaluation of the multidisciplinary intervention (nutrition and physical exercise) in an outpatient consultation setting in a group of overweight individuals

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Abstract

Introduction: Lifestyle intervention through changes in eating habits and physical exercise is essential for the treatment of overweight.

Aim: To evaluate the physical profile of overweight individuals in the first visit(t0) and one month(t1) after nutritional monitoring (individualized food plan and individual prescription of physical exercise) to promote weight loss.

Methods: We included adult individuals who were evaluated for their physical profile by measuring arm circumferences(cm), femoral circumferences(cm), handgrip strength(kg/force) and lower limb strength/resistance (nr. of repetitions). Anthropometric data (weight, fat mass, lean mass, and BMI calculation) and food intake were also collected. All subjects received an a individualized food plan (FP) and were randomly divided into the intervention group (IG) (received a home-based exercise plan (EP)) and control group (CG), without EP.

()3

Results: We included 23 individuals (both sexes; mean age = 48 years). There was a reduction in weight(-0.6kg), BMI(0.2kg/m2) and BM(1.1kg/-0.8%) and increase in BM(0.2kg/0.5%), only in IG. There was a mean decrease in arm circumference from 34.22 cm to 33.75 cm in the CG, and from 32.99 cm to 32.26 cm in the GI. The evaluation of lower limb strength/resistance showed a mean increase from 16 to 18 repetitions in the CG and from 19 to 24 repetitions in the IG(p=<0.001). Regarding the prescribed food plan, both groups tended to report lower energy intake and higher protein contribution to the VET, with the difference being more pronounced in the control group (CG) (5.1%). The IG tends to report higher contribution of lipids (1.0%) and lower contribution of HC (-4.9%) to the VET.

Conclusion: Although the period was short, this study suggests that the prescription of structured physical exercise by a professional simultaneously with nutritional monitoring in consultation environment, seems to contribute to improve the physical and functional profile in overweight individuals.

Keywords: physical exercise, overweight, food plan

21130 | Anthropometric evolution and physical profile in a group of overweight individuals followed in nutrition consultations

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Abstract

Introduction: The treatment of overweight and chronic noncommunicable diseases requires intervention in eating habits and physical exercise.

Aim: To improve anthropometric values in overweight individuals previously exposed to nutritional monitoring, this study evaluated the physical profile of these individuals in two moments, at the first consultation (t0) and 3 months (t3) after individual prescription of physical exercise (PE).

Methods: Anthropometric and food intake data were also collected. All individuals received an individualized food plan (FP) and were randomly divided into two groups: intervention group (IG) which received a PE plan to be performed at home and control group (CG) with no PE prescription. The physical profile was measured by measuring the arm circumferences (cm), femoral circumferences (cm), handgrip strength (kg/force), and lower limb strength/resistance (number of repetitions) of these individuals.

Results: We included 22 individuals of both sexes with a mean age of 48 years. In the CG there was a mean increase in fat mass (FFM) from 34kg at t0 to 34.17kg at t3, an increase in the evaluation of lower limb strength/resistance from 16 repetitions at t0 to 21 at t3, and a decrease in the right arm circumference from 34.28cm to 33.70cm. In GI there was a decrease in mean weight from 86.22kg in t0 to 84.77kg in t3, a decrease in MG 36.08kg in t0 to 34.18kg in t3, and an increase in lower limb strength/resistance assessment from 19 repetitions in t0 to 25 repetitions in t3, and an increase in handgrip strength from 29.64kg in t0 to 32.08kg in t3.

Conclusion: These results show that the promotion of structured physical exercise simultaneously with nutritional monitoring during consultation environment seems to be essential for an improvement of the physical and functional profile in overweight individuals.

Keywords: overweight, physical exercise, food plan

21167 | Differences on the reaction time of young swimmers and basketball players

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Abstract

Reaction time (RT), defined as the time interval between the appearance of a stimulus and the beginning of a response, is considered highly relevant in sports. RT is believed to strongly contribute to the delay at which a motor response can be implemented in a game situation (Magill & Anderson, 2010). However, such influence might be dependent on the task characteristics.

In swimming, RT is considered critical as it represents the swimmer's delay at the start of the race after an auditory stimulus. In Basketball, a decrease on RT becomes essential only when is followed by an appropriate action (Popowczak et al., 2021). Therefore, we hypothesized that due to the characteristics of each sport, basketball players would show a shorter Choice Reaction Time (CRT) and swimmers a shorter Simple Reaction Time (SRT).

Once these athletes are constantly exposed to the demands of the sport, our aim was to investigate whether this exposure would lead to differences in SRT and CRT even on the early stages of preparation. Six basketball players (6 females, 8.83 ± 0.41 years, 1.67 ± 0.82 years of practice) and six swimmers (3 females, 12.67 ± 0.52 years, 6.00 ± 0.00 years of practice) aparticipated in this study and performed the Deary-Liewald Task (Deary et al., 2011) test to obtain the CRT and SRT. We inferred differences between sports through a Mann- Whitney U test for independent groups.

 \square

There were no differences on SRT and CRT between basketball players and swimmers (Table 1). Studies suggest that there is a correlation between the years of practice and the development of RT, and the sample of swimmers presented more years of practice compared to the basketball players. Despite the Deary-Liewald Task being a reliable and easy-to-use tool to test CRT and SRT, we must consider that the complex interaction between the athlete and it's environment might not be captured by such simplistic approach.

0.180
0.818

Table 1. Mean \pm standard deviation of simple reaction time (SRT) and choice reaction time (CRT) and Mann-Whitney U statistics and *p*-values.

Keywords: Choice reaction time; Simple reaction time; Basketball; Swimming

References

Deary, I. J., Liewald, D., & Nissan, J. (2011). A free, easy-to-use, computer-based simple and fourchoice reaction time programme: the Deary-Liewald reaction time task. *Behav Res Methods*, *43*(1), 258-268. <u>https://doi.org/10.3758/s13428-010-0024-1</u>

Magill, R., & Anderson, D. (2010). *Motor learning and control*. McGraw-Hill Publishing New York. Popowczak, M., Cichy, I., Rokita, A., & Domaradzki, J. (2021). The Relationship Between Reactive Agility and Change of Direction Speed in Professional Female Basketball and Handball Players [Original Research]. *Frontiers in Psychology*, *12*. <u>https://doi.org/10.3389/fpsyg.2021.708771</u>

21180 | Which constraints influence the participation level of physical education (PE) students in football?

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Abstract

Inclusive education should include all, regardless of disability, socio-economic background, culture, gender or ethnicity (Ainscow, 2005). This study aims to understand how specific constraints influence the participation level of PE students in football settings, that may promote inclusion. The initial evaluation was filmed and consisted of a Gk+4v4+Gk game situation for 20 minutes (10 minutes of free play plus 10 minutes with constraints). A total of 20 students were distributed in 4 teams (A - control group, B, C, D). Each team included 2 students with low performance level, with the remaining 3 students with a good performance level. The game structure was Gk-1-2-1. The constraints were: Team B - The ball needed to pass through every player before scoring a goal (worth 3 points). Team C - when a player with more difficulty assisted a on a goal or performed a shot, 2 points were set; when making a pass or recovered the ball, 1 point was given; goal worth 3 points; Team D - The team had 3 targets (a formal 5v5 goal located at the center of the pitch, with a goalkeeper, and 2 side goals with the same width as the formal goal). Only the 2 low level players were allowed to score in the 3 targets (3 points if a goal was scored in the formal goal or 2 points if they run with the ball through or made a short pass — no more than 1 meter — to other 2 targets). At the end of each game, the students playing under constraints and 1 random student with a good performance level, filled out a survey. 5 classes were used for the application of the constraints and 20 minutes of the final part of each class were reserved for the Gk+4v4+Gk game. It's expected the elements of the group with a low performance level will increase their participation and efficacy in the attacking and defensive actions. Since the study is still being applied, there are no specific conclusions yet.

Keywords: constraints; physical education; football; inclusive education

Acknowledgements

This work is supported by the Foundation for the Science and Technology (FCT) under Grant 2022.09013.PTDC.

References

[1] Ainscow, M. (2005). Developing inclusive education systems: what are the levers for change? *Journal of Educational Change*, 6(2), 109-124. doi:10.1007/s10833-005-1298-4

21236 | The influence of psychological pressure on dribbling performance

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Abstract

Soccer is the most popular sport in the world. Considering the high psychological pressure during soccer competition, and the reported effects of anxiety on performance for a large set of motor skills, one would expect an effect on soccer skills. Therefore, it is important to understand the influence of psychological pressure on soccer performance. This would inform researchers and practitioners in finding strategies to help athletes control their emotional state in training and matches. Thus, this study investigated the influence of psychological pressure on soccer dribbling performance. An experiment was carried out with female soccer players, under 17 years of age $(15.40 \pm .843)$ (n = 10). The experiment consisted in the performance of the dribbling without pressure and later the same players performed the same exercise with psychological pressure (i.e., instructions emphasizing competition and observation by teammates). Right after experiencing pressure over their performance, a question was asked to measure anxiety levels of those who participated. Statistical procedures included Wilcoxon non-parametric test and Pearson correlation test. Level of significance was set at 0.05. The results showed that psychological pressure had an increasing effect on dribbling time (p = .036). Additionally, we observed that trait anxiety led to higher longer dribbling times in no pressured situation (r = .797; p<0.01). It means that a person with higher trait anxiety perceives the situation as more threatening.

1047

Keywords: soccer, psychological pressure, dribble, anxiety, performance

21256 | Aesthetics of football and the relationship athlete-ball: a visual essay through image analysis

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Abstract

Although football is *the* worldwide sport of contemporary society, its aesthetic value is still quite unrecognized by coaches, athletes and fans. Nevertheless, in an inconscient or neglected way, images created by the game are a great source of appreciation and delight for all the participants in football and help to configure its aesthetics³. In recent years there has been an effort from scholars to draw attention to this subject and to improve knowledge about football's aesthetics^{1,2}. The aim of this approach was to help strengthening the knowledge on football's aesthetics through an interpretative and comprehensive image analysis, placing the emphasis on the game's most iconic element, the ball. Six photographs were selected within a vast database of photographic records of the 2022 World Cup, available online on the website of the Spanish newspaper El País. The analysis was guided by the principles of reading and interpreting established by the hermeneutical circle.

The results have revealed that the frozen movements of the players interacting with the ball highlighted the drama of the game expressed by the agility, creativity, strength and risk exhibited by the athletes on their relationship with the ball. Sometimes they want to control it, other times they want to keep it and still others to project it towards the safest and most desired place, the goal. There's no way of scoring without the ball and the whole game of football is marked by a dealing with a paradox: keeping the ball away from the goal and aiming to 'kiss' and deform the beautiful goal net meshes. The way the players look at the ball is very expressive and emphatic, and this kind of expressiveness adds aesthetic value to the pictures and through it we can better understand the aesthetic value of the game. In this regard, it is recommended that this kind of aesthetic analysis should be included in coaches and athlete's education.

Keywords: Spherical; Aesthetics; Education; Football; World Cup 2022.

References

[1] Edgar, A. (2014). Sport and art. An essay in the hermeneutics of sport. London: Routledge.

[2] Kreft, L. (2015). Aesthetic imagination in football. Sport, Ethics and Philosophy, 9 (2), 124-139.

[3] Lacerda, T.O. (2018). Imagem e valor estético da performance desportiva. Uma análise a partir de imagens fotográficas. In Eugénia Vilela & Né Barros (Eds.), *Performances no Contemporâneo,* 73-85. Porto: Coleção Estética, Política e Artes, Faculdade de Letras, Universidade do Porto.



Figure 1: "Canadian Stephen Eustáquio trying to steal the ball from Belgian Leandro Trossard." Source: El País Newspaper, Martin Meissner (AP). Available on: <u>https://elpais.com/deportes/mundial-futbol/2022-11-23/la-cuarta-jornada-del-mundial-de-qatar-en-imagenes.html</u>



 Figure 2: "Christian Bassogog, from Cameroon, fights for possession of the ball against Srdjan Babic, from Serbia, during this Monday's match played at the Al Janoub stadium" Source: El País Newspaper, Clive Mason (Getty Images). Available on: https://elpais.com/deportes/mundial-futbol/2022-11-28/la-novena-jornada-del-mundial-de-qatar-en-imagenes.html



Figure 3: "Cameroonian midfielder Andre-Frank Zambo Anguissa (left) disputes a ball against Swiss player Granit Xhaka during Thursday morning's match" Source: El País Newspaper, Manan Vatsyayana (AFP). Available on: <u>https://elpais.com/deportes/mundial-futbol/2022-11-24/la-quinta-jornada-del-mundial-de-qatar-en-imagenes.html#foto gal 5</u>


 Figure 4: "Michy Batshuayi scores the goal for Belgium." Source: El País Newspaper, Matthew Childs (Reuters). Available

 on:
 https://elpais.com/deportes/mundial-futbol/2022-11-23/la-cuarta-jornada-del-mundial-de-qatar-en

imagenes.html



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Figure 5: "Aerial view of Ghana's first goal against Portugal" Source: El País Newspaper, Manan Vatsyayana (AFP). Available on: <u>https://elpais.com/deportes/mundial-futbol/2022-11-24/la-quinta-jornada-del-mundial-de-qatar-en-imagenes.html#foto_gal_5</u>



 Figure 6: "Junior Hoilett, executing a corner against Morocco." Source: El País newspaper, Miguel Medina (AFP).

 Available
 on:
 https://elpais.com/deportes/mundial-futbol/2022-12-01/la-jornada-11-del-mundial-de-qatar-en-imagenes.html

21258 | Effect of a hydrogym session on blood pressure of people recovered from COVID-19.

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Abstract

COVID-19 (CV-19) has left chronic sequalae in infected individuals. Considering that the senility process exposes the elderly population to greater weaknesses, the post-CV-19 consequences in this population can be alarming. The chronic effects of CV-19 on cardiovascular parameters such as blood pressure (BP) in the elderly has been a recurrent research topic. It is consolidated that exercises (EX) such as aquatic aerobics promote cardiovascular, physical and other benefits parameters. Objective: to analyse the effect of a session of water EX in BP, of elderly people recovered after contamination by CV-19. Methods: 29 elderly volunteers with diagnosis established by identification tests of CV-19. Before the protocol, the volunteers remained at rest sitting for 10 minutes (min). BP was measured after initial rest, before the session (PRE), and after 15 min of the exercise session (POST). The BP assessment took place in the sitting position sitting. The protocol of EX was composed of 5 sets of 4 EX for the main muscular groups, lasting 1 min each and intensity from 9 to 10 on the Borg scale, totaling a 25-minute session. The present study was approved by the ethics committee and research at the Federal University of Mato Grosso. The Paired t test was used to compare PRE and POST moments. The analysis was conducted in the SPSS program (version 18) and the significance level adopted was 5%. Results: Mean age was approximately 67 years, BMI (kg/m2) approximately 28. A significant reduction in Systolic BP (SBP) was observed (PRE = 120.17 ± 15.28 mmHg; POST = 114.24 ± 15.87 mmHg, t = 3.555, p = 0.001) but not in DPB (PRE = 71.48 ± 10.33 mmHg; POST = 73.1 ± 10.97 mmHg, t= -1.693, p= 0.102). Conclusion: A session of aquatic aerobic EX can reduce SBP of the elderly people after CV-19.

Keywords: Blood Pressure; Covid-19; Physical Activity, Elderly.

Acknowledgments

FAPEMAT – Brazil Study and Research Group on Aquatic Activities and Exercise Physiology Federal University of Mato Grosso

L046

21270 | Comparison of offensive performance indicators based on final match status of the champion team in Brazilian men's football championship 2021 teams

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Abstract

INTRODUCTION: Performance indicators (e.g., goal kicks, ball possession, corner kicks, precise passes, etc.) are described as a selection or combination of action variables that aim to define some or all aspects of performance that can lead to a successful outcome.

OBJECTIVE: To compare the offensive performance indicators in wins and losses in Champion team from the Brazilian Championship 2021.

METHODOLOGY: The study is observational descriptive research. The data related to the 38 games of the 2021 Brazilian First Division Championship were obtained through the InStat Scout Platform. For the statistical analysis of the data, variance analysis (ANOVA) was used to compare the total number of goal chances created by the teams, total number of kicks, total number of kicks in the direction of the goal, total number of passes made, total number of assists and total number of dribbles performed, in addition to the overall performance index that generally encompasses offensive and defensive performance, called the InStat Index (offensive technical performance) between teams that lost, tied or won games.

RESULTS: The 1-way anova showed that there is an effect of the group winning (Average: 235.52; SD: 5.55), tie (Average: 223,92; SD: 6,05) and loss (Average: 209.67; SD: 8,38) with respect to overall technical performance (InStat Index) [F(2,35) = 34.109; p<0.05], and for shots on goal 1047 [F(2,35) = 3,412; p<0.05], in victory (Average: 7,00; SD: 2.46) and tie (Average: 4,92; SD: 2,74). CONCLUSION: We conclude that the shots on goal and the overall performance index that generally encompasses offensive and defensive performance, called the InStat Index (offensive technical performance) are the differential actions in the offensive pattern of the Champion team in the 2021 Brazilian Men's Football Championship matches. The winning team was the one that created more clear chances of goal, shotting the opponent's goal more often.

Keywords: key performance indicators, soccer, offensive phase

21277 | Exploring the interplay between sport anxiety and tactical knowledge in athletic performance: Insights from a study on male adolescent Portuguese players

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Abstract

Sport anxiety and tactical knowledge are two important aspects of athletic performance that are closely related. Sport anxiety is a learned adverse emotional reaction to a perceived threat that has not actually occurred and refers to the feelings of nervousness, apprehension, and worry that athletes experience before or during a competition. It can have a negative impact on an athlete's ability to perform at their best, hindering an athlete's ability to apply their tactical knowledge (i.e., the understanding and ability to execute strategies and game plans to achieve success in a sport) effectively during a competition. This is because anxiety can impair an athlete's attentional focus and decision-making abilities, which are critical for executing tactical plans. The present study aimed to analize the relationship between anxiety and tactical skills in 727 male adolescent Portuguese players (10-16 years-old), from various team sports (soccer, handball, volleyball, water polo, basketball). The players were recruited as participants of the "In search of excellence: A mixed-longitudinal study in young athletes (INEX) study" (2016-2019) and completed a multisection questionnaire tapping the targeted variables. Pearson correlations showed significant low negative associations between total anxiety and the procedural tactical knowledge skill of positioning and deciding (r=-.27, p<.001) and between anxiety and the declarative tactical skills of knowing about others (r=-.23, p<.001), and knowledge about ball actions (r=-.179, p<.001). These findings are consistent with previous research, suggesting a close relationship between sport anxiety and tactical knowledge and implying that effective management of anxiety and the development of tactical knowledge are crucial aspects of an athlete training for optimal performance. However, further studies are needed to investigate the impact of anxiety on athletic performance across different competitive levels and age groups.

Keywords: anxiety, tactical performance, sports performance, team sports

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21280 | Effects of an exercise program based on the Pilates method, applied to school adolescents, on spine alignment, trunk strength, and flexibility

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Abstract

Introduction: Postural imbalances in adolescence due to lifestyle with low physical activity and long screen periods are problems that require preventive attention. Studies have shown the effects of the Pilates method, mainly in the adult and elderly population, being scarce in adolescents between 15 and 17 years, specifically.

Objectives: This experimental study aims to evaluate the effects of a 15-session program, with Pilates Matwork exercises, in the school environment, on the variable's spinal alignment, strength, and flexibility of the trunk in adolescents.

Material and Methods: Forty-Three participants with a mean age of 15.41 (±0.67) years were divided into two groups: 14 students in the control group (CG) and 29 in the experimental group (EG). The participants of the EG were submitted to 15 sessions of 40 minutes of exercises based on the Pilates Matwork method in place of part of the physical education class, and the CG anatomic maintained their regular school activities. The variables: spinal front and lateral alignment (head anteriorization and misalignment by adapted "simethography"), core stability and strength (stabilizer and plank test), handgrip strength (handgrip), and trunk flexibility (sit and reach) were evaluated before and after the intervention period.

Results: The intervention of 15 Pilates sessions showed a positive effect for the EG compared to the CG on trunk flexibility, core stability, and strength. Comparing the initial and final moment of the intervention, the EG obtained significant improvements in spinal front and lateral alignment, core stability and strength, handgrip strength, and trunk flexibility, are no significant improvements in core strength.

Conclusion: This work supports the use of interventions based on the Pilates method in adolescents in the school environment, although of short duration, since they seem to have beneficial effects on the stability and strength of the core and trunk flexibility with possible repercussions on postural health.

Keywords: Intervention, Pilates Method, Adolescents, School, Stabilization of the spine, core

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YOUNG RESEARCHERS MEETING









