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PITCH

Biology

Personal care products as emerging aquatic pollutants: Effects in key steps of the reproduction cycle of the pacific oyster (Crassostrea gigas)

Ana Carvalhais, Cláudia Mieiro, Mário Pacheco

Personal care products (PCPs) encompass a diversified group of chemicals, such as, insect repellents, disinfectants, fragrances and UV-filters, used regularly in human's routine. These compounds are produced in large quantities, released into the aquatic systems and are environmental persistent, bioactive and bioaccumulative. The project main objective involves studying the potential toxic effects of three PCPs (a disinfectant – triclosan, a synthetic musk fragrance – galaxolide and an organic UVA filter – 4-methylbenzylidene camphor), individually and in mixture, on the reproduction of pacific oyster (Crassostrea gigas). Four critical steps on oyster reproduction will be assessed: (1) gametes viability, (2) fertilization, (3) settlement and (4) gametogenesis and gonadal maturation, upon which a set of reliable biomarkers for the assessment of environmental pollution will be evaluated (oxidative stress, metabolic, genotoxic, reproductive, endocrine and histological parameters). This project will provide background information on PCPs effects on bivalves' reproduction, which can be extrapolated to other external fertilizing organisms.

Biology

Mechanistic and functional studies on a novel Symbiodinium–driven calcification process under current and future climatic conditions

Cláudio Brandão, Jörg Frommlet, João Serôdio

Coral reefs are amongst the most diverse ecosystems worldwide, and their ecological success is largely owed to the mutualistic symbiosis that they establish with the marine dinoflagellates of the family Symbiodiniaceae. Even though these microalgae are primarily recognized as the symbionts of marine invertebrates (such as corals and jellyfish), they also thrive as free-living cells in the environment. The existence of such environmental populations has been known to science for decades, and yet, they remain enigmatic, as hardly any aspects of their free-living lifestyle are yet explored.

One such aspect of their life cycle that has been recently discovered is that in culture the majority of these microalgae are capable of producing small, sand-like carbonate structures that encase the algae as endolithic cells. The discovery of these so-called symbiolites in vitro provided the first evidence of an endolithic life cycle strategy of symbiodiniaceans and laid the foundations of the work planned throughout my PhD.

The main goals of the present work are to understand what is the ecological relevance of an auto-endolithic strategy in the dinoflagellate life cycle, to assess whether climate change is likely to impact this calcification process, and to study the existence of endolithic population in the environment (Lizard Island, Great Barrier Reef, Australia).

Biology

Generational transmission of pro-genotoxic/anti-genotoxic alterations induced by pesticides - a path to predict the real impact on aquatic populations

Ana Raquel Marçal, Mário Pacheco, Sofia Guilherme

The prediction of the real ecologic impact caused by genetic damage at the population level is only possible through the evaluation of the genetic/epigenetic information transmitted through generations. There is a need to understand how a parental exposure to a genotoxicant could show a negative impact on the offspring. This work aimed to understand the genotoxic and epigenetic impact of pesticides on the population of

Procambarus clarkii. After a genotoxic screening of the most used pesticides, the herbicide penoxsulam was chosen for an intergenerational study where: (i) its genotoxic potential on P. clarkii F0 generation; (ii) the oxidative stress on juveniles (F1); (iii) the DNA methylation patterns after penoxsulam exposure on F0 and F1 generations, was assessed. A crayfish population from a pesticide-free local was exposed to an environmentally relevant concentration (23 µg L-1) of penoxsulam. The comet assay was used to assess the genotoxic potential in P. clarkii' somatic cells (gills and hepatopancreas) and male gametes. The oxidative stress was evaluated on juveniles' gills and hepatopancreas. by assessing the LPO and the response of antioxidant enzymes (CAT, SOD, and GPx). The DNA methylation was measured in the crayfish muscle with the Methylflash Global DNA Methylation (5-mC) ELISA Easy Kit (Epigentek). The results showed that penoxsulam: (i) caused DNA damage on adult's crayfish somatic and germinative cells; (ii) induced oxidative DNA damage on juveniles' crayfish hepatopancreas cells; (iii) did not affect the methylation pattern on F0 generation, however, it caused significant changes in the global DNA methylation of their offspring. These findings demonstrated that the herbicide penoxsulam is genotoxic and pro-oxidant for the species P. clarkii. Moreover, it was unveiled the penoxsulam ability to alter the DNA methylation pattern in the crayfish offspring. Changes in the epigenome can lead to alterations in the genetic expression and this could impact its success. Overall, these results highlighted the value of integrating more endpoints in the pesticide risk assessment, that allow an evaluation to predict the real pesticide impact on aquatic populations.

Biology

Immediate post-fire response of native animal communities

João Puga, Nelson Abrantes, Jacob Keizer, Francisco Moreira

Centuries of continuous human-induced alterations in ecosystems coupled with recent climate change have transformed the natural role of fire into a significant disturbance to forested areas of Southern Europe. Adding to knowledge gaps about how wildfires affect animal communities in the short term and how post-fire recolonization occurs, the need to find solutions to invert wildfire impacts is becoming increasingly urgent. After four years of investigating these matters, WILDRECO summarizes the main results obtained and reveals the applicability of this new knowledge while searching for solutions to prevent and mitigate the negative impacts of fire on biodiversity in Mediterranean forest ecosystems.

Biology

MaISResist - Protecting MAize from cephalosporiosis: bacteria Induced Systemic RESISTance

Diana Matos, Paulo Cardoso, Leire Molinero-Ruiz, Etelvina Figueira

Maize is the most produced sown crop in Portugal (grain and silage), involving 75.000 farmers and occupying 150.000 ha. In the last years late wilt (cephalosporiosis), a disease caused by the pathogenic fungus Magnaporthiopsis maydis (former Cephalosporium maydis), represents a major threat to maize. The disease reduces production up to 59% in Portugal and causes serious economic losses. Currently the pathogen is controlled by using maize resistant varieties, but the success of this methodology is dependent on the fungus virulence. Volatile organic compounds produced by bacterial isolates (BVOCs) have the ability to inhibit growth of some fungi.

This proposal aims to study the ability of BVOCs to inhibit M. maydis growth and to induce systemic resistance in maize to control cephalosporiosis. Molecular techniques and metabolomics methodologies, in combination with greenhouse experiments and field trials will allow the development of a biologically-based methodology for the control of the disease in maize.

Biology

Squaring the circle of bivalves' valorization: how to ensure food safety preserving nutritional features?

Vitória Pereira, Prof. Dr. Mário Pacheco, Dr. Rui Rocha, Dr. Luís Conceição

Aquaculture of low-trophic species, as marine bivalves, can represent a path for sustainable food production. Microbiologic contamination is, however, one of the major concerns inherent to food safety and thus depuration is frequently needed to ensure legal levels, associated with bivalve consumption. Yet, depuration can induce physiological stress and nutritional loss, compromising organoleptic characteristics and reducing shelf-life. Bivalve feeding during depuration may be the solution to overcome these problems, and, assuming that the whole microalgae are the most common form of ingestion, a realistic assessment of their potential is required. Overall, the main objective of this project is to determine if bivalve (Ruditapes decussatus and Cerastoderma edule) feeding during depuration can contribute to improve product quality and reduce food

losses, through survival, biochemical profile, antioxidant and antigenotoxic biomarkers analyses. Furthermore, the resulting knowledge should contribute to low-trophic species aquaculture boosting, improve bivalve nutritional value, and enhanced human quality of life.

Biology

The use of endogenous insects to promote a more sustainable shrimp aquaculture

Felipe Lourenço, Olga Ameixa, Ricardo Calado, Isabel Medina

Aquaculture is a growing and efficient food production system in line with the Blue Growth strategy. However, worldwide, aquaculture industries rely on wild fisheries as a source of fishmeal and fish oil to meet nutritional requirements of several marine species (mainly in protein and long-chain omega-3 polyunsaturated fatty acids), contributing to the collapse of fisheries stocks. Alternative plant origin ingredients are not able to meet these nutritional needs and have several environmental and economic costs.

Evidence shows that costal and marine insects, due to their feeding habits, present a nutritional composition richer in omega-3, being potentially good candidates to feed marine species. This project is investigating this by testing endemic costal insect species regarding their nutritional composition, such as the fly Fucellia maritima, which has PUFA in its composition and developed rearing methodologies which can be readily used to produce adequate aquafeeds and contribute to ensure food security through native insect biodiversity.

Biology

Water physicochemical parameters and their influence in the Photodynamic Inactivation of microorganisms

Maria Bartolomeu, Adelaide Almeida, Amparo Faustino

Wastewater (WW) containing pathogenic microorganisms (MO), pharmaceuticals and personal care products (PPCPs), and soluble microbial products (SMPs), is subject of concern since it affects the quality of receiving waters. Traditional methods to reduce pathogens concentration by disinfection processes (chlorine, UV) are expensive, unsafe, and sometimes ineffective, highlighting the need for new technologies. The promising results of photodynamic inactivation (PDI) of MO with photosensitizers suggest its application to microbial inactivation. One of our work aims is to assess photodynamic action applicability for microbial inactivation on WW. We have been evaluating the efficacy of PDI on different microorganisms' species, including pathogenic ones. We have been performed experiments with different water matrices compositions to inquire about some influencing conditions in the effectiveness of microbial photodynamic inactivation. Some results of bacterial inactivation in phosphate-buffered saline (PBS), distilled water, tap water, well water, river water, swimming pool, wastewater, and aquaculture water are presented and discussed.

Biology

Single and combined effects of microplastics and adsorbed contaminants on molecular and biochemical responses of freshwater species

Mariana Rodrigues, Prof. Dr. Fernando Gonçalves, Dr. Ana Marta Gonçalves, Dr. Nelson Abrantes

Microplastics (plastic particles with < 5 mm) are one of the most emerging aquatic pollutants since they are ubiquitous and persistent particles. The environmental occurrence and the potential effects of microplastics and its combination with adsorbed contaminants has been widely reported for aquatic systems. Notwithstanding, regarding freshwater systems there is still an immense lack of information. Hence, this work aims to provide new insights into the ecotoxicological effects of single microplastics (microspheres of polystyrene), as well the combined effects of microplastics with an organic or inorganic contaminant (a polycyclic aromatic hydrocarbon – benzo(a)pyrene; and a metal – copper, respectively) at relevant environmental concentrations. Distinct freshwater organisms from different trophic levels are being used for short and long-term exposure. Until now, results pointed-out that polystyrene is less toxic than the two other contaminants both for producers (R. subcapitata and L. minor) and for the primary consumer (D. magna). This information will be complemented with the biochemical analysis that are still ongoing. Regarding the combination of the microplastic with a contaminant, we hypothesized that the organism's response to the contaminants will be influenced by increasing or decreasing their toxicity. Furthermore, this work also aims to assess the potential for bioaccumulation through the food web, its biochemical implications for organism's health and, lastly, for ecosystem.

Biology

The genus Diaporthe on blueberry plants in Portugal: from species diversity to pathogenicity

Sandra Hilário, Artur Alves, Liliana Santos

Blueberries (Vaccinium corymbosum) are widely cultivated worldwide and largely consumed due to their known antioxidant and medicinal properties. Its production in Portugal has been increasing over the last 20 years, becoming a highly profitable crop. However, the fast growing of blueberry production has been accompanied by an increase of diseases caused by plant pathogens, mainly fungi. Among these, Diaporthe species are known agents of stem canker, dieback, and twig blight. Therefore, the overall aims of this research plan are to gain knowledge about the diversity of Diaporthe species occurring on blueberry plantations in Portugal, assess their pathogenic potential to blueberry plants, evaluate the impact on plant physiology and analyse the genomes of D. vaccinii (a quarantine pathogen in Europe) and other relevant species identified during the project. This approach will allow us to gain knowledge into diverse aspects of the biology of these pathogens, namely those related to pathogenicity/virulence and plant cell wall degrading enzymes, which are of the utmost importance to understand the infection mechanism at the cellular and molecular levels.

For this, a collection of 116 fungal isolates obtained from symptomatic blueberry plants was initially evaluated based on their overall genetic diversity, from which 25 isolates were selected and characterized based on DNA sequence data. The phylogenetic analyses revealed the presence of eight known Diaporthe species and one hybrid, described for the first time in this genus. Furthermore, to assess the pathogenic potential of the identified species to different blueberry cultivars, pathogenicity tests were carried out, which allowed us to get knowledge about the most susceptible cultivar and the most aggressive species to this crop.

In this current year, Diaporthe vaccinii and one of the most aggressive species (D. amygdali) were selected to perform pathogenicity trials under well-watered and water-stress conditions to evaluate the impact of these pathogens on plant physiology. We aim to measure morpho-physiological related parameters, such as water potential, CO2 assimilation rate, stomatal conductance, transpiration rate. Moreover, some biochemical analyses will also be carried out to quantify pigments, proline, total soluble sugar, lipid peroxidation and hormones. Also, the genomes of the 2 species (D. vaccinii and D. amygdali) were sequenced and currently a functional annotation is being executed, to further analyze the genomes.

Biology

Application of the biorefinery concept to value the invasive species Procambarus clarkii

Telma Veloso, Prof. Dr. Fernando Gonçalves, Prof. Dr. Sónia Ventura

The red swamp crayfish Procambarus clarkii, native from EUA, is the most well-established invasive species in Europe, becoming the major biodiversity threat of freshwater systems. The success of their environmental compatibility is related to high plasticity, borrowing activity, ability to integrate into the food web at many levels and low predation rates. In spite of the several and diversified methods that have been proposed or used, all have high costs and noneconomical return.

The exoskeleton of P. clarkii is composed by chitin (15-20%), proteins, including pigments (25-40%) and calcium carbonate (40-55%), which represents a considerable source of these biocompounds with biotechnological relevance. In this way, we propose the development of sustainable efficient techniques to extract astaxanthin, chitin and collagen from the invader P. clarkii in order to enrich environmental management strategies with an economic resource that can support the removal of the crayfish from invaded ecosystems.

Biology

Indoor-generated particulate matter: chemical signatures and associated mutagenic and cytotoxic effects

Daniela Figueiredo, Helena Oliveira, Célia Alves

Epidemiological studies have shown that ambient particulate pollution has adverse effects on human health. Less attention has been paid to indoor particles, despite the fact that people spend ~90% of their time indoors and that indoor exposure may be even more harmful than outdoors. However, the application of source apportionment models to quantify the contribution of sources to indoor particles is infeasible so

far due to the lack of emission profiles. The detailed characterization of particulate organic and inorganic compounds emitted from indoor activities by multiple techniques (e.g. GC-MS, ICP-MS, etc) is the main goal of this work. The originality of the project is centred on the evaluation of the potential carcinogenic, mutagenic and toxicological effects of the different constituents extracted from indoor-generated particles towards human cell line models. By exploiting state-of- the-art equipment and facilities, a panoply of cell responses to particles will be assessed.

Biology

The role of emerging contaminants and environmental factors on fish personality

Niedja Santos, Miguel Oliveira, Inês Domingues

The influence of human activities on the environment has been intensively studied in the last decades. Although the assessment of molecular, biochemical and physiological alterations induced by contaminants on fish has been increasingly studied, little is known concerning their effects on personality, a definer factor in responses to stimuli, including predators and feeding opportunities, and thus, organisms to survival and reproduction. Thus, anthropogenic substance/abiotic alterations that affect an individual personality can also influence the population in a determined environment, hence affecting their ability to succeed, and the entire equilibrium of an ecosystem. The present research project aims to determine several sensitive endpoints, for example, personality and personality traits transferred from parents to offspring, at different stages of fish life and determine how these endpoints are affected by emerging contaminants (e.g. caffeine and metformin) and abiotic factors alterations (variation in temperature – constant and unpredictable).

Biology

Toxicity assessment of realistic combinations of plastic nanoparticles and three persistent environmental drug contaminants.

Ana Filipa Nogueira, Bruno Nunes

One of the major issues nowadays is that pharmaceuticals are continuously introduced into aquatic ecosystems, along with a series of other substances. Similarly, plastics are being continuously spread in the marine ecosystem and reduced to small fragments. Both may present major challenges to non-target exposed aquatic species, since they may occur either independently or in combination. Besides, microplastics may serve as preferred vectors for the dispersion of a large set of chemicals, including drugs. This project aims to tackle the aquatic contamination by different hydrophobic drugs, nanoplastics, and a realistic mixture of both pollutant forms. Consequently, we will study the toxicological effects of sodium valproate, tretinoin, and fenofibrate at biochemical, genotoxic effects, and the behavior levels, and subsequent assessment of the effects at a mesocosm level, on several sentinel and model species, namely the polychaete Hediste diversicolor, the mollusk Mytilus galloprovincialis, and the fish Danio rerio.

Biology

Whole-Genome Sequencing of bacteria resistant to carbapenems from Ria de Aveiro

Patrícia Matos, Marta Tacão, Isabel Henriques

Over time, studies were carried out to characterize bacterial isolates from hospital origin that were resistant to carbapenems. However, this resistance does not only occur in hospital environments, which led to the emergence of studies characterizing bacterial isolates resistant to carbapenems in different environments. This problem is of utmost importance as these antibiotics are used as a last resort therapy for the treatment of infections caused by multi-resistant bacteria.

Hence, the present study aimed to verify the occurrence of bacteria resistant to imipenem along the Ria de Aveiro estuary and proceed to their isolation and subsequent characterization. For this purpose, 26 water samples were collected along the estuary, in three samplings campaigns (Autumn, Spring and Summer). Bacteria were selected in m-FC culture medium supplemented with imipenem (4□g/ml). After 24h at 37 ºC, single colonies (n=439) were preserved in glycerol (20%) at -80ºC. The presence of genes that confer resistance to carbapenems was verified by PCR in 8 isolates. After characterization by antibiotic susceptibility tests and molecular typing by BOX-PCR, five isolates were selected for complete sequencing of their genomes. After genome analysis, the isolates were identified as Klebsiella pneumoniae (n=1), Citrobacter freundii (n=1), Aeromonas caviae (n=2) and Pseudomonas guariconensis (n=1). Carbapenemase genes blaKPC-3 (in K. pneumoniae and C. freundii), blaGES-5 (in A. caviae) and blaVIM-2 (in P. guariconensis) were detected. Genes encoding class 1 (n=3 genomes) and class 3 (n=1) integrases were also

identified, as well as genes encoding extended spectrum beta-lactamases (e.g., blaCTX-M; n=1) and resistance to fluoroquinolones (n=5) (e.g., oqxA).

With this work it was possible to verify the occurrence of bacterial isolates that are resistant to carbapenems in different points of the Ria de Aveiro estuary, indicating the existence of bacteria with acquired resistance to last resort antibiotics in a location widely used by humans for different purposes. Moreover, the acquisition of carbapenem resistance genes by common human pathogens, such as Klebsiella pneumoniae, detected in this study, corresponds to a serious public health problem.

Biology

Mercury as a human reproductive toxicant

Magda Henriques, Maria Teresa Herdeiro, Susana Loureiro, Margarida Fardilha

Mercury (Hg) is one of the most widespread contaminants, predominantly generated by anthropogenic activities such as industrial, pharmaceutical, and agricultural activities. Exposure to Hg has been associated with adverse effects on human health, such as kidney and neurological damage, and human reproductive abnormalities (e.g., miscarriages, spontaneous abortions, stillbirths, and low birth weights). Several studies also showed that increased Hg levels were associated with male infertility and subfertility status and that infertile subjects with unexplained infertility showed higher levels of Hg in hair than fertile ones. However, it is still unknown how this happens. The main goals of this work were to i) evaluate the effects of Hg on human reproductive health; and ii) identify molecular markers to predict and prevent this. For that, a cross-sectional study was carried out in eligible women and men from Centro Hospitalar do Baixo Vouga, located in Aveiro. A detailed questionnaire regarding sociodemographic, diet, lifestyle and reproductive data was completed by participants and samples of hair, saliva, urine, semen, placental tissue and umbilical cord were collected. The total Hg (THg) levels were quantified in hair, placental and cord tissues using the Advanced Mercury Analyzer (AMA-254, LECO). In females, results showed Hg bioaccumulation in biological samples and a significant positive correlation was found between THg levels found in hair and all matrices analysed. Further, significantly higher THg levels in umbilical cord were found in women with infertility-related conditions and although, not statistically significant, we also found a trend to higher THg levels in other biological matrices for women with infertility-related conditions. Additionally, in males, our preliminary results showed a trend to higher hair THg levels in males with infertility-related conditions. However, THg levels in male hair do not correlate with any seminal parameter evaluated. Are there changes only at the molecular level? A combined molecular approach will answer the question. Thus, based on THg levels in hair and the safety limits established by US EPA and WHO, female participants were divided into 3 groups: 1) THg levels lower than 1000 ng/g (N=5); 2) THg levels between 1000 ng/g and 1800 ng/g (N=5); 3) THg levels higher than 1800 ng/g (N=4). Urine samples from participants of each group will be used for metabolomic analysis to recognize metabolites altered by Hg. And what are the molecular mechanisms by which Hg affects human fertility? Results obtained in the metabolomic approach will be subjected to an extensive statistic and bioinformatic analysis in order to understand the possible cellular and biological processes altered at different levels of exposure to Hg.

Biology

Development of antibacterial bio-based materials for active food packaging through phage incorporation

Márcia Braz, Maria Adelaide Almeida, Carmen Freire

The recurrent use of antibiotics, including in animal production, significantly increases the appearance of multiresistant bacterial strains, resistant to the most used antibiotics. These bacteria are responsible for foodborne illnesses which are a serious social problem. Consequently, it is imperative to develop new approaches to overcome this problem, namely in food industry, where an effective bacterial control is crucial to public health. Phages, virus that only infect bacteria, can be a suitable approach. Phage treatment has demonstrated to be an effective strategy to inactivate bacteria, with promising results and producing less resistant mutants than the common antibiotics. In order to protect them from environmental challenges and improve its efficacy, allowing slower and continuous release, the incorporation of phages in food packaging can be a more effective alternative. Thus, this project aims to establish a safe and effective protocol by producing new antibacterial biopolymeric films (e.g. cellulose, starch, chitosan and gelatin) incorporating phages for active food packaging in order to avoid food contamination and bacterial resistance. The most effective phages for food pathogens inactivation, and the best bio-based materials suitable for food packaging will be selected for films preparation and afterwards tested in food samples. It is expected that the implementation of this sustainable methodology for food packaging will prevent infectious diseases that may arise from eating contaminated food and will improve food security. Acknowledgments: Thanks are due to the University of Aveiro, to CESAM and CICECO research units, to FCT/MCTES for the financial support to CESAM (UIDP/50017/2020 + UIDB/50017/2020) and to CICECO (UIDB/50011/2020 + UIDP/50011/2020), through national funds and the co-funding by the FEDER, Operational Thematic Program for Competitiveness and Internationalization−COMPETE 2020, within the PT2020 Partnership Agreement. Thanks to FCT for the doctoral grant (2020.06571.BD).

Biology

Photodynamic inactivation for blood disinfection by immobilized photossensitizers

Lúcia Marciel, Maria Adelaide Almeida, Maria Amparo Faustino

Presently, there is no approved disinfection protocol for red blood cells (RBC) due to the collateral damages on the cells. Antimicrobial photodynamic therapy (aPDT) can be an alternative disinfection method with promising outcomes. This approach refers to the combination of light, dioxygen and a photosensitizer (PS) to induce microbial inactivation through the action of reactive oxygen species (ROS) produced under these conditions. Previous results of our group, using cationic porphyrin Tri-Py+-Me-PF [5-(pentafluorophenyl)-10,15,20-tris(1-methylpyridinium-4-yl)porphyrin tri-iodide] have demonstrated a remarkable antimicrobial activity for blood disinfection through the photodynamic process. In this study, it was evaluated the effectiveness of this cationic porphyrin immobilized on silica (Tri-Py+-Me-PF@SiO2) to disinfect blood components, since this immobilized porphyrin can be removed after treatment. For that, Staphylococcus aureus was selected as model of Gram positive bacteria. The Tri-Py+-Me-PF@SiO2 was effective in the photoinactivation of bacteria S. aureus at 80 µM, causing 4.3 log CFU mL-1 reduction of bacterial concentration in plasma. The effective reduction of S. aureus by the Tri-Py+-Me-PF@SiO2 provided promising indications towards its use to disinfect blood.

Biology

Upconversion nanoparticles for multimodal therapy of melanoma

Párástu Oskoei, Helena Oliveira, Ana Daniel-da-Silva, Maria Gaspar

The main goal of this work is to develop multimodal nanoplatforms for melanoma skin cancer treatment. The originality is centred on the development of nanoplatforms formed by UCNPs with a shell of mesoporous silica to allow the load of photosensitisers (PS) and anticancer drugs that, under NIR excitation will produce photodynamic therapy, release of anticancer drug (chemotherapy) and plasmonic hyperthermia (photothermal therapy). These nanoplatforms will then be tested in vitro with melanoma cell lines to: i) evaluate the effect of each nanoplatform on cell viability upon NIR irradiation; ii) evaluate the underlying cytotoxic mechanisms due to single and combined therapies in the different melanoma cells lines; iii) seek for synergistic effects of combined therapies. The therapeutic efficacy of the nanoplatforms will then be investigated in vivo in mice grafted with melanoma tumours to evaluate the efficacy of combined therapies in suppressing the tumour growth.

Biology

pErCEPT- Quantification of ConcEntration and time resolved Effects: towards an Adverse Outcome PaThway

Fátima Santos, Mónica J.B. Amorim, Cornelis A. M. van Gestel

An AOP translates a sequence of key events from a molecular-level initiating event and an ensuing cascade of steps to an adverse outcome with population-level significance and they are mostly qualitative. Toxicokinetics allows to translate an external concentration into an internal concentration over time, but this information is often lacking, and testing done with different organisms at different exposure conditions can lead to different effect concentrations. Internal concentrations as well as effect concentrations based in internal concentrations are a more appropriated method to describe toxicity. Toxicodynamics studies will translate the internal concentration into a phenotypic effect, which with toxicogenomics will allow for the construction of a Quantitative AOP. The study is being performed with the soil oligochaete Enchytraeus crypticus, an invertebrate and whole organism model for which a range of tools is available.

Biology

Ecotoxicological and biochemical risks of xenobiotics on the health status of marine aquatic environments

Andreia Filipa Mesquita, Fernando Gonçalves, Ana Marta Gonçalves

This project aims to address single and combined toxic and biochemical effects of pollutants in non-target marine species at different temperatures, with the selection of specific fatty acidsas biomarkers of stressors. Intergovernmental Panel about Climatic Changes (IPCC) report predicts a raise in temperature at the next 100 years with the major effects on estuarine and coastal environments. Metals and organic pollutants from anthropogenic activities cause the most damage to the ecosystem. In the last decades,was observed an increase on the pesticides applications, mainly in the Mediterranean zone due to the great need of food production related with exponential raise of mankind.This work pretends to support material to IPCC group and provide information to additional legislation and regulation of pollutants to protect water quality and minimize environmental damages and ultimately in humans,with significantly reduction of marine pollution. Finally, this proposal intends to model stressors' effects, based on biochemical analysis to predict populations and ecosystem vulnerability.

Biology

Application of the biorefinery concept in cyanobacterial blooms valuation

Inês Macário, Fernando Gonçalves, Joana Pereira, Sónia Ventura

Global warming and the anthropogenic degradation of water quality are pointed out as two major causes of the worldwide increase in frequency, severity, and duration of harmful algal blooms (HAB). Cyanobacteria, major constituents of HAB, can cause ecological, economic and human health problems, highlighting the urgency of improving HAB management strategies to ensure water quality. An innovative perspective for cyanobacteria management is the exploitation of their biotechnological potential. Several exploitable products produced by cyanobacteria (e.g. bioactive pigments, lipids, proteins, polysaccharides) present high market value. This work proposes the use of the biomass of cyanobacteria blooms, physically removed within traditional control actions, as a feedstock for future valuation, thus allying profit to water quality management. Therefore, its main goals are (i) the extraction of phycobiliproteins from laboratory cultures of common bloom-forming cyanobacteria; (ii) and the application of improved extraction processes to natural blooms. Following a concept of biorefinery, we intend to create a win-win relationship for water quality management jointly benefiting economic and environmental sustainability.

Biology

Effects of drought and contamination on freshwater macroinvertebrates

Joana Santos, Joana L. Pereira, Fernando J.M. Gonçalves, Bruno B. Castro

Climate change has been increasing the frequency and magnitude of droughts. These have serious repercussions on freshwater ecosystems, causing negative effects on the biodiversity they sustain. The occurrence of drought can also enhance the adverse effects of other impacts to these ecosystems, such as chemical contamination from agriculture. Thus, it is imperative to accurately assess the influence of drought in the response of freshwater communities. Given the high sensitivity and bioindicator value of benthic macroinvertebrates, their response along drought and contamination gradients is being studied in this work to assess whether their resilience to anthropic impacts is compromised or not by drought.

Biology

Ecotoxicological Effects of Emerging Contaminants in Lentic and Lotic Environments

Carlos Silva, Fernando J. Mendes Gonçalves, Joana Luísa Pereira, Nelson J. Cabaços Abrantes

The presence of emerging contaminants (EC) in the environment is a global and ever-growing concern, as many of these chemicals have deep relations with human activities (e.g., personal care products, pharmaceuticals, agriculture/industrial use). Their critical role in many human activities makes them both hard to replace/eliminate and guaranteed to enter wastewater treatment systems. Most wastewater treatment plants (WWTPs) were not designed to remove these contaminants, and so many of them will be released into recipient aquatic ecosystems along with the treated effluent. This makes WWTPs one of the major entry points for this type of contaminants, and their impact on the surrounding environment is of major interest.

In the present work, we selected 3 WWTPs of different sizes and levels of technology. For each one, we quantified EC, metals and pesticides, both in the treated effluent, and in sediment collected at different distances from the effluent discharge point. Additionally, at each sampling point, we sampled macroinvertebrates and periphyton to classify each site's ecological status and the responses of the benthic biota to the discharged effluent (and enclosed contaminants). Preliminary results confirmed the presence of EC in both effluent and sediment samples. Results also showed shifts in composition and abundance within macroinvertebrate and periphytic communities depending on the distance to the effluent entry point, which can be feasibly related to this point-source contaminant source.

Biology

Wild mammals in Portugal: their faecal microbiome as a source of pathogenic bacteria and antibacterial resistance.

Diana Dias, Sónia Mendo, Carlos Fonseca, Tânia Caetano

A high number of human infectious diseases arise from wildlife. These so called zoonoses are diseases transmitted between animals (including livestock, wildlife, and pets) and humans. In 2019 about 330 000 zoonoses were reported in EU by the EFSA and the ECDC. Shiga toxin-producing Escherichia coli (STEC) and Salmonella spp. infections were among the most reported causes of these zoonotic diseases. Additionally, since 2014, WHO considers antibiotic resistance (AMR) as an emerging global problem and a threat to the public health. However, wild animals are rarely exposed to antibiotics and therefore low levels of AMR are expected.

The main goal of this work is to characterize the AMR associated with wild mammals and its potential as reservoirs of pathogenic bacteria.

Faecal samples of mammal species with distinct phenology (wild boar, red deer, otter, and red fox) were collected from areas under distinct anthropogenic pressures, in Portugal. A total of 286 samples were processed. E. coli isolates (n=271) were subjected to AST and according to clinical breakpoints, 35% of them were resistant to at least one of the antibiotics tested. Enterococcus spp. isolates (n=244) were subjected to AST and 87% were resistant to at least one of the antibiotics tested. Cultivable STEC (n=52) were recovered from 17% (n=49) of the samples collected from the four mammals. 20 representative strains were selected for whole genome sequencing. For the assembly, annotation and genome characterization, multiple web-based bioinformatic tools were employed. The 20 strains belong mainly to serotype O27:H30 (n=15), followed by O146:H28 (n=2), O146:H21 (n=1), O178:H19 (n=1) and O103:H2 (n=1). In addition to stx, all strains encode several virulence factors, mainly toxins, adhesins, fimbrae, secretion systems, among others. We have isolated 11 Salmonella spp. strains from red fox, otter and red deer, which will be further sequenced and characterized. Our results show that wild mammals are reservoirs and possible sources of pathogens and AMR. Considering the “One Health” concept, it is crucial to establish local monitoring programs worldwide that benefit human, animal and environmental health.

Biology

Application of microorganisms to enhance maize sustainability and tolerance to drought

Carina Sá, Paulo Cardoso

Climate change and water availability can lead to drought situations, negatively influencing agriculture production worldwide. New techniques are needed to mitigate crop losses. The utilization of beneficial microorganisms such as plant growth-promoting bacteria (PGPB) is a way to improving soil conditions in areas under drought since the soil microbial communities play a relevant role in the growth and productivity of crops. The utilization of PGPB helps plants survive in stressed environments by promoting faster germination and development, increasing soil productivity in a sustainable and environmentally friendly manner. This Ph.D. intends to investigate the influence of PGPB in maize field development when subjected to drought. To increase the productivity of maize fields in drought situations and reduce the use of chemical fertilizers.

Biology

Developing epigenetic biomarkers of metal exposure in Daphnia

Guilherme Jeremias, Fernando Gonçalves, Joana Pereira, Jana Asselman

Freshwater ecosystems are largely endangered as a consequence of human activities. An efficient monitoring of metal contamination is an emerging concern and major challenge towards preventing freshwater biodiversity loss. Epigenetic mechanisms reflect the impact of environmental factors, including contaminants, on genes. Epigenetic modifications are highly responsive to stressors, which sets them as early-warning signals of environmental exposure and potential new molecular targets for biological remediation. The aim of this project is to develop and validate epigenetic biomarkers of metal exposure, using copper as a model contaminant and test stressor. Daphnia, a key organism in freshwater ecosystems widely considered in regulatory frameworks, will be tested under different scenarios of copper exposure (assessing the sensitivity and selectivity of epigenetic modifications). Individual, population, genetic and epigenetic endpoints will be assayed, and the holistic analysis of such results will represent a key validation step towards incorporating epigenetic biomarkers in the risk assessment of metals.

Biology

Environmental friendlier Plant Protection Products

Libânia Queirós, Joana L. Pereira, Patrícia Pereira, Fernando J. M. Gonçalves

The development of environmental friendlier Plant Protection Products (PPPs) is a current concern and a regulatory requirement.

The agrochemical industry has been invested in this regard, especially by the reformulation of available PPPs, both considering the PPP' composition (e.g. banned active ingredients and formulants have to be replaced) and the type of formulation (e.g. new types of formulations like microcapsules have been developed). However, two major problems have been identified in this context: (1) the mixture of active ingredients (a.i.) has not been tested in a systematic way, in order to identify effective combinations that may be less harmful to the environment; (2) the microencapsulation of the a.i. can pose a threat to soil biota, by compromising the recognition and avoidance behavior response.

This work addresses these two issues based on laboratorial assays with non-target and target indicators of selected PPPs, contributing to the development of greener formulations, while ensuring the maintenance of their effectiveness.

Biology

NoPlastic - Effects of nanoplastics on marine polychaetes: alone and in combination with trace elements

Marta Silva, Miguel Oliveira, Adília Pires, Dick Vethaak

Several environmental stressors have been identified as drivers of habitat change that may influence marine nearshore ecosystems. The problematic of the presence of plastic debris was raised for the first time in the 1970's but only recently was it recognized as a serious concern. Ocean currents and the slow degradation of large plastic items generating micro- and nanoplastics made plastic pollution ubiquitous. Recent studies analysed the effects of microplastics to aquatic organisms but few studies addressed the effects of nanoplastics.

The proposed research focuses on the effects of nanoplastics to polychaetes addressing nanoplastic behaviour and kinetics, acute and chronic effects. Assays will consider the effects when alone and combined with selected metals/metalloids.

Biology

Sustainable alternative aquafeeds for shrimp aquaculture

Davide Silva, Newton Gomes, Daniel Cleary, Rui Rocha

The main bottlenecks in aquaculture are the current dependency on fish meal and oil and lack of control over disease outbreaks. The use of fish meal and oil is one of the biggest arguments against aquaculture, challenging the reasoning behind the economic and environmental sustainability of the sector. On top of that, the need for antibiotics to treat and prevent diseases is both expensive and a public health concern as more evidence is found regarding the severe consequences of the unprecedented use of antibiotics. The framework for this task consists of insect-based diets (IBD), with Tenebrio molitor, as substitutes to fish meal and oil and microbiome modulators to control disease outbreaks in controlled aquaculture systems when rearing the whiteleg shrimp Litopenaeus vannamei.

We will use a multidisciplinary approach considering molecular biology, biochemistry and recent advances in experimental aquaculture. This work aims to define the optimal substitution level of fish meal and oil by IBD in shrimp and to modify the aquaculture microbiome to confer increased resistance to the most prevalent pathogens.

The major limitation to this project could be the inadequacy of IBD to meet the nutritional needs of shrimp. Nevertheless, previous studies have shown that IBD can be included in aquaculture diets with results comparable to conventional diets. This project will establish the first results of IBD in the whiteleg shrimp husbandry.

Biology

RARE OR THREATENED BOTANICAL SPECIES FROM THE BRAZILIAN CERRADO AND PROMOTION OF SCIENTIFIC CULTURE - the importance of botanical symbols as ambassadors of actions of dissemination / scientific dissemination and awareness / conservation / regional environ

Wilma Ferrari, Amadeu Soares, Marcos Antonio dos Santos Silva Ferraz, Fernando Correia

Scientific illustration of rare plants from the Cerrado biome in Goiás (Brazil), with a view to knowledge for preservation.

Biology

Biology and ecology of global changes

Challenges of artisanal fishing for the sustainability of fish stocks and the production chain in Pemba Moçambique.

Iracema Hussein, Fernando Morgado

Artisanal fishing has economic and social importance in Mozambique, being a tradition and a factor of regional identity that is part of the culture of the different regions and continues to supply local and regional markets. Artisanal fishing faces many challenges due to the lack of specific policies, strategies and scientific studies that can support and improve the organization and management of fishery resources, which contribute to the improvement of the livelihoods of fishing communities and the sustainability of fishery production. These problems stem from insufficient management and interconnection between harvesting, monitoring and marketing, resulting in non-systematic coordination between fisheries management efforts and the promotion of the development of the fishing sector, fundamental aspects for decision-making and definition of development strategies. The general lack of information about the historical evolution and current state of artisanal fishing, in its various aspects, biological and socioeconomic, is also a recurring problem that offers low political visibility to the sector and, therefore, helps to perpetuate deficit situations. Knowing the state of exploitation of artisanal fishing resources through historical analysis is, therefore, a fundamental tool to develop and validate a strategy for the sustainable management of fishing resources and artisanal fishing. Therefore, the statistical processing and treatment of the data will be carried out by applying descriptive and multivariate statistical methods to describe the nature of the data analyzed, explore the relationship of the data with the underlying population, create a model to summarize the understanding of how data relating to the underlying population, prove (or refute) the validity of the proposed model and use predictive analyzes to anticipate future trends, and do virtual Stock analysis to predict future catches through current stock trends.integrated into a perspective of seeking effective and efficient responses to the current and predictable challenges that artisanal fishing faces, the work will contribute to the improvement of scientific knowledge and will stimulate actions relevant to policies directly associated with the development of technological and economic solutions in artisanal fisheries in Cabo Delgado Province, Mozambique.

Keywords: Artisanal fishing, sustainability, virtual analysis, fishing resources, Cabo Delgado.

Biology and ecology of global changes

Sustainable Plant Protection Products - from conventional to novel practices

Catarina Malheiro, Susana Loureiro, Rui Morgado

Current global food demands pose challenges for sustainable agriculture, putting more pressure to ecosystems, alongside with services provided for society. Negligent use of pesticides and fertilizers are one of the major causes of ecosystem services deterioration. Therefore, it is necessary to improve and develop sustainable methods to achieve productivity demands and food security, without compromising environmental integrity and public health. Novel technologies (nanofertilizers, organic fertilizers, bio(nano)pesticides) have been receiving attention by plant nutrition/protection sectors due to their ability to achieve more efficient use of resources, by matching crop demands with controlled nutrient supply. Thus, it is a scientific challenge to verify if these agriproducts can increase agricultural productivity without compromising functional biodiversity. Looking at soils' functional biodiversity, using bioassays to assess these functions, is this PhD workplan baseline. The final output is to provide tools to evaluate sustainable agricultural practices and validate non-hazardousness of novel agriproducts that are being developed and produced.

Biology and ecology of global changes

Mechanisms constraining distribution and demographic responses to environmental change in migratory birds

Manuela Rodrigues, José A. Alves, Pedro M. Araújo, Jaime A. Ramos

Environmental changes are widespread and occurring at high rates. Climate and land use changes have direct impacts on species but also interact between them making their effects unpredictable and hard to disentangle. Species are responding to these changes in a variety of ways, with frequent alterations in distribution, phenology, or demography. However, these responses are not always enough to guarantee favourable population dynamics. In this work, I will study a migratory waterbird population, the Eurasian Spoonbill Platalea leucorodia leucorodia, which is currently expanding to identity the mechanisms driving expansion, and its consequences for breeding and demographic patterns. I will try to detangle the effects of several environmental drivers by: a) looking for the principal variables constraining the locations of new breeding colonies, b) investigating how phenology and breeding parameters relate with environmental variables, either in the same population breeding in different periods of the breeding season, or comparing with other Mediterranean population, c) study the spatial movement and dispersal of juveniles to ascertain each areas are playing important roles in the maintenance of the species in Portugal.

Biology and ecology of global changes

ARISE - Effects of free and encapsulated AnticanceR bIomoleculeS in zEbrafish

Fabiana Vieira, Susana Loureiro, João Tedim

In the last decades, pharmaceuticals and engineered nanomaterials (ENMs) have been considered emerging contaminants in aquatic environments. Antineoplastics are a group of pharmaceuticals commonly found in aquatic environments but their environmental impact is scarcely studied. Encapsulation of antineoplastics in non-toxic ENMs has been proposed for targeted drug delivery and decrease of side effects in humans. However, their effects in the ecosystem are poorly studied. Therefore, the need of an in-depth assessment of such effects induced by antineoplastics, in both free or nanostructured forms, is crucial to derive an accurate environmental risk assessment (ERA), by developing and/or adapting standardized testing procedures and improve risk-based

regulations. The present proposal aims at evaluating the effects of a state-of-the-art clinic antineoplastic, a novel compound with anticancer properties, and nano-drug delivery systems based on both anticancer compounds using the zebrafish model. Finally, the effects at different organizational levels will provide robust information for ERA.

Biology and ecology of global changes

Understand response mechanisms of two Pinus spp. to Brow-Spot Needle Blight Disease, caused by Lecanosticta acicola

Pedro Monteiro, Glória Pinto, Julio Casero, Luis Valledor

European forest trees healthiness is increasingly threatened by climate changes and by emerging pathogens such as Lecanostica acicola, the causal agent of Brown-spot Needle Blight disease (BSNB), being responsible of threatening Pinus spp. in European forestry, with potentially huge production and sustainability losses. The new EU plant health policy sets ambitious goals for protection of trees. The main mission of this project is to fill scientific knowledge gaps on mechanisms behind tree-pathogen interactions.

Using different Pinus spp. with a differential behaviour against BSNB, P. radiata being susceptible and P. pinea considered resistant, new experiments, through a multidisciplinary research platform (from physiology to 'omics), will be designed to support contingency plans (selection and early detection) and integrated pest management strategies to minimize damages. In this study, morphological (plant symptomology and height) and physiological (leaf-gas exchanges) parameters were accessed in order to understand host's response to L. acicola inoculation.

Biology and ecology of global changes

Response of Mytilus galloprovincialis and Hediste diversicolor to cosmetic chemicals, under climate change scenarios

Alessia Cuccaro, Rosa Freitas, Carlo Pretti

Personal care products (PCPs) like sunscreens and preservatives are frequently released into several marine matrices, representing significant environmental and ecotoxicological risks. Specifically, organic UV filters and parabens can be accumulated in sediment and in surface waters. Furthermore, the toxicity resulting from these emerging pollutants together with climate change in marine ecosystems has still received little attention up to date, despite it must be a priority in order to prevent a loss of biodiversity. During this first year of PhD, I focused my attention on investigation of combined impacts of one UV filter, namely 4-Methylbenzylidene camphor (4-MBC), and two of climate change related factors, namely salinity and temperature variations, on marine invertebrate species.

To achieve these objectives, the negative effects were assessed on the ragworm Hediste diversicolor and the mussel Mytilus galloprovincialis, using short and long-term exposures, evaluating them at molecular, cell and organism level for a deeper understanding of the responses induced in both species at different life stages and ecological levels.

Biology and ecology of global changes

Antineoplastics ecotoxicological effects in estuarine bivalve species under a changing environment

Vanessa Queirós, Rosa Freitas, Ulisses Azeiteiro, Carlos Barata

In marine ecosystems, organisms are currently exposed to a combination of stressors which create a range of associated environmental and ecotoxicological risks. Several stressors have been identified as key and emerging drivers of environmental change that may significantly influence marine coastal systems. These include alterations in the range and variability of physical and chemical conditions related to climate change and the magnitude and duration of exposure to emerging pollutants, namely antineoplastic drugs that present a worldwide application and increasing use in cancer treatments. However, the toxicity exerted in non-target organisms is almost unknown, especially when acting as mixtures and under predicted climate change scenarios. The present work will measure the impacts induced in two populations of the bivalve species Mytilus galloprovincialis and Ruditapes philippinarum, when chronically exposed to recently environmentally detected antineoplastic drugs (Cyclophosphamide, Ifosfamide, Cisplatin and 5-Fluorouracil), under actual and predicted climate change variables. The capacity of bivalves to recover their health status after exposure will also be evaluated.

A suite of early warning signals will be used, measuring the alterations induced at transcriptomic, biochemical and physiological levels.

Biology and ecology of global changes

Climatic niche dynamics and diversification in lizards and snakes

Matthew Moreira, Carlos Fonseca, Danny Rojas

What factors explain the variation in species richness throughout the globe? This is a central question in ecology and evolution. Diversification rates are ultimately responsible for the uneven distribution of species richness, and identifying factors that could explain the accumulation of species over time is important, especially under the current biodiversity crisis. Here, we address this issue using scaled reptiles (order Squamata). We aim to assess the effect of the evolution of the climatic niche and species traits (parthenogenetic reproduction and body temperatures) on diversification. Additionally, we will also test for habitat suitability under different future scenarios of climate change. Overall, these macroevolutionary and macroecological approaches will facilitate the understanding of the diversification of scaled reptiles, and ultimately how global changes impacts their diversification patterns.

Biology and ecology of global changes

Large carnivores in space and time – understanding wolf dynamics through non-invasive methodologies

Gonçalo Costa, Carlos Fonseca, Chris Sutherland

Large carnivores are among the most endangered species in our planet largely due to habitat fragmentation and human persecution. Successful carnivore conservation requires robust monitoring, although large home ranges and low densities make these species notoriously difficult to study. The recent development of renewable energy plants poses novel threats to these already threatened species, especially when built within large carnivore strongholds. While subject to impact assessments, these assessments typically lack the resources and spatiotemporal scale to adequately evaluate effects of construction on large carnivores, and therefore, fail to provide managers with robust conclusions about population level impacts. The goal of this PhD is to develop a standardized, systematic, replicable, cost-effective and robust approach to human infrastructure impact assessment on large carnivores, specifically the Iberian wolf, using camera trapping, non-invasive genetic data collection and state of the art statistical methods.

Biology and ecology of global changes

Marine macro-litter ingestion by deep diving cetaceans stranded in the Atlantic Iberian coast

Sara Sá, Dra. Catarina Eira, Dr. José Vingada, Dr. Amadeu Soares

Marine litter is a global and growing threat to marine habitats, wildlife and even human health. With respect to marine macro-litter, entanglement and ingestion are the primary forms of direct damage. In cetaceans, marine litter ingestion has been documented in 50 of the 86 existing species (58.1%). Beaked whales and sperm whales have been suggested to be especially vulnerable to marine debris ingestion, due to their highest ingestion rates among cetacean species. These deep divers live in oceanic waters and forage at great depths, particularly feeding on cephalopods, but also fish.

A total of 169 deep diving cetaceans stranded in Portugal and northern Spain (Atlantic Iberian coast) between 1990 and 2019. Among them, 59 individuals (34,9%) were necropsied by dedicated regional stranding networks. Approximately half of the necropsied individuals (45,8%) had ingested macro-litter, mostly plastic and fishing gear items. Considering deep divers presenting ingested macro-litter, 11.1% of the cases were considered lethal and 70.4% sublethal. Therefore, litter ingestion was considered a significant cause of death for deep diving cetaceans in the study area. Concerning Ziphiidae species, ingested macro-litter was found in 59.09% out of 22 Cuvier's beaked whales, in all three Blainville's beaked whales and in one True's beaked whale. Ingested macro-litter was also found in 50% out of ten sperm whales and in 27,78% out of 18 pygmy sperm whales.

We report high ingestion and mortality rates, which corroborate deep divers as highly susceptible to marine litter ingestion. This higher susceptibility among deep divers is probably primarily related with their benthonic feeding habits. Our results suggest that marine litter is a significant conservation threat to deep diving cetacean populations in deep-sea areas surrounding the Iberian Atlantic.

Biology and ecology of global changes

Preliminary POP evaluation in bottlenose dolphins stranded in the Portuguese coast

Ana Sofia Tavares, Catarina Eira, Amadeu Soares

Marine chemical pollution by Persistent Organic Pollutants (POPs), such as Polychlorinated biphenyls (PCBs) and Organochlorine pesticides (OCPs), has been a relevant topic on marine conservation since the 1960s. These compounds are lipophilic and their bioaccumulation on long-lived top predators, such as marine mammals, is particularly concerning. At elevated concentration levels, these traditional contaminants lead to several negative health effects in marine mammals including lower reproduction rate, lower immune response and increased probability of infectious disease, among others. Recent data suggest a decline of the coastal bottlenose dolphin (Tursiops truncatus) population off continental Portugal. This species is included in Annex II of the Habitats Directive (92/43/CEE), which stipulates that Marine Protected Areas should be defined to protect the population, and its threats and pressures must be monitored.

This preliminary study aimed at evaluating a suit of contaminants in bottlenose dolphins stranded along the Portuguese coast. Blubber samples (n=10) were collected by the stranding network team between 2010 and 2012, and later stored at the Marine Animal Tissue Bank (Ecomare). Samples were analysed by GC-ECD and GC–MS and 18 compounds were targeted (PCBs and OCPs). The most concerning concentrations were detected for total PCBs (29,7 µg/g), which is above the toxicity limit threshold for physiological effects on marine mammals. The 4,4´- DDE (4,89

µg/g) metabolite also presents high levels and p,p'-DDE/∑DDT > 0,6 indicates an earlier (not recent) higher environmental DDT availability. Several compounds were detected in higher concentrations in bottlenose dolphins than in common dolphins from the study area, probably as a result of higher contaminant intake from prey items.

A higher number of samples will be analysed in order to improve the ecotoxicological evaluation of bottlenose dolphins in the Portuguese coast and to assess possible effects of biological variables such as sex, age class and total length. This preliminary evaluation corroborates that traditional POP concentrations remain high in small cetaceans despite the legally enforced bans over the years.

Biology and ecology of global changes

Effects of trabectedin on the biomarker activity and microbial community structure of Danio rerio

Évila Damasceno, Amadeu Soares, Susana Loureiro, Leticia Lotufo

Currently, dozens of millions of patients treat cancer using cytotoxic drugs, that are highly toxic at low doses also to non-cancer cells, causing genotoxic, mutagenic, and carcinogenic effects. Besides, cytotoxic drugs are low degraded by conventional wastewater treatment plants, even using advanced treatment technologies. Thus, due to their high toxicity and environmental presence, cytotoxic drugs represent high environmental risk.

The aim of the current study is to assess the effects of trabectedin, a cytotoxic drug, to the zebrafish Danio rerio, through an integrative approach using endpoints that are disregarded by environmental risk assessment of pharmaceuticals. In order to address the objective, the present work will try to answer three questions: 1) Does trabectedin cause eco-, geno- and neurotoxicity to D. rerio?; 2) How does trabectedin affect the microbiome of D. rerio? and 3) Can trabectedin alter the metabolic pathways in D. rerio? Preliminary results using the zebrafish embryo, at a biochemical level, indicated that the exposure of D. rerio at 22.5 µg L-1 of trabectedin inhibited cholinesterase activity. Accordingly, behavior was altered with trabectedin increasing the total distance moved by larvae.

DNA damage was registered to D. rerio larvae at low concentrations of trabectedin (up to 1.7 µg L-1), however not significantly when compared to the control exposure. Furthermore, a preliminary study indicated that trabectedin seems to affect the structure of the bacterial community analyzed in the aquatic exposure medium of zebrafish larvae. Results showed the potential hazards associated with the presence of trabectedin in the environment at the range of µg L-1.

Biology and ecology of global changes

The ecotoxicological impacts induced by mixtures of emerging pollutants in marine species exposed to different climate change scenarios

Carla Leite, Rosa Freitas, Eduarda Pereira, Carlo Pretti

Several stressors have been identified as key and/or emerging drivers of environmental change that may significantly influence marine near-shore systems. These include the magnitude and duration of exposure to pollutants and alterations related to climate change. Still, the toxicity resulting from emerging pollutants such as surfactants and rare earth elements has received little attention, especially when acting as mixtures (also with classical pollutants) and particularly under predicted climate change scenarios. Since environmental stressors often do not act alone, this work will access the impacts when organisms are exposed to the combination of multiple stressors (pollutants, warming, salinity shifts) identifying early warning signals of environmental change. Ecotoxicological tools, including biochemical, histopathological and physiological markers, will assess the impacts induced in Mytilus galloprovincialis mussels and their recovery capacity. Obtained results will generate fundamental knowledge for the establishment of appropriate regulatory guidelines and practices to ensure the preservation and sustainability of biological resources.

Biology and ecology of global changes

Effects of fluoxetine exposure on Danio rerio: A biochemical and behavioral perspective

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Psychiatric drugs have been increasingly prescribed and, due to a reduced efficiency of waste water treatment plants their environmental levels have been increasing increased concentration in aquatic ecosystems. Fluoxetine (FLX) is a selective serotonin reuptake inhibitor (SSRI) detected

in the aquatic environment at concentrations in the range from ng/L to µg/L. In this work, the effects of FLX on juvenile zebrafish (Danio rerio) were evaluated assessing effects at biochemical (e.g. neurotransmission, energy metabolism and oxidative stress) and behavioural levels (locomotor activity, thigmotaxis, novel tank diving test, social behavior and mirror test) after 21 days exposure to 0.1, 1 and 10 µg/L, plus control. Overall, no significant effects on neurotransmission and energy metabolism were detected. For the antioxidant enzyme GPx, a decreased activity was observed at a highest concentration tested. FLX did not affect the juvenile's exploratory and social behavior, however the reaction to light and dark stimuli, as well as aggressive behavior was affected. Overall. effects increased with concentration increase. Based on the results obtained, the chronic exposure of juvenile zebrafish to FLX can change biochemical parameters and affect their behavior.

Biology and ecology of global changes

Soil fungi and their ecological services in agricultural soils

Maria Cristina Oliveira, Artur Alves, Miguel Â. Pinheiro de Carvalho

Soil fungi play a central role in agroecosystems. They can participate in organic matter decomposition, nutrient delivery for plant growth, plant protection or in interactions as pathogens or limiting factors with animal or plants. Despite the great importance of fungal diversity in agricultural ecosystems, only a few studies focus their roles and services. In this project, we intend to quantify fungal communities in agricultural soils and assess their functional genes to understand how fungal groups respond to different agro-systems and crop management. One of the hypotheses of this project is that "long-term monoculture and polyculture have different impacts on fungal communities". To test this hypothesis, soil samples were collected from 18 agro-systems: vineyards and banana plantations under monoculture and horticulture plantations under polyculture. DNA was extracted from theses samples and the abundance of fungi was determined through absolute quantification of the beta-actin gene in real time PCR. Results showed that highest values for fungal abundance were obtained for three agro-systems under polyculture. However, a kruskal test demonstrated that there is no significant difference between polyculture and monoculture. Therefore, this initial analysis does not support our hypothesis regarding fungal abundance. Nevertheless, it does not mean that there is no impact on fungal functional diversity. Therefore, it is important to analyse fungal functional groups, which is the next step of this study. Additionally, soil fungi were isolated from the 18 agro-systems, which resulted in a collection of 114 fungal isolates, preserved at 4ºC for further studies and at -80ºC for long-term preservation. Knowledge resulting from this project is expected to be of great help to understand and select appropriate cultural practices to maintain or increase soil quality and health.

Biology and ecology of global changes

Demographic processes of a long–distant migratory waterbird facing global changes

Hugo Ferreira, José A. Alves, Jocelyn Champagnon, Tamar Lok

Migration occurs as a response to seasonal changes and allows birds to exploit localised peaks in resources abundance. Current changes in land use and climate are causing substantial disturbance to the wintering and migration sites, ultimately affecting optimal decision-making process of migratory birds. But, the capacity of birds to respond to environmental changes remains little explored, owing to the difficulty of following individuals throughout the annual cycle.

This project proposes to understand the demographic processes affecting the population dynamics of a migratory bird species, the Eurasian Spoonbill, throughout its annual cycle and to provide a comprehensive overview of the mechanisms beyond the interindividual variation in migration tendencies. Due to its diverse wintering strategies, the growing population of spoonbill in the Camargue, provides a unique opportunity to compare the dynamics of the different migration strategies and to understand the capacity of this species in adjusting its migration patterns in response to ongoing environmental changes.

The analyses will be performed using a long-term colour-ring data set of more than 3000 chicks since 2008. I will analyse capture-resighting data, developing multi-event models. First, I will estimate the proportion of the population that follows each migratory strategy (East Atlantic Flyway, Mediterranean Basin, Resident) considering the variation in detection rates. Secondly, I will assess how annual survival varies in relation to wintering grounds. Finally, using 3G-loggers, I will assess the use of the Camargue complex landscape and its interaction with environmental changes. I will be able to identify which type of areas are being used to rest and forage by juveniles after fledging and assess how breeders obtain energy from this heterogenous landscape.

With this work I aim to not only identify key conservation needs of this emblematic species, but also gain a better understanding of migratory waterbirds and valuable insights for advocacy of conserving wetlands.

Biology and ecology of global changes

Emerging and classical pollutants in a changing environment: impacts to estuarine bivalves

Madalena Andrade, Rosa Freitas, Eduarda Pereira, Montserrat Solé

The usage of electrical products, including computers, smartphones, televisions, tablets and batteries among others, has been considerably increasing in the last few decades. As there is a faster development of these products, its life span is getting shorter leading to a growing amount of discarded products. In consequence, the treatment of the electrical waste produced is not being accompanied properly and due to a lack of recycling or bad management of this waste, chemical elements and compounds, as classic and rare-earth elements, can be released in the environment. In fact, these elements may accumulate in the environment, including in the water and in organisms. Nevertheless, the environmental risks resulting from these pollutants are almost unknown, especially considering marine systems, as estuaries, which may be challenged by foreseen climate changes, as the increasing temperature and shifts in the salinity of the water. Furthermore, the co-existence of mentioned pollutants may result in different effects, and so far, the combined effects of such mixtures have not been investigated. Bivalves as mussels and clams may be some of the organisms affected by these pollutants and climate change factors. Considering that these organisms are very socio-economically important, it is of great concern to study and investigate which effects the pollutants from electrical waste under climate change scenarios, may occur in the future of those. Furthermore, it is known that bivalves are good indicators of the quality of their environment as they can reflect site-specific conditions, especially due to their low mobility, filtration of the water-column to feed, and high abundance and widespread distribution. The main objective will be identifying early warning signals in the mussel Mytilus galloprovincialis, a worldwide considered good bioindicator, by measuring the alterations induced by WEEE (containing technological critical elements such as rare earth elements, e-waste elements), at biochemical and physiological levels, under actual and predicted climate change scenarios.

Biology and ecology of global changes

Effects of Ag2S NPs and AgNO3 on the soil bacterial community related to the nitrogen cycle

Sara Peixoto, Susana Loureiro, Isabel Henriques

The regulation of nitrogen cycle is mediated by the soil bacterial community, making this community a key functional player in this ecosystem. The disruption of this cycle might compromise the ecosystem functioning. Currently, the application of biosolids as fertilizers in agriculture can lead to the exposure of soil bacterial community to sulfidised silver nanoparticles (Ag2S NPs), generated during the wastewater treatment process.

Considering the crucial role of microorganisms on soil functions, we aimed to study the effects of 10 mg kg−1 soil of Ag2S NPs or AgNO3 on the soil bacterial community, including microorganisms related to the nitrogen cycle, using an indoor mesocosm (multi-species, with plants and invertebrates), during 28 days of exposure. For this, a metagenomic analysis was carried out, targeting the 16S rRNA gene. At day-28, the relative abundance of some genera related with the nitrogen cycle [nitrogen fixation (e.g., Candidatus Thiodiazotropha - decreased in AgNO3-treated soil and increased in Ag2S NPs-treated soil), nitrification (e.g., Fluviicola - decreased in AgNO3- and in Ag2S NPs- treated soil), and denitrification (e.g., Pseudomonas- increased in AgNO3-treated soil)] was influenced by silver exposure toward the control. Concerning silver forms, stronger effects were observed in AgNO3-treated soil, possibly due to the higher silver dissolution rate in porewater. The predicted functional analysis revealed that the relative abundance of genes related to nitrification was significantly affected by the Ag2S NPs and AgNO3 exposures. For instance, the relative abundance of amoA and nxrB gene was significantly reduced in the Ag2S NPs-treated soil (-16.1% and -11.2%, respectively) and significantly increased in AgNO3-treated soil (+10.1% and +23.4%, respectively) toward the control. To confirm this predicted result, the abundance of these genes was analysed by qPCR. It was observed that only the AgNO3-treated soil stimulated the relative abundance of ammonia-oxidizing (amoA gene; +62.4%toward Ag2S NPs) and nitrite-oxidizing (nxrB gene; +101.8% toward the control) bacteria.

Our study highlights that silver exposure may affect the composition (Ag2S NPs and AgNO3) and /or functioning (only AgNO3) of the soil ecosystems.

Biology and ecology of global changes

An overview on jellyfish aquaculture: for food, feed, pharma and fun

Inês M. Duarte, Sónia Cotrim Marques, Sérgio Miguel Leandro, Ricardo Calado

Interest on jellyfish research has significantly increased over the last two decades, mostly driven by the potential benefits of their high end uses. Recent efforts have been put forward towards the commercial use of scyphozoan jellyfish, although the pipeline leading to their full exploitation

is still at an early stage of development. Indeed, further research and several technical advances are still required to expand the use of these bioresources to a larger and more sustainable scale. The present work provides an overview on the state-of-the-art of culture systems for jellyfish throughout the different stages of their life cycle and describes several potential applications for jellyfish aquaculture, namely as food for human consumption, as feed for other organisms, as a source of bioactive compounds for pharmaceutical and other biotechnological applications, and for fun as marine ornamental species. Overall, this work aims to raise awareness on the relevance that jellyfish will likely play on the development of sustainable blue bioeconomy frameworks fostering a sustainable valorization of marine living resources.

Biology and ecology of global changes

The Meridional Harbour Porpoise in Portuguese Coastal Waters

Andreia T. Pereira, Dra. Catarina Eira, Dr. José Vingada, Dr. Amadeu Soares

The Harbour porpoise (Phocoena phocoena) population in Atlantic Iberian waters is declining towards unsustainable values and its extinction in Portuguese waters is foreseen within 2 decades unless Human-induced mortality decreases (particularly, mortality due to fisheries bycatch). In order to assess the harbour porpoise abundance and densities in Portuguese coastal waters, annual aerial campaigns were conducted during a 5-year period (2011 and 2015) from Caminha to Vila Real de Santo António. Distance sampling analyses estimated the highest harbour porpoise abundance (n=2550) in 2013 followed by a sharp decrease in 2014, with 1397 estimated individuals for the study area (CV=35.07 and CV =39.16, respectively). The density values ranged between 0.038 individuals km-2 in 2011 and 0.102 individuals km-2 in 2013. The overall estimated abundance was 1810 individuals whereas the density was 0.072 individuals km-2 (CV=16.81). Values indicate concerning annual fluctuations, which could be linked to mortality events. Actually, the number of harbour porpoise strandings in the Portuguese coast peaked in 2014, coinciding with the abrupt decrease in abundance and density. During the same period, higher probabilities of harbour porpoise occurrence were mapped through Kernel Density Estimates emphasizing a larger harbour porpoise hotspot situated in the Northern region of the Portuguese coast. This hotspot overlaps with the recently approved Maceda – Praia da Vieira NATURA 2000 site, where dedicated conservation measures (mainly bycatch mitigation) and systematic monitoring of the Portuguese porpoise population are urgently needed.

Biology and ecology of global changes

Distribution and persistence of carbapenem-resistant Enterobacteriaceae and carbapenemase genes in a highly polluted Portuguese river

Pedro Teixeira, Marta Tacão, Artur Silva, Isabel Henriques

Carbapenem-Resistant Enterobacteriaceae (CRE) infections are a major human health concern. The environment is gaining notoriety as an important component in the transmission of resistant bacteria, including CRE. Lis river (Central Portugal) is a highly polluted river where we previously identified CRE with high clinical relevance. In the present work, we accessed the distribution and temporal variation of CRE and carbapenemase-encoding genes in Lis River over a one-year period (2018-2019), taking also into account the potential influence of environmental factors and other antibiotic resistance genes (ARGs). Our findings demonstrated that Lis River is a heavily polluted river enclosing antibiotic resistant bacteria and ARGs, including CRE and carbapenemase-encoding genes, that are able to persist over a two-year period. We found that water quality parameters related to eutrophication levels, agriculture and animal land use are linked with the shaping of the river resistome composition, as well as human and swine faecal contamination. Additionally, wastewater treatment plants seem to be associated with higher concentrations of CRE and ARGs. Altogether, the contamination of Lis River with CRE constitutes a public health threat that needs to be addressed.

Biology and ecology of global changes

Microplastics: methodologies, sampling and ecotoxicity

Joana Prata, Teresa Rocha-Santos, Isabel Lopes, João P. da Costa

Microplastics are ubiquitous and persistent environmental contaminants which must be assessed for the impacts of environmental concentrations, especially in freshwater system. The objective of this work was to determine the impacts of microplastics in aquatic environments. The PhD was divided in three stages: 1) development of an easy, cheap, and reliable sampling procedure for microplastics, including fractions ≤100 µm; 2) use of the methods to sample a freshwater system under high anthropogenic pressures; 3) use of environmental concentrations in ecotoxicity assays using freshwater microalgae (Raphidocelis subcapitata) and zebrafish embryos (Danio rerio). The developed method was based on grab samples, removal of biogenic organic matter, and Nile Red staining to aid identification. Douro river near the city of Porto was sampled, revealing mean concentrations of 231 MP L-1. Based on this concentration, toxicity assays were conducted on freshwater organisms. Statistical

analysis is still being conducted to determine if environmentally relevant concentrations can produce adverse effects on organisms. Final integration of results will allow to determine if current microplastics concentrations produce harmful effects on exposed organisms.

Biology and ecology of global changes

Breaking down barriers in One Health: an integrative approach to parasitic diseases from Portugal to Africa

Ana Figueiredo, Atle Mysterud, Carlos Fonseca, Rita Tinoco Torres

Emerging infectious diseases (EIDs) are a worldwide research priority, with significant impacts on human and animal health. The ongoing anthropogenic influence on the ecosystems has triggered changes in land-use and climate, enhancing the introduction and spread of EIDs with zoonotic significance. Due to the complexity of interactions in the human-animal-environment interface, EIDs should be analysed following the One Health framework, addressing the importance of infectious and parasitic diseases (IPDs). Despite the considerable efforts to tackle this problem in developing countries, given their inadequate sanitary conditions and lower socioeconomic status, the need for further investigation in developed countries is rising due to the increased contact with wild and livestock reservoirs. This project aims to understand the role of wildlife as reservoirs and spreaders of IPDs for livestock and humans, comparing two contrasting socioeconomic and environmental scenarios: Portugal and Mozambique. A multidisciplinary approach, using DNA pathogen characterisation, connected with landscape ecology models and the establishment of high-risk infection areas, will allow the implementation of disease surveillance networks to prevent and control IPDs outbreaks. We expect an increased incidence and prevalence of infection in areas with higher wildlife density and where human-animal contacts are more frequent, with an aggravated scenario for Mozambique, due to the limited access to basic needs. Spatial differences in habitat structure, resource availability and urbanisation induce modifications in wildlife community structure, which is expected to increase contact and transmission risk. Implementing educational programs as a project outcome is proposed to decrease IPDs impacts on public and animal health.

Biology and ecology of global changes

Ascidians' ability to remove dissolved and particulate organic matter in an integrated multi-trophic aquaculture

Luisa Marques, Ana Isabel Lillebø, Ricardo Jorge Calado

Integrated Multi-Trophic Aquaculture (IMTA) has the potential to support aquaculture's growth, by culturing species with complementary ecosystem functions, allowing selected species to feed on available organic matter resulting from the use of formulated feeds. However, global climate changes for the oceans of tomorrow reveals that current selected species for IMTA may need revision, in order to cope with expected changes. Tunicates are filter feeders that feed on living and non-living organic material, by circulating seawater through the inhalant siphon and expelling the filtered water through the exhalent siphon. The cultured biomass of these invertebrates has shown great potential as an ingredient for fish feed due to their high protein content, as well as a source for important bioactive molecules with biomedical application. The main objective is to study and evaluate the potential of ascidians as extractive species in an IMTA system, occurring in Ria de Aveiro Lagoon.

Biology and ecology of global changes

Toxicologic effects in clams Ruditapes philippinarum exposed to remediated seawater by GO-PEI previously contaminated with Hg under warming scenario

Francesca Coppola, Rosa Freitas, Etelvina Figueira, Paula Marques

Advanced investigations on the use of graphene based nanomaterials have highlighted the capacity of these materials for wastewater treatment. Research on this topic revealed the efficiency of the nanocomposite synthetized by graphene oxide functionalized with polyethyleneimine (GO-PEI) to adsorb mercury (Hg) from contaminated seawater. However, information on the environmental risks associated with these approaches are still lacking. The focus of this study was to evaluate the effects of Hg in contaminated seawater and seawater remediated by GO-PEI, using the species Ruditapes philippinarum, maintained at two different warming scenarios: control (17 ºC) and increased (22 ºC) temperatures. The results obtained showed that organisms exposed to non-contaminated and remediated seawaters at control temperature presented similar biological patterns, with no considerable differences expressed in terms of biochemical and histopathological alterations. Moreover, the present findings revealed increased toxicological effects in clams under remediated seawater at 22 ºC in comparison to those subjected to the equivalent treatment at 17 ºC. These results confirm the capability of GO-PEI to adsorb Hg from water with no noticeable toxic effects, although temperature

could alter the responses of mussels to remediated seawater. These materials seem to be a promise eco-friendly approach to remediate wastewater, with low toxicity evidenced by remediated seawater and high regenerative capacity

of this nanomaterial, keeping its high removal performance after successive sorption-desorption cycles.

Biology and ecology of global changes

Biomedicine

Discovery of relevant molecular targets for neuronal regeneration

Patrícia Correia, Sandra Vieira, Frank Bosse, Fernando Ribeiro

Aims: Spinal cord injury (SCI) has devastating functional consequences to patients, but effective treatment still lacks. Sciatic nerve injury is a widely used model to discover new regeneration associated genes (RAGs). Some transcriptomic studies have already profiled spinal cord or sciatic nerve tissue after lesion to pave the discovery of new RAGs, but it is difficult to depict the neuronal-specific response from analyses of the entire tissue. Further, the first hours after injury are extremely important for the differential response observed between Peripheral Nervous Injury (PNI) and Spinal Cord Injury (SCI). As such, we started a non-targeted study to investigate the early differential transcriptomic alterations in the affected neuronal populations, and further performed in vitro proof-of-concept experiments for one differentially regulated gene after neuronal injury: MPP3.

Methods: Laser Capture Microdissection was used to dissect Rat Dorsal Root Ganglia (DRG) and Motor neurons after Peripheral Nerve Injury (PNI), and DRG and Pyramidal Cortex Neurons after SCI. mRNA sequencing was then used to provide insight into the transcriptome of the dissected neuronal populations and to search for highly relevant transcripts. We first investigated the endogenous distribution and expression of our targets in SH-SY5Y cells. In vitro studies to investigate neurite outgrowth capacity of the selected molecular target, were performed using SH-SY5Y neuroblastoma cells, differentiated with Retinoic Acid (RA) and Brain-derived neurotrophic factor (BDNF).

Results: Our gene enrichment analysis revealed that protein metabolism, and cytoskeleton organization pathways are some of the most regulated after PNI, while after SCI, laminin-binding and steroids maturation pathways are altered. Preliminary results show that MPP3 localizes in the nucleus, cytoplasm and membrane of SH-SY5Y cells.

Conclusions: Our non-targeted sequencing analysis allowed the identification of the most relevant pathways regulated in the acute phase of PNI and SCI. Further neuronal regeneration assays should be performed to prove the relevance of MPP3 after an injury. Overall, these results will impact the development of therapeutic strategies that may stimulate regeneration and repair after spinal cord injuries or related pathologies.

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Biomedicine

Characterization of protein aggregation profiles across the mammalian lifespan

Stephany Francisco, Manuel António da Silva Santos, Ana Raquel Soares

The aging process is a major risk factor for the development of several diseases especially neurodegenerative and metabolic disorders. As cells age, their ability to maintain protein homeostasis (proteostasis) progressively declines, leading to the accumulation of misfolded insoluble proteins, a phenomenon known as protein aggregation. The formation of insoluble protein aggregates has been established as a biological hallmark of several age-related diseases such as Alzheimer´s Disease and Type II Diabetes. It has been reported that proteins aggregate during healthy tissue aging yet, the altered biological mechanisms remain to be elucidated. The question is whether protein aggregation arises as a consequence of alterations in protein synthesis and degradation pathways during aging. We hypothesize that protein aggregation occurs during natural tissue aging due to an age-associated decline of proteostasis responses responsible for misfolded protein degradation. In this study, we performed SWATH mass spectrometry analysis to detect age-related shifts in protein expression that occur in young, middle-aged, old, and late old aged C57BL/6 mice. Detergent-soluble and insoluble proteins were isolated from total protein extracts of hepatic tissues to produce SWATH aging profiles for the identification of aggregation-prone proteins and their respective biological processes. Our results reveal that the proteins

present in insoluble liver aggregates in middle- and old aged mouse groups are largely involved in proteostasis-related degradation processes. In summary, we show for the first time that detergent-insoluble protein aggregates containing proteostasis-related components accumulate during natural aging in the mouse liver. Future studies will examine the eligibility of these proteins as targets for anti-aging therapeutic strategies.

Biomedicine

Analysis of protein aggregation in plasma of patient with heart failure with preserved ejection fraction

Marisol Gouveia, Fernando Ribeiro, Sandra Vieira, Mário Santos

Background: Heart failure with preserved ejection fraction (HFpEF) is responsible for substantial morbidity and mortality with a tremendous negative impact on the quality of life of HF patients. Currently, the available treatment options have limited success to improve prognosis. HFpEF and one of its most important predisposing conditions, hypertension, have been related to protein homeostasis deterioration and accumulation of misfolded protein aggregates.

Goal: To compare the level and content of different plasma circulating protein aggregates in HFpEF patients with the ones of subjects with hypertension and age-matched individuals. Methods: Thirty volunteers were recruited for this study; ten patients with HFpEF (72.9±3.7 years, LVEF: 59.9±5.9%), ten hypertensive subjects (72.1±2.8 years), and ten age-matched (69.0±2.7 years) individuals with cardiovascular risk factors. Clinical data, medication, anthropometrics, and cardiorespiratory fitness were recorded. Different types of protein aggregates were analysed, namely SDS-resistant aggregates (SRA), isolated by diagonal 2D electrophoresis; amyloid-like protein aggregates, assessed with thioflavin T staining; oligomeric and fibrillar species, detected by conformation-specific antibodies. Furthermore, isolated SRA were identified by mass spectrometry (MS). Results: HFpEF patients had similar plasma levels of SRA to those of age-matched individuals and 5% less SRA than adults with hypertension. Conversely, HFpEF patients present 10% more amyloids and fibrils and 15% more oligomers than the age-matched group, and 1.3%, 6% and 29% more amyloids, fibrils, and oligomers than the hypertension group, respectively. Of note, the hypertension group showed a slight increase (4 to 9%) of SRA, amyloids, and fibrils than the age-matched group. Identification of SRA by MS showed the presence of some aggregated proteins (e.g. haptoglobin, ceruloplasmin) involved in the maintenance of protein homeostasis.

Conclusion: Altogether, patients with HFpEF seem to contain an increased burden of some circulating protein aggregates, especially the toxic oligomeric species. Our preliminary results showed that the load and the profile of the aggregated proteins in the SRA are similar between groups. Thus, further studies are needed to understand the pathophysiological impact of the level and nature of protein aggregates in HF.

Biomedicine

Development of an epididymal organoid: an innovative strategy to study and modulate sperm function

Daniela Patrício, João F Mano, Margarida Fardilha

Development of an epididymal organoid: an innovative strategy to study and modulate sperm function

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Infertility is a disease from the reproductive system where ~50% of the cases are attributed to a male cause. The reduced sperm motility and poor interaction between sperm cells and the oocyte are the main causes of male infertility.

The spermatozoa are immotile after spermatogenesis, and it is through the journey in the epididymis that sperm maturation and motility acquisition occur. Although the importance of the epididymis on sperm maturation is accepted, the role of epididymis in sperm physiology is not fully understood. Moreover, it is known that PP1γ2 becomes inactive from the caput to the cauda and epididymal cells produce small vesicles (epididymosomes) that interact with the sperm membrane, becoming maturation.

The ability to mimic the epididymal environment in a laboratory setting, deepen the knowledge on sperm maturation is a challenge. Organoids' technology has been essential to model organogenesis, organ function, disease, or drug response in many tissues. On the male reproductive system, organoids and organotypic cultures have been developed for testis, but the epididymis remains almost forgotten.

To overcome the lack of knowledge on the epididymis role, we propose to develop, for the first time, a three-dimensional (3D) epididymis and blood-epidydimal barrier (BEB) organoid using hollow tubes technology. Hollow tubes were obtained by building-up multilayers of marine-derived polysaccharides (chitosan and alginate) on sacrificial tubular templates using layer-by-layer technology. Cells from bovine epididymis were isolated and it will be cultured in the inner side and the endothelial cells in the other side of the tube. The ability of the organoid to maturate sperm will be determined by access to sperm motility, morphology, and proteomic profile. A successful in vivo 3D epididymis and BEB organoid will allow as to study the epididymis-sperm interaction, unraveling possible targets to modulate sperm function.

Biomedicine

Combinatory use of RPA and PARP1 inhibitors in breast cancer cell lines

Soraia da Silva, Rui Gonçalo Martinho, Maria Carmo-Fonseca, José Bragança

Loss of tumor suppressor BRCA2 is strongly associated with breast cancer susceptibility. BRCA2 is essential for homologous recombination repair, a DNA repair pathway crucial for genomic stability.

Cells mutant for BRCA2 cannot repair DNA damage accurately through homologous recombination and consequently rely on alternative error-prone pathways for DNA repair. Thus, tumor cells mutant for BRCA2 become dependent on these alternative repair pathways for survival.

The most recent generation of therapies for breast cancer target PARP1, a protein essential to initiation of several DNA repair pathways. Inhibition of PARP1 compromises the DNA repair alternative pathways leading to tumor cells death.

Despite tumor cells mutant for BRCA2 being particularly sensitive to PARP1 inhibitors, tumor resistance has been frequently observed after long-term treatments.

This motivated us to explore a recently described RPA inhibitor (HAMNO) in breast cancer cell lines. RPA is a ssDNA-binding protein whose function is crucial for protecting ssDNA and avoiding the formation of secondary structures, being particularly important for DNA replication and DNA repair. Our hypothesis was that RPA inhibitor could be a potential targeted therapy for breast cancer.

We observed that chemical inhibition of RPA in the triple negative breast cancer cell line (MDAMB231) lead to a decreased viability of the tumors cells, being this cell line more sensitive to RPA inhibitor than other breast cancer cell line and a non-derived cancer cell line.

The combination of both inhibitors at high doses did not significantly enhanced loss of cancer viability when compared to individual treatments. However, and surprisingly, the combination of both inhibitors at low doses enhanced cancer cell viability when compared to individual HAMNO treatment, suggesting that PARP1 inhibitor suppressed the toxicity of RPA inhibitor.

In conclusion, the RPA inhibitor HAMNO has a therapeutic potential against triple negative breast cancer cells, but its combinatory use with other inhibitors should be carefully evaluated. This highlights the importance of carefully assessing the usefulness of the combinatory use of drugs, as unexpected biological responses can limit its efficiency or even be counter-productive.

Biomedicine

The role of NAD metabolism in neurons

Diogo Neves, Raquel Silva, Sandra Vieira, Brian James Goodfellow

Background:

Nicotinamide adenine dinucleotide (NAD) is critical for energy production and cell metabolism. It acts both as a coenzyme for oxidation-reduction reactions that culminate in ATP synthesis and as a substrate for NAD-consuming enzymes which include sirtuins, ADP-ribose transferases (ARTs), poly (ADP-ribose) polymerases (PARPs) and cADP-ribose synthases. NAD+ biosynthesis in mammals is supported by several precursors including quinolinic acid (QA), nicotinamide (NAM), nicotinic acid (NA) and nicotinamide riboside (NR) and their respective limiting enzymes QPRT, NAMPT, NAPRT and NMRK1/2. Some of these have been shown to be involved in tissue differentiation, an important process for regeneration.

Goals:

Our aim is to elucidate the roles of NA precursors and NAD biosynthetic enzymes during neuronal differentiation. For this, we are using SHSY5Y cells as a model.

Methods:

Briefly, to induce differentiation SH-SY5Y cells were exposed to retinoic acid (RA) for 5 days and to BDNF for 2 days. Cells were collected on days 5 and 7 of differentiation for Phase Contrast Microscopy and protein and RNA were extracted at the same timepoints for Western Blot and RT-PCR, respectively. Protein was also extracted to measure the Histone Deacetylase activity of the cells.

Results:

Our results show alterations in the expression of NAD biosynthetic enzymes during the course of RA-BDNF differentiation, particularly an increase in NAPRT protein expression levels after a 5-day treatment with RA. The inhibition of NAPRT enzymatic activity did not affect NAD consumption and the differentiation phenotype.

Conclusions:

NAPRT may have additional roles in neuronal differentiation beyond NAD production. It is crucial to understand the role of NAD precursors and other NAD enzymes in brain development to unveil their potential as therapeutic targets in regenerative medicine.

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Biomedicine

Identifying Novel Molecular Targets for Myotonic Dystrophy type 1 (DM1)

Dhvani Hitendra Kuntawala, Sandra Rebelo, Rui Vitorino

Identifying Novel Molecular Targets for Myotonic Dystrophy type 1

Myotonic Dystrophy type 1 (DM1) is a group of disorders that is caused by autosomal dominant genetic mutations. The affected gene is on the arm of the chromosome 19 and is named Myotonic Dystrophy Protein Kinase (DMPK). This disorder is caused by cytosine-thymine-guanine trinucleotide (CTG) expansion in the 3'untranslated region of the DMPK and involves myotonia and increasing muscle weakness. The disordered physiological pathways of DM1 remain evasive. Recently, patients with DM1 have shown metabolic alterations through clinical evidence, these alterations may be related to lipins. It is also important to know these molecular novel targets for this disease. Lastly, the US Food and Drug Administration has not approved any treatment for either myotonia or impaired walking movements.

There is little known about these novel molecular techniques or targets, thus our aim is to identify novel molecular targets for Myotonic Dystrophy type 1.

The first step will be performed by a bibliometrics analysis of metabolic alterations associated to Myotonic Dystrophy type 1 from databases such as Web of Science and Scopus using VOS viewer software, which shows scientific landscapes and related terms through a network and identify novel metabolic targets of DM1.

Biomedicine

Protein aggregation and the mouse aging transcriptome

Margarida Ferreira, Manuel A S Santos, Gabriela Moura

Aging is characterized by a time-dependent decline of physiological function and it is considered the major risk factor for a wide variety of diseases, ranging from cardiovascular, metabolic, respiratory, neurodegenerative and cancer diseases, among others. Among the many molecular hallmarks attributed to this process is the loss of proteostasis, characterized by the accumulation of toxic aggregates of misfolded proteins. This work aimed to evaluate the implications of physiological age-related transcriptional dysregulation to the loss of proteostasis, and its workflow comprised the re-analysis of a previously published and publicly available RNA-Seq dataset (GSE132040). We have combined differential gene expression with weighted gene correlation network analysis (WGCNA) to identify expression signatures accounting for the pairwise relations between gene expression profiles during aging in the brain, heart, liver, skeletal muscle, and pancreas of C57BL/6 mice. Functional enrichment analysis of the overlap of genes identified in both approaches showed that immunity-related responses, mitochondrial energy metabolism, tissue regeneration and detoxification are prominently altered in the brain, heart, muscle, and liver, respectively, reflecting an age-related global loss of tissue function. We also observed that aging triggered common biological processes in distinct tissues, particularly proteostasis-related pathways in the brain, muscle and liver, which we highlight as important features of murine tissue physiological aging. Our results will be

complemented with additional datasets produced in-house and integrated with proteomics and translatomics data to comprehensively provide insight into the aging phenotype and underlying biological mechanisms. This work was supported by the Portuguese Foundation for Science and Technology (FCT) (iBiMED: UID/BIM/04501/2020; MF: SFRH/BD/131736/2017; SF: SFRH/BD/148323/2019) and by European investment funds (FEDER) through COMPETE 2020 (GenomePT: POCI-01-0145-FEDER-022184; MEDPERSYST: POCI-01-0145-FEDER-016428-PAC; WISDOM: POCI-01-0145-FEDER-029843), and through CENTRO 2020 (pAGE Integrated project: Centro-01-0145-FEDER-000003; MEDISIS: CENTRO-01-0246-FEDER-000018).

Biomedicine

Unraveling the molecular mechanisms deregulated in response to LAP1 dysfunction

Cátia D. Pereira, Odete A. B. da Cruz e Silva, Philippe Chevalier, Sandra Rebelo

Lamina-associated polypeptide 1 (LAP1) is a ubiquitous transmembrane protein that resides in the nuclear envelope (NE), a highly organized double membrane that encloses the eukaryotic genome. In the last decade, several mutations in the human LAP1-encoding TOR1AIP1 gene were associated with clinical phenotypes that range from tissue-specific disorders (muscular dystrophy, cardiomyopathy and/or dystonia) to a multisystemic syndrome. Despite increasing evidence for the pathogenicity of LAP1 deficiency, the physiological functions of this protein remain poorly characterized. With the aim of getting new insights into LAP1's biological significance, patient-derived skin fibroblasts bearing the pathological LAP1 E482A missense mutation (reported in a case of severe dystonia, cerebellar atrophy and cardiomyopathy) and age-matched control skin fibroblasts were used to investigate the molecular consequences of human LAP1 depletion. Significant alterations in the protein levels and/or subcellular localization of LAP1, its known binding partners and other relevant NE/endoplasmic reticulum proteins were detected in patient-derived cells as compared to control ones. This work will permit to expand current knowledge on how LAP1 functionally operates, as well as to uncover which signaling pathways are deregulated in response to LAP1 dysfunction and, hence, could be targeted for the development of disease modifying therapies for LAP1-associated pathologies.

Biomedicine

Modulation of inflammation and the gut microbiota to improve ageing outcomes

Rita Melo-Miranda, Catarina Almeida, Rui Martinho, Ana Sousa

Ageing, one of the current main health challenges, is accompanied by numerous changes, including the development of a low level of chronic inflammation ("inflammageing") and dysbiosis of the gut microbiota. Yet, the contribution of these factors to the observed differences in frailty of the ageing population is unknown. Throughout ageing, microbiota dysbiosis and inflammageing influence each other in a positive feedback loop, whose onset remains unidentified.

This project proposes to investigate whether this feedback loop can be interrupted, and how this interruption can impact age-related signs.

To achieve this aim, we will use an animal model of ageing and reduce inflammation using compounds with anti-inflammatory properties. These animals will be further colonized with a labelled commensal strain of Escherichia coli. We will then explore the consequences of reducing inflammation by comparing the adaptive pattern of E. coli obtained in these conditions with the one obtained in the untreated control group. This will inform us on how reducing inflammation can impact microbiota dysbiosis and other age-related signs such as gut permeability, thus potentially improving the healthspan of the elderly population.

Biomedicine

Alzheimer's disease risk gene BIN1 specifically associates with common comorbidities

Maria Cachide, Odete A. B. da Cruz e Silva, Ana Gabriela Henriques

With the world's population rapidly aging, the prevalence of Alzheimer's Disease (AD) is increasing, representing one of the leading causes of morbidity and mortality worldwide. Several genes have been identified as presenting risk for distinct pathological conditions among them AD. Genome-wide association studies identified the Apolipoprotein E (APOE) as the highest risk factor for AD and the Bridging Integrator 1 (BIN1) as the second highest. For the latter, the single nucleotide polymorphism (SNP) rs744373 is the one most frequently associated with AD risk. Given that other pathologies are increasingly described as important AD risk factors, the associations to comorbidities that these two genes (APOE and BIN1 rs744373 variant) confer, were addressed in a primary care-based study group, denoted pcb-Cohort. Regarding BIN1, data from the pcb-Cohort shows that with respect to dyslipidemia (DYS) cases, carriers of BIN1 risk allele G positive (rs744373 variant) were at a significantly lower

risk. Furthermore, correlations were evident for respiratory conditions (RESP); significant differences were seen for BIN1 G non-carriers. Bivariate and Multivariate analyses revealed that BIN1 G allele carriers were more likely to exhibit Diabetes Mellitus (DM) as determined by the latter analyses. Taken together, the data here presented, clearly shows that BIN1 rs744373, one of top genetic risk factors for AD, also associates with other diseases, namely DYS, RESP and DM.

Biomedicine

The influence of insulin resistance in Alzheimer's disease

Steven Alves, Odete A. B. da Cruz e Silva

Growing evidence show that brain insulin resistance is an early molecular pathologic event that lead to the development of Alzheimer's disease. Using SH-SY5Y cells as a neuron-like model, we were able to successfully induce insulin resistance. Interestingly, we observed that 24h treatment with Aβ peptide decreased the intracellular levels of insulin receptor alpha subunit, possibly leading to insulin resistance. Moreover, 24h of Aβ caused an accumulation of intracellular APP, which was attenuated in insulin resistant cells. Furthermore, insulin resistant cells showed an unexpected decrease in molecular weight, that may be explained by changes in post-translational modifications.

Insulin resistance appear to have a direct impact on key Alzheimer's disease proteins, however further work is necessary.

Biomedicine

Synaptic mechanisms regulating Alzheimer's disease progression

Marta Dias, Ramiro Almeida

Retrograde trans-synaptic signaling from post to pre-synaptic neurons has been shown to be a mechanism of neuronal spreading of several neurodegenerative diseases, including Alzheimer's Disease (AD). However, in AD, it is not well understood how local exposure to amyloid-β oligomers (AβO) in axons can trigger a retrograde cellular response and, as a consequence, trans-synaptic signaling. In this study, we want to unravel if and how axonal degeneration and cell death can be triggered by local treatment of distal axons with AβO, as well as how synapses are affected. To attain this goal, we cultured E18 rat primary hippocampal neurons in microfluidic chambers that allow a specific stimulation of axons and the assessment of its impact in neuronal function and viability. Our results show that local application of AβO to the axonal compartment of the microfluidic chambers decreases the number of synaptic clusters, followed by an increase in axonal degeneration and a decrease in neuronal viability. These results indicate that a localized stimulus in axons induces synaptic dysfunction and triggers neuronal degeneration and cell death. Our observations will clarify how an increase in protein aggregation in a neuronal subdomain triggers a cellular response that spreads from distal axons to the cell body, which are often localized far apart in the central nervous system and might explain the spread of the aggregation-based diseases between different brain regions.

Key words: Alzheimer's Disease, axonal degeneration, synaptic dysfunction, retrograde transport, amyloid-β oligomers.

Biomedicine

Plasmacytoid dendritic cell activation during ER stress

Beatriz Ferreira, Catarina Almeida, Iola Duarte, Philippe Pierre

The accumulation of misfolded proteins triggers the activation of the unfolded protein response (UPR) in order to restore endoplasmic reticulum (ER) homeostasis. ER stress can lead to the activation of the innate immune system and consequent production of pro-inflammatory cytokines, even in the absence of an infection. Plasmacytoid dendritic cells (pDC) are specialized in rapidly producing high amounts of type I interferon (IFN-I), therefore presenting a large ER. As a consequence, these cells are important players in anti-viral responses, being also involved in autoimmunity. In fact, pDC are key in systemic sclerosis-associated fibrosis. Interestingly, ER stress has been associated with this pathology. Here, we unravelled the impact of two UPR pathways on pDC activation – double-stranded RNA-activated protein kinase (PKR)-like endoplasmic reticulum kinase (PERK) and inositol-requiring enzyme 1 (IRE1). Combining the use of pharmacological stimulators and inhibitors of ER stress, as well as genetic engineering to delete key UPR genes, we found that triggering ER stress with subtilase cytotoxin (SubAB) promotes pDC activation in a PERK dependent manner. Currently, we are dissecting the molecular mechanisms leading to pDC activation and consequent IFN-I production triggered by ER stress. With this work, we expect to contribute to the development of new therapeutic strategies for autoimmune diseases such as systemic sclerosis.

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Biomedicine

Metabolic-driven histone marks remodeling during transdifferentiation of fibroblasts into induced cardiac-like myocytes (iCLMs)

Magda Correia, Bruno Bernardes de Jesus, Sandrina Nóbrega-Pereira

Cardiovascular diseases (CVD) are the leading cause of mortality in developed countries. CVD pathologies are typically characterized by the loss of cardiomyocytes which leads to heart failure. Whereas following injury the capacity for regeneration of adult mammalian heart is limited, the neonatal heart is capable of substantial regeneration, but this capacity is lost at postnatal stages. Interestingly, this is accompanied by a shift in the metabolic pathways and energetic fuels preferentially used by cardiomyocytes from embryonic glucose-driven anaerobic glycolysis to adult oxidation of substrates in the mitochondria.

Cardiac fibroblasts (CFs) contribute to scar formation after cardiac injury in the human heart. The use of direct reprogramming of resident CFs by cardiogenic transcription factors (TFs) into induced cardiac-like myocytes (iCLMs) has emerged as an attractive strategy. In this approach, a specific combination of TFs, Mef2c, Gata4, and Tbx5 (MGT), can create functional beating cardiomyocytes directly from mouse postnatal fibroblasts in vitro and in vivo. In direct cardiac conversion, several epigenetic barriers need to be overcame to allow the switch from fibroblast to cardiac transcriptional program with, for instance, reduction of H3K27me3 marks in MGT-induced cardiomyocytes.

Metabolites are key players in genetic and epigenetic expression programs, as the regulation of histone marks by serving as substrates or cofactors for chromatin-modifying enzymes with, for instance, acetylation and demethylation of histones relying in the availability of acetyl-CoA and the Krebs cycle-derived a-ketoglutarate, respectively. Importantly, lipids and glucose are important sources of acetyl-CoA and have been implicated in histone acetylation landscape transitions driving skeletal muscle stem cell fate and regeneration. With this project we intend to explore the impact of age and nutritional availability in the genome-wide histone acetylation and methylation landscape transitions driving transdifferentiation of fibroblasts into iCLMs in vitro. High-throughput histone proteomic analysis have the potential to illuminate new epigenetic players in cell lineage conversion, guiding to potential axis enhancers or reducers of transdifferentiation. Our preliminary data suggests metabolic cues in the retroviral-induced MGT transduction of MEFs, raising the possibility of metabolite-driven conversion of MEFs into iCLMs.

Biomedicine

Exploring the peroxisome-dependent antiviral immune signaling

Bruno Ramos, Daniela Ribeiro, Jonathan Kagan

Peroxisomes are ubiquitous and essential organelles with a critical role in a variety of metabolic processes. Importantly, in concert with mitochondria, peroxisomes act as signalling platforms in antiviral defence. In this project I will perform a detailed study of the peroxisome-dependent antiviral signaling mechanisms. I aim to completely unravel the specific components of the signaling pathway and will also pinpoint the viral infection steps that trigger its activation as well as the event that leads the switch to the mitochondrial signaling.

My findings will be of great biological relevance and may contribute for the identification of targets for the development of novel broad-spectrum antiviral therapies.

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Biomedicine

NAPRT gene (de)regulation in cancer and beyond

Sara Pereira, Raquel M. Silva, José Luís Oliveira

Nicotinamide adenine nucleotide (NAD) has an essential role in the normal physiology of the cell by participating in processes such as energy metabolism, DNA repair, cell proliferation and survival. Consequently, it is involved in innumerous pathological processes, including carcinogenesis, and for that reason NAD metabolism has become an attractive target to the development of anti-cancer therapies. Nicotinate phosphoribosyltransferase (NAPRT) is one of the key enzymes responsible for NAD synthesis, that has gained interest in the last decade, due to its potential role in cancer treatment. The research developed during this PhD was focused on the study of the NAPRT gene.

First, a survey on NAPRT expression regulatory mechanisms, namely transcription factors, RNA binding proteins and microRNAs led us to suggest that NAPRT might be involved in functions beyond NAD metabolism. A special attention was given to the study of expression quantitative trait loci (eQTLs), a study that was expanded to the genome-wide level. Next, we performed a comprehensive description of NAPRT alterations in cancer, including point mutations, copy number variations and methylation, which emphasized that NAPRT variation might be tissue specific. At last, we proposed a new methodology to obtain a gene expression signature and found differentially expressed genes between NAPRT-high and NAPRT-low expression groups, in several tissues, involving both normal and tumor samples.

Additionally, we performed a global study of the NAD interactome that resulted in the identification of potential NAD-binding proteins.

Altogether, the results of this work have contributed to a deeper knowledge on NAPRT gene that can be used to improve its application in personalized therapeutic approaches and has expanded its functions beyond cancer.

Biomedicine

The role of protein mistranslation in fungal pathogenesis

Carla Oliveira, Manuel Santos, Ana Rita Bezerra

The role of protein mistranslation in fungal pathogenesis

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The complex biology of the human pathogen Candida albicans is reflected in its ability to proliferate in numerous body sites, adapt to drastic changes in the environment, and grow in yeast, pseudo-hyphal and hyphal forms. Much has been learnt in recent years about the relevance of this phenotypic plasticity, but the mechanisms that support it are still not fully understood. C. albicans translates the CUG codon as both leucine (Leu) (~3%) and serine (Ser) (~97%) in normal growth conditions, but Ser/Leu levels change in response to stress. Previous studies demonstrated that atypical translation of the CUG codon (mistranslation) is a source of unexpected morphological and genomic diversity, but its role in C. albicans pathogenesis remains unknown. In this work we investigate the functional role of the proteome diversity produced by CUG mistranslation and its impact on genome evolution. Here, we show that increased Leu incorporation at CUG sites induces hyphae formation in media where C. albicans normally grows in the yeast form. The data show that increasing Leu at CUG sites triggers the degradation of the hyphal repressor Nrg1, allowing the expression of hyphal genes. Since filamentation is important for host tissue invasion, this work shows how mistranslation of a single codon may play a critical role on pathogenesis. Studies are underway to understand how mistranslation induce genomic diversity. We expect that the gene variants uncovered in our study can provide a foundation to understand the role of CUG mistranslation on C. albicans adaptation to diverse host niches.

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Biomedicine

Unravelling the roles of proteotoxic stress on genome diversification and disease

Inês Sousa, Manuel Santos, Gabriela Moura

The association of protein aggregation with aging and several neurodegenerative diseases suggests that gradual proteome aggregation and the collapse of the proteostasis network may accelerate aging and the development of aging related diseases. Given that the effects of proteotoxic stress triggered by the accumulation of aggregated proteins, in the cell are complex and still unknown, the way this accelerates aging and leads to the onset of disease are significant scientific challenges. Previous studies on bacteria and yeast have shown that the induction of proteotoxic

stress increases the mutation rate in the genome. However, little is known about this association between proteotoxic stress and the accumulation of DNA mutations. Thus, the goal of this project is to assess whether protein aggregation and proteotoxic stress destabilize the genome and increase mutation rate through the combination of experimental evolution of humanized yeast, and NGS to evaluate the long-term effects.

Biomedicine

The role of Metal Induced Protein Phosphorylation in neuropathology related protein aggregation

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Metal ions play essential roles in the brain, and anomalous levels can contribute to neuronal dysfunction across different neurodegenerative diseases, such as Alzheimer´s disease (AD).

Senile plaques (SPs) and neurofibrillary tangles (NFTs) are histological AD hallmarks, resulting from extracellular Aβ1-42 deposition and intracellular Tau phosphorylation, respectively. In AD, protein phosphatase 1 (PP1) and PP2A activity is reduced by 30% and 66% respectively, resulting in Tau hyperphosphorylation and Aβ aggregation. Moreover, previous studies concluded that Protein Phosphatase 1 and 2 (PP1/2) activity diminished after exposure to different metals.

Protein phosphatases are involved in dephosphorylation of several proteins involved in different biological processes, and their activity can be regulated by several Phosphatase Interacting Proteins (PIPs), which determine their subcellular localization as well as substrate specificity and that can also be regulated by metals. We hypothesise that modulating the levels of metals interacting with protein phosphatases and PIPs impacts protein aggregation-related disease phenotypes.

Our results show that protein aggregation decreases upon treatment with Zn2+ and Nanoparticles of Zinc Oxide (NPs ZnO), suggesting a possible neuroprotective effect of these metals. Moreover, the protein aggregates induced by metals are distinct from aggregates produced when mimicking AD with aggregated Aβ1-42 peptide. On the other hand, metals such as Al3+ or Fe3+ induce alterations in APP processing and Tau phosphorylation as observed in AD, suggesting a neurotoxic effect of these trivalent cations. Currently, the effect of metals in Aβ-induced aggregation and AD phenotype is being evaluated. Interestingly, metals promote a decrease in PP1 activity, PP2A levels increase after metal exposure. These results reinforce the notion that metals promote alteration in PPs' activity and consequently interfere with several biological processes. Hence, a bioinformatic analysis was performed to determine which PIPs are regulated by metals and relevant to AD. A set of 104 metal binding PIPs that also bind PPs and are relevant to AD were identified. The most relevant PIPs to AD will be selected to explore the effects of metals in these proteins and consequently in AD. Thus, one can target PIPs given that they provide a specific target, with respect to cell type and subcellular localization, thus limiting toxic side effects.

Finally, successful conclusion of this project will allow the development of neuroprotective strategies for AD involving metals, protein phosphatases and PIPs.

Biomedicine

Elucidating the role of tRNA-modifications in Human diseases

Ana Poim, Manuel Santos, Ana Rita Bezerra

Deregulation of tRNA-modifications have been associated with several diseases including cancer, ALS and some metabolic disorders. However, we do not yet understand how these modifications influence the pathogenesis of diseases. Here, we will study how tRNA hypomodification influences the accumulation of genome adaptive mutations and how can affects the levels of mistranslation in the proteome. We have experimental evidence indicating that tRNA deregulation alters the genome: mistranslation yeast accumulates compensatory mutations very fast; mistranslating cells acquire drug resistance by deregulating protein expression and accumulating genomic compensatory mutations. Published results from yeast tRNA-modifying-enzyme gene-knockout strains showed an increase in protein aggregation and mistranslation and sharp decrease in cellular levels of specific tRNAs. We suspect that cells can resolve tRNA-hypomodification and protein aggregation induced stress through the accumulation of compensatory genomic mutations. With it, we will better understand this phenomenon and it should provide us new insights on how tRNA-hypomodification may cause human diseases.

Biomedicine

Defining the meiotic roles of chromatin remodelling proteins

Brigite Cabrita, Rui Gonçalo Martinho, Helder Maiato, Susana Chuva Lopes

Meiosis is essential for gamete production, ensuring maintenance of ploidy after fertilization and the generating genetic diversity. Chromosomes suffer major structural changes for homologous chromosome pairing, alignment and meiotic recombination.

The synaptonemal complex (SC) is a protein structure that forms between homologous chromosomes and is crucial for synapsis formation and meiotic recombination, holding them together along their length. Defects in the SC are associated with chromosome segregation defects, which are the primary cause of birth defects, miscarriages, and human infertility.

Chromosomal architecture is affected by histone post-translational modifications and by distinct chromatin remodelling proteins. We and others have identified the histone demethylase Kdm5 and the polycomb protein Sfmbt as being crucial for meiotic chromatin architecture and SC dynamics during prophase I. The MAIN AIM of this project is to molecularly define the role of Kdm5 and Sfmbt in the regulation of SC dynamics, recombination and female fertility.

Biomedicine

Deciphering the interplay between autophagy and Toll-like receptor 9 and 7 activation

Paulo Antas, Evelina Gatti, Catarina Almeida

Plasmacytoid dendritic cells (pDCs), a particular population of dendritic cells (DCs), express Toll-like receptors (TLRs) that enable them to recognize pathogens and trigger an immune response. When activated, pDCs secrete pro-inflammatory cytokines and have the unique ability to produce massive amounts of type-I interferon, which makes them an essential component of antiviral immunity, while also being important contributors to the pathogenesis of some autoimmune diseases. However, the exact mechanisms regulating pDCs function are not yet fully understood. Autophagy is a process responsible for degradation of cellular components and microbes in lysosomes, helping in the maintenance of intracellular homeostasis. In addition, autophagy was recently identified as a regulatory element of innate immunity. Thus, our goal is to investigate the interplay between autophagy and TLR activation, deciphering the signaling pathways involved as well as the relevance of this link to pDCs activity. In this work, we stimulated a human pDC cell line (CAL-1) with a TLR7 ligand, in the presence or absence of the autophagy inhibitors spautin-1 and Vps34-IN1. It was found that both inhibitors induced a slight increase in TNF-α production, which was further promoted with TLR7 activation. Interestingly, Vps34-IN1 but not spautin induced IFN-β mRNA expression. Presently, we are dissecting the molecular players regulating the autophagy – innate activation crosstalk. This functional intersection between autophagy and TLR signaling in human pDCs, may in the future be explored for development of novel therapies to treat autoimmune diseases.

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Biomedicine

Novel exosomal Aβ-binding proteins as biomarker candidates for Alzheimer's disease

Tânia Martins, Prof. Dra. Ana Gabriela Henriques, Prof. Dr. Jens Wilftang

Alzheimer's disease (AD) neuropathological alterations begin around 15 years before clinical symptoms´ manifestation, highlighting the need to identify new molecular signatures that can assist in early and differential diagnosis. Exosomes are small extracellular vesicles (EVs) than can be easily obtained from the peripheral biofluids and since their cargo can reflect disease stages, it enhances their value as important source of biomarkers for AD. In this PhD project, bioinformatic analysis of exosomal proteomes databases and Mass spectrometry converged in the identification of novel putative exosomal biomarkers for AD. These were reported to bind the Abeta peptide, which is present in senile plaques, one of the AD hallmarks. The levels of biomarker candidates were then validated in serum-derived exosomes. The work carried out gives a relevant contribution to the development of potential blood-based tools for dementia/AD diagnosis.

Biomedicine

Microbial shifts during an acute exacerbation of chronic obstructive pulmonary disease

Sara Dias, Catarina Almeida, Alda Marques, Ana Margarida Sousa

Chronic obstructive respiratory disease (COPD) is the 3rd leading cause of death worldwide and is associated with high disease and economic burden. People with COPD harbor different microbiota profiles in comparison to healthy individuals, and their dynamics shift within different disease stages. Acute exacerbations of COPD (AECOPD) are highly heterogenous events of symptoms worsening that play a pivotal role in the disease trajectory. Viral and bacterial infections have been pointed as the main cause of AECOPD. Nevertheless, these pathobionts have also been identified in COPD stable state (stCOPD) making a simple causal relationship unlikely.

For that reason, we queried the role of airway microbiota in the onset of an AECOPD event. We hypothesized that shifts in the whole microbial community concomitant with intra-species diversification and strain-specific immune response could trigger an AECOPD.

To test our hypothesis, we followed the disease course of a patient with COPD (♂, 77y, GOLD III, FEV1pp: 43, GOLD B) for 7 months, comprising stCOPD and AECOPD states. Sociodemographic, anthropometric, clinical data and saliva samples were collected monthly during stCOPD, while in AECOPD the patient was clinically evaluated twice (onset and after 21 days) and saliva samples were collected every two days. 16S rRNA sequencing was performed to establish microbiota profiles of stable and AECOPD periods. This gave us insight about species of interest for bacterial isolation, to understand differences between stCOPD and AECOPD. Optimization of bacterial culture conditions and isolation of strains/clones of interest followed by whole genome sequencing are being performed to evaluate intra-species diversification. At the same time, a deeper access of whole microbiome shifts, including viral and fungal descriptions, is being obtained by shotgun metagenomics.

Till the moment we have observed a microbiota composition shift towards increased frequencies of Proteobacteria, particularly Haemophilus genus (potentially pathogenic facultative anaerobe), and decreased frequencies of Prevotella genus (mainly a commensal anaerobe of airways) within the beginning of AECOPD. No significant differences were observed in alpha diversity between periods of stability and exacerbation. Moreover, we have established the conditions for isolation of Haemophilus and have isolated Haemophilus parainfluenzae and Haemophilus influenzae from patient's saliva samples.

Exploration of data is still ongoing, but by providing a detailed description of microbial shifts during the onset of an exacerbation along with clinical assessment, we believe we can contribute to understand the role of airway microbiota in COPD exacerbations.

Biomedicine

Impact of tRNA modifications for pathogenicity and host responses upon influenza A virus infection

Diana Ribeiro, Ana Raquel Soares, Daniela Ribeiro

The Influenza A virus (IAV) is responsible for the main seasonal respiratory epidemics in humans. Its ability for genetic reassortments and rapid antigenic evolution hinder vaccine development and leads to occasional lethal pandemic infections. Hence, IAV becomes quickly resistant to current therapies, stressing the importance of discovering new antiviral treatments. IAV is completely dependent on the host cell translation machinery to synthesize its own proteins. Transfer RNAs (tRNAs) are the effector molecules of translation that recognize mRNA codons through their anticodons to decode the 20 standard amino acids. Generally, host codon usage reflects cellular tRNA levels, however the IAV RNA genome is highly skewed towards A/U-ending codons, while the human genome is biased towards C/G- ending codons. Nevertheless, IAV is still able to efficiently hijack the human translation machinery and select specific host tRNAs to optimize viral translation. To ensure translation efficiency and fidelity tRNAs are extensively modified post-transcriptionally by numerous tRNA modifying enzymes (tRNAMES). tRNA modification levels can change quickly in response to an external stimulus and genome recoding by coordinated alterations of tRNA modifications induces optimal translation of transcripts in response to cellular stress. As viral infections are sources of host cellular stress, changes in the host tRNA epitranscriptome are expected to guarantee the effectiveness of the viral genome translation. We propose to elucidate how IAV exploits the host tRNA epitranscriptome to facilitate viral propagation and evade host antiviral responses. To that end, we profiled the gene expression of all human tRNAMES in UniProt and Modomics involved in tRNA modifications using the Arraystar NuRNATM Human tRNA Modification Enzymes PCR Array to identify which tRNAMES were deregulated upon IAV infection. We found that several tRNAMES were deregulated at two-, four- and eight-hours post-infection, most of which catalyzing modifications at the tRNA anticodon loop region. Since tRNA modifications occurring at the wobble position directly affect the decoding of viral A-ending skewed codons, we selected ELP3 for further studies. We confirmed that ELP3 expression is significantly downregulated during IAV infection at both mRNA and protein levels. Upon ELP3 silencing in A549 infected cells we observe a significant decrease in the production of new viruses by the cells. Collectively, these results show that ELP3 may play an important role in IAV replication. More experiments are currently being conducted to comprehend the relevance of ELP3 in this context.

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Biomedicine

Unraveling the impact of age and bisphenol A exposure in sperm molecular profile

Joana Santiago, Margarida Fardilha, Joana Vieira Silva, Manuel Santos

Infertility affects near 15% of the couples in reproductive age and half of the cases were at least in part attributed to a male cause. It is known that advanced paternal age and exposure to environmental chemicals negatively affect male fertility. However, little is known concerning the molecular mechanisms underlying these conditions. Despite virtually devoid of transcription and translation, several types of RNAs have been identified in human sperm. The sperm protein and RNA profiles are strongly affected by lifestyle factors, aging, endocrine disruptors, and diseases, that may impact seminal quality leading to infertility and failure in fertilization. Alterations in its content may also lead to abnormal early embryo development, ultimately resulting in pregnancy loss. Thus, the main objective of this work is to study the molecular profile of spermatozoa of men according to their age and levels of bisphenol A in seminal fluid, using proteomics and transcriptomics. These approaches may allow the recognition of potential biological markers of sperm quality decline and poor fertility to be used in the clinic to diagnose and manage male infertility.

Biomedicine

Development and application of a novel multiplex platform to support the management of coronary artery disease through urine and plasma sample analysis

Luís Perpétuo, Rui Vitorino, Adelino Leite-Moreira, Artur Silva

Coronary artery disease (CAD), the most common cardiovascular disease (CVD), frequently leads to myocardial infarction and causes millions of deaths annually. To diagnose CAD faster and less invasively, novel multi-biomarker urine tests need to be developed. This test would aim to improve diagnosis and reduce mortality from cardiovascular disease, in direct response to the United Nations Sustainable Development Goals. As part of this project and in combination with the applicant's ongoing PhD in Biomedicine, it is of interest to conduct a multi-omics study, specifically proteome and peptidome profiling of plasma and urine samples, develop and test methods for data collection using mass spectrometry (MS) and nuclear magnetic resonance (NMR). With this test, we exploit the potential for immediate clinical monitoring for CAD, to detect the disease as early as possible so that it can be treated and cause as little harm to the patient as possible.

Biomedicine

Recoding the Saccharomyces cerevisiae genome through codon ambiguity

Ana Rita Guimarães, Manuel António da Silva Santos, Ana Rita Macedo Bezerra

Although the genetic code is generally viewed as immutable, alterations to its standard form show significant flexibility in codon identity. Our laboratory has advanced within the field by reversing the CUG codon in Candida albicans, which is ambiguous and atypically translated as Ser, from Ser back to Leu. This raised the intriguing hypothesis that synthetic codon ambiguities combined with experimental evolution have the power to reassign rare codons from their frozen identity state. To test this hypothesis, we used a Saccharomyces cerevisiae deletion strain which is viable upon deletion of a single-gene L-tRNA. This renders the Leu codon "orphan", which enables us to exploit its vulnerability by engineered a seryl-tRNA to misincorporate Ser at these sites on a proteome wide scale. We then evolved the recombinant strains over 500 generations.

Initially, strains expressing the mutant tRNA had lower fitness than the control strain, but recovered growth rate during evolution, showing high level of tolerance/adaptation to recoding. Combination of a loss-of-function fluorescent reporter with MS/MS confirmed the reassignment from Leu to Ser. Adaptation to reassignment comes with major changes to genome structure, such as ploidy alterations and a higher occurrence of copy number variations (CNVs), indicating high genomic instability. This is also accompanied by transcriptomic alterations to accommodate the later changes.

The overall data show that the deleterious effects of tRNA loss can be overcome through codon ambiguity and reassignment. Such strains can be used to incorporate novel amino acids into proteins and to better understand how diverse organisms from the three domains of life reassigned codons throughout evolution, and how they deal with proteome instability.

Biomedicine

Developing a new PCa treatment: modulation of protein phosphatase 1 complexes using bioportides

Bárbara Matos, Jonh Howl, Carmen Jeronimo, Margarida Fardilha

The development of new and effective therapeutic approaches for prostate cancer is currently one of the major challenges of the scientific community in oncology. Phosphatases, and in particular protein phosphatase 1 (PP1) emerged as promising drug targets in this context. Thus, the main goal of this work is to establish an efficient strategy to disrupt a key PP1 complex with important roles in prostate cancer progression. To accomplish this goal, a peptide sequence derived from the region that include the PP1-binding motif of caveolin-1 (CAV1) was synthetized using microwave-assisted solid-phase peptide synthesis. This peptide was coupled to the cell penetrating peptide (CPP) penetratin to enable an efficient cellular delivery and was purified by semi-preparative scale high-performance liquid chromatography. The predicted mass of the peptide was confirmed by mass spectrometry.

The ability of this combined peptide (named bioportide) to affect prostate cancer cells progression was evaluated in vitro. In this context, prostate cancer cells (PC-3 cell line) were incubated with the synthetized bioportide coupled to a fluorophore (TAMRA) and the intracellular accumulation was evaluated by microscopy. In addition, PC-3 cells were incubated with different concentrations of the bioportide and a mutated homologue (control) and cells viability (PrestoBlue cell viability assay) were determined. We found that the bioportide was able to enter the cells after 1h at a concentration of 5 μM. Despite the incubation with the bioportide for 24h did not significantly affect the prostate cancer cells viability, after 48h incubation, a concentration of 5, 10 and 20 μM of the bioportide significantly reduced the prostate cancer cells viability. These results highlight the potential of the synthesized bioportide to negatively impact the prostate cancer cells proliferation and consequently delays cancer progression. Further analyses are now required to confirm the disruption of the target interaction and to better elucidate the mechanisms of cell death.

Biomedicine

Carbamates exposure in male infertility: cellular and molecular mechanisms

Sílvia Moreira, Maria de Lourdes Pereira, Pedro Fontes Oliveira, Vicente Seco-Rovira

In recent decades, infertility has been increasing worldwide, with 50% of cases associated with the male factor. Several causes are pointed out as contributing to male infertility, however not all cases are diagnosed, a situation known as idiopathic infertility. Among the factors correlated with idiopathic cases is exposure to environmental toxicants, namely pesticides. Indeed, the use of these chemicals has not only increased concomitantly with infertility, but has been associated with the decline in male fertility by affecting both the normal functioning of the hypothalamic-pituitary-gonadal (HPG) axis, but also by inducing damage to the testicular tissue and sperm. Aminocarb belongs to the class of carbamates, the most used class of pesticides in the world. Notwithstanding, it lack species selectivity, which can affect human health, although there is no evidence of harmful effects of aminocarb on the male reproductive system. The aim of this study is to elucidate the molecular and cellular mechanisms of action of aminocarb that lead to male infertility. First, we hypothesized that aminocarb induces testicular cell toxicity. To test this, we evaluated the cytotoxicity of this compound on Sertoli cells, responsible for the support and nutrition of germ cells, and observed that aminocarb reduces cell´s proliferation and viability when used at high concentrations and induces cell´s proliferation when low doses are applied. Thus, we conclude that aminocarb has endocrine disrupting properties and impairs the mitochondrial performance of Sertoli cells, which may lead to male fertility dysfunctions.

Biomedicine

A Bioinformatics Pipeline for the Discovery of Non-Invasive Biomarkers for Prostate Cancer

Tânia Lima, Rui Henrique, Rui Vitorino, Margarida Fardilha

Prostate cancer (PCa) is one of the most prevalent types of cancer. However, the limited accuracy and invasive nature of the currently used diagnostic tools (digital rectal examination, PSA serum levels, prostate biopsy) has driven the demand for new non-invasive biomarkers. Urine is a noninvasively collected biofluid that contains proteins that are secreted or have come in direct contact with the prostate, reflecting the molecular changes associate with this organ. Therefore, it is considered a valuable source of biomarkers. It is believed that the integration of

proteomics data from different studies is vital for identifying new PCa biomarkers, but studies carried out in this regard have few converging results. Hence, using a different approach, the novelty of this study is the integration of urinary and tissue proteomes of PCa patients, focusing on urine-tissue overlaps. This comparative analysis increases the power of individual studies and places urinary proteome data as a reflection of the molecular changes occurring in PCa tissue. Considering that kidney and bladder are the main contributors to the urine proteome, the proteins expressed in these two organs, as well as in the tumors that affect them (kidney and bladder cancer), were not considered for the final list of potential urinary markers for PCa. This detailed bioinformatic analysis revealed molecular features consistently dysregulated in urine from PCa patients that mirror the alterations in prostate tumor tissue. Furthermore, MSMB, KLK3, ITIH4, ITIH2, HPX, GP2, APOA2 and AZU1 proteins stood out as candidate urinary biomarkers for PCa. The integration of this comparative analysis with the experimental proteomic analysis of urine samples from PCa patients disclosed potential protein biomarkers that are being validated in new cohort of patients.

Biomedicine

The effect of mesenchymal stem cells secretome on axon regeneration and post-injury synapse formation

Diogo Tomé, Ramiro de Almeida

Throughout development, neurons exhibit an intrinsic growth capacity that allows their axons to grow and establish correct synaptic contacts. However, once the synaptic connections have been established, the developmental growth capacity of central nervous system (CNS) neurons declines. This loss, together with environment changes, largely account for the failure of adult CNS neurons to regenerate. Therefore, it is crucial to investigate the key molecules and mechanisms involved in axonal regeneration and synapse formation. Mesenchymal stem cells (MSC) are important for neuronal survival and repair and these regenerative properties are largely linked to the expression and release of a wide range of molecules (neurotrophic factors and cytokines) and microvesicles, the secretome. We have recently shown that MSC secretome promotes axonal outgrowth of CNS neurons, but its effects on axon regeneration and synaptogenesis remain elusive. In this work we aimed to uncover the effects of the secretome of a population of mesenchymal progenitors residing in the Wharton Jelly of the umbilical cord, known as human umbilical cord perivascular cells (HUCPVC), on axon regeneration and post-injury synapse formation of CNS neurons. We found that application of HUCPVC secretome to both rat cortical and hippocampal neurons induces an enhancement of axonal branching, a crucial event for the establishment of functional synapses. Moreover, HUCPVC secretome is also able to induce synaptic vesicle clustering, a hallmark of synapse formation. In addition, by performing axotomy in microfluidic chambers, we show that HUCPVC secretome promotes axonal regeneration and, more importantly, synapse formation in the injured axons This synaptogenic effect is axonal intrinsic with no contribution from the cell body. Together, our results demonstrate that MSC secretome has regenerative and synaptogenic properties and reveal a potential role of the secretome to act locally in axonal regenerative therapies.

Biomedicine

Unfolding the interplay between viruses and cellular proteostasis

Alexandre Nunes, Ana Raquel Soares, Daniela Ribeiro

Viruses are opportunist pathogenic agents that represent a major health threat. To efficiently contain the spread of a specific virus, a deep knowledge of the host-virus interplay mechanisms is pivotal.

To replicate, viruses require precise interactions with host components and often hijack the host cellular machinery throughout its life cycle. Viruses take control and strongly affect several mechanisms involved in protein synthesis and processing to its own benefit, leading to proteostasis imbalances of the host. However, the exact mechanisms and the consequences of these proteome imbalances for the host are still not well understood. Considering that proteostasis is essential for both cellular viability and viral replication, this project aims at unraveling the precise mechanisms by which proteostasis related pathways are modulated upon viral infection and explore these pathways as potential antiviral targets. By the end of this project, sufficient data will be generated to identify novel promising targets to modulate respiratory viruses' infections and understand whether protein quality control reprogramming is a common mechanism used by these respiratory viruses to enhance protein synthesis and replication.

Biomedicine

Protein Phosphatase 1 (PP1) as a target for drug treatment against SARS-CoV-2 infection

Pedro O. Corda, Margarida Fardilha, Daniela Ribeiro, Mathieu Bollen

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is an RNA virus that is the cause of the COVID-19 outbreak and has infected and killed thousands of people worldwide. In recent years, several studies have related protein phosphatase 1 (PP1) to the pathogenesis of several RNA viruses (including SARS-CoV), showing that this phosphatase appears to have a role in the viral infection process. PP1 is a highly conserved phosphatase in eukaryotes and binds to its interactors through specific binding motifs, making them potential targets for the development of drug therapies. Also, some reports have shown the positive effect of PP1 modulation during viral infection. Here we propose to study the role of PP1 in the pathogenesis of SARS-CoV-2 and to understand how the interaction between this phosphatase and viral proteins can be modulated to reduce viral propagation.

Biomedicine

Inhibition of SETD7 methyl-transferase activity impairs mammary epithelial cell differentiation and lactogenesis

Fátima Monteiro, Luisa Helguero, Cecilia Williams

Introduction: SETD7 (SET7/9, KMT7) is a lysine methyltransferase that targets histone and non-histone proteins, including many with relevance to breast cancer and mammary epithelial biology such as ERα, E-cadherin, beta-catenin and STAT3. However, SETD7 role in cancer remains elusive due to contradictory results suggesting its effects are context dependent. Yet, the increase of SETD7 expression during the differentiation process tends to be consistent across different cell types such as cardiomyocytes and muscle cells. We previously found that the SETD7 transcript is also increased throughout HC11 mammary epithelial cell (MECs) but its effects in MEC remain to be investigated. Thus, our aim was to study SETD7 activity on cell proliferation, epithelial and lactogenic and differentiation of two mouse mammary epithelial cell (MEC) lines (HC11 and EpH4).

Materials and methods: HC11 and EpH4 were cultured to obtain functionally differentiated/lactogenic (DIF) cells. SETD7 catalytic inhibition was achieved using 8 nM of (R)-PFI-2 for 24h. Cell proliferation was evaluated by cell counting, epithelial cell differentiation by E-cadherin and beta-catenin levels and localization, lactogenic differentiation by qPCR of igfbp5, lactoferrin expression and by beta-casein levels, as well as TLC and GC-FID to characterize lipid composition. Results and Discussion: SETD7 mRNA and protein levels are induced upon lactogenic differentiation. In DIF cells, inhibition of SETD7 activity increased cell proliferation and downregulated E-cadherin and beta-catenin proteins as well as Lactoferrin, igfbp5 and beta-casein expression. Phospholipid metabolism related genes, Chpt1 and Pcyt2, were also affected by SETD7 inhibition resulting in altered lipidic profile different from the lipogenic phenotype of lactogenic cells. PE biosynthesis could be downregulated with (R)-PFI-2 treatment in DIF cells and thereby impair secretory activation during lactogenesis. Conclusion: Altogether, our results suggest that SETD7 loss of activity in fully differentiated MECs correlates with an increased regulation of cancer-related processes and decreased PE biosynthesis, which may facilitate cancer development.

Biomedicine

Cellular responses to viral infections

Mariana Marques, Dr. Daniela Ribeiro, Dr. Maria João Amorim, Dr. Markus Islinger

Viral infections are one of the most persistent threats to human health. Influenza A virus (IAV) is the causative agent for most of the annual respiratory epidemics in humans and the major influenza pandemics in the last century, resulting in high mortality rates in the elderly and individuals with chronical disease conditions, and an enormous impact on the economy and social living.

IAV has developed multiple strategies to hijack and control host cellular mechanisms to efficiently replicate in host cells. Some of these strategies comprise the manipulation of cytoplasmic and endoplasmic reticulum mechanisms involved in protein metabolism homeostasis.

With this study, we intend to characterize the interplay between IAV and the host cell proteostasis control mechanisms throughout the whole course of the infection cycle. Our results suggest that the virus deregulates the IRE1 branch of the unfolded protein response. Besides, we show that the virus disturbs host cell protein homeostasis by inducing the accumulation of insoluble protein aggregates at a time of the infection that coincides with the vRNPs' egress from the nucleus and viral protein translation.

Our data have shown that these aggregates comprise both viral and host cell proteins, being the latter mainly associated with RNA metabolism mechanisms. We have further demonstrated that the chemical disruption of protein aggregates formation in cells upon infection prevents an

effective replication cycle, thus showing that these structures are critical for viral protein production and proper formation of infectious virus particles.

Overall, our results may lead to a better understanding of the interplay between IAV and the host cell, which may lead to the development of novel antiviral strategies.

Biomedicine

Inter-organelle crosstalk in Hepatitis C virus infection: in pursuit of novel antiviral targets

Vanessa Ferreira, Markus Islinger, Daniela Ribeiro

The hepatitis C virus (HCV) requires complex lipid metabolic remodeling for efficient replication and, thus, relies on the efficiency and plasticity of the intracellular organelles' network. Peroxisomes, lipid droplets (LDs) and the endoplasmic reticulum (ER) have been shown to be involved in the HCV lifecycle but the interplay between these organelles has hardly been explored in the context of viral infections. Hence, in this work, the goal is to explore this interplay by performing a detailed analysis of the alterations in the peroxisomes-ER and peroxisomes-LD associations upon HCV infection. Importantly, these interactions will be modulated and their relevance for HCV propagation and antiviral defense will be assessed. Furthermore, these findings may contribute for the identification of cellular targets for the development of novel antiviral therapies.

Biomedicine

Identification of novel therapeutic targets to modulate proteostasis in humans

Marisa Pereira, Ana Raquel Soares, Miguel Mano

The average life expectancy of the world's population is increasing, as well as the incidence of age-related diseases (ARD), including cancer, neurodegenerative, and metabolic diseases. One of the most important features, transversal to aging and ARD, is the impairment of the proteome homeostasis network (proteostasis). This is often characterized by an abnormal accumulation of protein aggregates within cells, impaired protein synthesis, proteotoxic stress generation, and ultimately cellular dysfunction/death. However, the cellular and molecular mechanisms that drive the occurrence of these phenotypes are still under investigation.

During protein synthesis, transfer RNAs (tRNAs) are responsible for delivering the amino acids to the growing polypeptide chain by matching their anticodons with the respective mRNA codons. To ensure their correct functionality, tRNAs need to undergo a panoply of different modifications catalyzed by tRNA-modifying enzymes. More recently, deregulation of specific tRNA-modifying enzymes and/or tRNA modifications have been reported in different ARD, but their significance for proteotoxic stress in the disease context is underexplored.

Here, we show that knockdown of the tRNA-modifying enzyme, Elp3, in human cells, induces a decrease in the catalyzed tRNA modifications (ncm5U34, mcm5U34, and mcm5s2U34) and a consequent accumulation of protein aggregates, proteotoxic stress generation, and decreased protein synthesis rate. We also found that ELP3 expression is downregulated in Alzheimer's and Huntington patients. Additional experiments are ongoing to dissect the role of Elp3 in neurodegenerative disorders.

In summary, our work validates the tRNA-modifying enzymes as new players in the proteostasis network, constituting promising therapeutic targets to attenuate protein aggregation phenotypes observed in conformational disorders.

Biomedicine

A spectroscopic study of age-related changes in protein conformation in biological samples

Sandra Magalhães, Brian Goodfellow, Alexandra Nunes

The world is aging, and we must face the challenges that this brings. The increase in life expectancy leads to a huge need to prevent age-associated diseases and improve healthspan. In this way, it is crucial to improve the knowledge of the aging process and of the mechanisms that contribute to it. Ideally it would be of great interest to have a panel of biomarkers of healthy aging that would allow an estimate of the biological age of an individual. The loss of proteostasis is one of the hallmarks of ageing and is well described in different aging models. FTIR spectroscopy is a simple and inexpensive method, widely used in biomedical research. It gives a metabolic fingerprint of the sample and is also sensitive to the secondary structure of proteins. Therefore, the goal of this this PhD work is to identify age-related protein aggregation profile and identify aging biomarkers

using FTIR spectroscopy. We analyzed skeletal and cardiac muscle tissue of C57BL/6J female mice at 4 timepoints (6 months, 12 months, 17 months and 24 months) using FTIR spectroscopy and our results showed relevant differences in secondary structure of proteins between young and old mice. In cardiac muscle, it seems that old mice have higher levels of intermolecular B-sheets that younger animals. On the opposite, in the skeletal muscle, older mice appear to have lower content of these structures. We also compared both muscle types and it seems that, for all ages, cardiac muscle has lower content of aggregation-prone intermolecular B-sheets structures. This data also supports FTIR as a suitable approach for protein conformational studies and to reveal a healthy ageing signature.

Biomedicine

Biochemistry

Agrifood byproducts-derived blisters: an innovative circular economy for developing biodegradable packages

Joana Lopes, Paula Ferreira, Manuel A. Coimbra, Idalina Gonçalves

Agrifood industry produces biobased wastes that are often discarded while still containing valuable biomolecules. Dust from air suction in the locust bean gum (LBGd) processing industry is a good example of it. On the other hand, the ecological footprint of non-biodegradable packages, particularly the single-use ones, demands the development of more sustainable materials. In this PhD, the feasibility of using LBGd-derived dust for developing biobased blister packaging is being studied.

The LBG-derived dust showed to be a protein-rich byproduct (56% of protein) that also possess polysaccharides (28%), lipids (6%), phenolic compounds (12%), and ashes (2%). When applied to biobased plastics production, protein-rich LBG dust allowed to achieve stretchable materials (90% elongation at break) with moderated water tolerance (60-90° surface water contact angle), depending on the protein-rich LBG amount used. Moreover, although the LBGd materials are able to be thermoformed, the obtained shapes are partially lost over short time (2 h). Altogether, these properties limit the LBGd plastics application. To overcome these drawbacks, calcium carbonate ($CaCO_3$) recovered from eggshells and a crosslinker (genipin) have been incorporated into the LBGd-based formulations. Both $CaCO_3$ and genipin allowed to increase the hydrophobicity and plasticity of LBGd films, as well as to maintain the stability of the thermoformed shapes, for a little longer than the initial ones.

Overall, protein-rich locust bean gum byproduct revealed to be a suitable raw material for developing flexible and water-tolerant biobased plastics, whose mechanical and physicochemical performance can be improved either by other molecules derived from agrifood byproducts, opening an opportunity for their valorization as natural compounds through a circular economy.

Biochemistry

Toxicometabolomics of particulate matter (PM): towards mechanistic insights and new biomarkers

Tatiana Silva, Iola Duarte, Helena Oliveira, Peter Hoet

Although air pollutant emissions have decreased substantially over the last decades, problems related to air quality persist. Epidemiological studies have shown that environmental pollution by particulate matter (PM) has adverse effects on human health, requiring a better understanding of PM biological effects. Omics approaches offer the opportunity to discover unanticipated effects on human cells and to define new biomarkers of toxicity. This work aims to investigate the biological effects of airborne PM, collected in different locations, using NMR metabolomics of in vitro cultured macrophages and lung cells integrated with traditional toxicological endpoints.

As a proof of concept, we have started by exposing human THP-1 monocytes to certified urban atmospheric particles (supplied by NIST), with sizes below 30 uM and a well characterized chemical composition. We have then quantified some inflammatory cytokines in the medium supernatants, in addition to assessing the changes in the metabolic activity of exposed cells, compared to controls, at different time points. The results showed that PM and PM-derived compounds affected the phenotype and metabolism of monocytes/macrophages, appearing to induce glycolysis and glutaminolysis, among other changes. We are now conducting studies on real airborne PM samples, collected in different locations in Portugal, to assess how the particles chemical composition correlates with cellular effects, at the phenotypic and metabolic levels.

Biochemistry

Establishment and characterization of cellular models to modulate breast cancer-associated macrophages

Ana Sofia Dias, Catarina R. Almeida, Luisa A. Helguero, Iola F. Duarte

Cancer development, disease progression and response to therapy are strongly influenced by the tumor microenvironment (TME). Tumor-associated macrophages (TAMs) are abundant infiltrating immune cells, which, according to their activation state, may display either tumoricidal functions (inflammatory M1-like macrophages) or pro-tumorigenic functions (anti-inflammatory M2-like macrophages). In breast cancer (BC), higher frequency of M2-like TAMs strongly correlates with increased relapse rate, poor outcome, and with aggressive histopatological subtypes. Hence, shifting TAM polarization towards an anti-tumoral M1-like phenotype has emerged as an attractive strategy to aid cancer treatment. To develop such immunomodulatory strategies, it is important to establish and characterize in vitro cellular models of TAMs. To generate TAMs in vitro, we have incubated human monocytes (THP-1)-derived macrophages with medium conditioned by BC cells (metastatic MDA-MB-231 and non-metastatic MCF-7 cell lines), and performed their metabolic and phenotypic characterization.

The generated TAM showed higher transcript levels of M2-markers (such as IL10 and NOS2), compared to uncommitted macrophages and the secretion of the pro-inflammatory cytokine TNF-α was not detected, suggesting that BC-conditioned medium skewed macrophages to an immunosuppressive M2-like phenotype. Furthermore, TAM underwent several metabolic adaptations, such as decreased catabolism of branched-chain amino acids (valine, leucine and isoleucine) and increased TCA cycle and/or citrate export.

The results set the basis to establish an in vitro model of TAM, which will be used to investigate their pharmacological metabolic modulation towards anticancer functions.

Biochemistry

Development of nanostructured microcarrier-based bioinks from protein nanofibrils for improved 3D-bioprinting

João Carvalho, Carmen Freire, Carla Vilela, Helena Oliveira

The use of 3D bioprinting technologies to fabricate tissue analogs is often limited by the availability of bioinks with adequate mechanical performance and biological properties. Given so, the goal of this PhD project is to develop novel microcarrier-based bioinks based on protein nanofibrils for 3D bioprinting applications. Such bioinks, with expectable high bioprintability, enhanced mechanical properties and improved cell density and viability, will constitute a new family of advanced bioinks and an innovative approach in the 3D-bioprinting realm. To achieve this, protein nanofibrils with desirable properties, namely morphology and aspect ratio, will be prepared. Then, microcarriers will be obtained from protein nanofibrils, and loaded with cells from selected cell lines (e.g., osteoblasts, keratinocytes, and hepatocytes). The bioinks will be finally created by combining the cell-loaded microcarriers with a suitable hydrogel matrix. After the thorough optimization of the bioprinting parameters, the bioinks will be used to fabricate living tissue-constructs with tailored characteristics. A detailed characterization of all the biomaterials, bioinks, and printed tissue-constructs will be performed along every step of the plan to grant the optimal performance of the new bioinks.

Biochemistry

Deep eutectic solvents comprising active pharmaceutical ingredients for incorporation in biopolymer-based drug delivery systems

Sónia Pedro, Carmen S. R. Freire, Armando J. D. Silvestre, Mara G. Freire

Many active pharmaceutical ingredients (APIs) are insoluble or sparingly soluble in water and conventional pharmaceutical vehicles, making difficult their formulation and drug delivery. Deep eutectic solvents emerge as new alternatives in this field since they may confer high drug solubility, permeation, stability, and therapeutic action, being further possible to use different API classes in their composition. Moreover, DES can be integrated into polymer-based drug delivery systems, enabling to control the release of the respective APIs. However, their combination with natural polymers, e.g. alginate and nanocellulose, as well as the range of therapeutic targets and the biomedical approaches used to prepare the delivery systems is still limited. In this vein, the goal of this work is to develop innovative drug delivery systems, based on distinct DES and biopolymers with improved therapeutic action and controlled drug release.

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Biochemistry

Microwave-assisted extraction of coffee byproducts-derived polysaccharides suitable for paper coating

Gonçalo Oliveira, Paula Ferreira, Cláudia Passos, Idalina Gonçalves

Paper-based materials are usually coated with non-biodegradable petroleum-based polymers for allowing their use in food packaging, compromising their biodegradability and recyclability. On the other hand, agrifood industry byproducts are worldwide generated and often discarded, implying the valuable biomolecules waste. Coffee cascara (CC), coffee silverskin (CS), and spent coffee grounds (SCG) are coffee industry byproducts rich in polysaccharides, lipids, and phenolics often landfilled, which quite reflect this reality. To minimize both these issues, in this PhD thesis, the feasibility of valorising coffee industry byproducts through development of biodegradable plastic formulations suitable for paper coating is being studied. As first stage, the influence of using microwave-assisted extraction (MAE), a green technology, to fractionate coffee byproducts-derived polysaccharides suitable for paper coating was explored. As results, water-soluble fractions rich in galactomannans and arabinogalactans were obtained from SCG, while pectic polysaccharides-rich residues were recovered from CC and CS. Therefore, MAE revealed to be a proper methodology to fractionate the coffee byproducts into polysaccharides that, according to literature [1,2], allow to develop biodegradable plastic formulations. Further studies will focus the ability of using these polysaccharides to develop bioplastic formulations suitable for paper coating, thus opening an opportunity to valorise coffee byproducts while minimizing the ecological footprint of paper-based materials.

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Biochemistry

Exploiting the role of long non-coding RNAs in the direct conversion of fibroblasts into induced neural stem cells

Francisco José Santos, Bruno Bernardes de Jesus, Simão Teixeira da Rocha, Sandrina Nóbrega-Pereira

Direct conversion of fibroblasts into a desired cell type is an alternative to the use of induced pluripotent stem cells (iPSCs). This method has been used to generate induced neural stem cells (iNSCs), although it remains somewhat inefficient. Long non-coding RNAs (lncRNAs), key regulators of gene expression, have been shown to mediate reprogramming of fibroblasts into iPSCs and are differentially expressed during different stages of neuronal development. Likewise, lncRNAs might be novel modulators of direct conversion and may contribute to the efficient generation of cells for regenerative purposes. In this work, candidate lncRNAs (lnc-NR2F1, PNKY and SOX2OT) will be modulated to increase the efficiency of direct conversion of fibroblasts into iNSCs. Overexpression of transcription factor SOX2 alone, in human fibroblasts, seemed to drive cells to a neural-specific fate. After overexpression, endogenous SOX2 expression was activated, as well as other neural-specific genes. The overexpression of lncRNA PNKY was also evaluated, but did not produce the same effect as SOX2. To better understand the link between of SOX2OT and SOX2, neuroblastoma cell line SH-SY5Y was used. SOX2OT was downregulated and resulted in an increase of the expression of SOX2 and in phenotypic alterations in the cells. In the future, we will evaluate the affect of SOX2OT downregulation in the differentiation of SH-SY5Y into neuron-like cells, and pair lncRNA downregulation with overexpression of SOX2 in human fibroblasts.

Biochemistry

Polysaccharide-based nano-in-microparticles for plasmid DNA pulmonary delivery

Sara Valente, Cláudia P. Passos, Bruno Filipe Carmelino Cardoso Sarmento

Therapies can enter the organism via the pulmonary system although requiring a vehicle. It is hypothesized that polysaccharide-based nano-in-microparticles can be used to transport plasmid DNA through the pulmonary system and deliver it specifically to hematopoietic stem cells (HSC). Chitosan nanogels will be formed by crosslinking with genipin. The targeting will be achieved by surface modification of the nanocarrier with antibodies specific for HSC. The nanocarrier will be combined with plasmid DNA. The nanoparticles will be incorporated into Trojan microparticles that are capable to deliver the nanoparticles into the systemic circulation through the pulmonary system. Spray-drying will be performed to obtain the microparticles as a dry powder, using galactomannans as excipient. The formulations will be tested in vitro for their cytotoxicity, stability, and capability to deliver the plasmid DNA to the cells.

Biochemistry

Unravelling the impact of growth conditions in polar lipidome of selected microalgae and their bioactivities

Daniela Couto, Pedro Miguel Dimas Neves Domingues, Maria do Rosário Gonçalves dos Reis Marques Domingues, Joana Silva Laranjeira

Microalgae are used in food, feed, and industry. They are rich in lipids with nutritional and health beneficial effects, representing an emerging and sustainable resource with potential applications in different fields. However, there is a lack of knowledge on their polar lipidome, hindering the full exploration of their biotechnological potential. Moreover, the microalgae lipidome is very sensitive to environmental and growth conditions, which can be used to increase the production of added-value products. This work aims to characterize the lipidome of selected microalgae with industrial added value, using mass spectrometry-based approaches, to identify variations in the lipidome with growth conditions and evaluate their bioactive properties, aiming to contribute to the use of microalgae as sustainable and renewable natural sources of bioactive compounds and to foster the exploration of novel applications.

Biochemistry

Development of cellulose-based motors for biomedical applications

Ana Silva, Carmen S. R. Freire, Armando J. D. Silvestre, Carla Vilela

This PhD project aims at the exploitation of cellulose, a natural, abundant and sustainable resource with appealing chemical and mechanical properties, for the development of nanomotors, i.e., systems that can convert an energy source into autonomous movement. Cellulose nanocrystals (CNCs) were chosen as the starting material owing to their nanometric size, high surface-to-volume ratio, ease of surface modification and rod-like morphology. The CNCs were functionalized with three distinct metallic nanoparticles (NPs), namely gold (AuNPs), platinum (PtNPs), and magnetite (Fe3O4NPs) nanoparticles through the in situ reduction of the appropriate salts. The inclusion of AuNPs allows for easy monitorization of the motors, and the catalytic activity of PtNPs in hydrogen peroxide medium (fuel) and the application of an external magnetic field (Fe3O4NPs) can be explored to propel the nanomotors, highlighting the potential of these nanohybrid systems for biomedical applications, e.g., in cancer diagnosis and treatment.

This work was developed within the scope of the project CICECO-Aveiro Institute of Materials (UIDB/50011/2020 & UIDP/50011/2020) financed by national funds through the Portuguese Foundation for Science and Technology (FCT)/MCTES. FCT is also acknowledged for the doctoral grant to A.C.Q.S. (SFRH/BD/140230/2018) and the research contract under Scientific Employment Stimulus to C.V. (CEECIND/00263/2018).

Biochemistry

Fatty acid β–oxidation disorders: Lipidomics as a tool to decode changes in patients lipid profile

Inês Guerra, Ana S. P. Moreira, Maria do Rosário Domingues

Fatty acid oxidation disorders (FAOD) are inborn errors of metabolism causing defects in FA mitochondrial β-oxidation. Most common FAOD involve accumulation fatty acids, hydroxy fatty acids and acylcarnitines. This causes lipotoxicity, affecting several organs (e.g. myocardium) leading to malfunction and co-morbidities that are life-threatening. Patients need to follow a life-long low-fat and high-carbohydrate diet.

Changes in the lipidome have been associated with several diseases. FAOD disturb lipid homeostasis, but how lipidome is impacted with FAOD is barely known. Despite previous evidence that polar lipids, the main components of cell/organelle membranes and signalling molecules, can be affected in FAOD, this has been scarcely studied. Supported by collaboration with clinicians, this proposal aims to identify specific lipid signatures of medium-chain and long-chain FAOD using mass spectrometry-based lipidomics, contributing to elucidate pathophysiology, identify possible biomarkers for prognosis, monitor possible imbalances, and evaluate therapeutic efficacy. Lipid profile changes in blood, namely plasma and red blood cells fractions, collected in clinical follow-up, either in metabolic crisis or on a routine basis, will be analysed.

Biochemistry

Bioactive compounds from sulphite pulp production streams for applications in functional food and cosmeceutical industries

Dmitry Evtyugin, M.R.M. Domingues, S.I.P. Casal Vicente

Sulfite spent liquor (SSL) and alkaline extract from bleaching stages (AEB) form the major part of waste streams from acidic sulphite pulping. Nowadays, SSL and AEB,mostly burned for inorganic base and energy recovery, are considered as underutilized natural resource. In the production of dissolving pulp from eucalypt wood these industrial streams are known to contain ellagic acid (EA) and sterols, including their derivatives, whose structure and properties have not yet been studied. The valorization of EA and sterols, compounds with paradigmatic biological functions, could represent an important profit for pulp companies and meet the evergrowing demand for high-value natural compound recovery from wastes and by-products, employing cost efficient and eco-friendly methodologies. Hence, the development of a large-scale production of EA and sterol-based products from industrial streams of acid sulphite pulping of eucalypt, and a subsequent evaluation of the aforementioned compounds as potential bioactive additives in functional food and cosmeceutical industries, are the main topics of the present PhD project.

Biochemistry

MiAL (MicroAlgae Lipids) - Exploitation of microalgae lipidome: a lipidomics strategy to bioprospect anti-inflammatory phytochemicals

Tiago Conde, Rosário Domingues, Pedro Domingues, Bruno Neves

Microalgae are an alternative source of bioactive components used in the food, feed, nutraceutics, cosmetics and pharmaceutical industries. They are rich in lipids with nutritional and health beneficial effects, and their polar lipidome represents a sustainable exploitable resource to promote health. Moreover, chronic inflammation is a serious condition that contributes to pathogenesis of different diseases. Immunomodulation with natural products is an attractive strategy to prevent this. However, the immunomodulatory activity of microalgae lipids is still poorly understood. This work aims to characterize the lipidome of microalgae with commercial value, using mass spectrometry-based approaches, to identify bioactive lipids, and understand their impact in the modulation of immune cells, aiming to contribute to the use of microalgae as sustainable and renewable natural sources of bioactive compounds.

Biochemistry

ProtoSyn: A modern approach to protein design

José Pereira, Sérgio M. Santos, Bruno Correia

Computer simulations have revolutionized the way new therapeutics, drugs, processes, and materials are researched and developed. Prototype candidates can be tested and screened a priori, cutting costs and development time in virtually all areas of science. One such application of computational chemistry is the rational design of custom-made peptides.

ProtoSyn has been developed over the past 2 years as a new software package for computational design of small peptides. This modern software has been developed in Julia, a recent new programming language that aims to simplify the “two-language problem”, where a scientific software

often requires both the employment of a simpler scripting language, such as Python, for the user-interaction, and more dense and specific language for the computationally intensive work, usually C or C++. This has, historically, greatly reduced the accessibility of new developers to improve and build upon existing solutions in effective and meaningful ways. Besides aiming to have a much lower entry barrier to both new developers and contributors, ProtoSyn also intends to be a simple solution, tailored for non-specialized scientists who wish to employ computer simulations in their workflow. Moreover, ProtoSyn has native support for distributed computing, SIMD and GPU acceleration, among others, while implementing TorchANI, a machine-learning energy function able to accurately predict the correct position of atoms in a structure with DFT precision. Where a regular DTF calculation could take up to 50 hours of CPU time, ProtoSyn, empowered by the TorchANI AI, takes less than 0.3 seconds.

Biochemistry

Metabolic profile of the in vivo response to a potential anticancer drug - Pd2(spermine)

Tatiana J. Carneiro, Ana Maria Gil, Maria Paula Marques, Carmen Diniz

Pd(II)-compounds are increasingly emerging as alternatives to Pt(II)-based drugs used in cancer chemotherapy, often triggering severe side-effects and acquired resistance. In particular, Pd(II)-complexes with biogenic polyamines, such as spermine (Pd2Spm), have exhibited beneficial cytotoxic properties, drawing the importance of investigating their impact on in vivo metabolism to possible negative effects of its potential use. The present work reports a 1H NMR metabolomics characterization of the impact of Pd2Spm, compared to cisplatin (cDDP), on the metabolism of healthy mice, to identify putative metabolic markers of biotoxicity. The polar (and lipophilic, data not shown) metabolomes of kidney, liver, and breast tissue of BALB/c mice were evaluated, as a function of drug-exposure time (1, 12, 48 h). Compared to cDDP, Pd2Spm triggered faster metabolic response and recovery to control levels for all organs tested. These results are suggestive of a potential lower toxicity of Pd2Spm exposure.

Biochemistry

A lipidomic perspective of autoimmune diseases

Helena Ferreira, Maria do Rosário Domingues, Tânia Melo, Artur Paiva

Autoimmune diseases (AID) are a heterogeneous group of pathologies that are characterized by chronic inflammation and dysregulation of the immune system. Tests used for diagnosis are either non-specific or non-sensitive, impairing proper diagnostic and prognostics. Altered lipid metabolism and lipid peroxidation have been reported in AID, thus lipidomics is emerging as a promising approach for AID diagnostics. The aim of this work is to explore mass spectrometry (MS) based lipidomics applied to AID to identify a specific lipid signature of each AID; to identify markers for early diagnostic, prognostic and prediction of relapsing episodes; and to evaluate therapeutic efficiency. Modern liquid-chromatography high resolution MS will be used to profile plasma phospholipids, oxidized phospholipids and sphingolipids. The results gathered with this project can be explored as a promising tool for personalized medicine, improving health and fostering the reduction of morbidity and mortality of AID patients.

Biochemistry

Biorefineries

New paper functionalization strategies by superficial photopolymerization

Fábio Silva, Carmen Freire, Ana barros, Ricardo Pinto

Paper is one of the oldest commodities used by mankind, especially as a support for printing and writing. However, nowadays, it is also applied as packaging and sanitary products and, due to its biodegradability, recyclability and renewable characteristics, paper has found a wider range of advanced applications, including sensors, conductive papers for electronic devices, thin-film solar cells, and functional papers for medical diagnosis. Many of these new applications are possible due to the use of coatings, which confer new functionalities to paper, such as conductivity, antimicrobial activity, hydrophobicity, or specific optical properties. An expeditious way for the functionalization of paper is the application of

photopolymerizable coatings. This type of coatings can be formulated without solvent (avoiding the formation of VOCs) and their curing is done through the incidence of light, in a matter of seconds. Through the design and optimization of the coating formulation, the curing conditions and final properties of the coated papers can be tuned to better suit industrial production while attributing paper the desired properties. In this presentation, following a brief introduction to the research challenges of the project, it will be shown the latest results regarding the development of a photopolymerizable tung oil-based coating, capable of attributing paper with hydrophobic properties, and the first steps on the design of a new photopolymerizable coating formulation, based on acrylate/methacrylate monomers. This work was carried out under the Project Inpactus – innovative products and technologies from eucalyptus, Project N.º 21874 funded by Portugal 2020 through European Regional Development Fund (ERDF) in the frame of COMPETE 2020 nº246/AXIS II/2017 and in the scope of the project CICECO- Aveiro Institute of Materials, UIDB/50011/2020 & UIDP/50011/2020, cofinanced by national funds through the FCT/MEC.

Biorefineries

Production and upgrading of producer gas from biomass gasification

Helena Gomes, Luís António da Cruz Tarelho

Biomass gasification is a key technology to generate gaseous fuels with potential to replace fossil fuels. However, it still faces several challenges regarding the full implementation of the process at the industrial level: producer gas diluted in nitrogen and the presence of undesired byproducts.

The objective of this work is to study the generation of a high-quality fuel gas by gasification of residual forest biomass, using different gasification agents and gas improvement/cleaning techniques, including: the use of catalysts to promote tar destruction and improve gas quality and the implementation of a high temperature filter to remove particulate matter. The goal is to obtain data to support scaling-up of biomass gasification technology. The technical and economic pre-feasibility of the biomass gasification process will be evaluated to determine its potential within the Portuguese context. The framework for this study derives from the 7th and 12th Sustainable Development Goals from 2030 Agenda – United Nations.

Biorefineries

Hot water soluble dialdehyde cellulose as a powerful platform for novel bio-based products

Sandra Raquel Dias, Falk Liebner, Carmen Freire

Periodate-mediated oxidation of cellulose is an interesting approach that can yield two types of 2,3-dialdehyde cellulose (DAC). Depending on the degree of oxidation, either a non-soluble surface-functionalized solid or a product nearly quantitatively soluble in hot water are obtained. Owing to its intermediary oxidation status, both types of products bear a great potential for chemical onward conversion or modification of other substrates. Hot water-soluble DAC (hws-DAC) is considered particularly appealing because it can be used in papermaking, food-grade packaging, biomedical coatings, high-performance bioplastics or oxygen barrier films. Besides being biocompatible and biodegradable, its production and processing can be regarded as a promising environmentally compatible technology since organic solvents are omitted and the oxidant can be recycled in high yield by ozone which, in turn, can be generated from atmospheric oxygen.

In this context, this PhD project aims to prepare hws-DAC by periodate-mediated oxidation of hardwood kraft pulp and to explore new applications for this cellulose derivative. While the properties of hws-DAC from bleached pulp serve as benchmark, one major goal of this project is to investigate to what extent different contents of lignin in pulp from different bleaching stages affect DAC yield, solubility, pH stability and properties of obtained products. Dependent on these results, potential applications will be considered. This includes incorporation of hws-DAC in papermaking processes and development of DAC-based films with high oxygen barrier properties. Furthermore, biodegradability and eco-friendliness of neat DAC and DAC-based materials will also be evaluated.

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Biorefineries

Production of new polymeric materials from lignin

Fernanda Vieira, Ana Barros, Dmitry Evtyugin, Paula C. R Pinto

Lignin is one of the most abundant by-products of the Kraft pulp mill with huge application potential. Being an aromatic oligomer rich in phenolic and hydroxyl groups OH, lignin can be considered as a suitable raw material for the synthesis of a diversity of eco-friendly polymers, which can boost the added value of Kraft lignin and can contribute to a sustainable environment. This Ph.D. project focuses on the development of synthetic strategies to obtain lignin-based polyols from Kraft lignin isolated using the Lignoboost™ process for the production of polyurethane (PU) foams and adhesives and subsequently for the preparation of functional composites. Oxyalkylation with propylene carbonate was the method used to obtain the lignin-based polyols and the optimization of oxyalkylation process was performed using the response surface methodology, which allowed to reduce the amount of PC by 25 to - 50%, depending on the temperature and time conditions of the process and also on the purpose of the application as rigid foam or adhesive PU. The formulation of rigid foams was optimized using a design of experiments towards the production of a thermal insulation material. However, producing bio-based products does mean these products are safer. In fact, the isocyanate used in the synthesis of PU is very toxic. Therefore, strategies that have been used to replace isocyanate to produce a novel class of polyurethane, namely non-isocyanate (NIPU) will be discussed to fully explore the potential of lignin as raw material to develop safer and greener products.

Biorefineries

Chemical characterization and biological evaluation of extracts from residual biomass of Eucalyptus globulus and Acacia dealbata

Cátia Oliveira, Armando J. D. Silvestre, Artur M. S. Silva, Sónia A. O. Santos

The exploitation of wood from Eucalyptus globulus, the main raw material for the production of pulp and paper, generates a wide variety of forestry by-products whose integrated valorization may represent a significant contribution to the profitability of the sector and the national economy. The paper industry generates large quantities of forestry residues, such as bark, branches and leaves of E. globulus, as well as other biomass residues from other species, namely invasive species such as Acacia dealbata that, during forest management, generate large quantities of wood and undifferentiated forestry biomass which, together with the E. globulus residues, are most often only used to produce energy in the factories.

However, currently, there is a high interest in the exploitation of natural resources as a source of bioactive compounds with potential added value, namely biological and functional properties, which have a wide range of applications, such as in pharmaceutical, cosmetics and/or food sectors.

In this regard, the extraction of compounds with high-added value from forest biomass and the exploitation of their potential is a topic that is of great importance for the national economy, since it will bring added value to the forest biomass before their use in energy production.

In this context, the objective of the PhD is to study the chemical composition of E. globulus leaves and also of the bark, wood and leaves of A. dealbata and to evaluate the bioactive potential of the extracts in order to contribute to the declassification of residues, reduction of residues and promoting the status of useful by-products with various industrial applications.

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Biorefineries

Biobased thermoplastic composites with high cellulose incorporation

Bruno Valente, Carmen Freire, Carla Vilela, Carlos de Pascoal Neto

Biocomposites, reinforced with cellulose fibers, are increasingly relevant within the composite industry, with an expected annual growth rate of 11.8% until 2024. Nevertheless, petroleum-based matrices such as polypropylene or polyethylene continue to be a major issue to the environment, which fosters even more the already increasingly demand for bio-based matrices. As a result, entirely biobased composites, also labeled as green composites, where both the polymeric matrix and the reinforcements are biobased, are increasingly sought after. However, the weak compatibility between the hydrophilic cellulosic fibers and the hydrophobic matrices, and the limited mechanical performance of the composites, still presents a challenge.

In this context, this PhD aims to produce and fully characterize green composites made of bio-based matrices, such as poly(lactic acid) (PLA) or poly(hydroxybutyrate) (PHB), reinforced with bleached eucalyptus pulp fibers (BEKP). In an attempt to overcome some of the beforementioned challenges, chemical or mechanical treatments of the fibers, the use of additives or combinations of the above are among the possible options. More specifically, in this work, the combined effect of the use of mechanical treated BEKP fibers and of an additive, epoxidized linseed oil (ELO), was investigated. The resulting composites, obtained by a simple melt-mixing procedure, showed that the addition of ELO to PLA- and PHB-reinforced with 40 wt.% of mechanically treated BEKP decreased the tensile and flexural moduli of the composites while increasing the elongation at break. Moreover, the incorporation of this additive negatively influenced the water uptake resistance but improved the impact strength of PLA-based composites up to 140% and the melt flow rate of PHB-based composites up to nearly 230%.

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Biorefineries

Separation, fractionation and modification of technical lignin from Kraft pulping for advanced applications

Patricia Figueiredo, Patricia Figueiredo / Falk Liebner / Dmitry Evtuguin

Kraft lignin is a virtually unexploited renewable resource that could be made available globally in ten-million-ton scale. It is one of the principal constituents of black liquor, the latter containing all pulping chemicals as well as all solubilized constituents of the biomass pulped. This liquor is typically concentrated by evaporation and fed to the recovery boiler for regeneration of both inorganic chemicals and electrical energy from burning of the organic constituents. Considering the relatively low heating value and elaborate up-concentration of black liquor on the one side and the fascinating properties of the biopolymer lignin on the other hand imparting higher plants intriguing properties, currently amplifying activities aiming at a better material use of lignin can be well understood.

The good water solubility of lignosulfonates is a strong pro that paved way towards many commercial applications for this comparably small fraction of technical lignins, such as dispersants, emulsifiers, adhesives, complexing or retarding agents. Introduction of electrically charged moieties would render kraft lignin similarly attractive. While post-pulping sulfonation of kraft lignin has been studied to some extent confirming that competitive products can be obtained but at questionable expenditure, cationization of kraft lignin appears more appealing since beyond water solubility, other intriguing properties imparted by positive charge can be obtained, too. Particularly, applications relying on physical interaction with negatively charged surfaces or molecular receptors are of specific interest.

Therefore, this PhD project aims to explore the opportunities of chemical kraft lignin modification, in particularly cationization using different quaternization reagents and targeting increased water solubility largely independent of pH.

Acknowledgement: This work was carried out under the project Inpactus – innovative products and technologies from eucalyptus (project number 21874) – funded by Portugal 2020 through the European Regional Development Fund (ERDF) in the frame of COMPETE 2020 nº246/AXIS II/2017.

Biorefineries

Subcritical and supercritical technologies for the production of natural extracts from forest biomass

Vítor H. Rodrigues, Inês Portugal, Carlos Manuel Silva

The management of invasive species generates significant amounts of biomass residues, which usually end up being burnt for energy production. However, these biomasses have been reported to contain compounds with important bioactive properties. In this work, Acacia dealbata bark and leaves have been extracted with Soxhlet and supercritical fluid extraction (SFE), and the obtained extracts characterized using gas chromatography coupled to mass spectrometry (GC-MS). Several triterpenoids were identified, with the main ones being lupenyl acetate (LA) and lupenone (Lu). Total extraction yield, LA and Lu individual extraction yields and concentrations have been optimized in terms of pressure, temperature and cosolvent addition. Overall, SFE was able to reach the Soxhlet total extraction yields, and surpass those of LA and Lu. The same was verified for LA and Lu concentrations. The next steps will focus on the modelling of the extraction process and determining valid scale-up criteria for a techno-economic analysis of the process at industrial scale.

Biorefineries

Production of cellulosic sugars and bioethanol

Mariana Amândio, Jorge M. S. Rocha, Ana M. R. B. Xavier

Eucalyptus globulus is recognized as one of the most widely used species in the pulp and paper sector. However, debarking is a key operation to ensure a high yield of the pulping process and quality of the pulp, which results in large amounts of this industrial residue. It is estimated that at least 10 tons of bark are generated for each 100 tons of pulp products. Typically, the bark is burned for energy purposes, although it can be converted into more profitable applications, contributing simultaneously to the implementation of the concept of biorefinery and the circular economy model.

The conversion of E. globulus bark into cellulosic ethanol involved four main stages: pretreatment, hydrolysis, fermentation and product recovery. The integration of the production of cellulosic sugars into the pulp and paper sector leads to sustainable waste management, valorization of feedstock not suitable for pulp production and boosts the market opportunities. Also, this sector already has industrial facilities and logistics well established.

In this context, the main objective of the PhD project consists of studying the production of cellulosic sugars and bioethanol from E. globulus bark kraft pulp. For this purpose, it is crucial to optimize the operational conditions, evaluate the valorization of post-fermentation biomass and replacement supplementation solutions for low-cost alternatives and study the effect of several configurations in the yield and efficiency of the process.

Biorefineries

Fractionation of kraft black liquor using aqueous biphasic systems

Inês Rocha, João Coutinho, Sónia Ventura

The conversion of pulp and paper mills in biorefineries requires the maximization of the value of process streams, particularly those of lower value, extracting or converting their compounds into added value compounds. Lignin and its degradation products, being a major component of black liquor, are some of the few natural sources of aromatic compounds widely available. Their recovery is one of the most important goals not yet achieved in the context of forest biorefinery. In this project we propose to extract and fractionate the aromatic components of black liquor, consisting mainly of lignin in macromolecular form but also as oligomers and monomers, by liquid-liquid extraction using aqueous biphasic systems (ABS).

Biorefineries

Biotechnology

Development of functional food targeting cardiometabolic risk

Andreia Silva, Artur M. Silva, Susana Cardoso, Manuel A. Coimbra

Cardiovascular diseases (CVDs), the leading cause of death worldwide, are closely related to several interrelated risk factors, namely hyperglycemia, hypertension, dyslipidemia, insulin resistance and obesity. Diet has been pointed as one of the most important strategies to fight CVDs and, in this topic, the phenolic compounds resveratrol, epicatechin-gallate and hydroxytyrosol assume particular relevance. Nevertheless, their usage as functional food ingredients needs to overcome several challenges, including stabilization and solubility issues modulated by polysaccharides and proteins. This work intends to elucidate the impact of distinct vehicles of polysaccharides or proteins (either co-mixed or as complexes) on the stability and bioaccessibility of the aforementioned phenolics and design functional foods fortified with specific phenolic-polysaccharides blends/complexes able to assure bioactivity towards CVDs prevention. Up to now, resveratrol was investigated to develop functional bread and lemon juice. The vehicles tested for bread fortification were zein nanoparticles and γ-cyclodextrin complex, at a final amount of 0.5% of resveratrol. In the lemon juice, it was applied the γ-cyclodextrin complex to a final concentration of 0.625 mg of resveratrol/mL juice. The γ-cyclodextrin complex showed to be quite promising in lemon juices. In lemon juice, the γ-cyclodextrin complex promoted the solubility of RSV in the aqueous matrix that, consequently, contributed to the slight increase of bioaccessibility as compared with free resveratrol (2%,

compared to 0.5% of free resveratrol in the intestinal phase). Moreover, the antioxidant potential of resveratrol was preserved for at least 28 days. Regarding the bread, the antioxidant potential of resveratrol complexed with γ-cyclodextrin was preserved, while the bioaccessibility and bioavailability did not seem to improve with the tested vehicles. Overall, no apparent physicochemical changes were noticed in both products, but further sensorial analysis are required. Moreover, to understand the implication of resveratrol in bread, a study of digestibility was started, with the first results showing that the presence of 2% resveratrol does not affect starch digestibility. Regarding hydroxytyrosol, natural extracts from olive leaves have been performed to valorize this agricultural waste.

Biotechonology

Solid phase extraction of bacteriorhodopsin and application in luminescent solar concentrators

Gabriela Kovaleski, Sónia Ventura, Maria Rute de Amorim e Sá Ferreira André

The study of flexible luminescent solar concentrators (LSCs) has grown as a strategy in the development of renewable energies. Despite the investment in the use of more biocompatible LSCs using natural active optical centers, their application still suffers from their loss of stability and consequent low device efficiency. In this work, the potential of bacteriorhodopsin (BRhod) as an active optical center will be studied. Considering the need for low-cost devices, this plan will focus on studying more efficient downstream technologies. The process will start by optimizing cell lysis for BRhod recovery using aqueous solutions of ionic liquids (ILs) derived from the choline cation, as they are more biocompatible and selective. After BRhod recovery, solid phase extraction processes (SPE) will be applied for protein purification (purity>98%), using commercial adsorbent materials. Thus, these materials will be used for their lower cost and biocompatibility, but also hydroxyapatite a waste from the fishing industry.

Biotechonology

Human plasma derived hydrogels for myocardial tissue engineering

Sara Santos, Catarina Custódio, Michael Monaghan, João Mano

Heart failure due to myocardial ischemia (MI) is a global cause of death. Heart remodeling mechanisms after MI include replacement of functional myocardial tissue with fibrotic scar tissue. Despite all the promising results on the use of current therapies, still new strategies have to be developed to generate new functional muscle tissue within the scarred regions. In this project it will be explored the use of human derived hydrogels with tunable mechanical properties to develop cardiac microtissues that resembling native myocardium. These innovative human based platforms could exhibit the right biochemical and mechanical environment to support the development of myocardium tissue in vitro and used in regenerative strategies.

Biotechonology

Biotechnological tools for plastic waste remediation using marine fungi

Ana Paço, Teresa Rocha-Santos, Artur Alves

The presence of plastic in the environment, and the constant increase in its production, make plastic one of the great problems of today for which solutions are needed. Biodegradation has been presented as a possible natural solution and different microorganisms have been studied for this ability. However, information about this biological process is still needed, for example, the genes and all the metabolic pathways involved are not yet known. Thus, the application of tools such as genomics, proteomics, and metabolomics would allow us to obtain valuable information for the development of a viable biotechnological process for the treatment of plastic waste.

Biotechonology

Poly (glycerol sebacate) (PGS): a base for new materials

Bruno Godinho, Artur Jorge Faria Ferreira

The synthesis of poly(glycerol-co-diacid) polyester materials can produce a wide range of products with relevance.

Poly (glycerol sebacate) (PGS) and its conjugations with other elements bring up an attractive class of biomaterials. The molecular weight, degree of branching, mechanical properties and surface chemistry can be controlled by fine-tuning synthesis procedures to match custom specifications. In this 3rd year, the pitch will focus on a small part of the results involving PGS, poly (glycerol succinate) (PGSuc) and poly (glycerol sebacate/succinate) (PGSSuc). The pre-polymers were synthetized in different ratios of each diacid (sebacic and succinic), since 100% sebacic acid (PGS) until 100% succinic acid (PGSuc). The prepolymers (55% degree of esterification) were analyzed by electrospray ionization (ESI) mass spectrometry. The information obtained from ESI for each pre-polymer will be presented with some detail.

The covid 19 situation resulted in some delays, so this 3rd year is not the finish of my PhD.

Biotechonology

Bioengineering humanized 3D co-culture osteosarcoma models in static and dynamic microenvironment for therapy development

Cátia Monteiro, Catarina A. Custódio, João F. Mano

To date, the majority of osteosarcoma (OS) therapies with evidenced efficacy in preclinical models fail during human clinical trials. The shortage of robust drug screening platforms that more accurately predict patient's response underlie these misleading results. To provide a reliable platform for tumor drug discovery, a humanized 3D osteosarcoma (OS) model was developed exploring the potential of methacryloyl platelet lysates (PLMA) hydrogels to sustain spheroid growth and invasion, and promote a synergistic tumor-stromal cell interaction in a tri-culture setting. Tumor cells showed to chemotactically promote stem cell alignment towards tumor center. The exposure of OS models to doxorubicin revealed an improved drug resistance of PLMA-based models, comparing with scaffold-free spheroids. In the future, the combination of microfluidic technology with rather innovative human-derived hydrogels, tumor growth, invasion, migration and intravasation events will be recapitulated in a dynamic bone-mimicking environment, named osteosarcoma-on-a-chip. The relevance of this project relies on providing 3D complex models to recapitulate tumor invasion and tumor-stromal cell crosstalk in static and dynamic environments for therapy development purposes.

Biotechonology

Macroalgae as bio-factories

Samuel Patinha, Sónia A. O. Santos, Sílvia M. Rocha, Helena Abreu

Bioprospection of bioactive compounds from macroalgae has gained increasing interest in the last years. When submitted to extreme environmental conditions, these marine resources can produce higher amounts of quite exclusive bioactive secondary metabolites which can be promising pharmaceutical, cosmetic or nutraceutical agents. However, little is known about the effect of abiotic/biotic conditions on macroalgae composition which could be exploited to obtain macroalgae with higher bioactive compounds (such as linear diterpenes, PUFAs, sterols and phlorotannins) content.

Some green and brown species will be used as models to maximize their cultivation under different abiotic conditions aiming to an increased content of target bioactive compounds. Moreover, environmental-friendly extraction methodologies will be optimized in order to obtain phenolic and lipophilic rich extracts which upon validating their bioactivities they could be further exploited in high-value applications.

Biotechonology

Hyperbaric inactivation - a nonthermal approach to inactivate Alicyclobacillus acidoterrestris endospores

Carlos Pinto, Jorge A. Saraiva

Alicyclobacillus acidoterrestris is a gram-positive, thermophilic microorganism that produces highly resistant spores that represent an atypical case of an endospore able to germinate and outgrowth in acidic food products, as it is generally accepted that most endospores are unable to germinate/outgrowth at pH levels below 4.6, with the acidity hurdle blocking the nutrient receptors of the spores. Indeed, this particular endospore represents a threat to the industry, as it is rather prevalent in fruit juices and concentrates and, in its vegetative form, it is able to produce guaiacol, which is responsible for the off-flavours and odours in fruit juices and concentrates contaminated with this microorganism.

Lately, high-pressure processing (HPP) has been widely used for nonthermal pasteurization of foods, although, as for any pasteurization procedure (either thermal or nonthermal) it is unable to destroy bacterial spores, although, the combination of high temperatures (above 70 °C) with HPP has shown to be efficient for endospore inactivation. Nevertheless, the combination of these temperatures with HPP may also cause considerable changes to the food products (although in a lower extension compared with intense thermal processes aiming the inactivation of spores, such as sterilization).

In a previous study, hyperbaric storage (HS) at uncontrolled room temperatures (RT) has shown to be quite efficient to inhibit endospore development, and in some cases resulting in A. acidoterrestris inactivation in commercial apple juice, with the results pointing out that these spores could be reduced below detection limits within 48 h, which led to the hypothesis that an increase of the set pressure level could result in higher inactivation rates, in a range of pressures usually higher than those used in hyperbaric storage (up to 100 MPa)4, but lower than those used in HPP (above 450 MPa), leading to a new concept aiming endospore inactivation, called hyperbaric inactivation (HI). This principle states the use of hydrostatic pressures between 150-250 MPa to inactivate microorganisms that are usually resistant to HPP, such as bacterial spores.

In the present study, hyperbaric inactivation was performed, using A. acidoterrestris endospores inoculated in commercial apple juice (pH 3.70) as case-study. The HI conditions were set to 150, 200 and 250 MPa up to 24 h, at uncontrolled room temperature (20-23 °C). At the same time, an HPP (600 MPa/3 min) and thermal pasteurization (90 °C/30 sec) were performed to infer how a previous endospore activation step would impact their behaviour under HI conditions. The inactivation kinetics results followed a Log-Logistic model for all the evaluated pressures. With this methodology (and for all the evaluated pressures), it was possible to reduce A. acidoterrestris endospore counts below quantification limits after 24h, with at least 4.54 log units' reduction. Moreover, a thermal and HPP pre-treatment to the inoculated apple juice revealed to accelerate the inactivation rates, being possible to achieve the detection limit (1.00 log CFU/mL) after 24h at 150 MPa, with a thermal pasteurization pre-treatment of (90 °C/30 sec), while HPP at 600 MPa/3 min performed equally to the non-pre-treated samples.

These results seem to indicate that HI can be used to inactivate bacterial spores in food products, with wider potential, to improve the safety of such products.

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Biotechonology

Development of Decellularized-Matrix Based Organotypic in vitro 3D Tumor Models

Luís Ferreira, João F. Mano, Vitor M. Gaspar, Jason F. Burdick

Breast cancer is the most frequently diagnosed cancers in women, with triple negative breast cancer remaining the deadliest presentation. Given its late aggressive presentation, metastatic potential and evasive phenotype treatment has remained elusive. Immunotherapy is an increasingly explored treatment for advanced and metastatic breast cancer owing to its encouraging clinical success obtained in other malignancies. Despite its groundbreaking potential, recent reports evidence that advanced triple negative breast cancer displays inherent resistance to immunotherapeutic approaches. To overcome this limitation, researchers are actively developing next-generation immunotherapeutic approaches and investigating their synergistic combinations with chemotherapeutics. Robust preclinical validation of these combinations remains however limited by the lack of 3D in vitro models that fully mimic breast tumors cellular and extracellular matrix crosstalk. The development of physiologically relevant 3D microtumor testing platforms that fully recapitulate these hallmarks is yet to be explored and urgently required. The current work plan aims to develop innovative 3D in vitro models comprised by dynamic tumor-ECM mimetic decellularized matrix derived scaffolds for co-culture of triple negative breast cancer, stromal and immuno representative cellular populations. These immunocompetent 3D models are envisioned to be used in high-throughput screening being and therefore accelerate the discovery of more effective immuno-chemotherapeutics combinations.

Biotechonology

Valorization of Opuntia ficus-indica L. through an integrated production of high value products

Ricardo Ferreira, Susana M. Cardoso, Jorge A. Saraiva

The species Opuntia ficus-indica L. is an important food resource throughout the Mediterranean basin. However, the commercial flow of the products of this crop will have to face strong challenges from the already rooted markets.

This project aims to develop new value-added Opuntia products, which include juices and functional products obtained from the main by-products of juice production, ie peels and seeds. Peels will be used as an ingredient in gluten-free flours, that in turn can be used in the formulation of distinct food products, namely enrriched bread. Instead, seeds remaining in the pomace will be used for oil extraction. Notably, innovative non-thermal processing technologies, namely high pressure processing (HPP), will be herein exploited as a non-thermal pasteurization in juices, as well as a green methodology for seeds oil extraction, aiming to achieve differentiated products from the currently marked.

Biotechonology

Enzymatically degradable hydrogel-based systems to control cell's microenvironment and migration

Maria Mendes, Dr. Ana Sofia Silva, Professor João F. Mano

Inspired by the need to develop more relevant materials for TE applications, highly innovate enzymatically degradable hydrogel-based systems are herein proposed. Firstly, by combining the enzymatic degradation with the external magnetic field guidance, we are exploring the development of a magnetoenzymatic carrier system to sculpt a topographical patterning that resembles the native vasculature within laminarin hydrogels. For that, magnetic nanoparticles were prepared and entrapped into a poly-L-lactic acid (PLLA) shell for the development of the magnetic microcarrier system. The enzyme α-amylase, which is able to degrade laminarin, was further immobilized in the PLLA shell via aminolysis and glutaraldehyde coupling reactions, respectively. Secondly, we hypothesise that the incorporation of α-amylase into laminarin hydrogels can alter the mechanical properties of the structure, promoting the controlled outward cell migration for potential therapeutic applications. Overall, we propose two distinct enzymatic-based systems to overcome the major challenges in using thick and densely populated hydrogels, namely the low diffusion of nutrients and the formation of a necrotic core.

Biotechonology

Shikonin-loaded biopolymeric nanocarriers for macrophage targeting and inflammasome modulation

Matias Cardoso, Dr. Iola Duarte, Dr. Vitor Gaspar, Prof. João Mano

Host immune response to medical devices and implantable biomaterials is key to their functional integration. Macrophages are essential in the regulation of the inflammasome and, thus, in the overall innate response, leading either to inflammation resolution or persistence. The development of biomaterials to modulate the inflammasome is a promising strategy towards the promotion of implant integration. In this work, we have developed macrophage-targeted biopolymeric-based nanocarriers for the controlled release of immunomodulatory metabolic drugs. Shikonin, a natural naphthoquinone with anti-inflammatory properties, was encapsulated into zein-hyaluronic acid nanogels. These nanocarriers were efficiently taken up by macrophages, showing low toxicity. The ability to modulate the cells inflammasome was also demonstrated through assessment of caspase-1 activity and IL-1β production. Macrophages phenotypic characterization showed the immunomodulation potential of theses nanocarriers promoting a pro-regenerative environment. NMR exometabolomics was employed to assess the metabolites and metabolic pathways affected by inflammasome activation and its NP-mediated attenuation. Looking forward, we aim to develop a novel class of versatile inflammasome-modulating biomaterials to mitigate implant-related inflammation.

Biotechonology

Pancreatic islet transplantation using mesenchymal stem cells as a long-lasting microenvironment modulator

Ana Rita Sousa, Mariana Braga de Oliveira, João Mano

Mesenchymal stem cells (MSCs) transiently adopt an immunosuppressive phenotype when pre-exposed to pro-inflammatory triggers and recent evidence report short-lived MSCs to generate an adjuvant effect after infusion in humans receiving allogeneic transplants. Thus, the goal of this project is to explore the immunosuppressive potential of MSCs using allogeneic pancreatic islet transplantation as a model. We intend to modulate the two main features of MSCs: the secretome and the cell surface molecules. While the MSC encapsulation in inert matrices under different pro-inflammatory pre-stimulation regimens showed to induce the production of anti-inflammatory and pro-angiogenic molecules, the production of cell-based constructs that persistently present tolerogenic cell surface molecules already showed to be non-toxic. Future studies evaluating the ability of our systems to inhibit alloreactive T cells (the main culprits of allogeneic rejection) and to impair the rejection of allogeneic pancreatic islets in vivo will provide further clues to the efficacy of these setups.

Biotechonology

Magnetic responsive plataforms to control cell behavior for tissue engineering applications

Lúcia Santos, Doctor Ana Sofia Silva, Professor João F. Mano

Magnetic responsive systems have been gaining momentum in the controlling of cell attachment/detachment in cell culture, namely harvesting of sensitive cells, single-cell analyses and development of cell sheets (CSs). By taking advantage of this knowledge, we are exploring the construction of CSs aided through magnetic field to attain functional tissues. For this, supermagnetic iron oxide nanoparticles were incorporated within cells' environment, allowing the fabrication of complex, stratified and hierarchical magnetic tissues in a simple, one-pot and cost-effective manner. Micro to macro magnetic CSs were successfully engineering. In an attempt to develop completely biomaterial-free CSs, smart magnetic responsive surfaces are being developed through the chemical modification of glass surfaces with magnetic-based polymers. We anticipate that by combining the magnetic field with the hydrophobicity of the magnetic-responsive glass surface, CSs can be created and detached from the surface, enabling the in vitro creation of 3D tissues with clinical relevance.

Biotechonology

Liquefied microcapsules as dynamic microbioreactors for bone regeneration

Maryam Ghasemzadeh Hasankolaei, Prof. João F. Mano

Biochemical and biophysical properties of biomaterials provide multiple mechanical cues influencing cell behavior. It is known that the viscosity of the extracellular matrix (ECM) can influence the path of differentiation towards a specific lineage. Recently, the importance of the microenvironment viscosity in the fate of stem cells was shown in 2D surfaces. However, the physical interaction of cells with their microenvironment is more precisely mimicked in 3D systems.

Herein, we propose our well-established cell encapsulation system of liquefied and multilayered capsules (LMC), as microbioreactors in which the encapsulated cells are exposed to variable core viscosities. Taking advantage of the unique compartmentalized and liquefied core environment, microcapsules were cultured under a dynamic system by simply using a shaker. The LMC technology was combined with electrospraying to produce such microbioreactors at high rates, thus enabling the application of microcapsules for high-throughput screening. Results demonstrated that microbioreactors with higher core viscosity led to the significantly larger size of aggregate and higher osteogenic characteristics including hydroxyapatite marker.

These results confirmed the potential of LMC as a reliable microbioreactors for bone regeneration applications.

Biotechonology

Natural phenolic compounds – gut microbiota dynamics: a reciprocal modulation approach for personalized nutrition

Adriana Pais, Prof. Armando Silvestre, Dr. Sónia Santos

Human health is closely influenced by gut microbiota, since there are about 800 bacterial species that establish a commensal relationship with the host. Gut microbiota composition imbalances – denominated as dysbiosis - could alter the host's health, resulting in diseases like colorectal cancer and inflammatory bowel diseases. Several factors can modulate gut microbiota composition, being diet one of the most important. Natural phenolic compounds, commonly found in human diet, are widely known for their positive effects on human health. Simultaneously, their ability to modulate gut microbiota composition has attracted scientific community attention, since they could result in an increase of beneficial gut microbiota density. At the same time, gut microbiota metabolizes phenolic compounds, which could influence their effect on human health. Hence, this work aims to study the two-way relationship between phenolic compounds and gut microbiota, developing strategies to exploit the most promising phenolic metabolites, as at the same time the gut microbiota ecosystem is also enhanced. Therefore, phenolic compounds can be used in precision healthcare strategies, particularly in personalized nutrition.

Biotechonology

Metabolic markers of osteogenic differentiation of MSCs by NMR metabolomics

Daniela Bispo, Daniela Bispo, Ana M. Gil, João F. Mano

Mesenchymal stem cells (MSCs - multipotent cells) can differentiate into a variety of cell lineages, namely osteogenic thus having great potential in bone regenerative medicine. Metabolomics offers exquisite insight into the metabolism of living organisms and, although some studies have already characterized MSC metabolome during differentiation, very few have monitored osteogenesis, with mass spectrometry approaches predominating [1-3] compared to nuclear magnetic resonance (NMR) spectroscopy [4]. Our aim was to unveil the metabolic pathways most affected by osteogenic differentiation. We applied NMR, in tandem with univariate and multivariate analysis, for the first time to our knowledge, to monitor simultaneously the endo- and exo-metabolomes of adipose-derived human MSCs throughout osteogenesis in 2D cultures (days 0-21). Our results showed significant differences over time in several endo-metabolites (including amino acids, choline compounds, among others). There was a clear metabolic separation before and after 7 days of culture. This work paves the way to characterize the dynamic metabolism of stem cells during osteogenesis, ultimately enabling its monitoring through metabolic biomarkers, eventually translatable to in vivo clinical tissue regeneration strategies.

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Biotechonology

Innovative Biomedical System Based on Enzymatically Degradation of Hydrogels

Mehrzad Zargarzadeh, João F. Mano, Catarina A. Custódio

Hydrogels possess the capability of holding a large amount of water in a three-dimensional (3D) network and mimicking many features of the native extracellular matrix (ECM) which makes them attractive materials for biomedical applications[1]. Laminaran-based hydrogels are interesting due to their tuneable mechanical properties and high cytocompatibility[2]. Here, we develop a radically novel self-sustained 3D bioscaffolds for cell culture that takes advantage of the degradation products (mainly glucose) of the laminarin hydrogels. In vitro studies of this self-feeding hydrogel have demonstrated significantly high viability of the encapsulated MSCs cells in glucose free culture medium, attributed to the sustained release of glucose resultant from enzymatic degradation of the hydrogel. In order to further validate practical ability of these hydrogels, in-vivo studies are being assessed through subcutaneous implantation. Photo-crosslinkable platelet lysates (PL)-based hydrogels have exhibited to support distinct human-derived cell cultures owing to their high content of bioactive molecules, such as cytokines and growth factors[3]. Aiming at taking advantage of all features of both PL and laminaran hydrogels, here we combine UV responsive laminaran-methacrylate

and PL-methacrylate derivatives plus an adequate enzyme to fabricate a multicomponent hybrid hydrogel. This hydrogel is newly designed as a scaffold material for the sustained delivery of glucose produced via enzymatic degradation of laminaran and granting cell adhesin by presence of PL. Such innovation is expected to circumvent the limitations of the current hydrogels strategies that lack on nutrients diffusion and adhere motifs, boosting the application of hydrogels in diverse biotechnological contexts.

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Biotechonology

3D anisotropic scaffolds for spinal cord regeneration

Joana Sousa, Paula Marques, João Mano

Spinal cord injury can mean permanent loss of functionality at the sensory and motor level. Currently, there is no treatment capable of fully restore spinal cord physiology, and patients' well-being is ensured by palliative and rehabilitation approaches. In this regard, neural tissue engineering offers an opportunity to associate cells, biomolecules, biomaterials and microfabrication techniques to reconnect the two stumps of the injury. To overcome this inhibitory environment, we are specifically focused on mimicking the spinal cord white matter alignment via the design of various anisotropic scaffolds: aerogels with vertically aligned pores, hydrogels with vertically aligned chains of nanoparticles and hydrogels with vertically aligned magnetic fibres. The scaffolds are composed of a photopolymerizable platelet lysates hydrogel (PLMA), graphene-based materials (GBM) and superparamagnetic iron oxide nanoparticles (SPIONs). PLMA is a complete xeno-free solution and important source of growth factors and proteins. GBM are increasingly engineered as components of biomedical platforms in neuro-repair strategies. SPIONs can be targeted through external magnetic fields in order to create ordered structures and stimulate cells in situ. In the future, in vitro studies with neural stem cells will be performed to assess which microarchitecture has the best chance to promote aligned tissue regrowth between the proximal and distal ends of the injury.

Biotechonology

Dynamic Control across Adaptable Hydrogels and Engineered Cell Assemblies

Pedro Lavrador, João Mano, Vítor Gaspar

Human tissue extracellular matrices (ECM) experience dynamic changes in composition, architecture and organization that constantly influence their biosignal presentation and functions. This is derived from their viscoelastic nature, stress relaxation properties and wholly cell-programable backbone design. Recreating the dynamic nature of tissue matrices and its biological complexity cannot be achieved with conventional covalently-crosslinked hydrogel networks that are purely elastic, or with binary 2D patterning of biochemical cues. Recently, it is being increasingly established that developing biomaterial platforms endowed with dynamic behavior similar to native ECM vastly enhances encapsulated cells' functions and behavior. This project will be supported by dynamic covalent chemistries for attaining chemodynamic adaptable 3D networks that can more closely convey the permissive mechanics of native tissues ECM. Alternatively, advanced cell surface engineering concepts are envisioned to be leveraged to materialize cells as building blocks for assembling cell-rich structures that are biodynamic in nature due to their living components. Overall, these two research branches are expected to yield 3D microtissues with tissue-like composition and adaptable features arising from their chemodynamic and biodynamic designs. Conceptually, harnessing dynamic control over cell-ECM environments and cell-cell interactions will collectively contribute to alternative design routes for establishing native ECM-mimicking 3D contexts or to produce sophisticated architecture-defined materials that are generated through controlled cell assembly.

Biotechonology

Marine science and engineering

Agri-food byproducts as a source of biomolecules for sustainable bioplastic packaging production through blown extrusion

Paulo Brites, José Martinho Marques de Oliveira, Idalina José Monteiro Gonçalves, María de los Desamparados López Rubio

In this PhD thesis, starches with different physicochemical characteristics, such as amylose quantity, granule size, and molecular weight, will be obtained from industrial potato washing slurries and rice bran and used as biobased thermoplastic matrix targeting to develop bioplastics suitable to be processed by blown film extrusion . Also, inorganic and organic compounds will be extracted from these byproducts to serve as fillers, namely silica and cellulose, and plasticizers, including lipids and oligosaccharides. The natural lipids obtained from rice bran will be used to chemically modify the obtained starches through transesterification, and, after hydrolysis, their free fatty acids will be used in direct starch esterification, aiming to improve the hydrophobicity, processability and mechanical properties of the thermoplastic starch. This PhD thesis will greatly impact the bioplastic packaging industry, by allowing the development of biodegradable and sustainable starch-based formulations compatible with the blown film extrusion, while implementing a circular economy between agrifood and plastic industries.

Materials science and engineering

Processing and characterization of complex concentrated alloys produced by powder metallurgy

Tiago Silva, Augusto Lopes

During the last decade, an increasing number of studies have been conducted on metallic materials with a quasi-equimolar proportion of three or more components. These new alloys called complex concentrated alloys (CCAs), introduce new possibilities of developing materials with improved properties such as higher hardness, lower thermal conductivity, high strength at room and elevated temperatures, enhanced wear behaviour and improved corrosion resistance.

The main objective of the present work is to obtain CCAs by powder technology that can be used in demanding technological applications. In this context, several new CCAs compositions are being developed using thermodynamic calculations, mechanical alloying and conventional sintering. This allowed to obtain materials with an interesting set of properties such as high hardness/density ratio and corrosion resistance.

Materials science and engineering

Hybrid thin films with electrochromic response

Alice Marciel, Manuel Pedro Graça, Rui Ramos Ferreira e Silva

In recent times, relevant investments have been done to promote the implementation of electrochromic (EC) materials in displays or light modulation systems. Transition metal oxides (TMOs) in the form of thin-films have high potential for these applications. TMOs nature, “green” production processes, low consumption of raw materials and higher device durability when compared with organic electrochromic devices are strong motivations to focus on their research and development. Among TMOs, hybrid niobium molybdenum oxides (NbxMoyOz) are very interesting for electrochromic proposes showing an intense electrochromic colour change and relevant electrical and dielectric properties in a wide range of temperatures (220 K and 330 K).

Materials science and engineering

KNN thin films as candidate for energy harvesting

Rui Pinho, Paula Vilarinho, Elisabete Costa

Electronic devices are currently powered by batteries, which are bulky, require high maintenance, and carry a large environmental footprint. Such limitations are rather expensive, or not feasible in remote places, wireless sensors and wearable devices 1. Thus, lighter, smaller, and long-lifespan

power sources are requested. Due to the recent advances in electronics towards low power consumption devices, harvesting environmental vibrational energy is one possible solution 1–3. Piezoelectric effect offers the simplest method to convert mechanical into electric energy, with the easiest maintenance and highest durability 2. Piezoelectric energy harvesters require high electromechanical factor and piezoelectric coefficient 1. The standard piezoelectric is Pb(Zr,Ti)O3, PZT. Yet, health and environmental restrictions to lead led to a hunt for lead-free alternatives 4. Among them, potassium sodium niobate (KNN) withstands due to high Curie temperature (TC = 420 °C), reasonable piezoelectric and electromechanical coupling coefficients 5. Following the actual miniaturization trend, the fabrication of these materials in the form of thin films is mandatory. The performance of thin films differs from their bulk counterpart (polycrystalline or single crystals) due to strains caused by lattice mismatch and/or differences of thermal expansion coefficient between the substrate and the film, the interface between the different layers, and/or local polar regions created by point defects such as oxygen vacancies. Strain is the most critical feature because it affects the low frequency (the useful frequency range for piezo harvesting) dielectric properties, which are directly related with the soft phonon mode. In ferroelectrics, atomic positions and lattice vibrations are stress dependent, and therefore polarization and transition temperatures as well 6.

Strains can be imparted to thin films and have already been used to improve the mobility of charge carriers in semiconductors for transistors, and to tailor transition temperatures in ferromagnetic and superconductor materials 6. Due to the direct coupling between strain and ferroelectricity, large shifts in TC were obtained. It is widely accepted that compressive strain decreases permittivity and TC while compressive strain have an opposite effect 7–9. The effects of strain on ferroelectric transition, structure and microstructure have been studied for several materials, including PZT, PbTiO3, BaTiO3 and SrTiO3, which is not ferroelectric but exhibits ferroelectricity when strained 8–10. However, such knowledge is rather scarce for KNN thin films but very relevant for the development of lead-free piezoelectric harvesters. In this work we have developed KNN thin films at a low crystallization temperature and studied the effect of strain in the structure of oriented KNN thin films. We have demonstrated that it is possible to crystallize KNN thin films at a temperature (T) as low as 400 ºC, which is considerably lower than the conventional T (650 ºC) reported for the crystallization of KNN thin films, thus opening the possibility for integrating KNN thin films with polymeric substrates. The study of strain effects allowed to follow the differences in the structural evolution with temperature for oriented KNN thin films as function of the substrate, which has been pursuit to engineer the electrical performance of thin films.

Materials science and engineering

Atomic layer deposition of high-k dielectric films for diamond transistors

Aneeta Jaggernauth, Rui Silva, Joana Mendes

The miniaturization of microelectronics has initiated exploration into Si-substitute materials that are better able to perform under extreme conditions, such as in temperatures >400oC. The efficient heat extraction, high breakdown field and chemical inertness of diamond favour its use in such environments, and its doping with boron (BDD) presents the opportunity for use in microelectronics. MOSFETs based on polycrystalline diamond films can be cost effectively fabricated but high leakage currents and low capacitive coupling between oxide and semiconductor interface prevent their reliable and optimal use under harsh conditions. These challenges can be alleviated by incorporating high-k materials both as gate insulator and semiconductor surface passivation layers, for achieving surface stability, high charge carrier concentration and leakage current minimization. These applications on BDD thin films remain in infancy, having mainly been explored for Al2O3, but dielectrics with higher k values and appropriate energy band offsets may prove more expedient to BDD's surface termination and band structure. In this work high-k TiO2 and Ta2O5 thin films, are deposited on BDD via atomic layer deposition (ALD), and its process parameters studied. These endeavours converge at the fabrication of MOSFETs to determine BDD and dielectric film performance.

Materials science and engineering

Vacuum and temperature influence on UC emission in Gd2O3: Yb3+, Er3+

Talita Ramos, Luís Días Carlos, Ricardo Longo, Oscar Malta

Temperature and pressure are fundamental physical parameters, so their monitoring is crucial for various industrial and scientific purposes, especially using a non-invasive technique.

Currently, we are investigating if the UC-emission profile changes under ambient pressure versus vacuum, and how can we use these changes to monitoring pressure temperature. Based on the interdependences of these physical parameters can be possible to convert the luminescent thermometer (Gd2O3:Yb3+, Er3+) into a remote vacuum sensor. Thanks to the presence of thermalized couple levels of Er3+, we are able to correlate the enhancement of the laser-induced heating of the upconverting sample placed in vacuum (using Er3+ 524/560 nm band-ratio), with changes of the pressure values in the system. The unprecedented enhancement of the laser-induced heating of the sample observed under vacuum conditions, due to enhancement of the light-to-heat conversion is associated with limited thermal convection (heat transfer) in a vacuum, leading to the unprecedented heating of the material irradiated with a 980 nm laser, compared to the heating effects observed at ambient conditions, where air molecules transfer the generated heat to the surroundings and cool down the sample.

Materials science and engineering

Multifunctional red mud-based alkali-activated materials for acid mine drainage sludge treatment

João Carvalheiras, Rui Novais, João Labrincha

Red mud is a highly alkaline and toxic waste generated in large quantities (115 million tons per year) during the production of alumina by the Bayer process. The reuse of red mud is an urgent and pressing issue, requiring innovative recycling methodologies. A new and unexplored, but promising solution, could be its use as a precursor in the synthesis of alkali activated foams idealized for water treatment systems.

The main goal of this project is to synthetise and use red mud-based alkali activated materials as a multifunctional material to extract heavy metals and buffer the pH of acid mine drainage from Portuguese mines. We have successfully used red mud as the main precursor in AMM synthesis. To study the heavy metals adsorption behaviour, lead adsorption tests in synthetic wastewater were conducted by varying the solid/liquid ratio, pH and pollutant concentration in the solution. The results indicate that adsorption by this innovative way is not only viable, but very effective. The lead removal capacity reached 30.70 mg/g (at pH 5, C0 = 600 ppm). pH strongly affects the lead adsorption capacity, the AMM adsorption capacity decreasing when pH values lower than 5 are employed. Preliminary tests using real wastewaters were already conducted to access AMM multifunctional behaviour.

Materials science and engineering

T-RTM development: thermoplastic composites production for autoparts

Filipe Martins, Paulo Lima, Martinho Oliveira

Polyamide 6 (PA6), sometimes erroneously denominated as nylon 6, is an engineering thermoplastic. Among other sectors, PA6 is used in the automotive, construction and food industry due to its high mechanical strength, thermal and chemical resistance.

Industrial in-situ polymerization strategies allow the synthesis of polymers inside the mold. Regarding polyamide, ε-caprolactam in-situ polymerization reaction can be driven by anionic ring-opening polymerization. At a given temperature, the process starts once the monomer is mixed with an activator and a catalyst. Then the viscosity of the mixture will tend to increase to the point where the liquid reagents solidify and polymerize into a polyamide.

Comparing to traditional methods, in-situ polymerization requires a lower processing temperature and the process is particularly useful in the development of polyamide matrix composites. When in-situ polymerization starts, melted reagents have a very low viscosity which could be beneficial due to a superior adhesion to compatible reinforcing phases. PA6 can be used on structural components if it´s reinforced with carbon fiber because of its potential to increase the mechanical behavior of the composite.

Nowadays the T-RTM industrial process presents several problems. More knowledge is necessary to address important fields like raw materials, processing conditions and mold project. These fields will be approach with special attention to the processing parameters and the technology itself. The use of new formulations involving carbon requires new processing parameters and new mixing solutions.

Materials science and engineering

Hybrid Nanostructures of Carbon/Metal Oxides for Solar-Driven Abatement of Organic Pollutants

Inês Oliveira, Rui Silva, Cláudia Silva

Water contamination is caused by thousands of different organic pollutants in very low concentrations, as a result of rapid urbanization and industrialization. There is a need to develop new nanomaterials for the efficient treatment of wastewater by means of photocatalysis processes powered by sunlight. Among several nanomaterials, zinc oxide (ZnO) and titanium dioxide (TiO2) are two of the most used metal oxide semiconductors used in photocatalytic reactions. ZnO and TiO2 have low toxicity, chemical stability, and wide band gap energy. An enormous effort has been put to improve the properties of these materials by the combination of their physicochemical properties with those of carbon nanotubes. These properties can be tuned according to the desired photocatalytic processes to subsequently improve the efficiency.

Herein, we present a controlled deposition of two metal oxides, ZnO and TiO2, via atomic layer deposition (ALD) on high surface area supports, such as wave-like patterned carbon nanotube (w-VA-CNTs) arrays. The thin films are conformal and uniform, with 26 and 11 nm layers of ZnO and TiO2, respectively, which were obtained at 200 °C after 200 ALD cycles. The photocatalytic degradation of Rhodamine B using the synthesized nanostructures was assessed by following the absorbance of an aqueous solution of this dye over 240 min of irradiation (Figure 1c). Both materials show photocatalytic activity towards the degradation of Rhodamine B, which constitute very promising results towards their utilization in real wastewater streams.

Materials science and engineering

A Quest for High Performance Ceramic Thermoelectric Modules

Parisa Amirkhizi, Dr. Shahed Vazeh Rasekh Modabberi, Dr. Andrei Kavaleuski

One of the promising methods to recover the wasted energy, produced in different industry or natural process is “green” thermoelectric power generation. Nowdays particular interest is given to the oxide materials, due to enhanced thermal and redox stability, and good thermoelectric properties specially at high temperature, as well as absence of toxicity, and natural abundance of prospective constituent compounds.

This work is focused on strengthening the competitiveness of oxide-based thermoelectric technology and their application using different novel approaches to produce micro- and nanostructural ceramics. The desired effect on the performance will be provided improving the grain´s boundary, enhanced phonon scattering at the induced defects and micro-/nanostructural inhomogeneities, modifications on charge carries enhancing thermoelectric performance. The key research challenges include identification and evaluation of oxide systems with promising properties, seeking effective strategies for improving thermoelectric performance using different process to induce redox condition, and at the same time achieving nanostructured materials.

Materials science and engineering

Food science and technology and nutricion

The study of pine nut skin potential as a functional food ingredient

Soraia Silva, Elisabete Coelho, Manuel António Coimbra

Pine nut skin, resultant of the pine nut processing, represents about 2.4% of the whole kernel weight [1], having an annual volume of approximately 550 metric tons worldwide [2]. Although nut skins have been demonstrated as valuable sources of phytochemicals with health beneficial effects [3,4], pine nut skin composition is not yet established. The skins have potential as inexpensive sources of bioactive compounds, and the growing interest for functional ingredients and the demand for the utilisation of low-cost wastes and by-products justify their interest. Within this work, pine nut skins bioactive potential was studied, aiming to propose them as a functional food ingredient.

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Food science and technology and nutricion

HealthyPassion: from Purple Passion Fruit bioprospection to development of a functional food for asthmatics

Alexandre Fonseca, Sílvia M. Rocha, Armando J.D. Silvestre, Cláudia C. Loureiro

Asthma is characterized by the chronic inflammation of the respiratory airways induced by cellular mechanisms that produce increased levels of reactive oxygen species (ROS). The intake of exogenous antioxidant compounds through diet has been reported as one of the potential strategies to mitigate the effects of oxidative stress in asthma and a human trial has demonstrated that purple passion fruit peel extract can reduce several asthma symptoms. This work aims to take advantage of the purple passion fruit health benefits to develop, through a sustainable production process, a functional food capable of promoting well-being in asthmatic patients. Different parts of purple passion fruit produced in Portugal revealed to be a relevant source of macro (i.e. dietary fiber) and micronutrients (i.e. vitamin C) as well as polyphenols. In order to prepare bioactive enriched extracts, optimization of the green extraction methodologies was assessed based on in vitro bioactivities evaluation. Assays to produce 3D printed gummies are in progress to incorporate the enriched extracts.

Food science and technology and nutricion

Increasing of the value of European brown macroalgae through its application as food imgredients in functional foods

Ana Circuncisão, Manuel A. Coimbra, Susana M. Cardoso

The consumption of marine products has been increasingly gaining attention, as people become more aware of the relation between diet and health. In fact, more than the basic nutritional value, food may be a rich source of bioactive compounds important to healthy development and greater resilience against disease. In this regard, brown macroalgae have been recognized as a rich and balanced source of nutrients and under-exploited health-promoting compounds, among which phlorotannins (PTs), fucoxanthin (Fx), laminarans, fucoidans and alginates are claimed to exert promising bioactivities, including antioxidant and immunomodulatory effects. Such properties make these compounds attractive for the development of added-value functional foods, although it is imperative to establish the scientific basis for their sustainable extraction, assuring their safety, stability, bioavailability and functionality along the gastrointestinal tract.

In this context, the present work aims to study the potential use of extracts from characteristic European brown macroalgae, namely Fucus vesiculosus and Laminaria digitata, as sources of valuable functional food ingredients in foods. To achieve this, a holistic sustainable extraction strategy has been applied in order to obtain extracts/pure fractions of phlorotannins, fucoxanthin, laminarans, fucoidans and alginates, the bioactive principles of functional food ingredients in new food formulations. Up to now, aqueous extracts (29-39%) for both macroalgae revealed higher mass yields comparing to those obtained by hydroethanolic (8-34%) solvents. Yet, EtOH:H2O mixtures were able to recover superior amounts of PTs and Fx in both Fucus and Laminaria. Among the distinct conditions applied, 100% EtOH and 70-80% EtOH were the most suitable conditions to recover PTs and Fx, respectively. While ranging sample-solvent ratios, it was verified that Fucus may be a potential source of Fx comparing to Laminaria, whereas the opposite occurred for PTs content. Further experiments will focus on the holistic extraction of brown macroalgae polysaccharides, followed by biological characterization of all fractions. This will allow to achieve other important goals of this PhD work, that is to study the possible interactions that can be established between algae fractions and food matrix components, as well as to assess what happen to algae-functional ingredients in terms of their stability, bioavailability and bioactivity after digestion process.

Food science and technology and nutricion

Use of emerging processing technologies to functionally modulate biodegradable films and coatings

Renata Amaral, Jorge Saraiva, José Lopes da Silva

Thermoplastics became essential in our everyday life and, despite synthetic non-biodegradable polymers have several advantages like the low prices and easy industrial processing, they represent a threat to world sustainability as they produce enormous amounts of non-biodegradable wastes. For that reason, several strategies have been used to develop biodegradable packages, mainly those from biodegradable biopolymers, such as starch. Starch is an important biopolymer since it is a renewable source, low price (can be extracted from industrial by-products) and widely available. Moreover, several studies revealed that starch-based films and coatings are suitable, as they are odourless, colourless, provide

an aesthetic appearance, can act as an antioxidant and antimicrobial carrier and are edible. Notwithstanding, these films can present some challenges like high hydrophilicity and retrogradation. Therefore, this work aims to explore novel structure/function relationships of starch using emergent technologies like high pressure, ultrasounds, and pulsed electric fields, singly and in combination. The changes induced in starch by these physical treatments are different of those made with temperature/water and may originate films with different and better characteristics, such as lower water vapor permeability, higher tensile strength, and elongation at break. This work will allow to produce tailormade films/coatings made from potato industrial wastes. More importantly, it is going to be assessed the films and coatings suitability in real food products.

Food science and technology and nutricion

FunctionalCoffee: In vitro gastrointestinal digestion-fermentation of coffee for validation of its hypocholesterolemic potential as a functional food

Fernanda Silva, Filipe Coreta-Gomes, Manuel A. Coimbra, María Dolores del Castillo

Coffee, one of the world's most consumed beverage, have been linked to several health-promoting properties. Coffee's bioactive ingredients, such as polysaccharides and lipids, have been associated to these beneficial effects, namely the hypocholesterolemic potential. Despite essential in many biological processes, cholesterol is an important risk factor for the development of cardiovascular diseases, as a major contributor for human mortality. Targeting the reduction of blood cholesterol through convenient and affordable hypocholesterolemic food ingredients is both a challenge and a demand. Coffee is hypothesized to have a high potential for this purpose: 1) intrinsic richness in bioactive compounds, 2) modulation of nutrient content, 3) intake timing after major meals, when more cholesterol exists in the intestinal lumen, and 4) high index of consumption. This work proposes to disclose the mechanisms by which coffee compounds can affect cholesterol bioaccessibility and bioavailability, particularly the dependence of their hypocholesterolemic properties on gastrointestinal digestion and microbial fermentation.

Food science and technology and nutricion

Impact of pH and water activity on food preservation by hyperbaric storage

Vasco Lima, Professor Jorge Saraiva

Proper storage conditions are necessary to preserve foods, to avoid or delay deterioration or quality issues. Cold storage of foods is worldwide used as the main strategy, but it is responsible for great energetic consumptions and emissions of global greenhouse gases, which is environmentally unsustainable.

Recently, Hyperbaric storage (HS - food storage under mild pressures), has been proposed as an alternative to refrigeration that can be used at room temperature (RT), which is a major advantage, allowing for lower energy costs and green-house gas emissions and has been showing to preserve foods products equally/better than

refrigeration.

The main objectives of this PhD plan are to evaluate, for the first time, the impact of pH and water activity (major influencers of microbial development) of food products on storage/preservation using HS at RT, focusing on microbiological growth (with selected microorganisms) and quality attributes, including endogenous enzymatic activity and lipid oxidation on food models and real case-studies of fruit juices.

Initial results regarding the inactivation of inoculated Escherichia coli in the watermelon juice point to a quicker inactivation (below the detection limit, ~4.8 log units reduction) of the most acidic watermelon juice (pH 4.0), in comparison to samples with pH 5.0 or pH 6.5. Additionally, increasing the pressure level also allows for a quicker

inactivation.

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Food science and technology and nutricion

Shelf-life extension of pasteurized and ready-to-eat foods by hyperbaric storage at room temperature

Álvaro Lemos, Jorge Saraiva, Ivonne Delgadillo

For many foods, low temperature storage (refrigeration) from production to consumption is necessary to maintain quality and safety. This is especially important for ready-to-eat (RTE) foods with a more or less long shelf-life based on an unbroken cold chain. However, some studies have revealed that RF represents approximately 1% of the CO2 emissions worldwide and is the third major source for the whole of the food industry (James, James, 2010). Therefore, it is essential to find environmentally friendly food preservation methodologies. Hyperbaric storage (HS) is a new concept for the storage of foods that involves applying mild pressures, between 25-100 MPa, over a few days to some months of storage time (Lemos, Ribeiro, Fidalgo, Delgadillo, Saraiva, 2017). HS has opened the possibility of storing foods above atmospheric pressure at room temperature (RT), where energy is only needed to compression phase of the pressure vessel. Furthermore, as the temperature does not need to be controlled and the pressure applied should be as low as possible, the energy costs and the carbon footprint will be minimal (Bermejo-Prada, Colmant, Otero, Guignon, 2017).

A commercial RTE fish soup was stored under HS/RT at 75 MPa to evaluate its effect on natural microbiota (total aerobic mesophiles) up to 63 days to assess its shelf-life compared with atmospheric pressure at: room temperature (AP/RT) and refrigeration (RF). Moreover, a sensory evaluation was carried out with an untrained panel, taking into account the main attributes of fish soup such as colour, consistency and viscosity, and overall acceptability.

In this work, RF presented a microbial shelf-life of about 14 days, reaching unacceptable levels of total aerobic mesophiles (> 6.0 log CFU/mL) at 21st day. Conversely, HS/RT at 75 MPa were capable not only to inhibit microbial growth but also to inactivate microorganisms, achieving the detection level (< 1.0 log CFU/mL) at the same 21st day, extending microbial shelf-life at least up to 63 days. Moreover, the physicochemical analyses namely pH and colour, showed a similar behaviour between samples preserved by HS/RT and RF. Nevertheless, in sensorial analyses after 14 days of storage for each condition, RF samples were closer of fresh samples than HS samples, mainly due to colour and aroma attributes, although from a microbiology point of view RF is clearly worse.

The present work shows the potential of HS/RT to preserve RTE foods comparing with RF, with the advantage of the first promoting higher microbial safety and opening the possibility of longer shelf-life, with minor quality differences versus RF and basically with no energy consumption.

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Food science and technology and nutricion

Innovative Sequentially Combined Processing Technologies to Improve the Quality of Egg Pasteurized Products

Ana Ribeiro, José A. Lopes da Silva, Jorge A. Saraiva

Title: Innovative Sequentially Combined Processing Technologies to Improve the Quality of Egg Pasteurized Products

Ana C. Ribeiro, José A. Lopes-da-Silva, Jorge A. Saraiva

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Egg is a highly perishable product, being often associated with salmonellosis. To avoid this problem, thermal pasteurization (TP) is usually applied, but this treatment causes changes in functional properties [1 – 3]. A possibility to minimize these limitations is the use of high pressure (HP) to cause sub-lethal damages in microorganisms, thus decreasing their thermal resistance, allowing a subsequent less intense TP [4].

The aim of this study was to evaluate the performance of sub-lethal HP pre-treatments (50 – 400 MPa/5 min) followed by a less intense TP (60 ºC/3 min) on egg yolk (EY), comparing with the commercial TP procedure (60 ºC/6.2 min), to assess the effect on inactivation of Salmonella Senftenberg 775W and on egg functional and physicochemical properties.

Results showed that ccommercial TP caused reductions up to 3.25 log CFU/mL, while the less intense TP alone led to only ≈1.98 log CFU/mL decrements. When pressure was applied, overall, the results showed that an increase of pressure alone led to an increase of S. senftenberg 775W inactivation. Although, the combined treatments (HP+TP) carried out at 50 – 225 MPa, showed an increasing inactivation pattern (up to 4.6 log CFU/mL), thus enhancing the thermal inactivation effect. Parameters such soluble protein content showed no differences between commercial TP and the combined treatments. Regarding lipid oxidation, an increase of about 20 – 49% in malonaldehyde content occurred regardless of the applied treatment, but the combined treatments showed lower levels of oxidation compared to commercial TP. The emulsifying activity index was improved with treatments, and no differences between combined treatments and the commercial TP. Although, the emulsion stability index showed the same tendency, being the commercial TP about 15% higher than the combined treatments. These hint the possibility to use sequentially combined treatments (HP followed by TP) to enhance inactivation of S. Senftenberg 775W and also improving/maintaining EY properties.

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Food science and technology and nutricion

STORAGE UNDER PRESSURE OF DAIRY FOODS AS AN ALTERNATIVE TO REFRIGERATION

Ricardo Duarte, Jorge Saraiva, Ivonne Delgadillo, Ana Gomes

The possibility to preserve foods under pressure at naturally variable (uncontrolled) room temperature (Hyperbaric Storage/HS) is a novel preservation methodology/concept that allows significant energetic costs reduction, since no energy is needed to maintain the temperature, while for pressure, energy is only needed to generate the pressure, but not to maintain it [1]. HS acts by microbial growth inhibition similarly to refrigeration [2, 3], with possible no temperature control throughout the storage period. As a consequence, HS also becomes an environmentally friendlier technology, with a carbon footprint estimated to be about 26-fold lower compared to refrigeration storage [4]. Effective management of cold chains utilizes about 50% of total energy in food industry [1]. Substitution of refrigeration by HS, would allow significantly energy reduction, as substantial reduction in food products losses during processing, storage, transport and sale, when refrigeration fails. Additionally, HS requires pressure levels much lower (up to 150 MPa) than those used for pressure pasteurization (500-600 MPa), but enough to significantly slow down/inhibit microbial growth similarly to refrigeration.

During this PhD work, HS showed great results in inhibiting as well as inactivate microbial load present normally in dairy products, as well as in inoculated microorganisms and endospores. Also, overall, the physicochemical properties of this products were maintained in values similar to does observed for refrigeration storage. Although an increase in free amino acids throughout storage was observed, no changes in total protein was detected, with HS milk and fresh cheese samples presenting a more similar volatile organic and fatty acids profile to the samples prior storage, even after 60 days at variable room temperature.

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Food science and technology and nutricion

Political science

Políticas públicas locais de gestão do património cultural em cidades Património Mundial

Diamantino Raposinho, Filipe Teles, Luís Mota

O projeto pretende aferir a importância dos sistemas de governação no quadro da implementação de políticas locais de gestão de cidades Património Mundial ao nível mundial, especialmente na Europa. Pretende-se, assim, responder a uma falta de estudos empíricos sobre o processo de implementação de políticas de gestão de cidades Património Mundial, através da análise da importância relativa de diferentes fatores críticos inerentes a esta fase do processo de políticas públicas.

O plano de trabalhos prevê a caracterização dos sistemas de governação nas cidades Património Mundial, definindo tipologias, percebendo o seu efeito sobre os resultados e impactos das políticas de gestão destas cidades. Através de uma análise comparativa internacional mundial e de estudos de caso na Europa, será possível identificar os fatores críticos para a implementação, a importância relativa dos sistemas de governação e entender melhor o processo de políticas públicas em contextos complexos como são as cidades Património Mundial.

Political science

Drawing Lines in the Sand: position-taking and polarisation in the European Parliament

João Moniz, Carlos Jalali, José Santana-Pereira

It has become a commonplace to say the European Union (EU) has become a politicised issue (Marks & Hooghe, 2009), i.e. the process by which EU decision-making is transposed into the realm of mass politics from the realm of elites (De Wilde & Zürn, 2012). This process is grounded in each country's domestic public sphere, as European issues become more salient for both public opinion and interparty competition (de Wilde, 2011). This communications seeks to advance our understating of the phenomenon by looking at how the national dynamics of politicisation translate into the European Parliament (EP).

However, politicisation at the EU level itself has been neglected by the literature, with notable exceptions (Brack, 2015; Proksch & Slapin, 2010). Given the second-order nature of EP elections (Reif & Schmitt, 1980) which favor challenger parties, the EP is disposed to the presence of issue entrepreneurs willing to politicise the EU. Additionally, the EP offers great comparative framework for the analysis of party politics since it hosts a wide variety of ideologically distinct political parties from diverse political cultures within the same institutional constrains across time.

In this paper, I analyse the politicisation of the EU by applying the Wordfish algorithm (Proksch & Slapin, 2008) to the EP plenary debates around critical moments of the integration process, thus providing a longitudinal map of the politicisation of the EU. This innovative method of quantitative text analysis can process large amounts of textual data and estimates party positions on single issues form the word frequency of the texts.

Political science

The Self-Governance's Process in Chinese Villages – Case Hezhai and Case Nanhai

ZHONGPU FAN, Jorge Tavares da Silva, Carlos Jalali

Na década de 1980, a China continental vivia sob um regime de partido único e caracterizado por um socialismo de caracteristicas chinesas. Foi a partir de 1980 que nas vilas chinesas se iniciou o processo de auto-governação.

Com toda a sua singularidade, o sistema político chinês é uma conjuntura do autoritarismo orientado pela meritocracia e dos elementos democráticos limitados. O estudo irá apresentar o processo de evolução da auto-governação através dos estudos qualitativos em dois casos particulares: o de Hezhai e o de Nanhai. Terá o objetivo de analisar a tendência da democratização no poder local chinês, ao longo do desenvolvimento económico, em que se centra o trabalho do Partido Comunista Chinês, mediante uma comparação entre os dois casos. Na primeira parte, será analisado o contexto político chinês – o socialismo com características chinesas. A seguir, explicará os elementos democráticos que estão a decorrer na política chinesa. Na terceira parte, demonstrará os pormenores da implementação da auto-governação nos dois casos. Por fim, a comparação será feita entre Hezhai, a vila mais pobre, e Nanhai, a vila mais evoluída.

Political science

Acting as policy entrepreneurs during COVID-19: The Case of Serbian Think Tanks

Irena Djordjevic, Carlos Jalali, Sonja Stojanovic Gajic

The starting point of this analysis is John Kingdon's (1984) Multiple Streams approach used to analyze whether think tanks can be acknowledged as policy entrepreneurs during COVID-19 crisis. For such purpose, the case of Serbian think tanks is examined, analyzing problems they raised, policy alternatives they proposed along with strategies they applied. Moreover, by comparing issues brought by think tanks and Governmental policy, it is assessed to what extent think tanks proposals match with the ones the Government introduced. The findings show that the selected think tanks applied diverse strategies in addressing problems, which were in majority cases accompanied with specific proposals on how to resolve them. In addition to focusing on issues that are in line with their area of work and referring to their pet proposal, think tanks as well raised some new problems, which were not on their agenda before. Finally, more than half of the problems addressed in the Government program were also recognized as important by think tanks. Therefore, it may be concluded that think tanks played the role of policy entrepreneurs during COVID-19 crisis, but in order to assess whether they were the ones that brought such ideas to policy makers, further analysis is required.

Political science

The Radical Left in Latin America: A perceptional approach

Tiago Conceição, Carlos Jalali

The (comparative) study of the radical left in Latin America remains scarce. Moreover, the categorizations that exist so far address exclusively incumbent parties, while neglecting a set of electorally relevant political parties that dwell further to the left of the political spectrum. To fill this gap and reach a better understanding of the distinct groups of parties that compose the broad Latin American Left, we adopt a perceptional approach based on three expert surveys and one elite survey to find out what parties compose the radical left in Latin America. Although the flaws of such an approach are well known and discussed in the literature, this consists of an early attempt at establishing an international categorization of a set of parties that had been forgotten by academics and that have, according to our findings, managed to secure (regular) parliamentary representation in all but 3 Latin American countries.

Political science

Managing Intra-Party Factionalism: the case of Iberian Radical Left Parties

Pedro Lourenço, Varqá Carlos Jalali, Tiago Conceição

Radical left parties (RLPs) are often described as fraught with high levels of internal factionalism. However, research on how this is handled internally by the parties remains scarce. Considering that, we set on answering the following question: 'how do radical left parties manage intra-party factionalism?', by attempting to unveil the (in)formal strategies and procedures used for this purpose. Our study draws on a comparative analysis of four RLPs – the Portuguese Communist Party (PCP), Left Bloc (BE), United Left (IU) and Podemos – from 2010 to 2019. These parties provide a great ideological and organizational diversity (e.g. leadership models), electoral success, and have recently been involved in government participation, coalition-building processes or serious intra-party conflict. Knowing that parties remain fairly secretive organizations, we provide a privileged insight into some of these mechanisms through the complementary analysis of 26 semi-structured elite interviews with (ex) party (faction) members, and a set of party and media documents.

Political science

Marine science, technology and management

Assessing the effects of temperature, ultraviolet radiation and turbidity on prokaryotic communities in carbonate reef sediments

Tamara M. Stuij, Newton C.M. Gomes, Nicole J. De Voogd

This project is about composition and function of sediment microbial communities in coral reef environments. Surface sediments are known to harbour a wide variety of prokaryotes which vary over small spatial scales. They are important in nutrient turnover and fulfil essential roles in the biogeochemical cycles of the ocean, but how specific environmental conditions, like temperature and turbidity, shape the prokaryotic communities is still largely unknown. As such in this project I aim to assess the diversity and putative function of prokaryotic communities in carbonate reef sediments and investigate the effects of temperature, ultraviolet radiation and turbidity on sediment prokaryotic communities.

Marine science, technology and management

Rhizosphere Engineering of Salicornia ramosissima with Plant-Growth Promoting Bacteria (PGPB)

Maria João Ferreira, Ângela Cunha, Javier Cremades, Helena Silva

Crop cultivation of halophytes represents a sustainable alternative to traditional agriculture and an opportunity to reclaim salinized soils, particularly in a climate change scenario. Plant-Growth Promoting halotolerant Bacteria (PBPG) associated with the roots of halophytes mitigate salt-stress, improve the access to nutrients and serve as biopesticides. Plant microbiome can also affect the production of plant metabolites, although our knowledge of that relation is still limited. Halotolerant bacteria associated with the roots of the halophyte Salicornia ramosissima were isolated (120), identified and characterized as to their PGPB traits. Halotolerant Proteobacteria, Firmicutes and Actinobacteria have been recovered from the rhizosphere and the endosphere of S. ramosissima, and the most abundant taxonomic class was Bacilli. The isolates collection exhibited a wide variety of PGP traits, although none expressed all traits. The production of exopolysaccharides, siderophores, IAA (indole-3-acetic acid), ACC deaminase and the ability to solubilize phosphate was well represented in the collection. In contrast, only 4% of the isolates were able to fix atmospheric nitrogen. Several extracellular enzymes related to biocontrol of phytopathogens were also produced by an interesting percentage of isolates. Considering the PGP traits profile, 4 isolates were selected (Bacillus aryabhattai SP20, Pseudomonas oryzihabitans RL18, Salinicola endophyticus EL13 and Stenotrophomonas rhizophila EH7) and inoculated on S. ramosissima seeds, under two salinity conditions (1% and 2% NaCl). Interestingly, the combined inoculation of all the isolates produced the fastest and highest percentage of germinated seeds, highlighting the potential of bacterial consortia inoculants. To better understand the relation of plant microbiome on plant metabolite production, bacterial communities and plant metabolites were investigated in S. ramosissima plants collected in a natural saltmarsh and an intensive crop field within the same estuarine system (Ria de Aveiro, Portugal). Wild plants were enriched in sugars, sterols and terpenoids, while crop plants enriched in saturated and unsaturated fatty acids. Some correlations (Pearson) between taxa and metabolites were found, suggesting that microbial engineering of the plant microbiome can modulate the plant metabolic profile.

Marine science, technology and management

Climate change impact on estuarine aquaculture activity along the Portuguese coast

Humberto Pereira, João Miguel Dias, Inés Álvarez

Portugal is one of the world's countries with the highest consumption of fish per capita, not capturing or producing enough fish to ensure its needs. To respond to the high demand for fish consumption, aquaculture infrastructures for fish and bivalve's production have been installed in most of the national estuarine systems. However, there is limited information about the best physical, chemical, and microbiological conditions for aquaculture production of species with high commercial value.

This work aims to identify and evaluate areas, along the Portuguese coast, with high potential for aquaculture activity (as well as critical areas), promoting its sustainable growth considering the possible impacts of climate change.

High resolution biophysical numerical models will be explored for several Portuguese estuaries and lagoons to develop local maps of physical, chemical, and microbiological variables under present and future climate change scenarios. These results will allow us to establish classes for a Suitability Index to fish and bivalve species, contributing to increasing the available knowledge on high potential areas and species to explore in Portuguese coastal systems.

Marine science, technology and management

Salt intrusion modeling in Aveiro Lagoon under morphological and climatic changes

João Pinheiro, João Miguel Dias

Most studies to date on climate change have neglected effects on saline intrusion in estuarine environments. Furthermore, most estuarine environments have highly dynamic morphologies, with concurrent natural variability and effects of human actions, which may amplify climate change impacts on salt intrusion. These may be particularly meaningful in changing salinity distribution and, consequently, impacting the ecological equilibrium of estuarine habitats. Indeed, such variations could be critical for the development and survival of certain species used to live in a specific range of salinity. The purpose of this PhD work is to evaluate changes in salinity distribution in Aveiro La goon in response to climate change and morphological modifications, assessing past and future differences and quantifying the main physical driver's relative contributions. Modifications of salt transport mechanisms induced by both factors will be analyzed and characterized, aiming to understand the local estuarine dynamics. To achieve these goals, a novel three-dimensional application of the Delft3D modeling suite will be developed for Aveiro Lagoon, and different numerical simulations will be performed for scenarios of climate change and human induced morphological modifications. As a case study, Aveiro Lagoon is an area of great interest since it has been exposed to several dredging operations during the past decades that changed the Lagoon morphology, which are planned to continue in the future.

Marine science, technology and management

Modeling the physical processes that underlie Harmful Algal Blooms in North-Western Iberian shelf and Rias Baixas

Elisabet R. Cruz, Jesús Dubert, Rita Nolasco, Xose Antonio Padin

North Western Iberian shelf and Rias Baixas (NWISR) are a coastal upwelling region with a recurrent annual presence of Harmful Algal Blooms (HAB) of Dinophysis species and decadal intermittent blooms of Gymnodinium catenatum. These species are responsible for diarrhetic shellfish poisoning (DSP) and paralytic shellfish poisoning (PSP). Different physical mechanisms have been suggested to explain the presence of HAB on the NW Iberiancoast. Someauthorssupportthattheinner-shelftransportofalreadyestablishedoffshore populations is enough to account for the numerical increase of HAB after upwelling relaxation and downwelling. Others consider that only the hypothesis of an alongshore transport of allochthonous populations by inshore currents can explain sudden outbreaks of HAB on the coast. There is evidence that both hypothesis can occur and that there are blooms with epicenters in the Portuguese coast that can reach the Galician Rias and viceversa. A two-way nesting configuration of CROCO, a 3-D hydrodynamic ocean model, was computed to obtain a high-resolution configuration forced with realistic forcings. These outputs are going to be used to study some scenarios of HAB transport using a lagrangian model, the Connectivity Modeling System (CMS). The spatial and temporal patterns of HAB will be analyze through the computation of Empirical Orthogonal Functions (EOF) and,asafinalapplication,abasicforecastsystemwillbebuildusingArtificialNeuralNetwork(ANN).TworecenteventsthatIwillliketohighlitaretheacceptanceofapapertitled "A high-resolution modeling study of the circulation patterns at a coastal embayment: Ría dePontevedra(NWSpain)underupwellinganddownwellingconditions"atFrontiersjournal and my participation at the "Biennial Observation of Carbon, Acidification, Transport and Sedimentation in the North Atlantic (BOCATS2)" cruise at RV Sarmiento de Gamboa, from Vigo to Iceland from 26th May to 28th June.

Keywords: Harmful Algal Blooms (HAB); North Western Iberian shelf; Rias Baixas; 3-D model.

Marine science, technology and management

Phage Therapy in Bivalve Depuration

Pedro Costa, Adelaide Almeida

With the rising of bivalve production in aquaculture and to avoid human diseases transmitted by bivalve consumption (e.g. Vibrio and Salmonella), it is necessary to develop new methods of decontamination. This study aims to efficiently decontaminate bivalves (Ruditapes decussatus and

Cerastoderma edule), employing phage therapy (using bacteriophages, viruses that only infect bacteria) during depuration (method currently used). The isolation, selection and characterization of phages constitute major steps for the employment of this therapy. Evaluating the ability that each phage has to inactivate bacteria is essential, however, the standard methods used to assess bacterial inactivation are either very time consuming or don't have enough precision for effective screening. As such, the current work employs a new protocol adapted from the resazurin assay to assess the bacterial inactivation by phages by measuring cell activity. Since this method is fast, precise and allows the testing of multiple samples at the same time, it is optimal for screening assays. With this protocol, it was possible to select from a variety of phages, the ones with the best inactivation, moreover, it allowed for the screening and selection of the best performing cocktail to be used to control several pathogenic bacteria at the same time during depuration.

Marine science, technology and management

Photodynamic inactivation of Escherichia coli on Sea Bass Fillets

Cátia Vieira, Maria Adelaide de Pinho Almeida, Maria Amparo Ferreira Faustino

Aquaculture is a growing sector of worldwide importance. However, the occurrence of disease outbreaks in fish-farming tanks, as well as the introduction of pathogenic bacteria during the processing of fish, can lead to deterioration of food products and endanger consumers. Moreover, most of the conventional antimicrobial techniques available to control these infections can result in thermal or chemical changes and even contribute to the development of resistant microbial strains. To address these challenges, innovative and alternative antimicrobial approaches must be developed. Recent studies suggest antimicrobial Photodynamic Therapy (aPDT) as an environmentally friendly and cost-effective technique to decontaminate food products without the development of resistant microbial strains. Therefore, the aim of this study was to evaluate the Photodynamic inactivation of Escherichia coli ATCC 25922, a gram-negative model for microbiological analyses in food, in Sea Bass fillet. To achieve this goal, preliminary assays were performed in Phosphate-Buffered Saline and Saline Artificial Water to assess the photodynamic efficiency of Tetra-Py(+)-Me and Methylene Blue (MB) in the inactivation of E. coli, in different solution matrices. Potassium iodide (KI) was also tested in combination with both photosensitisers (PSs) as a potential enhancer agent aPDT efficiency. Afterwards, solutions of each PS were prepared in PBS and the photodynamic treatments were performed in the flesh and skin of Sea Bass fillet contaminated with E. coli. The results obtained showed a E. coli reduction of ca. 2 Log CFU.mL-1, which corresponds to 99% of the total bacterial inactivation in Sea Bass fillet. These results are promising and suggest aPDT as an efficient antimicrobial approach to disinfect fish products contaminated with bacteria and to provide healthy and microbiological safe food.

Thanks are due to the University of Aveiro and FCT/MCTES for the financial support to CESAM (UIDP/50017/2020+UIDB/50017/2020) and LAQV-REQUIMTE (UIDB/50006/2020), to the FCT project PREVINE (FCT-PTDC/ASP-PES/29576/2017), through national funds and when applicable co-financed by the FEDER, within the PT2020 Partnership Agreement and "Compete" 2020. Thanks are also due to the Portuguese NMR and Mass Networks. C.V. thanks FCT for her doctoral grant (SFRH/PD/150358/2019).

Marine science, technology and management

Using natural geochemical fingerprints to expose illegal, unregulated and unreported (IUU) fisheries: Seahorses as a case study

Ana Cabral, Ricardo Calado, Carla Patinha, Miquel Planas

Seahorse populations are under an unprecedented pressure from illegal, unreported and unregulated (IUU) fishing. Additionally, many seahorse species are Data Deficient, meaning that there is a gap in the knowledge about traits regarding their ecology and biology, and about their exploitation, which increases the difficulty of managing the seahorse fisheries and trade in a sustainable manner.

The analysis of elemental fingerprints (EF) of seahorses' mineralized structures (e.g., vertebrae and bony plates), holds the potential to reveal the place of origin of traded and apprehended seahorses.

This research aims to fine-tune the use of a geochemical tool to determine EF of seahorse populations and species (namely the Eastern Atlantic species Hippocampus hippocampus and H. guttulatus) and confirm or refute claims on their place of geographic origin. It is expected that the construction and refinement of traceability tools, will potentially result in reliable resources to the fight against the IUU activities, namely the poaching of seahorses from marine protected areas (MPA).

Marine science, technology and management

Interactions between microplastics and pollutants in the aquatic environment and their ecotoxicological effects

Joana Rodrigues, Teresa Rocha Santos, Juan Santos Echeandía

In the present thesis, the interaction between microplastics and contaminants are investigated as well as whether sorbed contaminants can be translocated to aquatic organisms or aggravate toxic effects through MPs acting as vehicles. Since this phenomenon has a lack of answers, this study could be an important contribution to clarify the risks posed by the presence of microplastics in the marine environments in terms of pollution and ecosystems health, in order to prevent them.

Marine science, technology and management

Host-parasite interactions: new insights on trematode impacts on their bivalve hosts and how to predict outbreaks

Simão Correia, Luísa Magalhães, Sergio Boo, Manuel Vera

Bivalves represent important socio-economic and ecological resources to coastal communities and ecosystems. Nonetheless, bivalve natural stocks have been affected by overfishing, inefficient management, degradation of environmental conditions and emergent diseases. Among these factors, disease outbreaks caused by trematode parasites can lead to severe economic and ecological losses through mass mortalities. However, their recognition as major drivers of bivalve population dynamics is still unsettled due to a lack of information regarding host-parasite interactions and outbreaks abiotic predictors. In this context, this thesis aims to identify the multi-level impacts of trematodes: at the individual level, through the study of host gene expression, reproductive cycle and immunology; and at the ecosystem level by analysing how changes induced in the hosts influence ecosystem functioning, and by identifying the factors involved in trematode outbreaks. The outcomes of this thesis will help to fully understand host-parasite dynamics and improve the development of novel approaches to control disease outbreaks.

Marine science, technology and management

Spiny lobsters in a changing ocean- how phyllosomata of commercially important species will cope with warmer and more acidic oceans

Simão Maia, Ricardo Jorge Guerra Calado, Sérgio Miguel Franco Martins Leandro, Sam Dupont

Fisheries of decapod crustaceans are important socio-economic drivers that are vulnerable to ongoing global changes. The present proposal aims to evaluate how global changes may impact the first larval stages of three commercially important spiny lobsters: Palinurus elephas, Palinurus mauritanicus and Panulirus regius. The range of distribution of these species overlaps in the eastern Atlantic and it is important to understand how early phyllosomata of a temperate coastal species (P. elephas) copes with a changing ocean when compared to a deep-water species (P. mauritanicus), as well as when contrasted with a species with subtropical affinity (P. regius). Furthermore, jellyfish blooms associated to climate change can positively impact the development of phyllosomatas.

The development and biochemical profile of larvae from these commercially important spiny lobsters will be determined to infer how they may adapt to future climate changes. These experiments will shed light over the phenotypic plasticity of early spiny lobster phyllosomata in the oceans of tomorrow.

Marine science, technology and management

Improving the lipid profile of Black Soldier Fly for aquafeeds

Daniela Rodrigues, Olga Ameixa, Ricardo Calado, José Vázquez

Black Soldier Fly (BSF) can be fed using different types of substrates and, as such, modulate its biochemical profile. Here we used an expired salmon aquafeed and two macroalgae (Ulva sp. and Fucus sp.) as diets for BSF larvae aiming to promote the incorporation of n-3 Polyunsaturated Fatty Acids (PUFA) and obtain an improved insect meal to be processed as an aquafeed ingredient for marine species.

We tested different levels of feed replacement (0%, 25%, 50%, 75%, 100%) blended with chicken feed (control) during larval rearing and surveyed the levels of n-3 PUFA incorporated in different larval instar (1st, 3rd, and 5th instars) for a period of 10, 7, and 2 days, respectively. Results revealed that in just 2 days BSF was able to incorporate eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), with a fish feed replacement of 75% and 50%, respectively.

The maximum amount of EPA attained was 4.54%, with 100% replacement after 10 days, and 6.37% for DHA with 75% replacement after 7 days. An increase in the levels of DHA, PUFA and n-3 fatty acids was recorded in BSF after just 2 days at a replacement level of 25% by Ulva sp., while for Fucus sp. only after 10 days and at a replacement of 50% was it possible to detect improvements in DHA and other PUFA levels. Moreover, detrimental effects were recorded in trials performing 75% and 100% replacement by fresh macroalgae and expired salmon feed, namely, in growth, survival, and life cycle duration.

These results suggest that BSF larvae likely display a level of phenotypic plasticity allowing to shape its n-3 PUFA profile.

Marine science, technology and management

Language sciences

Effects of Pragmatic Intervention Programme in Language Impairment

Tatiana Pereira, Marisa Lousada, Margarida Ramalho

Pragmatic is often impaired in preschool age children with Developmental Language Disorder (DLD) and Autism Spectrum Disorder (ASD). The main goal of this study is to explore the effects of the Pragmatic Intervention Programme in children with pragmatic impairments (DLD and ASD). The study will be carried out with preschool children (between 4 and 6 years old), through a randomized controlled study with follow-up.

Children recruitment is underway. The results obtained will be an added value for the scientific community, as they will contribute to an evidence-based practice, as well as to minimize the possible emotional, academic and behavioral problems, through the stimulation of attitudes promoting inclusion among communicative partners and the valorization of joint work between health and education professionals.

Language sciences

Rehabilitation sciences

Effectiveness of Body Weight Support Treadmill Training on Gait in Patients with Multiple Sclerosis

Ana Almeida, Rui Costa, Andreia Sousa

Abstract

BACKGROUND: Walking is frequently impaired in patients with multiple sclerosis (MS) in an extent that, fifteen years after the start of the disease, in over 50% of the cases walking assistance is still needed. Treadmill training (TT) with body weight support (BWSTT), has been incorporated in rehabilitation programs with positive results for MS patients. However, it is not clear that the results based on functional measures could effectively evaluate the biomechanical changes introduced by BWSTT. Systematically examining of different percentages of BWS, intensities, frequencies, durations, and types of training using combination of kinematic, kinetic and metabolic outcome measures could develop optimal training protocols that maximize benefits for a variety of MS patients with different clinical needs. OBJECTIVE: To evaluate the effectiveness of BWSTT in functional gait improvement in MS patients. METHODS: Three studies will be conducted: a) Study I - a randomized, controlled, prospective study, with crossover design will be performed to compare BWSTT and TT intervention in a sample in 12 MS patients with EDSS 4.0 to 6.0, to determine, based on clinical features, the subjects that benefit most from BWSTT; (b) Study II - a cross-sectional observational study will be performed in subjects with MS, EDSS 4.0 to 6.0, to determine the influence of BWS percentage variations in treadmill training to improve gait quality index and efficiency; c) Study III - a randomized, controlled, prospective, longitudinal study, with crossover design, to analyze the

effectiveness of a customized BWSTT based on gait biomechanical and clinical features on gait independence regarding the individual functional evolution of the subjects over time, in patients with MS with EDSS 4.0 to 6.0. EXPECTED RESULTS: Knowing which patients benefit with BWSTT and defining accurately the protocols to use could provide more information on the impact on gait in MS patients to allow gains in the recovery potential of patients. Dissemination and knowledge transfer resulting in the publication of three studies in international journals and communications in international meetings are expected.

Key-words

Multiple Sclerosis, Walking Impairment, Exercise, Bodyweight Support Treadmill Training, Rehabilitation

Rehabilitation sciences

Clinical reasoning in neurological physiotherapy: Why we do what we do? A Bobath Concept perspective

Cláudia Marques, Daniela Figueiredo, Julie Vaughan-Graham, Rui Costa

Summary: Clinical reasoning is a complex skill that is essential for professional practice and deemed to be the phenomenon that leads to physiotherapists' thinking processes and decision-making in practice. However, the ability of these professionals to make clinical decisions has been under-researched in neurological physiotherapy.

Objectives: The purpose of this project is to explore the clinical reasoning process and practice in Portuguese physiotherapists with Bobath certified education and training. Specifically, it aims to: (a) explore how Bobath physiotherapists develop their own clinical reasoning, decision-making and practice; (b) compare and contrast these clinical reasoning and practice with two other groups, non-Bobath education physiotherapists and Bobath Expert instructors physiotherapists; and (c) compare intervention sessions between Bobath and non-Bobath training physiotherapists.

Methods: An exploratory qualitative approach will be performed. It will involve a qualitative description of guided recall using video-records of treatment sessions followed immediately by in-depth interviews. Bobath certified training physiotherapists and non-Bobath physiotherapists will be included.

Expected results: This project will identify the differences between the clinical reasoning and intervention in Bobath and non-Bobath certified training physiotherapists. It will provide an interpretive understanding of the perceptions, assumptions and representations underpinning the clinical reasoning process and practice used by experienced Bobath therapists, illustrating the insight into the reality of decision-making in the planning and delivery of neurological physiotherapy in Portugal. It will also recognize the core aspects of Bobath clinical practice that require consideration in optimising the quality of critical thinking, decision-making and practice knowledge in the context of health care.

Rehabilitation sciences

Development of a modified backpack to minimize postural changes in school children

Sandra Silva, Fernando Ribeiro, Francisco Pinho

Background: The backpack is the healthiest carriage way of the school material but constitute a considerable external perturbation that can lead to postural changes.

Objectives: The main objective is to investigate and describe kinetic and kinematic patterns of human movement, using a non-linear approach, while using a backpack, in real-life context, as the starting point to develop a modified backpack (prototype) that allows minimizing postural changes along the school path.

Methods: In order to fulfil the main objective, three cross-sectional studies will be conducted, on subjects who attend the first year of the second cycle of the basic education and carry a traditional backpack to transport their school materials: (1) This study will be conducted to develop and validate a wearable instrument for kinetic and kinematic assessment of human movement, MySuit, which comprises inertial measurement units, electromyography sensors and force sensor resistors. Each part will be compared with a commercial device, and the different signals will be registered simultaneously. The evaluation will be in functional tasks, such as full gait cycle, sit-to-stand, stand-to-sit and reach. (2) This study aims to evaluate and compare kinetics and kinematics variables obtained in laboratorial and real context, while using a backpack. MySuit will be used to collect the data, such as anticipatory postural adjustments, co-activation and activation sequence (kinetics parameters), and joint angular velocity and acceleration, maximum and minimum angles (kinematic parameters). On the participant's backpack, will also be placed an inertial measurement unit and a global positioning system sensor synchronized with de central unit processor.

All the variables will be analysed with a non-linear approach. (3) This study will be conducted to analyse the kinetic and kinematic of human movement, in the laboratorial context, while carrying a modified backpack-MyPacK, developed based on the results of study 1 and 2. For this, the data will be collect wearing MySuit and MyPacK, in the most representative functional tasks of real-life environment (identified in study 2). Finally, it will be developed an algorithm with a supervised Machine Learning (Artificial Intelligence) system to achieve the most important variables that imply the complexity of postural behavior related with the most adaptable BP configuration.

Available results: During the present year we performed the following tasks: 1) literature review; 2) submission and approval by the Instituto Politécnico de Saúde do Norte Ethics Committee; 3) Partial development of the instrument that will serve as the basis for all data collection that supports this PhD - MySuit; 4) participation on the 2nd International Congress of Health and Well-Being Intervention.

Rehabilitation sciences

The contribute of workplace health promotion in workers performance and absenteeism: An occupational health intervention on manufacturing industry

Lurdes Gonçalves, Fernando Ribeiro, António Amaro, Carlos Costa

Several European Union countries have put great focus on the development of a healthy workforce, in response to the epidemic of "lifestyle" disease. The burden of non-communicable diseases, such as cardiovascular diseases, is rapidly increasing worldwide. They are also associated with high absenteeism and low productivity, in the labor context.

This is particularly problematic, in a decade which the company's productivity is highly dependent on the human capital. Given that adults spend more than 50% of their day at work, workplace is an important setting for health promotion initiatives.

Most occupational health studies focus the reduction of work-related musculoskeletal disorders; few used a comprehensive approach aiming to also decrease the burden of cardiovascular diseases. This project aims to assess the effects of an occupational health and wellbeing intervention in absenteeism rate, individual performance, quality of life, social skills, work-related musculoskeletal disorders, and cardiovascular health of industry workers.

Rehabilitation sciences

Characterization of the institutionalized elderly population to guide physical therapy practice

Joana Pinto, Alda Marques

Abstract

Summary: The elderly population will increase over the next years and, whether due to functional decline, presence of multimorbidity or personal motivations, a growing institutionalization of this population is expected. Each person will have their own healthcare issues and treatable traits but there are inconsistencies in how physical therapy practice can be personalized to optimize outcomes.

Aims: This study will characterize the institutionalized elderly population, analyze treatable traits based on simple, clinical and commonly used measures in physical therapy practice to guide personalized interventions. Secondary aims include to: explore the behavior of treatable traits in institutionalized elderly, over time; understand reasons of institutionalization, and further perspective of elders, loved ones and formal caregivers about physical therapy outcomes to assess at admission in nursing homes.

Study-design: A mix-methods study will be conducted, with a quantitative (longitudinal study) and a qualitative (walking interview method) approach, with elders living in nursing homes.

Methods: Functional ability, health-related physical fitness (HRPF), commonly referred symptoms in the elderly (pain, dyspnea, fatigue, anxiety and depression), and QoL will be assessed. The elderly will perform the Physical Performance Test (PPT) and the Grocery Shelving Task (GST) so that functional ability can be verified; the Senior Fitness Test (SFT) to assess the HRPF; numeric pain rating scale (NPRS); modified medical research council (mMRC); functional assessment of chronic illness therapy-fatigue scale (FACIT-F Scale); hospital anxiety and depression scale (HADS) to assess, respectively, pain, dyspnea, fatigue, anxiety and depression. Finally, QoL will be assessed with EQ-5D. Monitoring of symptoms and QoL will be conducted at 3 months, 6 months and 12 months after the initial assessment, through phone calls. Qualitative studies using a walking interview methodology will be conducted to explore the motivations of the elderly to go to a nursing home and the perspective of the physical therapy outcomes to assess at admission in nursing homes.

Rehabilitation sciences

Chronic neck pain in high school students: characterization and effectiveness of pain neuroscience education and exercise

Rosa Andias, Anabela G. Silva

Chronic musculoskeletal pain is a common complaint among adolescents and its prevalence has been increasing over the last few years. Furthermore, chronic musculoskeletal pain has a negative impact on several domains of life with present and future consequences. Among the numerous chronic musculoskeletal pain syndromes, neck pain (NP) has been the most reported in adolescents. Some studies have been associated chronic NP and associated disability with functional and psychosocial factors, sleep, and physical activity in adolescents. Both psychosocial factors and sleep impairments also have been associated with central sensitization. Some of these variables have also been identified in some longitudinal studies as being associated with the persistence of chronic NP and its new-onset in adolescents. However, there are few studies comparing these factors simultaneously or including other relevant factors, such as fear of movement or central sensitization, specifically in adolescents with chronic NP. Thus, there is a gap in the characterization of chronic NP and associated changes in adolescents, which prevents the design of interventions adapted to the needs of this age group. Studies exploring the effectiveness of intervention strategies, such as exercise or pain education, are also scarce.

The two main aims of this research project were: i) to characterize chronic idiopathic NP and associated psychosocial and functional changes, disability, sleep, and self-reported symptoms of central sensitization in adolescents; ii) to design and assess a tailored intervention based on exercise and Pain Neuroscience Education for adolescents with chronic NP. These aims were achieved by conducting 4 interdependent studies, that is, two systematic reviews, an observational characterization study, and a randomized clinical trial.

Rehabilitation sciences

PICk UP – PersonalIsed CommUnity-based Physical activities for patients with chronic obstructive pulmonary disease

Patrícia Rebelo, Alda Marques, Dina Brooks

Chronic Obstructive Pulmonary Disease (COPD) is a major individual, social and economic burden worldwide. Pulmonary rehabilitation (PR) is a fundamental evidence-based intervention to manage COPD, but its benefits tend to decline over time. Reasons for this decline are the challenges faced by this population to sustain a long-term physical activity (PA) lifestyle, leading to worse health-related quality of life. Personalised PA modalities with social interaction, delivered post-PR, are warranted to enable a shift from a disease-based to a patient-centred model and encourage a sustainable behavioural change. Although such programmes have the potential to sustain PR benefits and promote patients' long-term adherence to PA, their availability within the community is scarce.

This study will implement and assess the effectiveness of a personalised community-based PA programme (PICk UP) to maintain PA levels and to prevent the decline of PR benefits in several health-related domains, in people with COPD. Additionally, we aim to find predictors of adherence to the PICk UP programme and to the sustainability of a physically active lifestyle.

PICk UP will establish a collaboration between academy, health-care centres and city councils in order to integrate people with COPD within the community PAs and to embrace urban facilities. We will implement a personalised community-based PA programme, using the available resources and adapting them to patient's needs and preferences, thus, providing a sustainable response to support healthy lifestyles and enhance PR benefits. This project will be developed during 48 months and will be composed of 3 tasks: i) design of PICk UP; ii) randomised controlled trial; and iii) dissemination and knowledge transfer; resulting in the publication of at least four papers.

So far, 20 people with COPD have already been recruited and started PR (April 2021) and 27 sports-related professionals from the partner city councils completed the specific training. Our systematic review "methods to assess free-living physical activities intensity in COPD" showed that several outcomes, outcome measures and instruments have been used to assess free-living PAs intensity.

Rehabilitation sciences

Impact of a program of infant and young child feeding practices in the reduction of pediatric mortality and nutrition outcomes in emergencies - Easybite Project

Ana Cláudia Lopes, Marisa Lousada

Summary: Optimal breastfeeding and complementary feeding practices could prevent 20% of deaths amongst children less than five years-old. The Speech and Language Therapist is the professional responsible swallowing and related functions, and therefore, breastfeeding. However, no randomized studies were found where this professional has a role in the promotion of breastfeeding in emergency settings. Aims: Explore the effects of two types of breastfeeding interventions in an emergency setting. Methodology: A randomized controlled single-blind clinical trial study will take place in Lesvos Island (n=276). The sample will be randomly divided into an experimental group, which will receive the support regarding breastfeeding and infant and young child feeding, and a control group that will receive standard perinatal care. Expected results: It is expected to see a percent difference between both groups in terms of mortality and morbidity rate, % of children suffering from malnutrition and % of exclusive breastfeeding.

Rehabilitation sciences

Chronic Pain And Cognitive Function In Patients With Chronic Low Back Pain: Association And Impact On Rehabilitation Outcomes

Ellen Pereira Nery, Anabela G. Silva, Nelson P. Rocha, Vítor T. Cruz

Chronic idiopathic low back pain (cLBP) is highly prevalent and has been increasing as the most common musculoskeletal condition and it is associated with high levels of disability. Evidence suggest an association between cognitive impairment and chronic pain, as neural systems involved in cognition and pain processing are related. However, further evidence for specific pain syndromes, particularly cLBP, is needed. Furthermore, studies exploring the benefits of combining cognitive training to rehabilitation of cLBP patients are scarce. Therefore, this work aims to characterize the association between cLBP and cognitive function and to assess the effectiveness of the best-evidence non-pharmacological intervention and cognitive training for adults with cLBP.

This will be achieved by conducting two systematic reviews, a prospective-observational study on the association between cLBP characteristics and cognitive function, and a randomized assessor-blind clinical trial based on non-pharmacological best-evidence intervention and cognitive training on cLBP. This project's findings will inform clinical practice.

Rehabilitation sciences

SCIMBIONT – Spinal Cord Injury Rehabilitation: gut dysbiosis and immune biomarkers as functional prognosis tools and new therapeutic targets

Maria Cunha, Sandra Vieira, Ana Margarida Sousa

Spinal cord injury (SCI) is a complex and devastating neuropathology with consequences on multiple organs and systems that reduces patient's functionality and quality of life. No current effective therapy exists for SCI. Although regeneration of the injured spinal cord is pursued worldwide, our society demands viable 'non-spinal centric' alternatives that increase patients' recovery and health status. Among the highly incident complications and comorbidities that greatly impact SCI patients' is gut dysbiosis and chronic immune dysfunction, potentially leading to increased infection rates and decreased spinal cord repair. We hypothesize that restoring gut dysbiosis may improve immune function, decrease comorbidities and improve patients' functionality.

Rehabilitation sciences

Pulmonary rehabilitation during acute exacerbations of chronic obstructive pulmonary disease: a mixed-methods approach

Ana Machado, Alda Marques, Chris Burtin

Acute exacerbations of chronic obstructive pulmonary disease (AECOPD) account for more than 70% of disease-related costs and negatively impact patients' health status. Pulmonary rehabilitation (PR) is a cornerstone intervention for the management of stable disease with the potential to be equally effective in AECOPD. However, studies assessing PR role during/shortly-after AECOPD have been mainly conducted in inpatient settings, despite most AECOPD being managed in the community, and have been delivering PR with different components, intensities, durations and outcome measures, not considering patients' needs/expectations. This has led to controversial results across studies. To overcome these drawbacks, adequately powered studies delivering well-designed community-based PR programmes and exploring patients' perspectives are urgently needed to guide research and clinical practice. This mixed-methods project proposes to design/implement and evaluate a community-based PR programme specifically tailored to patients' self-reported and clinical needs during AECOPD.

Rehabilitation sciences

Core Outcome Set for pulmonary rehabilitation in patients with chronic obstructive pulmonary disease (COPD)

Sara Souto-Miranda, Martijn Spruit, Alda Marques

Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality worldwide. Pulmonary rehabilitation (PR) is fundamental however, response to this intervention varies among patients with COPD. One of the main reasons for this differential response is the heterogeneity of outcomes used and reported, hindering bench-marking between and within PR centres, the conduction of meta-analysis and the scientific/clinical advance of a vital treatment to respiratory patients. This problem can be overcome with the development of a Core Outcome Set (COS) - minimum set of outcomes that should be consistently measured and reported. Thus, this thesis aims to develop a COS for PR in patients with COPD. It will be developed in stages, according to the Core Outcome Measures in Effectiveness Trials (COMET) initiative methodology: i) identify existing knowledge – systematic review of the literature, ii) fill gaps in knowledge if needed – observational studies of effects of PR in overlooked outcomes, iii) elicit views about important outcomes in a consensus process – qualitative study with interviews and Delphi survey, iv) hold a face to face meeting to finalise the recommended COS. Finally, a review of the clinimetric properties of the most used measures for the core outcomes will be conducted, to recommend not only the core outcomes, but also the core measures. This COS is expected to facilitate consistency among trials, lessen the risk of outcome reporting bias and inform clinical and research practice.

Rehabilitation sciences

Environmental sciences and engineering

Should future cities be compact or sprawled? Development of an eco-indicator to assess future urban planning strategies

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Environmental sciences and engineering

SKILLS AND EDUCATIONAL CONTEXTS FOR ECOLOGICAL AND ENVIRONMENTAL LITERACY IN TEACHER TRAINING ON 1ST AND 2ND CYCLE OF BASIC EDUCATION

Susana Silveira, Filomena Martins, Filomena Teixeira

ABSTRACT

The integration of environmental policies with educational and science policies in teacher training, in formal education and other learning contexts, ensuring the transfer of scientific knowledge "Science for education" and assuring education for sustainable development, both in the initial teachers training, and in the context of continuous training, constitute United Nations Educational, Scientific and Cultural Organization's goals (UNESCO).

Integrated in a school-wide aproach, that promotes the envolvement of schoolar comunity to achive environmental sustainable goals (as required by UNESCO strategic/referential documents transposed to public environmental and educational policies in Portugal), it was

implemented an investigation project that aims to find: i) If teaching and learning practices that involves methodologies favoring the development of key competences in Education for Sustainable Development (EDS) could improve Ecological and Environmental Literacy (EEL); ii) whether an initial and continuous pedagogical training that promotes educational practices linked to natural contexts and real situations by a Science, Technology, Society and Environment approach could induce similar educational practices of teachers involved in that practices.

The investigation, based on a qualitative and interpretative research-action methodology, was focused on teaching and learning practices at a higher education school institution with student classes of Basic Education courses, and also in a workshop envolving pre-service teacher training and in-service teachers. Intrinsically to the teaching and learning processes in natural and environmental sciences, environments that facilitate the construction of knowledge and development of competences in ESD are valued (critical and systemic thinking; normative; integrated problem solving, combined with skills of strategic and anticipatory decision-making) that contribute to the LEE (affective competence; cognitive competences; ecological knowledge; socio-political knowledge; knowledge of environmental issues; environmentally responsible behavior).

In this educational context, are encouraged learning moments that includes i) study visits to natural/semi-natural spaces/field classes; ii) study visits to environmental interpretation equipment; iii) use of digital resources on ecological processes; iv) use of digital resources on environmental issues; v) identification/recognition and analysis of problem-issues in contexts of proximity/daily issues; vi) question-oriented practical work (research and document analysis to support the grounding of opinion in guided discussion and decision-making); vii) project work in a CTS/CTSA perspective.

As earliest results, we coud notice that pre-service learning experiences, based on diverse and significant ecological or environmental contexto (complementing to initial training in Basic Education) were important to develop EEL skills. The pre-service studentes were able to conduct similar educational practices in the internship context, that improved their pedagogical performance on ESD.

From this achievements, it can be reconized that developed skills were of primordial importance to give them confidance to deal with cognitive, social and behavioural competences, promoted by teaching lectures and experiencial work done at this intervention project of teachers training. It can also be said that educational contexts for EEL in teacher training on 1st and 2nd Cycle of Basic Education could influence their future educational practices, corroborating the recognized training isomorphism.

It should be noted that the strategy implemented in the in-service training workshop, in which teachers in training and in-service teachers participate, can create educational conditions for shared action in internship centers, a fact that enhances continued actions in EDS.

Key-words: Ecological and environmental literacy; Education for sustainable

Environmental sciences and engineering

Ozone uptake by Mediterranean grapevines: a modelling approach

Daniel Blanco-Ward, Ana Miranda, Elena Paoletti

There is concern in the wine industry regarding climate change as a potential threat to wine production, mostly focusing on atmospheric variables, bioclimatic and extreme indices. Current ambient ozone levels can have an effect as a strong phytotoxic oxidative agent on yield and quality of a key crop for Mediterranean areas such as the grapevine. Ozone precursor's emission control measures might be offset by climate change, phenological advance and cultural practice. A Chemical Transport Model has been used to simulate high-resolution ozone deposition over the Portuguese Demarcated Region (DDR) during a field campaign monitoring growing season. The study aims to advance knowledge on which key factors and model reformulations should be considered to successfully reproduce grapevine ozone uptake under the local Mediterranean conditions. Results provide evidence for sustainable strategies to preserve high-quality wine production in a context of climate change.

Environmental sciences and engineering

Gasificação e pirólise de misturas de biomassa e CDR

Jose Antonio Mayoral Chavando, Luís António da Cruz Tarelho, Valter Bruno Reis E Silva

Gasification and pyrolysis of RDF and agro-residues can be used to generate a variety of energy vectors and organic products that can be used to replace fossil fuels in a variety of applications. This dissertation is comprised of two sections. (1) Pyrolysis of RDF and HDPE blends with biomass, and (2) Gasification of RDF and HDPE blends with biomass. The first section will investigate the effects of cracking temperature, heating rate, and increasing RDF or HDPE weight percentage on the pyrolysis product yields.

Environmental sciences and engineering

Short-term impact of bench terrace construction on soil fertility

Martinho Martins, Jacob Keizer, Nelson Abrantes

This pitch addresses how primary forest soil fertility are affected by construction of terraces in mountain eucalypt plantations. Over the last decades, the construction of terraces has become a widely applied practice in forested areas of north-central Portugal but has received little attention, regarding implications for hydrological and erosion processes but also for soil quality, including key nutrient loss. In addition, the fast rotation cycles associated to eucalypt tree, may lead to negative effects in the soil quality at long-term, and ultimately, lead to important soil function limitations. Addressing this research gap, is important to assess the changes in soil key nutrients of the mineral soil in recently bench terraces. To this end the direct effect of terracing on soil mineral stocks of C, N and P as well as on labile C and N fractions were evaluated by compare soils before and immediately after the terrace construction.

Environmental sciences and engineering

Non-exhaust emissions from motor vehicles

Ismael Casotti Rienda, Célia Alves

The link between increased particle pollution and health problems is well documented, prompting the introduction of strict exhaust emission standards. However, research has shown that non-exhaust emissions, such as tyre/brake wear and road dust resuspension, have recently exceeded the contribution from the exhaust share. The chemical characterisation of non-exhaust particles is vague and incomplete, with difficulties in separating from other sources correctly. In this work, road dust is sampled with an in-situ resuspension chamber in various Portuguese cities, in different road environments and pavement types. The use of sensitive analytical techniques such as thermo-optical analysis for organic and elemental carbon, GC-MS for a vast array of organic compounds, ion chromatography for water-soluble ions, ICP-MS/ICP-AES for trace and major elements, allows a comprehensive characterisation and subsequent development of emission profiles for each source. Moreover an ecotoxicological assay based on bioluminescence of Vibrio Fischeri bacterium has been implemented to evaluate the effects of PM on live beings, in an attempt to elucidate potential health effects.

Environmental sciences and engineering

Assessing air quality in cities under climate change scenarios: a source apportionment approach

Sílvia Coelho, Myriam Lopes, Joana Ferreira

Air quality is strongly dependent on meteorological conditions and it is therefore sensitive to climate change. According to the latest report of the IPCC (Intergovernmental Panel on Climate Change), climate change will have complex effects on chemistry, transport and deposition of local air pollutants. Nowadays, the Aveiro Region (central region of Portugal) is recognized as one of the regions affected by poor air quality, being particulate matter (PM), the most critical air pollutant. Citizens' exposure to particulate matter has been threatening human health, increasing mortality and morbidity and contributing to a broad range of negative health outcomes. This highlights the need of studies that assess the future climate change effects in the air quality of Aveiro Region, at a high-resolution level, which can allow the identification of early climate adaptation strategies.

For this analysis, the Weather Research and Forecasting model, forced by the Max Planck Institute Earth System Model, at a high-resolution level, was applied for two temporal periods, one statistically representative of the recent-past (1976-2005) and other statistically representative of the medium-term future climate (2041-2070). For the future simulation, the IPCC greenhouse gas concentration scenario RCP8.5 was adopted. The meteorological outputs were used as inputs for the Comprehensive Air Quality Model with Extensions, with its Particulate Source Apportionment Technology, to quantify the contributions of multiple source areas, categories, and pollutant types to ambient pollution, over the Aveiro Region.

Preliminary results of source apportionment modelling points out to a great influence of the urban sources like road traffic and residential combustion emissions on the PM levels in Aveiro Region. Furthermore, since future climate results indicate a trend to higher values of daily minimum and maximum temperatures, as well as a reduction of the number of precipitation days, an increase of up to 8% of PM concentrations in urban areas is expected.

The applied approach constitutes an added-value in the evaluation of climate change and its impacts in the air quality, as well as on the contributions of different source activities and source regions to PM concentrations. This information can be useful in understanding the potential benefits of reducing emissions from a particular source category and in designing integrated climate change and air quality management strategies.

Environmental sciences and engineering

Nature-based solutions for climate change adaptation: impact on heat island effect and air quality

Ana Ascenso, Ana Isabel Miranda, Peter Roebeling, Carla Gama

Nature-based solutions (NBS) can provide effective answers to current and future environmental problems in urban areas, such as climate change and increasing urbanization. Direct impacts of NBS are widely recognized and include urban cooling, air quality improvement, and enhancement of cities resilience to climate change. NBS also have a positive socio-economic impact, by improving health and well-being of citizens. Indirect impacts of NBS are less well known, and consist of population dynamics and urban compaction that, in turn, impact on urban cooling and air quality improvement. The impacts of urban vegetation on air quality and ambient temperature depend on many factors, such as vegetation type, location, pollutants, climate conditions, and topography. Therefore, the implementation of NBS needs to be specific for each city.

This thesis, which is contributing to the H2020 UNaLab (Urban Nature Labs) project, aims to improve the knowledge regarding NBS implementation in an urban environment to better understand their effects and consequences, and to support the decision-making process. The direct and indirect NBS impacts on urban heat and air quality, for present and future climates, are under assessment in three European cities with different climates: i) Eindhoven, The Netherlands; ii) Tampere, Finland; and iii) Genova, Italy. The state-of-the-art online air quality modelling system WRF-CHEM was applied to simulate meteorological and concentration fields over the study areas with a spatial resolution of 1 km2. First results indicate that NBS can have a small impact on air quality and a bigger impact on temperature, also NBS are more effective in areas with high temperatures and poor air quality. The city that least benefited from NBS was Tampere with an average reduction of 5% in surface temperature, 7% in nitrogen dioxide (NO2), and 1% in ozone (O3) concentrations. Temperature-wise Genova had the largest reduction (6.7%) while Eindhoven had the largest improvement in NO2 (12%). This study reinforces the importance of exploring case-specific solutions, considering environmental characteristics and challenges.

Environmental sciences and engineering

Copper-based nanomaterials to treat soils contaminated by forest fires in Portugal

Mohammadreza Khalaj, Isabel Capela, M. Elisabete V. Costa, Mohammadreza Kamali

Copper-based nanomaterials to treat soils contaminated by forest fires in Portugal

Mohammadreza Khalaj, Isabel Capela, , M. Elisabete V. Costa, Mohammadreza Kamali

Abstract:

This study aims to develop novel and efficient copper-based nanomaterials (CuBNMs) with enhanced properties for improving the treatment of soils contaminated by persistent organic pollutants (POPs). The fate of CuBNMs in the environment after the remediation process will also be evaluated. The main goal is pursued by using CuBNMs as catalysts for tackling the POPs problem in contaminated soils system. In this regard, three main aspects will be addressed in this study including firstly, the type and properties of synthesized CuBNMs that influence their capacity for the degradation and removal of POPs from the forest fires ash runoff (FFAR), and polluted soil by advanced oxidation processes (AOPs) and adsorption mechanisms; secondly, the capacity of CuBNMs to degrade and remove POPs from the FFAR and contaminated soil; and finally, the fate of the synthesized CuBNMs.

Environmental sciences and engineering

Smart valorisation of organic side streams for food and feed by the Black Soldier Fly using a circular economy approach

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Given the paradigm of the sustainability of food and feed needs in the coming decades, it is urgent to find alternative solutions to the conventional sources of protein and the industrial rearing of insects has been gaining ground.

The Black Soldier Fly (BSF), an insect of the Stratiomyidae family, is one of the most successful insects in insects rearing due to some of its characteristics, such as short life cycles, high yields of feed bioconversion, versatility regarding substrates, and the possibility of transform wastes in high-value products. Even though, this species need specific conditions to breed successfully indoors and achieve optimal development ratios.

This project aims to assess the influence of different residues, as substrates, in bioconversion yields, optimize the quality of substrates, assess the final product composition under nutritional aspects, and compare the environmental impacts of the insect protein production versus conventional sources.

Environmental sciences and engineering

Business and economics

IMPLEMENTAÇÃO DO SISTEMA DE GESTÃO DA QUALIDADE NAS INSTITUIÇÕES DE ENSINO SUPERIOR EM ANGOLA

Nicolay Africano, Maria João Pires da Rosa

Resumo

A gestão da qualidade no subsistema do Ensino Superior em Angola tem sido alvo de crescente interesse motivado pelo impacto na performance das instituições do setor. As instituições de ES em Angola, considerando que são instituições de carácter multidimensional, isto é, envolvem uma diversificação de funções e atividades (ensino e programas académicos, investigação, recursos humanos, estudantes, infraestruturas e meio académico) deveram procurar instrumentos necessários para o auxílio da melhoria dos serviços que prestam a comunidade académica.

A educação constitui o sector mais determinante para o futuro de uma sociedade. Esta importância aumenta com o nível de desenvolvimento do País ou da região, nomeadamente porque a competitividade exige níveis de qualificação mais elevados, que não são possíveis de alcançar sem que os sistemas de ensino-aprendizagem obtenham a eficácia de satisfazerem as necessidades da comunidade em quantidade e qualidade que se pretende.

Os processos de ensino aprendizagem são os mais complexos de gerir, quer pelo tempo do curso, quer pelas interligações dos conhecimentos, quer ainda pela fraca integração dos diversos agentes educativos. A dificuldade começa na definição das necessidades vastas e de natureza muito diferenciada, e segue pela debilidade das metodologias de concessão e desenvolvimento dos currículos, encontrando também impasse oscilante na formação profissional dos agentes educativos.

Recorreremos a uma metodologia de investigação quantitativa, apoiada por elementos da variável qualitativa como: Fontes documentais; revisão bibliográfica dos conteúdos teóricos que suportam a investigação empírica, bem como análise de documentos legais da instituição (legislação sobre o Ensino Superior, estatutos, regulamentos da instituição). A abordagem quantitativa envolverá a aplicação de um questionário aos gestores das IES Angolanas.

O tratamento estatístico dos dados permitirá uma caracterização geral da gestão da qualidade no ensino superior Angolano, bem como testar empiricamente a relação de influência entre as variáveis definidas em cada hipótese do modelo conceptual previsto.

Com a presente pesquisa pretende-se contribuir na melhoria contínua do subsistema do ensino Superior, bem como ajudar a compreender a importância da gestão da qualidade nas IES.

Palavras chave: Ensino Superior, Sistema de Gestão da Qualidade, Norma ISO 9001:2015, Angola.

Business and economics

SUSTAINABLE DEVELOPMENT IN ANGOLA: CURRENT SITUATION AND FUTURE PROSPECTS

Joaquim Kanumbua, Margarita Robaina

Abstract

The general objective of this paper is to present the current situation and perspectives of Angola in relation to the Sustainable Development Goals, in particular, to those related to human development, poverty, economic growth and employment, energy, and greenhouse emissions. The paper concludes that promotion and financing for energy transition, treatment and recovery of solid waste and education depends mainly on the government's energy policies, on the initiatives of civil society and on investors. To achieve sustainable development Angola has currently a great challenge. The global economy is emigrating to renewable energies, which will reduce the price of the barrel of oil on the international market, therefore it's urgent to diversify the Angolan economy by investing in renewable energies. Based on the main sources that support the general budget of Angola, such mineral and oil exploration, seems that the attempt to cut CO2 emissions will hurt economic growth of Angola.

Keywords: Angola, sustainable development, electricity consumption, CO2 emissions, Sustainable Development Goals .

Keywords: Angola, sustainable development, electricity consumption, CO2 emissions, Sustainable Development Goals

Business and economics

Analysis of the investor profile in Portugal

Diogo Ribeiro, Prof.ª Doutora Mara Madaleno, Prof.ª Doutora Anabela Botelho, Prof.º Doutor Júlio Lobão

In this study we analyze the profile of investing in Portugal, understanding how sociodemographic characteristics, subjective knowledge and behavioral deviations can influence financial decisions, namely the construction of an investment portfolio and participation in the securities market. For the development of this study, we used a database provided by the CMVM, where 2,381 individuals were invited (after balancing the sample, 1136 responses resulted). Thus, studies were developed to assess the risk profile of individuals. Subsequently, the above mentioned characteristics were related to the levels of financial literacy, digital financial literacy, the fact that it declared that it had had losses, the value of the relative assets in securities and finally we analysed the process of choice and allocation in a set of financial instruments. We found in all studies that the variable of interest is sensitive to the risk profile of individuals.

Business and economics

European Investment Funds, Portugal 2020 and Public Sector Modernisation

Adriana Nishimura, Manuel Au-Yong Oliveira, Maria José Sousa

Since joining the European Union in 1986, Portugal has received over 130 billion in European Structural and Investment Funds (ESIF). This mixed methods study aims to find out the impacts of ESIF for the development of Portugal and the economic growth of its regions; to enquire whether there is meritocracy and efficiency in the allocation of EU funds to Portugal; and to portray a panorama of the modernisation of the Portuguese Public Administration, in terms of human resources management, innovation and e-Government. The Public Administration reform, supported in the National Reform Programme, configures a transversal axis to the programming of the Portugal 2020 Partnership Agreement, and the absorption of EU funds seems to relate to the institutional capacity of public administrations. The results of the study, through the perception of public managers and citizens, indicate that EU funds have been fundamental for Portugal's development. Conversely, there is a significant appreciation that corruption or practices such as lobbying and favouritism may exist in the allocation of funds and in the projects approval.

Business and economics

A força de microfinanças na drástica redução da pobreza e no empoderamento das pessoas. "O modelo Financeiro Tridimensional" Caso de São Tomé e Príncipe

Salvador Fonseca, Jorge Mota, António Morreira

1- O projeto chama-se: A força de microfinanças na drástica redução da pobreza e no empoderamento das pessoas. "O modelo Financeiro Tridimensional" Caso de São Tomé e Príncipe

2- Justificação do projeto de investigação

São Tomé e Príncipe (STP) é um estado insular localizado no Golfo da Guiné, composto por duas ilhas principais (Ilha de São Tomé e Ilha do Príncipe) e vários ilhéus, com uma área territorial de 1001 km2. Não tem fronteiras terrestres, mas situa-se próximo das costas de Gabão Guiné Equatorial, Camarões e Nigéria, e dista cerca de 380 kms da costa Africana.

A indústria financeira em STP vem sendo desenvolvida a uma velocidade muito superior a média de outros sectores da atividade económica com a criação, fusão e extinção de bancos e surgimento de muitas empresas de microfinanças. Também com a sua contribuição, o país tem crescido economicamente a taxa média de 4% nos últimos anos e, passou de grupo de Estados menos desenvolvidos para o grupo de desenvolvimento médio.

Não obstante este salto, o país ainda enfrenta um grande problema de pobreza que ascende aos 53% da sua população.

É nesta perspetiva que, este trabalho visa, a partir da revisão sistemática de literatura, pesquisa de dados secundários sobre este tema e, recolha de dados primários no campo, colher subsídios necessários para a criação de um modelo financeiro tridimensional de redução de pobrezas que conjugue (1) a rendibilidade mútua, (2) o empoderamento das pessoas com o enfoque para as mulheres rurais e (3) a redução sustentada da pobreza através de pacotes ou programas e acções de microfinanças, como elemento catalisador de redução da pobreza entre as famílias e, focados para diversos tipos de comunidades existentes em São Tomé e Príncipe de forma a que, a médio longo prazo, cada elemento da comunidade intervencionada consiga atingir o ponto de inflexão no que tange ao índice de pobreza e, posteriormente, a extensão do modelo para os países vizinhos, mutatis mutandis.

Business and economics

Evolution of research in the solid urban waste management sector in Brazil

Isabel Costa, Marta Ferreira Dias, Margarita Robaina

The discussion about the evolution of the stages of research at the doctoral level is of fundamental importance for the researcher's maturity as well as for the improvement of the thesis proposal. In this sense, this work aims to: i. present a brief retrospective of the scientific production developed so far and ii. share the most recent results of the ongoing research, whose approach concerns the evaluation of the efficiency of urban solid waste management in Brazilian municipalities through data envelopment analysis.

Business and economics

Essays on Sports Economics: The European Super League of Football

Anthony Macedo, Marta Ferreira Dias, Paulo Reis Mourão

The thesis is divided in 3 main research questions (RQ). The 1st one is “Which are the main trends and gaps in the current scientific literature regarding the European Super League (ESL)?” and a literature review and a bibliometric review were developed to answer it.

The 2nd RQ is “Which would be the consequences of a ESL for football demand?”. To estimate such impact requires assessing how consumers evaluate current European football and what they expect from a ESL. Therefore, a survey was conducted, and follows a second round of surveys in September, data treatment, and establishment of an econometric model.

The 3rd RQ “Does competitive balance and competitive intensity in football make the game more boring or more attractive?” aims to test if competitive balance and competitive intensity may lead to more defensive strategies and less goals, which could turn games more boring.

Business and economics

Risk-Taking Behavior: Interplay of Risk Governance, Board Feminism, Competition and Charter Value

John Agyekum Addae, Prof. Jorge Humberto Fernandes Mota, Prof. António Carrizo Moreira

Growing incidences of cyclical global financial crisis has been aligned to excessive risk-taking behaviours by banks. This has heightened debate on bank risk-taking behaviour among academics, regulators and policy makers. International and national stakeholders have implemented an array of regulatory measures to tame banks risk levels. The study employ GMM technique to analyse bank level panel dataset form Bureau van Dijk Bank to explain how charter value, competition, board feminism and risk government affects bank performance and risk taking behaviour. This results of this study contributes to SDG goal 8 target indicator 10 that aim at strengthening the capacity of financial institutions whiles deepens understanding on bank risk-taking behaviors to promote sound financial system.

Business and economics

HRM Practices and Performance: Conceptualization and Identification of HRM Practices that Lead to High Performance in Higher Educational Institutes of Portugal

Altaf Akbar, Professor Conceição Cunha, Professor Ana Dias

Human resource practices play an important role in any organization for its development and efficiency in operations. It is therefore, in contemporary times Human Resource Management (HRM) achieved a paramount significance. The main objective of HRM is to make effective use of employees, reducing risk and maximizing return of investment (Stone, et. al. 2015). The changing organizational environment in the marketplace pushed managers to improve efficiency in the production and service delivery processes by increasing their ability to use the best practices of people management at the time. There are various theories which underpin human resource management and few of them are; organizational life cycle theory, role behavior theory, resource dependency theory, institutional theory, transaction cost theory, comparative advantage theory and general systems theory (Theriou & Chatzonglu 2014).

Business and economics

STUDY OF THE RELATIONSHIP BETWEEN CONSUMER BEHAVIOR AND ELECTRIC VEHICLES

Tiago Valente, António Moreira Carrizo, Victor Moutinho

The current work has reviewed the literature intensively regarding the topic in study, dividing it into four groups that sum up the factors influencing the Electric Vehicles (EVs) acceptance – Financial Incentives; Situational Factors; Technological Factors; Consumer Characteristics. The discussion previous developed allowed us to understand which direction to follow. We have concluded that there is an exhaustive list of factors that explains the acceptance of EVs. The technology itself and associated ones are constantly evolving, creating the need to update it in the literature. Driving range, price and lack of experience are found the three most significant barriers over time consistently. Considering the main conclusions and the main gaps found in the research, we have reached a set of propositions to undertake in our work. Despite the review done before comprehending all vehicles with an electric battery (in general), we will only address Pure Electric Vehicles. Society is heading to tightly understand the differences between pure electric vehicles and other cars with battery. Even the government incentives are distinct, the savings in fuel, the inherent advantages, the maintenance and reliability, the driving range, etc. What makes us assume that these discrepancies will also affect the consumer psychological components and others. We will clearly distinguish the respondents by cohesive groups, such as household income, innovativeness stage, etc. We will include innovations that are getting in the context of EVs and may influence attitudes and change what has been studied in the last years by researchers. The current work aims to produce more conceptual development and use different approaches to deepening knowledge in the literature regarding Electric Vehicles (EVs) adoption. Through a quantitative approach, by exploring how consumer behavior performs regarding EVs, we focus on the main barriers and the main factors leading to the acceptance of this new technology. To investigate the suggested research questions, we intend to present a new valid conceptual framework.

Business and economics

Entrepreneurial Ecosystems in Low-Density Territories

João Almeida, Ana Dias Daniel

It is consensual that rural territories face significant challenges in almost all countries. However, these territories have a central role in meeting the major global opportunities and challenges of the 21st century, offering several distinct advantages to entrepreneurs. Entrepreneurial ecosystems (EEs) are receiving growing attention from scholars, practitioners and policy-makers. Despite the prevalence of rural territories across the countries and the increasing recognition that entrepreneurship is a key driver of their economic and social development, studies on EE are mainly focused on ecosystems in large and urbanized regions. Given the uniqueness of rural territories and the increasing challenges, it is crucial to map and understand their ecosystem and the links between the different actors in order to improve the development and sustainability of EEs within these territories. Using a mixed-method approach an innovative framework will be proposed and validated by analysing rural municipalities in Portugal and its different dynamics and stakeholders. The results of the project and theory developed will contribute to deepening the knowledge on EEs in rural territories, allowing to identify political tools and practical implications for the several ecosystems' stakeholders, in order to promote inclusive and sustainable practices within the ecosystem, fostering local competitiveness, local development and quality of life.

Business and economics

Ageing Europe: Understanding the challenges and the opportunities of living longer in the Households Energy Use

Vera Magalhães, Victor Moutinho, Margarita Robaina

The share of the elderly in the total population (population ageing) is increasing, with relevant impacts on the economic growth, the energy use, the related carbon emissions, as well as on the sustainable development path. This investigation analyses the challenges and opportunities related to the effect of the population ageing on the residential energy consumption for the 28 member states of the European Union for the period 2005-2018, through the employment of econometric and efficiency methods. This investigation is presented in four different papers published in peer-review journals. The first paper aims to assess the efficiency of electricity consumption of the households of an ageing population at country level through the employment of the method Data Envelopment Analysis (DEA). The second article focuses on the determinants of the electricity consumption efficiency of an ageing population through the employment of the method DEA, followed by the Fractional Regression Model (FRM) method. The third paper focuses on the effect of population ageing on the residential energy consumption through the employment of the econometric method Panel Corrected Standard Errors (PCSE). Moreover, the panel was divided into groups that account for energy needs similarities based on the Heating and Cooling degree-days index. The fourth paper analyses the relationship between the residential energy use and the energy poverty of the elderly, by focusing on variables directed linked to this population stratum. All the papers derive policy implications in accordance with the results found in the analysis.

Business and economics

Essays on the Effects of Energy Poverty on Finantial Economic Devolopment

José Ferreira, Mara Madaleno

For over 50 years, Energy Poverty (EP) has been a matter of concern both in Europe and in Portugal. The literature points out that Portugal has been one of the least studied countries in the context of PE, being studied as part of a set of other European countries losing its individuality. The main objective of this thesis is to analyze the situation of PE in Portugal, mainly to understand how PE affects the economic and financial situation and its development. For this purpose we need to know first the current situation, to create indicators capable of measuring PE situations effectively, and to understand what is the macroeconomic and microeconomic impact of PE on the economic and financial development of Portugal.

Business and economics

The Life of Consumption Communities: A Study on Vegan Communities

Ana Hungara, Helena Nobre

This PhD project aims at understanding how consumption communities are created and extended over time and the different styles in consumers' interactions within the community. This paper starts by offering a literature review departing from a bibliometric analysis on Consumer Culture Theory (CCT), consumption/brand communities and vegan communities. In the second part, the paper presents the study design of the thesis and a timeline for the project development. This study will hopefully contribute to marketing research by defining typologies of consumers and mechanisms for community retention that can be applied to other research contexts.

Business and economics

Creation of intellectual capital through knowledge management in international assignments

Adriana Gradim, Vera Teixeira Vale, José Vale

Intangible aspects such as intellectual capital and knowledge have gained importance as the most valuables sources of competitive advantage for organisations. With globalisation, organisations started to increase their investment in mobility (e.g., expatriation assignments) to gain global knowledge that guarantees competitive advantage.

Therefore, there is a change on the role of international assignees that are seen from a strategic perspective as individuals who carry vital knowledge for the organisation. However, few studies analyse the relationship between international assignments and both intellectual capital and knowledge management concepts in organisations. This work aims to comprehend the impact of international assignees on knowledge and intellectual capital management in knowledge-intensive organisations along with the development of mechanisms to promote its efficient management through a multi-method single in-depth case study.

It is expected that this work has both theoretical and practical implications. This research is then important for the academia where works on this area are scarce and in need of further development. Moreover, with the knowledge economy and the importance placed in intangible aspects that help organisations achieve a sustainable competitive advantage, the theory developed will contribute to deepening the understanding of how international assignees are managed in the field of knowledge and intellectual capital management. This work is also important for the industry since the findings can help to identify mechanisms to manage intellectual capital and knowledge between the organisations and its individuals who engage in processes of mobility, as well as between the organisations' individuals. It is expected that it can help companies to increase intellectual capital through a more efficient knowledge management.

Business and economics

Accounting

The subsequent measurement of goodwill

Mónica D'Orey, Professora Doutora Carla Carvalho

The accounting treatment of goodwill is an ongoing issue on the agendas of bodies such as the FASB, the IASB or EFRAG.

The IASB is known to be discussing feedback on the Discussion Paper (DP)- Business Combinations - Disclosures, Goodwill and Impairment, which was published in March 2020. The DP sets out the Board's preliminary views on how companies can provide better information so that investors can hold them to account for the concentrations they have effected.

The overall objective of the Thesis is to analyse the reasons for the existing dichotomy between amortisation and impairment. It is intended to analyse the perceptions of the participants in the IASB PD discussion process, complemented by the analysis of the preparers' perceptions on the subsequent measurement of goodwill, as well as by the auditors' perceptions on amortisation versus impairment and its impact on the audit. The Thesis will consist of three studies, with distinct but interconnected objectives.

Keywords: Goodwill; Amortisation; Impairment; Directive 2013/34/EU; Subsequent measurement; IASB;

Accounting

The Holy House Mercy in Bahia: Accounting and the use of Slave Labor - A Case study

Henrique Cabirta, Lúcia Lima Rodrigues, Alberto J. Costa

The use of slave labor in Brazil was intense in its duration, (approximately four centuries), as well as in the number of imported captives, (close to four million Africans). There is no historical accuracy of the time when the first black slaves arrived in Brazil. However, the first steps taken for sugar production in this territory between 1516 and 1526 may be the reference for the beginning of African exploitation (Goulart, 1975). The history of Accounting is an area that, although very important for the understanding of our own country, is still very little explored by researchers (Rodrigues & Craig, 2018)

Accounting

Essays on the application of the Integrated Reporting

Cláudia Conceição, Profa. Doutora Graça Azevedo, Prof. Doutor Jonas Oliveira, Profa. Doutora Cláudia Pereira

The origin of Integrated Reporting (IR) developed by the International Integrated Reporting Council (IIRC) was based on previous concepts of integrated reporting and corporate reporting initiatives. Studies indicate that large companies tend to implement broader objectives and compare

information practices, because this additional dimension allows them to generate added value, a social and environmental impact. Understanding the reasons that lead managers to adopt the IR, as well as the determinants of the adoption of the IR and the evolution of the IIRC, analyzing to what extent the level of earnings management varies with the adoption of the IR, continue to be areas of investigation in IR under-investigated. We hope to propose a methodology to measure the IR at the Earnings Management level and test its links with some determining characteristics. Thus, we believe that we can positively fill theoretical gaps in the degree of intensity of the relationship between the RI and contribute to investigators.

Accounting

Effective and Potential Implications of Blockchain Technology for Auditing

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The development of blockchain technology and some of its peculiarities such as smart contracts and asset tokenization have important implications in the auditing environment. This paper aims to evaluate the current stage of blockchain technology application on auditing area, analyzing scientific publications since the emergence of this distributed ledger technology, identifying the main implications what is already reality and the potential effects of its improvements in the audit professionals' activities performance, based on the proposals and suggestions on the main research indexed by Scopus and Web of Science databases. Through a proof of concept, this study advances with the contribution of demonstrating the creation and tracking a token on a public blockchain, evidencing the representation of assets in digital form, known as tokenization. The token example was created on the Ethereum testing platform (Ropsten Test Network). It is possible the traceability for different wallets and proof of ownership, for the purposes of possible disclosure to any interested with internet connection. The new possibilities, like real time auditing, associated with the conference of assets physical existence and their comparison of what is on the blockchain with the accounting records and the real world by the auditors represents a new reality and new challenges in terms of skills and knowledge.

Accounting

Preparing a Systematic Review in Financialization Politics and CEOs' Compensation Mechanisms

Rita Vieira, Graça Azevedo, Jonas Oliveira

It is recognized the importance of the literature review in any research. This presentation aims to demonstrate how ProKnow-C and Ordination Methods were used to select the articles' final portfolio to a Systematic Review in the theme "Financialization Politics and CEOs' Compensation Mechanisms".

Accounting

The relationship of ESG disclosures to organizational performance and in results management

Susana Nunes, Graça Azevedo, Jonas Oliveira

The aim of the study is to determine whether Environmental, Social and Governance (ESG) disclosure is an effective tool drive firm's performance and to reduce earnings management and investigate the moderating effect of Corporate Governance on these relationships between 2010 and 2019. To investigate these effects, we will use statistical regression models. We measure firm's performance using Tobin's Q and ROE financial indicators. The variable earnings management we measure through discretionary accruals estimated by the Modified Jones Model (Dechow et al., 1995) and real earnings management following Roychowdhury (2006). This study can contribute to the question of sustainability and business performance in a long-term perspective.

Accounting

Critical accounting Research – a contribute for a new accounting model

Tiago Jorge, Augusta Ferreira

International accounting references establish an accounting model based in fair value models and future assumptions with essentially quantitative characteristics, which do not describe, in a qualitative and interpretive way, the historical facts that occurred in an organization. In consequence fraud in Financial Reporting may occurs by accounting manipulation of future assumptions . In this sense, to overcome this limitation, this investigation intends to contribute with a new accounting model , based on a narrative, supported by the Focault `s historiography paradigm that favors the integralizing historical narrative of the events of an entity and the preservation of historical cost, adjusted for inflationary effects, in the reporting of assets and liabilities.

Accounting

The disclosure of innovation in the annual report and accounts and its impact on the cost of capital and market value

Filipe Duarte, Carla Carvalho, Paulo Alves

O conteúdo dos relatórios e contas anuais, e muito particularmente a forma somo se redige a sua narrativa, adquire particular relevância no que respeita ao impacto que o mesmo tem na tomada de decisão por parte dos seus stakeholders, designadamente ao nível do custo de capital das empresas e do seu valor de mercado, adquirindo particular importância o investimento em inovação.

Além da tradicional informação contabilística, aqueles relatórios têm evoluído no sentido de também incorporar cada vez mais informação não financeira, de que resultou a nova tendência de divulgação de informação, o denominado relato integrado.

Importa, por isso, conhecer se e como divulgam as empresas o seu investimento em inovação e qual o impacto dessa divulgação no mercado, preenchendo deste modo um gap que identificamos na literatura. Assim, pretende-se estudar, por um lado, como é divulgada a inovação nas narrativas dos relatórios e contas anuais, que importância assume aquela divulgação e como tem evoluído no tempo, em face do alargamento da base informativa; e, por outro lado, analisar o impacto que a divulgação daquela informação tem no mercado, concretamente quanto ao custo de capital e no valor das ações; em particular nos mercados de capitais inglês e norte americano.

É de todo importante e pertinente a elaboração deste trabalho, realçando a importância da transversalidade que deve existir entre a contabilidade e a gestão, do que é escrito, de quem o faz e da necessidade de existir formação interdisciplinar na elaboração dos relatórios anuais.

Accounting

Corporate Scandals and Corporate Governance: An Index Analysis

Carlos Lopes, Augusta Ferreira, Carlos Ferreira

One of the most outstanding contributions of Corporate Governance is the increase in operational performance and the prevention of fraud, but corporate scandals have not stopped appearing despite Corporate Governance evolution over the last 30 years. There are many indicators or evaluation indexes. In this aspect, we are concerned about whether these indexes could signal to shareholders and other stakeholders about the scandals.

Accounting

The Effect of Corporate Governance on Market Value and Earnings Quality: Evidence from Ghana

Isaac Antwi, Prof. Carla Carvalho

This study investigates the relationship between corporate governance mechanism and firm financial performance, and its impact on market value and earnings quality report of Ghanaian listed firms on the Ghana Stock Exchange from 2010-2019. This thesis consists of three essays, presented as chapters, on corporate governance. The first chapter examines corporate governance compliance that focuses on market values. The following two chapters study corporate governance mechanisms that drive firm performance, and whether firms with good corporate

governance practices present a higher quality of accounting information. The findings are expected to contribute positively to emphasise the importance of compliance, improvement of corporate governance research, and accounting reporting to boost public confidence in the quality of information and improve investor's decision-making.

Accounting

DBI - Doctorate in Business innovation

Investigation on Microcavity Laser and Silicon Photonic Transceiver

James Wang, James Wang/ António Teixeira

This report describes the development progress of a silicon photonics integration. Current major silicon pohtonics ingegration and silicon transceiver technology was introduced. In order to reduce the power consumption and easy to manufacture for silicon transceivers, need to find a new solution for optical light source. Current microcavity is a good solution and many researchers already studied a lot, but the laser emission of a complete microcavity can only rely on the leakage of the evanescent wave at the circular boundary and has circular symmetry, the directionality of its output light is very poor. By connecting the whispering gallery microcavity and the FP cavity to form a coupled cavity structure, the whispering gallery microcavity has high Q value, good high-speed modulation characteristics, and the FP cavity has higher output power and good directional output characteristics to realize the coupled microcavity. Increased laser output power. Hybrid square-FP coupled cavity laser (Hybrid Square-Rectangle Laser, HSRL) directly connects the square microcavity with the FP cavity to form a coupled cavity structure, which realizes the mode Q value control and single-mode lasing. What's more, use the FEM method to do some simulation to improve the coupling loss from FP cavity to silicon waveguide. For this current HSRL, just can output the light from the FP endface, but we can't monitor the laser power. So we propose the new design for next step.

DBI - Doctorate in Business innovation

Traceability for Industrial Environments based on a High Tamper Proof System Enabled by Blockchain Technology

Miguel Teixeira, Armando Nolasco Pinto, José Paulo Santos

The world is changing, consumers are more informed and more demanding. They want to track their products and their origins. Transparency plays a key role in the moment of choice. High customization is struggling the value stream and the supply chain. Manufacturers need to track efficiently their products and processes and give real time information for all interested parts internally and externally. Many challenges need to be addressed on a plant shop floor. This thesis proposes a decentralized network architecture approach to track and trace physical and logical assets on an industrial environment, by means of a tamper proof system, using blockchain technology, based on data capture on the field using identification and IoT devices. Discusses how to deal with concerns like security & privacy, efficiency & latency.

DBI - Doctorate in Business innovation

Additive Manufacturing for Smart Plastics

Ana A. Silva, Prof. Paula Vilarinho, Prof. Pedro Fonseca

The continuous evolution of nowadays technologies implies a modification in our daily life objects, like the car. Every year Original Equipment Manufacturers (OEMs), like PSA and VW, are presenting new car concepts with focus on the User eXperience (UX) and the Human Machine Interface (HMI). Also, the automotive industry is heading to deliver a customized car to each user. This idea will be possible due to the advancement of Industry 4.0 concepts, namely end-to-end engineering, from conception to delivery.

This PhD project aims to design, develop and demonstrate a set of innovative solutions through the use of Additive Manufacturing (AM) technologies, to produce customizable parts and to improve user interaction. The AM processes will allow these customized parts to provide enhanced interaction possibilities for the automobile user.

DBI - Doctorate in Business innovation

Innovation and Performance: Trends in the digital era

Américo Santos, Profª Celeste Varum, Profª Elisabete Vieira

Using data from the Portuguese CIS, it is analyzed the impact on turnover of automation and cooperation, and also, the mediating effect of open innovation on automation. It is separated the effect of different open innovation partners concluding that depending on that the returns can be either enhanced or hindered.

Automation is the allocation of functions to machines, aiming to increase productivity and, consequently, generating value through higher revenues and reduced resources that can be used on innovation processes.

Jobs that remain after automation are increasingly related to innovation and require highly skilled employees that engage increasingly in Open innovation. The Open innovation paradigm can be understood as the antithesis of the traditional vertical integration model. As such, it is translated in a vertical alliance and increases joint product performance. The mediating role that Open Innovation has in the relationship between automation and turnover, is another question that is analyzed. The automotive industry is a good example of this positive effect as it profits from the joint efforts with Open innovation partners to achieve its goals.

DBI - Doctorate in Business innovation

Leveraging Smart Factories: A digital transformation on the shop floor of a Felt Hat Bodies Industry

Alexandre Rios Paulo, Ana Luísa Ramos, Borges Gouveia

O tema da investigação reside na concetualização de uma arquitetura MES (Manufacturing Execution Systems) dedicada à Indústria de Feltros para Chapéus, com vista à digitalização do shop floor e à alavancagem de fábricas inteligentes. Pretende-se neste processo aplicar conceitos de gamificação na conceção do MES de modo a captar e fixar novos recursos produtivos estimulando a sua produtividade.

DBI - Doctorate in Business innovation

"ESTUDO DO DESEMPENHO DE FELTROS PLANOS, PRODUZIDOS POR DIFERENTES MÉTODOS DE CONSOLIDAÇÃO"

Acácio Coelho, Prof. Martinho Oliveira, Prof. Raúl Fangueiro

Este projeto de doutoramento tem como objetivo o desenvolvimento de feltros planos, a partir de fibras de lã ultrafinas, combinando os processos de compactação por feltragem, utilizados normalmente na produção de feltros para chapéus, com os processos de consolidação mecânica por agulhagem, utilizados na produção de não tecidos.

DBI - Doctorate in Business innovation

Orchestration Framework to Support Decision Making in Value Stream Oriented Organizations

Maria João Lopes, Eugénio Rocha, Petia Georgieva

Can organizations develop an integrated framework to solve specific data related use cases using a generic approach? This is the hypothesis at hand here in a cross-domain doctorate connecting Mathematics, Business and Computer Science.

DBI - Doctorate in Business innovation

Design

Augmented catalogue in the museum experience: a design perspective

Valéria Boelter, Mário Vairinhos, Álvaro Sousa

Museums have undergone many changes in the last decades, mainly due to new concepts of "participatory museum" and "digital technologies" that transform these spaces into places of experiences, where not only works are preserved, but knowledge is also dynamically exchanged. In this sense, the designer can contribute to the creation of participatory tools and techniques before, during and after the exhibitions to promote enriching experiences. The objective of this study is to propose a new museographic experience through an Augmented Reality catalogue and, in this way, bring the collection to the public beyond the space of the museum.

Design

The experience of the new: about people's relationship with artefacts

Cristiane Menezes, Vasco Branco , ndias@ua.pt

Esta investigação aborda a problemática das experiências de uso de um artefato novo e a percepção simbólica do novo.

Parte do estudo do contexto da geração 65+, os quais experimentaram muitos artefatos novos ao longo das suas vidas, e identifica os diferentes significados do conceito do novo, com vista à proposta de uma taxonomia do novo em design.

Propõe desenvolver um conjunto de orientações sobre os significados das relações e interações dos séniores ativos com os artefatos e aplicá-los a projetos de design.

Pretende-se provar que as percepções do design suscitam diferentes conceitos do novo e expectativas de experiências holísticas significantes que envolvem forma e uso. Como corolário, avança-se igualmente com a hipótese de que essa taxonomia pode-se constituir como uma base heurística importante para o ensino e a prática do design.

Design

Food Design as a tool for social development

Lígia Afreixo, Francisco Providência, Sílvia M. Rocha

The study is part of a food design research having the aim to assess the relevance of the olfactory experience on social development and the improvement of public health. Its immediate and primitive connection to the emotions zone establishes an experience of direct connection to motivations and desires, transporting memory to the construction of a moral consciousness about what we smell and eat, contributing to the physiological sanity although conditioned by culture. However, the organoleptic diversity in early life can condition the citizen's flexibility concerning the adoption of innovative practices and, consequently, of a greater aptitude related to public health, environmental sustainability, and, most importantly, cultural creativity. Recognizing the implication between the capacity to adopt new behaviors and the extent of children's organoleptic learning, this exploratory study (inquiry) covering a universe of 20 food smells was carried out in educational establishments, considering children aged 3-5, from polarised socio-economic groups.

The data treatment of the study led us to conclude that the most depressed socio-economic group presents a more reduced organoleptic lexicon than the other group, implying, consequently, a lower aptitude for the creative adaptation to the different, a condition for innovation.

Design

Design furniture for contemporary scenarios and environments of collaborative workplaces. Design Factory Aveiro case study.

Rita Cruz, Fátima Pombo, Teresa Franqueira

The digital nomadism that stimulates the mobility practice and flexibility of the work, contributing to the valorization of the lightness (Gilles Lipovetsky), requests a design that is capable to answer those needs and therefore capable to predict and propose new ways of working. Rex Miller highlights the importance of creating a healthy environment where companies, organizations and their employees can thrive. Nicola Gillen believes that the future of work lies in a hybrid model between remote and presential work. Therefore, the workplace will be more collaborative and should be more flexible to facilitate these moments of interaction, sharing and socialization. This investigation intends to create furniture systems to sustain sceneries of collaborative working. To fulfill the proposal, a flexible and modular office furniture system is designed, in which the materials to be considered are fundamental in the relationship and experience of users with the space and activities.This system will stand out for its ergonomic, acoustic, well-being and comfort characteristics, and for the selective choice of materials, not only in line with the circular economy, but also with its qualities of low intrusion into spaces.The study case of the Design Factory Aveiro comprise a research field of experimental base and observation of the users behavior in agreement with several tests accomplished in real context, whose results support the materialization of the project. The investigation still goes by the accomplishment of furniture prototypes in partnership with Guialmi (Office Furniture Company) and implementation in the Design Factory Aveiro for a detailed evaluation of the argument of this project.

Design

From the interpretation of the project to virtual reality for the preservation of Portuguese domestic interior design

Liliana Neves, Fátima Pombo, Pedro Beça

This PhD project aims to expand knowledge about the history of interior design with special attention to Portuguese domestic interiors, by its interpretation and consequent translation as virtual space. The Arquitectura Magazine (1927-1988) is the documentary source, considering that at the time in Portugal it was the way to spread the work and knowledge developed in architecture and interior design. Three case studies were selected, namely Ofir House (1957) by Fernando Távora; Matosinhos House (1954) by Álvaro Siza Vieira and Oporto House (1943) by Viana de Lima. Each project refers to particular circumstances: a space that was on ruins through several years and was almost lost forever; a private property; and a house that was demolish, respectively. Living in contemporary times, digital content became a core path to promote cultural heritage and it is growing as a fundamental tool to learn and teach about design history, by making that legacy online, accessible to all. Therefore, this research also intends to contribute with a design methodologythat allows the translation of the interpreted domestic project to virtual reality, as reliable and reasonable as possible, enhancing the preservation of its memory. The proposed design methodology focuses on hermeneutics analysis, through the interpretation of textual documentation, period photographs and author's technical drawings.This methodology is organized into 5 phases, which include the definition of the project under study, data collection, analysis and processing of these data, modelling of 3D space and its application in Virtual Reality.

Design

Bringing Augmented Reality to Information Design

Ana Marques, Vasco Branco, Rui Costa

Considering Design as an activity of cultural mediation with technology, this research project seeks to explore the potential of digital technologies, namely Augmented Reality (AR), in the construction of storytelling in Information Design. This research will be framed by the project Towards a Portuguese Design Observatory: Models, Instruments, Representations and Strategies, launched in august 2018, that intends to: “collect data, to systematize information and to develop strategic research about the ecosystem of Portuguese Design, making possible and supporting relevant decisions about entrepreneurial, institutional or public politics initiatives regarding Portuguese Design; on the other, to conceive, develop and test new representation strategies (a mix between new media and conventional supports) towards a better understanding and visibility of the ecosystem of Portuguese Design enabling public enrollment.”1

It is in this last intent that the doctoral thesis gains relevance.

This research adopts a practice-based approach (Saikaly, 2005) [2] or, according to the typologies of Frayling (1993), a research methodology through art and design [1].

Given the projetual nature of this proposal, it is foreseen the development of augmented narratives created by information design entailed in the communication of results relating to Design Obs., which will be ensured through publications, exhibitions and any other dissemination material of the project where the use of that technological media denote itself as added-value.

These artifacts will be evaluated to confirm both its experiential quality as its contribution to increase the knowledge about Portuguese Design. This research shall contribute as well to rectify the current scarcity of written reflection about the possible convergences between information design and augmented reality technologies, hence reflecting the overlaps of content, form and media.

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[2] Saikaly, F. (2005). Approaches to design research: towards the designerly way. Proceedings of the 6th International Conference of the European Academy of Design, Design System Evolution. Hochschule fur kunste Bremen, Alemanha, 29-31. Retrieved from https://pdfs.semanticscholar.org/dd2a/56a6b770dd817030ce58ee6b784fbc7ad889.pdf?_ga=2.261999307.732202381.1553188221-103134867.1549546811

1 retirado da candidatura do projecto Design Obs. (POCI-01-0145-FEDER-032445) a financiamento pela FCT

Design

Wild-land Firefighter-athlete: an answer to the Protection vs Comfort dichotomy through the Design of a Protective Equipment

Filipe Bento, Prof. Doutor Francisco Providência, Prof. Doutor Nuno Dias

Firefighting is some of the most dangerous occupations that require intensive physical work in hazardous environments. The evolution of thermal barrier in the Protective Equipment has increased in the firefighter's conductive protection. Lack of garment breathability result in saturation of undergarment microclimate, increasing skin injuries and premature exhaustion. However, conduction burns represent only 3% of injuries, against 40% of convective heat related.

Firefighting is changing. The willful and adventurous firefighter of the past has given way to a new model, under a coordinated command, highly trained fighters operating in difficult terrain and steep slopes fighting fires with hand tools, in an anaerobic physical activity making them true firefighter-athletes.

A design-driven project-based study will take place, to develop a Protective Equipment - jacket and pants - that addresses an answer to the Protection vs Comfort dichotomy. The inputs raised from the sources of evidence - Theoretical Framework, Firefighting and Technology - will be subject to validation in a triangulation exercice, shaping the Design Program, consisting of symbolic and functional dimensions.

The symbolic dimension is decisive in the rhetorical representation of the contemporary firefighter meaning. The firefighter-athlete self-representation should improve psychological comfort, redefining the firefighter behavior on-duty.

The functional dimension is divided in 3 categories: (1) Thermal Protection Performance, focused on the convective heat protection, by using air-gaps in the pressures zones and a 'natural sensor' on the other areas; (2) Ergonomy, using action-pleats taking advantage of the body dynamics to pump the hot air inside the garment system - using air-gaps and air-channels - through forced convection; (3) Cooling Strategies, using passive air-vents - exhausting the pumped hot air - and a PCM cooling vest to lower firefighter's body temperature. Comfort wise, these solutions should mitigate the ergonomic and physiological issues, reducing the firefighter heat strain.

The Protective Equipment in development, along with the theoretical model raised from the Design project activity, aim to be an answer to the Protection vs Comfort dichotomy and to promote a paradigm shift to firefighter-athlete.

Design

Cooperativa Árvore Poster Collection: Progress Notes from an Ongoing Investigation II

Mariana Almeida, Helena Barbosa

A investigação em curso assenta na identificação do espólio inédito de cartazes da Árvore – Cooperativa de Actividades Artísticas (Porto, 1963). Sumariamente, trata-se de uma colecção heterogénea de 6442 especímenes, datados da segunda metade do século XX em diante. Devido ao seu potencial interesse cultural, a colecção foi adquirida pela Associação de Colecções Berardo, pelo que é sob um protocolo de colaboração estabelecido entre três entidades (Universidade de Aveiro, Cooperativa Árvore e Associação de Colecções Berardo) que o trabalho se encontra a decorrer. Da separação dos duplicados, resultou um conjunto de 3756 peças dos mais variados formatos e origens; um material tão plural quanto o programa e interesses da instituição que os reuniu, representativo de acções próprias e de terceiros.

Concretamente, esta investigação parte da colecção de cartazes para analisar temas da história e teoria do design, memória e design gráfico em Portugal, procurando narrativas de índole hermenêutica, que contribuam para a amplificação da compreensão da actividade cartazista em contexto nacional. Propõe-se o design como mediador para alcançar um entendimento holístico sustentado pelo conhecimento formulado sobre os artefactos gráficos em contexto de arquivo.

Pretende-se, assim, criar substrato para o design, através de metodologias de contacto directo com os artefactos, de entrevistas com os artistas/designers identificados, de estudos de caso relacionados com arquivos nacionais semelhantes e no cruzamento de fontes documentais bibliográficas, enquadradas pelas áreas temáticas abrangidas.

Na participação no Research Summit 2021, faz-se um novo ponto de situação dos progressos do trabalho, cujo título provisório "Memória em Arquivo: Discursos do Design Gráfico a partir dos Cartazes da Cooperativa Árvore" reflecte o seu carácter histórico, a partir do cartaz, enquanto artefacto quotidiano, passível de ser preservado em arquivo; enquanto repositório de pistas para narrativas que, daí, se podem extrair por análise qualitativa e da interpretação vinculada ao design gráfico.

De acordo com o plano geral de trabalhos, ao longo do ano, foi sendo desenhada, adaptada e preenchida uma base de dados, com 29 campos, de forma a agregar e sistematizar as informações sobre cada cartaz. Nos Serviços de Biblioteca, Informação Documental e Museologia da Universidade de Aveiro, decorreu o processo de catalogação, que, interrompido pela pandemia, foi, entretanto, retomado. Todavia, por motivos circunstanciais, encontra-se novamente suspenso, devido a falhas técnicas no equipamento de captura de imagem. O prejuízo para o calendário estabelecido, no que respeita à obtenção do registo visual, é significativo, com impacto directo na concretização dos objectivos programados. Por opção metodológica, será a partir da base de dados e das imagens obtidas por digitalização, que a colecção será posteriormente mapeada e as hipóteses de investigação mais claramente definidas.

Por estas e outras condicionantes relacionadas com as restrições à circulação e ao contacto interpessoal, a investigação enveredou pela observação preliminar das informações coligidas na base de dados, e pela exploração do campo teórico com mapeamento e leitura de publicações académicas e não académicas relativas ao "estado da arte" que sustenta o projecto. Para concluir, o roteiro desta investigação, financiado por uma bolsa de doutoramento FCT/UA, está marcado por algumas comunicações realizadas, já com outras aprovadas e agendadas para breve.

Design

Education

Global Citizenship Education through Intercomprehension in the first years of schooling

Francisco Parrança da Silva, Ana Isabel Andrarde, Mónica Lourenço

The education of global citizens capable of participating critically and in a reflected way in the resolution of glocal problems that concern us all, assumes relevant importance as we face the challenges of building a more sustainable world. For this aim and, as the plurilingual and multicultural interactions that characterize the globalized world occur more often and assume greater importance in our daily lives, global citizens need to be able to live and interact with linguistically and culturally distinct Others and their views of the world. But how to educate global citizens who are prepared to deal with these challenges? As a possible answer, Intercomprehension emerges, which, in the context of Global Citizenship Education is understood as a bridge to the Other and to the understanding of the world in all its complexity.

Based on the aforementioned, this research aims to understand how we can educate for global citizenship through Intercomprehension in the first years of schooling, which led to the research question: "How to educate for global citizenship through Intercomprehension in the first years of schooling?". Build upon a Critical Theory paradigm we develop a design-based research divided in four phases that will take four years to complete. In the first phase, already finished, we completed the literature review that serves as support for our research. The second stage, the one we are right now, was dedicated to through a set of educational projects designed by teachers and educators about sustainable development and Global Citizenship collect data that will allow us to understand how to educate for Global Citizenship through Intercomprehension in the first years of schooling. The data collected from focus groups with teachers, individual teacher interviews and individual teacher and children learning portfolios will be analyzed according to a predominantly qualitative methodology through Content and Discourse analysis – this corresponds to the third research phase. For the fourth and last phase we intend to conclude our thesis and to share and disseminate this research and its results.

It is expected that the results of this investigation will allow us to understand curricular characteristics, domains and dynamics that make possible the integration of Global Citizenship Education through Intercomprehension practices in the first years of schooling in Portuguese context.

Education

Educating for biocultural diversity in first years of schooling: a path to sustainability

Bruna Batista, Ana Isabel Andrade, Gabriela Portugal

Thinking about education currently requires an action focused on issues and problems that we face in our daily lives, insofar as we intend to contribute to the common good of society, through research, training and didactics that treat that as changes that they are discussed today, integrate the discourses, practices and political agendas of tomorrow. Recognizing sustainability and the multiple spheres of itself derive as a major global priority not only at the political level, but also at the economic, social, cultural and environmental level, it is important that we rethink education so that it is (re)oriented towards finding solution to current global challenges, which today are characterized by their volatility, uncertainty, complexity and ambiguity (VUCA). Thus, we understand education as a fundamental means to face these challenges, being essential an educational action focused on values, respecting and valuing the well-being of all species and guaranteeing quality of life for them. As such, from a perspective based on the Sustainable Development Goals and on the recognition, respect and appreciation of the Other (animal and plant species), it is intended to understand how an action focused on biocultural diversity, that is, on interdependent and evolutionary relationships existing between the languages, culture and biology that surround us, we can contribute to managing the world that includes people, planet, prosperity, peace and partnerships.

Thus, the project we present here focuses on design-based research to be developed in the context of first years of schooling and adressing issues of education for biocultural diversity as a contribution to sustainability. Through a set of intervention projects designed by educators and teachers from primary education on education for sustainability and which include resources and strategies related to biocultural diversity, we intend to understand how we can contribute to an education that, by embracing this perspective, directly contribute to sustainability issues. By means of data request techniques such as focus groups and documentary request of portfolios (which include records of teachers and children) we intend to answer our research question: "How to educate for biocultural diversity in education processes for sustainability in the first years of schooling?". Given the research question, the objectives that support the development of the study are: O1: To analyze the role of education for biocultural diversity in the first years of schooling from the theoretical and normative framework that supports the investigation; O2: Build knowledge on the integration of educational practices for biocultural diversity in the context of education for the first years of schooling; O3: Co-build education projects for sustainability that address biocultural diversity in the early years of schooling; O4: Analyze the intervention projects designed and implemented in order to understand how to educate for biocultural diversity in the first years of schooling and what their contribution to sustainability is.

The investigation will last four years and is organized in four phases. The first phase concerns the development of a theoretical framework around the key concepts, capable of supporting an investigation. The second phase focuses on the co-construction and implementation of intervention projects by educators and teachers with their groups and classes. The third phase concerns the analysis of data so that, in the fourth and final stage, we can proceed with the construction of resources and dissemination of results.

Education

STEAM and creative thinking: a formative proposal for initial primary teacher training

Erika Ribeiro, Ana V. Rodrigues, Jen Katz-Buonincontro

We are still in the second decade of the 21st century. However, it is of extreme importance to discuss the teaching and learning process expected for this century and for the future, since our globalized society is constantly and quickly changing, with wide open access to information. Thus, discussions regarding education should go beyond the planning of disciplinary contents. It should also encourage the development of many capacities and construct an integrated view of knowledge, which empowers students to have better decision-making and problem-solving skills. This research project aims to develop, validate, and evaluate a formative proposal with a Science, Technology, Engineering, Arts and Mathematics (STEAM) approach that promotes creative thinking in the initial training for primary science teachers. The study has a qualitative nature and is framed in a socio-critical paradigm. Also, it intends to contribute to the design of Curricular Units in a scope of Didactics of Science through Design-Based Research (DBR). The idea is to not only elaborate an online training course, but also to create potential guiding principles to further similar training courses.

Education

Teaching experimental sciences program in primary education: from curricular organization to learning assessment

Patrícia Christine Silva, Ana V. Rodrigues, Paulo Nuno Vicente

This presentation is aimed at exhibiting the PhD project entitled “Programa de Ensino Experimental das Ciências no 1.º CEB: da Organização Curricular à Avaliação da Aprendizagens”. This project has as its main objective the development of an Experimental Science Teaching Program (PEEC) for Primary Education, including: i) a curricular proposal for sequential and systematic experimental science teaching over the four years; ii) activities and teaching resources to support its implementation in teaching context; and iii) a learning assessment component focused on the development of scientific skills that includes activities (digital games) and evaluation sheets.

We are currently atimplementation stage, evaluating it the PEEC at Escola Ciência Viva de Vila Nova da Barquinha - Centro Integrado de Educação em Ciências.

Preliminary results reveal aa positive feedback from the teachers who implemented the activities. Teachers identify several strengths of the PEEC resources, including: i) facilitating the preparation of the sessions; ii) adequate resources for the age group; and iii) activities that contribute to the development of learning in science.

Education

Going digital and keeping intercultural connection

Ângela Espinha, Maria Helena Araújo e Sá

Research has been showing that interaction between students that live and communicate in different languages and cultures would allow them to develop plurilingual and intercultural competences. Since, in the school setting, it is not always possible to promote by face-to-face contact, new forms of communication can help to solve this limitation. We present an oriented didactic proposal for the development of intercomprehension among secondary school students from different Romance language countries, using an online platform. In this presentation, we discuss on the way in which they express their availability and willingness to enter into an intercultural relationship through the way they communicate with each other, from a linguistic and cultural point of view. By analyzing the “profiles” and “discussion forums” spaces of the platform, we realize that, on the one hand, students share different information about themselves highlighting the positive characteristics and the ones that they believe would value social perception of themselves and trigger in the group the desire to enter into a relationship. On the other hand, they include features that explicitly demonstrate they are aware of the Other present in the platform and they want to connect and to engage in an intercultural relationship.

Education

QUALIFICAÇÃO ACADÉMICA E PROFISSIONAL DOS DOCENTES DO ENSINO SUPERIOR NOS PLANOS DE DESENVOLVIMENTO INSTITUCIONAL EM ANGOLA

Rangel Domingos, Nilza Costa, Maria Mendes, Diana Oliveira

O projeto a desenvolver surge da preocupação levantada em torno da qualidade do Ensino Superior (ES) em Angola, resultantes das políticas públicas, da sua expansão e emancipação em toda a extensão do território nacional. Uma das necessidades apontadas para alcançar essa qualidade é a de investir na qualificação académica e profissional do quadro docente. Assim, sustentados no que acima escrevemos traçámos como objeto da nossa tese compreender o modo com as Instituições de ES estão a avaliar a sua qualidade e, em particular, como a qualificação académica e profissional docente (QAPD) é planificada no quadro dos Planos de Desenvolvimento Institucionais (PDI). Esperamos que do levantamento do que existe possamos propor sugestões para a melhoria da qualidade do ensino, através de orientações que valorizem a QAPD.

Education

EARLY INTERVENTION IN AUTISM SPECTRUM DISORDER: Children's needs and support from the National System of Early Childhood Intervention

Tânia Soares, Paula Santos, Ana Serrano, Marilyn Espe-Sherwindt

The prevalence of Autism Spectrum Disorder (ASD) has been increasing in recent years, as has inclusion in schools and society. Knowing that the ASD affects the child's development, posing difficulties to their education and social inclusion, we question whether the intervention made with these children from 0 to 6 years old is converging with the specifics of their needs. Decree Law 281/2009 created, in mainland Portugal, the National Early Childhood InterventionSystem (SNIPI), aiming to support children aged 0-6 years with developmental delay, disability, or serious developmental risk due to biological and/or environmental conditions, and their families. Research developed in Portugal presents results that point to the need to discuss the convergence of this model in face of the specific needs of children with autism. Thus, we propose to understand the needs of these children and analyze the support provided to them and their caregivers by the SNIPI. This paper is part of a doctoral project in Education, a case study of national scope. According to a qualitative methodology, it will focus on the results of questionnaire and/or interview surveys to families, kindergarten teachers and professionals from the SNIPI . The analysis of the perceptions of these stakeholders will allow us to identify strengths and constraints, as well as formulate proposals for improvement, with a view to contributing to the development of Early Autism Intervention in Portugal.

Education

FUNDING POLICIES FOR RESEARCH CENTERS: a study at a Portuguese university

Emilce Pacheco, Dora Maria Ramos Fonseca

In this investigation we will analyze the regulations of the financing policies and understand their impacts on the Research Centers of a Portuguese university. The nature of the investigation is mixed, considering that we will use a qualitative and quantitative approach. The interpretive paradigm will support the methodological basis of the study, and a sense will be taken that the art of understanding hermeneutical studies is far beyond the interpretation of texts, as they are traditionally thought. On the contrary, the process of understanding will be present in every process of life experience in which written, spoken or symbolic language demonstrates aspects of human reality. We will use the Case Study since it is an investigation plan that involves intensive and detailed study of a well-defined entity. Data collection will be carried out by means of documentary survey, to verify the main scientific financing policies, the financing values and the criteria for the granting of financing, production and scientific dissemination, in the period of 2014 to 2020, this time frame is outlined by the Portugal 2020 program, in its lines of action there were specific financing aimed at research and innovation. We will also use the interview (university manager, center managers and middle managers) and questionnaires (researchers). In the analysis of the data we will use the content analysis supported by WebQDA, for the interviews and for the statistical data of the questionnaires and the financing values (we will calculate the analysis of variance (ANOVA) support from the SPSS.

Education

Music Education in Secondary School: didactic contributions to quality education

Maria João Vasconcelos, Helena Caspurro, Nilza Costa

Abstract:

The focus of this study lies in the need to discuss, theoretical and practical perspectives, on Music teaching, learning and assessment process, specifically within the scope of basic education internationally and nationally. This attempts to enhance and provide more effective responses to what is currently sought for quality education for all (UNESCO, 2015). In the context of the Music school subject, there is a tendency to value forms of knowledge transmission based on performative reproduction of music (Priest, 1998; McPherson, 2005; Mills & McPherson, 2006). That is, a tendency to look at products resulting mainly from what the teacher taught, and not so much on processes and results of what the student are able to learn based on the possibilities generated and focused on discovery, action and creativity. Thus, this PhD project assumes a didactic thinking and acting, by a teacher-researcher (author of the project), directed to the development of creative-musical thinking in the subject of Music in Secondary School (namely in Portugal at the "3rd Cycle of Basic Education"). The principle "sound before symbol"/"sound before sign" (McPherson & Gabrielsson, 2002; Mills & McPherson, 2006), and the valuing of processes based on problem solving and the acquisition of specific music and transversal skills (group work, communication, self/hetero evaluation) will be highlighted. The didactic perspective and action of the teacher-researcher assumes a coherence between the triple teaching & learning & assessment, as advocated by several authors (e.g. Fernandes,

2009; Fautley, 2010). This presentation reports on the results obtained so far, and which includes a short state of the art, an exploratory study carried out in a school (Vasconcelos, Caspurro & Costa, 2016), and the main study with a design of action research.

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Education

Adaption to Telework and health education of higher education workers in the Covid-19 pandemic

Eugénia Taveira, Anabela Pereira, Madalena Cunha

The pandemic, caused by the SARS-CoV-2 coronavirus, forced home confinement and teleworking became a common option for those whose functions could permit it.

The use of telematic methods prevails at this turning point and there is a need for rapid and unforeseen adaptation, both by workers and by employer organizations and entities.

The absence of information or action strategies in an unforeseen situation, namely confinement, suggests that in this context it will be important to make a contribution to the continuous training of employees, through initiatives in terms of health education and the development of competencies that promote health. welfare.

For this purpose, it is intended to assess the way in which employees in administrative areas and management perceive their adaptation to telework, identifying their physio-social risk factors, as well as the impact on their quality of life and well-being. A quantitative study will be made in which the participants will reply to a protocol of questionnaires.

Moreover, in this context, the physio-social risk factors will be investigated.

The results obtained will allow thinking and developing strategies for adapting to this new work and lifestyle pattern, in order to mitigate any stress factors that these changes entail, thus promoting greater well-being for teaching staff. Higher education, either through continuous training actions or through the creation of an online platform with guidelines to motivate for the promotion of health and well-being in the context of teleworking and in unforeseen crisis situations.

Education

Transnational Mobility of Non-Higher Education Students in Portugal: a case study

Isabel Abelheira, Manuela Gonçalves

This communication presents the research project in development, whose object of study is the transnational mobility of non-higher education students, more specifically within the scope of the Erasmus+ Program (key action KA2). The research will be guided by the general question: "How is the implementation process of the Erasmus+ Program configured, in the field of transnational mobility of students, in non-higher education in Portugal?", proposing to understand how this mobility develops and gives new meaning to a Group of Schools from Portugal. It fits into the interpretive paradigm and the methodology assumes a mixed nature, with a qualitative predominance, since data will be analyzed through the techniques of content analysis and descriptive statistical analysis, obtained through document analysis, semi-structured interviews and questionnaire survey. The investigation has two strands: an extensive one, in order to obtain the mapping of School Groupings that joined the Erasmus+ Program (key action KA2), and an intensive one, through case study design, which aims to understand how a Group of Schools reframes and recontextualizes the Erasmus+ Program (key action KA2) in the context of its concrete action. The aim of this work is to contribute to filling a gap in research on the subject, both at the level of education and from the perspective of educational policies, since only existing scientific production in Portugal on the transnational mobility of students at the level of higher education is known.

Education

Programa Intergeracional: Territórrios do Sentir-se

Márcia Leardine, Maria Helena Araújo Sá, Gabriela Portugal, Liliana Sousa

Temos como objetivo discutir as contribuições das práticas intergeracionais para as reflexões acerca dos desafios inerentes à promoção do diálogo intercultural, a fim de contribuirmos para a reflexão das estruturas sociais, institucionais e epistêmicas, que impliquem não apenas o mero reconhecimento e tolerância de outras pessoas e culturas, mas também a sua valorização, em diálogo e transformação mútuos. Nosso programa, intitulado "Territórios do senitr (-se)", tem como pilar primordial as vozes das crianças e dos idosos, capturadas dialogicamente, a partir da metodologia multimodal representacional que se assenta em uma abordagem diversificada que atenda as diferentes formas de partilhas dos sujeitos da pesquisa, que terão contato com diversas formas e modalidades para representação de suas vozes, pensamentos e ações, numa perspectiva intergeracional.

Education

Comics as a tool for Science Communication and Education: developing an interactive learning resource

Marina Mota, Cristina Manuela Sá, Cecília Guerra

This research focuses on the development of a Science Comics, an interactive learning resource, for Science Communication and non formal Education. It will integrate didactic strategies directed to the development of learning and key competencies in Health and Well-Being of children in the early years of schooling. The resource will be developed (from its conception to its implementation and impact evaluation) in a non-formal education space for learning Science - the Fábrica Centro Ciência Viva de Aveiro - involving potential users and experts in the area (children, monitors and science teachers, health professionals, designers and didactics researchers). The research methodology adopted is of the Research and Development (R&D) type, being of a qualitative nature. It is hoped that this project can contribute to guide professionals in Education regarding the use of Comics in Science Communication and Education.

Education

Social In(ex)clusion pathways in Vocational Education and Training: towards a socio-educational proposal with and to its protagonists

Ana Traqueia, Manuela Gonçalves, Rosa Madeira

The communication aims to present the doctoral project "Social In(ex)clusion pathways in Vocational Education and Training: Towards a socio-educational proposal with and to its protagonists", which is being developed in the Education PhD Program at the University of Aveiro.

The origins of Vocational Education and Training (VET), in Portugal, allows us to identify, as an embarrassment, the prejudice and stigmatization that associate it with paths of school failure, the disadvantaged socioeconomic context of most students and the image of low quality teaching. So, the following research question was established: How to promote, through a participatory socio-educational approach to be undertaken with VET students and graduates, dynamics that enhance the development of subjectivities resilient to the impact of social disqualification of biographical and school trajectories, towards their self-determination and social empowerment? On the one hand, VET is presented as a context that promotes the social inclusion of young people at risk of dropping out of school who, otherwise, would not have a worthy alternative to access compulsory education. On the other hand, one cannot fail to recognize the impact of stigmatization and social representations and the reproduction of social inequalities. In this sense, social inclusion and exclusion are presented as a multidimensional phenomenon, showing the relationship structural constraints and the subjectivities of the different contexts of action. The investigation fits itself into the sociocritical paradigm and a qualitative approach will be developed, using Life Stories and Participatory Action-Research, methodological options justified by the interventional aim of promoting social change, in which the participants assume themselves as social actors.

The sociocultural, economic and political transformations that have taken place in recent decades set new societal challenges, agreed through the 2030 Agenda, which bring to the debate the issues of social justice, equity, inclusion and Human Rights. We consider that VET has an important role to this commitment to inclusive and quality Education, to the promotion of fair and sustainable employability and the reduction of social inequalities and the students and graduates' participation will contribute to their empowerment and to social change.

Education

Grief Counseling: the specialized training in the portuguese context

Cristina Felizardo, Paula Santos

The research proposes to design a specialized training curriculum in Grief Counseling, adapted to the Portuguese context. Tasks will be carried out that allow: the characterization of the training reality of Grief Counseling in the international context, with evidence of increasing the competence and effectiveness of this formal intervention in grief; mapping the training needs of Portuguese professionals who, in the exercise of their professional activity, intervene with people in mourning; and the critical analysis of both contexts for the design of a curriculum for Grief Counseling Training, in the Portuguese context. The methodology adopted for this investigation is predominantly qualitative, with the application of the Educational Design Research (EDR) method, as we aim at the dual purpose of: solving a problem in a real context (the need to train professionals who work with grief processes); and generate lasting knowledge (the curriculum design). The techniques for data collection and analysis are analysis, inquiry and observation, associated with various instruments – interview, questionnaire, observer diary and focus group. The investigation is in phase 1 of the project, which corresponds to the construction of the theoretical framework, and a systematic literature review was conducted to outline the concept of normal grief. The first results characterize normal grief as a normative, individual and subjective process, which takes place after a life-changing event, with a view to harmonious adjustment to the new reality. It is composed of a set of responses, or coping mechanisms, which when positive reduce the symptoms of grief. Despite a difficult experience it leads to a positive outcome, namely the individual's personal development. In the following phases, we propose to characterize the training of grief counseling, in the international context, to map the training needs felt by Portuguese professionals who, in the course of their activities, are called upon to support people in mourning and, from the perspective of co-construction, propose the design of the specialized training curriculum in grief counseling for the Portuguese context.

Keywords: Grief; Grief Counseling; Grief Counseling Training

Education

Interculturalidade na formação contínua de professores: O caso do Projeto Escolas Interculturais Bilíngues de Fronteira

Andrea Ulhoa, Maria Helena Almeida Beirão de Araújo e Sá

A apresentação refere-se a uma investigação em curso, a qual incide sobre as potencialidades de um programa de formação contínua, perspectivado como investigação-ação-formação, a ser desenvolvido no âmbito do Projeto Escolas Interculturais Bilíngues de Fronteira da Organização dos Estados Ibero-americanos (OEI), junto a professores dos anos iniciais da escolaridade, que atuam em escolas da fronteira entre Portugal e Espanha.

Education

Diversidade linguística e cultural no ensino e aprendizagem de língua portuguesa em Moçambique

Tomásia Mataruca Nhazilo, Maria Helena Araújo e Sá

Esta apresentação tem como objetivo descrever o estágio atual da pesquisa em curso sobre a Diversidade linguística e cultural nos discursos e nas práticas dos professores de Língua Portuguesa em Moçambique. O estudo é de natureza qualitativa, insere-se no paradigma interpretativo com o design de estudo de caso e está a ser realizado no âmbito do estágio Pedagógico da Licenciatura em Ensino de Português na Universidade Pedagógica de Maputo. A recolha de dados foi ajustada de modo a fazer face às restrições impostas pelo covid 19, estando a decorrer (i) uma ação de formação, ii) questionário aos professores; iii) análise dos documentos reguladores e manuais de LP. Espera-se que os resultados venham a ser disseminados por meio de publicação de artigos em revistas científicas da área, participação em conferências bem como a publicação de um capítulo de livro que já se encontra no prelo.

Education

Plurilingual program for the deaf: paths towards inclusion, empowerment and active citizenship

Carolina Lúgaro, Maria Helena Araújo e Sá, Ana Isabel Silva

The multiple challenges of the contemporary world require an education that provides instruments for the exercise of an active and full citizenship in the various spheres of action of individuals.

Recognizing that the contemporary world demands new literacy practices and with a view to including and integrating the deaf in an essentially diverse, plural, and multimodal world, a study is underway on the effects of an Intercomprehension Program (PIL) on the development of multiliteracies of the deaf.

This study is part of a perspective of education-for-all, based on valuing and dialogue with diversity, critical thinking, and deployment of personal knowledge and experiences. In this context, based on studies on the pedagogical application of intercomprehension (Oliveira, 2016; Paulo, 2019), perspectives of authors who study aspects related to plurilingual multiliteracies of the deaf (De Meulder et al., 2019; Hoffman et al., 2017; Kusters et al., 2017) and in the theoretical and heuristic frameworks developed under the European projects Miriadi and EVAL-IC, the general objective of the program is the development of the multiliteracies of deaf students with a view to their emancipation, empowerment and exercise of full citizenship.

Education

FACTORS THAT DETERMINE THE NON PURSUIT TO HIGHER EDUCATION FOR STUDIES IN MOZAMBIQUE: THEIR MITIGATION THROUGH DISTANCE EDUCATION

Patrícia Cuamba, Antonio Moreira & Ana Carla Amaro, moreira@ua.pt

In Mozambique, student do not continue studies to higher education due to low income of families, low purchasing power. In the other hand, student attend poor school, lacking learning resources, the ict are not used in educational context, so the education has low quality.

Education

Responsible research: an experience with a intercultural and collaborative research partnership

Raquel Carinhas, Maria Helena Araújo e Sá, Danièle Moore

Esta contribuição pretende indagar as incidências de projetos de investigação-intervenção com redes educativas interculturais na reconceptualização do conceito de 'responsabilidade social, compreendido nas dimensões individuais, institucionais e societais (Dreveton, 2015). Descreveremos e analisaremos, primeiramente, algumas escolhas e práticas investigativas tomadas ao longo de uma experiência de investigação

com uma rede educativa intercultural entre escola, museus e famílias criada no âmbito de um projeto de doutoramento em curso ancorado no paradigma de uma Didática das Línguas e do Plurilinguismo, diversitária/alteritária e descentrada (Castellotti et al., 2016), comprometida com os objetos e os participantes do estudo (Alarcão et al., 2009). Revisitando a experiência de investigação no terreno, procuraremos, a partir dessa análise do diário de investigação e das interações síncronas e assíncronas da rede educativa, identificar os contornos da 'responsabilidade social', discutindo os modos de apropriação, individuais e coletivos, desse conceito refletidos nas posturas epistemológicas, metodológicas e éticas adotadas pela investigadora implicada no terreno ao longo da e face à investigação que se encontra a desenvolver. A contribuição possibilitará problematizar, à luz da nossa própria experiência e a modo de vigilância crítica (Vieira, 2019), o modus operandi de investigações em educação em línguas (mas não só) e de co-construção de conhecimento científico quando os participantes são envolvidos na própria investigação (Thamin & Miguel-Addisu, 2020).

Education

Research on Education for Linguistic and Cultural Diversity in Portugal: Contributions to its sustainability

Ricardo Torres, Ana Raquel Simões, Susana Pinto

The concept of Education for Linguistic and Cultural Diversity (ELCD) has been conducting European and National linguistic educative policies and, consequently, inquiries which take it as guiding principle have received high funding. However, there is a lack of studies that critically systematize the emerging knowledge from these investigations. In this domain, stands out the scarcity of scientific information related to the comprehension of the taken courses, mostly in what concerns to the sustainability and impact of the results. That said, this inquiry emerges to fill this gap. Based on an interpretative paradigm and in a qualitative nature, its goal is to propose guidelines to the development of sustainability strategies which enhance the project's results impact. Therefore, it seeks to answer three research questions: (1) "how is the knowledge built in the area of ELCD, in the past 19 years, characterized?"; (2) "what is the impact of projects in ELCD and their results on the discourses of institutions and of the subjects involved in them?"; and (3) "what sustainability strategies enhance the impact of projects in ELCD on institutions and participating subjects?". Aside to that, objectives and methodological procedures were drawn, such as: identify and characterize, through meta-analysis, ELCD financed projects which integrate Portuguese researchers and take aim on National educative contexts; understand the perceptions of the involved actors relatively to projects' impact and sustainability strategies, using interviews and focus groups; and discuss the above mentioned strategies with the study participants, funding entities and other researchers, by means of a seminar.

Education

Images of languages and the Other in a school community

Sara Santos, Ana Raquel Simões, Susana Pinto

Considering the relevance that the concept of image has been acquiring in the area of Didactic of Languages, as well as its proven function in orienting individual behaviours and social relationships, this project focus on the analysis of the images of languages and the Other of different members of a school community: students (9th and 12th grades); guardians, teachers, staff and school management bodies.

This case study pretends to: i) identify the images of languages and the Other in a school community (students in the 9th and 12th grades, respective guardians, teachers, staff and management bodies); ii) understand how the images are (inter)related in the different members of the school community; iii) understand the evolution of the imagens in two different moments of the educational path (9th and 12th grade); iv) compare the images of the students with the studies of Simões (2006) and Senos (2011); and v) identify factors (historical, sociolinguistic, social, economic, political…) involved in the construction of the images. The results will make it possible to delineate suggestions to contribute for a work at Portuguese school concerning linguistic and cultural diversity awareness and the development of intercultural and plurilingual competence.

Education

Breaking down walls and building bridges between nature and kindergarten

Raquel Ramos, Aida Figueiredo, Ana Coelho

This research aims to design, implement and evaluate a Collaborative Training Program (CBP), in online format, in Preschool Education (EPE), integrated in the project "Invisible Boundaries: Education in Nature Environment" (LI), in order to articulate the educational practices of kindergarten teachers and the Casa da Mata Program (PCM), of the LI project. The CBP coincides temporally with the PCM, which will run from May 24 to July 2, 2021, and is based on a digital platform allocated to the website "Crescer sem Muros", exclusively designed and programmed according to the objectives and needs of the study contexts.

The project emerged, on the one hand, from the need to foster collaboration between educators from PCM and JI, and on the other hand, from the concerns raised by current research regarding the lack of opportunities for children to act in nature, and therefore the need for articulation between outdoor spaces/nature and the classrooms of the JI. This problem has implications in terms of health, cognitive, socioemotional, motor development and environmental awareness of the child.

Through a qualitative case study, we intend to assess the contributions of the CBP, on the one hand, in the reorientation of the conceptions and educational practices of the 5 educators, before and after their participation in the CBP, using multiple techniques for data collection and processing - the researcher's diary, document analysis, semi-structured interviews, participant observation, written, photographic and video records and content analysis with the support of Webqda software. And, on the other hand, in the quality of the educational offer at the time of the observations, through the evaluation of the levels of emotional well-being and implication of 16 children participating in the study, before, during and after the CBP.

The study may contribute to the development of innovative articulation strategies in diversified contexts, through collaborative work between professionals - researcher, coordinators, educators and specialists in nature education. Ultimately, the relevance of this project stems from the need for research, training and intervention in the area, especially regarding outdoor/nature and indoor articulation, as well as the contribution and implications it aspires to achieve in the quality of educational and training offers in Portugal.

Education

Reading and writing game in the teaching of English in a collaborative environment: a case study in Primary education

Marta Fortunato, António Moreira, Ana Raquel Simões

This presentation is based on an ongoing PhD project, that focuses on the influence of gamification on the promotion of learning reading and writing in a collaborative problem-solving context in Primary English classes. This is a qualitative case study that relies on different data collection techniques and instruments and their triangulation, to make its conclusions more consistent and provide it with scientific validity. It pursues two objectives: 1) to assess the influence of gamified activities on the learning of reading/writing in Primary education and of its implication for their resolution; 2) to assess the influence of these activities on the development of collaborative work skills in a problem-solving context, namely: i) understanding, exploration and resolution; ii) groups' organisation and cohesion.

In spite of not having any conclusive results yet, we were able to ascertain from the preliminary analysis of the data collected, that learners were engaged and motivated for English language learning. We could also check that the contact with reading and writing activities in English, stimulated by the principles of the gamified pedagogy, aiming to solve real world problems, seemed to foster the development of soft skills, such as creativity and critical thinking and also the deployment of group work strategies.

Education

Civil engineering

INDOOR THERMAL COMFORT AND ENERGY PERFORMANCE OF RESIDENTIAL LIGHT STEEL FRAMING BUILDINGS

Eduardo Roque, Romeu Vicente, Ricardo Almeida

Given the proliferation of the Light Steel Framing (LSF) constructive system for residential buildings, it is crucial to characterise how these buildings perform in the southern European context, in terms of thermal comfort and energy efficiency. It is also important to compare LSF buildings with the typical southern European constructions. Acknowledging the relevance of experimental studies for this matter, a long-term monitoring campaign was established. The obtained results reveal significant opportunities and limitations for the LSF constructive system. In terms of energy

efficiency, it was found that LSF buildings provide sound advantages in reducing energy consumption for heating the indoor environment. However, this constructive system is more prone to higher daily indoor temperature fluctuations and more expressive peak values, accentuating the overheating risk during warmer months and discomfort due to overcooling during the winter. Therefore, enhancement techniques shall be studied to mitigate the possible drawbacks and promote this sustainable constructive system.

Civil engineering

BIM-based on concrete bridges life cycle management

Ali Alhameedi, Paulo Cachim

This paper investigates how to model concrete bridges with integrated life cycle viaduct (BIM) that can benefit from this technology in the design, construction, operation, maintenance, and monitoring stages. Bridge information modeling (BrIM) has become necessary and vital in planning, designing, and constructing bridges. BIM was used to obtain accurate drawings as well as cost estimation and visualization. This paper reviews bridge information modeling as an integrated method for modeling and simulating the concrete bridges' life cycle. In practice, BIM uses reliable and safe construction methods to perform advanced structural analysis in the design stages.

Moreover, suitable sites for installing and erection mobile cranes are selected during the construction and other necessary heavy equipment. The controlling of the components of the precasting or on-site casting, if any. It is creating and organizing documents, calculating the quantities of all materials involved in constructing concrete bridges. It also acts as a means of managing the operation, maintenance, and monitoring phase. The paper briefly describes BrIM models' uses in the design, construction, operation, monitoring, and maintenance stages of concrete bridges. This paper also reviews the engineering programs used in modeling and simulation to use BIM, Autodesk, Bentley, and FEM applications. BIM is an effective tool to automate the life cycle of bridges.

Civil engineering

Partition walls: Innovative approach through sandwich panel

Susana Ferreira, Miguel Morais, Vítor Costa

This PhD aims to develop a new solution for interior partition walls through sandwich panel. It is thus intended to design a solution for building modular walls, lightweight, easy to transport and apply. The solution is suitable to incorporate the structure to support bathroom sanitary ware. Within the scope of PhD it is also intended that fundamental criteria will be established to ensure that the modular wall system functions at an optimum level. Experimental tests will be performed in the areas of structure, fire and acoustics. This method is crucial to optimize the final solution in order to deliver a high-quality proof-of-concept that complies the most scientific literature and follow the European guidelines and directives as well.

Civil engineering

Circular economy approach to construction materials incorporating paper & pulp industry wastes

Fábio Simões, Victor Ferreira, Miguel Morais

The construction sector consumes a lot of natural raw materials and other resources (water and energy) and they are finite and withdrawn from Earth. In addition, there is an increase of waste production, CO2 emissions and other forms of pollution. Part of the solution for this problem is the use of wastes as alternative raw materials in the construction sector by the development of competitive circular solutions on the construction sector. For example, pulp and paper industry is also an intensive consumer and producer of wastes (approximately 11 million tonnes/year). In the same way, other sectors consume huge amounts of natural resources, such as the construction sector (approximately 5,4 billion tonnes of raw material consumption). Thus, these sectors (pulp & paper and construction) can work in symbiosis to create a circular model, where pulp and paper wastes become secondary raw materials in the construction sector.

This research involved a literature review on pulp and paper and other wastes used as alternative raw materials in construction products as well as a review on circular economy, sustainable construction and on life cycle analysis on construction materials. The thesis case study has involved two large scale demonstrators in the construction materials area (precast concrete and road pavements containing wastes) to research and confirm the developed solutions at laboratory into the real scale. In the end, the sustainability and business models of developed solutions are being analysed and discusses in order to frame the context of circular economy in these cases.

This PhD work is being done and supported by H2020 project PAPERCHAIN (Grant Nº730305).

Civil engineering

Guidelines for Artificial Nourishments Interventions: Improving Design Processes

Margarida Ferreira, Carlos Coelho, Paulo Alves Silva

Worldwide, several artificial nourishments projects have been performed to reduce the sedimentary deficit on the coastal zones. After being deposited, the sediments are redistributed due to the hydrodynamics actions at the placement site, leading to the need of regular re-nourishments.

This proposal intends to study the performance of artificial nourishments projects in a long-term perspective based on numerical modelling and to bring forward proposals of nourishments design based on its cost-benefit analysis. It is expected to present contributions to improve long-term numerical modelling abilities, merging cross-shore and longshore processes on the same model. Different types of nourishment scenarios will be analysed either in conceptual and real coastal domains, improving the guidelines for artificial nourishment design. These scenarios should include the different factors that determine the performance and longevity of a nourishment project: adequate nourishment volume in each intervention, sediments deposition location, sediment dynamics at the placement site and sediments characteristics.

Civil engineering

Fire design of tapered steel members

Élio Maia, Paulo Vila Real, Nuno Lopes, Carlos Couto

Part 1-2 of the Eurocode 3 provides several approaches to the stability verification of steel members. However, no specific fire design rules are given for the case of tapered steel members, resulting in the use of conservative and uneconomical fire protection measures. The objective of this thesis is to develop and validate fire design rules for tapered members, thereby filling a gap in the current version of the EN 1993-1-2.

Civil engineering

BUILDING CONDITION ASSESSMENT APPLIED TO PUBLIC BUILDINGS

Raquel Matos, Fernanda Rodrigues, Hugo Rodrigues, Aníbal Costa

Building maintenance and rehabilitation are considered positive contributions for sustainability and the decrease of greenhouse gas emissions of the built environment. Despite this, almost no maintenance and rehabilitation solutions and processes were subject to Life Cycle Assessment (LCA) ensuring their reliable sustainability. This work proposal aims to develop a Computerized Maintenance Management System (CMMS), with a more reliable Building Condition Assessment (BCA) strategy supported by Key Performance Indicators (KPIs) and a cost-benefit analysis algorithm, taking advantage of LCA tools integrated with BIM methodology. A BIM-based platform that allows an easy and strict life-cycle building observation with reliable management actions will be developed. This presentation focuses on the current development of the PhD thesis entitled " Building Condition Assessment Applied to Public Buildings", which is expected to be concluded in January 2024. It provides an overview of the work done until now, as well as of the expected future developments.

Civil engineering

Development of Novel Formulations for Bathroom Hardware

Isabel Correia, Ana Barros, Dmitry Evtyugin

Abstract

JBMC is a company that produces thermoset hardware (sanitary goods) by compression moulding. The proposed doctoral project deals with the problems related to the final quality of the product and the dependence from suppliers of raw materials that monopolised the market. Furthermore, the final products reveal insufficient chemical and bacteriological resistance, and the premature material aging. At the same time, any information is available regarding the raw materials' composition and the basic characteristics determining their performance. During several years JBMC has been trying to improve the quality of produced products. However, these efforts to increase the chemical and bacteriological resistance of the finished products was not successful. The present study aims to elucidate the chemical composition of raw materials and to develop new formulations to reduce quality problems. Another objective deals with reducing the company's dependence on a single raw material supplier, by installing a pilot unit.

DBI - Doctorate in Business innovation

Refining, petrochemical and chemical engineering

Electrochemical reduction of N2O

Laura Holz, Duncan Fagg

Nitrous oxide (N2O) reduction is a green-house gas responsible for many environmental problems, such as photochemical smog, acid rain, ozone layer depletion and global warming.

The aim of the current work is to bridge the solid-state chemistry and heterogenous catalysis, by studying the non-Faradaic electrochemical modification of catalytic activity (NEMCA) of the N2O reduction reaction, usin La0.6Sr0.4Co0.2Fe0.8O3-d -LSCF as electrocatalyst.

A single 3-probe cell reactor was developed, composed of 8 % mol Y2O3 – stabilized ZrO2 as electrolyte, LSCF as working electrode and inert gold (Au) as counter and reference electrodes.A buffer layer of Ce0.9Gd0.1O2-d (CGO) was used to prevent the inter-reaction between the YSZ and LSCF.

The experiments performed in the galvanostatic mode showed that applying negative currents (i.e -0.1 and -0.25 A), an increase of the catalytic rate (r O2 mol s-1) was observed, resulting in a substantial increase of N2O conversion. The Faradaic efficiency (Λ) also known as enhancement factor, was also calculated for the tested experimental conditions (i.e 700 °C), and showed values that exceed unity, evidencing non-Faradaic electrochemical behaviour. The results show that NEMCA can be an alternative and effective tool for this green-house gas treatment, highlighting its environmental importance.

Refining, petrochemical and chemical engineering

Industrial engineering and management

Impact of energy cost management on the financial performance of companies by application of exergy concept

Maryam Hajishams, João Carlos de Oliveira Matias, Margarita Matias Robaina

This work intends to apply the exergy concept (a thermodynamic concept) as a novel approach for analyzing the impact of energy cost management on the financial performance of companies. Initially, the relationship between energy efficiency (through exergy), environmental and financial performance will be studied, and measurement methods and theoretical models will be constructed and, finally, will be implemented in multi-case studies. The research design will be based on exploratory and explanatory approaches and will be composed namely by the systematic literature review, interviews, and multiple analysis methods, such as Principal Component Analysis (PCA) and Data Envelopment Analysis (DEA). Expected results, impacts and benefits will be centered on decrease of natural resources depletion and environmental protection, on the benefits of energy efficiency on the environmental protection, and on sustainable financial performance of companies, helping their managers not only to create and improve strategies for its Competitiveness but also for sustainable development.

Industrial engineering and management

Development of supply chain management strategies for the Angolan cement industry

Pedro Campos, Carina Pimentel

O cimento é um bem de consumo prioritário em todas as sociedades modernas. Face à sua importância torna-se relevante entender os fatores determinantes que influenciam a gestão da cadeia de abastecimento do cimento, pois, só com o pleno conhecimento de causa se podem desenvolver estratégias de gestão adequadas que suportem o funcionamento da indústria cimenteira e assegurem uma estrutura ágil e/ou eficiente que facilite a distribuição dos produtos deste setor industrial.

Industrial engineering and management

PDS - O estado (possível) da arte

Ricardo Ferreira de Mascarenhas, Prof. Carina Pimentel, Prof. Maria João Pires da Rosa

Face ao desenvolvimento durante o ano transacto é justo fazer um ponto de situação e apresentar a justificação da área de estudo. (nota a detalhar posteriormente)

Industrial engineering and management

Digital Transformation for Organizational System of Engagement: Delivery Model and Assurance

Tiago Almeida, Leonor Teixeira, Carlos Ferreira

Digital transformation has been classified as a megatrend by many worldwide researchers (IF Insight & Foresight, 2019). The larger worldwide companies are performing Digital Transformation to introduce new capabilities and adapt their processes, tools, and strategy towards challenging digital marketing. Companies are forced to innovate, digitally transform, and adapt permanently to remain competitive and succeed. If they don't, they are doomed to die. Most of the recent trends such as 5G, Smart Home, Smart City, Artificial Intelligence (AI), Digital Currency, E-Learning, Blockchain, Industry 4.0, Digital Health and Augmented Reality (AR) require digitalization and most of them are having a direct impact on the society, affecting our lifestyle and have huge challenges on data processing and security. Also, many public institutions like schools and universities got struggled when they were confronted with the lack of readiness and the absence of digital strategies.

The Systems of Engagement (SoE) evolution became even more important on the user's experience therefore, the capacity of organizations to adapt their systems is critical to surviving in the medium-long term. The main purpose of this PhD thesis is to contribute to the identification of the main aspects that organizations can use as best practices, public or not, could use when implementing or developing digital projects onto their Systems of Engagement. For that, a study will be conducted by using Design Science Research methodology.

Industrial engineering and management

From a Start-Up to a SME: Development and Test of a Transition Support Framework for R&D Companies

Cristiana Teixeira, Maria João Rosa, Leonor Teixeira, António Teixeira

Start-ups, newly created companies producing cutting-edge technology, face unique challenges during their growth and evolution – namely lack of resources, small size, lack of structure and absence of formalized operations management procedures, particularly quality management ones. The purpose of this project is to analyze the specificities of such companies in their transition from star-ups to small and medium size companies and to identify and characterize the processes they should formalize (and how they should structure them) in order to support growth without hindering innovation. Particular attention will be given to the quality management principles and practices that such companies should implement in order to assure and improve their quality during the transition and afterwards. By developing and testing a transition support framework based on existing literature and on the use case of the Portuguese R&D start-up PICadvanced, S.A., a practical tool with broad applicability will be obtained, able to support R&D start-ups in their evolution as they mature into established Small-Medium Enterprises.

Industrial engineering and management

Urban Logistics Optimization

Bruno Machado, Carina Pimentel, Amaro Sousa

Urban Logistics research using optimization models and methods to support decision making in urban logistics context.

Industrial engineering and management

Digital Transformation Process in Convenience Stores Retail

Roberto Rivera, Marlene Amorim, João Reis

Investment in technological solutions at the service of citizens is increasingly common. In recent years, several locations have become Smart Cities with the support and application of Information, Communication and Technologies (ICT) that contribute to sustainable development, foster social participation and increase the quality of life of citizens. Hence, this PhD project aims to contribute to the accelerated digital transformation, through the development of a service model based on an Information System that will enable the implementation of market solutions focused on consumers in the proximity retail sector in Urban clusters (population groups with a density of at least 300 inhabitants per km²) and thus facing some of the challenges of industry innovation and sustainability in the context of the 2030 Agenda for Sustainable Development Goals. By applying mixed methods during the investigation, the aim is to understand the phenomenon under evaluation from different perspectives in search of convergence and corroboration of results. It will be observed diagnostic processes and implementation of technologies in buy and sell processes and the behaviors of both consumers and retailers regarding the acceptance of these new tools through a socio-technical analysis. Thus, it will contribute to the evolution of this sector through an analysis of recent technological resources that will bring the physical processes closer to the virtual ones in convenience stores retail, enriching the shopping experience and fostering support for local retailers and owners through understanding and analysis of buying patterns of customers.

Industrial engineering and management

Strategies for Deployments of Next Generation Optical Networks

Cláudio Rodrigues, António Luis Jesus Teixeira, Marlene Paula Castro Amorim

Different forecast scenarios for both 25G-PON and 50G-PON global ONT/ONU market are presented based on a Bi-Logistic modeling function with reference to GPON existing data.

Industrial engineering and management

Bottleneck Identification & Prediction in Manufacturing Systems

Ângela Brochado, Ana Moura, Amaro de Sousa, -

For many years, managers alongside researchers tried to understand and develop a standard method for bottleneck identification, to apply to the manufacturing industry. However, the existence of many different production systems and variables represents a challenge. So, the objective of this project is to develop a unique manufacturing control system, by taking into consideration all differences and disturbances between manufacturing processes. Besides identification, the second goal is to predict these bottlenecks to help production management planning. In this presentation, some relevant results are presented, as well as next steps of work.

Industrial engineering and management

Process Management and Digital Twin: Capacity-building support tool within the scope of Industry 4.0

Sara Castro, Leonor Teixeira

In an industrial era characterized by the digital transformation of business processes, a new paradigm arises: The Industry 4.0. Digital Twin is an emergent concept within this era consisting of a virtual representation of companies, being its main objective the replication and analysis of production systems in real-time. However, the design of business processes involving those digital ecosystems remains a pressing challenge for companies. Therefore, this project arose by the need to answer to these difficulties through Business Process Management, by building a framework of good practices and a capacity-building instrument for organizations to implement Industry 4.0 concepts. The results of this study will contribute to: i) provide a better understanding of the current processes digitalization state from a BPM perspective; as well as ii), a facilitated decision making by the management level of companies, from the synchronization of processes in the virtual world with the real one.

Industrial engineering and management

Information systems for the development of tourism in the digital era: A framework for Accessible Tourism

Pedro Teixeira, Leonor Teixeira, Maria Celeste Eusébio

With a new digital era transforming tourism, it is essential to study technological impacts in travel and leisure activities. In addition, the topic of accessibility is a trend amongst tourism scholars, generating major economic and social impacts, especially amongst people with disabilities (PwD). Even though the accessible tourism market is rising and presents a great business opportunity, this market is largely ignored, as tourism supply agents fail to disseminate accessible tourism offers, creating a major issue: shortage of information. Information systems can be a potential solution, improving accessibility through connectivity. The objective is to design, develop, implement and validate a research framework capable of creating a concept of a Web-based Information System (WBIS) to support information management, in the accessible tourism context. The intended roadmap illustrates the process of creating an accessible and adaptable technological solution, so future investigations in accessible information technologies can have a sustained and validated research basis. Information and communication technologies. Linking technological development, tourism, and social inclusion components, this project presents itself as an interdisciplinary and important study. In the future, this project could be of high importance for engineering information systems for tourism, and have a big social and economic impact, concerning the accessible tourism market.

Industrial engineering and management

Absenteeism and Ergonomics in the Cork Industry: some insights and tools to improve working conditions

Alfredo Silva, Ana Luisa Ramos, António Ramos, Marlene Brito

The study was conducted at a Portuguese cork stoppers company, faced with a situation of high absenteeism. The aim is to evaluate the company's workstations with greater absenteeism related to musculoskeletal diseases and suggests adequate ergonomic working conditions for those workplaces. The first step was to determine which workstations have the highest rate of absenteeism in the company. Then an ergonomic assessment tool will be developed using the main ergonomic evaluation methods. Finally, the tool will be validated by evaluating the workstations with the worst absenteeism rate due to musculoskeletal problems of the company.

Industrial engineering and management

The Citizen as a Key Stakeholder of Smart Cities and Industry 4.0: Study and Development of Decision Support Frameworks

Diogo Correia, Leonor Teixeira, João Lourenço Marques

In the past, a reactive attitude predominated where policymakers only thought about solutions after the onset of problems. Nowadays, cities need a proactive mindset, highlighting the importance of information and communication technologies to support decision-making. At the same

time, cities shall be created by citizens and for the citizens. Furthermore, it is vital to promote in urban planning active civic participation and guarantee that the citizen has at disposal the necessary services and essentials. Events such as the Covid-19 pandemic demonstrate the fragility of traditional supply chains and the need for proximity logic to deliver essential goods. The supply chain is expected to organize itself automatically to meet the end user's needs in real-time. The citizen is thus a preponderant and central agent in the evolution of both Cities and Industry. Thus, after three phases, the Smart City concept remains unclear, and its implementation still represents a challenge for decision-makers. Thus, the present work wants to clarify the concept of Smart City, enunciate the barriers and challenges, and establish the key performance indicators to monitor its implementation. In addition, will be studied citizens' involvement, formulated participatory methodologies, and conceptualized a framework to support the definition of a Smart City strategy. Furthermore, the present work also intends to study the relationship between Smart Cities and Industry 4.0, understanding the influence between the concepts and defining the main guidelines for realizing their visions.

Industrial engineering and management

Social and Economic Geography - Other : social-ecological periurban ecosystem

Asefi Sedigheh, João Matias, Carlos Gonçalves

influenced by global environmental changes, a rapid urban sprawl into peri-urban areas has increased social

exclusion, environmental degradation and thus reduced the socio-ecological systems resilience. Yet, this progress will be more complicated considering challenges of socioeconomic inequalities to benefit-access of shared urban-rural transition at minimized Peri-Urban Interfaces (PUI) [1].

The importance of dynamic inter-linkages of social-ecological systems in PUI to manage resilience has been widely studied. However, the significance of interactions between the components of social-ecological systems, within the higher structural complexity of PUIs in a more sustained resilient socio-ecological system, is a rather neglected topic.

Drawing a model of coral reef topographies, this study will characterize and explore peri-urban reefs in Portugal

that can coping, adapt and benefit from changes that increase resilience. Empirical and theoretical research will be conducted to provide insights into peri-urban socio-ecological systems resilient planning to create mutually

profitable frameworks engaging stakeholders and decision-makers.

Industrial engineering and management

Electrical engineering

Packaging of Photonic Integrated Circuits

Ana Tavares, Prof. Dr. António Teixeira

The evolution of the industrial sectors where optical components are used, mainly telecommunications and sensors, will occur together with (and as a consequence of) integration. This already happened in the past with electronics and optics will follow the same path. Photonic Integrated Circuits (PICs) are already in a high phase of development, but not ready for mass market yet. One of the major challenges is related with its packaging, which evolves several areas: thermal efficiency, opto-electronic interfaces performance and fiber alignment.

This work pretends to study and develop new encapsulation techniques for PICs, customizable and with good performance in all areas. The mail goal is to develop an encapsulated PIC for the next generations of Passive Optical Networks (PONs).

Electrical engineering

A GaAs Active On-Chip Antenna for SATCOM Applications

Bernardo Lopes, João Nuno Matos, Nuno Borges Carvalho, Ricardo Correia

The ever-increasing global demands for inter-connectivity, higher coverage, higher bandwidth, and lesser latency are putting a strain on satellite communication capacity. The blooming of the smart antennas technology has driven researchers to utilize its added benefits such as, the ability to adjust the antenna's beam pattern to highlight the level of signals of interest and yet minimize the interfering signal's level, to enhance network capacity throughout the most relevant areas of wireless communication systems such as 5G and Satcom. Advanced and highly integrated Galium Arsenite (GaAs) systems will be a competitive technology to reduce hardware cost and enable high performance, single-chip and mmWave front-ends. This PhD aims to contribute to the development of active on-chip antennas for SATCOM Applications by exploring the use of GaAs substrates. The main goal is to implement and characterize the GaAson-chip antenna contributing to smart antennas' future use.

Electrical engineering

Disaster resilient network design and resource management of elastic optical networks

Fábio Barbosa, Amaro de Sousa, Agostinho Agra

Disaster-based failures became more frequent in time and wider in scope, degrading drastically the communication services supported by telecommunication networks. This is of utmost importance since communication services are an important part of our society critical infrastructure. This issue is even more critical in core optical networks where a single optical fibre can carry a very large amount of service demands.

When a disaster occurs, it is important not only to quickly recover the failed network elements (post-disaster problem) but also to evaluate and minimize the disaster impact on services between nodes outside the disaster area (pre-disaster problem). This work focuses on the pre-disaster problem and aims to enhance the preparedness of optical networks to disaster-based failures.

Electrical engineering

Design and Characterization of Power Amplifiers for Emerging Technologies

Sanket Chaudhary, Nuno Borges Carvalho, Arnaldo Oliveira

In order to support higher data traffic demands, a wireless transmitter system is expected to be more linear and spectral efficient. Since power amplifiers (PAs) determine the quality-of-service of the wireless transmitter, it is expected to be more power-efficient over the wideband application. As an initial stage of the PA design, experimental characterization of the active device through the load-pull process becomes more significant. In a real-time scenario, PAs are expected to be operated for complex modulated communication protocol. Hence, excitation signals in the load-pull process play a crucial role in the load characterization process. Modulated load-pull characterization provides more comprehensive information on the PA characteristics. While characterizing the optimal load for the PA using modulated load-pull process, analysis of the excitation signal statistics, such as complementary cumulative distribution function (CCDF) and peak to average power ratio (PAPR) at the different stages of the PA provides more comprehensive information for the optimal load selection. Moreover, for the wideband applications, the frequency varying optimal load approach implemented through the load-pull process also provides more enhanced and comprehensive information on the PA performance.

Electrical engineering

Phase Shifters based on Metamaterial Transmission Lines for Millimeter Wave Beamformers

Raul Arruela, João Nuno Pimentel da Silva Matos, Tiago Miguel Valente Varum

Phase shifters and Vector Modulators (VM) are essential components in phased arrays. Typical VMs are based on IQ modulation and presents some disadvantages such as high insertion loss and size, which cause several difficulties in practical implementations (e.g., in multi-beam hybrid beamforming systems). In this work a new VM architecture is proposed. This new circuit is based on Polar modulation, and it is simpler, more compact and with better performance. Simulation and measured results are presented as well as a comparison between the two types of VMs.

Electrical engineering

Optimization of industrial communication systems based on 5G

André Perdigão, Rui Aguiar

Since the industry began to be automated, there was a growing need for communications between devices. To address this, some communications were implemented in production. But wireless communication has so far had low reliability and high latency, therefore, most factory communications used wired or proprietary solutions. With the arrival of 5G, interest in virtualizing the industrial environment has increased.

Digital Twin is the answer to this, by creating a twin of each piece of equipment in the factory it will become easier to operate, automate and interact with the production line, while increasing efficiency and flexibility.

But to fully benefit from this technology, there are many challenges to solve from modelling to communications. The work is focused on how to ensure reliable communications between the Digital Twin, the physical object and the factory systems.

Electrical engineering

Adaptive Transceivers for Elastic Access Networks

Beatriz Oliveira, Paulo P. Monteiro, Fernando P. Guiomar, Maria C. R. Medeiros

The steadily growing traffic demands impose high capacity and low latency requirements in future networks. For example, fronthaul links should be able to provide beyond 400 Gbit/s to cope with the demands of the emerging 5G communications. With the current digital radio-over-fiber approach based on binary modulation, this can only be achieved at the expense of transmitting several channels multiplexed in the wavelength domain. Coherent optical transceivers have been proposed for the fronthaul link because their robustness allows higher order modulation formats, thus increasing spectral efficiency and potentially solving the fronthaul bottleneck. This will reduce the number of transceivers at the expense of more complex digital signal processing (DSP). Therefore, the use of coherent communications will only be commercially attractive if it brings an effective reduction of both cost and power consumption per transmitted bit. In this presentation, these topics are discussed, and some major contributions are presented.

Electrical engineering

Next Generation RF Power Amplifier Design Using Artificial Intelligence

Catarina Belchior, Luís Nunes, Pedro Cabral

The next generations of communication systems will need to fulfill very demanding requirements which will certainly impact the usual component design methodologies and constraints taken into account during project stages. Due to their impact on the overall system performance, power amplifiers are key elements to be studied. The traditional power amplifiers design flow is driven by specific requirement sets which, due to complexity reasons, renders the process inflexible design rules. The objective of this PhD work is to incorporate artificial intelligence in the overall power amplifier design process giving the possibility to generate optimal new designs with no human interaction in record time.

Electrical engineering

Simplified Coherent Transceiver for Optical Communication Networks

Romil Patel, Prof. Armando Pinto, Dr. Nelson Muga

This research work focuses on designing low-cost transceiver architecture for the short-reach optical links. We propose a novel architecture, namely DC-Value Transceiver, for the simplified coherent transceiver. A summary of the experimental analysis and major outcomes are covered in this presentation.

Electrical engineering

FPGA Acceleration of ML Algorithms for 6G Physical Layer

Fábio Coutinho, Arnaldo Silva Rodrigues de Oliveira, Pétia Georgieva, Hugerles Sales Silva

Machine Learning (ML) has been seen as a fundamental technology in many applications to deal with complex problems, finding an optimal solution, which would otherwise be too costly or impractical to find. Regarding the Sixth-Generation (6G) wireless networks, ML will be a fundamental technology to support the challenging performance requirements. Furthermore, this technology can be applied to the Physical Layer (PHY) processing functions, improving its global behavior, as traditional algorithms suffer from performance-limiting problems such as interference, time-varying, and non-linear effects that cannot be accurately modeled. The most recent work concerning this topic is restricted to simulation. To study the feasibility of ML real-time processing and deployment in 6G PHY functions, Field-Programmable Gate Array (FPGA) platforms can be used. In this context, this Ph.D. aims to implement, accelerate and optimize FPGA-based ML techniques and self-learning algorithms for PHY receiver processing functions, considering the highly dynamic and demanding 6G network environments.

Electrical engineering

Energy Efficient Power Amplifier for Next Generation Mobile Handset

Maryam Sajedin, Prof. Jonathan Rodriguez, Prof. Mnuel Violas, Dr. Issa Elfergani

This report intends to develop a load modulation power amplifier for wideband scenarios of next-generation 5G/6G mobile handsets to enable very high speed cellular network' s connectivity. To achieve this goal, taking the excellent advantages of Monolithic microwave integrated circuits (MMIC) technology, a fully integrated Doherty architecture supported by advanced model and circuit design theory at mm-wave frequencies was proposed.

Electrical engineering

High-Power Dynamic RF Transistor Behavioural Models for Power Amplifier Design

João Louro, Luís Cótimos Nunes, José Carlos Pedro

The design of radio-frequency power amplifier (PA) architectures for wireless communication systems has been evolving, so that, nowadays, the use of nonlinear transistor models is indispensable to fulfill the stringent requirements in terms of efficiency, linearity and bandwidth.

Behavioural models are a good alternative for the cases where equivalent-circuit models are very difficult to extract or when the foundries had not yet enough time to provide them for the newest technologies. Very high power transistors, in particular are known for being difficult to model due to the distributed nature of these electrically large devices.

Unfortunately, although there are already several works to present dynamic behavioural models for complete PAs, only a few works have dealt with the inclusion of the dynamics at the transistor level, which is fundamental for PA design.

The main objective of this PhD work is exactly to conceive and extract a high-power transistor dynamic behavioural model in a simulator, which is sufficiently fast and robust to be used for modern concurrent band and load modulated PA designs. Accordingly, this thesis also intends to demonstrate the importance of considering the dynamic behavioural model for the transistor, by implementing and optimizing an advanced PA architecture to operate in a concurrent-band scenario, where different memory effects are excited.

Electrical engineering

Multi-technology RU for nG Networks

Samuel Pereira, Arnaldo Oliveira, Nuno Carvalho, Paulo Monteiro

Different wireless technologies use different carriers frequencies. In typical RF implementations, this requires a separate RF chain for each carrier, making this approach expensive and bulky. An all-digital approach can solve this problem. Multiple carries can be generated digitally and their frequency can be adjusted in run time. Moreover, a single FPGA pared with an RF-DAC can provide a compact solution for a frequency reconfigurable transmitter capable of multi-band and muiti-tecnology transmission.

Electrical engineering

Multi-terminal radio-sensing and communication network

Leonardo Lamas, Atílio Gameiro, Adão Silva, Daniel Castanheira

Integrated radio-sensing and communication have raised attention in recent years, becoming a candidate as a use case for 6G. This work presents a multi-terminal radio-sensing and communication scenario and the main foreseen challenges. Also, some initial results obtained for a bi-static MIMO scenario are given. Finally, the following steps to be carried out are presented.

Electrical engineering

Load Insensitive Doherty Power Amplifier

Cristiano Gonçalves, Pedro Miguel da Silva Cabral, José Carlos Esteves Duarte Pedro

Power amplifiers are used for various applications and their performance has a considerable impact on the overall system operation. Normally, amplifiers are designed to operate with a fixed output load, however, they can be forced to operate under varying load conditions due to various causes. In this non-optimal regime, the amplifier performance is degraded, mainly in terms of output power and drain efficiency. This work presents a load insensitive Doherty power amplifier. The load insensitiveness is achieved by dynamically changing the supply voltages of both the carrier and peaking transistors depending on the actual output load.

Electrical engineering

SWIPT Transceivers Design for IoT applications

Diogo Matos, Nuno Borges Carvalho, Ricardo Correia

The Internet of Things (IoT) is progressively increasing and evolving every year, leading to large networks of sensing to reach everything and everyone, from smart cities to smart houses. However, this increase brings two crucial problems: the extensive use of batteries of the sensors and energy consumption in the communication. To overcome this problem, several techniques and technologies emerge. Some of them are wireless power transmission (WPT) and energy harvesters (RF-DC converters) that can recycle the radiation existing in the air.

Electrical engineering

Device Imperfections in CV-QKD

Daniel Pereira, Armando N Pinto, Nuno A Silva

Continuous-variable quantum key distribution (CV-QKD) provides a theoretical unconditionally secure solution to distribute symmetric keys among users in a communication network. However, the practical devices used to implement these systems are intrinsically imperfect, and, as a result, open the door to eavesdropper attacks. In this work, we show the impact of receiver device imperfections on the estimated channel parameters, performance and security of a CV-QKD system. The presented results show that, due to the erroneously estimated channel parameters, non-monitored imbalances can pose a security risk or even reduce the system's performance. Our results show the importance of monitoring these imbalances and hint at the possibility of compensating for some receiver imbalances by tuning other components.

Electrical engineering

Quantum Technologies to Support Secure and Fast Multiparty Computation

Mariana Ramos, Armando Nolasco Pinto, Nuno Alexandre Peixoto Silva, Paulo Alexandre Carreira Mateus

Current Telecommunication networks have two big issues, that have been under discussion by scientific community: Security and Privacy. Security can be solved using QKD to implemente symmetric cryptography. This is widely accepted in scientific community, since there already are comercial solutions in the market. On the other hand, privacy is a more complex problem to solve. Privacy is crucial in scenarios where multiple

parties want to perform statistical analyzes using joint databases but keeping their inputs private. SMC has occurred as a generic tool for computing on private data, since it has a natural advantage in solving security and privacy issues in a wide range of areas such as medical, financial and government applications. Oblivious transfer arises as the cryptographic primitive to enable SMC implementation. In this work, we present a discrete-variable polarization encoded quantum communication system to support quantum oblivious transfer protocol implementations to provide the large deployment of SMC applications.

Electrical engineering

Quantum Secure Multi-Party Computation in Vehicular Network

Zeinab Rahmani, Armando Humberto Moreira Nolasco Pinto, Luis Manuel Dias Coelho Soares Barbosa

Quantum Secure Multi-Party Computation (QSMC) is a technology that takes the advantages of quantum features allowing multi parties to communicate in a secure and efficient manner while preserving their privacy. In this proposal, we implement a collision detection scenario in which vehicles can broadcast information in a vehicular network. Our main contribution lies in the integration of the three quantum communication technologies Quantum Key Distribution (QKD), Quantum Oblivious Key Distribution (QOKD), and Quantum Oblivious Transfer (QOT) with MASCOT multi-party protocol enabling inter-vehicular communication. This quantum approach significantly improves efficiency and security when compared to the classical implementation since both it is robust against quantum computer attacks.

Electrical engineering

Smart Antennas for the Future LEO Satellite Constellations

Amélia Ramos, João N. Matos, Tiago Varum

Half of the world's population is not online and empowered by many space industries there is an on going distribution of Low-Earth Orbit (LEO) satellites which will allow to reach remote areas with less economical power. One of the key elements in this future communication systems is the antenna element and thus the main goal is to develop an adaptive antenna structure, suitable to for tracking satellites and aligning its beam with the most favorable. Meanwhile the antenna prototype will be integrated efficiently with the compact RF frontend, lowering production costs and easing mass production.

Electrical engineering

Timely and reliable localization based on optical camera communication

Miguel Rêgo, Pedro Fonseca, Luís Alves

Indoor positioning technologies have long been the focus of research, mainly given that technologies such as GPS do not perform satisfactorily in this context. Since most established alternatives are either prohibitively expensive or not sufficiently accurate, a new alternative has been explored, using visible light sources as the positioning references. When using a camera as the receiver, this allows for inexpensive and accurate indoor positioning systems. Furthermore, it allows for the transmission of simple packets of information using optical camera communication (OCC) for the beacon identification. This work aims to explore and propose new techniques for camera-based visible light positioning systems. More specifically, the objectives are to explore new OCC techniques suitable for such applications, increasing the robustness and number of identifiable beacons, and to propose new localization algorithms for improved accuracy and timely position estimation, extending the existing techniques to larger scenarios.

Electrical engineering

Concealed target tracking using enhanced radar techniques

Luis Duarte, Professor Luís Nero Alves, Professor Carlos Ribeiro, Professor Rafael Caldeirinha

This thesis aims at addressing a novel radar using the Swept Time-Delay Cross-Correlator (STDCC) technique that presents high-resolution and multi-user operation with its good interference immunity. Its radar signal processing is based on all-digital binary sequences that represent a

quantum leap in radar future front-end architecture, presenting significant advantages in terms of low baseband computational demand and low-cost radar system

due to its time-relaxed data acquisition and its all-digital waveform generation.

In particular, the envisaged technique is sought to mitigate incumbent and mutual interference risks. This work will also address multi-PN transmission for direction-of-arrival estimation and radar imaging of concealed objects.

Electrical engineering

Energy Harvesting Mechanisms for Smart City Solutions.

Ajibike Eunice Akin-Ponnle, Prof. Nuno Borges Carvalho, Dr. Felisberto Sequeira Pereira

The daily increase in number of end-users to the interconnected networks of wireless sensors and/or Internet of things (IoT) devices that are supporting the smart city; the need to maintain low carbon burning during the post COVID-19 pandemic era; and smart city automation in the times of emergency or rescue mission; as well as for the purposes of social distancing; prompted our proposal of Smart Turbine Harvesting systems of ubiquitous and self-sustaining energy supply to IoT networks, whereby there is no need of physical replacement of batteries; termination to the grid; maintenance visit to sites during lockdown or social distancing.

Electrical engineering

Techniques for optically backhauling Internet of things (IoT)

Kota Madhava Reddy, António Teixeira, Pedro Renato Tavares Pinho

Create an additional interface on the optical transceiver (PIC).

Electrical engineering

Space Debris Radar Data Processing Techniques

João Pandeirada, Miguel Bergano, Paulo Marques

Space debris is a threat for satellites and space-based operations, both in-orbit and during the launching process. Portugal is a member of the EU Space Survey & Tracking (EUSST) and is developing capabilities in radar sensors. Instituto de Telecomunicações is implementing a monostatic radar at 5.56 GHz that aims to provide information on objects up to 10 cm2 of cross section at 1000 km of altitude.

This PhD aims at the development of a fully automated signal processing algorithm toolset to operate the radar at request, process the echo signals, characterize the objects and interface with an operational center to generate catalogue files. The focus of the work is research and implementation of advanced signal processing techniques for detecting, tracking and imaging of space debris in a versatile signal processing chain.

Electrical engineering

Information extraction from biomedical text

Rui Antunes, Sérgio Matos

There is a huge throughput of scientific publications in the life sciences field. This hinders the update of current knowledge, creating the need for automatic methods to extract information from free text. A major task is the identification of named entities and their relations, with the main goal in the biomedical domain to identify interactions between proteins, chemicals, diseases, amongst others. The extracted information allows creating valuable structured data for re-use and exploitation in precision medicine, drug discovery, and basic biomedical research.

In our work we investigate deep learning neural networks and contextualized word embeddings for joint extraction of entities and relations.

Electrical engineering

Thermal management of high-power electronic devices using diamond

Shusmitha Kyatam, Prof. Luís Filipe Mesquita Nero Moreira Alves, Dr. Joana Catarina Mendes

The current study investigates temperature effects in electronic devices and analyzes an efficient cooling technique using diamond at both device and assembly/system levels. It also deals with thermal modelling of devices such as p-n diodes, LEDs and photonic integrated circuits.

Electrical engineering

Visible Light Communication based Indoor Localisation

Neha Chaudhary, Luis Nero Alves

In this thesis, we first study the various traditional algorithms and RSS algorithm being the most popular and easy to implement, we have performed a system modeling based on RSS and polynomial regression approach in order to reduce the positioning error. We also investigate possible configurations of indoor VLP systems and evaluate VLP channel models such as the directed light-of-sight (LOS) optical channel and the non-LOS optical channel model. Apart from RSS, machine learning algorithms such as, ANN and CNN are gaining importance due to their improved performance and reliability. Hence, we will implement ANN, ANN (i.e., classification) and polynomial regression, and CNN in the VLP system to determine the positioning accuracy. Moreover, ANN (i.e., classification) together with polynomial regression is performed for a furnished room environment to understand the impact of furniture and object reflections.

Electrical engineering

Towards lifetime prolongation of robots service using cooperative multi-mobile robots

Mojgan Ghanbari, Pedro Fonseca, Rui Escadas Martins

Today's economy increasingly relies on technological approaches to provide increased levels of efficiency and quality. This trend includes the utilization of robots constantly increasing applications and areas, expanding to industrial automation, in what concerns service robots. This quest is driven by, among others, shortage of qualify personnel in some areas of work or complicated environment, elderly with mechanized assistance, and the reduce operational costs. This work explores and introduces a novel approach to combine mobile robot service and wireless charging (both direct and reverse) to have lifetime service of mobile robots, with adaptable power management in face of possible tasks changes during performing period. For this matter a network of multi-mobile service robot is proposed instead of one robot. Therefore, merge the advantages of mobile service, wireless charging, and approach the cooperative in single bundle with adaptable amount for each component of network being workstation(s) or shuttle and service robots.

Electrical engineering

Bio-radar: Non-contact system for vital signals acquisition

Carolina Gouveia, José Vieira, Pedro Pinho, Daniel Albuquerque

The Bio-Radar system is capable to measure vital signs accurately, namely the respiratory and cardiac signal, using electromagnetic waves and thus without requiring the direct contact with the subject. For this purpose, this

system is based on the micro-Doppler effect, which relates the received signal phase variations with the distance change between the subject chest-wall and the radar antennas. This distance variation occurs due to the chest-wall motion while the subject is breathing. Since the vital signs extraction is directly related with distance variation measure, any involuntary body motion will interfere in results. On the other hand, the random body motion can also provide useful information, not only to identify the subject's psychophysical state, but it can also be useful to improve some signal processing aspects. Thus, the general body motion is characterized and signal processing algorithms are going to be developed to take advantage of random body motion as additional information. Furthermore, implementation strategies are going to be explored to integrate such

system in customized applications. For this purpose, it is required to guarantee the low profile appearance and develop algorithms robust to the inherent monitoring conditions.

Electrical engineering

Smart Analog Passive Circuits using Ferroelectric Materials for Software Defined Radio Systems

Patrícia Bouça, Nuno Borges de Carvalho, João Nuno Matos, Paula M. Vilarinho

Radio System designs are moving towards fully digital transceivers, where the input signal should pass through an analog to digital converter. This thesis proposal approaches the evolution of smart analog circuits, such as input filters, that somehow will limit the existence of potential jammers and allow all signals within the dynamic range of the converter in an SDR approach.

The innovative features will be focused on the development of input analog RF front-ends that are adaptable in frequency and power, which may vary according to input power, and of ferroelectrics that have predictable nonlinear behavior and adaptability at mmWave frequencies for wireless and satellite communications.

The challenge in need of a solution is to design three functional dimension (3fD) analog RF front-end that can vary its three functional dimensions (frequency, output power, and bias voltage) and limit the dynamic range by using ferroelectric thick and thin films.

Electrical engineering

Measuring RF Distortion to Enable Worldwide Access to Information

Ricardo Figueiredo, Nuno Borges Carvalho

Providing worldwide access to information is one of the ultimate goals of RF telecommunication. To reach it RF hardware solutions must continuously evolve. At the moment, Massive Multiple Input Multiple Output (MIMO) solutions are the next step towards global access to telecom services. However, nonlinear distortion is not well understood in modern telecom scenarios. Thus, solving existing distortion characterization limitations is part of enabling worldwide access to information. This includes improving nonlinear dynamic characterization, studying distortion under different signal characteristics, evaluating distortion over the air, and establishing identities between distortion measures performed in these different scenarios. This PhD work tackles the aforementioned distortion characterization challenges, and this presentation will address the most significant results and achievements up to the present moment.

Electrical engineering

Optimization of Hybrid Structures in Integrated Photonics

Adebayo Emmanuel Abejide, Antonio Teixeira, Mario Lima

The demand for low-cost but high-speed transmission is growing at unprecedented speed as we approach Zettabyte era and this is a major challenge for future access networks. To meet this demand, holistic research approach is required.

Infrastructure expansion with costly and complex installations cannot be an alternative because access networks are extremely cost conscious since every tenth of a dB and penny count coupled with 5G cost efficiency roadmap. In view of these challenges, this thesis intends to perform parameters optimization model of photonic integrated circuit (PIC) conventional building blocks (BBs) for access networks high speed signal generation.

Optical modulator used for signal generation in PIC is an important BB through which electrical signal is encoded on its corresponding optical carrier signal before being launched into the fiber.

Hybridization of existing modulation component functionalities and approaches with parameter optimization could guarantee power budget, extinction ratio (ER) and overall signal efficiency requirement of high speed signal with no extra cost. Such model could meet the requirements of high-speed signal generation for datacentre interconnect (DCI) and passive optical networks (PON) such as 25/50 Gb/s per wavelength high speed PON (HSP)

Electrical engineering

High density Photonic integrated Circuits

Sushma Pandey, António Teixeira, Yahya Sheikhnejad

Photonic Integrated Circuits (PICs) enables the integration of several photonic functions on a single chip providing the potential for cutting-edge solutions in terms of space, aggregated functionality, and efficiency. Meanwhile, size reduction exacerbates several problems and limitations, for example, heat dissipation.

This problem not only affects the heat-generating functional block but also its neighboring functional blocks due to thermal crosstalk. This research work addresses paths to model, optimize, and reduce the impact of thermal crosstalk between elements inside a PIC. For this purpose, a detailed study of several functional building blocks will be performed followed by modeling them considering thermal crosstalk effects. The proposed plan has a strong emphasis on research, laboratory testing, and model development aiming at increasing the data rate reducing size simultaneously without sacrificing functionality.

The ultimate result will be a set of design rules for thermal crosstalk minimization and performance optimization of mapping inside a PIC.

Electrical engineering

Over-The-Air Characterization of 5G MIMO Systems

Marina Jordão, Nuno Miguel Gonçalves Borges de Carvalho, Arnaldo Silva Rodrigues de Oliveira, Rafael Ferreira da Silva Caldeirinha

The main objective of this thesis is to provide methodologies to characterize MIMO antenna arrays and IoT devices in 5G scenarios Over-the-Air (OTA).

OTA methods are currently being explored to characterize and calibrate MIMO systems. Consequently, in this Ph.D. OTA techniques to characterize and calibrated MIMO antennas are presented with the main goal of improving MIMO systems operation, using multi-sines.

Thus, a characterization system will be presented to extract the active reflection coefficients in MIMO antenna arrays when the antenna beam is steered along a specific direction.

IoT devices will play a significant role in 5G, such as RF-DC converters and backscatter systems, and measuring them to improve their efficiency is a requirement. Characterizing these devices taking into consideration different specifications such as multi-sines, voltage sweeping, and power is difficult, using only the traditional measuring equipment. Thus, methodologies combined with appropriate measurement strategies to characterize IoT devices will be the main goal in this work plan.

Electrical engineering

Physical engineering

New Design Solutions for Automotive Led Lighting

Luis Pereira, João Pinto, Antonio Pontes

This work presents a thermal study from a polymer-based automotive lamp using CFD simulation and its validation with thermography technics. In this work, during this research it is possible to see that the CFD results are coherent with the experimental data. Also, that even small thermal conductive variation in the PCB have noticeable impact in the steady state temperature of the optoelectronic components.

Physical engineering

Intelligent Scanning Method for Adaptive Positron Emission Tomography

Pedro Encarnação, João Filipe Calapez Albuquerque Veloso

Positron Emission Tomography (PET) is one of the most important medical imaging modalities, particularly in Oncology, with unique capability to produce 3D images of radiotracer biodistribution. Preclinical PET imaging is now a vital tool for translational biomedical research, but it requires dedicated systems with very high spatial resolution and depth-of-interaction encoding techniques, due to the small size of the animals studied and the small diameter of detector rings. easyPET.3D is a cost-effective benchtop PET system using a patented method based on a 2-axes rotation of 2 detector modules achieving a very high spatial resolution and fine sampling with only a small number of cells. The unique method of easyPET.3D allows the quick scan of billions of different lines of response, which requires dedicated reconstruction algorithms and computation strategies.

This project aims to develop iterative image reconstruction algorithms that provide high quality images of easyPET models scans, while maintaining its unique sampling accuracy.

In order to achieve low reconstruction times, the algorithms are being developed for graphics processing units (GPU) that have a massive number of parallel processors.

Additionally, by taking advantage of the concept and existing EasyPET prototypes, this project aims to implement an intelligent method based on automatic identification and detailed scan of regions of interest in the field-of-view, thus enhancing sensitivity and image contrast.

Physical engineering

Multifunctional biomaterials for implant coatings

Sílvia Gavinho, Manuel Pedro Graça, João Paulo Borges, Jorge Silva

This research intends to be an important step towards solving real problems and needs that affect the prosthetics field, such as the dental implant sector, which presents an increase in peri-implant infections, which can lead to implant loss and the need for additional surgeries. In this study, we intend to contribute to the decrease of this inconvenience by coating customized implants with microstructured films, with antibacterial properties. For this purpose, biomaterials will be produced, in this case, modified bioglass with the insertion of ions such as Mg, Sr, Zn, Ag, Ce (or others). Besides the synthesis of the materials and coatings, their physical, chemical and biological properties will also be analysed. The deposition of the bioglasses on the substrates will be done through an innovative abrasive system in order to avoid problems associated with the usual Plasma Spray method. In order to increase the osseointegration capacity of these implants, electrical polarization studies will also be performed.

Physical engineering

Assessment of the easyPET.3D system performance: NEMA NU 4-2008 standard and animal model

Fabiana Ribeiro, João Filipe Calapez Albuquerque Veloso, Ana Cristina Aguiar dos Santos

Os sistemas de Tomografia por Emissão de Positrões pré-clínicos têm aplicação na aquisição de imagens de pequenos animais para estudar diversas patologias humanas, validar novos medicamentos e terapêuticas, bem como desenvolver novos radiofármacos. No entanto, o seu elevado custo e as infraestruturas necessárias limitam a sua aquisição. A tecnologia easyPET.3D vem preencher esta falha, na medida em que permite uma significativa redução do número de componentes e, por conseguinte, do custo final do equipamento, mantendo uma boa sensibilidade e uma resolução espacial de última geração em todo o campo-de-visão. O desempenho do easyPET.3D será estabelecido tanto com fantômas, através de metodologias (National Electrical Manufacturers Association NU 4-2008 standard) que possibilitam comparar diretamente equipamentos comerciais, como com modelos animais, determinando-se o seu potencial para estudos pré-clínicos.

Physical engineering

Magnetic heat pumps with optimized heat transfer

António Lopes, João Cunha de Sequeira Amaral, Vítor António Ferreira da Costa

This PhD focuses on numerically simulating magnetic refrigeration devices for their optimization while searching for novel device geometries. One of the challenges was correctly simulating the heat-exchange processes of magnetic refrigerants due to the temperature dependence of their specific heat and thermal conductivity, which the latter is still commonly ignored by the community. In this presentation, I will convey the results from a simple 1D heat transfer validation model and discuss its use compared to simulations in 2D models Comsol Multiphysics. In addition, ongoing experimental work on a magnetic heat pump prototype, developed under the Bosch/UA SGH project, is updated.

Physical engineering

Electrolyte materials for intermediate temperatures fuel cells

Bruno Melo, Manuel Pedro Fernandes Graça, Luís Manuel Cadillon Martins Costa

The ever-present need for reducing the greenhouse gases emission encourages the research of alternative energy sources. Fuel cells with highly efficient catalysts and electrolytes are one of the most promising hydrogen-based technological solutions. Nowadays, proton-conducting Polymer Electrolyte Membrane Fuel Cells are used for temperatures below 100 °C and Solid Oxide Fuel Cells between 800-1000 °C. Intermediate Temperature Fuel Cells (ITFCs) remain under improvement, since new capable electrolytes between 200-500 °C are still needed. This class of fuel cells has potential to overcome some of the challenges found in fuel cells nowadays.

Proton-conductive materials such as CsH2PO4, SnP2O7 and its doped materials have been reported as promising materials for ITFCs. However, since they have low mechanical strength and low thermal stability, usually a matrix material is mixed with the conductive phase to form composite electrolytes. The present work wishes to extend the existing study regarding composite materials for ITFCs.

Physical engineering

Novel Rear Architecture for Bifacial Thin-film CIGS Solar Cells

André Violas, Pedro Salomé, Tobias Törndahl

In recent years, the most interesting development in photovoltaics was bifacial solar cells as production increases by ≈15 % due to albedo reflection (ground reflection) [1,2]. However, most of the reflection is not used efficiently as silicon does not absorb and/or converts in an efficient way diffuse and low-irradiance light due to its low absorption coefficient [3]. Moreover, photovoltaics will be the most important energy source by 2050 [4]. This proposal will bring the bifacial solar cell concept to thin-film technology due to their good behaviour in low-irradiance conditions. Such breakthrough will allow for high-efficiency solar cells with an increase in electricity generation yields over 30 % comparing with bifacial-silicon, and leading to theoretical conversion efficiencies of about 42 % with additional optimized light management at the back contact (with luminescent light up-conversion systems at the back contact) [5]. Moreover, the referred development will be based on a novel transparent back contact structure showing: high optical transmission, electrical conductivity, interface passivation, and diffusion barriers. Therefore, a combination of nanostructured materials will be integrated into thin-film solar cells. The current Cu(In,Ga)Se2 (CIGS) solar cell stack is constituted by a) rear electrical contact (Mo), b) absorber layer (CIGS), c) buffer n-type layer (CdS) and d) transparent conductive oxide (TCO). Hence, the Mo back contact will be replaced by the novel transparent conductive contact structure, which should withstand the CIGS harsh growth conditions [6].

On the other hand, a better comprehension of the CIGS properties will enable further developments in correspondent solar devices. Electrical simulations of complete solar cells may help on the comprehension of the limiting mechanisms of such device performance, where, with simple approaches, complex structures became easier to be better understood. Therefore, the Solar Cell Capacitor Simulator (SCAPS) 1D simulation tool supports the experimental findings and provide an additional insight on the impact of the novel back contact structures on cell performance. Baseline models that effectively describe the solar cell behaviour are a great starting point to more specific and dedicated studies. Therefore, the 10-year-old former baseline model is updated to describe the properties of recent CIGS solar cells.

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Physical engineering

Admittance measurements of optoelectronic devices

José Cunha, Pedro Salomé, Paulo Fernandes, Ana Silva

In this work, admittance measurements are used to perform the characterization of the optoelectronic properties of Cu(In,Ga)Se2 (CIGS) solar cells. The circuit-fitting of the AC electrical measurements allows for and in-depth study of several optoelectronic parameters. In particular, it allows to have a better understanding of the electrical behaviour of the different layers and/or interfaces that composes the device under study. Such analysis was applied to study the impact of the CIGS absorber layer reduction from the standard thick (~ 2 µm) to the ultrathin range (~ 500 nm). Moreover, such absorber layer reduction to the ultrathin range requires additional attention to the rear interface, considering the cumulative effects of its recombinative nature with the fact that in ultrathin devices charge carriers are photogenerated closer to the rear interface. Thus, a common method to mitigate rear interface recombination is the use of an insulator layer as passivation layer with point contact structures between the metal rear contact and the absorber layer. As such, admittance measurements were performed on standard thick and ultrathin CIGS devices, as well as in the passivated ultrathin devices, to further comprehend the optoelectronical implications of the absorber thickness reduction and the passivation layer introduction on the solar cell device. The admittance analysis procedure will be shown, as well as results already accomplished during the course of this thesis.

Physical engineering

Multi-core fibers devices for high capacity optical networks

Liliana Sousa, Ana M. Rocha, Rogério N. Nogueira

Spatial Division Multiplexing based on multi-core fibers has been proposed as a possible solution to deal with the demand for higher capacity, caused by the increase of the use of applications like Internet of Things, cloud gaming and video conferences. Thus, the main goal of the proposed research is to study, develop, fabricate and optimize multi-core fiber couplers and switches. They will be integrated in optical amplifiers and ROADM (Reconfigurable Optical Add-Drop Multiplexer) architectures, which are mandatory devices to any transmission system. During this year, a new design of a long-period grating based single-mode fiber to multi-core fiber coupler was numerically analyzed, which showed promising results. The next step is the development of the proposed coupler.

Physical engineering

Fibre optics sensors for e-Health applications

Cátia Tavares, Paulo Antunes

This work focuses on the development of fiber-optic sensors (with silica and plastic fibers) for e-Health monitoring equipment, as well as the implementation of data transmission, processing and visualization systems. The main aims are the development of sensors to monitor pressure and shear forces to aid the prevention and treatment of ulcer pressures; sensors to monitor heart and respiratory rate to control the physical and psychologic health status of users; and sensors to monitor the posture of seated users/patients (workplace office chairs and wheelchairs) to reduce pathologies associated with poor posture and increase productivity.

Physical engineering

Flexible Triboelectric Nanogenerators for a Self-charging System in Mobile Electronics

Ismael Domingos, Helena Cristina Ramos Jerónimo Dias Alves, Luis Filipe Mesquita Nero Moreira Alves, Monica Felicia Craciun

A rapid development in personal electronics has raised challenging requirements for their portable and sustainable power sources. Motion energy is available anywhere at any time and can be harvested by triboelectric nanogenerators. These technologies usually demand high cost processes and materials and still suffer from low power output, as well as instable output values due to charge generating stimulus with variable intensities. This work aims to produce triboelectric nanogenerators based on carbon materials integrated in flexible substrates to be applied in wearable

devices. These will be developed using low-cost materials and processes, exploring different material combinations and device structures to optimize performance depending in tribo-response. Energy harvesting efficiency will be optimized through signal stabilization and conversion using techniques as maximum power point tracking-based control. This will provide a sustainable power source able to convert ambient energy into a stable and continuous power output compatible with modern technologies.

Physical engineering

Red nano-emitting devices based on Eu-implanted AlN NWs

José Cardoso, Maria do Rosário Correia, Nabiha Ben Sedrine

The achievement of efficient green and red III-N emitters is fundamental for the development of powerful monolithic white LEDs. This can play an important role in obtaining more energy-efficient lighting solutions and thus contribute to mitigating global energy consumption problems. Full-color displays and innovative microdisplays are also applications opportunities for these emitters. One possible approach to improving the III-N based red emitters' efficiency is to incorporate trivalent europium ions (Eu3+) into the host. This strategy has already provided the achievement of devices with efficiencies close to 10%, a value higher than those reported in the literature for red emitters based on InGaN/GaN multi-quantum well structures. Based on our recent study, the increase of the AlN molar fraction in AlGaN nanowires (NWs) leads to an enhancement of the Eu3+ luminescence intensity as well as a reduction of the luminescence intensity thermal quenching.

In this pitch, it will be presented the recent developments in this field carried out within the scope of the PhD thesis. In particular, it will be highlighted the achievement of red emitters based on Eu-implanted p-n junction AlN NWs. To the best of our knowledge, this is the first time that an electroluminescence signal is obtained from III-N structures implanted with rare-earth ions.

Physical engineering

Novel Light management Concepts in ultra-thin CIGS solar cells

António Oliveira, Pedro Salomé, Maria Rosário Correia

Currently, one of the trends making their way through the PV industry, is the search for new application possibilities. Cu(In,Ga)Se2 (CIGS) thin film solar cells stand out due to their class leading power conversion efficiency of 23.35%, flexibility and low cost. Using sub-µm ultrathin solar cells, has been gaining prevalence, due to the reduction in material consumption and the processing time. However, such reduction has significant drawbacks, since two issues arise: decrease light absorption and increased predominance of interface recombination. The solution proposed in this research make the use of high-performance substrates, resulting in reduced rear interface recombination and increased rear optical reflectivity. Accomplished by the introduction of a highly reflective metallic layers or nanostructures, and a passivating dielectric and selective electrical contact between the absorber and Mo electrode. The structure fabrication has been accompanied with optoelectronic simulations for the assessment of optimum architectural parameters and accurate optical gain analysis.

Physical engineering

Optical Fiber Sensors for Structural Health Monitoring

Luís Pereira, Paulo Antunes, Humberto Varum

The Structural Health Monitoring (SHM) is emerging in response to the need for safety, security, lower life cycle costs, and post disaster condition surveys. Early detection of damage and rigorous assessment of structural safety require monitoring systems, and the obtained data can be used to calibrate numerical models of structural analysis and assess their integrity. In order to prevent the collapse of civil structures and consequent human, material and economic loss, the implementation of monitoring systems had become a necessary tool for the current society. Recent advances in optical fiber sensing technologies have fostered the development of innovative solutions for SHM, due to the compelling advantages of these sensors over conventional electrical sensors. In addition, optical fibers have the capability of acting simultaneously as a sensing and communication medium which enable the use of the already implemented optical fiber network to transmit data and their easy integration in complex sensing configurations in remote and harsh environments. In this work we aim to develop and test new low-cost optical fiber sensor prototypes, using Fiber Bragg Gratings (FBGs) as the main sensing optical device, to be implemented in SHM for structural and material analysis. After testing and evaluating their performance, the sensors will be ready to integrate into existing structures and materials, where the conditions will be examined by monitoring specific parameters and the obtained data can then be used to evaluate the structural integrity and safety.

Physical engineering

Luminescent QR codes for smart disposable labelling and real-time temperature sensing

João Ramalho, Rute A.S. Ferreira, Luís D. Carlos, Paulo S. André

The general use of smartphones assigns additional relevance to QR codes as a privileged tool to the Internet of Things (IoT). Crucial for QR codes is the evolution of IoT-connected smart tags with enhanced storage capacity and secure accesses. This PhD Workplan proposes the development of multiplexed luminescent QR codes, activated by UV/vis radiation, based on organic-inorganic hybrid materials doped with lanthanide ions to increase storage capacity per unit area using the colour and spatial multiplexing creating news designs.

Exploring the materials thermal dependence is possible to use the QR codes to sense temperature in real-time using a photo taken with a smartphone, acting as an optical sensor. Furthermore, the spatial multiplexing concept creating super-modules (s-modules) built from adjacent spatial multiplexed modules with regular geometrical shapes, assisted by colour multiplexing, we modelled and design a single QR code with, at least, the triple storage capacity of an analogous size black/white QR code, acting as a smart-tag ensuring restrict access and trackability.

As proof of concept, the s-modules are printed using luminescent low-cost and eco-friendly inks into banknotes specimens adding additional security measures by creating different access levels. Access to the restricted information is attained only under UV irradiation and encrypted for secure transmission.

The concept of active QR codes for smart trackability and IoT was further improved by the development of a free friendly-user mobile app. This prototype of a QR code with increased storage capacity can simultaneously provide safety features and temperature sensing, working as smart disposable sensors labels.

Physical engineering

Computer engineering

Lifelog and Information Retrieval from Daily Digital Data

Ricardo Ribeiro, António José Ribeiro Neves, Alina Liliana Trifan

The wide availability and small size, together with the decrease in pricing of diferente types of sensors, has made it possible, over the last decade, to acquire a huge amount of data about a person's life in real time. These sensors can be incorporated into personal electronic devices available at reasonable cost, such as smartphones and small wearable devices. They allow the acquisition of images, audio, location, physical activity and physiological signals, among other data. With these data, usually denoted as lifelog data, we can then analyze and understand personal experiences and behaviors. This process is called lifelogging. This thesis explores several openc challenges in the research area of lifelogging, an interdisciplinary research topic. The main goal of this thesis is the development of a lifelogging system capable of helping people in retrieving memories from their recorded experiences and consequently improving their quality of life. One of the potential applications that will be explored focus on supporting people with memory problems, such as people with dementia, through the visualization of lifelog data and contextual data extracted from these personal lifelogs.

The several contributions proposed in this thesis include creating solutions for the pre-processing of lifelogs, the extraction of relevant information from these lifelogs and the user interface for visualization and interaction of the lifelogger with the system. The acquisition of lifelog data by people with memory problems and their anonymization are also objectives of this work.

Computer engineering

Digitizing Human Behaviour

Daniel Canedo, António José Ribeiro Neves, Pétia Georgieva

In this Research Summit a brief summary of the proposed PhD thesis on Human Behaviour Estimation is presented. Three Computer Vision modalities will be considered for this system: facial expressions, postures and gaze. The main goal of this PhD proposal is to give users the freedom of applying the proposed system on their scenarios. Therefore, it is proposed to shift the classification task to the user. Before the runtime, several tools will be disposed to the user so that it is possible to create the relevant classes regarding a specific application. Afterwards, the system can be started up and the produced metrics are compared with the created classes to find similarities. Since such system might face different

environments, cameras, camera angles, and tasks, this PhD thesis should tackle some relevant research problems of each modality, such as occlusions, uncontrolled environments, illumination, pose variation, and real-time performance. In the end, the proposed Human Behaviour Estimation system should be applicable to several scenarios using non-invasive digital images captured by cameras. For instance, it could be used to diagnose mental disorders, to monitor risky driving behaviours, improve marketing strategies based on the estimated people's reaction towards an advertisement, monitor risky working habits that may lead to injuries, monitor patients, detect anomalies in a crowd, and so on.

Computer engineering

Service Continuity for Safety-Critical Edge Computing Applications

Seyed Mohammad Hosseini, Prof. Dr. Joaquim José de Castro Ferreira, Prof. Dr. José Alberto Fonseca, Dr. Paulo Jorge de Campos Bartolomeu

Despite recent advances in hardware capabilities, mobile computing still cannot meet the demand of many applications that require large amounts of data generation, processing, storage, and computing resources. A potential solution to these challenges is to move computing to centralized clouds, but it may be under pressure from many issues such as network congestion and privacy policies, which has led to the development of Mobile Edge Computing (MEC).

MEC is an important enabler of those applications and services that require real-time operations. However, collecting the benefits of MEC and the automatic vehicles goes through a series of challenges that clearly go beyond infrastructure deployment costs, and all of which are related to supporting the continuity of service, i.e., the uninterrupted user experience of a service. In this regard, service continuity refers to service-level user experience, where the User Equipment (UE) is mobile and can become unavailable due to handover delays, network disconnection, or power outage. This proposal aims to introduce a new way of continuing services for critical safety edge computing applications.

Computer engineering

Dynamic Security Mechanisms for Softwarized and Virtualized Networks

Vitor Cunha, João Paulo Barraca, Daniel Corujo

The advancements of softwarized (SDN) and virtualized (NFV) networks, such as 5G and beyond, unlock Network Slicing and newer use-cases in tighter cooperation with business verticals. The Industry 4.0 revolution, smart electrical grids, and improvements in transportation safety are just some examples. Network security plays a significant role in these scenarios, and the technology shift presents new challenges as well as opportunities. Working alongside the existing security practices, we introduced Moving Target Defense (MTD) mechanisms that focus on disrupting the fundamentals of a network attack within the network context at that time. We have integrated the MTD innovation H2020 5GROWTH European project Aveiro pilots and proceed with the final exploration of other novel security mechanisms (CMD). Furthermore, we have enabled the redirection of live TCP connections initiated with one service to another function, seamlessly and without resetting the connection, to enable more advanced honeypot applications.

Computer engineering

Big Spatial Data Integration and Enrichment with Provenance Control

Paulo Pintor, José Manuel Matos Moreira, Rogério Luís de Carvalho Costa

In the last few years, an increasing number of devices generated vast amounts of data, commonly called Big Data. This brought many opportunities - and challenges - in terms of knowledge discovery, as distributed and heterogeneous data may be combined and used to create high-quality models of events and phenomena.

Current big data integration uses some kind of distributed query execution engine that does not really integrate data in terms of concepts and neither provides distribution transparency. There is no general model to be used. Also, integration workflows usually involve manual transformations and the loss of provenance information. In this research, I will investigate data integration, with a special focus on big spatial data. A generic model for data integration and enrichment will be developed to improve knowledge discovery capabilities while maintaining provenance information. I will also evaluate querying capabilities of existing languages and optimizers, and propose required improvements.

Computer engineering

Context mixed reality for situated visualization

Nuno Martins, Beatriz Santos, Paulo Dias

Mixed reality (MR) is well suited for situated visualization (SV), a method used to represent data in context, with a great deal of potential in a wide array of situations. However, MR-based visualizations are commonly constrained to the users' single egocentric viewpoint reducing their ability to explore all the available information. The research work tries to devise new methods which aim to overcome this limitation.

Computer engineering

A jointly trained neural pipeline for biomedical Q&A

Tiago Almeida, Sérgio Matos

In 2017, an IBM study [1] stated that "Over the last two years alone, 90% of the data in the world was generated". A significant part of this trend is related to textual and other non-structured data. Recognition of the value of these data turned text analytics into a major area of research, where Deep Learning techniques have emerged, replacing previous information retrieval and extraction systems, often based on carefully engineered features or rules.

This proposal aims to leverage Deep Learning to design an end-to-end system that: 1) builds a language model; 2) learns, from training examples, how to identify relevant documents and passages from large textual repositories; and 3) generates, based on the extracted passages and language model, a natural language answer for a given question. This pipeline presents, at least, three distinct and measurable system iterations, easing the validation and evaluation process during the research and development process.

At the time of writing, the developed model is already capable of retrieving the most relevant articles showing state-of-the-art results in the BioASQ 8 and 9b, Trec-Covid and TREC-PM international challenges. Additionally, some encouraging results were also achieved regarding the snippet retrieval task in the ongoing BioASQ 9b challenge.

Computer engineering

3D visualization and correlation from different spectroscopic imaging modalities to define the pathogen niche

Yubraj Gupta, Prof.Carlos Costa, Prof.Eduardo Pinho, Prof.Rainer Heintzmann

We are aiming to develop an improved normalized data analysis algorithm for the 3D visualization of infected cells using 2D image stacks. For that goal, we will explore different types of spectroscopic data sets consisting of fluorescence imaging, Confocal laser scanning imaging, Raman imaging, real-time intra-vital multimodal imaging (CARS, TPF, FLIM, SHG) and FIB-SEM of infected cells from controlled in-vitro experiments and later we are also going to apply some well-recognized machine and deep learning methods to parcellate or classify the images.

Computer engineering

Collaborative Research Framework for Pathomics

Rodrigo Escobar Díaz Guerrero, José Luis Oliveira

Infectious diseases are a major cause of death worldwide. Several clinical studies show that prompt and targeted therapy, adapted to the patient's needs, leads to optimal outcomes. However, the course of an infection is highly variable and differs greatly between individuals. Thus, in order to treat patients efficiently and successfully, powerful diagnostic methods and a profound understanding of disease pathogenesis is crucial.

Imaging approaches that provide spatial information about disease processes and enable detection and therapeutic monitoring of infections allow personalized visualization of the disease state.

These imaging approaches can be used for diagnosis, monitoring treatment response as well as for elucidation of pathogenesis mechanisms. Despite different classification schemes and algorithms, clinical assessments are often based on the physicians' clinical experience. This illustrates the need for defined, automated measurements that can determine the severity of an infection.

Our goal is to investigate and develop a computational platform for data/image analysis to support pathomics-based research in collaborative scenarios. The platform will be able to extract statistical, morphological, and spatial characteristics for the correct identification of pathogens in tissues.

Computer engineering

Remote Collaboration using Augmented Reality: Development of methodologies and characterization of the collaborative process

Bernardo Marques, Paulo Dias, Beatriz Sousa Santos, n.a.

Remote Collaboration shows great potential in scenarios where physically distributed collaborators need to achieve a shared goal. Augmented Reality (AR) can be an advantage in these situations, allowing to establish a common ground between users, improve understanding and awareness of the task and its context. However, due to the innovative nature of the field, most of the research efforts have been devoted to experiment with AR technology and propose methods to support its design and development.

As the field progresses, the characterization and evaluation of the collaborative process become an essential, but difficult endeavor, to develop novel systems, where AR is used in a way that favors more effective collaboration. Nevertheless, evaluation is particularly challenging in this multifaceted context involving many aspects that influence the collaborative effort. Therefore, in order to contribute to a more in-depth knowledge, it is paramount to understand where the field stands and how it addresses collaborative work using AR.

In this research, we conducted a critical analysis, in which we discuss the maturity of Collaborative AR and propose a roadmap of important research actions. Next, we adopted a user-centered methodology involving industrial partners to probe how AR could provide solutions to support their collaborative needs in a scenario of remote maintenance.

After a preliminary case study with an AR collaborative prototype, it became clear that given the complexity and multitude of factors that could influence the effectiveness of collaboration, it was necessary to perform a deep reflection to better understand all the dimensions that could influence and should be considered when dealing with collaboration.

To achieve this goal, we propose a conceptual model, as well as a taxonomy to foster the harmonization of perspectives. Based on this model, we outline a methodological framework to help researchers design and evaluate the collaborative process in a more informed and complete manner. It successfully supported evaluations of team-members during tasks of remote assistance through AR. Thus, enabling the framework to show its versatility and potential in eliciting a more comprehensive characterization of the collaborative process. Furthermore, it establishes itself as a general-purpose evaluation solution, potentially applicable to a wider range of collaborative scenarios.

Computer engineering

Mechanical engineering

Safety and emissions algorithms for assessing the interaction between motor vehicles and vulnerable road users

Elisabete Ferreira, Margarida C. Coelho (orientador), Eloísa Macedo (co-orientador)

Road traffic has been responsible for high levels of pollutant emissions, several injuries and deaths. Many studies have been focused on safety or emissions issues, but an integrated approach considering safety-emission hotspots is rather scarce, particularly, with respect to impacts involving Vulnerable Road Users (VRU), such as pedestrians and cyclists. The recent advancements in technology and in-vehicle automated functions will reshape the road traffic environment, and soon, Conventional Vehicles (CVs) and Connected and Autonomous Vehicles (CAVs) will coexist and share the road infrastructure. Therefore, this Ph.D. research seeks to develop an integrated approach focused on advanced algorithms to reduce driving behavior volatility through safety and emissions warnings in an urban environment. Real data will be used to evaluate driving volatility and pollutant emissions. Safety and emissions will be combined through an integrated methodology under a statistics-optimization-data mining framework. The deliverable of this research will be:

1. a thorough and microscopic characterization of individual driver decision mechanisms focused

on safety and emissions hotspots in urban areas, with a major concern on VRU exposure;

2. a tool of driver warning and control assistance mechanism to be applied in both CVs and CAVs.

Mechanical engineering

Enabling closed-loop additive manufacturing through an on-demand feedstock material customization system

Tiago Gomes, Victor Neto, João Oliveira

Awareness about the need for circular production models has been growing, derived from alarming issues such as the amount of plastic waste that is ending up in the oceans. The application of circular material flows where plastics from the end of life original products is reprocessed and used to produce a similar value product has, however, an important drawback :material properties degradation and variability. Those issues often discourage the use of reprocessed feedstock in traditional mass-production technologies, especially when repeatability is an important factor. At the same time, extrusion-based additive manufacturing is promising for the creation of such material flows, since the batches are much smaller. This puts it at the center of an emerging recycling proposition: distributed recycling, which shows great sustainability potential. However, when functionality and consumer-oriented products are considered, the issues stated before may still be a hindrance. That served as a starting point for the present doctoral program. Here the objective is the creation of conditions for reliably printing thermoplastics in closed loop. For that, the feasibility of a production method with thermoplastic reparation, accounting for the feedstock properties variability using specific additives, through the application of prediction algorithms, will be investigated.

Mechanical engineering

Bidirectional Human-Robot Object Handover in Collaborative Contexts

Afonso Castro, Vitor Santos, Filipe Silva

Human-Robot Collaboration represents one of the most significant subjects for human-life improvement. The ultimate goal is to achieve physical interaction, where handing over an object plays a crucial role in an effective task accomplishment. The main objective of this work is to design a human-like, bidirectional handover system. For a natural and intuitive collaboration, the machine must behave like a human especially in the pre-grasping and grasping phases. Besides this, a fluent bidirectional handover is mandatory for an articulated function development. These two challenges are the focus of the proposed investigation aiming to shed light on the complex combination of predictive and reactive control mechanisms promoting coordination and understanding.

Following recent progress in artificial intelligence, this work aims to explore learning as the key element to allow the generation of coordinated actions and their shaping by experience.

Mechanical engineering

Design of novel heterogeneous thermomechanical tests using topology-based optimization methodologies

Mafalda Gonçalves, A. Gil Andrade-Campos, Sandrine Thuillier

Virtual manufacturing is nowadays a powerful tool for the development of new engineering parts. Numerical simulation software is widely used for this purpose by reproducing real material behavior. However, the accuracy of the obtained results is dependent on the quality of the calibration of its complex models. Today, the calibration of material models still uses classical standard homogeneous tests, being a high number of tests required for an acceptable calibration. Heterogeneous mechanical tests have appeared to tackle this issue by providing higher quality and quantity of information with a reduced number of tests. However, the majority of the new proposed mechanical tests and specimens were developed using empirical knowledge or shape optimization procedures. In this scope, this Ph.D. aims to design novel heterogeneous mechanical tests using topology optimization techniques in thermoelastoplasticity. Topology optimization is a promising methodology for creating innovative geometries impossible to achieve with other design methods and, consequently, highly heterogeneous displacement fields. Digital Image Correlation (DIC) is applied to take advantage of these heterogeneous fields, leading to a precise material characterization and cost-efficient calibration of constitutive models. The development methodology will take into consideration the effect of the spatial resolution and noise of the optical technique and will be experimentally validated and used in calibration procedures.

Mechanical engineering

Digital twin development in metal forming: calibration aided by digital image correlation and artificial intelligence

João Henriques, António Gil D'Orey de Andrade Campos, José Manuel Cardoso Xavier

The automotive industry benefits from a digital-twin paradigm on metal forming processes to increase efficiency and reduce the delivery-time of parts. The concept of digital twin can date back to Grieves's in 2003 [1]. However, at that time the concept of digital twin was not mature enough due to technology limitations. These virtual products will represent a replica of their physical counterpart, to deliver critical information of the closed loop product lifecycle. This approach should yield innovative solutions, increase the quality of the delivered products, and reduce costs [2].

However, the development of the virtual platform requires the precise reproduction of the material behaviour and the accurate virtual simulation of the forming process. Although simulation of processes by FEM is well established, the calibration of the material constitutive models is still facing open challenges. Accordingly, the digital/virtual replica of the process must deliver the same type of observations, e.g., in terms of full-field deformation measurements. This process increases in complexity for more complex material models, increasing the number of experimental tests needed, which proves to be a time-consuming process due to exhaustive experimental campaigns [3]. To tackle this issue, it is required to use inverse identification techniques that can simplify the experimental campaign without compromising the accuracy of the models. The main point that controls the reliability of the digital twin and its numerical simulations is the pertinence of the representation or modelling of the mechanical behavior of the material and, in particular, the material parameters of the constitutive equations involved in the model [3]. Nowadays, one of the real challenges concerns the determination of the material parameters with an optimal quantity of information to guarantee the ultra-reliability of the predictions.

In this communication, a Ph.D. project is presented. This Ph.D. work aims to design a metal forming digital twin through: (i) the calibration of the constitutive models using advance VFM techniques; (ii) the approximation of the digital/simulation and experimental worlds via synthetic images construction; (iii) the development of an enhancer/corrector for the existing well-known models using artificial intelligence. This corrector module, using machine learning (ML) techniques, modifies the stiffness of the analytical material models formulation, providing flexibility to the hybrid module leading to an even better calibration and reproduction of the material behavior and (iv) the experimental validation using heterogeneous kinematic full-field measurements. The Arcan experimental apparatus will be used to calibrate an anisotropic elastoplastic model to an aluminium alloy and a DP-steel. The experimental data will be used to train the ML-corrector.

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Mechanical engineering

Towards virtual forming and design: implicit material modelling using AI techniques and big data generation

Rúben Lourenço, A. Andrade-Campos, Pétia Georgieva

Numerical simulation has become a vital component of the product development process, allowing to reduce the number of experiments between design iterations, thus reducing delays and costs. However, accurate numerical simulations require constitutive models capable of providing precise material data. The fast development of complex materials exhibiting non-linear behavior pushed the development of more advanced and complex constitutive models.

Conventionally, constitutive laws are developed based on simplified assumptions and expressions that rely on empirical parameters, computed or calibrated via experimental methods. The calibration process ensures the compatibility between observed and simulated mechanical responses. As the models become more advanced in their physical basis, empirical expressions also become more complex, often requiring extensive experimental campaigns.

Over the years, several calibration methodologies have been developed to improve the accuracy of constitutive models. Nevertheless, one model's performance is always constrained by its mathematical formulation, as it is written explicitly. Today, Machine Learning (ML) techniques, such as Artificial Neural Networks (ANNs) have the potential to overcome these limitations. However, their use the field of constitutive modelling was not fully explored and requires large amounts of data to be successful.

This PhD project aims to develop accurate data-driven implicit material models using ML techniques, to be used in the simulation of sheet metal forming processes. To conveniently train these ML and hybrid models, big data concerning material behaviour will be generated through the development of non-homogeneous strain field and complex strain paths tests using design optimization techniques.

Mechanical engineering

Recommendation engine anduncertainty techniques for the efficientcalibration and selection of mechanicalconstitutive models

Mariana Conde, A. Gil Andrade-Campos, Sam Coppieters

Numerical simulation is now mandatory for engineering analysis and development. Simulation-software uses complex models and its success reproducing mechanical behaviour depends on the quality of these models and related material parameters. However, methods to experimentally characterise the mechanical behaviour of materials and to identify material parameters of constitutive models are still expensive and non-robust. Additionally, the selection of the appropriate constitutive model for the required material simulation is a cumbersome task and still an open-problem.

This PhD aims to develop KPIs for the selection of accurate constitutive models as a recommendation engine. This recommendation engine will support the decision for an adequate calibrated model regarding others, guarantying that the material is well reproduced. Uncertainty analyses are considered in both the model calibration and heterogeneous material-testing processes. To reduce the material-testing campaign, a dedicated test involving non-homogeneous strain fields and complex strain paths will be designed.

Mechanical engineering

Modelling, simulation and control of tankless gas water heaters: a hardware-in-the-loop approach

André Quintã, Jorge Ferreira, Nelson Martins

There is a growing concern about the scarceness of natural resources and the emissions problematic. Water heating is a relevant part of a household's energy use, and tankless gas water heaters are widely used. There are design and engineering challenges to develop more efficient devices, with lower emissions of pollutant gases, reduced water waste, and providing comfort improvements from the user point of view.

The overall purpose of this PhD project is to study and develop tools and methodologies to implement and evaluate advanced control strategies that improve TGWH environmental and comfort indices.

The PhD student will develop mathematical models of individual components, parametrized with experimental data. Based on these models, research on advanced predictive and adaptive control strategies will be carried out for embedded applications. A virtual-test-bench platform will be developed based on hardware-in-the-loop-simulation methodologies, for evaluation on different TGWH configurations and control strategies performances.

Mechanical engineering

Components manufacturing for medical application - case studies

António Festas, João Paulo Davim, António Ramos

A medical device can be described as an instrument, an appliance or software that is intended to be used in human beings in a way that will help to improve or analyse its clinical situation.

One of the major requirements for a medical device to be considered or be used as such is the need to comply with several criteria. To be compatible with living systems is one of those, and these lead to the need of using biomaterials.

Amongst metal biomaterials currently the most used are titanium alloys. Due to its properties it's a reference biomaterial for most orthopaedic applications. Even so, titanium alloys do not fully meet all biocompatibility requirements, hence the need to develop new alloys in search of an ever-increasing level of biocompatibility.

With the development of new titanium alloys, it is necessary to know their degree of machinability, that is, the ease with which they can be machined. With this knowledge, it is possible to assess whether these alloys, compared with traditional alloys, can replace them and what are the advantages they offer in their manufacturing.

The work carried out in the scope of this PhD comes to evaluate the machinability of new titanium alloys and to verify if they can be a valid substitute for the currently most used alloys.

Mechanical engineering

Mechanical investigation of thermoplastic based nanocomposites fabricated by additive manufacturing

Yiyun Wu, Victor Neto, Robertt Valente

Additive Manufacturing, also known as 3D printing, have been showing significant potential for raw materials saving and customized geometries for complex structure components. And Nanocomposites also attract researchers and industry because of their potential combination of properties from both the nanomaterials and the host materials matrix. Thus, the marriage of nanomaterials and AM offer new opportunities to each other. In the present PhD program research, mechanical properties of 3D printed carbon nanotube reinforced polylactic acid composites are systematically investigated. The single and combined parameters effects during filament preparation and printing processes, including materials parameters, process parameters and design parameters, are studied by both quasi-static and dynamic mechanical investigations. Specifically, the interfacial behaviors of 3D printed composites deserve special attention because interfaces play an important role and have great effect on whole properties of 3D printed parts. The deformation processes and failure mechanisms of laminated composites were analyzed in association with morphological evolution under both macro scale and micro scale. Besides, the hybrid effects of different nanofillers are researched to balance the rigidity and ductility of composites. Based on the experimental investigation, validated modeling and simulation of 3D printed nanocomposites are built to predict and do further analysis for failure processes and mechanism. The work therefore intends to provide a completed research from filament preparation to validated simulation regarding mechanical properties, processing control, processing scalability and product performance of 3D printed composites.

Mechanical engineering

Intelligent methodologies for digital manufacturing in machining

Sílvia Carvalho, João Paulo Davim Tavares da Silva, Ana Lúcia Horovistiz

Digital manufacturing is already a reality in many production systems, where computers are responsible for controlling and monitoring the process. The research topic is related to a problem, that affects all the industrial sectors that use machining, which is the difficulty of integrating intelligent technologies in fabrication by machining, due to the complex thermomechanical and tribological characteristics of the process.

The dissertation aims to develop intelligent machining methodologies for two biomedical titanium alloys, namely Ti6Al4V and Ti6Al7Nb to create strategies to assist the factories of the future. The selected materials, Titanium alloys are difficult to cut materials that are used in high-value products, so the development of intelligent strategies presents even higher benefits from the social, economic, and sustainable point of view.

To achieve the dissertation goals hybrid solutions based on experimental trials and computational methods such as finite element analysis, digital image processing, artificial intelligence algorithms will be explored to analyse the response variables during real machining processes (which are

the cutting forces, temperature gradient, tool wear, metal chip morphology, surface integrity), to develop material and processes models, to optimize the cutting processes and introduce intelligent features into the machining process.

Mechanical engineering

Optimization of process parameters in Laser Metal Deposition to improve geometrical accuracy, mechanical and microstructural properties

Mehran Ghasempour-Mouziraji, Dr Daniel Gil Afonso, Ricardo José Alves de Sousa

Metal alloys are widely used in various industrial applications due to having proper mechanical properties and durability. An array of methods can be utilised to produce metal parts. While the industry is mostly settled on traditional material forming and material removal processes, new smart manufacturing processes are gaining relevance. Of these methods, Additive Manufacturing (AM), particularly Laser Metal Deposition (LMD) is one the best methods to reach this goal. Due to the basis of this method, generating parts layer by layer, combined shape and multi parameter optimization would be highly beneficial from cost and time point of view. But nature of this process is based on rapid solidification which would result in variation in parts geometry. In this research, by using Finite Element Analysis, followed by experimental tests and multi parameter optimisation method, LMD process is studied and an optimal combination of parameters are offered based on the industrial requirements.

Mechanical engineering

Coupling tool to assist design and engineering of mold temperature control systems by topology optimization and hybrid fabrication

Sofia Rocha, Mónica Oliveira, Victor Neto

The search for high quality plastics, especially in high performance products, combined with the need to reduce the production time, led to investigate additive manufacturing (AM) as a solution to produce injection tooling.

AM provides the possibility to create unique and complex geometries, improving both quality and time consumption of the injection molded parts. Furthermore, the design freedom granted by AM concedes the opportunity to envisage new and enhanced temperature control strategies in injection molds. This opportunity plays an important role in the design and manufacture of injection tooling, since these techniques can decrease cycle time, due to a better temperature control within the mold cavity, thus increasing productivity. In addition, it may also contribute to the achievement of better part quality, mainly by reducing heat gradients.

This research led to the start of the present doctoral program, where the goal is to create a numerical tool to assist the design of enhanced temperature control strategies, taking advantage of additive manufacturing, leading to the production of hybrid molds. To accomplish the overall program goal, it is intended to develop a tool to enable the generation of an optimal temperature control system. The latter implies coupling topology op-timization techniques with validated thermo-mechanical models, rendering the developed tool the capability of assisting tool design and engineering as well as process control.

Mechanical engineering

Development of a Physiological Collagen architecture in Engineered Tissue Cartilage Through a Combined Approach of Mechanical Stimulus with Anisotropic Fibrous Scaffolds on a Bioreactor Environment

Ângela Semitela, António Completo, Paula A.A.P. Marques

Tissue engineering (TE) strategies for repairing and regenerating articular cartilage face critical challenges to approximate the biochemical and biomechanical microenvironment of native tissues. The major challenge of TE cartilage is the difficulty to mimic their mechanical properties to the native ones. The importance of the arcade-like collagen fibre structure for the load-bearing properties of native cartilage is well emphasized in literature. However, despite extensive cartilage TE research, few studies have assessed the importance of collagen fibril depth-orientation on the mechanical properties of engineered-cartilage. Thus, a new strategy to be explored is the combination of electrospun scaffolds with a depth-dependent fibre alignment with depth-varying mechanical stimulus protocols on a bioreactor environment, to mimic the native arcade-like collagen organization, reducing the risk of failure of this promise method for osteoarthritis treatment.

Mechanical engineering

Advancing thermal energy storage using refrigerator-freezers for solar-powering, cold chain resilience and demand response within smart grids

Luís Rodrigues, Jorge Ferreira, Vítor Costa

Phase-change materials (PCMs) can be used to harness the inherent potential of domestic refrigerator-freezers for thermal energy storage (TES) – more specifically, latent-cold energy storage (LCES). One aspect of this research will focus on the optimization of this potential via the use of an actively controlled thermal transfer circuit. Intelligent management of this active system – via a microcontroller and a purposely optimized algorithm – will allow the expansion of the capacity of the otherwise (more common) passive approaches. It will also potentially avoid their frequently documented inefficiencies and disadvantages. Actively controlled LCES systems are very rarely studied, particularly in domestic appliances, hence, the high innovative potential of this research. An efficient and capable LCES will, in turn, allow the implementation of three distinct functionalities: (i) autonomous solar-powered operation (i.e., via a direct connection to a photovoltaic array); (ii) demand-side load management (DSLM), i.e., load-shifting/shedding from high energy demand (or low supply) to low demand (or high supply) periods; and (iii) increased resilience to power outages. Solar operation and DSLM will be also the object of research within the current project. The first will be optimized via the use of a variable speed compressor and a novel maximum power-point tracking (MPPT) system, comprised of novel and specialized hardware and microcontroller firmware. The former will also be studied in a connected Internet-of-Things (IoT) smart grid (SG) framework. IoT and SG technologies can considerably enhance the effectiveness of DSLM, allowing real-time demand response (DR), which, in turn, may contribute to increase the penetration of erratic renewable sources (i.e., wind and solar), by absorbing the excessive production peaks and avoiding consumption during low production periods.

Mechanical engineering

Development of Embedded Maintenance Algorithms for Equipment Failure Forecast

Diogo Costa, Prof. Dr. José Paulo Oliveira Santos, Prof. Dr. Eugénio Alexandre Miguel Rocha

Determining appropriate maintenance policies plays a significant role in assuring the sustainability of enterprises, both from a financial, as well as environmental standpoint. Industry's digitization created a new inflow of information, that when properly taken advantage of, can enable smarter approaches to maintenance. However, this also created a new sustainability issue, as managing larger and larger volumes of data is itself an immense task. As such, we are developing a decentralized solution for predictive maintenance, adapted to specific features of the Portuguese industrial landscape, through the integration of embedded artificial intelligence maintenance devices that allow for forecasting of equipment failures, permitting intelligent scheduling of maintenance times, and subsequent reduction and early prediction of manufacturing bottlenecks. We are moving away from cloud-dependent paradigms. In fact, despite predictive maintenance not being a new concept in of itself, current solutions are based on centralized architectures where the entire process is dependent on a single element, introducing single points of failure that jeopardize identification of possible critical failures. Therefore, predictive maintenance algorithms will be deployed in Edge Devices, increasing data acquisition and preprocessing efficiency. This data will be used for anomaly detection and failure/degradation pattern identification (through, e.g., Machine Learning techniques), providing timely warnings and a failure time window permitting early maintenance rescheduling. The goal of the platform is to reduce operational costs and enhance resource usage by avoiding or minimizing down-times and optimizing maintenance operations.

Mechanical engineering

Using smart edge devices and Big Data analytics for predictive maintenance

Pedro Nunes, José Santos, Eugénio Rocha

The technology sophistication is leading to the increasing of competition in almost any field. The industrial maintenance is one of the major concerns for decision makers, since it may represent a significant percentage of the enterprise's costs. Predictive maintenance is the answer for a competitive production industry. It uses sensor data, together with mathematical models and artificial intelligence techniques, to optimize the schedule of maintenance interventions. However, despite some enterprises have data collection systems, the potential of this data is under-exploited, because maintenance sheets have not a uniform syntax or due to the lack of an effective platform to process and extract knowledge of large amounts of data in real time. In addition, the existing predictive models are applied to a specific machine or part. This problem served as a starting point for this doctoral program, whose main objective is the creation of a new decentralized architecture where smart devices with embedded services, are able to process data locally, extract knowledge and automatically build models with the available data, in order to detect

relevant events and to estimate the degradation level of industrial equipment. It is expected that the final solution to be effective in different industrial

Mechanical engineering

Inside a Collaborative Cell: Perception, Calibration and Safety Requirements

Daniela Rato, Prof. Miguel Oliveira, Prof. Vítor Santos, Prof. Angel Sappa

The ultimate goal of a collaborative manufacturing cell envisions a space where humans and robots work on a standard task with efficiency and complete safety. Nowadays, most collaborative cells required human operators to perform unnatural gestures to communicate with the robot. Additionally, these systems display limited interaction between humans and robots: often, the reaction to unexpected motions from the human operator is solved by halting the robot's movement. This plan proposes to tackle these limitations by developing advanced perceptual mechanisms based on multiple sensors of multiple modalities. Multi-modal because different modalities bring different types of information that give rich information about inside the cell. Multi-sensor to ensure that the cell is fully covered, even when there are unforeseen occlusions. Using advanced and robust perception will guarantee a language between the human and the robot, where the automatic system supports the communication burden, creating an efficient operation.

Mechanical engineering

Development of predictive tools for controlling the polymers morphing behavior in 4D printing

Mylene Cadete, Victor Neto, Idalina Gonçalves

Additive manufacturing is a growing industry, where the integration of knowledge and technological development in new materials, printing methods, software, and machines is constantly increasing. Recently, 4D printing concept has been gaining attention from scientists and engineers of different disciplines. The integration of responsive materials to stimuli combined with 3D printing technology opens the possibility for solving processing issues, such as the production of complex structures that can undergo programmed temporal changes in response to external stimuli. However, as 4D technology emerges from 3D printing, various challenges still need to be explored, such as the controlled morphing effect. Herein, in this workplan, the influence of extrusion/deposition processes and printing strategies in the molecular structure of thermoplastic compounds will be studied. The success of this study will give rise to a new prediction tool that contributed for automatizing decisions related to the enhanced printing of structures with the shape changing ability.

Mechanical engineering

Chemical engineering

Natural Deep Eutectic Solvents as efficient media for the fractionation of bleached kraft pulps hemicelluloses and cellulose in Biorefinery processes

José Silva, Armando J. D. Silvestre, Mara G. Freire, Carmen S. R. Freire

Deep Eutectic Solvents as alternative solvents for the fractionation of bleached kraft pulps polysaccharides in Biorefinery processes

Lignocellulosic biomass is a key material for the transition to a sustainable bioeconomy since it is the most abundant and renewable source of energy and materials that is capable of fulfill the current fossil resources-based economy. This work contributes to the development of integrated lignocellulosic based biorefineries through the fractionation of cellulose and hemicelluloses bleached kraft pulps (BKP), using deep eutectic solvents (DES).

This study started by the use of a cholinium chloride:urea based DES in conditions that successfully extracted xylans from eucalyptus wood. The unexpected low extraction yields when applied to BKP led us to study alternative DES systems and to access the effect of the pulp processing in xylan extraction yield in order to understand this phenomenon.

Chemical engineering

Pretreatment of human serum using ionic-liquid-based three-phase partition systems to improve diagnosis and prognosis

Marguerita Rosa, Mara Freire, Francisca Silva, João Coutinho

Lung cancer is placed among the deadliest types of cancer worldwide, mainly due to the long asymptomatic phase and the high percentage of false positives given by current diagnosis techniques (X-rays or computed tomography scans). To overcome these shortcomings, lung cancer biomarkers quantification in human fluids represents a potential early-stage diagnosis approach. However, most often, its reliability is constrained by the low concentrations of biomarkers in human fluids and their tendency to be masked by other abundant molecules. Thereby, a sample pretreatment step aimed to reduce those abundant molecules while improving biomarkers detection is usually applied. In this work, we propose an alternative approach based on three-phase partitioning (TPP) systems composed of polymers, phosphate buffer and ionic liquids, as pretreatment strategies of human serum aiming the depletion of the most abundant proteins and the concentration of the chosen biomarker, namely human serum albumin (HSA) and Immunoglobulin G (IgG).

Chemical engineering

Production of Recovered Carbon Black

Sebastião Costa, Carlos Silva, Inês Portugal, Germano Carreira

Carbon Black (CB) is a solid carbon material traditionally produced from fossil fuels. Both the manufacturing method and process conditions greatly influence CB properties, determining its application in a variety of products and industries. The major use of CB is as a reinforcing filler in rubber products, especially tires. Due to increasing awareness regarding the impacts of fossil fuels and circular economy benefits, pyrolysis technologies are being developed to transform end-of-life tires into Recovered Carbon Black (rCB) along with other products (Bio-diesel and syngas). Giants of the tire industry as Bridgestone, Continental and Michelin are aware of the environmental advantages associated with the rCB production; thus, these companies decided to incorporate this recovered material as a substitute of the conventional CB until 2030-2050 in order to fulfil their sustainability projects.

This work is being developed in partnership with BB&G-AWES, focusing on the optimization of the thermal conversion of end-of-life tires to produce rCB, fulfilling market specifications in terms of chemical composition and contaminants content (ashes, polycyclic aromatic hydrocarbons, etc.). Therefore, characterization techniques have been applied to determine the physical, chemical, and morphological properties of rCB, before and after conventional and innovative purification methods that are being implemented and assessed.

In parallel, numerous tests have been performed in the pilot unit engineered by BB&G to optimize the pyrolysis conditions (temperature, dwell time, etc.). The process has been modelled considering the three products obtained during the pyrolysis of tire crumb (rCB, diesel and syngas). All studies carried out in the pilot plant promote the continuous improvement of the process and consequently the products quality.

Chemical engineering

Hybrid hollow fiber membranes with encapsulated ionic liquids: a new separation process

Liliana Silva, Pedro J. Carvalho, João A. P. Coutinho

The increasing concentration of greenhouse gases (GHG) in the atmosphere, especially CO2, is of particular concern due to the inherent environmental risks associated to unpredictable climate changes, such as the increasing average global temperature. Challenging enforced climate frameworks are reachable only if innovative technologies for CO2 capture are developed aiming at a cleaner energy production. Post-combustion stands as the most appealing emission sources due to an easy retrofit of existent and new technologies into existing power plants. Several physical and chemical processes, based on absorption, adsorption, membranes and cryogenic separation, are commercially available and widely used by the natural gas processing industry. However, when envisioning post-combustion, the current technologies, requiring large separation units and high CO2 partial pressures, stand unfeasible. Thus, innovative post-combustion technological development for removing acid gases, envisioned using green solvents, is indispensable aiming at a clean energy production, anthropogenic CO2 capture, transportation and/or reconstitution into value-added products.

Innovative post-combustion technology for removing acid gases has been proposed by many researchers but, none has reached a development level fit for deployment at an industrial level. Emerging self-claimed green solvents have been proposed as promising materials with unique properties not achievable by any other material. Unfortunately, academia tends to focus on enhancing equilibrium capacity, neglecting other properties, like transport properties, that impose important penalties on process performance, and thus on cost, that ultimately prove the process unfeasible. This core thinking allowed to identify and propose emerging alternative solvents as the solution for CCUS but failed to foresee the unrealistic industrial scale-up. Aiming at developing a technical and economically viable process, the pursuit on improving CO2 solubility, viscosity, and heat capacity must be addressed from a process engineering perspective, emphasized on the principles of green chemistry and green engineering.

Several approaches were proposed for improved CO2 absorption for suitable industrial implementation. Among those, chemical absorption using Ionic Liquids (ILs) has attracted special interest due to the solvents' high capacity, even at low CO2 partial pressures. However, the use of ILs alone presents several drawbacks (high viscosity/regeneration energy demand) that lead to high operational cost and ultimately economical/technical unviable processes that hamper the development of new separation units capable of fulfilling industry demands.

The use of a solid phase to immobilize the solvents has been recently proposed. In fact, we have shown that confining ILs in submicron porous inert matrices result in improved mechanical stability, higher mass transfer rates, virtually instant sorption kinetics and low energy regeneration demand at mild conditions, capable of overcoming the major drawbacks of the bulk solvents. Nonetheless, its application in conventional separation units results in high pressure drops even at low flow rates. However, the recent development of a matrix able to physically support the encapsulated solvent in the porous material, that minimizes the loss of surface contact area while presenting no resistance to the gas passage, has high potential to leverage the successful future of this novel technology.

Chemical engineering

Integrated recovery processes for high-value bioactive compounds from agroforest by-products using ionic liquids

Inês Cardoso, Mara G. Freire, Armando J. D. Silvestre

The development of eco-friendly extraction platforms to obtain high value bioactive compounds (HVBCs) from waste and raw materials is a current priority within the circular economy context. This work aims to valorise orange peels, a waste from the food industry, through the isolation of added value phenolic compounds using sustainable extraction processes. For this purpose, novel biobased ionic liquids derived from glycine-betaine, able to increase the solubility of rutin and naringin by several orders of magnitude, were investigated as alternative solvents. Experimental design was applied to optimize extraction conditions. Under optimum conditions, the proposed process resulted in the efficient and selective extraction of rutin and naringin, allowing the solvent reuse. The developed process is a competitive alternative to conventional processes comprising organic solvents.

This work was developed within the scope of the project CICECO-Aveiro Institute of Materials, UIDB/50011/2020 & UIDP/50011/2020, financed by national funds through the FCT/MEC and when appropriate co-financed by FEDER under the PT2020 Partnership Agreement. Inês S. Cardoso acknowledges FCT for the PhD grant SFRH/BD/139801/2018.

Chemical engineering

Ion effects on Protein Model Compounds in Aqueous Systems: Experimental and Computational Studies

Mehriban Aliyeva, João A. P. Coutinho, José R. B. Gomes, Simão P. Pinho

Aqueous salt solutions are the natural environment of many biomolecules, playing an essential role in regulating their structure and physico-chemical behavior, governing numerous biochemical processes. The knowledge of the solubility and activity of amino acids (AAs), peptides, and proteins in the presence of salts is therefore of utmost importance from a biological perspective and in many food and pharmaceutical applications. Furthermore, AAs can be used as model compounds (MC), aiming to provide insights into the behavior of larger macromolecules. Though much work has been devoted to this subject, the results obtained by some authors differ from each other, and molecular-level mechanisms are still unclear which shows the significant input of this study to existing literature. The aim of this work is to study the impact of different cations and anions on the amino acid's solubility by combining information from experimental (solubilities, densities, NMR spectroscopy) and computational techniques (molecular dynamics simulations). In this work, the solubility measurements of amino acids with different polarities in aqueous salt solutions were decided to be carried out. The selected ions (cations such as ammonium, potassium, sodium, magnesium, calcium, and anions such as nitrate, chloride, sulphate, and hydrogen phosphate) were chosen from the Hofmeister series due to their biological relevance while covering a wide range of aqueous solubility effects. The selected AAs are L-aspartic (L-Asp) acid, L-phenylalanine (L-Phe), L-leucine

(L-Leu), Glycine (Gly), and L-tyrosine (L-Tyr), dipeptides (Gly-Gly, Gly-Leu, Gly-Phe, Gly-Asp), and one tripeptide (Gly-Gly-Gly). To put into play results from experimental solubility and those found from molecular dynamics the effect of pH on the solubility of Gly, diglycine, and N-acetylglycine in aqueous solutions with the same salt concentration also will be studied.

The final goal is to achieve an understanding of the Hofmeister effect of salts on the behavior of peptides in a solution that may be extended to more complex systems such as proteins.

Chemical engineering

Development of Ionic-Liquid-based Devices for the Removal of Cytostatic Drugs from Urine Excreted by Cancer Patients

Rafael Francisco, Mara G. Freire, Ana C. A. Sousa, Márcia C. Neves

Cytostatics are a common therapeutic option in the treatment of cancer and recovery of transplants. Nevertheless, these drugs are toxic, so their handling and elimination are sources of risk. With developments in cancer treatments, chemotherapy is now usually complemented and/or replaced by treatments in the home environment, where excretion of cytostatics, which occurs through urine or feces, can lead to contamination of surface water, since the excretions flows into the sewage system, reaching wastewater treatment plants that are incapable to completely remove the cytostatics from the water.

Ionic Liquids (ILs) shown huge potential to remove drugs from aqueous solutions, therefore, Supported Ionic Liquids (SILs) will be used to remove cytostatic drugs. These SILs will be incorporated into a device to be used by cancer patients when urinating, avoiding preventing cytostatics from reaching the environment.

The SILs synthetized demonstrated great potential, being able to remove cytostatics faster than Activated Carbon. Furthermore, the SILs were used to remove cyclophosphamide of Zebra fish maintenance water completely denying the effects of the cyclophosphamide in Zebra fish embryos.

Chemical engineering

Measurement and computer simulation of diffusivities and polymer-solvent partition coefficients in supercritical fluids & liquids

Bruno Zêzere, Carlos Manuel Silva, José R. B. Gomes

Agroforestry and fishery residues are important sources of bioactive compounds like astaxanthin, squalene and quercetin. These molecules have well-established biological activities and high added value, which raises their interest under the biorefinery concept. To obtain such compounds, a rigorous design of extraction processes and equipment is necessary, which requires equilibrium and transport properties, such as tracer diffusivities (D12). This work aims to determine the D12 of such compounds, in green solvents, like supercritical CO2 (SC-CO2), pure or modified with a cosolvent (e.g., ethanol and ethyl acetate), either employing experimental techniques or computer simulations.

Over the last year, within the scope of this PhD, a computational strategy based on atomistic classical molecular dynamics (MD) simulations has been developed for the calculation of D12. In liquid ethanol, deviations under 10 % between calculated and experimental data have been achieved for quercetin, gallic acid, ibuprofen and n-butanol at temperatures from 298.15 K to 333.15 K and pressures up to 300 bar. In CO2 modified with 16 % (mol/mol) of ethanol, for temperatures between 313.15 K and 333.15 K and pressures between 150 bar and 250 bar, the deviations are under 5 %. Finally, regarding phenomenological modelling, a 2-parameter correlation for D12 calculation of polar systems was simplified expanding its applicability. Also, a machine learning model was developed for the estimation of D12 in SC-CO2 achieving an average deviation of 2.58 %.

Chemical engineering

Novel Separation Processes for the Fractionation and Purification of Terpene

Sérgio Vilas Boas, João Coutinho, Simão Pinho, Olga Ferreira

Terpenes are the most diverse class of natural compounds, being widely found in essential oils (EO) and exploited in several industrial fields. In this work, important equilibrium properties such as aqueous solubility and octanol-water partition coefficients of some industrially relevant terpenes, such as eucalyptol, camphor, and menthol, were collected. Additionally, the use of some more environmentally benign solvents was studied selecting ionic liquids (IL) or deep eutectic solvents (DES) as separation agents for the fractionation of high value-added terpenes from EOs. The infinite dilution activity coefficients of terpenes and these solvents, either pure IL or IL mixtures, were measured or estimated with COSMO-RS. Auspicious results were obtained using [P6,6,6,14]Cl, [P6,6,6,14][(C8H17)PO2], [C4min][OAc], [C8min]Cl, [C12min]Cl or the mixture of [C4min]Cl and [C12min]Cl in the fractionation of the major compounds of some EO, such as limonene/linalool (citrus EO), menthone/menthol (peppermint EO), and camphor/borneol (EO of some flowers from Asteraceae and Lamiaceae families). Further separation agents will be selected using the COSMO-RS model for the preliminary screening. From the infinite dilution activity coefficients, potential entrainers for distillation and liquid-liquid extraction of relevant EOs were already identified. For those systems, vapor-liquid and liquid-liquid equilibrium studies will be conducted.

Chemical engineering

Three-step bioplastic production using coffee waste

Joana Pereira, Luísa Serafim, Paulo Lemos

The coffee industry generates high amounts of residues, like spent coffee grounds (SCGs). Those are produced during the coffee brewing process, being still very rich in lipids and sugars, which makes their valorization through biological processes feasible. SCGs can be a potential substrate for many added-value products. Amongst these, bio-based polymers stand out as candidates due to the current need for environmental-friendly alternatives to plastics. Polyhydroxyalkanoates (PHAs) are biodegradable polymers with similar properties to traditional plastics and can be produced from complex carbon sources by mixed microbial cultures (MMC). The combined use of MMC and low-cost substrates can lead to a significant reduction in the production cost of these polymers. In this work, a three-step production system was applied, where physical separation of the different steps is used to ensure optimal conditions. This strategy included: (1) acidogenic fermentation of the SCGs to produce short-chain organic acids (SCOAs) mixtures in a Fluidized Bed Biofilm Reactor (FBBR); (2) culture selection, in a Sequencing Batch Reactor (SBR) reactor, using the SCOAs-rich stream produced, by imposing high selective pressure for microorganisms with PHAs storage ability; and, finally, (3) PHAs production stage where the selected microorganisms accumulate PHAs at maximum capacity using the acidified stream in a Fed-batch Reactor. Finally, a study of the microbial communities' structure, composition, and dynamics, in both the FBBR and the SBR reactors, was conducted by high-throughput 16S rRNA gene sequencing and in situ cell detection approaches (FISH and CARD-FISH).

Chemical engineering

Extraction of tannins from wine by-products using eutectic solvents

Rodrigo Neto, Sónia Santos, Joana Oliveira, Armando Silvestre

Tannins are natural polymers composed of catechin units and its derivatives. These components have been increasingly used in the production of leather, wood agglomerates and wine, and therefore, their global demand has also increased.

Tannins rich extracts can be obtained from dedicated crops (e.g. quebracho) by conventional extraction methods (e.g. maceration with hot sulfite solution), with low specificity and yield, yet with high cost, which limits their industrial application.

Consequently, the development of novel extraction methodologies and the use of more sustainable biomass sources (e.g. agroforestry by-products rich in this type of components such as grape pomace) is of great importance. In this context, Eutectic Solvents (ESs) have been proposed has good alternatives for conventional solvents due to their low price, easiness of preparation, biocompatibility, and ability of being custom made to a specific application.

Herein, I report the use of ES in the extraction of tannins from white grape pomace. Several hydrogen bond acceptor and donor combinations were tested from which choline chloride and glycerol can be highlighted due to their high extraction yield. Furthermore, these compounds synergize very well with the addition of water and ethanol further contributing to the development of a cheap and sustainable extraction process. In addition, with this quaternary solvent system it is possible to control the mean degree of polymerization, allowing for a customization of the extracts' characteristics that no other extraction process offers. Further improvements can be achieved, using as microwave irradiation, in which the best yield was obtained using a combination of choline chloride, lactic acid and water. Despite, resulting in a yield similar to the one obtained with the previous system, the extraction time was much shorter, and the mean degree of polymerization was much higher further reinforcing the potential that ES have on the improvement of proanthocyanidin extraction.

Chemical engineering

Combining bioremediation and extraction for metal recovery

Ana R. F. Carreira, João A. P. Coutinho, Eduarda Pereira, Helena Passos

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As industrialization, urbanization and society grow, it becomes clear that the extraction of metals from primary sources will be unviable in a relatively short future. The overexploitation of metals will lead to metal scarcity, price inflation and issues in the industrial supply chains. Therefore, it is necessary to develop a sustainable and cost-effective methodology to recover metals from secondary sources. This work aims to develop an integrative approach for the recovery of metals from wastewaters by combining bioremediation with ecofriendly liquid-liquid extraction. Bioremediation is a naturally occurring process that can be used to preconcentrate metals present in effluents while liquid-liquid extraction will enable their separation and purification. The achievement of a concentrated metal solution is possible by properly optimize the bioremediation process. To do so, ten different types of biomass were selected – including cyanobacteria, macroalgae and microalgae – to establish the best adsorbent. Then, parameters such as pH, initial metal concentration, the metal counterion of and the sorption kinetics were taken into consideration to better understand the sorption process and to enhance the sorption capacity of metals. In the future it is expected to integrate bioremediation and liquid-liquid extraction, aiming to separate and recover the metals present in the obtained preconcentrated metal solution.

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Chemical engineering

Stimuli-responsive aqueous biphasic systems as alternative separation strategies

Ana Rufino, Mara G. Freire, João A.P. Coutinho

This PhD thesis aims to develop stimuli-responsive aqueous biphasic systems (ABS) capable of acting as separation techniques to deal with complex matrices. ABS are an alternative liquid-liquid separation strategy, being formed by a combination of two hydrophilic solutes (two polymers, a polymer and a salt, or two salts) above certain concentrations in aqueous media. The use of ionic liquid (IL)-based ABS allows for increased selectivity and separation performance compared to conventional ABS. On the other hand, stimuli-responsive ABS allow the integration of several steps in the upstream and downstream processes. Based on these advantages, novel stimuli-responsive IL-based ABS were developed and characterized, namely ABS responsive to temperature and pH. Future work aims the development of magnetic-responsive ABS to apply in the separation of high-value compounds and disease biomarkers.

Chemical engineering

Valorisation of pigments from marine biomass

Mariam Kholany, Sónia P.M. Ventura, João A.P. Coutinho

In the biorefinery context, both bulk and specialty chemicals can be produced and extracted from biomass, resulting in a potentially more sustainable alternative to petroleum-derived products. Nature has an outstanding capacity to efficiently harvest light. It has inspired us on numerous biomimetic applications of natural pigments such as their use as optically active centres in luminescent solar concentrators to improve a device absorption and emission properties.

Marine Haloarchea is the main focus of this thesis as they are major natural producers of pigments with interesting biological activities, namely bacteriorhodopsin and bacterioruberin. Bacterioruberin is an uncommon C50 carotenoid with great biotechnological interest, which exhibits a higher antioxidant capacity than the C40 carotenoids such as β-carotene, making it interesting for the food, pharmaceutical and biomedical industries. Bacteriorhodopsin is a photon-pump transmembrane protein, with great foreseen applications in the photo-optical field.

The goal of this thesis is to extract and purify the pigments from different extremophiles by applying neoteric systems based on alternative solvents. Following the optimization process at lab scale, the scale up of the process is anticipated. In an effort to formulate food and cosmetic

grade compatible extracts, bacterioruberin recovery was accomplished through the use of bio-derived alternative solvents. Also, aqueous extracts rich on bacteriorhodopsin (raw or purified) are used for the development of more efficient LSCs, in the framework of project SusPhotoSolutions.

Acknowledgments: This work was developed within the scope of the project CICECO-Aveiro Institute of Materials, UIDB/50011/2020 & UIDP/50011/2020 and CESAM, UIDB/50017/2020 & UIDP/50017/2020, financed by national funds through the FCT/MCTES. The authors are also grateful to the FCT for the doctoral grants of M. Kholany (SFRH/BD/138413/2018).

Chemical engineering

Thermochemical recovery of plastic waste

Anareth Cavuquila, Ana Timmons, Carlos Silva

The pressure to reduce the environmental impact caused by plastic waste and the need to reduce dependence on fossil fuels and diversify raw materials for the plastic industry has motivated the search for new technologies for the recycling and recovery of these residues at academic and industrial level. Despite the advances achieved in the recycling of plastics in recent years, a large part of the waste ends up being deposited in landfills with emphasis on multilayer plastic packaging, since it is not possible to recycle them using the currently available approaches, at the industrial level. This work aims to develop an integrated process to recycle this type of packaging in a logic of circular economy, with the quality required for application in new plastic products. For this, selective extraction of the polymeric layers with solvents and selective precipitation of the dissolved polymer is considered. Bearing in mind that the process may not be economically viable for the recovery of all layers of polymers, it is envisaged to couple this unity to another pyrolysis unity to process the final waste from the process for hydrocarbons and energy production.

Chemical engineering

Boosting Biorefinery: Eutectic mixtures as alternative solvents in the extraction and processing of polysaccharides

Eduarda S. Morais, Armando J. D. Silvestre, Mara G. Freire, Carmen S. R. Freire

The fast depletion of fossil resources and the environmental impact associated with their massive use led to an increased focus on the utilization of renewable resources, such as biomass, to supply society with commodities. It is estimated that at least 30% of all chemicals will be derived from renewable resources by 2050. However, many processes applied in the production of added-value chemicals and biomass fractionation need to be more efficient and sustainable. Deep Eutectic Solvents (DES), are a new class of low-cost bio-based solvents, and, if properly designed, seen as greener alternatives to conventional organic solvents often used in chemical processes.

DES are of easy preparation, and may display unique physicochemical properties, negligible toxicity and high biodegradability. Due to these features, DES emerged recently as one of the most promising classes of solvents for biomass fractionation, towards a fully sustainable bio-based economy. In this sense, the developed PhD work focused on the extraction and solubilization of polysaccharides from biomass and their subsequent transformation into added-value products, namely furfural and 5-hydroxymethyl furfural (5-HMF). The different processes conditions were optimized aiming at maximizing the resulting yields.

The products recovery and solvents reuse were considered as well, resulting in the development of sustainable and integrated processes.

Chemical engineering

Solvatochromic parameters prediction using COSMO-RS

José Pedro Wojeicchowski, João A.P. Coutinho, Marcos R. Mafra

The development of novel green solvents demands the knowledge of polarity, which can be described through solvatochromic parameters. Considering the need of such data for non-conventional solvents, we developed predictive models to estimate the Kamlet-Taft (K-T) parameters (α, β and π^*) for deep eutectic solvents (DES). The models, based on Conductor-like Screening Model for Real Solvents (COSMO-RS) descriptors, were initially developed and tested for 175 organic solvents. After that, this approach was extended for DES. The developed equations showed a very good performance for all 3 K-T parameters, and this is the first work to propose models for all the K-T parameters for DES. Moreover, through a polarity investigation it was shown that DES rather than replace common solvents, can extend their range of polarities, reinforcing their designer solvent ability.

Chemical engineering

Study of the acid sulphite process for the production of dissolving pulp

Inês Mendes, Dmitry Evtyugin, António Prates

Dissolving pulp is a type of bleached chemical pulp, used as a raw material in the production of added value products, related to chemical processing for the production of viscose fibers, cellophane, cellulose ethers and esters, among others. This type of pulp can be produced either by the acid sulphite process or by the pre-hydrolysis kraft process, being characterized by the high content of α-cellulose and, also, by the low content of lignin and hemicelluloses.

Bearing in mind that each application of the dissolving pulp requires different contents of α-cellulose, knowledge of the process is imperative to obtain a pulp with the desired quality. In this context, the present PhD has as main objectives (1) the optimization of an industrial process for dissolving pulp production and (2) the determination of the reaction kinetics of the same process.

Chemical engineering

Study on the improvement of reactive washing of cork stoppers

Diana Branco, Dmitry V. Evtyugin, Luís Cabrita

Cork is the bark extracted from cork oak tree (Quercus suber L.) and 49% of world cork production is Portuguese, which has an important impact in Portuguese economics. This raw material has unique properties such as low density, low permeability to liquids, ability to adhere to a glass surface, compressibility, resilience, elasticity, chemical inertness and resistance to microbial growth that promotes its use as stoppers for wine bottling. From the oak bark to the cork stopper, cork has to pass through several industrial steps, where reactive washing (RW) plays an important role in disinfection and appearance of the final product in terms of color homogeneity and brightness. This PhD project focuses on the study of the RW process, more exactly the optimization of RW process currently in use by reducing solvents and process time and implementation of alternative bleaching solvents, to achieve better visual appearance, color uniformity and technical performance of the final stopper. In this way, it was already achieved the evaluation the chemical composition of the cork stoppers, the optimization of RW in laboratory-scale reactor and the analysis of cork stopper surface before and after washing process through FTIR-ATR and UV-Vis spectroscopy, ISO brightness, measurement of contact angles and wetting envelope. At this point is being study the scale-up of the optimized RW from laboratory-scale to pilot-scale, increasing from 15 to 500 stoppers, while evaluating the technical performance of the stoppers in bottle.

Chemical engineering

Enhanced Extraction of Phenolic Compounds using Biobased Solvents as Hydrotropes

Bruna P. Soares, José V. Oliveira, Simão P. Pinho, João A. P. Coutinho

Water is the most sustainable solvent following the Green Chemistry principles: it is readily available, non-flammable, non-toxic, cheap, and environmentally benign. Unfortunately, many compounds that present relevant properties and bioactivities are poorly soluble in water. Rather than using different solvents to process these compounds, hydrotropes can be used to overcome this limitation. In this work, two classes of biobased non-ionic hydrotropes were selected, namely glycerol ethers and alkanediols, to enhance the solubility of hydrophobic compounds and study the mechanism behind the hydrotropy phenomena. Both classes of hydrotropes can provide tunable solvent properties changing the OH group position and the alkyl chain length, which allows the design of different solvents. For that purpose, the solubility curves of phenolic compounds in water mixtures of hydrotropes were the main focus of this study. The recently proposed cooperativity hydrotropy model was used to fit the solubility data, and the apolarity was found to be the main factor for the hydrotropic effect. The best identified hydrotropes are now being applied to extract of phenolic compounds from juçara fruit, a by-product of the palm-heart industry. Preliminary results show that hydrotropes have as much or greater extraction power than traditional solvents such as ethanol.

Chemical engineering

Cultural studies

Understanding Consumers' Self-Projects: A Netnographic approach of Self-Care Practices

Ema Rolo, Helena Nobre, Vania Baldi

Title: Understanding Consumers' Self-Projects: A Netnographic approach of Self-Care Practices

Abstract:

Globalization and postindustrial socioeconomic transformation have eroded the traditional bases of sociality and encouraged instead a dominant ethos of radical individualism oriented around a ceaseless quest for personal distinctiveness and autonomy in lifestyle choices (Maffesoli, 1996; Arnould and Thompson, 2005). Online communities have become organic aggregate meeting-places focused around connected consumption interests and lifestyles under which various discourses are negotiated (Weijo et al., 2014). These environments have opened up the ways that consumers approach the self-project, which continually produces itself for competitive circulation (Susman, 2003) through the attention paid to one's health and physical appearance and continuous self-actualization (Lupton, 2014; Sassatelli, 2015; Ruckenstein and Pantzar, 2017; Lupton and Smith, 2018). For such a mode of subjectivity, consumer identity is an ongoing construction that requires concerted effort and investment. Using Foucault's concept of power and governmentality (1979, 1980), we explore motivational performances of self-care (regarding body enhancement) in the production and negotiation of power relations in the social media landscape. Under the lens of Consumer Culture Theory in line with Cultural Studies focus in identity work, this study explores how power is enacted through motivational performances of self-care on social media and how an online community's social imaginary promotes convergent self-projects. This research adopts a netnographic approach (Kozinets, 2020) to further understand the cultural phenomenon of self-care through positive body representations. In netnography, understanding cultural meaning is the logic that inspires data collection and its analysis. Data collection followed netnographic ethics process through archival downloading (investigation), immersion journal noting (immersion), and computer-mediated communications (interaction). Preliminary findings found that motivational discourses of self-care through the apparatuses of biopower, may inadvertently encourage an ethos of individualism and participate in the production of normative categories that regulate consumers' offline lives.

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Cultural studies

Gone with the Wind - Research about Jianghu Dage subculture in China

CHENG YUAN, CARLOS JOSÉ DE OLIVEIRA E SILVA RODRIGUES

My research is strictly in the field of sociology, and of course the most important one is the subcultural research in cultural studies.

This research focuses on "Jianghu Dage", a sub-cultural group living in China, which is different from mainstream cultural groups, but a social group that develops according to the value system in the same surrounding environment as the individual. They are different from mainstream society in some respects, but they obey part of the norms and laws of mainstream society. They have unique codes of conduct and group awareness, and have some social functions.

In my thesis, I tried to answer the following questions. First, the emergence and evolution of Jianghu Dage groups. Second, the identity of Jianghu Dage. Third, the representation and connotation of Jianghu Dage subculture. Fourth, the relationship between Jianghu Dage and the mass media. Fifth, the future of Jianghu Dage" subculture.

Cultural studies

Eventicities [Eventicidades]

Daniel Campos, Carlos José

Sociocultural events have been a constant object of research and academic studies, whether in the area of event management, tourism or economics. This work presents the cultural events analyzed in relation to their connection with local identities through Cultural Studies methodologies. Events, including festivals and various parties, have proliferated due to the initiative and / or encouragement of many cities that often attribute the ability to reinforce the local cultural identity. With the modern globalization process, there is a tension between global cultural identities, affecting mainly national and consequently local cultural identities. In this sense, this work seeks to understand whether and how events have affected local identities and how they have contributed to their diffusion, reinforcement or even conflict.

Cultural studies

A Filmografia de David Lynch à Luz dos Estudos da Consciência de António Damásio e Amit Goswami.

Luís Carlos S. Branco, Anthony David Barker, Carlos Fernandes da Silva

A minha tese de doutoramento procura analisar as obras de arte como experiências cognitivas e interseta-se, por isso, com os Estudos da Consciência. Pela sua não-linearidade e por seguir, não uma lógica narrativa padronizada, mas, sim, uma lógica da consciência e das emoções, o criador abordado é o cineasta David Lynch. Para interpretar a sua filmografia recorro, por um lado, à noção de consciência incorporada (ou seja, a consciência imersa no corpo), presente na obra e trabalho do neurocientista António Damásio, e, por outro, às teorizações do físico Amit Goswami, referentes à asserção da consciência dilatada e estendida. Pretendo, portanto, encontrar elementos pertinentes na filmografia de Lynch que me permitam confrontar, interrogar e quiçá fundir estas duas visões: a embodied mind (cognição incorporada) e a out of body extended mind (cognição quântica). A fenomenologia da criatividade, observável em Lynch, será, em simultâneo e em interligação, alvo de estudo e análise.

Cultural studies

Cartography of Bear Resistances and Normativities: A Study in the Locative Media

Alexandre Almeida, Maria Manuel Baptista

In this research our objective is to cartograph the resistance and normativities present in individuals self-identified as Bears: men, most homosexuals, whose main characteristic is bodily and facial hair and bulky body. Our observation point will be users of the locative social network Growlr, a smartphone application aimed at this audience. We intend to deepen the knowledge on issues related to the articulations between the processes of subjectivation and resistance in hybrid spaces, specifically in the context of Growlr, deepening the possibilities of interaction between urban and virtual spaces. We will carry out surveys, collect and analyze public profiles in that network and deepen the investigation through interviews with subjects who live in the cities of São Paulo, Brazil, and in Lisbon, Portugal, with subsequent content analysis of their speeches. We intend to identify how users perform in this digital space and how this process is reflected in the daily relationships of these men.

Cultural studies

Body-Written/Written-Body: Processes of (De)territorialization from Narratives of Elderly Writers

Francisco Barbosa Junior, Maria Manuel Rocha Teixeira Baptista

Portugal stands out as a country with high aging estimates for the coming decades; at the same time it is considered among those European countries with more lack of assistance to their elderly. However, knowing that the number of illiterate elderly people in the country has been decreasing, and that elderly people who use writing for self-expression are emerging, to write, for example, their life stories - or even publish them, according to authors such as Foucault and Chiantaretto call it self-writing, we seek in this study to identify the processes of territorialization and deterritorialization concerning the relationship between these elderly people who write to self-express, who write their life stories and their writings. In other words: we sought to investigate the relationships between the act of writing for self-expression, to write their life stories and the construction of the subjectivities of these elderly people, and how both (the act of writing their stories and the construction of their subjectivities) interfere with each other. Thus, in this qualitative approach investigation, we will conduct narrative interviews with these elderly people, who we call elderly writers, according to the concept of self-writing. And in order to contribute to the selection process of study participants, we will use the "snowball" technique, in which the interviewed elderly person suggests the name of another elderly person as a possible individual to be interviewed. And as an aid to the analysis of the data collected, we will use the technique of Content Analysis (Bardin, 2008). We believe that this investigation will contribute to understanding the relationship between writing and subjectivity of these elderly people, about the experiences of being elderly and the discourses that permeate these old age, and about the importance of literature in this area, being, therefore, an academic contribution, scientific and social.

Cultural studies

Identity and imagined comunities in the media

Rita Himmel, Maria Manuel Baptista

Ideologies, including that of cultural identity, tied either to political belonging, to the Nation-State or Europe, "construct some narrative, however impoverished and impure, to connect the past and the present: where they came from, with where they are and where they are going to" (Hall, 2016, p. 144). In this project we aim to explore media discourses, in Portugal and Germany, about these identities based on "imagined communities" (Anderson, 1983/2016), namely about what are represented as the Portuguese, German and European identities. Our empirical analysis allows us to ascertain that media discourses tend, to a large part, to (re)produce essentialist representations of others, following and us vs. them dynamic, that is strongly shaped by power. However, this hegemonic view is breached, in some instances, mainly when an attempt of complexification, proximity or representation is made.

Cultural studies

Cartografias de cuidado de si feminino: práticas decoloniais

Renata Araujo, Maria Manuel Baptista

No contexto dos povos do sul global, segundo o conceito definido por Boaventura de Sousa Santos, propõem-se uma pesquisa qualitativa, do tipo cartográfica, a ser realizada com mulheres – estudantes, técnicas e docentes – que mantenham vínculo com a Universidade da Integração da Lusofonia Afro-brasileira (UNILAB). A partir da noção de cuidado de si de Foucault e de conceitos propostos por autores da teoria decolonial – como colonialidade do ser e do poder e a noção de gênero decolonial – pretende-se realizar entrevistas em profundidade, Photovoices e grupos focais com estudantes de origem africana para triangular a coleta de dados com entrevistas às servidoras da instituição vinculadas à Pró-Reitoria de Políticas Afirmativas e Estudantis, com o objetivo de explorar as (de)colonialidades em torno das práticas de cuidado de si. A análise de conteúdo será utilizada para tratamento dos dados. Pretende-se, com essa proposta, analisar, no período compreendido entre o ano de 2021 e início de 2022, relações étnico-raciais, opressões de gênero e disputas de saber-poder no contexto da UNILAB percebidas em torno de práticas cotidianas de cuidado de si de universitárias de origem africana. Dessa forma, espera-se contribuir para a construção de conhecimento sobre o contexto de povos do sul global, especificamente na UNILAB, aprofundando a crítica à colonialidade/modernidade e criando subsídios para o incremento de políticas estudantis.

Cultural studies

Quem é Quem?

Rita Moreira, Gillian Moreira

Quem é Quem? A descoberta da personagem, através da criação artística, onde se investiga no campo dos estudos culturais.

Cultural studies

Afrofuturism and resistance cultures in Brazilian comics

Edmilson Miranda, David Callahan

The research investigates, through a specific focus on the phenomenon of Afrofuturism, comics that discuss what being black represents in Brazil. It is proposed to map the publications launched between 2011 and 2021, to distinguish Afrofuturist characteristics and understand how they dialogue with post-colonial and decolonial discourses. The Brazilian experience in discussions about blackness adds to the contribution of comics as a language to register the presence of Afrofuturism as an indication of the emergence of decolonial expressions, in contrast to hegemonic thinking. Given the extensive English-speaking academic production on this subject, it is intended to contribute to research in Portuguese and focusing on the Brazilian reality, indicating a methodological approach aligned with Cultural, Post-Colonial and Decolonial Studies.

Cultural studies

Motivação e identificação cultural na aprendizagem de PLE por universitários chineses

Yiwen Li, Gillian Grace Owen Moreira

Segundo Malaca Casteleiro, linguista, investigador e examinador externo do Instituto Politécnico de Macau, “a China é um dinamizador da língua portuguesa no mundo, existindo atualmente diversas universidades a lecionar o idioma.” No entanto, quais são as motivações que inspiram as pessoas chinesas a aprender a língua portuguesa? Isso acicatou a minha curiosidade. Com variadas motivações, as pessoas chinesas começaram o caminho da aprendizagem da língua portuguesa, e durante esse processo de aprendizagem, elas adquirem cada vez mais conhecimentos culturais sobre Portugal, Brasil, e até outros países lusófonos através, principalmente, dos manuais didáticos de PLE. Na verdade, este processo da aprendizagem de uma língua estrangeira é um processo de identificação cultural, portanto, o sentimento de pertencer a uma cultura determinada irá, em certo grau, influenciar a intenção de aprendizagem contínua dos aprendentes da língua estrangeira. Nessa perspetiva, este trabalho pretende-se investigar as motivações de aprendizagem da língua portuguesa dos alunos universitários da China e o processo de identificação cultural deles com Portugal mediante questionários, e analisar a correlação entre as duas vertentes.

Cultural studies

Literary studies

O deus que mata e o deus que morre

Clovis Torquato Jr, Marai Fernanda Brasete, Alex Valentin Villas Boas, xxxx

O estudo é uma comparação literária entre As Bacantes de Eurípides e o Evangelho de Marcos quanto às reações que Dionísio e Jesus têm diante da rejeição e hostilidade. O ponto central, de vários outros periféricos, consiste na observação que de que diante da hostilidade e rejeição Dionísio gera violência matando (ainda que indiretamente através do frenesi da mulheres na montanha) Penteu, enquanto que Jesus sofre violência, sendo crucificado por Pilatos.

Literary studies

The Golden Age: a comparative study on the representations of old age in Chinese and Portuguese children's literature

Beilei Li, Ana Margarida Ramos, Ran Mai

This paper aims to make a comparative analysis of the description of the elderly in Chinese and Portuguese contemporary children's literature. This project falls within the field of literary research, focusing on children's literature, and also within the framework of Age Studies. It analyzes the descriptions of older people in the selected corpus, with a view to reflecting on how the two countries with very different cultures reconstruct the intergenerational relations in literature.

Literary studies

Death in Eça de Queirós life and work - From aesthetics to spirituality

Rui Alvarenga, António Manuel Ferreira

We present the main objectives around a new perspective of the Eca de Queirós work, investigating the specific field of its thematic approach around the representation of death. Structured in four chapters, the project will revisit the influence of Eça de Queirós life path in exploring the theme of death, in its correlations with illness and aging, as well as the connections with the society in which he lived, and hints of a pronounced spirituality.

Literary studies

The road novel in Portuguese literature: Genre and genealogy, modernity and mobility

Eduardo Nunes, Isabel Cristina Rodrigues

My thesis focuses on the study of the road novel genre in Portuguese literature. It tries to trace some of its antecedents as far back as the 19th century, while adressing the genre's suitability to depict modern forms of mobility (namely, automobility). In doing so, it is argued that the road novel becomes a privileged site of reflection around important issues of mobility in our contemporary world.

Literary studies

"Not everything has gone with the wind. The trajectories of the chronicle in the Contemporary Portuguese Literature"

Marta Marques, Isabel Cristina Rodrigues

Taking over, in a symbolic key, the title of a novel whose author combined journalistic activity with literary writing ("Gone with the wind", by Margaret Mitchell), we will try to analyze how the fictional investment of Literature and the colloquiality of Journalism converge in the exercise of the chronicle, a known hybrid genre.

In fact, the contemporary Portuguese chronicle has been a prey to a theoretical-critical silencing that does not do justice to its literary and cultural importance in the last decades of the 20th century, which is why, similarly to what has been done in Brazil, we intend to direct our analytical focus on the chronicle as a type of text, as reactive to the adoption of a stable genological conceptualization as instigating in what concerns to its literary and journalistic representation. We will seek, therefore, to trace the mapping of the contemporary circuits of the chronicle, both from a theoretical and a critical-analytic point of view.

Literary studies

Pierre Menard, The Quixote beyond Cervantes

ALAN SIMOES, ANTÓNO MANUEL FERREIRA

The research is still in a fairly early stage, but significant results have already been found from the Jesuit theology influence, in Miguel de Cervantes and the Philosophy of Michael de Certeau, especially his concepts of "La Fable mystique"

Literary studies

A mente estranha: Imagens da neurodiversidade na narrativa portuguesa e brasileira contemporânea.

Marcos Costa, Paulo Alexandre Pereira

Este trabalho enquadra-se no contexto teórico e metodológico dos Literary Disability Studies e se propõe a revelar os expedientes empregados na crescente ficcionalização da experiência da neurodiversidade nos campos literários português e brasileiro, através da análise comparativa de seis narrativas contemporâneas. Serão, a propósito do corpus selecionado, problematizadas questões como as motivações autobiográficas dos autores e a natureza confessional dos textos, o estatuto e processos construtivos da personagem neurodiversa, ou os códigos socioideológicos subjacentes às opções temáticas ou técnico-discursivas patentes na urdidura textual, por forma a esclarecer os mecanismos de representação ficcional da neurodiversidade, bem como justificar a sua crescente visibilidade na cultura contemporânea.

Literary studies

Design and the materiality of picturebook: a comparative study between Brazil and Portugal

Maria Adriana Silva, Ana Margarida Ramos, Diana Navas

Design and the materiality of picturebook: a comparative study between Brazil and Portugal

This research work will study the importance of the graphic project and the contribution of the materiality of the children's book between the years 2010 and 2019 in Portugal and Brazil, from a corpus of representative works of both literary productions, with an emphasis on the picturebook of single authorship. A comparative analysis of these productions will be carried out at the textual and peritextual level, without forgetting the illustration and graphic design, with a view to highlighting the importance of materiality in the construction of meanings. The corpus of analysis will include works by authors who stood out in the aforementioned decade and who are capable of approximation (by generational affinities, training and artistic practice) based on the criteria used in Comparative Children's Literature such as distinction through awards and mentions relevant, national and international, in addition to critical reception.

Literary studies

Physics MAP-fis

Misinformation Spread in Complex Networks

Guilherme Machado, Gareth Baxter, Ronaldo Menezes

We propose to study the problem of misinformation spreading in social media, from a theoretical stand point. We consider misinformation as a contagion process, spreading through complex networks. We start by analyzing state of the art models constructed for the spreading of diseases, which include competing and mutating strains of viruses. We show how these models may be adapted to the spread of misinformation: mutations are interpreted as changes in the content of a news while it’s spreading, and different news compete for users attention. Later, we study models for complex contagions, which consider the influence of several agents in the transmission of a single contagion (“peer pressure”). In the remainder of the PhD, we will gather empirical data on the spreading of misinformation, from social media users of Reddit and Twitter, which we will model by extending the studied theoretical models.

Physics MAP-fis

Astrophysical Phenomenology of Non-Kerr Black Holes

Jorge Delgado, Carlos Herdeiro, Eugen Radu

A considerable body of evidence supports the existence of black holes (BHs) in the Universe. It is still unknown, however, if the observed BH candidates realize the paradigmatic BH of General Relativity: the Kerr solution.

The next decade promises to shed light on this issue: ongoing observations are mapping the spacetime geometry close to BH candidates with unprecedented accuracy. This evidence will come from i) gravitational wave astronomy, in particular with the LIGO/Virgo detectors; ii) X-ray observations with the next generation of satellites (e.g. ATHENA and eXTP); iii) large baseline interferometry, using the Event Horizon Telescope; and iv) astrometric measurements, using the GRAVITY instrument. These forthcoming experiments make it timely to explore the associated phenomenology for alternative models to the General Relativity BH paradigm.

This is the purpose of this thesis, focusing on the theoretically most well established alternative models to the Kerr solution, both in and beyond General Relativity.

Physics MAP-fis

Studies of C60 fullerene dimerization

Jorge Laranjeira, Leonel Marques, Manuel Melle-Franco

Nowadays materials based on carbon are investigated intensively due to their properties. These properties can be tuned exploring dimensionality and/or using dopants. Our work is focused on studying materials based on carbon obtained from C60 polymerized trough high pressure high temperature treatments. Under pressure C60 molecules bond to each other forming, in a first step, dimers and then polymers. At low pressures, bellow 9 GPa, one-dimensional and two-dimensional polymers are formed with molecules bonding to each other trough 2+2 66/66 cycloaddition. Above 9 GPa three-dimensional polymers are formed using a different bonding configuration between C60 molecules but little is known about these polymers and their molecular bonding schemes. In order to obtain information about how C60 molecules would bond at such high pressures we recurred to Automekin (a quantum chemistry software designed to find reaction mechanisms) to study possible C60 dimers as well as to categorize them energetically between each other. We found out approximately 40 totally new (unreported) hypothetical dimers from which we extracted candidate bonding schemes for 3D polymers. Now we are trying to construct these structures with the objective of characterizing experimental phases.

Physics MAP-fis

The weirdness of water

Fernando Maturi, Prof. Luís D. Carlos, Prof. Carlos D. S. Brites, carlos.brites@ua.pt

Despite its simple molecular structure, water is one of nature's most fascinating and complex substances. Specifically, much has been questioned about the existence of phase transitions in liquid water, which are hard to be observed experimentally. From this perspective, this research aims to demonstrate the anomalous behavior of liquid water through temperature-dependent upconversion luminescence of lanthanide-doped nanoparticles. The use of lanthanide ions such as ytterbium and erbium for doping nanoparticles paves the way for obtaining a thermometer that does not require calibration, which is suitable for investigating the changes in the nanoparticle's medium as a function of temperature. The effects of solvent and the increase of the temperature on the Brownian velocity of nanoparticles allow gathering information on the structure of the hydrogen bonding network of liquid water, which can be the key for the understanding of its anomalous properties.

Physics MAP-fis

Hyperspectral microscopy for intracellular temperature determination

Rodolfo Silva, Luís Carlos, Rute Ferreira

Measuring the temperature at the submicron scale is a crucial task in several scientific investigations in areas of biology, physical and chemical research. In cellular behaviour studies, such as cellular division and cellular death the effect of temperature plays a key role. Luminescent nanothermometers based on trivalent lanthanide ions have become subject of interest due to the combination of sensitivity, spatial and temperature resolutions. Here, Gd2O3:Yb/Er nanoparticles will be used as luminescent upconverting thermometers in different media (water,

culture medium, and MNT-1 cells). Under NIR excitation, the nanoparticles display efficient emission in the visible spectral range, independently of the media, whose relation between the temperature and the thermometric parameter is described by a well-established equation making this a primary thermometer. The emission of the nanoparticles is further studied using hyperspectral microscopy [5]. In particular, the surface of the sample will be mapped at the submicron scale and the homogeneity of the upconversion emission spectra will be quantified.

Physics MAP-fis

Black holes and solitonic objects with bosonic fields

Alexandre Pombo, Carlos A. R. Herdeiro, Eugen Radu

When, in 1609, Galileu first pointed his telescope at the night sky, a wonderful new window for Human understanding unlocked. What he did not know was that what he saw was only ∼ 4.9% of all there is. The remaining 85.1% is the so-called dark sector. Which, up to this day, little known.

Almost 300 years later, in 1915, Albert Einstein developed his theory of General Relativity (GR), and objects so strong that not even light could escape, emerged. Such are known as Black holes (BH), and while they are the most extreme object in the cosmos, they are also the simplest. This simplicity is known as the Kerr hypothesis and states that all astrophysical BHs are described by the Kerr solution, and therefore, completely defined by just two parameters: their mass and angular momentum.

The aim of this thesis is the study of new BH models and gravitational solitons that are allowed by models where bosonic fields occur. In an attempt to not only explain the dark sector but also the future observational data.

Physics MAP-fis

Primary luminescent nanothermometer for temperature measurements reliability assessment

Joana Martins, Luís D. Carlos, Rute A. S. Ferreira

The potential applications in disparate fields led to a rapid evolution of luminescence thermometry. In particular, luminescent thermometry based on trivalent lanthanide ions (Ln3+) has become very popular in the last decade due to the unique versatility, stability, and narrow emission band profiles covering a broad spectral range (from ultraviolet to the infrared) with relatively high emission quantum yields. Nevertheless, the reliability of Ln3+ ratiometric nanothermometry measurements has been recently questioned in a few works reporting fake temperature readouts caused by experimental artifacts and even intrinsic effects. Using upconverting NaYF4:Er3+/Yb3+@NaNdF4@PAA (PAA stands for polyacrylic acid) core-shell nanoparticles, we show how the primary luminescent thermometer concept can be used to correct the thermometric parameter (the intensity ratio (Δ) of the Er3+ 2H11/2→4I15/2 and 4S3/2→4I15/2 transitions) from the interference of the intruding 2H9/2→4I13/2 emission ensuring, thereafter, reliable temperature measurements.

Physics MAP-fis

Atmospheric rivers in the Arctic: from case studies to long-term analysis

Carolina Viceto, Irina V. Gorodetskaya, Alfredo Rocha, Annette Rinke

Recently, significant increase in the atmospheric moisture content has been documented over the Arctic region, which might be explained by the enhanced poleward moisture flux that is expected to continuously increase in the future. This might be caused by several factors, including increased moisture transport intensity. In this PhD we focus on the anomalous moisture transport events confined to long, narrow and transient corridors, known as atmospheric rivers, which are expected to have a strong influence on Arctic mass and energy budget.

This PhD started with the analysis of case studies with anomalous moisture transport, identified as atmospheric rivers, reaching Ny-Ålesund, during the intensive measurement campaigns that took place in Svalbard (North Atlantic) from May to June 2017. We used observational data and multireanalysis products in synergy with regional climate model simulations. Building on these detailed case studies, this work is now being extended to longer time periods from an historical period until present and future. Spatial patterns were analysed for the Arctic latitudes, covering the Atlantic, Pacific, and Siberian moisture transport pathways. Furthermore, we performed a more detailed analysis at different sites north of the Arctic circle. Specific attention was given to the atmospheric rivers characteristics during the Multidisciplinary drifting Observatory for the Study of Arctic Climate (MOSAiC) expedition from September 2019 to October 2020.

Physics MAP-fis

Online-coupled atmospheric-aerosol regional forecast model for solar energy production

Rui Silva, Alfredo Rocha, Ana Carvalho

Solar radiation has been explored for energy usage purposes as a renewable energy source. The installation and running of solar energy systems require a good solar radiation climatology and radiation forecast. Such information has been obtained to a great extent using atmospheric numerical models, but aerosol interaction with radiation and clouds is frequently omitted in these models. However, the radiative forcing of aerosols and clouds can be considerable under particular conditions. It is now established that atmospheric aerosols must be included in atmospheric and climate models to improve numerical weather prediction (NWP) and climate simulations. Despite the existence of studies on the feedback mechanisms related with aerosols, there are still scientific questions to answer regarding their influence on the radiation budget, atmospheric dynamics, and thermodynamics. The work proposed here intends to include the effects of the aerosols in NWP and climate models, by implementing an online coupled atmospheric-chemistry model for the Iberian Peninsula, and hence improve the radiation simulation at the surface for solar energy production.

Physics MAP-fis

Trivalent lanthanides ions for luminescent molecular logic

Sofia Zanella, Carlos António Delgado Sousa Brites, Maria Rute de Amorim e Sá Ferreira André

The evolution of the internet of things, the digitalization to networking is increasing the demand for computing power as a technological challenge. Therefore, the current ongoing belongs to nanostructured materials where a proper structure is obtained by means of bottom-up nanotechnology. In early 90's, the pioneering works of Prasanna da Silva et al. inspired a first general and practical approach to information processing and computing based on molecules able to perform logic operations. Since then, the research field grows studying systems based on organic molecules and exploiting chemical inputs.

Despite it is nowadays recognized that Ln3+ ions can improve the state-of-the-art of Molecular logical devices, only a few works have been reported so far. In mostly of the reported works, the Ln3+ ions respond to chemical inputs and the Molecular logical devices operate exclusively in wet conditions. Nevertheless, physical inputs have several advantages as homogeneity between input and output, reconfiguration, integration, remote control, dry conditions that allow the system to perform cycles of the same logic operations.

Recognizing the potential of molecular logical devices based on Ln3+ ions emission, the goal of this project is to develop molecular logic devices exploiting the optical properties of Ln3+ ions as active computing centres. This work will explore several possibilities focused on physical stimuli that will permit the systems to perform different binary arithmetic operations and even more complex logic operations including the possibility of storing the information.

Physics MAP-fis

Geosciences

The SW Iberia Rifted Margin: Lithospheric Structure, geodynamic processes and seismic hazard

Ricardo Correia, Luis Menezes Pinheiro, Valenti Sallares

The work carried out in this research project has been focused on processing, modelling and interpretation of a coincident wide-angle seismic (WAS) and multichannel seismic (MCS) data collected along NW-SE ~320 km transect, in SW Iberian Margin, located SW of cape São Vicente. The overall objective is to constrain the structure, large-scale boundaries, and petrological nature of the main geological domains of the SW Iberian margin, with the aim to better understand the geodynamic processes that underlie the formation and evolution of this region. The basement affinity of the crustal domains in SW Iberian margin is still a matter of debate. Therefore, contributing with new insights is not only important to better understand the geodynamic evolution of the study area, but also for understanding the earthquakes generation in this region.

We applied joint refraction and reflection travel-time tomography (TTT), using a combination of arrival times identified at both WAS and MCS recordings, to invert for the 2D P-wave velocity (Vp) structure of the crust and uppermost mantle, as well as the geometry of the main structural boundaries identified as seismic reflectors: the top of the acoustic basement and the Moho. Combining WAS and MCS travel-times brings a remarkable increase in the resolution and accuracy of the imaged structure, particularly for the upper layers.

The inverted model shows a Vp structure with abrupt lateral velocity and structural variations, marked by a rough Top of Basement topography and sharp changes in crustal thickness. In the northernmost part of the model there is evidence of mantle exhumation. The Moho shallows beneath the NE continuation of the Horseshoe Basin and the Gorringe Bank, coinciding with the location of the Marquês de Pombal, São Vicente, and Horseshoe thrust faults. The inversion of deep seismic phases reveals the presence of four southwest dipping reflectors and sheds new light into the deep geometry these major regional thrust faults.

The velocity model characterization and crustal affinity interpretation will be complemented with magnetic and gravimetric data modelling, and posteriorly integrated with previous models from this the area, for a broader vision and to properly understand the regional geodynamic evolution.

Geosciences

Petrogenesis of fine-grained granites from the Fornos de Algodres area (Central Iberian Zone) and correlations with the main intrusions from the Viseu-Fornos batholith: Unravelling Variscan tectonic and magmatic processes

Luís Portela, Maria do Rosário Azevedo

Granitic magmatism constitutes one of the main processes of material and heat transfer to the continental crust in orogenic settings.

During the final stages of Variscan collision, involving the oblique convergence between Laurussia, Gondwana and other peri-Gondwanan continental microplates at the end of Palaeozoic, large volumes of granite magmas intruded the Iberian crust (ca. 320 to 290 Ma).

The Viseu-Fornos batholith, located in the Central Iberian Zone, comprises several intrusions of late collisional granites emplaced into Neoproterozoic to Lower Palaeozoic metasediments, immediately after the main Variscan ductile deformation events. Granite types range from porphyritic biotite granites associated with minor bodies of basic and intermediate igneous rocks to biotite-muscovite granites of variable grain-size and highly differentiated muscovite granites. The geochemical and Sr-Nd isotopic compositions of the main granite units lye between those of mantle-derived magmas and crustal metasedimentary rocks, suggesting that granite genesis involved varying degrees of hybridisation between mantle- and crust-derived magmas at depth, followed by fractional crystallisation.

This study focuses the petrogenetic relationships between small plutons of fine-grained biotite and biotite-muscovite granites (Lusinde, Almeidinha, Forcadas, Juncais, Cortiçô, Fuínhas) occurring in the area and the larger intrusions of the batholith. Preliminary whole rock geochemical and Sr-Nd data show that one of the targeted plutons (Lusinde) probably corresponds to a body of intermediate rock of hybrid origin. In contrast, the biotite-rich finer varieties (Almeidinha, Forcadas) appear to represent magma batches derived from feldspar-rich lower crustal sources, whilst the biotite-muscovite granites (Juncais, Cortiçô, Fuínhas), presumably formed through partial melting of mixed metasedimentary crustal sources (Ediacaran-Cambrian metapelites and metagreywackes).

Geosciences

Gerontology and geriatrics

between_generations: intra and inter-generational transmission of health behaviours in families with genetic conditions

Carla Oliveira, Liliana Sousa, Álvaro Mendes, Jorge Sequeiros

Generativity is a task of adulthood centered on the interest in educating and guiding the younger generations. Genetic diseases exist in the family and the processes of genetic transmission are known; however, there is little knowledge about the family transmission of health behaviours, particularly about the role of older generations. This project aims to deepen the knowledge about the role of older generations in families with genetic diseases (Huntington's disease and Paramyloidosis), considering generativity, in general, and health and risk management behaviours, in particular. A mixed methodology is adopted: i) generativity (quantitative): Loyola Generative Scale applied by questionnaire and ii. health

management behaviours (qualitative): Critical Incident Technique. The results are relevant to know the developmental tasks of older members in these families; and understanding family influences that facilitate or hinder disease management.

Gerontology and geriatrics

Feeding difficulties in institutionalized people with dementia: a social-ecological approach

Lígia Passos, Daniela Figueiredo, João Tavares, Melissa Batchelor

Abstract: Dementia is a chronic/progressive syndrome characterized by the deterioration of cognitive function and the ability to perform activities of daily living, beyond the expected in primary aging (1). In advanced stages, people with dementia may have feeding difficulties, usually manifested by oropharyngeal dysphagia, low food intake, refusal to eat and aversive behaviors (2). It has been increasingly recommended that feeding difficulties can be reduced by applying a social-ecological approach to care (3), such as the C3P Model – Change the Person, Change the People, Change the Place (4). However, evidence on the effects of such model remains scarce.

Therefore, this project aims to develop, implement, and evaluate an intervention program, based on the C3P Model, for people with dementia with feeding difficulties in nursing homes. Institutionalized people with dementia and nursing assistants will be involved. It is expected that the intervention will improve the feeding practices in nursing homes, as well as the nutritional status and well-being of people with dementia.

Keywords: feeding difficulties, person with dementia, social-ecological model, intervention, long-term care; nursing homes

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Gerontology and geriatrics

Technology-mediated dance intervention in older adults with mild cognitive impairment: impact on cognitive and physical functioning

Pollyanna Stefane, Anabela G. Silva, Oscar Ribeiro

This project aims to add to the available knowledge on technology-mediated dance intervention by conducting 4 studies: i) a systematic review on technology-mediated interventions, including dance, for cognitive and physical functioning; ii) a feasibility pilot study followed by iii) a randomized, controlled, single-blind trial to assess the effectiveness of using a dance intervention mediated by a dance mat on the cognitive and physical functioning and iv) a secondary analysis of data from this trial to determine factors associated with the intervention's clinical success. All studies include individuals with MCI. The overall results will inform clinical practice and further research.

Keywords: Technology; dance; older adults; cognition; physical activity.

Deprescribing în the Elderly

Anabela Pereira, Óscar Ribeiro, Manuel Verissimo

The number of multimorbid older people with polypharmacy has increased significantly with the augment in longevity. Polypharmacy in older people can or cannot be appropriate. Polypharmacy is associated with several adverse health outcomes, including the risk of falls and falls, adverse drug events, changes in physical function and cognition [1], fragility [2], and mortality [3]. The prevalence of polypharmacy in Portugal based on the SHARE study is 36.9%, the highest in Europe [4], which means that probably there is a high prevalence of potentially inappropriate medication (PIM).

Deprescribing is the process of withdrawing an inappropriate medication, supervised by a doctor to control polypharmacy and improve health outcomes [5]. Deprescribing interventions are safe and effectively reduce inappropriate drugs in the elderly [6-8]. Deprescribing forces a change of behaviour, namely the behaviour of medical prescription and the patient's greater involvement [9]. It is a complex process influenced by multiple factors, facing several barriers to its implementation. The attitudes and perspectives of physicians and patients towards deprescribing are the most frequent barriers encountered.

The main objectives of our research project are to study the Portuguese physicians' and patients' or caregivers' attitudes and perceptions towards deprescribing.

To assess physicians' attitudes and perceptions toward deprescribing, we use semi-structured interviews with the opinion leaders in the area; focus group with physicians that are specialists in general and family medicine and geriatric medicine; online questionnaire for Portuguese physicians enrolled in the Portuguese Medical Association.

To study patients' attitudes and perceptions towards deprescribing, we performed the translation, cross-cultural adaptation and validation of the rPATD (revised Patients' Attitudes Towards Deprescribing) questionnaire, both the patient's version and the caregiver's version [10]. We will investigate the relationship between patient agreement with deprescribing and other variables, such as sociodemographic characteristics, the number of medications, trust in the physician, self-reported health status, comorbidities, health literacy and medication expenditure.

Preliminary results:

So far, 190 people aged 65 and over are included, selected by convenience sampling in outpatient rehabilitation clinics. The mean age is 73.22 years (STD +/-6.38), predominantly women (66.8%), 93.3% are retired. The level of education is low, with 66.7% have completed primary school (four years) and 9% less than primary school. The Self-reported health status is reasonable for the majority (72.7), good for 14% and very good for 2.3%. The vast majority manage their medication alone (91.8%). Overall, 90.4% of the participants are satisfied (58.8%) or very satisfied (31.6%) with their current medication. Still, a significant number of patients, 82.9% (40.1% agree, 42.8% strongly agree), are willing to stop one or more of their medications if their doctor said it was possible. These results are similar to the results published internationally using the rPATD questionnaire.

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Vocal Aging: Acoustic and articulatory study of speech changes with age

Luciana Albuquerque, Catarina Oliveira, António Teixeira, Daniela Figueiredo

Este estudo pretende analisar as alterações de fala com a idade, tanto a nível segmental como suprasegmental. A nível segmental pretende-se caracterizar as vogais orais do Português Europeu (PE) produzidas por indivíduos saudáveis de várias idades e géneros, através de dados acústicos e articulatórios. A nível suprassegmental, o objetivo é estudar os efeitos da idade e do género nos parâmetros acústicos (e.g., ritmo e entoação) em fala espontânea.

Um conhecimento mais aprofundado destas alterações será essencial para uma intervenção terapêutica mais eficaz por parte dos profissionais que lidam com as alterações vocais decorrentes do envelhecimento, permitindo, desse modo, realizar um diagnóstico diferencial. Para além

disso, os atuais sistemas de reconhecimento de fala não funcionam adequadamente com alguns segmentos da população, porque os modelos acústicos são, normalmente, treinados usando fala de jovens adultos, sendo fundamental conhecer as características acústicas da fala de idosos.

Gerontology and geriatrics

Recommendations of good practices for the prevention of aspiration pneumonia in older adults at risk of oropharyngeal dysphagia

Joana Santos, Maria da Assunção Coelho de Matos, Óscar Ribeiro, Luis M. T. Jesus

Aspiration pneumonia (AP) is a frequent cause of morbidity and mortality in the older population. Oropharyngeal dysphagia (OD) is one of the risk factors for AP and can also lead to malnutrition and dehydration. Both have a multifactorial etiology and need multidimensional intervention approaches. Formal intervention plans have shown the potential to reduce the risk of AP; however, in Portugal, studies on OD are still scarce and there are no validated recommendations for the prevention of AP. It is intended to develop, validate and implement good practice recommendations for the prevention of AP in older people at risk of OD, using the Delphi method and the creation of an educational program to train formal caregivers in nursing homes. Its ultimate aim is to contribute to improving the quality of healthcare in this setting and to the safety and quality of life of its users.

Gerontology and geriatrics

Gerotranscendence and Well-being in Institutionalized Older Adults

Taiane Abreu, Lia Araújo, Oscar Ribeiro, Laetitia Teixeira

Gerotranscendence is an adaptive aging theory that postulates about a mindset shift that occurs in late-life and it is associated to wisdom and life satisfaction. Despite this positive associations, the concept of gerotranscendence remains abstract and complex. The aim of this project is to clarify the concept of gerotranscendence and to explore its usefulness as an intervention program for institutionalized older adults. This populations presents high prevalence of emotional distress, and with COVID-19 pandemic, there are even lower levels of well-being. Therefore, in an specifically way, this project incorporates (a) the literature review with a conceptual analysis of transcendent theories and a systematic review on gerotranscendence interventions to understand their precepts and benefits; (b) the access the gerotranscendence construct through the validation of the Portuguese versions of two international assessment scales of gerotranscendence; (c) the development, implementation and evaluation an intervention program based on gerotranscendence for institutionalized older adults; and (d) the formulation of a guide with recommendations based on the conclusions of the project for professionals working in the field of aging.

Gerontology and geriatrics

History of sciences and scientific education

A Perspective on the Brazilian Scientific History: the creation of the Brazilian Society for the History of Science

Luiz Neto, Dra. Isabel Malaquias

The Brazilian Society of the History of Science (SBHC) is used to understand the real value such scientific institution has in the Brazilian context. Therefore, the aim is to research the genesis of this scientific institution, its historical path, the relationship with other scientific institutions and the people who were fundamental to its creation and development. In this way, to understand the Brazilian scientific context, as well as, the importance of a scientific society focused on the study of science history. Document surveys are being carried out on: the creation of the Brazilian Society of the History of Science (SBHC), and the journals fostered. Several interviews (a total of 6 idealized interviews, and already carried out) with some current and old direction members have been conducted, trying to reach their reflection on what were the aims for the SBHC, their motivation and importance, considering the different Brazilian temporal contexts (social, political, economic ...); and having in mind that such an institution is a space for debates on the history of sciences and may foster the (re) construction of broad perspectives in the over time.

History of sciences and scientific education

Roots of Constructive Geometry in Science and Arts

Parisa Kharazmi, Supervisor: Prof. Dr. Helmuth R. Malonek

Several applications of geometrical constructions can be found in Architecture and Arts, guides for craftsmen, practical tools for measurements, and the use of history of mathematics in education.

The recent research was dedicated to a particular transmission problem of constructive methods in polygonal geometry from the Orient to the Occident. We focused on the work of the worldwide known Renaissance artist Albrecht Dürer (1471-1528) because his contribution to the construction of polygons was neglected in a recent detailed publication on the transmission problem.

History of sciences and scientific education

And Galen crossed the Atlantic. The syncretism of Luso-Brazilian medical practices and knowledge (1500-1650)

Marion PELLIER, Pascal BRIOIST (supervisor), António Andrade (supervisor)

The purpose of this thesis is to study of the mutual impregnation of Portuguese and "Brazilian" medical theories and practices in the 16th and 17th centuries. It aims, more precisely, at underlying the roles developed by the Lusitanians and indigenous people in the possible elaboration of a unique medical and medicinal knowledge at the crossroad of the two civilizations. This question stays without a precise answer for the long 16th and 17th centuries. We finally concluded this year that what we call the "tryptic business-conquest-religion" was the best resume for the Luso-Brazilian medical case. Science and innovation were here at the service of colonization and evangelization during those times of trouble. We think here, for example, about the Jesuits grabbing the local medical and medicinal knowledge in order to replace the societal pillar that shamans are and to, ultimately, acculturate indigenous people.

History of sciences and scientific education

Information and communication in digital platforms

Infocommunication management of Social Communicacion System of Brazilian Federal Prosecution Service

Allana Albuquerque, Telmo Silva, Jorge Ferraz

The main objective of this research is to present an infocommunicational management model aimed at analyzing the efficiency and effectiveness of the Social Communication System of the Brazilian Federal Prosecution Servic. This is a descriptive-exploratory study, which identifies and describes information flows structured by the use of digital platforms. It involves qualitative and quantitative analysis, which portray the types of platforms, the infocommunicational skills of communication professionals, the structure, governance and communication flows capable of defining infocommunicational management.

Information and communication in digital platforms

Inclusão digital em comunidades rurais no estado do Ceará: diretrizes para sustentabilidade em projetos sociais com mulheres.

Rossana Moura, Maria João Antunes, Elmira Simeão

A COVID-19, veio para dividir o mundo de "antes" e o de "depois" da pandemia. Com o aparecimento da nova doença e os novos comportamentos de isolamento social, as Tecnologias de Informação e Comunicação passaram a ter um papel mais importante ainda, principalmente em

comunidades isoladas e de difícil acesso. Portanto, esse estudo busca contribuir com o meio rural brasileiro na construção diretrizes que subsidiem, uma agenda pública, de Projetos de inclusão digital e social para mulheres residentes em comunidades rurais.

Para concretizar esse estudo, primeiro será preciso conhecer o contexto sócio cultural das comunidades rurais, a forma como vivem e se relacionam. Para essa fase utilizaremos a pesquisa Documental em órgãos oficiais do Governo Federal, estadual e municipal e também informações contidas em dissertações de mestrado e teses de doutorado.

Após esse processo e com conhecimento prévio das comunidades, passaremos a identificar as necessidades de acesso à informação e comunicação por meio de Grupos Focais e questionários (poderão vir a ser online) e será com aproximadamente 15% da população de cada comunidade escolhida. Num segundo momento, será utilizado a pesquisa bibliográfica para comparar os principais projetos de inclusão digital e social internacionais, do Brasil de comunidades rurais do Ceará buscando variáveis que possam mostrar diretrizes de sustentabilidade. (apontados como aqueles que contribuíram para o sucesso, ou desafios dos projetos.)

Ainda no sentido de identificar variáveis de sucesso, será feito entrevistas, com coordenadores dos projetos identificados e selecionados. O método proposto para a análise de dados recolhidos do questionário aplicado será descritivo e aos dados recolhidos das entrevistas e grupo focal será análise de conteúdo.

A partir de analisados o conjunto de informações e dados, será esboçado uma primeira versão de diretrizes de sustentabilidade. No segundo momento e após analisar projetos de inclusão digital na perspectiva das mulheres e identificar as "diretrizes" que melhor se adequam ao modo de vida dessas mulheres, será elaborado a versão final da proposta de diretrizes que venham a subsidiar políticas públicas em Projetos Rurais de Inclusão Digital e Social.

Information and communication in digital platforms

Personal Data Protection by Legal Design: a communication centered on informed and unequivocal consent

Larissa Oliveira, Maria João Antunes, Isabel Fortuna

The right to know which of our personal data is collected and stored, as well as for what purpose it is used, is guaranteed by the Principle of Transparency, one of the pillars of the Personal Data Protection regulation and other laws inspired by it, including the Brazilian. Faced with a scenario of debate on the implementation of the Regulation, this work intends to present, as its main result, a prototype of a digital platform to support the understanding of the terms of consent for all personal data through a plain language that returns informational self-control to the holder of the personal data.

Information and communication in digital platforms

Location based-games and active ageing: the pokémon go study in seniors´ life

Jesse Filho, Ana Isabel Veloso

Digital and mobile technologies have been increasing as a part of people's everyday's life and these have brought them ways to improve their daily life, for all ages and in many different sectors, including health, safety and participation, the pillars of active aging in society, as the World Health Organization (2002) points out. The elderly have taken advantage of the use of technologies and there is an on-growing research around this, but there are few studies about the use of digital games, especially those that use geolocation as the game mechanics. In this way, the goal of this study is to verify the potential of location- based mobile games to engage players over 50 years of age and lead them to active aging.

A similar bibliographic and research study similar to this one, surveys made in Portugal and participant field observation with Pokémon Go players over 50 years old who live in the city of Porto are the main data collection instruments used in this investigation.

Through a mixed methodology, quali and quanti data with the goal of clarifying what has been discovered about a recent filed are analyzed to answer whether these types of games in fact enhance active aging.

The field observations occurred both during the moments of interaction of the target audience with the games and on social networks, since there is no communication channel in the game itself. Both at national and local level, the data indicates that the players' experiences and the level of immersion they feel when interacting with games in this category present greater actions with the same bases as active aging, namely: health, participation, security, education, socialization and well-being, which are enhanced by the most diverse game mechanics, and mainly those related to location-based games, which establish strong relationships between the subjects and the environment, and especially in maintaining the intrinsic motivations of each subject in search of active and healthy aging.

Information and communication in digital platforms

Participatory methodologies in the creation of a Web documentary with the community of Bairro Herculano

Inês Santos Moura, Vania Baldi

The context of the present research is the urban community of the "ilha" Herculano Neighbourhood, that was built between 1880 and 1886, located in the city centre of Porto. The term "Ilha" is used to describe a set of small houses that were built for the working class in the late years of the 19th century (Pinto,2007). In this research it was intended to reflect on audio-visual methodologies as participatory video, photo elicitation, and their use for the co-production of a multimedia narrative about and in collaboration with the Herculano community. It was aimed to generate contexts that would provide visibility to the inhabitants of this community, placing them in the position of "actors" who are protagonists of the representation of their reality. All these participatory and audio-visual methodologies produced multimedia contents that are being used for a co-production of a Web documentary.

Information and communication in digital platforms

THE PROMOTION OF EMPATHY THROUGH PROACTIVE BEHAVIOURS IN INTELLIGENT ASSISTANTS FOR INTERACTIVE TELEVISION

Tiffany Marques, Jorge Ferraz de Abreu

The integration of intelligent assistants in the television ecosystem has been simplifying the accomplishment of tasks, such as the research of contents by the name of actors. However, despite their growing adoption, it can be seen that these assistants are restricted only to merely reactive behaviours and have a rather human and empathetic dimension towards the users. However, in other application domains, there has been the integration of proactive behaviours, which can counteract these barriers and, consequently, improve the respective User Experience (UX). It is precisely in this context of proactivity that this research project is designed, whose main purpose is to study which proactive behaviours can be integrated into an intelligent assistant for Interactive Television (iTV) in order to promote its empathy, improve the associated UX and, consequently, its adoption in a more fluid and massive way. It is thus intended to contribute to the advancement of intelligent assistants in the iTV domain.

Given the exploratory nature of the research, an empirical study will be conducted using the development research method. This will be combined with a user-centred design approach, which will follow an iterative design process, where it is intended to conceptualise, prototype and evaluate a set of proactive scenarios in order to promote empathy and enhance the UX of an intelligent iTV assistant. In addition, the prototyped scenarios will represent relevant contexts of use of a proactive intelligent assistant for iTV in the home environment.

Information and communication in digital platforms

STRATEGY TO SUPPORT THE CREATION OF DIGITAL GAMES BY YOUNG ADULTS TO PROMOTE ENVIRONMENTAL AWARENESS

Tanira Suandique, Pedro Beça, Monica Aresta

Illustrating to young people the extent to which human attitudes interfere with the well-being of terrestrial and marine species has been one of the objectives of several environmental organizations such as the United Nations Environment Program, the World Commission on Environment and Development, among others. However, there is a need to make this illustration through mechanisms that facilitate the retention of attention, and the enthusiasm during this learning, hence the need to have playful elements as facilitators of this process. Among the ludic activities, the digital game has been used more and more as a means for information transition, and above all to influence and change behaviors. Making young people create digital games around marine litter with emphasis on plastic pollution and developing them by visual tools, is believed to be a much more engaging mechanism that will boost knowledge and behavior change in relation to this theme. The work focuses on developing and validating a tool to support the creation of digital games to promote environmental awareness, targeting young adults in higher education in the city of Pemba, Cabo-Delgado province, northern Mozambique

Information and communication in digital platforms

THE SCHOOL LIBRARY IN THE DIGITAL AGE: PROPOSAL OF AN INFOCOMMUNICATION MODEL

Maria José Fonseca, Prof. Doutor Óscar Mealha

We have seen constant changes in the way information is accessed in the new media, we question the role of the school library in monitoring and preparing its users (students) for the changes in information environments. The thesis in progress focuses on the possibility of the school library being able to (re)define its infocommunication processes to foster new learning opportunities for students through smartphones in a "phygital" plan. The relationship of proximity of the researcher to the context provides a case study focused on the individual and with feasibility conditions. The research takes place in the natural environment, the school library, targeting students from the 5th, 7th and 9th grade, teachers and families of the host school of the D. Maria II Schools Group in Vila Nova de Famalicão, intending to understand this case, this situation and this context. We consider it necessary to act, supported by the infocommunicational paradigm, fostering safe, contextualized and timely changes.

Understanding the library within the education ecosystem, what conditions it has, how access to information and communication is processed, and how it is possible to create learning environments that are more intuitive, fast, attractive and rewarding in a just-in-time, anytime, and anywhere concept. We hope to present a redefinition of the infocommunication processes in the school library. Develop a research process supported by user (eXperience), mediated by the smartphone, which contributes to the area of information and communication and is applied in the specific context of education.

Information and communication in digital platforms

Heuristic model of a public health dashboard for citizen engagement in smart cities

André Branco, Óscar Mealha, João Marques

The relevant aspects of the United Nations new urban agenda refer to the info-communicational challenges of a city to be able to provide citizens with greater knowledge of their reality and how to involve them as a participant in the place. Cities have used dashboards with infographics and technologies to support politicians and experts. This research has the following question: What characteristics should a public health indicators dashboard for a smart city have to generate greater engagement of people? The investigation is qualitative in nature and will be guided by an inductive process. We will use the seven stages of scientific investigation in social sciences by Marquet&Quivy(2019) as a methodology. The research aims to propose an innovative heuristic model of open data indicators applicable to public health, that uses the available technologies of a smart city at the service of citizens and achieves greater engagement of citizen in response to their wishes, interests and needs. The COVID-19 contingency is a unique moment to validate the citizen-centric paradigm. The people-centric approach evidence highly empirical data that will be necessary to provide the heuristic model and establish the best indicators for the corresponding infocommunication processes. As results, we have the heuristic model of indicators, the associated process to arrive at the indicators and a prototype of a medium-fidelity of citizen dashboard, as a technological tool, for validation of indicators in the field. It is also expected to obtain greater citizen engagement in the territory and improve the relationship of information and communication between the citizen, the territory and its public agents. A smarter territory is achieved with a greater engagement of this citizen in the search for common well-being solutions and to make the city more inclusive and participatory.

Information and communication in digital platforms

Effective infocommunication processes on digital platforms for sustainability marketing

Loredana Kotinski, Prof. PhD Óscar Mealha, Profa. PhD Belém Barbosa

The proposed research is about how the messages of a sustainable world are presented on digital platforms through sustainability marketing and which of them are, in fact, effective in the task of promoting sustainability awareness among internet users.

The aim is to understand which infocommunication processes on digital platforms are effective for sustainability marketing. And the relevance of answering this question lies in the fact that you need to communicate effectively to effectively promote change.

Therefore, a survey based on the concepts of infocommunication, digital platforms and sustainability marketing is presented here. And whose interest is in how this infocommunication takes place on digital platforms, more specifically on social networks Facebook and Instagram, widely used by advertising, journalism and public relations.

Information and communication in digital platforms

Precaution and perception of online aggressions: infocommunicational behavior in the face of the risks at the Portuguese university level

Eliza Oliveira, Vania Baldi

O uso das tecnologias digitais é cada vez mais intenso e amplo. Todavia, a tal incremento acompanha-se também, em 2019, um aumento significativo de jovens portugueses envolvidos em ciberagressões. À medida que as políticas públicas e intervenções sociais tentam diminuir o número de vítimas, as agressões online trazem incomensuráveis repercussões negativas aos jovens envolvidos. Assim, identificar quais os perigos que constituem os maiores riscos relacionado às ciberagressões, analisar os contextos causais, bem como as dificuldades à sua precaução, pode direcionar a elaboração de políticas abrangentes e eficazes no âmbito nacional. A proposta desta investigação é compreender como os jovens portugueses percebem os riscos associados às agressões online e verificar quais são os comportamentos de precaução face a tais riscos. Os dados serão recolhidos junto aos universitários, pois representam a franja social que mais utiliza as tecnologias digitais, permanecendo constantemente expostos aos riscos de experienciar diretamente ciberagressões.

Information and communication in digital platforms

Infocommunication and digital platforms in the sharing economy: a multicases study about the trust in sustainable contexts

Raissa Sales, Vania Baldi, Ana Carla Amaro

The research aims to analyze experiences of sharing of goods and services digitally mediated and to propose good practices in the scope of the collaborative culture and economy in the network. It is intended to investigate experiences of sharing between those who offer to work without monetary remuneration, in a context where they want to acquire certain skills, and who make available their knowledge and social space to effect such learning. We look at the emergence of trust and shared interests between volunteers and hosts in the use of digital platforms and experiences in skills and work knowledge. Thus, we design a model based on the e-infocommunicational behaviors of these users and the consequent experiences. This construct will be based on a set of proposals for the success of sharing practices. It is expected, in the face of a collaborative ethos, to foster a participatory culture of good digital and cultural practices, fostering the intersection between academic discussions, the policies of the analyzed platforms and interested institutions.

Information and communication in digital platforms

Computer science MAP-i

Compression-based Tools for Non-Symbolic Data

João Carvalho, Armando Pinho, Susana Brás

Data compression models have been used to address several data mining and machine learning problems, usually by means of a formalization in terms of the information content of a string or of the information distance between strings. This approach relies on solid foundations of the concept of algorithmic entropy and, because of its non-computability, approximations provided by data compression algorithms. Data compression algorithms are symbolic in nature. Text and DNA sequences are well-known examples of symbolic sequences, with well-defined associated alphabets. Contrarily, speech, ECG or images of faces, to name a few, need to first be transformed into symbols, usually through sampling and quantization, before data compression can be applied. Early attempts to conciliate compression-based data mining and machine learning with non-symbolic data relied on the sax representation. Notwithstanding, many problems still lack satisfactory solutions, for example, how does time or space and amplitude changes of scale influence the performance of the data mining and machine learning algorithms and, how should they be performed in order to maximize the results. The challenges are even bigger in the case of multi-dimensional data (some attempts have been made regarding this research front, although at a very preliminary level. The main goal of this PhD research project is to explore alternatives to data representations, such as sax, aiming at increasing the performance of compression-based data mining and machine learning problems involving non-symbolic data. As testbed application, we will focus on ECG. The idea is to use the compression-based measures to compute similarities between segments of ECG, aiming, for example, at distinguishing different subjects. Clearly, this is a difficult problem, due to the high variability in the ECG of individuals along time, as well as to the acquisition conditions.

Computer science MAP-i

Extraction and Access to Information in Natural Language for Non-Developers - Democratizing Information

Emanuel Matos, Antonio Teixeira, Mario Rodrigues, Liliana Ferreira

Initial steps and results from Extraction and Access to Information in Natural Language for Non-Developers.

Computer science MAP-i

Multimodal Content Fusion For Modelling Patient Trajectories

João Silva, Sérgio Matos

For years, technology advancements have been applied in health care with the goal of preventing, diagnosing and treating diseases, as well as improving the quality of life of the general population. More recently, the increasing availability of medical data opened opportunities for the development of better technological solutions to help doctors in patient follow-up, clinical management, and decision making.

These solutions could benefit from exploring the multimodality of medical data, which comprise information from numerous sources such as EHRs, medical imaging and omics. However, incorporating these data sources is a challenging task due to their complex and heterogeneous nature. Moreover, certain data sources can be particularly challenging to explore, for instance EHR data which contain valuable text information stored as unstructured data.

This PhD aims to investigate solutions that can lever EHR data, extracting relevant information stored as unstructured data in EHRs, and that can combine multimodal clinical information to model patient trajectories. In this work, we will explore the potential of Deep Learning approaches to address the problem of multimodal content fusion.

Computer science MAP-i

Planning and Learning for Games

Fernando Duarte, José Nuno Panelas Nunes Lau, Artur José Carneiro Pereira, Luís Paulo Gonçalves dos Reis

Automated Planning and Reinforcement Learning are two successful areas of research in Artificial Intelligence. There are however application scenarios were these approaches cannot be directly applied. Despite the many differences between these two different methodologies, Automated Planning and Reinforcement Learning share some similarities and often try to solve similar problems. This fact has led researchers to propose techniques to integrate them in order to improve their efficiency. Games have been a popular domain for the study of Artificial Intelligence, since its beginning. Board games in particular were heavily used in the early days of Artificial Intelligence due to the formal and highly constrained, yet fairly complex decision making environments they provide. More recently, video games have gained a lot of attention. In fact, Game Artificial Intelligence, the study of Artificial Intelligence in games and for games (video games in particular), has become a fast growing research field on its own right, with several dedicated conferences and even a dedicated journal. Ensuing the path opened by these previous research efforts, this work proposes to implement techniques to integrate Automated Planning and Reinforcement Learning in the context of games. The objective is to leverage planning techniques to improve learning and conversely, leverage learning techniques to improve planning. The outcome of this research will be a framework integrating all the techniques implemented. Ultimately, this framework may be leveraged by other researches in the field.

Computer science MAP-i

Querying and Visualization of Semantic Data

Arnaldo Pereira, José Luís Oliveira

Over the years, a growing number of semantic data repositories have been made available on the web. However, this has created new challenges regarding how to exploit these resources efficiently. Querying services, such as SPARQL require knowledge that is beyond the typical user's

expertise. The use of natural language interfaces can facilitate access to semantic data. But this problem is far from being solved and remains a very challenging topic.

Computer science MAP-i

IoT technologies for animal grazing and posture control

Luís Nóbrega, Pedro Gonçalves, Paulo Pedreiras

The unwanted and adverse weeds that are constantly growing in vineyards, force wine producers to repeatedly remove them through the use of mechanical and chemical methods. These methods include machinery such

as plows and brushcutters, and chemicals as herbicides to remove and prevent the growth of weeds both in the inter-row and under-vine areas. Nonetheless, such methods are considered very aggressive for vines, and, in

the second case, harmful for the public health, since chemicals may remain in the environment and hence contaminate water lines. Moreover, such processes have to be repeated over the year, making it extremely expensive and toilsome. Using animals, usually ovines, is an ancient practice used around the world. Animals, grazing in vineyards, feed from the unwanted weeds and fertilize the soil, in an inexpensive, ecological and sustainable way. However, sheep may be dangerous to vines since they tend to feed on grapes and on the lower branches of the vines, which causes enormous production losses. To overcome that issue, sheep were traditionally used to weed vineyards only before the beginning of the growth cycle of grapevines, thus still requiring the use of mechanical and/or chemical methods during the remainder of the production cycle.

To mitigate the problems above, a new technological solution was investigated under the scope of the SheepIT project and developed in the scope of this thesis. The system monitors sheep during grazing periods on vineyards and implements a posture control mechanism to instruct them to feed only from the undesired weeds. This mechanism is based on an IoT architecture, being designed to be compact and energy efficient, allowing it to be carried by sheep while attaining an autonomy of weeks.

In this context, the thesis herein sustained states that it is possible to design an IoT-based system capable of monitoring and conditioning sheep's posture, enabling a safe weeding process in vineyards. Moreover, we support such thesis in three main pillars that match the main contributions of this work and that are duly explored and validated, namely: the IoT architecture design and required communications, a posture control mechanism and the support for a low-cost and low-power localization mechanism. The system architecture is validated mainly in simulation context while the posture control mechanism is validated both in simulations and field experiments. Furthermore, we demonstrate the feasibility of the system and the contribution of this work towards the first commercial version of the system.

Computer science MAP-i

Robust, Agile and Versatile Humanoid Locomotion Based on Analytical Control and Learning Residual Physics

Mohammadreza Kasaei, Nuno Lau / Artur Pereira, nunolau@ua.pt

we have been developing a modular locomotion framework for humanoid robots which is composed of a set of planners and controllers so that connected hierarchically to reduce the complexity and increase flexibility. This framework is combined with a reinforcement learning module to regulate the walk engine parameters adaptively and generates residuals to adjust the robot's target joint positions (residual physics). Particularly, our contribution is a biped locomotion framework composed of two major components --- an analytical planner and controller; and a fully connected neural network. The former is responsible for optimally controlling the overall state of the robot based on an abstract dynamics model. It is also responsible for generating reference trajectories using dynamic planners with genetically optimized parameters and overcome uncertainties up to a certain degree. The latter component --- a fully connected network --- is optimized with reinforcement learning to control the arms residuals, and the COM height of the robot, thus improving the upper body efficiency, adaptively updating the planners' parameters and controllers' gains as well as the constraints which impacts the overall stability and speed of the robot. We believe that using machine learning on top of analytical approaches is the key to open doors for humanoid robots to step out of laboratories.

Computer science MAP-i

Marketing and strategy

FEEDING EUROPE, THE PORTUGUESE GEOESTRATEGIC POSITION AND THE LOGISTIC GAINS, OPPORTUNITY FOR THE NEXT QUARTER

Eduardo Couto, Borges Gouveia, António Moreira

Food is a vital element for humanity existence and like air and water, any animal life, also human kind, need food as an essential for its survival. In modern age, food become mass-produced and transported around the entire globe, looking for the best productivity, searching ideal clime, available good soils and water. Heavy logistics and international trade, made food travel thousands of miles to reach our plate in another corner of the globe. Today large volumes of resources are dedicated for food production, transformation and distribution, so a vast quota of world global economy is taken by food business. The research work showed that the medium weighted agriculture production latitude of the world is coming down to south. Seaborne trading and logistics is feed currently feeding continents, volumes grow, and vessels are every day bigger. In the Atlantic front of the European Continent, may other destinations ports arise for a better efficiency of the logistics and time to market? Should we challenge the actual "status quo" of the international logistics systems to receive food commodities in Europe? The research work showed how this reality could be observed, interviewed some world leaders in grains and seeds commodities trade, international logistics and Ports administration, representing a broad spectrum of leaders across the EU, America and Portugal. We must recognize that a qualitative approach may be intensive, complex, expensive and time consuming, but it is rich in details and revealing in new ways to explain a complex future vision of such research questions.

Marketing and strategy

GIG ECONOMY PLATFORMS: A FIRST STEP TOWARDS ENTREPRENEURSHIP INTENTION

Bruno Carvalho da Silva, Dr. António Carrizo Moreira

The emergence of digital platforms has spawned a diversity of business models using the gig economy (GE) as the main structural basis. Philosophically accessed for the intermediation of peers in a short-term contract, sharing product or services, this matter has been largely associated with sharing economy and collaborative economy. Therefore, after an analytical literature review, focused on investigating how such platforms, promoting an individual independence appeal, affects the entrepreneurial activity, it was noticed two recurrent discussions in the agenda: (1) the establishment of a new neo-liberal capitalist scheme, creating a hegemony of market control based on tax evasion and exemption from responsibility over the worker and her/his service offered, to reduce costs; and, (2) the proposal of managerial autonomy for the individual, contributing to the empowerment of entrepreneurial knowledge/experience through this ecosystem, providing an alternative professional path for her/his wellbeing. To this end, studies on what motivates the adoption of such platforms have been proposed, following a critical nature based on concepts rarely empirically tested. However, to make an evident contribution to the discussion, this work investigates through 14 hypotheses interposed in a model of intent to entrepreneurship, if there is an eventual propensity to entrepreneurship on the part of individuals who are adopters of GE digital platforms. In sum, investigating which are the main factors on the relationship between GE worker, as a nascent entrepreneur, and GE platform, as resources constraining solution, that supports the orientation and intention towards venture creation. The research is supported by a mixed approach with quantitative questionnaires distributed online, composed of 10 constructs and 41 items adapted from behavioural and psychosocial theories of entrepreneurship intention models (Theory of Planned Behaviour - TPB and Shapero Entrepreneurial Event model - SEE) and in-depth interviews based on entrepreneurial orientation dimensions. The objective is to summarize the theoretical contributions and the practical implications to help scholars and practitioners on the development of structured policies and actions to empower the role of the individual towards entrepreneurship. Furthermore, contributing not only to self-development but also to social welfare.

Marketing and strategy

Developing and Validating a New Measurement Instrument

Denise Haller, Professor Doutor António Moreira, Professor Doutor Nuno Fortes

Researchers frequently study complex studies and need rigorous, valid and reliable measures. Despite of the existence of many measures with known psychometric properties, that can be used in empirical studies, sometimes researchers may need to develop a measure for a new construct because of the lack of scales to operationalise it. Our research in progress presents an approach to the process of constructing and validate a scale, to measure a new construct "Third parties support to ebusiness", which is related to IS studies. We describe briefly the multi-stage development process for the creation and validation of a new instrument, and highlight some findings of our study to assess the Content Validity.

Keywords: IS research methods, scale development and validation studies, measures, psychometrics, content validity.

Marketing and strategy

Family Wine Tourism:Experiences and challenges for holidays with children in wine destinations

Rafaela Malerba, Elisabeth Kastenholz, Maria João Carneiro

The lack of child-friendly activities is reported as a constraint for wine tourism, while some studies identify families as a significant potential segment for this activity. On the other hand, in different destinations, some wineries and cellar doors already offer services and experiences suitable for family and children interests. Hence, this research aims to understand the experiences of family tourists in wine destinations and the related opportunities and challenges faced by wineries managers, filling a gap in the scientific literature about the family wine tourism market. Through a mixed-methods approach, it intends to: describe services and experiences offered by family-friendly wineries in different countries, in terms of proposed benefits, activities and restrictions; analyse the perceived benefits, the dimensions of the experience and the determinants of satisfaction expressed on online reviews about family-friendly wineries; explore the influence of the presence of children in the behaviour and experiences of adult family wine tourists visiting Bairrada and Dão, in Central Portugal; recognise the motivations, experiences and constraints faced by those families, and to identify wineries' managers perceived opportunities and challenges regarding this market.

The project addresses different perspectives of family wine tourism: the practices of family-friendly wine attractions in different destinations, based on documentary research; the experience of visitors to an emerging family wine destination based on a quantitative survey and in-depth interviews; the perceptions of wine tourism suppliers, through in-depth interviews; and finally the experiences of visitors to family-friendly wineries, based on online reviews. It may contribute to marketing and tourism theoretical bodies, concerning situational influences (group composition) on tourist behaviour and experiences and the knowledge about the family tourism market, in a context especially marked by contradictory motivations and interests. It also provides evidence about best practices and strategies that may enhance wine destinations' development through family wine tourism.

Marketing and strategy

Modelos preditivos sobre a inteligência espiritual do líder e qualidade percebida em organizações em saúde

Andréa Fidelis, Andréia Vitória, António Carrizo Moreira

Neste trabalho está a ser apresentado os dois modelos preditivos elaborados para responder as seguintes questões: Qual a influência da inteligência espiritual do líder no comportamento dos trabalhadores e qual a influência da inteligência espiritual do líder na qualidade percebida da equipe. As variáveis trabalhadas são inteligência espiritual, inteligência emocional, job crafting, capital psicológico, qualidade percebida da equipe e qualidade percebida do utente.

Marketing and strategy

Entrepreneurial Ecosystems and Entrepreneurial Initiative: A Multidimensional Approach

Mariana Pita, Joana Costa, António Carrizo Moreira

European countries, since 2008, suffer severe effects related to the economic crisis, which aroused structural and social challenges. During the last fifteen years, the lack of competitiveness and growth in Europe, forced countries to reshape their strategies using entrepreneurship to overcome economic and social adversities. More than ever, Europe needs to be resilient and build entrepreneurial ecosystems prepared to recover and adapt to" exogenous shocks and endogenous pressures" (Cadenasso et al., 2006).

Entrepreneurship was recognised as a "powerful driver of economic growth and job creation" (European Commission & Comission, 2013). Therefore, new mechanisms were developed to promote entrepreneurship at large. Several European countries are implementing strategies to reinforce the pan-European Entrepreneurial Ecosystem since they lag behind global competitors (European Commission, 2019). However, countries reveal distinctive characteristics suggesting the need to seize the appropriateness of national environments and specific policies to stimulate entrepreneurship according to their distinctive enablers.

The Entrepreneurial Ecosystem has gained increased significance and attracted considerable attention from researchers and policymakers who attempted to understand the influence of context (Amorós et al., 2019) in entrepreneurship effectiveness, considering individual and collective dimensions (Schmutzler et al., 2019) using a multidimensional approach.

Understanding how and why Entrepreneurial Ecosystems (national or regional level) change over time and space is crucial to explore the relevance of its components and find supporting evidence about the determinants that are positively associated with more robust Entrepreneurial Initiative (individual level).

The present work aims to understand the relation between Entrepreneurial Ecosystems and Entrepreneurial Initiative, specifically, to identify the context and individual determinants that may influence entrepreneurial careers, using a multidimensional perspective. The research also intends to appraise the asymmetries and idiosyncrasies of different entrepreneurial ecosystems, supporting policymakers to fine-tune strategies place-based and to develop context-dependent instruments, avoiding flawed strategy. Ultimately, the article seeks to contribute to more effective and adequate entrepreneurship policies according to individual and context singularities, improving entrepreneurship at large.

The present work integrates entrepreneurial ecosystems theory and entrepreneurial initiative, focusing on the context and individuals' elements. The work is composed of (1) a longitudinal perspective of the phenomenon; (2) the creation of a new taxonomic approach based on a novel indicator: Entrepreneurial Ecosystem Quality; (3) a quantitative study exploring the effect of entrepreneurial ecosystems on entrepreneurial initiative; (4) and two quantitative studies, exploring the role of education on the entrepreneurial initiative, and analysing the impact of universities through its missions on the entrepreneurial initiative.

The work aims to enrich the knowledge on Entrepreneurial Ecosystems and their influence on Entrepreneurial Initiative, using a quantitative perspective grounded on multiple databases and exploited through Logistic Regressions.

A closer focus on entrepreneurial ecosystems acknowledges national singularities, which contributes to abandoning a "one size fits all" strategy concerning entrepreneurship. The heterogeneity of country profiles leads to entrepreneurship public policy inefficiency as a result of public policy short-sightedness. The empirical findings place entrepreneurs as a central piece of entrepreneurial ecosystems showing that the local environment and its elements affect the entrepreneurial initiative differently.

Marketing and strategy

The Impact of Innovation Capabilities on Export Performance of Mozambican SMEs

Eurico Navaia, António Carrizo Moreira, Cláudia P. Ribau

Abstract

Purpose – Although there are many studies on innovation capabilities and export performance, this research determines the impact of innovation capabilities on the export performance of small and medium enterprises (SMEs) associated with the moderating effects of government relationship and reactive and proactive behavior, mediating effects of exploratory and exploitation innovation, and competitive strategies (cost leadership and cost focus). Likewise, it determines the moderating effect of competitive intensity on the relationship between competitive strategy and export performance.

Design/Methodology/Approach - The study involves the analysis of 250 questionnaire-based survey of managers from SMEs operating in Mozambique that were subjected to a Partial Least Squares-Structural Equation Modelling (PLS-SEM) technique.

Findings – Export performance of SMEs has a positive relationship with innovation capability, however, when government support becomes insignificant, only SMEs with the proactive behavior increase their export performance. The results also suggest that exploratory and exploitation innovation and competitive strategy (cost leadership and cost focus) mediate the relationship between innovation capability and export performance. Competitive strategy of differentiation has a positive relationship on export performance but when competitive intensity increases, companies' export performance decreases.

Research limitations/implications - This study has implications for SMEs aiming at increasing their export performance and innovativeness. Limitation in using cross-sectional research, disregarding the intrinsic characteristics of a longitudinal survey, and considering one informant per company, which may have influenced some of the results.

Keywords: Export performance; innovation capabilities; competitive strategy; exploitation; exploratory.

Marketing and strategy

Mathematics

Riemann-Hilbert problem for the matrix laguerre biorthogonal polynomials

Assil Fradi, Ana Foulquié Moreno, Amílcar Brinquinho, Hamza Chaggara

In this presentation the Riemann-Hilbert problem, with jump supported on a appropriate curve on the complex plane with a two finite end points, is used for the study of corresponding matrix biorthogonal polynomials associated with Jacobi type matrices of weights |which are constructed in terms of a given matrix Pearson equation. First and second order differential systems for the fundamental matrix, solution of the mentioned Riemann-Hilbert problem are derived.

Mathematics

Cryptography with Coding Theory

Cláudia Sebastião, Paulo Almeida, Diego Napp

The arrival of quantum computers, though far away, is already a real threat to conventional information security systems. In order to study alternatives to current cryptosystems, post-quantum cryptography emerges.

Cryptosystems based on error-correcting codes are one of the most promising post-quantum alternatives for Public Key Cryptography, namely the McEliece cryptosystem.

Our work aims to develop a variant of this cryptosystem based on convolutional codes.

Mathematics

Classes of rational points in ADC forms.

Mónica Celis, Paulo Almeida, António Machiavelo

In this research we will explore the relationship between the rational solutions and integral solutions of quadratic Diophantine equations and connect it with integer factorization and the number of integer points in a quadratic form. The basis of this work will be the Aubry method to obtain integer solutions of the equation n = x^2 + y^2 from its rational solutions using a descent algorithm. This algorithm can be applied to many other quadratic forms known as ADC forms. Namely it can be applied to n = x^2 + 2y^2 which is related to the factorization of numbers of the form 4k+3.

Mathematics

Multivariate linear regression model for censored data

Rodney Sousa, Isabel Pereira, Maria Eduarda Silva

Em problemas reais envolvendo modelos de regressão linear (RL), pode-se obter melhor descrição da realidade considerando-se várias variáveis respostas em simultâneo, onde se analisam m ≥ 2 caraterísticas do mesmo fenómeno. Nestes casos, deve-se considerar o modelo de RL multivariada.

Devido a eventuais limitações dos aparelhos de medição ou da forma como se planeiam as experiências, os dados observados podem estar censurados, pelo que a variável só pode ser observada num intervalo restrito. Para lidar com este problema, no contexto multivariado, propomos dois métodos de estimação, nomeadamente, o algoritmo EM e a ampliação de dados. Estudo de simulação realizados sugerem que estes métodos têm bom desempenho.

Mathematics

Convolutional codes for network streaming applications

Filipa Santana, Raquel Pinto, Diego Napp

In our work we study convolutional codes equipped with rank metric tailor-made to deal with multi-shot network coding. We present novel constructions with better correcting capabilities than the existing ones.

Mathematics

Multivariate Contributions in the Decomposition of a Time Series

Alberto Silva, Adelaide Freitas

Extracting essential resources from any real-valued time series is crucial for exploring, modeling, and producing predictions. Throughout this investigation, we build graphical representations of the decomposition of a time series (ts) using multivariate visualization techniques, namely, the biplots. Furthermore, we suggested a new method for detecting change points in a ts using multivariate analysis features. Finally, we developed a new methodology for detecting the dominant periodicity of a ts through area biplots, implementing the R package areabiplot as an auxiliary tool for the proposed procedure already published and available in the Comprehensive R Archive Network.

Mathematics

Electrical Impedance Tomography

Ivan Pombo, Uwe Kahler

Electrical Impedance Tomography is a novel medical imaging method that uses electrical measurements at the boundary to obtain the electrical conductivity of inside tissues. We will present our work on the mathematical problem.

Mathematics

Applied mathematics

Queens' graph and its generalization

Inês Costa, Domingos Cardoso, Rui Duarte

The n-Queens' graph, Q(n), is the graph associated to the nxn chessboard (a generalization of the classical 8x8 chessboard), with n^2 vertices, each one corresponding to a square of the chessboard. Two vertices of Q(n) are adjacent if and only if they are in the same row, column or diagonal of the chessboard.

This research plan includes the deepening of the study of the combinatorial and spectral properties of Q(n) and the study of these properties for its generalizations.

In this pitch, the progress so far and the next steps of the investigation will be presented.

Applied mathematics

Stochastic Fractional and Generalizations in Optimal Control

Houssine Zine, Delfim F. M. Torres

In will present in this communication some scientific works related to the advancement of my research work within mthe doctoral program in applied mathematics of University of Aveiro jointly with University Minho and University Porto (MAP).

More precisely, Some papers are published reflecting clearly the research interest linked to the subject of my thesis at the international journals having high scientific impact as well as a number of other works are under submission..

Further, some particicipations at the international conferences and webinars designed and governed by our institution CIDMA are mentioned in this presentation.

Applied mathematics

Variational problems with time delay and higher-order distributed-order fractional derivatives with arbitrary kernels

Fátima Cruz, Natália Martins, Ricardo Almeida

In this work we study variational problems with time delay and higher-order distributed-order fractional derivatives dealing with a new fractional operator. This fractional derivative combines two known operators: distributed-order derivatives and derivatives with respect to another function.

Applied mathematics

Spatio-temporal models for time series of counts and their application to health outcomes

Ana Martins, Sónia Goveia, Manuel G. Scotto, Christian Weiss

Modelling and predicting the temporal dependence structure of time series of low counts have received considerable attention over the last years. Models such as the INteger Generalized AutoRegressive Conditional Heteroscedastic (INGARCH) and the INteger AutoRegressive Moving Average (INARMA) have been proven to be good candidates for modelling purposes. In fact, a recent work of the authors on the effect of air quality on respiratory hospital admissions has shown that the INGARCH models are suitable for this setting. Nevertheless, extensions to the analysis of time-space count data are still at a quite embryonic stage. Hence, this work aims at developing the integer-valued counterpart of the so-called space-time ARMA process. So far, we have been focusing on space-time MA processes, for which we have derived their first and second-order moment structure, as well as their corresponding space-time autocorrelation function. Additionally, we are currently developing and implementing parameter estimation procedures by using the well-known R programming language. This will boost the broad dissemination and the awareness of the usefulness of such models.

Applied mathematics

Multimedia in education

Promoting students' attitudes towards nature conservation with a mobile augmented reality approach – the EduPARK game

Rita Rodrigues, Lúcia Pombo, Teresa Neto

Nowadays, students are part of a generation that values the use of technology and as its interaction is permanent, it is relevant to create opportunities for students to interact with mobile devices, as a new way of learning. The study is framed by the EduPARK project that created an innovative app for authentic learning, supported by mobile and augmented reality (AR) technologies, for game-based approaches in a green park. The problem found – nature's conservation - very relevant nowadays, was still little explored in the EduPARK, therefore, it was considered relevant to develop an educational guide with a set of challenges and interdisciplinary questions with multimedia content related to the theme to alert students to the importance of protecting the environment.

The EduPARK activities for this study aim to investigate how playing a game, supported by an interactive mobile AR app, in an outdoor environment, the city park, may promote sustainable development learning in an interdisciplinary way and improve motivation for learning. To achieve this goal, we've developed an interdisciplinary educational guide, focusing on attitudes of nature conservation, which was integrated in

the EduPARK app. Data has been collected through direct observation of students during the sessions in the park, questionnaires and interviews to students and logs of EduPARK app. This research follows a qualitative approach and fits as a case study. The main target public are students of basic education in formal and non-formal educational context.

It is expected that the Interdisciplinary Educational Guide articulated to the innovative EduPARK strategies may promote: i) motivation for new ways of learning; ii) the construction of new interdisciplinary knowledge; iii) change of attitudes towards environmental problems in the current world; iv) nature conservation attitudes and v) healthy lifestyles.

Multimedia in education

Emergency Remote Teaching in publics schools of Federal District, Brazil, in context pandemic

Luís Lapa, Isabel Cabrita

The pandemic of COVID-19 imposed restrictions on all activities, education being one of the most impacted. Newspapers around the world reported the closure of face-to-face classes as a non-pharmacological action necessary to contain the spread of the disease. Educational systems reorganised their pedagogical proposals and started to provide students with alternative learning means, namely, with the support of resources mediated by digital technology. However, teachers and researchers note that this is not distance education, coining the term emergency remote learning. In the Federal District, Brazil, it was no different.

On March 12, 2020 the classes were suspended, 600 000 students stayed at home, and the Secretariat of Education implemented the Program "Escola em Casa DF", offering students non-presence pedagogical activities through a digital platform, teleclasses and printed material to those who do not have equipment or internet access. In this context, a PhD project entitled "Mathematical education mediated by digital technology in public schools of the Federal District, Brazil, in a pandemic context" emerged in the scope of the Doctoral Multimedia in Education Programme.

This is an investigation with mixed methodological option, based on the interpretative paradigm and materialized in a case study, whose research question is: "What are the conditions of implementation of the School at Home Project and to what extent the remote pedagogical support mediated by digital technologies, in a pandemic scenario of COVID-19, contributes to the learning of Mathematics in primary schools classes of public schools in the Federal District (DF), Brazil? To reach this answer, the following objectives were defined: 1) Analyse the policies defined by the schools' management bodies, 2) Identify the technological resources that are available to students and teachers, 3) Identify the technological and human resources that are available for the construction and maintenance of the Programme, 4) Characterise the digital competencies of teachers and students, 5) Analyse the practices of non-face-to-face teaching mediated by digital technologies and 6) Evaluate the repercussions of such teaching on the learning of Mathematics. Students, teachers and managers at the three levels - local, intermediate and central - will participate in the data collection by responding to questionnaire surveys and interviews.

Documentary collection will play an important role in data collection. Recognizing that no solution is, in a context like the present one, perfect and definitive, it is expected with the research results to subsidize and/or qualify the public debate about the use of digital resources in mathematics teaching, namely at primary school level.

Multimedia in education

Media Use and Media Multitasking Habits of Students and Teaching Staff of the University of Aveiro

Cláudia Barbosa, Luís Pedro

Digital consumer devices have penetrated our everyday lives, providing a platform to – among others - solve problems, communicate, exchange information, and participate in remote activities. This increasing popularity provides the impetus for a rising dependency to the extent that multitasking, especially involving media, has become a reality that can no longer be ignored in any professional setting. Studies on media use and media multitasking behaviours in an academic setting have been conducted at the international level, however none has yet been performed in Portugal. This study aims to develop a media use/media multitasking questionnaire, in a survey to be implemented with the teaching staff and student population of the University of Aveiro, with the purpose to identify and understand their media use and media multitasking habits.

Multimedia in education

A CASE STUDY ON APPLYING GAMIFCATION TOOLS IN BUSINESS MATHEMATICS FOR HIGHER EDUCATION STUDENTS

Paul Lawrance, Antonio Moreira, Carlos Santos

Abstract: Empirical research was conducted on applying Gamification in Higher Education using the dynamics and mechanics of gaming in a non-game context of the subject Business Mathematics for undergraduate students. A case study was used as a method to collect data using questionnaires, observations, and interviews. Online feedback was conducted as part of the semester completion for the subject Business Mathematics to test the usage of Gamification tools (Kahoot!, Socrative, Quizlet, Quizizz, and Showbie) in learning. It was found that Gamification tools enhanced students' motivation in learning and understanding mathematical concepts and that it has boosted their engagement in Gamification activities, increased critical thinking, and problem-solving skills.

Keywords: Gamification tools, Business Mathematics, Higher Education, Online Learning

Multimedia in education

THE POTENTIAL OF NEW MEDIA IN DISTANCE SECONDARY EDUCATION IN MOZAMBIQUE

Sérgio Cossa, Fernando Manuel dos Santos Ramos

Mozambique, in order to align itself with the Sustainable Development Goals, particularly that of "Quality Education", has elected in its Education Strategic Plan 2020-2029, as its main objective for secondary education: to expand equitable access and ensure retention and completion with quality for students to continue their studies, to insert themselves in social life as well as in the labour market. However, demand at this level exceeds the country's capacity for educational provision. In parallel, the supply of education, through distance education is, still, not very representative, with only 3% of the total number of students in secondary education, in 2018.

Thus, this study aims to investigate the potential of the new media in the provision of distance education in the 1st cycle of secondary education in Mozambique, focusing on the in-depth study of the methods and results under the Innovative Model of Open Schooling Project, underway in 15 schools. To this end, we start from the following research question: What are the main factors that can influence the success of the use of new media in the provision of distance education in 1st cycle secondary education in Mozambique? The answer to this question will help to understand the more and less positive aspects with a view to drawing conclusions that are useful for the generalisation of this Innovative Model of Open Schooling.

The study is structured on the basis of an analysis model, in which two concepts were constructed, namely: factors influencing the success of the new media in distance education and success in the provision of distance education in 1st cycle secondary education in Mozambique; and the construction of each of these concepts consisted in defining their respective dimensions and, for each dimension, the respective indicators. Therefore, the data collection process follows two main phases: The first, deals with identifying factors with an influence on the success of the new medium and the second, deals with identifying which of these factors are the most influential. The methodological approach, for this study, is mixed nature, with a sample of 300 students, 150 teachers, 15 school headmasters, 15 pedagogical deputy headmasters, 10 educational managers, who will be selected by sampling criteria due to the involvement of the researcher in the project. For data collection is being used questionnaire surveys, interview surveys, survey maps of educational statistics 3/3 and later will be used the technique of content analysis, with the support of software Nvivo and inferential statistics, for data analysis.

As it is a theme not yet explored in the Mozambican context, it is hoped that this study represents a starting point for deep reflections on the policies for the use of technological innovations and the opening of avenues for critical thinking on the use of new media in the provision of distance education.

Multimedia in education

Gamified and Open Educational Resources on research methods for doctoral programs in Technology-Enhanced Learning

Lorena Sousa, Luís Pedro, Carlos Santos

Technology-enhanced Learning (TEL) is considered an interdisciplinary field of research since it intersects several disciplines related to teaching and learning, such as education and psychology, and technology, such as computer science and information science. However, studies have shown that most doctoral programs are associated with a single discipline and have argued that doctoral training in TEL needs to adopt a more interdisciplinary approach to facilitate innovation. In order to integrate the programs for doctoral education in TEL in Europe, nine European

universities and the European Technology Enhanced Learning Association (EA-TEL) created the Doctoral Education for Technology Enhanced Learning (DE-TEL) project. The DE-TEL project aims to identify the best teaching practices in doctoral programs in TEL and to develop a proposal for a new program. This new program will have modules encompassing research methods and key topics in TEL, and this study, in particular, aims at developing an OER on research methods with gamification elements to support PhD candidates, professors, and researchers in doctoral programs in TEL. Under the methodological approach of Educational Design Research, this study consists of three main phases: context analysis, development and formative evaluation, and semi-summative evaluation. In the first phase, a survey was applied by the DE-TEL project to collect information on the practices and challenges of doctoral education in TEL and to find out the topics that are relevant to the area but have few educational materials available. Preliminary results have revealed that design-based research (DBR) is considered the most relevant research method by PhD candidates and PhD holders. Considering this, in the second phase, the gamified OER prototype about DBR is being designed and developed using the H5P tool. H5P tool is an open source and free to use tool that enables authors to create, share and reuse interactive HTML5 content, without the need for any technical skills. The H5P content is going to be integrated on Moodle, where it is possible to add gamification elements, such as generating badges according to the score and interactions performed by the user. This prototype will be formatively evaluated by PhD candidates, professors, and specialists through surveys and focus groups. As feedback is being received, adjustments will be carried out and the evaluation restarted until we have a final version of the prototype. Then, the sections about the other research methods are going to be conceptualized, designed, and developed to be formatively evaluated as well. In the last phase, a semi-summative evaluation will be performed to make the last adjustments to the OER, and finally implement and disseminate the results in doctoral programs in TEL. We expect, therefore, to integrate the methodological approaches of doctoral programs in TEL in order to avoid fragmentation of their curricula, and positively impact the learning of research methods in this area.

Multimedia in education

Impact of DEEP Psychoeducational Campaign on Portuguese University Students

Lersi Durán, Ana Almeida

Depression is a global health problem; as an illness it may affect any person, independently from age, job or social condition. University students are immersed in environments of high levels of stress and responsibility, which may cause depressive symptoms. Education and health promotion campaigns are strategies that facilitate the process of alerting population to health problems and contribute to their prevention. DEEP is an audiovisual campaign (AV) that comprehends a set of short-videos and challenges. This study aims to assess the impact of the psychoeducational campaign DEEP in EUPs' knowledge of depression. The methodological approach is experimental study, having a mixed nature. The first results show the effectiveness of the intervention in increasing knowledge about depression in university students.

Multimedia in education

COLLABORATIVE ENVIRONMENTS WITH A TRANSMEDIA APPROACH TO PROMOTE STUDENTS` MOTIVATION AND AUTONOMY WITHIN THE SCOPE OF MATHEMATICAL LEARNING

Marina Pereira, Professor Luís Pedro

"Collaborative environments with a transmedia approach to promote students` motivation and autonomy within the scope of mathematical learning" reports on a study carried out with vocational education students with a significant risk of failure or dropping out in their school career. Bearing in mind that these students have reduced levels of autonomy and motivation, an action-research plan was designed in which, through a transmedia collaborative approach and using digital technologies, it was intended to act, gradually, in the development of these 2 aspects over 2 research cycles, each with 4 and 2 weeks, respectively. There were no statistically significant differences in motivation and autonomy in the first implementation cycle. However, the results obtained in the second implementation cycle indicate an improvement in motivation and autonomy.

Multimedia in education

Data collection in times of trouble: online sessions games and focus group

Maria Reis, Ana Margarida Pisco Almeida

Associating an enjoyable activity with the school context, such as the introduction of Game-Based Learning environments, may increase student motivation, promote intellectual development and facilitate learning in various fields. However, in order that the Game-Based Learning benefits

can be recognized, it is important that joint formal evaluation techniques are available to bring objective data to the teacher for game selection. Thus, the creation of a digital application to support the cataloging and evaluation of educational games, based on practical and real cases and supported by evaluation models recognized by the scientific community, may make the process of choosing the game more robust. In times of pandemic, data collection techniques are adapted for the online modality and the thinking aloud format is given priority.

Multimedia in education

The potential of the Internet of Things to promote participatory citizenship

Manuel Santos, Vânia Carlos, António Moreira

This study is based on the issue of the poor involvement of students in their respective educational community, as far as participatory citizenship is concerned. To gather answers for the research question "What strategies can be developed within the scope of a Smart School Lab, with the aid of the Internet of Things, to enhance the participatory citizenship of students?", open and interventionist design-based research strategies were applied. An iterative evolutionary approach was also used, involving action and reflection in an interchanging way, with integrative activities that fueled the project in a cyclical process.

Three semi-structured interviews, two data gathering surveys and a teachers' focus group were implemented and analysed. The data collected provided a closer analysis of students' participatory citizenship and their engagement in community issues, as well as the teachers, parents, and municipality's perspective of the dialogue and communication among local participants. To achieve the addressed goal, a fifty-hour teacher training course was implemented in a cocreation process within a smart educational community, supported by a network of mentors (students, teachers, parents, local actors, and municipality).

Artefacts and guidelines were co-constructed between researchers, teachers, students, and the local community – didactic kits with transdisciplinary contents, promoters of citizen science skills and supported by digital electronics and IoT – that should persist beyond the study and be subsequently adopted, adapted, and used by other teachers from the institution where this study is taking place. Regarding the results expected with this study, we highlight: design principles and technology innovation, i.e., the production of "education" and "citizen" didactic kits, which will contribute, per se, to the common good, with the detection of environmental problems in the target city of study; the improvement of the students' citizen science skills and their participatory citizenship; and the realization of the potential of the IoT by the teachers who took part in the study, mainly as far as the development of pedagogical-didactic and social-communicative skills are concerned.

Multimedia in education

Metodologias Ativas em Espaços Flexíveis de Aprendizagem: Proposta de um Modelo de Formação de Docentes da Universidade de Aveiro

Gabriela Reses, Dra. Vânia Carlos, Dra. Sandra Soares

Esta investigação visa promover a inovação de práticas educativas de docentes da Universidade de Aveiro (UA), a partir da implementação ou potenciação de metodologias ativas no "SALT@ua | Space for Active Learning and Teaching", um recente espaço flexível de aprendizagem localizado no Departamento de Educação e Psicologia da Universidade de Aveiro. Nesse sentido, o estudo busca responder à questão: como conceber um modelo formativo de docentes na Universidade de Aveiro que potencie o uso de metodologias ativas em um espaço flexível de aprendizagem? O desenho metodológico do estudo é estruturado com base na Investigação-Ação na modalidade crítica. Os métodos de recolha de dados incluem técnicas de inquérito e observação dos participantes e a análise de dados baseia-se em métodos mistos. O projeto contribuirá para o desenvolvimento, implementação e avaliação de modelos de formação de professores do ensino superior que potencie a adoção de metodologias ativas em espaços flexíveis de aprendizagem.

Multimedia in education

APRENDIZAGEM BASEADA EM PROBLEMAS E COMPETÊNCIA DIGITAL: UM ESTUDO COM PROFESSORES EM FORMAÇÃO CONTINUADA

Ângela Bezerra, Patrícia Sá, Ana Uchôa

A investigação que se apresenta relaciona a Aprendizagem Baseada em Problemas (ABP) e a Competência Digital (CD), aspetos fundamentais para a docência no momento atual. Em uma sociedade cada vez mais digital, essa investigação se faz pertinente pois faz referência aos saberes

necessários para auxiliar ou potencializar a aprendizagem dos alunos do século XXI. Procura-se analisar o impacto de uma abordagem de ensino baseada em estratégias de ABP, em contexto de formação de professores, tendo em conta o desenvolvimento da CD para fins de ensino e aprendizagem, no intuito de responder a questão orientadora da investigação "Como a estratégia didática ABP pode contribuir para o desenvolvimento da CD de professores em contexto de ensino e aprendizagem?". Como documentos orientadores da investigação, tem-se os quadros de referência de CD, DigComp2.1 e DigCompEdu, e os apontamentos de Delisle, relacionado a estratégia didática ABP. É uma investigação de natureza qualitativa e se enquadra no estudo de caso. As técnicas de coleta de dados e de análise, condizentes com a natureza qualitativa, e já utilizadas nesta investigação, são respectivamente, inquérito por questionário e observação participante; e estatística descritiva e análise de conteúdo. Os dados foram coletados durante a primeira etapa do curso de formação, que corresponde a vivência dos participantes, professores de ciências de escolas localizadas em Sobral/Ceará/Brasil, com a estratégia didática ABP. Antes de iniciar o curso de formação, foram aplicados dois inquéritos por questionário aos participantes, um para avaliação diagnóstica no que refere a utilização das Tecnologias Digitais (TD) no contexto de ensino e aprendizagem, e o conhecimento sobre ABP; e o outro, para permitir autoavaliação dos participantes em relação a CD no referido contexto. Os dados revelam pouca utilização das TD pelos participantes, apesar da indicação de acharem benefício para a prática educativa. As TD mais utilizadas, segundo os participantes, são os canais de comunicação interpessoal, para atividades de disseminação e discussão; e tecnologias de publicação e partilha de conteúdo, para atividades de descoberta. As TD praticamente não são utilizadas para avaliação. Em relação a ABP, percebe-se pouco conhecimento dos participantes. A autoavaliação indica níveis de CD básico em relação a área de resolução de problemas, e níveis de CD básico a moderado em relação as áreas de CD, recursos digitais, ensino e aprendizagem, e avaliação, quando comparada aos quadros de referência referidos. No que refere a observação, um fator crítico que afeta o desenvolvimento dos participantes é a falta de tempo devido ao excesso de atividades no trabalho, em decorrência de mudanças nas ações educativas com a pandemia. Este fator comprometeu a permanência da quase totalidade dos participantes, ficando apenas uma participante a partir da terceira etapa da vivência com a estratégia. No entanto, percebe-se o desenvolvimento de atividades relativas a ABP e um leve incremento de progressão em relação as TD, considerando o uso e a capacidade de uso, quando se observa utilização e criação de recursos digitais. Espera-se com os fatores evidenciados até o final da coleta de dados, contribuir com direcionamentos que relacionem a ABP e o desenvolvimento da CD.

Multimedia in education

Peer learning and its impact on peer teacher students' academic performance – proposal of a procedure model

Ana Carvalho, Carlos Santos

This Multimedia in Education PhD project combines the study of peer learning as a flexible and innovative pedagogical approach with that of the support provided by digital technologies to address two major gaps: little scientific evidence of the impact of peer learning programs on peer teacher students' (PTS) academic performance and the lack of systematic guidelines to support the design of digitally enhanced peer learning programs. Under the framework of Educational Design Research (EDR), the project comprehends three milestones: (i) the preliminary research stage, involving a state of the art analysis, comprehending literature review and the study of five peer learning projects implemented in five Portuguese educational institutions; (ii) the development stage, related to the design and implementation of the prototype of a technology-enhanced peer learning program including challenge- and project-based learning, and involving English as a Foreign Language (EFL) upper and lower secondary students from three Portuguese basic & secondary schools; (iii) and the assessment stage, related to finding evidence of participation impact, particularly on PTSs' academic performance, under the cognitive (as for metacognitive skills), affective (as for motivation), and social (as for collaborative and communication skills) dimensions as well as the role of digital technologies in the promotion of the quality criteria of educational interventions, namely relevance, consistency, practicality, and effectiveness. Contributions of the study are expected to improve teaching and learning quality in basic and secondary education as well as promote more engaging, authentic, and personalized learning experiences in line with the development of 21st century skills.

Multimedia in education

RELAÇÕES ENTRE RESILIÊNCIA, LITERACIA E INCLUSÃO DIGITAL DE ESTUDANTES DE TECNOLOGIA DA INFORMAÇÃO NO BRASIL

Andreza Souza Santos, Ana Margarida Pisco Almeida, Marlos Alves Bezerra

O Brasil é um país que exibe inúmeros contrastes sociais e econômicos e a despeito da evolução tecnológica e do crescente acesso à Internet, apresenta muitos desafios no que concerne à inclusão digital. Este trabalho tem como objetivo principal investigar possíveis correlações entre variáveis sociodemográficas, inclusão digital e resiliência de estudantes de Tecnologia da Informação na faixa etária de 15 a 23 anos, que ingressaram em cursos técnicos de uma universidade localizada no nordeste brasileiro. Espera-se investigar se uma maior literacia digital proporciona um incremento na resiliência dos jovens ingressantes. Trata-se de uma pesquisa de métodos mistos, exploratória e descritiva, que utilizou as seguintes estratégias para a recolha de dados: estudo bibliográfico, inquérito por questionário online e inquérito por entrevista. Para

o levantamento dos dados junto aos alunos que estudam na cidade de Natal-RN, foi aplicado um questionário online composto por um conjunto de questões fechadas relacionadas a aspectos sociodemográficos, à inclusão e à literacia digital, além de uma escala de resiliência na versão brasileira da CYRM-19-Br (Child and Youth Resilience Measure). Já o roteiro de entrevista visou aprofundar as percepções acerca das respostas dadas no questionário. Para a análise estatística descritiva e inferencial foram utilizados os programas SPSS (Statistical Package for the Social Sciences), R e Minitab, enquanto que as respostas às perguntas abertas foram organizadas a partir da análise de conteúdo. Os resultados mostram que: jovens com maior literacia digital são mais resilientes; quase todos os estudantes possuem smartphone; mais da metade deles possuem wi-fi em casa; apenas 16,15% apresentaram baixa literacia e 38,54% apresentaram alta literacia; as variáveis sociodemográficas (como tipo de escola, faixa etária, gênero e renda familiar) não são preditores para a literacia digital; as redes de apoios e os recursos se mostram importantes para o desenvolvimento da resiliência e da inclusão digital. Espera-se que essa discussão possa nortear ações institucionais que promovam a resiliência dos alunos, reduzindo a evasão escolar; fortalecimento da colaboração internacional por meio de esforços de investigação; no nível macro, os dados podem subsidiar políticas públicas e promoção do bem-estar psicossocial de jovens da cidade de Natal.

Multimedia in education

Music

Doing ethnomusicological research in “times of trouble”: challenges, alternative modalities for fieldwork and current outcomes of a research on Portuguese Bombos during the Covid-19 pandemic

Lucas Wink, Maria do Rosário Pestana

This is a PhD research focusing on Bombos in Portugal. Situated in the field of Ethnomusicology and resorting to theoretical-philosophical postulates of Sound Studies, the project aims to study a set of aspects of Bombos by following ensembles’ activities traditionally and intensely held on the ground. Despite the great expression they have in social and relational life, Bombos have been historically neglected due to the ‘music-centrism’ evident in past academic ethnographic works. Committed to a critical and attentive listening approach, my research addresses not only the intense experience of sonic production and collective vibration participants engage when getting together to perform, but the social relations built around this sonic, a sonic articulating memories, kinds of knowledge, meanings and values expressed in complex networks of individual participation.

As of March 2020, however, due to the Covid-19 pandemic, the required security restrictions enacted by the government have created profound constraints. Musicians were suddenly prevented from meeting in person, traditional performance spaces were silenced and I was compelled to reorient my research towards what became the prevailing field of music making. I am referring, specifically, to the virtual field. In this presentation, I briefly illustrate the challenges and the circumstances of this unexpected shift, the actions musicians undertook in order to overcome the infeasibility of performing face to face and current outcomes of an ethnomusicological research conducted in “times of trouble” (Timothy Rice 2014).

Music

Politics of Sounding and Listening: the sound archive of the Bissau-Guinean Liberation Movement (1963-1974)

Rui Vilela, Susana Sardo, Patrícia Godinho Gomes, Julia Kursell

The research project aims at defining politics of sounding and listening by examining, firstly, its practices in the context of the Bissau-Guinean Liberation Movement (1963-1974), and, secondly, the ways of constituting a contemporary repertoire that is informed by anticolonial critique. For this purpose, it draws the aural environment of the struggle from archival and embodied sonic memories that are later convoked to contemporary artistic productions. The methodology conjugates ethnomusicological and artistic methods — respectively, participatory archival research, critical ethnographic fieldwork and collaborative artistic research — to conceive of sounding and listening practices as moments of knowledge production and dissemination capable of acting upon and inciting social orders.

Music

Conducting Practices in Youth Choirs: the Virtual Rehearsal Room

Eric Lana, Eric Lana / Supervisor: Ph.D ANTÓNIO JOSÉ VASSALO NEVES LOURENÇO, Co-supervisors: Ph.D ANTÓNIO GUILHERME ROCHA CAMPOS, Ph.D CLARISSA GOMES FOLETTO

The connections established by adolescents with music, namely, their Music Learning Ecologies (MLE) are increasingly linked to the use of mobile computing devices. Preventive measures of social isolation resulting from the evolution of the Sars-Covid19 epidemic have significantly affected the daily of children and adolescents' choirs from several parts of the world, which, has gradually invested in resources and models of online and distance practice. The aim of this research project is to develop new forms of choral practice that consider MLE and m-learning as elements of pedagogical approaches applied to adolescent's choral performance. In 2019, it has been implemented an action research environment dedicated to developing rehearsal practices and collaborative musical learning with youth choral mediated by mobile devices in the Canarinhos de Itabirito, a Brazilian Choir. The hybrid model, qualified as a Virtual Rehearsal Room, combined face-to-face actions with complementary activities monitored by distance, developed on a free digital platform hosted in Google Classroom. In 2020, this scenario brought a new challenge to the action research, namely: enhancing the Virtual Rehearsal Room as a practice space in remote online distance lessons. 54 choristers participated in 36 virtual rehearsals on the Zoom Meeting Platform and the learning and performance of 10 virtual choirs' concerts were made and are available online. The main applications used and evaluated were Google Classroom, Musescore, Youtube, Flipgrid, Soundtrap and Bandlab. Criteria for usability, ubiquity, interactivity, accessibility (Andrade, 2017) comprised the evaluation of the actions' effects. The research results will be available on a digital platform, which aim to disseminate the resources used and enable new perspectives for children's and youth choir practice. It is expected that the aggregation of the innovations addressed and implemented will optimize choral practice and contribute with new perspectives to the choralists and conductors.

Music

Escuta e Processos Criativos: a individuação do músico em performances de livre improvisação.

Sérgio Lima, Susana Sardo, Rogério Costa

Neste trabalho investigo como os músicos elaboram seus processos criativos e se percebem durante performance de livre improvisação. A performance de livre improvisação é compreendida por praticantes e estudiosos mais como um ambiente ou território para criação e performance livre de estilos e estéticas pré-definidas do que enquanto gênero musical. Propus investiga-la a partir da relação imbricada entre duas de suas faces: a técnica, como modo de ação e pensamento que elabora soluções para fomentar a performance e, por outro lado, a sua face estética que, no músico, atua informando e regulando sua ação técnica, através de processos que ocorrem no plano sensível. A face estética, na perspectiva teórica adotada, seria como um feixe de sensações que orienta o músico, potencializa e modula sua ação técnica. Neste nível sensível, a escuta se constitui processo fulcral para a elaboração da (re)ação do músico potencializando e configurando o ato performativo. Escutar é produção de presença consolidada como ativação de estado receptivo de atenção sensível para fenômenos na interioridade e exterioridade do músico. A investigação teve sua ação estruturada por meio de três vieses o primeiro, tratou de reflexão teórica sobre a improvisação e individuação do músico durante performance apresentativa; no segundo, no campo da pesquisa artística, busquei modular a questão filosófica para a forma de um conceito e problema artístico, quando montei laboratório de práticas sônicas junto a dois músicos atuantes na área, com vistas a elaboração e montagem de performance de livre improvisação cuja temática resultante desta operação foi "a criação enquanto ato coletivo em rede". O terceiro e último viés é, de fato, o eixo e preocupação central de toda a pesquisa e trata da perspectiva do músico improvisador com relação a forma como experiencia os seus processos criativos, técnica e esteticamente, em ambiente de livre improvisação. Por fim, através de abordagem etnomusicológica reuni relatos publicados de músicos sobre a temática, entrevistas com os músicos participantes do laboratório e da performance produzida nesta investigação e documentos diversos produzidos no contexto da produção da performance, para revisar meus questionamentos iniciais e fomentar novas perguntas para trabalhos futuros. Pretendi assim, uma articulação de cunho filosófico entre dois planos de operação: o metodológico e o ontológico, ao colocar em diálogo a performance e o pensamento que a subjaz, entendidos como dispositivos que se interceptam de maneira simbiótica permanentemente durante a pesquisa.

Music

Cândido Lima: contribution to the contemporary guitar repertoire

Antonio FRUSCELLA, Dr PEDRO JOÃO AGOSTINHO FIGUEIREDO RODRIGUES

The present work aims to discuss the guitar production of the Portuguese composer Cândido Lima (1939 -). His guitar opus is constituted of 28 solo pieces and 53 chamber music pieces according to the Portuguese Music Research & Information Centre catalogue and the composer himself. Despite this considerable dimension, Lima's guitar work is not usually introduced into the classical guitar repertoire. We consider that is due to

the lack of a specialized and revised edition added to the intrinsic difficulty of these guitar pieces from an idiomatic standpoint which constitutes a significant barrier for the overall knowledge of this repertoire also in terms of availability and visibility.

Therefore, this research suggests a creation proposal upon the guitar repertoire by Cândido Lima: A new version, thought-out in a collaborative relation with the author, for adapting it to the instrument pattern then to revaluate the importance of his unknown guitar repertoire.

The arrangement methods supplied solve eventual playability problems about specific repertoire, in order to balance the thoughtful composing technique implied by a non-guitarist composer with the instrumental practicability. Authors like Lima (2003), Martingo (2011), Marinho and Carvalho (2012), contribute to frame the whole work from a theoretical standpoint, moreover works supplied by others researchers like Peruzzolo-Vieira (2017), Ivanovic (2014), Ostersjo (2008) and Rodrigues (2011) will be used added to the collaborative relation with Cândido Lima from a technical stance. This process aims to arrange Lima's guitar repertoire with technical solutions and esthetical result without changes of the primary musical intention evoked by the composer in the scores.

Music

Musical activity's regulation and the construction of a musicians's social status during the Estado Novo: the case of the National Wind Quintet

Ana Margarida Cardoso, Maria do Rosário Pestana, Manuel Deniz Silva

Through this research project, I want to study the biographical and artistic routes of five musicians, who were founders of the National Radiostation's Wind Quintet. This group maintain its activity during 1940 and 1980, approximately, and it was constituted by the flautist Luis Boulton (1908 – 1998), the oboist José dos Santos Pinto (1915-2014), the clarinettist Carlos Saraiva (1910-2001), the bassoonist Ângelo Pestana (1925-2004) and the horn player Adácio Pestana (1925-2004). Those musicians started their musical apprenticeship in local philharmonic and military bands, where they learned to play an instrument, to conduct and to compose. Some years later, they entered on military bands of their districts and then, in Lisbon. That participation was added with the activity in the context of orchestras like Orquestra Filarmónica de Lisboa or Orquestra Sinfónica do Teatro Nacional de São Carlos, two of the three professional orchestras of Portugal, at that time. However, the musical activity was regulated through a "professional card", in the context of the corporatism implemented by the Estado Novo. That card certified the kind of musical participation in what musicians acted, for example, "oboe player", "Philharmonic and Civil bands' conductor", "composer", "orchestra's director", and so on. Through the studies developed by Manuel Deniz Silva (2010, 2017) and the research that was done in the National Trade Union's Archive, we conclude that having a professional card didn't mean that musicians were recognized for all their musical activity, for example, as instrumentalists, conductors and composer. Besides the existence of a lot of works in their personal archives, the majority of them was never stared and just a few of them were performed.

In this way, this study aims to contribute to better knowledge about the legitimacy process and the codification of a musician's social status, during the Estado Novo.

Music

Intertextual dimensions in "Expressions of a popular polyphony"

Túlio Santos, Sara Carvalho (Supervisor)

This presentation is an excerpt of my thesis, which lies on the investigation of compositional processes driven by the intertwining of structural aspects and elements of popular and classical music. The musical work this presentation is about is originally named "Expressões de uma polifonia popular beirã: do trabalho à romaria", for acordion and string quintet. The thesis main principle is the intertextual attitude as a motivating approach. It is an investigation in the field of compositional theory and practice based on intertextuality in music as a creative tool. However, it aims to broaden the approach of reframing elements of popular tradition culture, even maintaining recognizable elements circumscribed within the Portuguese-speaking sphere.

Music

ONLINE TEACHING AND LEARNING OF STRING INSTRUMENTS: IMPLEMENTATION OF A PROGRAM TO PROMOTE SELF-REGULATED LEARNING IN CELLO LESSONS

Dora Utermohl de Queiroz, Clarissa Foletto, Luís Pedro, Guadalupe López-Íñeguez

This research project is based on the assumption that the online teaching and learning modality requires a greater degree of self-regulation in students since the teacher is physically and temporally distant. Composed of two phases, the present research project intends to explore the characteristics, potentialities, and limits of the online teaching and learning of string instruments (violin, viola, cello, and double bass) proposing self-regulated learning as a theoretical framework. The first phase of the research seeks to understand what are the knowledge bases necessary for string teachers to carry out teaching and learning in the online modality through a multi-case study. The second phase corresponds to an action research and consists of conducting online cello lessons and planning and implementing the self-regulation promotion program. This project will involve higher education institutions from three countries: Brazil, Mozambique, and Portugal. At the end of this research, it is intended to achieve results that, in addition to contributing to obtaining the necessary knowledge for string teachers to work in the online modality, can also collaborate with the optimization of the learning processes that occur in this modality.

Music

Aplicaciones del Ajedrez a la Composición

Alberto Hortigüela, Sara Carvalho

En la presentación se describen brevemente algunas ideas de mi tesis doctoral que tienen que ver con las relaciones entre la estructura interna de la música y el ajedrez así como sobre la adaptación de posibilidades del ajedrez a la composición musical.

Music

Portuguese sound archives and ethnomusicological research: a short reflection over a difficult digital existence

Andreia Duarte, Prof. Doctor Susana Sardo, Doctor Cristina Cortês, -

This reflection comes in the scope of the ongoing PhD project Atlas 78: Paths towards the recovery of Portuguese sound memories, starting from the Collection of shellac discs of the University of Aveiro. This project will focus on the analysis of private collections of shellac discs, which were later institutionalized by the University of Aveiro. The main goal of this project will be to find methodologies and strategies for classification/declassification and communication that respond to the needs of different entities and epistemologies involved in the institutionalization of phonographic collections.

In many occasions, these sound collections are inscribed in obsolete media carriers and out of commercial circulation. Until the early 2000's, they were mainly saved through the action of individuals. This situation is especially true in the case of shellac discs, since its use was mainly commercial and, therefore, they were long overlooked by the government, institutions and research.

The Age of Information came with the amplification of needs, possibilities and challenges for the safeguard of these sound memories. Digitization was appointed as the only way to carry out the the preservation of obsolete media carriers (IASA 2001, UNESCO 2012). However, in Portugal there are still few actions taken towards the digital preservation of these artefacts, the memories built upon them and the resources that are needed to make their preservation and access sustainable. During the recent pandemic, the lockdown and the transition of all interactions to virtual spaces, enhanced this problem.

This pitch is dedicated to a reflection upon the conditions and the problems that sound archives for obsolete media carriers face in Portugal and that highly condition their existence.

Music

Looking for the desired sound: elaboration of arrangements and creations for guitar

José Santos, Jorge Manuel Salgado Correia, Gilvano Dalagna

The present artistic research is focused on the processes of music elaboration for guitar, whose tradition education where the maintenance of the “musical text” prevails, which often limit the creative possibilities oh the performance. To respond to these limitations, the present investigation intends to propose and discuss new perspectives for the performance with guitar, seeking to develop a critical reflection on the processes that involve such practices. Its main objective is to contribute to the development of the repertoire for guitar through new arrangements conceived in the light of the concepts as knowledge tacit (Polanyi,1958), embodiment meaning (Merleau-Ponty, 1968) and affordances (Gibson, 1977). To realize these objectives, the present project will be developed in three phases: planning, action, and reflection (practice-based research). The expected results of this project include: live concerts and the recording and editing of a album with new arrangements and creations. It is hoped with this research proposal, beyond to generate new artistic products, to collaborate for the discussion about the musical creation and performance for guitar, trough artistic research.

Music

Agapito de Miranda: Songbooks from 20th century Goa

Eduardo Falcão, Susana Sardo

This Ph.D. project focuses on the analysis of the unpublished work of the Goan self-taught ethnographer Carmo Gonzaga Miguel Agapito de Miranda (1911-1995) consisting of 10 manuscript volumes. These notebooks sum 5155 pages and contain scores, song lyrics, own compositions, and ethnographic notes in Portuguese about Goa's musical practices. From a decolonial epistemological perspective, the project intends to place the work of Agapito de Miranda within the intellectual production about music and, thus, contribute to the historiography of musical practices in Goa. The research problematizes what proposal of "Goan musical culture" is implicit in its work. To this end, it seeks to biography Agapito's musical journey to understand how he performed in Goa's musical scene. Due to the repertoire's ethnographic and symbolic importance registered in the manuscripts, the analysis of this document will contribute to a better understanding of the politics of memory in a postcolonial context.

Music

Musical performances with Plants: Seeking to connect to their imponderable world

Marisa Ponce de León, Jorge Correia / Filipe Lopes, filipelopes@esmad.ipp.pt / coorientador

My Artistic Research entitled “Phitopoetic Creation: Contribution to a Reflection on Ethical Responsibility in Musical Performance", within the Doctoral Program in Music of the University of Aveiro, comprises a series of creative exercises with plants. Plants are too often seen with a single utilitarian purpose, as mere producers of oxygen. The artistic perspective adopted seeks to counteract the anthropocentric and authoritarian tendency to objectify plants and intends to learn, feel and perform through the communication with plant sounds, so audience and performers can empathize with these sentients beings. Flute, multimedia, and technological devices which translate bio-electrical-signals from plants into sound, in real time, are used. This exchange of sound possibilities opens a field for creation in real time, with new resources of transformation and transmission of methodologies within the Academy in the XXI century that break with traditional paradigms in interpretation, including the improvisation as a fundamental creativity source.

Music

Reconquering the past. An exploration of technical-expressive composition resources for recreating the calypso of Costa Rica

Alonso Torres, Sara Carvalho

The recreation of Costa Rican calypso music offers a fertile field of study about the musical, ethical and social implications of attempting to recreate a music regarded as "folkloric" or "ethnic". In this presentation, I summarize the findings of my research in relation to the Costa Rican calypso musical practice and my interactions as an external musician with Kawe Calypso, one of the most active calypso bands from Costa Rica.

Music

Jorge Peixinho: Four artistic research proposals

Pedro Baptista, Pedro Rodrigues, Evgueni Zoudilkine

Jorge Peixinho (1940-1995) was a Portuguese composer at the forefront of the avant-garde musical movement from the second half of the twentieth century. His works catalogue, elaborated by Delgado, Machado and Machado (2002), was consulted as the main source for the identification of 21 guitar works, composed over a period of 24 years (1971 to 1994).

Aiming to raise awareness of these largely unknown works and to uncover unexplored possibilities that Peixinho's music might offer to guitarists, this communication presents four artistic research proposals, conceived as new ways to play Jorge Peixinho on guitar. Three of these proposals resource to technology to enlarge the role of solo guitar on Peixinho's works, namely Harmónicos I (1967), Sine Nomine (1987) and Nuno Peixoto de Pinho's LLOCK (2012), which was crafted from Peixinho's L' Oiseau-Lyre (1982) and Cantos de Sophia (1990). The fourth proposal consists of a new original composition for solo guitar, entitled Jorge Peixinho - In Memoriam (2021), which is intended as an homage to the composer, containing citations from diverse Peixinho's guitar works.

Music

Musical interculturality experiences in Macao 20th century: Artistic Recreation of Áureo Castro´s Solo Piano Works.

Ana Ferreira, Jorge Salgado Correia, Shao Xiao Ling

Áureo Castro's was a Portuguese musician that had a profound influence on the development of erudite music in Macao (China), a place of secular dialogue between the East and Western cultures. As a composer and enthusiastic of Chinese folk music and with a deep affection for Macao and its people, Áureo Castro composed some works that merges Western style and Chinese style, revealing traces of Sino-Western interculturality.

This research aims for a performative recreation of Áureo Castro´s solo piano works, composed in the second half of the 20th century, as an artistic expression of a singular intercultural exchange between China and the West.

As a performer, who also had living experiences in Macao, I aim to create a scenic-musical event. To achieve this purpose, I will explore new performative approaches that express not only the composer´s affection to Macao´s culture, but also to communicate to the audience the imaginary of an intercultural and mystic world of Macao.

This project will provide a wider recognition of Áureo Castro in Macao's cultural heritage and will contribute for the dissemination of his solo piano works. Furthermore, I hope to contribute for the development of Artistic Research and to encourage the study of new performative approaches that enhance musical interculturality.

Music

Without distances: A performance proposal regarding Domenico Scarlatti's sonatas transcribed by Enrique Granados

Laia Martin, Luca Chiantore

Enrique Granados published 24 transcriptions of Domenico Scarlatti sonatas in 1905. They are part of a tradition started in 1785 in which at least thirty pianists published their editions and transcriptions before Granados, and this tradition maintained its continuity until 1942. The comparative study of the transcriptions highlights the diversity of the level of modification in these publications, and sometimes, as in Granados transcriptions, under the same name. This fact requires rethinking a new framework to name them. Nowadays, the diversity of the transcriptions can be an opportunity for the performer to build a performance from the multiple possibilities this tradition offers him.

In this artistic research I propose a concert format with my live performance on the piano of the Granados transcriptions and the corresponding first bars of the Scarlatti sonatas recorded in different historical keyboard instruments by other performers. In it, the reproduction features of the digital music have been the basis of creating the links between the recordings and my live performance. They provide an option in which the new paradigms of digital listening emerge onto the stage achieving an updated recital and cycle concept. The use of sound technology and the collaboration with others have enabled my performance to be built by the proficiencies of performers of different traditions, the timbre of other instruments or by the decisions I had to make to link the recordings. It's also constructed from the new possibilities offered to me by the added or modified elements of Granados, and by my interpretation of the critical commentary Felipe Pedrell added to the first edition of the transcriptions.

Music

With Tiger Claw: Endemic piano performance in Baja California Sur from 1880 to 1980

del Peón Pacheco, Ana Flavia Lopes Miguel, Luca Chiantore

The geographical and social conditions in Baja California Sur, Mexico from the end of the 19th century until the 1980's, caused a particular way of playing different piano repertories. Geographical isolation created a condition of almost insularity, backwardness in comparison to central Mexico's modernity. The migratory processes also made the regional piano performance develop its own particular ways, it remains mostly intact, according to the tradition, with some interpretative practices used before the 20th century, as well as developing techniques and concepts that respond to its own aesthetic. Loudness and resonance were primary elements of this aesthetic, where the subtleties in the sound are not a priority. The main objective of my artistic research is to propose and create an interpretation for various piano repertoires with the socio-cultural and musical distinctive traditions found in what I define endemic interpretation that may be considered unusual for the academy and the way in which we have been executing a certain repertoire in relation to the score, the canonical tradition and the perspective of gender. A comprehensive ethnographic study has been needed and the final performance decisions will be a part of the autoethnography that includes the ways in which regional performance traditions have affected my own playing. With the concept of endemic interpretation I also try to help the study and recovery of artistic practices and musical values from other communities.

Music

Le charme du son: technical and aesthetic experimentation on piano music by Cécile Chaminade

Zanya Escolar, Shao Ling, Luca Chiantore

Este projeto procura propor uma aproximação ao repertório para piano de Cécile Chaminade a partir da experimentação com tratados sobre técnica de piano de seu tempo e outras fontes escritas e sonoras. Os escritos de Marie Jaëll, Blanche Selva, Maurice Dumesnil e E. Robert Schmitz revelam características interpretativas e pedagógicas únicas e são uma fonte importante de informação sobre o pianismo da época que ainda não foi explorado num nível prático no âmbito de uma investigação artística. A aplicação dessa experimentação à música de Chaminade – um repertório não considerado de primeira linha – permite-nos ampliar a visão historiográfica que temos de seus contemporâneos e entender melhor a heterogénea cena musical francesa do final do século XIX e início do XX. A interpretação desempenha um papel fundamental nessa busca, sendo a ferramenta chave para redesenhar quadros estilísticos e categorias historiográficas estabelecidas e, ao mesmo tempo, reivindicando o valor da experimentação corporal no âmbito da Artistic Research.

Music

Improvisation in western art music: A theoretical and practical model applied to the Douze Etudes pour Guitarre by Heitor Villa-Lobos

León Salcedo, Gilvano Dalagna, Paulo Vaz de Carvalho, NA

The current performance practice of the canonical repertoire in western art music lacks on the inclusion of improvisation processes compared with other music styles. However, there is a growing interest for improvisation in performers of western art music. In most cases, performers lack of strategies for improvisation that help them to guide their already acquired skills in their work and training. Professional performers have strong training in developing mechanical operations that allow them to play, this set of operations become mechanisms expressed in formulas of melodic designs, chord structures, arpeggios, scales, polyphonic or timbrical textures, etc, as part of the learning and practice of canonical repertoire. As result of this training, the average professional performer of western art music knows and can play a large number of mechanisms. These mechanisms can be deconstructed and transformed to become vocabulary that may be used as material for improvisation. Therefore, considering this perspective, we can propose a theoretical and practical model for improvisation in western art music departing from this first level of generating structural material from mechanism and oriented to performers. In this project, this approach will be applied to the Douze Etudes pour Guitarre by Heitor Villa-Lobos to obtain both, theoretical and artistic outcomes. To obtain these results, the proposed method is designed in phases, that spans documentary research, exploratory, experimentation and creative stages.

Music

Two generations amidst changing aesthetics: an artistic research on the divergences between Robert Schumann and Johannes Brahms

Juan Rojas, Luca Chiantore

Instrumental performance as a mean for a historiographic revision of the piano output of Robert Schumann (1810–1856) and Johannes Brahms (1833–1897) lays at the base of this artistic research. The concept of German romanticism, at the core of the traditional musicological canon, embraces both Schumann´s and Brahms´ piano compositions, in spite of the chronological gap between both of them: Brahms last piano works are more than sixty years ahead of the first, and most popular, Schumann's piano compositions.

This musicological stance is often reflected in current performance practices, which in turn, go on to reinforce the status quo of musical historiography in a process that do not cease to feedback itself, as shown by the narrow frame of possibilities that mainstream performance allows to differentiate between both composers. On the other hand, most historicist recordings of 19th century piano music reveal yawning divergences in relation to historical evidences of 19th-century performance practices as found on contemporary written sources and recordings from the early twentieth century.

This gap was already highlighted by authors like Clive Brown, Peres da Costa and Anselm Gerhard. Hence, this artistic research aims to reflect on the modern piano the changes and characteristics of performance practices in Schumann's and Brahms's piano works by means of a non-conventional reading of their works, in this concrete case the performer being informed and inspired by historical sources. Among the surveyed sources are to be found: treatises, methods, concert critics, etc.; organological modifications and changes of instrumental technique; recordings made by those pianists near to the Schumann-Brahms' circle like Carl Reinecke, Adelina de Lara, Fanny Davies, Ilona Eibenschütz, Carl Friedberg and Etelka Freund. In the performance several parameters are to be transformed in order to show the difference between those performance practices own to each composer.

That includes the broadening of the dynamic range linked to organological transformations as well as to the overall changes in performance´s aesthetics; long-line phrases replace a phrasing based on small melodic cells; asynchrony of hands and arpeggiation of chords decrease in favor of an accentuation based on the regularity of down- and upbeats; among other changes in pedalling, ornamentation, agogics and tempo management.

Music

The Franco-Belgian and Russian schools as references to perform Latin American repertoire for violin and piano: an artistic research project through the works of Luis Carlos Figueroa and Mario Gómez Vignes

Diana Rodríguez, Luca Chiantore, António Lourenço

The purpose of this artistic research project is to put forward a performance proposal of music for violin and piano composed in Colombia by Luis Carlos Figueroa and Mario Gómez Vignes. Taking as references the divergences of the sound and stylistic aesthetics of Franco-Belgian and Russian violin schools, which are pedagogical and performance approaches that remained in force until much of the twentieth century, showing particular characteristics regarding the sound production and use of musical expressive elements that made the most difference between the violinists representing each one of these two schools.

Taking into account that in Latin America and more specifically in Colombia there has been no pedagogical and performance tradition of the violin with its own aesthetic, as it has occurred in Europe. By taking these two schools as references, paths and possibilities can be opened for the performance of academic repertoire for violin that has been composed in Latin America.

Music

Migrating to the origin: Bird-becoming and musical performance interpreting Messiaen's Catalogue d'oiseaux

Carolina Santiago, Luca Chiantore

This project consists of an innovative interpretation of the solo piano work Catalogue d'oiseaux by the French composer Olivier Messiaen. The work is modified searching for an approach to the birdsongs that appear cited in it, also creating electronic music interludes with processed birdsongs following the intrinsic narrative of the prefaces of each piece. This performance will include a message of environmental awareness - extrinsic to this musical work, but justifying this change of the interpretative perspective - born of my concern about the disappearance of avian species and changes in their migration routes, consequences of the overexploitation of natural resources for the human being. The pianist will make an approach to the birdsongs that originated this work by performing at the artistic practice the becoming-bird, and also using the cahiers of notations of birdsongs transcriptions by Olivier Messiaen.

Music

Cantocando, Self-accompaniment practice's challenges

Germán Enrique Alcñantara, Luca Chiantore, Isabel Alcobia

Cantocando is an artistic research project that seeks to generate unconventional performative proposals exploring the practice of self-accompaniment applied to the nineteenth-century repertoire of singing and piano. Problematizing the dyadic relationships that permeate our views on musical practice (piano-singing, solo-accompaniment, among others), we explore from the double practice of playing and singing or "cantocar", the vicissitudes and characteristics of the repertoire and the possibilities that provides its performative realization.

It is intended not to result in an arbitrary proposal for interpretation, or in a reconstruction of a historically informed practice, but rather the use of singing/playing to develop new resources and interpretative modes in addition to generating, for both the artist and the public, new experiences that evoke new scenarios, generate new spaces, programs and why not new musical material.

Music

No sólo Böhm

María del Carmen Fuentes, PEDRO JOSÉ PERES COUTO SOARES, JORGE MANUEL SALGADO DE CASTRO CORREIA, Luca Chiantore

Las flautas de Maximilian Schwedler (1853-1940) constituyen un capítulo importante en el desarrollo de la flauta travesera. Capítulo hoy olvidado, pero que en ese momento histórico fue crucial para el desarrollo de la forma de tocar la flauta travesera en Alemania, donde la invención del sistema de Theobald Böhm (1847) no fue aceptada. Flautistas y directores de orquesta criticaron la homogeneidad de su sonido y de su afinación, escribiendo públicamente su posicionamiento en contra del sonido del nuevo sistema y a favor del de las flautas cónicas de madera de sistema antiguo. Esta tradición sonora se perpetuó en Alemania hasta bien entrado el s. XX. Siguiendo esta corriente nos encontramos el último eslabón de flautas de sistema antiguo en las innovaciones de Maximilian Schwedler (modelos de 1885, 1895 y 1898), construidas con la idea de poder competir en volumen sonoro y en facilidad técnica con la flauta de sistema Böhm, pero sin perder el color del sonido de las antiguas.

El objetivo de mi investigación artística es descubrir cómo suenan estas flautas alternativas a las de sistema Böhm. Con esta investigación pretendo crear un documento sonoro con las flautas originales de ese período, un documento que se sirve de la investigación musicológica, de la organológica, pero sobre todo de la experimentación. Este documento sonoro es lo único "vivo" que nos queda de estas flautas, el resto de informaciones son escasas y cortas descripciones de ellas en libros y artículos en alemán o en nglés.

Es por ello que se hace necesaria una investigación artística, para crear ese nuevo imaginario sonoro, para buscar nuevos caminos interpretativos que den pie a la reflexión y a una implicación personal del intérprete, poniéndolo a éste en el centro de la actividad musical. A través de esta experimentación se consigue un enriquecimiento en la búsqueda tímbrica del sonido de la flauta, permitiendo nuevas reinterpretaciones de las fuentes históricas.

Music

Nanosciences and nanotechology

Biodegradable and active fruit packaging using agrifood by-products as raw materials

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Large amounts of fruit losses and wastes are generated worldwide [1]. Appropriate packaging may contribute to solve or minimize this global problem, while assuring the products quality and safety [2]. However, sustainable issues have occurred regarding the fossil fuel-based packaging materials disposal in the environment. Bio-based biodegradable polymers, namely the abundant starch and cellulose polysaccharides, have been proposed as potential alternative raw materials for the production of sustainable food packaging. However, their high cost, non-competitive technical properties (hydrophilicity, low mechanical strength, and poor gas and water barrier properties), and the inherent ethical issues related with land-use are still obstacles for their use in packaging sector [3]. Considering the large amount of the agrofood industrial by-products containing starch and cellulose that are currently wasted, there is the opportunity to explore them as a source of bio-polymers for the development of sustainable packaging, without resorting to food target raw materials. In turn, the high food waste resulting from short shelf-life of perishable foods, such as fruits, has aroused interest in the development of active packaging systems capable of preventing food spoilage in a short period of time. For this purpose, the incorporation of scavengers of ethylene, a phytohormone that is responsible for inducing biochemical, physiological, and structural changes during the fruit ripening process, into bio-based matrices has been studied [4]. Potassium permanganate, nanosized TiO2, activated carbons, and silica-mesoporous materials are the most used materials for inhibition of ethylene action [5]. However, a strong effective, low-cost, biocompatible, and sustainable platform for ethylene scavenging is still a challenge.

This PhD Thesis boosts the European Green Deal action plan by moving towards the circular economy. Agrifood by-products, namely potato by-products and pine nut peels, are used as alternative raw materials for the 'green' development of biodegradable bioplastics based on starch as matrix and polysaccharide-based porous particles with ethylene scavenging activity that, when combined, will provide a sustainable active packaging for fruit preservation with a competitive physicochemical and mechanical performance compared to the existing bioplastics on the market.

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Nanosciences and nanotechology

A roadmap to produce hardmetals with enhanced corrosion resistance

Alexandre Ferro Rocha, António Alexandre da Cunha Bastos, Ana Maria de Oliveira e Rocha Senos

Hardmetals are composite materials used in applications requiring high abrasion and wear resistances. Often, the service conditions lead to corrosion of the material impairing its mechanical properties and compromising the function of tools and equipment. This is particularly true for cobalt binder based hardmetals, which are the standard in this sector.

With the purpose of enhancing the corrosion resistance of this type of material, a systematic study will be conducted to characterize and understand the influence of binder chemical composition and composite microstructure on the corrosion behaviour.

The information will be rationalized with the help of modelling and simulation tools and used to devise guidelines for a roadmap to higher corrosion resistant cemented carbides. It is expected that the theoretical framework to be developed can also be adopted to the design of other materials where galvanic corrosion may occur.

Nanosciences and nanotechology

Exploring the local heating effect induced by magnetic nanoparticles for development of responsive coatings and interfaces

Alesia Sushkova, João Tedim, Vítor Amaral

The PhD project aims at the development of SMART "remote-control" multifunctional coatings to provide environmentally-friendly, cost-effective and reliable means of rendering responsive functionalities to protective coatings. The goal is proposed to be achieved by integration of magnetic nanoparticles (MNP) into thermoplastic polymers, resulting in a composite/hybrid system to be applied in metallic substrates (aluminium alloys and steel). The approach is based on the unique feature of MNP capacity to be turned into hot spots through relaxation losses under the effect of external alternating current magnetic field. The heat developed by the process could be dissipated to the surrounding polymer matrix, allowing a rearrangement of the polymer network. Combining the local heat effect with controlled positioning and orientation of the MNP by external magnetic fields during coating application and curing one aims at inducing different reversible effects: self-cleaning/anti-fouling effect at the coating/air interface, healing of defects and corrosion inhibition in the bulk coating and reversible adhesion at the metal/coating interface.

Nanosciences and nanotechology

Resistive switching in amorphous diamond-like carbon nanocomposite films

Jaime Andrade, Nikolai Sobolev, José Pedro

Resistive switching (RS) devices show potential for application in numerous areas of the industry, amongst which is neuromorphic computing. However, there still exist numerous obstacles to its implementation, and thus an interest in studying the phenomenon, and developing new materials that exhibit RS and can be implemented in neural networks.

This work will focus on studying RS in diverse materials, including amorphous diamond-like carbon nanocomposite films, primarily a-C:H:SiOx. This material is cheap and easy to produce, and offers CMOS compatibility, being easy to introduce into the market. From this data, the switching and conduction mechanisms, and an electronic model of the devices, will be studied.

Nanosciences and nanotechology

Sustainable Piezoeletric Flexible Materials

Fernando Sá, Dra. Paula Celeste da Silva Ferreira , paula.vilarinho@ua.pt

Our world is rapidly evolving into a technology era, where automation and artificial intelligence will positively impact our society. The Internet of Things (IoT), i.e. the network that connects the physical objects, allows this evolution, by connecting every part of our day and improving live styles. These tasks can be achieved through nanosensors and nanogenerators that are embed in the devices, continuously feeding information, depending on their final applications, and successfully performing tasks that were once man-made. What most comprises the feasibility of these devices is their short battery life and difficult to reach location for maintenance cycles. This is where energy harvesting, mainly piezoelectricity, becomes a promising route. Piezoelectric materials are able to convert mechanical stresses into electric voltage and vice-versa. Electric power can be harvested from environmental vibrations resulting from e.g. human motion, working machines, wind and waves. Nowadays, electronics are based on dense ceramics and thin films to act as rigid sensors, actuators, capacitors, etc. Synthesis routes often involve hazard and toxic compounds, as well as high temperatures of crystallization. Furthermore, the disposal of these devices already represents a concern around the world, leading to negative impacts in the environment. This pleads for a change by reducing both the hazard conditions and compounds utilized for manufacturing and replacing them by biodegradable materials. On the other hand, flexibility allows to take full advantage of the piezoelectric effect, being imperative to add this property to these devices. This can be mainly achieved by adapting the crystallization conditions or using alternative manufacturing methods and materials. In this PhD work, we intend to build barium titanate (BT) piezoelectric thin films and nanocomposites through two different approaches: reduction of the crystallization temperature through wet chemistry methods and incorporation of previously crystallized BT nanoparticles into polymer and biopolymers. BT is a well-known lead-free piezoelectric, being the best alternative to PZT and other lead-based piezoelectrics. Furthermore, following the biodegradability trend, we intend to use biopolymers, mainly chitosan and PHA, as substrates and matrices. The main goal is to develop a flexible and piezoelectric material to be integrated into a nanogenerator or nanosensor, depending on its electrical tests and consequent performance.

Nanosciences and nanotechology

Multifunctional magnetic bionanocomposites for simultaneous bone regeneration and cancer treatment

Joana Gonçalves, Cláudia Nunes, Paula Ferreira

The innovation of this plan is the development of a multifunctional biocomposite for bone cancer therapy. It is intended to develop scaffolds to, simultaneously, promote bone regeneration and avoid the remission of the cancer cells, to be applied after bone resection. Based on these premises, the specific aims are: 1) to develop a chitosan-based scaffold with incorporation of hydroxyapatite (HA) to promote osteoconduction; 2) to produce magnetite nanoparticles (Fe3O4 NP) with high thermal performance to induce the death of cancer cells by hyperthermia; and 3) incorporation of fucoidan on Fe3O4 NP and chitosan scaffolds to potentiate the functionality with immunostimulatory and antitumoral activities. The methodologies selected are easy and eco-friendly, magnetite will be produced by co-precipitation and chitosan-based scaffolds will be obtained by freeze-drying, 3-D printing and robocasting. The materials developed are going to be deeply characterized to understand their specific functionalities for a synergetic effect on bone cancer therapy.

Nanosciences and nanotechology

UV-Vis blocking coatings for clear and transparent glass for food packaging

Mariana Silva, Paula Celeste da Silva Ferreira, Paula Maria Lousada Silveirinha Vilarinho, Cristina Aurora Ferreira da Silva

Surveys show consumers prefer to use clear and transparent beer bottles instead of the traditional amber bottles. However clear and transparent bottles are not capable of protecting beer from radiation, this can lead to the formation of undesirable compounds such as 3-Methyl-2-butene-1-thiol (3-MBT). This compound forms due to photochemical mechanisms that are activated with UV and Visible light (blue range). To stop this and similar compounds from forming it is necessary to add a radiation absorbing coating on top of the clear colorless bottles so that they can have a similar radiation protective ability as the amber ones. This coating is expected to be made of different inorganic oxides produced using a simple, cost-effective, and environmentally benign methodology such as the sol-gel approach. With deposition techniques such as dip-coating and spray-coating. Furthermore, beer stored in the different bottle types (traditional, transparent uncoated, and transparent coated) and kept in accelerated aging conditions, will be analyzed to compare the bottles' protective abilities.

Nanosciences and nanotechology

Niobium nitride as a potential electrocatalysts for electrochemical ammonia synthesis

Vanessa Graça, Dr. Duncan Fagg

The current industrial process for NH3 synthesis is the Haber-Bosch process (HBP) which is estimated to be responsible for 2.5 % of worldwide greenhouse-gas CO2 emissions. Therefore, electrochemical ammonia synthesis is a promising alternative by the direct synthesis of NH3 from steam and nitrogen. The key to the success of this process is to find a proper electrocatalyst for the nitrogen reduction reaction (NRR). Transition metal nitrides, namely, niobium nitride (NbN) has been highlighted by DFT calculations to potentially offer high catalytic activity for the ammonia formation reaction. A pure phase of the cubic NbN composition can be obtained from niobium pentoxide (Nb2O5) by a thermal ammonolysis route. In this work, we, therefore, study the influence of temperature and time on the crystal structure, microstructure, and nitrogen content of niobium oxynitride, using different techniques such as X-ray diffraction, X-ray photoelectron spectroscopy, scanning Electron Microscopy and thermogravimetry.

Nanosciences and nanotechology

Magneto-plasmonic nanoassemblies using dendrimers: chemical synthesis and water quality monitoring

Tiago Fernandes, Ana Luísa Daniel-da-Silva

The main goal of this research proposal is to develop new hybrid magneto-plasmonic nanostructures for application in water quality monitoring. Colloidal noble metal nanoparticles, for surface enhancement Raman scattering (SERS) detection, and magnetic metal oxide NPs, as vehicles for magnetic separation, are assembled into multifunctional nanosorbents mediated by dendrimers. These are hyperbranched polymers with high density of functional groups which are used here as colloidal stabilizers and coating agents. Moreover, their chemical composition and

architecture can be exploited to tune the optical/magnetic properties of the resulting nanoassemblies. These hybrids are investigated here as analytical platforms for the uptake of vestigial pollutants from water after magnetic separation and subsequent detection by SERS. The performance of the magneto-plasmonic nanoassemblies is assessed using laboratorial water samples containing pesticides, a class of emergent pollutants whose increasing use has brought a need of innovative detection methods for a variety of contexts.

Nanosciences and nanotechology

Wear and mechanical performance of 18Ni300-TiC nanocomposite manufactured by SLM for mould and tooling

Daniel Ferreira, Filipe Oliveira, José Martinho de Oliveira

In the present work, the wear performance of the selective laser melting (SLM) manufactured 18Ni300 maraging steel reinforced by 2 to 7 vol.% nanometric titanium carbide (TiC) was investigated using a pin-on-disk approach. A disk made of polypropylene reinforced with 40 wt.% fibreglass (PP40) was used as the counterpart material. The wear tests were carried out at 4.08 kgf (40 N) constant load and 0.4 ms-1 sliding speed at room temperature and humidity conditions. Obtained results demonstrated that the wear rate in the reinforced nanocomposite is about 80% lower than the unreinforced 18Ni300 matrix, being (3.24×10-7 mm3/m.N). The morphology and chemical composition of the worn surfaces was revealed by 3D optical profilometry and scanning electron microscopy (SEM), respectively. The resulting debris, during the sliding of the pins against PP40, were also observed by SEM and energy dispersive X-ray spectroscopy (EDS). SEM morphology of the residues showed distinct shapes and sizes, indicating that the wear mechanisms could be different in 18Ni300 and 18Ni300 reinforced by TiC. Similar coefficient of friction (COF) were recorded during the tribological tests.

Nanosciences and nanotechology

New Materials from nanostructures under high-pressure and temperature

Ana Pereira, Leonel Marques Joaquim

Assembling nanostructures is a very effective way to create novel nanomaterials displaying interesting physical and chemical properties. Such assembling could be readily realized by applying simultaneously high-pressure and high-temperature. We are employing a Paris-Edinburgh press to squeeze different types of nanostructures, such as fullerite C70, glassy carbon, adamantane, diamantane and carbon nanotubes, at extreme conditions of pressure and temperature. The samples recovered from high-pressure high-temperature treatment were systematically analyzed by x-ray diffraction. Several polymers of C70 have been obtained. Also hard amorphous phases, resulting from compressions of C70 and glassy carbon, and crystalline phases of pressurized diamantane have been obtained but not yet fully identified and characterized. So far we have explored the phase diagrams of such nanostructures up to 12 GPa at different temperatures. We plan to extend the compressions up to 15GPa, although we have faced some problems on heating the samples under such high pressures.

Nanosciences and nanotechology

Ionic-liquid-supported magnetic nanomaterials for the recovery of high economic value chemical elements

Joana Almeida, Maria Eduarda da Cunha Pereira, Mara Guadalupe Freire Martins, Tito da Silva Trindade

The increasing demand for critical raw materials along with the increasing need of making the industrial processes sustainable highlight the importance of obtaining them from secondary or alternative sources. Lithium, cobalt and nickel, as well as other critical elements (platinum, palladium, gallium, germanium, indium and niobium) are present in wastewaters of industries which use emerging technologies, and should be recovered due to their high economic value and within the circular economy concept.

The development of techniques and new materials with high efficiency has proved to be important to allow the reuse of these elements and, eventually, the waters after purification. Magnetic nanomaterials have gained interest as sorbents by allowing the removal of contaminants from the water by magnetic separation. In addition, the chemical modification of magnetic nanoparticles with ionic liquids (ILs) will allow to improve selectivity and sorption efficiency for critical elements. Moreover, this type of approach in principle allows the sorbents regeneration and thus represents an additional economic advantage.

The research communicated here concerns the sorption of high economic value chemical elements in ionic-liquid-supported magnetic nanomaterials for their removal and recovery from the water which contain them by using magnetic separation techniques. Fe3O4 NPs were synthesized, coated with silica, modified with Ils at the surface and then characterized using various techniques as follows: XRD, FTIR, TEM, Elemental Analysis, BET method and magnetic measurements. Subsequently, these magnetic NPs were evaluated for their sorption characteristics of high economic value chemical elements present in waters, testing variation of amount of ionic liquid ate the surface and different pH values. The evaluation of the amount of sorbent, the ionic strength and the presence of organic matter, as well as the kinetics of the removal experiments are being carried out.

Nanosciences and nanotechology

Temperature-responsive nanomagnetic logic gates for 3D monitoring of cellular hyperthermia

Rute Pereira, Nuno Silva, João Mano, Alessandro Lascialfari

Fe3Se4 nanoparticles have had a special attention from our Research Group in the past years due to their distinguished magnetic properties. These nanoparticles work as logic gates by recording a binary response: 1, if a given temperature threshold (in this case 42 °C) is exceeded during an heating event, or 0, otherwise. In the past, an experiment was conducted in which a layer of these nanoparticles was applied under a layer of cells, submitted, later, to hyperthermia assays using different heat doses, to identify which doses resulted in surpassing the 42 °C threshold. This layered design, without direct contact between nanoparticles and cells, works perfectly for 2D-assays. However, most applications concern 3D-objects where heat flows in 3D leading to a 3D temperature threshold distribution. During my PhD, I will bring the recording of a possible surpass of the temperature threshold after hyperthermia from 2D to 3D, from a layer of cells to tissues. Aiming this, I will develop materials incorporating Fe3Se4 nanoparticles, such as hydrogels and microcapsules, and test their biocompatibility. Later, these materials will be incorporated in Pancreatic Cancer tumours and the use of Magnetic Resonance Imaging for 3D temperature threshold mapping will be explored.

Nanosciences and nanotechology

Assisted - Cold Sintering Process towards the sustainable manufacturing of electroceramics

Camila Ribeiro, Paula Vilarinho, Elisabete Costa

Today needs for resource-efficient and competitive economy to overcome climate-change and environmental degradation, requires investing in environmentally-friendly technologies. Ceramic industry is an energy-intensive sector and hence, demand and potential to improve are enormous, particularly if alternative sintering technologies are considered. While so far, Cold Sintering Process (CSP) seems to be one of the most economically attractive sintering option, there are however major limitations (property/performance and wide-platform applicability validation) that are impeding realizing its potential. Furthermore, advanced-ceramics, as smart-responsive non-linear dielectrics, as piezoelectrics, for sensors and actuators, are presently core to a digital society and Industry 5.0. Within this context, in this work we propose an innovative approach: the direct application of an electric field and current during liquid-assisted cold sintering at ultra-low temperatures (<200ºC) under external pressure. It is expected that such an approach combined with the advantages of nanotechnology will be able to grant full application of cold sintering. As a proof-of-concept, this novel method is applied to functional ceramics, lead-free piezoelectrics (K0.5Na0.5)NbO3-KNN and tunable-dielectrics (Ba0.6Sr0.4)TiO3-BST.

Nanosciences and nanotechology

Exploiting cellulose nanofibres to design nanostructured bioinks for 3D bioprinting

Nicole Lameirinhas, Carmen Freire, Ricardo Pinto, Helena Oliveira

EXPLOITING CELLULOSE NANOFIBRES TO DESIGN NANOSTRUCTURED BIOINKS FOR 3D BIOPRINTING

Nicole Lameirinhas*; Ricardo J. B. Pinto; Helena Oliveira; Carmen S. R. Freire

Three-dimensional (3D) bioprinting is promoting great advances in a variety of fields, including tissue engineering and regenerative medicine, the creation of innovative drug testing models, and diseases research.

This technique consists on the deposition of bioinks (biomaterials and cells) in a previously defined special pattern, in a layer-by-layer fashion. Nowadays, there are many polymeric materials (synthetic and natural) that can be used for the development of bioinks, in particular hydrogel-based bioinks. However, it has been noticed an increasing interest in biopolymers, such as chitosan, gelatin, and alginate. Yet, most biopolymeric hydrogel-based bioinks lack long-term mechanical properties. One strategy used to overcome this limitation is the development of nanocomposite hydrogels using biobased reinforcing agents, such as cellulose nanofibers (bacterial cellulose (BC) and nanofibrillated cellulose (NFC)). Thus, the paramount goal of this work is the formulation of novel fibrous nanostructured hydrogels with high bioprintability, mechanical performance and stability, as well as cell density and viability, for 3D bioprinting of different living tissue constructs. Here, we combined NFC with gellan gum in four different NFC:GG mass proportions, namely 90:10, 80:20, 70:30 and 60:40, to develop a bioink that will be used for 3D bioprinting of constructs for potential application in disease research, namely cancer. This work will contribute to the development of more efficient, less invasive and more patient-oriented treatments, as well as increasing the probability of disease prevention.

This work was developed within the scope of the projects CICECO-Aveiro Institute of Materials, UIDB/50011/2020 & UIDP/50011/202 and, CESAM, UIDP/50017/2020 & UIDB/50017/2020 and supported by the project I&D NANOBIOINKS – Engineering bio-based nanofibers for the development of high-performance nanostructured bioinks 3-D bioprinting, CENTRO-01-0145-FEDER-031289-funded by the Operational Program of the Center Region, in its FEDER/FNR component, and by national funds (OE), through FCT/MCTES. Nicole Lameirinhas acknowledges the PhD grant SFRH/BD/140229/2018.

Nanosciences and nanotechology

Electroactive diamond surfaces for the removal of pollutants from wastewaters of the petrochemical industry

Priscilla Brosler, João Tedim, Filipe Oliveira

Increasingly restrictive European laws force industries, especially the most polluting ones, to quickly adopt measures that minimize the environmental impact of their production activities. The petrochemical industry is one of the main contributors to the pollution of the environment as it produces large amounts of wastewater containing toxic pollutants. This project aims at the development of electrodes composed of CVD diamond surfaces grown on Si3N4-TiN ceramic substrates. These electrodes will be applied in electrochemical oxidation processes of hazardous contaminants. To this end, CVD deposition conditions were appropriately adjusted so that boron-doped diamond surfaces exhibit strong electro-oxidative activity in the range of electrochemical potential of the target pollutants. At the same time, Si3N4 conductive ceramic substrates were obtained by adding TiN particles during pressureless sintering processes.

Nanosciences and nanotechology

DEVELOPMENT OF BIOPOLYMER BASED ADVANCED NANOSTRUCTURED BIOINKS FOR 3D BIOPRINTING APPLICATIONS

Maria Teixeira, Carmen Freire, Carla Vilela

Three-dimensional (3D) bioprinting is an innovative technology, which allows the fabrication of 3D living constructs by the layer-by-layer deposition of cell laden materials, the so-called bioinks. An ideal bioink should possess proper mechanical, rheological, chemical, and biological characteristics to guarantee high cell viability and the production of tissue constructs with good dimensional stability and shape fidelity. Due to these specific requirements, the development of suitable bioinks is a major area of research. Biopolymers, such as chitosan, gelatin and alginate are increasingly popular polymers for 3D bioprinting applications because they combine adequate physicochemical and biomimetic features for the engineering and development of novel bioinks. Nonetheless, these biopolymers also present some limitations related with weak mechanical properties or lack of cell-adhesion moieties. Thus, several strategies have been explored to overcome these drawbacks, for instance the formulation of composite bioinks by addition of reinforcing agents, or improved formulations by combination with bioactive molecules. Protein nanofibers, also known as amyloid fibrils, are very attractive nanomaterials for the production of nanocomposites because of their mechanical performance, thermal stability and bioactive properties. In fact, several materials based on protein nanofibers have already been produced for biomedical applications, but their use on the development of bioinks is still very narrow. In this context, the main goal of this PhD project is the formulation of advanced nanocomposite bioinks with high performance in terms of bioprintability, mechanical stability, as well as cell density and viability, by combining biopolymers and protein nanofibers. Herein, we present the results of our first work focused on the development of new nanocomposites based on alginate hydrogels reinforced with lysozyme nanofibers, in order to produce bioinks with good mechanical performance and high cell viability.

This work was developed within the scope of projects CICECO-Aveiro Institute of Materials, UIDB/50011/2020 & UIDP/50011/2020, financed through the FCT/MCTES, and NANOBIOINKS- Engineering bio-based nanofibers for the development of high-performance nanostructured bioinks

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Nanosciences and nanotechology

Graphene on paper for flexible devices: sensors and OLEDs

Bohdan Kulyk, Florinda M. Costa, Luiz Pereira, Elvira Fortunato

The growing interest in flexible electronics has been increasing the need for products and devices with novel functionalities. Graphene, thanks to its unique blend of outstanding properties, appears as a prominent candidate for this type of applications. At the same time, paper has been taking on an important role in the field of flexible electronics. Thus, the possibility of combining these two materials is highly appealing for the development of innovative devices and disruptive technologies.

The aim of this work is to develop two types of graphene-on-paper devices: sensors and organic light emitting diodes (OLEDs). All stages of this process are to be covered, from the synthesis of graphene to the microfabrication and characterization of the resulting devices, with the final objective of obtaining functional proof-of-concept prototypes.

This presentation focuses on the synthesis of laser-induced graphene by irradiation of conventional filter paper, a process which allows to fabricate conductive paths directly on paper in a fast and inexpensive manner. In the context of this PhD work, this material was employed to fabricate physical sensors for the measurement of strain and bending, thus demonstrating its potential for application in flexible, low-cost, environmentally friendly devices.

Nanosciences and nanotechology

Cold Sintering for the manufacture of lead-free piezoelectric ceramics towards sustainable electronics

Anna Wlódarkiewicz, Paula M. Vilarinho, Elisabete Costa

Lead zironate titanate (PZT) is currently the piezoelectric material that dominates the market. However, PZT contains more than 60 wt % of lead, which is a toxic element, and should be replaced with alternative, lead-free materials [1]. Potassium sodium niobate (K1-xNaxNbO3, KNN)) is one of the most promising lead-free piezoelectric materials due to its high Curie temperature and good piezoelectric performance [2]. Unfortunately, KNN presents difficulties during fabrication by conventional sintering at high temperature [3,4]. Therefore, development of low-temperature sintering routes is crucial for rendering KNN competitive.

Sustainable, low-temperature sintering techniques are also fundamental from the industrial, economical, and environmental perspective. For the industrial sector, being a major contributor to global emissions and environmental pollution [5], meeting the sustainability goals of the European Green Deal is one of the major challenges. Ceramic technologies, in particular the sintering step at very high temperatures (800-2000 ºC), are energy intensive [6] and require improvements to reduce their environmental impact. In this context, the present work aims at the development of Cold Sintering Process (CSP), which is currently considered to be the most economically attractive sintering techniques [5,6], for the lead-free KNN ceramics. CSP utilizes a second phase, a transient liquid, that facilitates mass transfer for densification via dissolution-precipitation process at low temperature (below 300°C) over a short time when uniaxial pressure is applied [7].

The main objectives of this work are: i) to develop and construct the Cold Sintering reactor, ii) to optimize the composition of a solvent to be used for Cold Sintering of KNN, taking into account the tendency of KNN to incongruent dissolution and limited solubility in water, iii) to sinter the KNN ceramics by Cold Sintering method and to determine the most adequate parameters of the process, iv) to characterize the KNN ceramics prepared by cold sintering and to identify the relations between conditions of the process and properties of the material.

It is expected that achieving these objectives will contribute significantly to the knowledge development in the field of sustainable ceramics processing , namely of KNN and to its application in the production of electronic devices, as, as well as to the establishing of an advanced, energy efficient sintering technology with the significant potential application potential in the fabrication of a broad range of functional electroceramic smaterials. .

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Nanosciences and nanotechology

Protein nanofibrils for myocardial infarction tissue regeneration

Tiago Carvalho, Carmen S. R. Freire, Hélder A. Santos

According to the World Health Organization, cardiovascular diseases, particularly myocardial infarction, are a leading cause of death, being heart transplantation the only form of treatment. Tissue engineering, that combines biomaterials and cells, is an alternative which have already demonstrated promising results. However, the design of biomaterials with suitable properties is still an important limitation.

Protein nanofibrils are misfolded proteins that self-assembled into long nanofibrils with remarkable mechanical performance, thermal stability, and insolubility in aqueous media. These nanofibrils have been used in the design of scaffolds for regenerative medicine, for example, for bone, muscle, or spinal cord regeneration. However, they have never been explored to produce biomaterials for the regeneration of myocardium. In this context, the objective of this PhD thesis is to exploit the potentialities that protein nanofibrils have for the development of biomaterial scaffolds for myocardial regeneration.

The work carried out during the last year aimed to study the effect of the addition of lysozyme nanofibrils (LNFs) to gelatin electrospun patches for myocardium infarcted tissue regeneration. The gelatin-LNFs electrospun patches were characterized in terms of physicochemical and biological properties. The addition of the LNFs promoted an improvement of the mechanical properties, bioabsorbability and antioxidant activity of the electrospun patches, while maintaining other properties of interest for the intended application, such as the electrospun fibers morphology and biocompatibility.

Additionally, injectable hydrogels of hyaluronic acid and gelatin reinforced with LNFs loaded with gold nanoparticles (Au NPs) were also prepared envisioning the same application. LNFs containing Au NPs were prepared by in situ synthesis of Au NPs. After confirming the injectability of the prepared hydrogels, further characterization revealed, once again, that the presence of LNFs increases the antioxidant activity of the materials. The addition of the LNFs loaded with the Au NPs impart the hydrogels with conductivity. Additional characterization will be carried out in the future, namely, rheology measurements, imaging with the gold nanoparticles, and biocompatibility assessment.

Considering these results, LNFs showed to be very promising functional nanostructures for the use on the development of innovative biomaterials for the regeneration of myocardium.

Acknowledgments

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Nanosciences and nanotechology

Can a graphene bridge reconnect the injured spinal cord?

André Girão, Paula Marques, María Serrano, António Completo

Spinal cord injury is a traumatic incident with devastating lifetime repercussions that affects thousands of people worldwide. Tragically, there are no available therapies proficient to significantly reverse the condition of the patients, who are caught in a spiral of hopelessness fomented by a drastically decline in their quality of life together with high lifelong healthcare expenses. Therefore, and considering the deficient natural regeneration process of the central nervous system, in this project we purpose a neural tissue engineering scaffold capable of combining the

bioactivity of graphene with a fibrous-porous architecture suitable for mimicking the morphology of the spinal cord. This biomimetic 3D microenvironment should present biochemical, electrical and mechanical features able to enhance neural stem cell differentiation towards neurons and glia. With effect, by understanding which factors influence the formation of a functional spinal cord neuronal network in vitro, it will be possible to highlight new directions for an ultimate spinal cord regeneration strategy.

Nanosciences and nanotechology

Diffraction and microscopy studies of novel functional oxides obtained via high pressure synthesis

João Cardoso, Andrei Salak, Joaquim Vieira, Vladimir Shvartsman

Many potentially promising Bi-containing complex perovskite oxides are hard to process via conventional methods. High-pressure synthesis is one of the few approaches to produce such compositions. After synthesis these oxide materials can remain at ambient pressure and temperature in metastable phases.Annealing of the as-prepared metastable phases may result in the formation of new phases through irreversible transformation, the phenomenon coined as conversion polymorphism. Conversion-stabilized polymorphs represent new perovskite structures with very interesting physical properties. The local structure, local magnetic and electromechanical response will be studied with transmission electron microscopy and with magnetic and piezo force microscopy, respectively.

Nanosciences and nanotechology

Carbon-based nanomaterials functionalized with porphyrins for cancer therapies

Ana Monteiro, Tito Trindade, Graça Neves

The functionalization of graphene and graphene-related materials with photoactivable molecules has been acquiring an increasing importance, namely in biomedicine. This PhD project aims to develop hybrid materials, through the conjugation of porphyrins (or phthalocyanines) with carbon nanomaterials (as graphene oxide - GO or graphene quantum dots - GQDs). Among the multiple bio-applications of these materials, a special focus is given to the photodynamic therapy (PDT) in tumoral cells and to the inhibition of telomerase enzyme through the stabilization of deoxyribonucleic acid (DNA) G-Quadruplex structures. The structural and morphological properties of the hybrids will be adjusted to optimize their action as potential anticancer agents.

Nanosciences and nanotechology

Nanostructures for biodetection: Synthesis, surface functionalization and, application in protein enrichment and diagnosis of cardiovascular diseases

Maria António, Ana Luísa Daniel da Silva, Rui Vitorino, None

The present work was written in the scope of the doctoral program in Nanoscience and Nanotechnology and aims to provide an overview of the different strategies applied to the detection of C-reactive protein (CRP), N-terminal pro brain natriuretic peptide (NT-proBNP) and galectin-3 (Gal-3) biomarkers using nanomaterials.

The purpose of the work is the synthesis, modification and bioconjugation of gold nanoparticles (AuNPs) and iron oxide nanoparticles (IONPs) for CRP, NT-proBNP and, Gal-3 detection in different biological fluids.

CRP, NT-proBNP and, Gal-3 were the selected biomarkers for the construction of a strategy for CVD diagnosis with focus on heart failure (HF) and atrial fibrillation (AF). Gold nanoparticles (AuNPs) and iron oxides nanoparticles (IONPs) will be used for biomarker detection and recovery on biological fluids, respectively. The detection method is optical-based, namely, through localized surface plasmon resonance (LSPR)-based with the objective of developing a colorimetric lateral flow assay, explained on work plan section. For the construction of this strategy, literature overviewed about the elements used in this strategy was made. The most recent strategies for CRP, NT-proBNP and Gal-3 detection using nanomaterials were divided into electrochemical assays, optical-based assays, point-of-care sensors, aptasensors, fluorescence assays, and multiple biomarker detection approach were reviewed. Also, a resume of synthesis methods, intrinsic properties of AuNPs and IONPs, strategies for its surface modification and bioconjugation with antibodies, aptamers and other interesting molecules was achieved. Finally, the interference of proteins from different biological fluids will be reviewed.

Public policies

Roadmaps for strengthening the institutionalization of nature based solutions in spatial planning

Rúben Mendes, Teresa Fidélis, Filipe Teles, Peter Roebeling

Nature based solutions (NBS) are gaining relevance in the scientific community, enabling innovative tools to deal with the resilience, adaptability and sustainability of cities. In spite progresses, gaps are still present in the literature regarding their institutionalization in the daily spatial planning and decision-making processes. The objective of this research is to define a set of actions able to facilitate the incorporation of the NBS in those processes, especially in the articulation between public policies and urban planning. To do so, it will be used a conceptual model based on critical discourse analysis to understand the drivers and barriers to the incorporation of NBS in a set of cities. These cities will be used as case studies with examples from both Portugal and other European cities. We intend to establish a set of measures, as a roadmap, to help the process of institutionalization of NBS within urban planning practices.

Public policies

Ocean, Public Policy and Development: the transformative role of Smart Specialisation Strategies (S3)

Carla Santos, Carlos Rodrigues, Sara Moreno Pires

O objeto de estudo é a compreensão da relação entre o desenho das políticas públicas para o mar (PPM) o poder transformativo do território que elas encerram e os desafios inerentes à materialização dessa transformação.

Estudar-se-á como as PPM à escala europeia, nacional e regional, em particular as Estratégias de Especialização Inteligente (RIS3), podem promover um desenvolvimento territorial inovador e sustentável. A investigação terá como contribuições científicas e sociais:

- Produzir conhecimento sobre a transformação dos territórios através de PPM, focando processos de política e governança, fatores que a condicionam e que potenciam um desenvolvimento sustentável(DS);

- Aprofundar conhecimento em domínios recentes (economia azul, especialização inteligente, mar) e relacioná-lo com conceitos estabilizados cientificamente (desenvolvimento territorial, governança, DS);

- Trazer contributos para apoiar a formulação e implementação das PPM em Portugal, em particular das RIS3, em consonância com as políticas europeias e Agenda 2030 da ONU;

- Contribuir para investigação futura sobre PPM e sustentabilidade.

Public policies

Os desafios contemporâneos do combate ao racismo – o caso da comunidade estudantil brasileira em Portugal

Aruanã Rosa, José Mota, Teresa Carvalho, Fabrício Pereira da Silva

O racismo tem-se apresentado como uma problemática mundial desafiante para as democracias contemporâneas. Neste sentido, as políticas públicas (PP) apresentam-se como um instrumento fundamental para reduzir as desigualdades raciais, de forma a tentar consolidar uma efetiva cidadania que associe o bem-estar individual e coletivo, em diferentes espaços geográficos. Nos últimos anos, as relações bilaterais entre Brasil

e Portugal têm-se acentuado, nomeadamente através da imigração brasileira para o território português, em particular de estudantes do ensino superior, totalizando 20.627 em 2018/19, e permanecendo a maior comunidade de nacionalidade estrangeira (DGEEC, 2020). Este fenómeno tem vindo a suscitar tensões sociais, verificados por crescentes episódios de discriminação e racismo veiculados nos media. Neste sentido, esta investigação pretende: i) compreender o racismo como um sistema transnacional de discriminação; ii) produzir estudos comparativos entre as políticas públicas de combate ao racismo desenvolvidas no Brasil, e as PP implementadas em Portugal, sob um prisma de análise crítica das legislações em ambos os espaços; iii) estudar as dinâmicas do racismo em Portugal, em particular as discriminações contra a comunidade brasileira, no contexto do ensino superior; iv) propor novas ferramentas de políticas públicas antirracismo numa ótica de emancipação dos grupos racializados.

Public policies

The University Foundation Form in the Public Portuguese Universities

Manuel Carmelo Rosa, Maria Teresa Carvalho, Pedro Nuno Teixeira

The objectives of this research project are to analyse the experience of the creation of university foundations in Portugal and evaluate some results in the governance of these institutions.

To attain these objectives I will develop:

A contextual analysis; The analysis of the nature and the objectives of the Foundation form of governance; The analysis of the main tendencies of the research on institutional governance in the field of the public policies on higher education; The analysis of similar experiences in some other sectors and in other european countries; and, The analysis of the perceptions of different actors in the higher education sector.

The Theory of the Neo-institutionalism in the public policies will be the theorethical basis to develop the hypothesis of answers to the research questions.

To analyse the evolution of the governance policies in public universities will be considered:

The changing processes; The role of legal influences in the organizational decision making; and, The tendency to create similar or convergent structures leading to the institutional isomorphism.

The research methodology will be based in: Document analysis; Case studies using comparative analysis; Semi-structured one to one in person interviews, following The Standardised OpenEnded interview methodology (Turner 2010); and Qualitative and quantitative analysis of the data collected.

The very preliminary available results are:

The University Foundation Form approved in Portugal by RJIES corresponds to a disruptive innovation, influenced by external institutions and inspired by New Public Management (NPM) global reform scripts; The University Foundation Form tends to narrow the self-governance of the public universities - e.g. the appointment of the members of the board by the government and the example of the Hungarian case; Effect of the international context in the forms of governance of the universities and in their way of operating (RJIES), with particular relevance for EU and OECD. This influence tends to create similar or convergent structures leading to the institutional isomorphism.

Public policies

Urban public policies territorialization – Case studies analysis of social policies implementation in large cities

Gabriela Chaves, Filipe Teles

In specialized literature, expressions such as “policy territorialization” or “policy territorial dimensions” have been used to highlight the need for intra-urban territorial arrangements, expressing a logic of policy spatialization. In metropolises and large cities, this logic has become increasingly present given the social complexity of those spaces.

Thus, cities can be perceived as governance labs and areas for public policies prototyping, therefore, it is where we propose to observe and analyze experiences in search of answers to the social policies implementation challenges.

Without intending to make an evaluation of the policies, the research will carry out a descriptive-exploratory study of three cases. The investigation seeks to understand how the implementation of social policies in large cities is affected by the territorialization strategy and whether this strategy can contribute to their qualification in metropolises.

Public policies

Cross-Border Higher Education: an overview of quality assurance policies

Nathan Carvalho, Maria João Rosa, Alberto Amaral

Higher Education (HE) has been changing over the past decades. The increase of Cross-border Higher Education (CBHE) provision is one of these changes and brings new possibilities and challenges for HE systems. This project intends to study the multiple facets of CBHE in Europe and its quality assurance, understood as a public policy. The research question is defined as: How is Cross-border Higher Education being operated in Europe and what are the main challenges it poses for quality assurance? This project follows a qualitative research approach, framed in the development of case studies. Three case studies will be elaborated under this research: Portugal, the Flemish Community of Belgium and the United Kingdom. To elaborate the cases, systematic literature reviews will be performed on the themes of CBHE and quality assurance in higher education, as well as document analysis and interviews with relevant actors, both at institutional, national and supranational levels. Also, as preliminar results has showed, it was possible to identify the relevance of QA for CBHE, the increase of Cross-Border External Quality Assurance (CBEQA) and the impact of Covid-19 in the CBHE system.

Public policies

GLOBAL GOVERNANCE IN HEALTH POLICIES: THE CASE OF PEOPLE'S REPUBLIC OF CHINA

Anabela Santiago, Carlos José de Oliveira e Silva Rodrigues, Jorge Tavares da Silva

Global governance for health assumes great relevance in a context of health problems on a global scale. The People's Republic of China (PRC) has accentuated its involvement in issues of global governance, and particularly global health governance in the the last two decades.

This research proposal is directed towards the analysis of Chinese health policies towards their degree of compliance with the formal requirements of global health regulators. The period analysed will be from 2003 to the present, as 2003 is a year of reform of the Chinese health system, also marked by the emergence of the SARS-CoV-1 coronavirus.

The policies analysis will be based on a qualitative methodology of content analysis, which will be supported by official documents issued during the above-mentioned period, including Five-Year Plans, Memoranda of Understanding, White Papers, Health Plans, among other key documents in the health sphere.

Public policies

Public policy on e-health: a study of e-health literacy on the Portuguese population

Marta Estrela, Maria Teresa Herdeiro, Fátima Roque, Pedro Lopes Ferreira

Digital technologies in health are crucial to promote the well-functioning of health systems and to empower individuals as part of a transition to an integrated, person-centered care. Hence, health and e-health literacy among both health professionals and the public should become an area of focus to guarantee that e-health is successfully adopted while ensuring the reduction of health inequalities by improving accessibility to digital health services.

This study seeks to apply a multi-disciplinary approach, which will allow for a societal analysis of e-health literacy in Portugal. As such, this study will allow for an in-depth analysis, thus complementing and adding new and reliable information to this relevant subject. The overall objective of this research project is to investigate e-health literacy in the Portuguese population and critically evaluate and measure the impact and effectiveness of initiatives and public policies developed to better educate the population. Furthermore, it is expected that this project can be used as a reference to help decision-makers and policymakers develop adequate public policies that will ultimately improve the e-health literacy of the population based on their needs.

Thus far, this PhD project has had a significant focus on the eHealthResp project (PTDC/SAU-SER/31678/2017). A systematic review on the impact of educational interventions has been conducted, and the usability of an e-health tool to aid clinical decision and empower the population has been assessed. The educational contents that comprise the eHealthResp educational intervention have also been validated through a Delphi

method approach. A thorough analysis of the response of the population to public health policies related to the COVID-19 pandemic has also been conducted.

Hence, considering the work already conducted and the aims of this PhD project, the next steps are to 1) conduct two systematic reviews on e-health literacy and e-health literacy policies; 2) conduct an in-depth analysis of the political and legislative framework regarding e-health and e-health literacy in Portugal through interviews; 3) analyze the e-health literacy of the Portuguese population and the barriers to the use of e-health tools with the validation and distribution of a questionnaire.

Public policies

Promoting territorial cohesion through the multilevel governance of Education policy: the link between Local & European dimensions in Portugal

Ana Grifo, João Lourenço Marques

Although it might be premature to identify a paradigm shift, Education policies tend to increasingly adopt a territorial viewpoint, therefore diverging from the often-unsighted focus on results and performance. Although benchmarking is still one of the main strategies of the European strategies regarding Education and Training, two other features arise: the exchange of best practices, through networks of governance and cooperation, and funding opportunities that intend to bridge the gap between European territories. Within the Educational field, the latter plays an important (and visible) role concerning the multilevel governance of Education, while merging material operations with strategic guidelines and requirements in line with the European framework. In Portugal, European funding instruments address infrastructural needs (building or rehabilitation of school facilities), social cohesion asymmetries, and educational underachievement, among others. It is still unclear if the approved operations and funds are allocated according to a territorial view of necessities (within the realm of Education).

Throughout the past year, this research was focused mainly on its theoretical ground, thus trying to navigate the complexity of the concept of "territorial cohesion", both individually and in association with Education Policies and Planning. The next steps will not only further examine the allocation of Structural Funds that intend to improve the Portuguese education system, but also engage in a qualitative analysis of (mainly local) Public Policies formulated a) by relying on a territorial approach, b) while translating European guidelines and influences. By the end, it is also expected to clarify the ways through which Education policies can consider territorial singularities and promote territorial cohesion, hence adding to the research around this concept.

Public policies

Health Policies in an Ageing Context: an Age-Friendly Healthcare study

Jéssica Tavares, Gonçalo Santinha, Nelson Rocha

Given the rapid growth of demographic aging, health care provided to elderly people with complex health needs is currently a challenge for health services and professionals and for public policies. The commitment to "Age-Friendly Healthcare" appears in this context, aiming at a change in the care environment that offers a new set of opportunities to this population group. However, the idea of "Age-Friendly Healthcare" is still to be discovered in its conceptualization, in the assessment of its potential and in the verification of how its operationalization can be appropriated by public policies. This project aims to understand its applicability in the Portuguese context and the principles that guide its operation. At a methodological level, quantitative and qualitative approaches will be combined, including a systematic literature review, document analysis, questionnaires, interviews and focus groups.

Public policies

Psychology

Validation and evaluation of the effectiveness of a joint program of cognitive stimulation and physical activity in healthy aging

Rute Rocha, Professora Doutora Isabel Santos, Professora Doutora Sara Fernandes

With this project, we intend to explore the impact of regular physical activity and cognitive stimulation, alone or in combination, on the cognitive functioning of sedentary elderly people with the same level of cognitive reserve. For the cognitive stimulation, the online NeuronUp program will be used, which will be validated for the Portuguese population in the first phase of the project. Subsequently, the impact of the three training conditions (cognitive stimulation, physical activity, or both together) on cognitive functioning will be studied, assessed with standardized neuropsychological tests. We also intend to monitor the maintenance of possible effects through a follow-up assessment 3 months after the completion of the interventions. The paper entitled "Impact of Physical Activity and Cognitive Stimulation on Aging: A systematic review study" was submitted to the journal Aging and Mental Health. The aim of this study was to investigate and systematize the existence of intervention programs that simultaneously use cognitive stimulation and physical activity in the cognitive function in elderly population, giving indications about their efficacy in contributing to healthy aging. This project involves participants aged between 65 and 85 years and data collection will be carried out in day centres, nursing homes, community centers and the general population. The pandemic caused by Covid-19 led to the isolation of the population and the closure of these spaces, causing delays in data collection. In order to mitigate the effects caused by the pandemic, the platform allows cognitive training at a distance, family members and technicians from the institutions will be involved in order to ensure the fulfillment of the proposed tasks and the neuropsychological assessment will be carried out complying with the safety measures. The next goals consist of project submission to the ethics committee and GDPR assessment, development of collaboration protocols with institutions such as day centers, community centers and nursing homes and start collecting data.

Psychology

Cognitive Functioning and Work-Related Outcomes in Cancer: Efficacy of a Web-Based Cognitive Rehabilitation Program (an update)

Ana Oliveira, Isabel M. Santos, Ana Torres, Linda M. Ercoli

This communication describes the work related to the ongoing doctoral project. The project aims to design, develop and evaluate a web-based cognitive rehabilitation program for working non-central nervous system (CNS) cancer survivors reporting cancer-related cognitive impairment (CRCI). Cognitive difficulties are experienced by many working non-CNS cancer survivors, being one of the most feared and worrying side effects related to cancer and cancer treatments. Considering its detrimental impact on quality of life, including work-related outcomes, it is crucial to develop and test effective and accessible intervention options to alleviate the impact of cognitive difficulties and improve work-related outcomes. Cognitive rehabilitation is considered the first-line intervention to address CRCI, being effective at improving cognitive functioning. The UCLA Cognitive Rehabilitation Intervention Program is one of such programs, with documented efficacy to ameliorate cognitive difficulties. Web-based interventions are emerging in the field of cognitive rehabilitation as a potentially valid delivery method of intervention, considering its accessibility, flexibility, acceptability and cost-effectiveness. However, studies on the effectiveness of such interventions are still scarce. Particularly in Portugal, there are no cognitive rehabilitation programs specifically designed and validated for cancer survivors. Moreover, the effectiveness of such programs has not yet been established regarding work-related outcomes. Therefore, the purpose of this research is to provide the Portuguese non-CNS cancer population and health practitioners access to an empirically validated eHealth intervention for CRCI. To that end, after performing a systematic review of the literature on the relationship between cognitive functioning and work-related outcomes on non-CNS cancer survivors and validating two psychological instruments that will be used as important outcome measures in the intervention study, we are developing the platform “CanCOG – Cognitive Rehabilitation in Cancer”, a web-based version of the UCLA Cognitive Rehabilitation Intervention Program, which will be accomplished in three phases: 1) Cultural translation and adaptation of the materials from American-English to European-Portuguese, 2) Design and development of the digital platform and evaluation of the interface usability, and 3) Study of the acceptability, feasibility and efficacy of the Portuguese web-based version of the program. If proven effective, this web-based intervention holds enormous promise to provide cognitive rehabilitation and improve supportive care to non-CNS cancer survivors. Ultimately, this study aims to provide a useful tool for health practitioners working with cancer survivors.

Psychology

Visual attention in deaf children

João Dele, Anabela Pereira, Paula Santos, Paulo Alves

Conhecemos o mundo por meio dos sentidos. O cérebro humano gere os sentidos e, pois que eles estão interligados, na ausência de um dá-se uma reorganização neural, a fim de se manter o equilíbrio do processamento cognitivo e evitar-se um deficit na exploração da realidade circundante. A atenção visual é um processo cognitivo que permite a recolha de informações válidas no ambiente, prescindindo dos aspetos externos do sentido auditivo. Por meio do teste psicológico d2 e de inquéritos por questionário aos pais e professores, o presente projeto pretende compreender a atenção visual em crianças surdas em idade escolar, ao mesmo tempo que se propõe em contribuir para um maior enriquecimento do curriculum do ensino primário e das competências dos respetivos professores, no tocante aos aspetos relacionados com a inclusão escolar dos alunos surdos, cujas repercussões espera-se serem extensivas ao ambiente sociofamiliar das crianças surdas.

Psychology

Firefighters under alert: Exploring symptomatology and the mediating role of compassion fatigue in the relationship between trauma and quality of life

Fabiana Rodrigues, Carlos F. Silva, Anabela Pereira, Isabel M. Santos

Firefighters play an important role in emergencies and are exposed to potentially traumatic situations, facing losses of quality of life (QoL), physical and emotional exhaustion, and a pronounced reduction in the ability to feel empathy and compassion for others - designated as Compassion Fatigue (CF). The current study assessed the impact of events (trauma), psychological distress, empathy and alexithymia of volunteer firefighters compared to career firefighters and to non-firefighter controls from the general population. More, we explored the effects of trauma on QoL among firefighters owing to CF. A total of 1062 individuals completed the protocol. Data suggested that both career and volunteer firefighters presented higher trauma than the control group. In subscales of empathy, career firefighters scored higher on the perspective-taking scale than the control group, while firefighters showed less personal discomfort ($p < .01$) and less fantasy compared to the control group. Firefighters showed less alexithymia, in the outward-oriented style of thinking than the control group. There is a positive direct effect of trauma on QoL. CF partially mediated the relationship between trauma and QoL. Greater levels of trauma in firefighters were associated with increased compassion fatigue, and consequently, poorer QoL. This exposition is worrisome for the mental health of firefighters, and it is suggested that need for more prevention and treatment efforts for firefighters, with the introduction of educational and therapeutic interventions. More, interventions should address the personal trauma process, protect against CF and seek to improve firefighters' well-being. These findings provide further evidence for greater understanding of firefighters' personal growth.

Psychology

End-stage renal disease as a "WE-Disease": Promoting psychosocial adjustment and treatment adherence through a family-based intervention

Helena Sousa, Oscar Ribeiro, Alan J. Christensen, Daniela Figueiredo

End-stage renal disease is a serious health problem due to the permanent loss of kidney function. Patients with this chronic condition cannot survive without renal replacement therapy, namely dialysis or renal transplantation and, worldwide, in-center hemodialysis is the most common modality. However, in-center hemodialysis is highly complex, as it requires patients to travel to a dialysis unit three times a week to receive treatment for at least four hours per session. In addition, patients have to manage several health-related behaviors that are crucial for survival, namely dietary and fluids restrictions, vascular access care, exercise, and polypharmacy protocols. These demands increase treatment burden and cause important life disruptions for patients and their families, who are the main source of support and care. As a consequence, nonadherence rates are high and associated with several complications, including early death. In this sense, several interventions have been implemented to improve psychosocial adjustment and adherence; nonetheless, the results have shown modest effects. These interventions were designed within a patient-oriented approach and, therefore, the influence of family relationships and support has not yet been considered. Given this, the main goal of this project is to design, implement and assess the effectiveness of a family-based self-management intervention. It is hypothesized that this approach, compared to patient-focused programs, will improve patients' and family members' psychosocial adjustment to ESRD and its demands, and maximize patients' adherence. To achieve this goal and to test this hypothesis, four tasks will be considered: (i) an in-depth analysis of the emotional, relational, and educational unmet needs of patients undergoing hemodialysis and their family members, in order to inform the design of family-based interventions; (ii) the validation of the Distress Thermometer (DT) for its application with patients with ERSD and their family members (the DT was originally developed by the National Comprehensive Cancer Network and is widely applied as a screening tool for emotional distress in oncology settings); (iii) the design of a family-based intervention to be tested (pilot study) on its feasibility and preliminary effects; and (iv) the development of a pragmatic randomized clinical trial (effectiveness of family-based intervention vs. patient-centered intervention).

Psychology

Same stimuli, different context: Effects of context framing on emotional subjective experience, gaze pattern and pupil size

Sónia Santos, Josefa N. S. Pandeirada, Natália Lisandra Fernandes

Disgust is elicited by high-fitness relevance stimuli as disgusting things tend to accommodate pathogens that can threat one's health. An attentional bias to such stimuli would ensure awareness of the disease threat, and trigger a suite of behavioural responses (e.g., avoidance behaviors). Accordingly, some studies suggest prioritized attention to disgusting, over neutral and fearful stimuli. However, few studies have monitored the participants' eye movements and pupillary responses when disgust-eliciting stimuli or disease-related stimuli are presented. Moreover, comparisons among different emotional categories are frequently made using visually-distinct stimuli introducing item-selection confoundings. Inspired by recent research that reported that different emotional states can be elicited by the same stimuli but framed differently, we explored this issue using the exact same stimuli thus avoiding this problem. While eye movements and pupillary responses were recorded, participants engaged in a 6-seconds free visual exploration of pictures of objects being held by clean or dirty hands. However, to some participants, the dirty hands were described has being covered with vomit (disease context), and to others with pasta sauce (non-disease context). For each image, participants rated their arousal, disgust, and emotional valence. Such procedure constitutes an improvement as compared to previous studies which compared the eye-data with subjective data from normative studies. In the data analysis, for each image, we defined two areas of interest: (1) one corresponding to the object which should correspond to a "neutral areal"; and (2) one corresponding to the hands which, to some participants, would be disease-related but not to others.

Our eye-movement data revealed: (1) more and shorter fixations in the disease (vs. the non-disease) context; (2) participants tended to distribute their gaze between the AOIs (in terms of proportion of first fixation, fixation frequency and dwell time) in a more balanced manner in the disease (vs. the non-disease) context; (3) participants performed a higher inspection of the two AOIs when dirty (vs. clean) hands were presented. Greater pupil constriction was obtained in the disease (vs. the non-disease) context, which is consistent with an increased parasympathetic response typically obtained during the experience of disgust.

The subjective ratings showed that pictures of objects held by dirty hands described as being covered with vomit (disease context) were rated as more arousing, disgusting and negatively valenced as compared to when they were described as dirty with pasta sauce (non-disease context).

Overall, our findings suggest that framing images in a scenario of potential contamination influenced the participants' subjective emotional experience and prompted a corresponding gaze pattern, characterized by a more in-depth visual analysis, well suited for a correct estimation of the infection load/disease risk in the immediate environment.

This study also provided further validation of the Objects-on-Hands Picture Database (Fernandes et al., 2019); we are currently using stimuli from this database to study the effects of contamination in memory performance. These stimuli enable us to implement a procedure where across different conditions all participants are asked to remember the exact same stimuli, thus avoiding item-selection concerns.

Psychology

Psychological adjustment and quality of life of elderly cancer patients

Sandra Silva, Sara Monteiro, Isabel Santos, Ana Bártolo

Demographic aging has been a constant in recent decades worldwide and in Portugal. The average life expectancy at birth of the Portuguese in 1970 was 67.1 years, after 47 years (2017) the average life expectancy is 80.8 years.

On the one hand, longevity is considered a positive phenomenon, but on the other it also means being more exposed to diseases, namely cancer, which is today the main cause of death worldwide.

The incidence of cancer continues to rise each year, and is projected to increase by around 70% over the next two decades. In 2018, it was estimated that worldwide there were 18.1 million new cases of cancer and 9.6 million deaths from cancer. Of these new cases, about 60% occurred in people over 65 and about 70% of deaths caused by cancer occurred in this age group.

Therefore, it can be said that aging is the main risk factor for the development of cancer and, despite this relationship, throughout history it was found that in most clinical trials, people over 65 years of age were excluded, resulting in scarcity of data. The same has occurred with investigations in the social and behavioral areas that focus on young adults, leading to a gap in understanding the needs and impact of an oncological disease on the mental health of the elderly.

Thus, the objectives of this study are to understand the factors that affect the psychological adjustment and quality of life of elderly patients with cancer and to understand whether elderly patients with cancer have more distress and worse quality of life than their peers without cancer.

Psychology

The Mnemonic Effect for Animates: Evidence from Prospective Memory

Sara B. Félix, Josefa N. S. Pandeirada, Marie Poirier, James S. Nairne

The main role of Human memory is usually attributed to retrieving information from the past (Retrospective Memory, RM). However, some authors have suggested that human episodic memory is future-oriented; that is, its main purpose is to collect experiences, to anticipate and plan for future contingencies (e.g., Klein, 2013). This appeals for the study of Prospective Memory (PM; i.e., the memory for intentions to-be-performed in the future, such as "taking a medication at lunch"). Klein's suggestion fits an adaptive perspective which proposes that cognitive processes (namely, memory) have evolved to operate in ways that benefitted the survival and/or reproduction of the Human species. An example of a memory tuning revealed under this framing is the animacy effect – the finding that people remember animate/living beings (e.g., animals) better than inanimate/nonliving items (e.g., objects; Nairne et al., 2013). Indeed, animates are relevant in many aspects related to the Humans' odds of survival and reproduction (e.g., animates can be mates, preys, predators, etc.). So far, the animacy effect has only been studied in RM; however, considering the adaptive value of PM (c.f. Ingvar, 1985), one could predict that animacy would also influence PM performance. We have addressed this question by using typical PM procedures (e.g., Smith & Hunt, 2014), while manipulating the animacy status of the PM targets. In this case, participants were actively engaged in an ongoing color-matching task: after watching six differently colored squares, a word was presented in a colored font; participants had to decide whether the color of the word matched the color or any of the just presented squares (Yes/No response). The PM task required them to provide a different response (press the SPACEBAR) when specific target words (animates and inanimates) were presented. PM performance was significantly better when the target was an animate comparatively to when it was an inanimate. This result extends the animacy effect to a new type of memory that has potential implications for our daily lives, as most of our daily memory errors are PM failures (Cockburn, 1995).

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Psychology

The influence of spatial frequencies, presence of conspecifics, perceptual load and anxiety in the detection of threatening visual stimuli

Luiz Biondi, Sandra Soares

Evidence shows that the detection of threatening stimuli depends on multiple factors such as spatial frequency, presence of conspecifics, perceptual demand and level of fear and anxiety. Supposedly, a subcortical pathway (the low road) transmits visual information associated with threatening stimuli (snakes and fearful faces) and grabs the attention automatically. Many studies have been shown to be contradictory regarding the characteristics that activate the low road, and few of them use eye-movement sensitive devices or control for the psychophysiological responses. This project aims to study visual characteristics related to threat detection, the effect of visual monitoring in different conditions, and visual search strategies under distinct perceptual loads with aid of an eye-tracker. We consider the investigation of this issue of paramount importance since it can be used to optimize treatments and diagnoses of anxiety disorders as individual variations in the low road could be associated with these conditions.

Psychology

Assessing the effects of action videogame playing on cognition: How videogames shape emotional and social aspects.

Joana Dias, Sandra C. Soares, Samuel Silva, Swann Pichon

Action videogame playing has been associated with enhanced attentional capacities, such as faster and more accurate perceptual decisions, superior performance in demanding visual searches and better attentional capacity. Investigators also focused on the negative aspects of videogames, suggesting that they induce more aggressive behaviors and differences in social cognition (e.g. a bias towards fearful faces). However, recent research suggests positive effects of videogame playing, which must be further explored. We will investigate if emotional aspects (social cognition, emotion regulation) are an important part to videogame playing, which can be used as an emotional and social tool. Giving on step further, we will also evaluate professional videogame players. All results will be correlated with physiological measures, in order to have objective autonomic indicators. This research aims at contributing to the emotional and social benefits of videogame usage, which can help determine videogame-based interventions to people with impaired emotion and social skills.

Psychology

Exploring the mechanisms underlying emotion perception: From vision to olfaction

Joana Grave, Sandra C. Soares, Birgit Derntl, António Macedo

Socioemotional stimuli, such as facial expressions, are critical to navigate in the social world by providing information on the emotions of others. Deficits in emotion perception are consistently observed in schizophrenia, bipolar disorder and autism-spectrum disorder – all characterized by social dysfunctions. Yet, some of the mechanisms underlying emotion perception are still unclear and most studies focus on visual stimuli, despite growing evidence for an emotional chemosensory communication in humans. In this project, we aimed to provide a broader comprehension of distinct aspects of visual and olfactory perception of emotional stimuli, with an emphasis on threat perception. Four experimental studies were performed in clinical and non-clinical samples. Firstly, we explored the motion extrapolation of facial expressions in the general population, by conducing an original Representational Momentum task with looming and receding fear, angry and neutral faces. Secondly, we used a target-letter discrimination task with angry, happy and neutral faces to investigate the exogeneous attention towards facial expressions in schizophrenia and bipolar disorder. Thirdly, we addressed the access to visual awareness by facial expressions in schizophrenia, by using a breaking continuous flash suppression task with fear, happy and neutral faces. Lastly, we studied the subjective and physiological responses to emotional chemosignals and common odors in autism-spectrum disorders; the chemosignals were samples of armpit sweat, previously collected from healthy donors while they were exposed to fear, happy and neutral film-clips. By using distinct samples, paradigms and stimuli, this project adds important evidence to the field of emotion perception.

Psychology

Chemistry

Covalent Organic Frameworks as Sustainable and Efficient Solution for Water Quality Monitoring

Soraia Fernandes, Artur Silva, Begoña Espiña, Laura Salonen

Water contamination is a serious worldwide problem that endangers both the environment and human health. A wide variety of contaminants have been found in the water, highlighting the importance of the development of new methodologies for water monitoring and purification. Covalent organic frameworks (COFs) are attractive materials receiving increasing interest in the literature due to their crystallinity, large surface area, and pore uniformity. Their properties can be tailored towards specific applications by judicious design of COF building blocks, giving access to tailor-made pore sizes and surfaces. Over the years COFs have been reported as efficient adsorbents for the capture of different hazardous compounds from water, and in our group we have been demonstrated their efficiency for the capture of biotoxins and pharmaceuticals from water. More recently their applicability for in situ passive adsorption was also demonstrated with high adsorption efficiency.

Chemistry

Carbon dioxide - one filling with three flavours

João Pereira, Ricardo Vieira, Ildefonso Marin Montesinos, Luís M. M. Mafra

We undertook a thorough solid-state NMR analysis of physisorbed CO2 species prior to and after amine-functionalization of silica surfaces; combining 13C NMR chemical shift anisotropy and longitudinal relaxation times. These methods were used to quantitatively distinguish otherwise overlapping physisorbed CO2 signals, which contributed to an empirical model of CO2 speciation for the physi- and chemisorbed fractions. The quantitatively measured T1 values confirm the presence of CO2 molecular dynamics on the microsecond, millisecond and second time scales, strongly supporting the existence of up to three physisorbed CO2 species with proportions of about 15%, 15% and 70%, respectively.

A total of six distinct CO2 environments were identified from which three physisorbed CO2 were discriminated, coined here as 'gas, liquid, and solid-like' CO2 species. This work extends the current knowledge on CO2 sorption mechanisms providing new clues towards CO2 sorbent optimization.

Chemistry

Hybrid nanostructures of graphene materials and polyoxometalate clusters for photodriven applications

Maria Martins, Tito Trindade, Helena Nogueira

In recent years, the chemical modification of graphene materials has been largely explored in order to obtain materials with new properties. The covalent functionalization of graphene oxide (GO) with an ionic liquid (IL: 1-octyl-3-(3-triethoxysilylpropyl)-4,5-imidazolium chloride) promotes the reduction of GO and results in a hybrid material that can incorporate lanthanopolyoxometalates (LnPOM) through anion exchange processes. LnPOM are interesting functional units in materials science because the photoluminescence of the lanthanide can be explored in the development of optical devices. For example, it has been described that LnPOM containing Eu3+ ion exhibit photoluminescent properties due to the excitation paths that involve ligand-to-metal charge-transfer states associated with O-Ln and O-Mo transitions. However, the preparation of luminescent graphene materials containing this type of LnPOM remains poorly studied.

This research aims to develop a new type of hybrid nanomaterials based on LnPOMs clusters supported in graphene oxide (GO) for photodriven applications. Among these applications, I am currently exploring such hybrid materials as luminescent sensors for the selective detection of heavy metal pollutants present in contaminated water. The results have shown that the presence of heavy metals induces significant changes on the photoluminescent behaviour of the hybrid nanomaterial. We took advantage on this observation in order to develop rGO-IL-LnPOM hybrid materials that have great potential as nanosensors for environmental pollutants monitoring.

Chemistry

Metabolomics-driven discovery of immunometabolic dysregulations and therapeutic targets in atherosclerosis

Luís Mendes, Iola Duarte, Artur Silva, John Jones

One of the most prevalent causes of mortality and morbidity in the developed world is Atherosclerotic cardiovascular disease (ASCVD), highlighting the importance of improving risk assessment and novel therapeutic strategies. Atherosclerotic plaque progression is associated with a low-grade chronic inflammation of the arterial walls, which is at the basis of several life-threatening health problems, including myocardial infarction and stroke. Persistent hyperactivation of innate immune cells (monocytes/macrophages) by circulating atherogenic compounds (such as oxidized lipids) has been linked to non-resolving inflammation in atherosclerosis. Recent findings indicate this activation may be critically dependent on intracellular metabolism, with monocytes/macrophages undergoing metabolic reprogramming to support different effector functions. As such, in this work, we aim to explore the metabolic dysregulations in pro-atherosclerotic monocytes/macrophages, while assessing the potential of metabolic immunomodulation to prevent/treat ASCVD.

Our main approach therefore consists of using NMR metabolomics and metabolic flux analysis to reveal changes in metabolites and metabolic pathways upon monocyte/macrophage pro-atherogenic stimulation. Our first results show extensive metabolic rewiring of human THP-1 monocytes incubated with 7-ketocholesterol and a subsequent inflammatory stimulation via LPS. We will later advance to further investigating the metabolic pathways/enzymes involved in this response and to assess the functional consequences of their modulation, namely using natural plant-derived small molecules.

Chemistry

What do we know about zeolite's acidity?

Carlos Bornes, Carlos Geraldes, João Rocha, Luís Mafra

Elucidating the strength of acid sites in zeolites is fundamental to fathom their reactivity and catalytic behavior. Despite decades of research, this endeavor remains a major challenge. Trimethylphosphine oxide (TMPO) has been proposed as a reliable probe molecule to study the acid properties of solid acid catalysts, allowing the identification of distinct Brønsted acid sites and the assessment of Brønsted acid strengths. Herein we show that 31P NMR resonances usually assigned to TMPO molecules interacting with Brønsted sites of different acid strength arise instead from both changes in the probe molecule confinement effects at ZSM-5 channel system and the formation of protonated TMPO dimers. This work overhauls the current interpretation of NMR spectra, raising important concerns about the widely accepted use of probe molecules for studying acid sites in zeolites.

Chemistry

Natural biosorbents for contaminated water treatment

Paula Figueira, Eduarda Pereira, Carlos Vale

Metal contamination is one of the worldwide major concerns since these contaminants are toxic even at low concentrations, as also as they are non-degradable and therefore tend to accumulate in rivers, lakes and oceans, disrupting aquatic life and ultimately cause negative effects in human health.

Thus, it is crucial to find effective ways to protect ecosystems by reducing the levels of potentially toxic elements in waters, which means to reduce the release of these contaminants into aquatic systems, protecting water quality. Also, it is important to adopt a water recycling and reuse mentality, reducing the excessive exploration of this natural resource. Several techniques have been employed in the field of water decontamination but the majority of them have some drawbacks, such as high costs, high volumes of sludges, that do not fulfill with the increasingly strict criteria imposed by the legislation.

This work intends to propose an alternative water treatment solution with lower costs associated enabling to achieve a considerable improvement in water quality, in an environmentally friendly perspective, and allowing the further reuse of the treated water.

Chemistry

Supramolecular phthalocyanine–graphene and –fullerene hybrid materials for dye-sensitized solar cells

Sara Gamelas, Leandro Lourenço, Augusto Tomé, João Tomé

The excessive use of fossil fuels to produce electricity have concern the scientific community worldwide due to their availability and environmental consequences. Dye-sensitized solar cells (DSSC) are promising alternatives to standard photovoltaics with high power conversion efficiency (PCE). The use of phthalocyanine (Pc) dyes in DSSC allow a better light-harvesting ability in the solar emission spectrum. Also, carbon nanostructures can be associated to Pcs by covalent or noncovalent interactions to perform excellent donor-acceptor assemblies for the improvement of the electronic features.

In this work, it is shown the synthetic routes and photophysical properties of phthalocyanine structures bearinh pyrene moieties as well as their possible application in DSSC systems.

Chemistry

Sustainable chemistry

Coordination Compounds to Treat Bone Tissue Disorders

Jéssica S. Barbosa, Filipe A. Almeida Paz, Susana Santos Braga

Bones are dynamic tissues that undergo a constant and complex remodeling process. In a healthy bone, the remodeling process involves the coupled action of bone formation, by osteoblasts and bone resorption, by osteoclasts. In some cases, however, there is an imbalance between these two actions, resulting in bone tissue disorders that are an important public health problem. Nowadays, there are already several treatments to help manage bone tissue disorders. Within those, bisphosphonates (BPs) are one of the most used class of drugs due to their remarkable high affinity to hydroxyapatite in bone. Along with BPs it has been common for physicians to prescribe mineral supplements, such as calcium. Nonetheless, such combined therapy is sometimes overlooked by the patients, compromising thus the efficacy of the treatment. In response to this problem, this work aimed at designing multi-component coordination compounds composed of bisphosphonates, as organic linkers, in coordination with mineral supplements (calcium, magnesium and/or strontium), as metal centers. Different combinations of these building blocks allowed the preparation of several coordination compounds.

Sustainable chemistry

Chlorella vulgaris and Porphyridium purpureum: two microalgae with polysaccharides and other potential valuable compounds

Andreia Ferreira, Cláudia Nunes, Manuel A. Coimbra, Tiago H. Silva

Microalgae are photosynthetic microorganisms considered an important and promising source of high added-value compounds, namely fatty acids and other lipids, amino acids and polysaccharides. Chlorella vulgaris and Porphyridium purpureum (synonym of P. cruentum) have great commercial interest and are easily available.

C. vulgaris is one of the only two microalgae approved for human nutrition and is rich in starch and structural polysaccharides that could have potential to be valued as food ingredients. The starch revealed an amylose/amylopectin composition and a granule size similar to the starch found in cereals. The structural polysaccharides are mainly galactans composed by 1,3-, 1,6- and 1,3,6- linked galactose residues. These linkages were also observed in the polysaccharides recovered from the growth medium, showing similarity between the exopolysaccharides and those present in the cell wall. This exopolymeric material revealed immunostimulatory effect on B lymphocytes. These findings open the possibility of the use of both starch and exopolysaccharides of C. vulgaris as food ingredients.

P. purpureum is a red saline microalga that have raised interest due to its ability to excrete high amounts of sulfated polysaccharides (sEPS) into the growth medium. P. purpureum is easily cultivated and could change its growth behaviour and composition in response to environmental variations. Thus, the effect of growth medium salinity (18, 32, and 50 g/L NaCl) on extracellular polysaccharides production yield and chemical structure were evaluated, revealing that the yield of sEPS excretion was higher (90 mg/L) at 32 g/L NaCl. The sulfated polysaccharides were mostly constituted by terminally linked xylose, 1,3 and 1,4-Xyl, 2,3,4-Gal, and 3-Glc, and mainly sulfated at C-3 and C-4 of t-Xyl and C-6 of O-3 linked Glc. The different salinity levels of the growth medium led to a slightly change of the sulfation pattern of the glucuronoglucogalactoxylan. Nevertheless, these differences were not substantial enough to change the most representative repeating units. These sEPS revealed immunostimulatory effect on B lymphocytes, which effect significantly decrease when sulfated polysaccharides were subjected to a desulfation, revealing the relevance of sulfate esters in biological activities. P. purpureum polysaccharides showed a great potential for fish aquaculture to enhance humoral immune activity.

Sustainable chemistry

2-(diazobenzyl)chromones: new templates for drug development

Vasco Batista, Diana C. G. A. Pinto, Artur M. S. Silva

The chromone nucleus remains a privileged structure in drug research, with known anti-cancer, anti-microbial, anti-inflammatory, and anti-cholinesterase activities, among others. However, the synthesis of chromone derivatives requires early-stage functionalization steps followed by a cumbersome construction of the bicyclic scaffold. The introduction of the versatile diazo functional group allows for late-stage functionalization and fast construction of new compound libraries.

In this work, we report the synthesis of a new category of stable diazo substrates, 2-(diazobenzyl)chromones. The unique character of its conjugation to the chromone ring leads to interesting reactivity not yet seen in diazo chemistry. Its application in cyclopropanation, O-H insertion, and olefination reactions was evaluated, along with the more extensive assessment of its reaction with aromatic amines. Changes in the aromatic

amine substitution pattern led to four distinct products, namely amines, imines, 1,2-dihydroquinoxalines and dihydrobenzoxazines. These new compounds could have promising biological activities in acetylcholinesterase and MAO inhibition.

Sustainable chemistry

Design of polysaccharide-based composite films with carbon fillers

Zélia Alves, Paula Ferreira, Cláudia Nunes

The interest to produce food packaging materials from renewable, available, and biodegradable polymers has increased over the last few years aiming the reduction of environment pollution produced by petroleum-based plastics. The research has focused on polysaccharides as main sustainable sources due to their good film forming ability, abundance, and easily extraction from biomass. The incorporation of distinct fillers into the polysaccharide matrix to overcome the poor mechanical, thermal and/or barrier properties of polysaccharide films has demonstrated good results, turning these materials more competitive. In addition, concerning the awareness to look for sustainable solutions to prevent the food waste, fillers can also impart active functionalities to the film, such as antioxidant, antimicrobial, and electric conductive properties. This last property will allow the sterilization of packaged food at low temperature via pulsed electric field technology, preserving and extending the shelf-life of food products. The aim of this PhD thesis consists in producing, by sustainable chemistry procedures, active food packaging materials based on polysaccharides with the incorporation of functional carbon-based nanostructures, and therefore, evaluate their physico-chemical properties and active performance.

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Sustainable chemistry

Design, synthesis and evaluation of novel potential antileishmanial agents

Carlos F. M. Silva, Diana C. G. A. Pinto, Pedro A. Fernandes, Artur M. S. Silva

The World Health Organization has identified leishmaniasis as one of the most neglected diseases of modern times that mainly affects people from developing countries. Approximately 350 million people are considered at risk of developing leishmaniasis.

Several classes of natural compounds, such as chromones, quinolines, acridines and tetrahydroacridines have been associated to numerous biological activities, with particular emphasis to their interesting antileishmanial effects.Considering this, our work has been focused on the design and synthesis of several derivatives to act against Leishmania, using primarily computational techniques, namely molecular docking, for a more direct approach.

A selective list of promising derivatives emerged from this preliminary study as potential antileishmanial agents against a specific enzyme of the parasite, S-adenosylmethionine decarboxylase (AdoMet DC). Since then, these derivatives have been synthesized and evaluated against Leishmania, proving that this class of compounds can be seriously considered for the development of novel antileishmanial agents, with some of them presenting IC50 values below 1.0 uM against the promastigote stage of the parasite.

Sustainable chemistry

Biopolymeric nanofibrous membranes for targeted food wastewater treatment

Rodolfo Ferreira, José António Lopes da Silva

Wastewaters from food industry represent a serious environmental threat due to high levels of suspended solids, nutrients and particularly reactive pollutants. Nutrient pollution generates eutrophication and several health hazards, as well as phenolic compounds, which show high toxicity even at low concentrations. This project aims to develop novel electrospun nanofiber membranes with improved adsorption capability for pollutants typically encountered in olive mill and wineries wastewaters – nitrates, phosphorous and phenolic compounds. Keratins, chitosan and yeast cell wall extracts, obtained from agri-food by-products (chicken feathers, shortfin squid pens and spent brewer yeast) will be the main biopolymers to be tested. The fibres will be further functionalized with graphene and/or TiO2 nanoparticles to improve their adsorption capability, hydrophobicity, anti-fouling and water flux characteristics, and potential photocatalytic performance. It is hoped that these materials can complement bioremediation treatments, and increase their efficiency, improve removal of certain contaminants and act as an effective recovery strategy of added-value compounds from the wastewaters.

Keywords: Electrospinning; Nanomaterials; Biopolymers; Wastewater; Adsorption; Food Industry.

Sustainable chemistry

Development of an improved microextraction method coupled to high-resolution techniques for assessing the atmospheric variability of water-soluble organic matter composition

Pedro Brandão, Regina M. B. O. Duarte, Armando C. Duarte

Atmospheric water-soluble organic matter (WSOM) play an important role in climate system, yet little is known about its molecular composition on timescales closer to atmospheric variability. This doctoral research project proposes the development of a new approach for capturing short-term changes of the chemical features of particulate WSOM. The research plan focuses on a green strategy using novel extractive phases a for the concentration and microextraction of WSOM, and subsequent offline/online characterization through high-resolution techniques (multidimensional NMR, mass spectrometry, and 2D liquid chromatography). Besides gaining highly time-resolved data on the chemical properties of atmospheric WSOM, this project will also allow the development of a miniaturized and green approach for a wide range of applications in environmental analysis.

Sustainable chemistry

Yeast microcapsules: promising drug delivery carriers made by nature

Rita Bastos, Elisabete Coelho, Manuel A. Coimbra

Brewer's spent yeast (BSY) is a major by-product from beer industry. During industrial fermentation processes, yeast cells are subjected to several physical, chemical, and biological stress that induce yeasts modifications and adaptation. With industrial handling, S. pastorianus yeast modifies the cell wall glucans structure to increase cell strength. Moreover, as BSY three-dimensional structure is preserved as a hollow and resistant glucan microcapsule, even after extensive alkali sequential extraction of polysaccharides. As a result, this PhD intends to open new perspectives for BSY valuation, exploring the basis for developing BSY microcapsule carriers (BSYM) for drug delivery, as a promising platform for non-invasive treatment of various medical conditions. The work has been focused in BSYM preparation, detailed structural characterization, and study of its recognition by murine and human cells receptors. S. pastorianus glucan microcapsules are effectively recognized and internalized by dendritic cells (DCs), promoting the maturation of murine and human DCs with the release of immune costimulatory cytokines. BSY microcapsules are a promising, safe, and biodegradable delivery vehicle made by nature, and its immune response is particularly important for DC mediated cancer immunotherapy applications.

Sustainable chemistry

Expanding azaindole synthesis via metal-catalyzed reactions

Ana Santos, Artur Silva, Maria Marques

Azaindoles are heterocyclic structures that when properly functionalized can possess a wide range of medicinal applications. Metal-catalyzed reactions like, the well-known Sonogashira, Heck, and Suzuki cross-couplings have been used on the synthesis of azaindoles. Even though these reactions are efficient in attaining azaindole derivatives, some drawbacks still remain. The use of harsh conditions and hazardous solvents is a key concern in terms of green chemistry development. On follow-up of our previous work using amino-halopyridines in a cascade C-N cross-coupling/Heck reactions, we envision replacing the palladium catalyst by highly stable palladium nanocatalysts. These hybrids were prepared and applied on the C−N/Heck reaction cross-coupling cascade for the synthesis of substituted azaindoles. The use of these nanohybrids afforded several azaindoles in improved yields, under milder conditions.

Furthermore, halogenation of aminopyridines still constitutes a challenge, since these reactions are usually low yielding and poor regioselective. C−H activation reaction comes as a suitable alternative, that relies on the activation of a C−H bond present in the aromatic ring, thus this method allows use of commercially available starting materials, while avoiding the halogenation step.

After our previous work, we investigated a new methodology using non-functionalized aminopyridines. The method consists on the formation of imine/enamine intermediates followed by in situ C–H activation/functionalization reaction to afford the desired azaindoles. Furthermore, synthesis of 4-zaindole and 6-azaindole scaffolds was attained in a regioselective manner.

Sustainable chemistry

Carbon-based nanomaterials from renewable sources for water treatment applications

João Nogueira, Ana Daniel-da-Silva, Andrei Kavaleuski

This research project aims to develop porous carbon nanomaterials, derived from biopolymer/silica hybrids, as alternative sorbents for water treatment. Novel synthesis routes and comprehensive characterization of nanomaterials constitute the core components of the proposed research.

Carrageenan based bio-silica hybrid nanomaterials have been prepared and used as sacrificial templates to prepare porous functionalized carbon nanomaterials using hydrothermal carbonization. The materials were fully characterized and preliminary adsorption tests of pharmaceuticals contaminants from aqueous solutions were performed. On going optimizations include silica etching to obtain a porous carbon nanostructures. Of note is a porous carbon-silica hydrochar, with properties better suited for ciprofloxacin adsorption than a non-hybrid carrageenan hydrochar – 19.8% vs 6.3%, respectively.

Synergistic effects between the soft (biopolymer) and hard (silica) templates will be investigated in the future. Aiming at facile separation from effluents, magnetic carbon materials will be also prepared through hydrothermal carbonization of magnetic bio-hybrids, and in-situ generation of magnetic nanophases. Finally, porous separation membranes will be prepared based on the best materials, in a hierarchical concept combining macroporous supports and immobilized carbon nanospheres with tuned micro-mesoporosity.

Relevant properties of the materials, including reusability, will be optimized, aiming at applications as sorbents for capturing pharmaceutical pollutants from aqueous solutions. Expected outcomes will contribute to the development of cost-effective technologies to obtain safer water at wastewater treatment plants.

Sustainable chemistry

Energy systems and climate change

Neural Network Modelling of Solar Thermal Hybrid Façade

Luís Martins, Fernando Neto da Silva

Climate change and sustainable development are probably the 21st century greater challenges. Renewable energies technologies have reached a point where it becomes affordable to produce on-site the energy necessary to fulfill the needs. This producer-consumer paradigm can become a synonym of sustainability (supply-to-demand matching), energy efficiency (closer production and consumption means less energy transport losses) and security of supply (production is endogenous). It should be noted that the cost of renewable energy is becoming increasingly lower - the cost of energy obtained from renewable sources is easily calculated and relates to the return on investment made in the system and its maintenance - and the uncertainties in the fluctuation of energy costs have a low degree of instability and will depend mostly on the maintenance of the system. This approach leads to a better environment with less air and noise pollution resulting in greener cities. In this work it is intended to demonstrate the potential offered by a hybrid solar thermal façade which heats air and water, cools air and may also be used for passive ventilation. The façade can be used in several contexts, such as: industrial processes with low enthalpy requirement, commercial buildings, hospital and hotels. The economic analysis of the solution is a rather important factor that may decide the viability of such a façade in a determinate location, so, to provide such information a model of the façade will be created using Artificial Neural Networks (ANNs). The use of artificial neural networks in various applications related with renewable energies, energy management in buildings and thermal systems analysis has been increasing significantly over the years. This technique has, however, a different approach when compared with others as it uses and depends on data collected previously from a working prototype or a simulated system. This data should characterize the system behavior/performance

Energy systems and climate change

Factors underlying clean vehicles' adoption: an assessment of climate change perception influence

Ana Paula Valente de Jesus, Marta Ferreira Dias, Margarida Coelho

In "Financing the Transition" (2018), European Union stated: "It is clear that the clean energy transition and the achievement of net-zero GHG emissions in the European economy can only happen with citizens' buy-in. Consumer choice will increasingly become complementary to technological change and often a pre-condition for technology change to happen."

Green mobility is an important vector for carbon-neutral goals achievement, meanwhile, the current demand for alternative fuel vehicles is quite modest. Several authors' studies suggest that climate change and environmental concerns are not a decisive factor in adopting green technological innovations. In this context, the purpose of this thesis is to determine which factors will boost the wide green mobility technology adoption and to understand the real influence of climate change perception on the decision-making process.

Energy systems and climate change

Energy performance certificates: Filling the gaps

Alexandre Reis, Marta Ferreira Dias, Alice Tavares

Energy performance certificates (EPC) are an integral part of the Energy Performance of Buildings Directive (EPBD) and should have an important role in the enhancement of the energy performance of buildings. However, they should be further improved. Nowadays, buildings can be renovated without caring about the environmental impacts of the components used. This emphasizes the need to track the environmental issues previously and during the rehabilitation of buildings decisions. We found that the Green Building Rating Systems (GBRS) have the potential to establish the requirements to increase the demand for building components that minimize the environmental impacts of its use. On the other hand, proper levels of indoor air quality (IAQ) in buildings are among the most important benefits and drivers namely for renovation, as they lead to better health and comfort of the occupants. Therefore it is very important to formulate strategies to control and enhance IAQ. As air pollutants often enter into the human body through inhalation, the respiratory system is, regularly, the main target of IAP, resulting in pulmonary diseases and allergies. Current EPC have, in some cases, limited reliability, compliance, market penetration, or acceptance by the users. A new approach must provide an improved and more reliable service to end-users, informing them also about the environmental impacts, the risk of Volatile Organic Compounds (VOC) inside their homes, the levels of CO2, and the risk of condensations. We aim to develop a new index based on the environmental performance and IAQ, looking beyond energy.

Energy systems and climate change

Evaluation of Impacts on Intercity Corridors for Efficient and Sustainable Mobility – Innovative Ways to Address Corridors Pricing

Carlos Sampaio, Jorge M. Bandeira, Margarida C. Coelho, Eloísa Macedo

Intercity corridors movements receive less attention from the scientific and political community when compared to urban transport. Road transport has high socioeconomic negative impacts such as emissions, road accidents, noise, and congestion. The infrastructure is not taxed in an integrated and effective way. Road tolls, taxes and public transport tickets, are never examined from an intermodal perspective and there are a lack of integration between the various traffic-related externalities.

The main objective of the thesis is to develop methodologies and tools for smart and dynamic pricing schemes to improve the traffic assignment, passenger flows distribution and mitigate negatives externalities.

Some preliminary results such as the mapping of traffic-related externalities allowed the identification of hotspots in the road network between Aveiro and Coimbra. This results also allowed to characterize each road segment in this specific corridor, and the methodology used can be applied to any intercity corridor.

Energy systems and climate change

Essays on the wind farms decommissioning

GISELA MELLO, MARTA FERREIRA DIAS, Margarita Robaina

Until recently, the decommissioning of energy projects had little relevance. However, with the increase of the number of projects reaching their end of service, this topic is now considered not only significant but also a challenge for the energy sector, namely concerning the wind sources. The end of service is technically complex and highly costly. But also there is a lack of data and experience than other energy projects, concerning the procedures of each of the feasible scenarios and their advantages and disadvantages. In addition, there is still a lack of information related

to socio-environmental impacts, waste management, input consumptions, legislation and economic aspects. Regarding the climate change and energy efficiency scenarios the adoption of viable and less polluting alternatives should be considered, such as repowering or refurbish of old equipment or obsolete technology which may reduce CO2 emissions and global warming potential. Thus, this research aims to analyse the life cycle chain, focusing in the end of service scenarios, in order to identify the challenges of this phase, under the socio-environmental, legislation, social and economic perspectives.

Energy systems and climate change

Telecommunications MAP-tele

Artificial Intelligence for Radio Resource Management in Beyond 5G/6G Mobile Networks

Ehsan AtefatDoost, Dr Jonathan Rodriguez, Dr Firooz Saghezchi

Network management and resource optimization in multi-cell networks are generally associated with binary or integer decision-making where, e.g., users all allocated to different BSs, and discrete time-frequency resources are assigned to UE mobile devices.

Radio Resource Management (RRM) is practically infeasible for large networks (like 6G), since integer programming problems scale poorly with the network dimensions, which causes computational complexity, and are thus not suitable for online operations.

Major works on RRM can be categorized into two main groups [Liang2019], [Ahmed]:

1. Conventional Optimization Methods

2. Deep Learning-based RRM, which includes:

a) Supervised DL: using CNN, RNN, and DNN

b) Deep Reinforcement Learning

To this end, we should develop a new optimal/suboptimal approach that enables data-driven methods to continuously learn and optimize resource allocation strategies in a dynamic environment.

Telecommunications MAP-tele

Efficient Virtual Resource Management for Shared RANs

Fatma Marzouk, Ayman Radwan, Joao Paulo Barraca

To provide effective management of networking resources, mobile stakeholders are widely adopting the cloud service paradigm, which exploits SDN (Software Defined Networking) and Virtualization in synergy to provide a flexible and shared computing platform providing new opportunities for Mobile Virtual Network Operators (MVNOs). The research work aims to fill the current gap in Self Organizing Networks (SON) application with regards to 5G and beyond, by harnessing the future emerging technology trends on network virtualization to provide a cost-effective solution to resource management within Cloud-Based Radio Access Networks. Specifically, the scope of the work encompasses energy efficient resource allocations (EE-RA) solutions that put forward realistic RAN consideration such as: (Distributed Antenna System)DAS consideration of RRHs mapped to a same BBU, the interference level, the users' QoS and the hybrid nature of resources in the C-RAN. It also includes the design of efficient dynamic slicing schemes for the shared RAN context, aiming to bring energy efficiency, while fulfilling the Service Level Agreement (SLA) of the different coexisting tenants.

Telecommunications MAP-tele

Supporting delay intolerance services in the Virtualized Edge

Hadeel Abdah, João Paulo Barraca

Adopting Virtualized Edge concept for the next generation networks promises improved delay-sensitive services for mobile clients by moving computational resources closer to users. However, this near-user deployment directly exposes the services to clients' mobility, making mobility management more challenging and calling for careful service management to keep SLA limits preserved. To overcome this challenge, numerous techniques have been proposed. Some of these techniques address task offloading and optimal service migration, in addition to improved handover mechanisms. In our research, we employ these mechanisms for the overall purpose of realizing QoS-awareness and designing an optimal orchestration strategy for VE platform.

Telecommunications MAP-tele

Smart Beamforming Metasurfaces for Future Telecommunications

Abdel Ghafour Abraray, Stanislav Igorevich Maslovski, Nuno Borges Carvalho

For a long period of time, the propagation medium between a transmitter and a receiver was out of control of the engineers working on the mobile wireless communication systems. Although the designs of the transmitter and receiver and their antennas could be optimized for some set of communication scenarios, both the antennas and the environmental objects that constituted the communication channel could not be customized in response to changing propagation conditions. However, the situation has changed since then. In recent years, smart metasurfaces based on artifi cial intelligence techniques have received considerable attention from the research community. Such dynamically reconfigurable metasurfaces can be used for creation of adaptive propagation environments, and they can be also employed in new multibeam antennas in order to generate arbitrary radiation patterns and achieve efficient beamforming and beamsteering functions. Metasurfaces have emerged as versatile tools for controlling wave fronts and performing nearly instantaneous operations on the angular spectrum of propagating electromagnetic waves. The focus of this PhD thesis is on the programmable metasurfaces and

the machine learning techniques for applications in the future wireless communication systems.

This PhD thesis aims at developing the theoretical and practical aspects of a new architecture for the smart, reconfi gurable antennas and antenna arrays based on the programmable beamforming metasurfaces for future device-to-device wireless communications. Two-dimensional metamaterials (metasurfaces) complemented by novel beamforming techniques will be employed for high-throughput microwave/millimeter/submillimeter

band communications. We aim to implement the signal processing and control associated with the formation and tracking of the communication beams within the smart, programmable metasurface layers. The proposed architecture will be used for adaptive beamforming by using a trained arti ficial intelligence network that incorporates the programmable metasurfaces as an integral part of such network. This new architecture will allow estimates of dynamic and channel propagation in real time and adaptive beamforming, and can be also used for quasi-optical near- field long-range wireless power transfer.

Telecommunications MAP-tele

Advanced Signal Processing and Channel Modeling Techniques for Ultra-High-Capacity FSO Transmission

Marco Fernandes, Fernando Guiomar, Paulo Monteiro, Mattia Cantono

Free-space optics (FSO) convey an enormous potential for ultra-high-capacity seamless fiber-wireless transmission in 5G and beyond communication systems. However, for its practical exploitation in future deployments, FSO still requires the development of very high-precision and robust optical beam alignment. In this PhD, we propose exploring FSO to achieve high-capacity multi-Terabit communications, boosted by the modeling and mitigation of atmospheric impairments using advanced Machine Learning techniques.

Telecommunications MAP-tele

Visible Light Communication Systems Architectures for the Internet of Things

Luís Rodrigues, Luís Nero Alves, Monica Figueiredo

During the last decade, everyday objects have been including Internet connectivity, improving life comfort and system's performance. Current IoT systems have been adopting RF technologies, which may present performance issues concerning lack of spectrum, network collisions, high

power consumption and security issues. Visible Light Communications uses visible light to communicate and offers some advantages over RF, such as unregulated spectrum, wide available bandwidth, spatial confinement, electromagnetic interference free, among others.

In the context of IoT systems, VLC has the potential to improve power consumption, spectrum reusage and security when used in small network cells such as individual rooms within a building. This work aims at the development of a VLC based IoT system exploiting m-CAP modulation, implementing a multi-band modulation, and IoT devices in analog domain, which results in low-cost, low-power consumption and low-complexity devices. At the end, it is expected a demonstrator using the proposed architecture.

Telecommunications MAP-tele

Waveforms for LiDAR

Daniel Bastos, Miguel Drummond, Arnaldo Oliveira

Light detection and ranging (LiDAR) is a key sensor for the future deployment of self-driving vehicles with higher levels of autonomy. State-of-the-art LiDARs are based on short pulses and threshold methods, which are sub-optimum and non-resilient to interference. This PhD research looks into alternative LiDAR waveforms and techniques that can improve both the performance and robustness to inteference of an automotive LiDAR system, while employing a simple and cheap architecture.

Telecommunications MAP-tele

Photonic techniques for high-capacity phased array antennas

Rui Oliveira, Miguel V. Drummond, Rogério N. Nogueira

Telecommunication's systems face ever-increasing pressure to increase capacity whilst maintaining the systems other parameters in check, namely power consumption and physical dimensions. Microwave-range, beamformed antenna arrays are expected to play a major role in achieving this goal, as they are the only means to achieve dynamic spatial-division multiplexing. However, traditional electronics techniques have failed to provide solutions for large or massive scale beamformed arrays, leaving microwave-photonics has a strong contender in this area. This field is rapidly evolving and there are still open questions on fundamental architecture problems. The thesis being pitched tackles these problems, bringing forward a new architecture for microwave-photonics beamforming, based around the use of wavelength-division multiplexing and a programable photonics processor based on a liquid-crystals on silicon panel. This architecture has the potential to handle hundreds of RF beams over an area about a centimetre square and to keep power consumption in check. The work has the potential to greatly impact the telecommunication satellites, flat-panel antennas, and the latest-generation cellular markets.

Telecommunications MAP-tele

Territory, risk and public policies

Traditional Communities and Territories in the Climate Change Adaptation and Strategies – from Law to Plan

Luciana Iocca, Teresa Fidélis, Alexandra Aragão, Cristiane Derani

Traditional communities and territories have been especially impacted by climate change in the face of increased dependence on natural resources. For this reason, they must be given special attention in climate policies. In addition, traditional knowledge has been recognized in international agreements as a potential contributor to environment protection and climate change adaption. This thesis evaluates how the legal instruments related to climate change (e.g., international agreements and local strategies) address protection and participation of traditional communities in the adaptive governance process. In addition, it highlights the perception of traditional communities about the rights guarantee. The research methodology is divided into two approaches, one essentially directed toward the analysis of international, supranational, national, and local legal instruments. The second approach to identify how traditional communities understand the legal instruments and their applicability in the context of their territories in Brazil and Portugal. Preliminary results show that it is recent the global recognition the value of traditional communities and territories for the promotion of environmental protection and climate change adaptation. Moreover, the traditional communities have not seen themselves represented in climate policies, especially at the local level.

Territory, risk and public policies

What is wrong with post-fire soil erosion modelling?

Ana Rita Lopes, Diana Vieira

Soil erosion models have been proven to be a valuable tool in the decision-making process, from emergency response to long-term planning, however, they were not designed for post-fire conditions, so they need to be adapted to include fire-induced changes. Further efforts are required on the adaptation of erosion models to burned conditions, addressing post-fire infiltration, burn severity, and post-fire mitigation measures. Future studies on post-fire soil erosion modelling could consider using a multidisciplinary model combination as well as including uncertainty analysis in their predictions for a better communication of the scientific outputs.

Territory, risk and public policies

Model adaptation to post-fire hydrological impacts

Marta Basso, Diana Vieira, Jacob Keizer, Marcos Mateus

A wildfire risk assessment should consider not only the occurrence and the behavior of fire, but also its damages to the ecosystem. Those damages are the so-called “second-order impacts” and include hydro-geomorphic events and water quality contamination from sediment and nutrients transport. This PhD project aims to test, calibrate, and validate different hydrological models to simulate post-fire scenarios within burned Portuguese catchment to combine the most suitable one to serve as a base of a wildfire risk assessment.

Territory, risk and public policies

Translation and terminology

THE TRANSLATION OF SETTINGS OF THE TOURIST-CULTURAL SEMANTIC FIELD - Creation of a database of collocations based on a parallel Italian-Portuguese corpus.

Carla Marisa Da Silva Valente, Maria Teresa Roberto , Orietta Abbati

Creation of a database of collocations based on a parallel Italian-Portuguese corpus.

Translation and terminology

Coreference devices in English-German and English-Portuguese translations

Pedro Ferreira, Ekaterina Lapshinova-Koltunski

In this study, we analyse translation of coreference from English into Portuguese and German. Recent research in multilingual coreference and pronoun translation has led to important insights, considering that the phenomenon is not limited to anaphoric pronouns (Lapshinova-Koltunski et al. 2020, Lapshinova-Koltunski et al. 2019 among others).

We start from the insights derived from the studies on English and German enabled through the ParCorFull parallel corpus (Lapshinova-Koltunski et al. 2018). This corpus contains English original texts and their German translations annotated with full coreference chains. We aim at extending the corpus with the translations of the same texts into Portuguese and adding annotations of corefence chains to these translations. In this way, the corpus under analysis will contain parallel texts for the language pairs English-German and English-Portuguese, with the same underlying source texts. Despite some typological convergences, these three major European languages present systemic differences in the realisation of coreference, and thus pose problems for multilingual coreference resolution and (machine) translation.

Our study will provide insights into the mechanisms involved in coreference translation in order to develop a better understanding of the phenomenon. The study being presented focuses on the variation of coreferential devices in English original texts and their German and

Portuguese translations. Using exploratory techniques, a diverse set of coreference devices as features is contemplated, which are assumed to indicate variation impacted by various dimensions, as well as potential translation strategies. The findings shall reflect differences on different dimensions. The results will be valuable for contrastive linguists and research in translation studies, whereas the extended corpus will prove to be a valuable resource with a variety of uses not only for multilingual NLP applications.

Translation and terminology

Scientific discourse and its mediation - translation/adaptation as a communication instrument in paediatric cancer

Anabela Mateus, Maria Teresa Roberto

This work intends to provide information in European Portuguese about paediatric cancer through a collection of translated/adapted texts that serve the needs of their users (caregivers and/or children and young people suffering from cancer and to create a guide/reference model based on the theoretical framework adopted to analyse the translations/adaptations.

Translation and terminology

Tourism

Co-creation of experiences in museums for PWSI and non-disabled people

Susana Mesquita, Maria João Carneiro, Ana Caldeira

People with sensory impairments (PwSI), such as vision or hearing loss, represent a large group of the population and they are one of the most marginalized group in society. Museums are important places for education and entertainment. Co-creation has emerged as a new approach as museums are beginning to recognize the role and relevance of co-creation. In the context of museums, some constraints are associated with the lack of access to museums objects related to environment, communication and attitudes.

This thesis is composed of 4 empirical studies offering an integrated analysis of co-creation of experiences in museums by PwSI and non-disabled people. The empirical research was undertaken through focus groups and a face to face and online survey questionnaire, with the aim of testing a model including the antecedents and the outcomes of the co-creation of the experiences under analysis.

As far as data analysis is concerned, the qualitative data collected, mainly during the focus groups, were analyzed using content analysis. Data obtained through questionnaire were analyzed using structural equation models, namely PLS. The present doctoral thesis aims to fill an existing gap concerning co-creation of experiences in museums for PwSI and non disabled people, as well as providing an actual insight about the topic.

Tourism

Designing an innovative visitor experience: Story-telling and Portuguese tiles

Ivana Stevic, Zélia Breda, /, /

This presentation informs about a socio-cultural, liminal tourism innovation case, resulting from an exploratory fundamental approach to creative tourism research. Aiming to conduct research for the benefit of the research itself, and to explore different methodologies in creative tourism in particular, the presented research initially adopts the ethnographic approach, consisting in a three-month long presence at an interdisciplinary idea lab. Direct observation, informal conversations and idea-generating sessions led to identifying the design thinking method that was adopted thenceforth. The results suggest that trans-disciplinary constructs and collaborative engagements can be powerful tools of transformation of and through research in creative tourism. The work demonstrates how experimenting with a multifaceted approach to research can result in creation of sustainable innovative practices that bring visitor experience, creative industries and technology together, and can tackle and reduce the gap between the tourism constructs and their practical application.

Tourism

Covid-19 impacts on teaching approaches in tourism studies: The case of public higher education in Portugal

Augusto Neves, Prof. Dr. Carlos Costa, Profa. Dra. Zélia Breda

The Covid-19 pandemic caused significant changes in human behavior and life in society. Among the changes observed, the one related to higher education stands out, where emergency needs and decisions were adopted, in order to avoid the total paralysis of this sector. Considering this scenario, this paper aims to determine how the effects of Covid-19 impacted teaching in accredited undergraduate tourism degrees in Portuguese public institutions. To this end, it is expected to carry out a qualitative-quantitative research, with an exploratory and descriptive character. Literature review revealed that Covid-19 accelerated the need for updating teaching/learning approaches in higher education, specifically with regard of the correct use of instructional technologies and to the implementation of learner-centred approaches. It also highlighted that digital literacy and skills development are considered essential for teachers and students in Tourism Higher Education. Therefore, these could be developed by using up to date teaching and learning approaches, supported by a set of instruction tools in a blended learning environment. Through the use of content analysis and service design thinking, it is expected: to determine whether Covid-19 anticipated/accelerated the process of adopting new approaches, methods and strategies in the teaching of accredited undergraduate tourism degrees in Portuguese public institutions; to identify the short and long term impacts that occurred in the routines, opinions and perceptions of students and teachers, caused by these changes; to develop a lesson plan organizing tool, with the aid of service design thinking, to support teachers of accredited undergraduate tourism degrees in Portuguese public institutions; and, to promote sustainability, innovation and updating in Portugal's tourism public higher education.

Tourism

Contributo do storytelling para o reforço do place attachment nos turistas

Manuel de Sousa, Rui Costa, António Moreira

Amplamente usado no turismo, o storytelling estimula a imaginação dos visitantes e influencia as suas expectativas e atitudes em relação a uma experiência. Por outro lado, vários estudos indicam que os turistas tendem a desenvolver um certo apego ao lugar visitado (place attachment), sempre que aí se verificam interações sociais e envolvimento significativo.

Partindo de dois conceitos bem estudados – storytelling e place attachment –, este trabalho procura estabelecer uma relação entre o primeiro e o segundo, tendo por exemplo o caso da cidade do Porto.

Para tal, serão realizados inquéritos e entrevistas. Espera-se que as conclusões das análises quantitativas e qualitativas possam ser úteis às entidades responsáveis pela gestão dos destinos turísticos. Espera-se, também, poder formular recomendações para quem interage com turistas, sejam guias de turismo, restauração, alojamento e estabelecimentos comerciais.

Tourism

The art of destination marketing: The role of art on destination image and place attachment formation

Tiago Borlido, Elisabeth Kastenholz

Like brands, art is representational and can add value to regional economies (Plaza, Haarich, & Waldron, 2013; Schroeder, 2005), and as such its contributes to tourism destination marketing can be of great importance. However, marketing literature is notoriously deficient regarding the relationship between art piece, destination image and place attachment, as perceived by tourists and population. Considering the importance of these constructs on consumer behaviour and decision making, as well as on a destination's competitiveness and sustainability, specifically in its social dimension (Aaker, 2002; Kaján, 2014; Ritchie & Crouch, 2010; Su, Wall, & Ma, 2017), this research seeks to determine the importance that painting may have on destination image and place attachment formation, both from the tourist and from the resident's perspective.

Tourism

Capacity Development for Destination Communities

Rogelio Flores Jr., Professor Dr. Carlos Costa

Capacity Development for Destination Communities

Keywords | capacity development, knowledge networks, partnerships, sustainable tourism

Abstract |

The thesis 'capacity development (CD) for destination communities' is aimed to investigate how knowledge networks and partnerships strengthen capacity in destination communities and improve governance to achieve inclusive, sustainable development. CD initiatives and programmes are needed to boost more resource support, empower the locals and strengthen communities at various levels: individual, organizational and institutional (UNDP, 2015). There are several issues that confront CD in various sectors and tourism destinations that include lack of resources, weak leadership and absence of relevant institutions (Aref, 2011, Aref & Redzuan, 2009; Smith, Krannich & Hunter, 2001). Examining knowledge networks and partnerships and how it can be utilized as a core foundation of CD is vital in developing a practical CD framework especially in less developed regions and contribute to supporting the achievement of key 2030 UN Sustainable development goals (SDGs). Specifically, the research aims to: (1) determine the impacts of strengthening capacity in destination communities; (2) examine the roles that knowledge networks and partnerships play in creating innovation, building capacity and empowering individuals, organizations and institutions; (3) assess the socio-environmental issues and challenges that impact the effective implementation of CD programmes; and (4) explore 'best practices' and present empirical evidence of CD approaches in various destination communities for the formation of a more holistic, practical CD framework. This research adopts a 'pragmatic' approach, not committed to any one system of philosophy and reality (Creswell, 2013; Saunders, Lewis, and Thornhill, 2009), while 'mixed' methods is applied, a research approach that bridges the gaps between quantitative and qualitative methodologies (Creswell, 2013). Findings of this study with reference to institutions, knowledge networks and collaboration would be useful for public, private and non-profit organizations in getting a wide range of data and information for reference and future research.

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Tourism

The Implication of Community Development for Social Innovation and Community tourism Market Access, in the Coastal Areas: The case study of Lautem Municipality, Timor-Leste

Feliciano do Ceu, Zélia Breda, Filomena Cardoso Martins

Community development is intended to introduce the people to understand the process and activity and equipped the people with new knowledge needed to improve the current situation and for self-sufficient in identifying their needs, creativities and able to make problem solutions both as an individual and as a group. Many authors have sufficient experience and knowledge in introducing community development approaches. These were made possible with the cooperation of the stakeholders and people of the community themselves who are open to social transformation at the level of community. Capacity-building programs are effective strategies in helping these people conduct social innovation to generate and implement new ideas about how the community should organize interpersonal activities or social interactions to attain one or more common goals. One approach to hone the community is through the tourism market at their level. The knowledge and confidence they will gain will enable them to understand how to link the market to the community to make it easier for them to distribute and sell their products

primarily to tourists and other consumers. Based on the practice of the community in the coastal area in Lautem municipality especially the community from the Tutuala and Com Village, the Portuguese and Indonesian time in Timor-Leste do not usually sit in the market to sell their product. The community indigenous people never distributed their products to the market because of the community's marginal cultural attitude, limited knowledge, and subsistence livelihood. The main objective of this article is to know the implication of community development on social innovation and community tourism market access in the coastal area, focusing on the case of Lautem Municipality Timor-Leste. The method that was used is data processing through a qualitative approach. Forty-one (41) participants were interviewed using semi-structural questions based on grounded theory data analysis. The results indicated that community development has a positive impact on social innovation, especially in the communities in the coastal area in Lautem municipality. This is because the community has the ability and capacity to improve their life and implement knowledge to deliver their products for selling in the market in the coastal area of Lautem municipality, and also in the city of Dili. The unique product that correlated to the community's capability is tourism products like accommodation, restaurants, fishing, handicraft, agriculture, home business like quiosque and the access to technology, transportation, financial, and manner of distribution of their products. The result of the market accessed also implies the changes of the community life, due to income, house improvements, access to education, health and hygiene, safety and security, green and conservation in the coastal area.

Tourism

Critical success factors for the development of cultural routes in tourism

André Pedrosa, Filomena Martins, Zélia Breda

Tourism routes have been implemented all over the world in the last decades. There are some well-known routes such as the Way of Saint James. However, there is still a lack of research about routes governance.

This research proposes to clarify the concept of routes in tourism and their uses and typologies, and to identify their critical success factors. A framework model for routes governance will be proposed based on the literature review and in the analysis of route´s performance. for instance the Traditional Saltmaking: The Atlantic Route (TSAR). The model will be applied to the TSAR in order to be validated and to evaluate the route performance, which has been inoperative since its foundation. Finally, concrete proposals will be made to enhance the performance of the Portuguese section of the mentioned route.

Tourism

The importance of training tourism professionals for the development of accessible tourism

Nuno Leal, Celeste Eusébio, Maria João Rosa

Accessible tourism is one of the research areas that arouses more interest on authors. However, most of the studies that have been carried out focus on physical accessibility, while few addresses the subject of interpersonal relationships, more specifically the attitudes of students and tourism professionals who face people with disabilities (PCI).

The objectives are: i) to report practices and methods used in other scientific areas with activities involving contact with the PCI, ii) to identify skills that tourism students should use while dealing with the PCI, iii) to assess the degree of importance on which competence is promoted on students, iv) to validate identified competences as most valued by different types of PCI, v) to developed a course based on knowledge acquired on research in order to provide tourism students with the needed skills to deal with tourists with disabilities.

Tourism

Advanced materials and processing

Extended corrosion protection of aluminium alloys via layered double hydroxide UV-degradation

Daniel Vieira, Joaquim Vieira, Christopher Brett, Andrei Salak

Layered double hydroxides (LDH) represent a numerous family of natural 2-D materials. Due to the unique combinations of functionalities, LDH find application in different areas ranging from optoelectronics, catalysis, energy storage to corrosion protection. LDH, of general formula [MII1-xMIIIx(OH)2]x+(Ay-)x/y·zH2O, are composed of alternating positively charged mixed metal MII-MIII hydroxide layers, and interlayers occupied by anions (Ay-) and water molecules [1]. The functionalities of LDH can be extended by employing specific cations.

In the last decade, the necessity to improve corrosion protection and replace chromates in metal surface treatment procedures for corrosion protection has dramatically affected the industry. To overcome this problem, the development of novel approaches has been a target of research. One of the emerging possibilities is LDH, due to their capability as a carrier of corrosion inhibiting species.

The mechanism of protection by LDH is still not very clear. The basic principle consists of the release of anions from the LDH interlayers, followed by the adsorption of organic molecules such as benzothiazole or mercaptobenzothiazole, on the surface of the metallic substrate with a consequent decrease in the corrosion rate [2]. Although anions are the most used, corrosion protection can also be achieved using cations. Ce3+ is well known for its corrosion protection capabilities [3,4]. It is traditionally trapped inside bentonite nano-capsules and is often used with LDH to achieve a synergetic effect and higher corrosion protection efficiency. The efficient inhibition by cerium ions occurs because the reaction between Ce3+ and hydroxide ions leads to the formation of insoluble hydroxide on the cathodic areas.

In this work, the changes occurring to LDH when exposed to long, 30 day, periods of UV radiation in order to cause release of cerium cations from the hydroxide layers has been studied. This approach allows promoting extended corrosion protection of the metal surface after the end of the anion-exchange process. The study was performed using Mg3Al1-xCex LDH intercalated with nitrate, where x was 7.5 mol%. The UV radiation promotes partial degradation of the hydroxide layer and release of cerium ions. UV-visible spectroscopy was used to quantify the amount of Ce3+ released.

The continuous corrosion protection of aluminium alloy 2024 with LDH degradation was assessed using electrochemical impedance spectroscopy (EIS) over a one-week period. Optical inspection and energy-dispersive X-ray spectroscopy (EDX) were used for surface characterization.

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Advanced materials and processing

PROJECT

Environmental sciences and engineering

Assessing the effects of nature based solutions on water quality and related ecosystem services

Fábio Matos, Peter Cornelis Roebeling

The global population is constantly migrating to the cities, leading to rapid urbanization worldwide. In these environments, toxic agents from industrial activity, as well as traffic and agricultural non-point pollution destabilize surface water quality, becoming a risk for ecosystems and human health alike. One way to combat this trend is to use Nature Based Solutions (NBS), nature-inspired infrastructure designed to mitigate environmental issues while providing additional economic and social benefits to communities. In this study, modelling software is used to assess the potential effects that different NBS can have on water quality in three case study cities of Europe, in the context of the UNaLab project. These

results are then used to estimate economic benefits in two ways: using a benefit transfer approach to calculate the value of water-related cultural ecosystem services, and using a cost-effectiveness method to calculate avoided decontamination costs.

Environmental sciences and engineering

Designing Circularity Assessment in Regions: a global and integrative index model

Filipa Figueiredo, Myriam Lopes, João Nunes, Ardi Dortmans

In this work, a new and innovative territorial circular design methodology will be developed, which will translate into a decision support tool that will allow assessing the level of integration of the Circular Economy - CE into a territorial macroeconomic metabolism to support decision-making. This new methodology will be constructed based on the integration of different methodologies such as MFA – Material Flow Analysis (for data collection), LCA – Life-Cycle Assessment (inclusion of life cycle thinking for the definition of criteria and indicators to consider) and MCDA - Multi-Criteria Decision Analysis (for the construction of a global index of quantification and mapping of the circularity level of a given territory).

The global index to be developed will be tested first on a regional scale in Portugal (at the level of the NUTII Centre Region) and its global scope will be validated by considering a case study on an international scale.

Environmental sciences and engineering

Adoption and diffusion of Nature-based Solutions in urban areas: a comparative study of Latin America and Europe.

Max López Maciel, Peter Roebeling, Elisabete Figueiredo

Climate change can affect the local infrastructure of cities, put inhabitants at risk, and affect human health and well-being. In Europe, it is expected that climate change will increase the intensity of heatwaves, floods, and droughts. On the other hand, several Latin American countries will also suffer the consequences of climate change, specifically the tropical parts such as the Central America Region, which is considered a “hot spot” for climate change impacts. One of the potential climate change adaptation measures for urban areas is implementing Nature-based solutions (NBS).

This research project aims to develop a methodology for measuring the level of adoption and diffusion of NBS in different case studies across Europe and Latin America. To determine strengths and opportunity areas when implementing them. Overcoming the existing gaps in the scientific field and supporting the local environmental planning in the NBS context.

Environmental sciences and engineering

Novel and Sustainable Carbonaceous Nanomaterials for the Separation and Storage of Hydrogen and Carbon Dioxide from Industrial Wastewater Derived Biogas

Behrouz Nemati, Professor Isabel Capela, Professor Elizabete Costa, Dr. Mohammadreza Kamali

Biogas produced during anaerobic digestion (AD) of an easily biodegradable substrate such as cheeses whey effluents (CWEs) arises as an important energy source to meet the future needs for clean energies. In this regard, the capture and storage (C&S) of both hydrogen and carbon dioxide from biogas is a fundamental step for its cost-effective cleaning.

The development of an efficient system with enhanced C&S capabilities will address the following objectives: (i)Carbonaceous nanomaterials (CNMs) with enhanced properties for hydrogen or carbon dioxide C&S will be synthesized in compliance with sustainability principles; (ii)CNMs prepared under controlled conditions will be used for efficient hydrogen C&S from AD biogas; (iii)CNMs with enhanced properties will be used for enhanced CO2 C&S from biogas; and (iv)synthesized CNMs will be used to design a two-step hydrogen-CO2 C&S system from biogas produced in AD of CWES. The above-mentioned strategies will be explored using various experimental and statistical analyses.

Environmental sciences and engineering

Accounting

The Portuguese Royal Silk Factory: Accounting System, Financial Aspects and Corporate Governance (1757-1816)

Cecília Duarte, Graça Azevedo, Leonor Fernandes Ferreira, Cristina Góis

In 1734, the Silk Factory Company was created by the Frenchman Robert Godin. Due to various financial problems, the future Marquis of Pombal decided that the management of the Factory should be transferred to the crown. Thus, by statutory imposition, the Royal Silk Factory was created on August 6, 1757. During the Pombaline administration, several Annexed Factories were founded around the Royal Factory, which produced products such as combs, watches, boxes, among others. With the death of D. José I and the accession to the throne of D. Maria I, the influence of the Marquis of Pombal came to an end.

The Marian reign was the scene of several political, economic and social events, among which the madness of the queen that prevented her from ruling and the three French Invasions (1807-1810), which dictated the court's flight to Brazil, stand out. The study that this thesis project proposes to elaborate comprises the first work to analyze the accounting system, the financial aspects and the governance model of the Royal Silk Factory through the comparison of the reigns of D. José I and D. Maria I , that is, during the time span from 1757 to 1816. Adopting a qualitative and quantitative research methodology, it is intended to carry out four scientific articles that, together, will form the doctoral thesis.

Accounting

The impact of COVID-19 on budgets and financial reporting in the Public Sector

Cláudia Soares, Doutora Augusta Ferreira, Doutora Cláudia Pereira, Doutor Carlos Ferreira

This crisis is unprecedented, and the way Governments acted had to be totally different from other crises. Immediate decisions had to be taken and these were not foreseen in the budgets. These decisions had an impact on budgets and financial reporting. The question that now arises is: what impact did it have? The overall objective is to identify the impact of COVID-19 on budgets and financial reporting in the Public Sector, particularly in Municipalities, both in terms of disclosure and results. The thesis will consist of 3 papers and the methodology use will be qualitative, through content analysis, and quantitative, through statistical analysis. Our sample consists of the 308 municipalities of Portugal and the period of analysis will be 2019-2021, if possible 2022. We expect to understand the impact of COVID 19 on public sector budgets and financial reporting.

Accounting

#BlackAccountantsMatter: An Investigation of Black Representation in Accounting and the Impacts on Promoting Diversity.

Drae Bent, Elisabete Vieira, Mara Madaleno

The Black Lives Matter movement emerged out of the call to cease turning a blind eye to racial injustice. Analogous to the Black Lives Matter movement, the present beckons the need to reverberate that Black Accountants Matter.

This study aims to investigate the representation of Black people in accounting and the impacts that representation has on promoting diversity. Specifically, this study investigates the relationship between Black representation and the variables of education, mentorship, retention, career advancement, gender, and sexual orientation. To test these relationships, an online survey in a five-point Likert scale format will be administered to the minority group of Black accountants based in New York City, USA, and London, UK. Additionally, one-on-one structured telephone interviews will be conducted with equal total counts of males and females. The gathered responses will be evaluated using statistical analysis, survey econometrics methodologies, content analysis, and thematic analysis.

These results will be used to analyze the success of Black accountants within the profession when they have representation in place. The results collected from this study will be expanded to develop the key significance of representation and support in both attracting and retaining Black accountants within the profession while giving them tools necessary for career progression. From the complete thesis, we hope to prepare and publish at least three scientific peer-reviewed journals.

Accounting

Impact of financial disclosure on the financing of SMEs in Portugal

Masidivinga Landu, Ana Maria Bandeira, Jorge Humberto Fernandes Mota

Financial disclosure makes it possible to reduce the asymmetry of information between investors, creditor and the company, contributing to the improvement of the relationship between different users of financial information.The aim of this study is to assess, in the context of small and medium-sized companies in Portugal, whether there is a positive or negative relationship between financial disclosure and bank financing. It is a quantitative study based on the techniques of descriptive statistics and multiple linear regression of panel data. It is expected that at the end of this research we will have an outline of the evolution of scientific publications on the quality of financial information, an understanding of how financial disclosure influences the financing decision in the context of SMEs in Portugal and cover the gap found in research on the relationship of these two variables in Portuguese SMEs.

Accounting

Changes on the accountants' role

Marta Santos, Carla Carvalho, Rui Robalo

This paper aims to analyze and to understand how changes can impact the role of accountants in the face of market globalization, technological evolution and the reporting of non-financial information.

This thesis aims to understand the new accounting tools needed by companies in the ever-changing digital world and to determine the new skills that accounting professionals may need to remain relevant and add value. The research method used in the first phase was given special attention to the literature review of the surrounding theme, in bibliographic consultations, and the distribution of a survey and interviews will be used to answer the research questions.

In this context, it is expected to contribute to the literature in the following aspects: Identifying how the new digital age has an impact on the role of accountants, verifying the extent to which accounting professionals will be prepared for non-financial reporting and how the accounting bodies managed changes in the roles of accountants.

Keywords: Disruptive technologies, Non-financial reporting, Accountants, Changes, Skills, Accounting bodies

Accounting

The effect of growth opportunities and systematic risk on cash holdings in Tehran Stock Exchange listed companies

Mehdi Gholamzadeh, Carlos Pinho

The aim of this study is to investigate the relationship between financial variables of the growth opportunity and the systematic risk with cash holdings adjustment of the companies. In this study "adjustment cash holdings" as the dependent variable, " growth opportunity' and " systematic risk" as the independent variable and five other variables such as "the level of cash holdings of last year", "cash flow ratio", "size of the company", "financial Leverage", "short-term debt" as control variables. According to the subject and its application, the study sample includes active companies listed in Tehran Stock Exchange. In this study, 94 companies were selected as samples. The data used in this research has been collected from the information of the companies accepted in Tehran Stock Exchange, during a year and since the beginning of 2014 until the end of 2019 and the result of the test of the hypotheses have been proposed. In this study, to test the hypotheses, a multiple regression analysis via consolidated data, has been used. The results show that the cash holdings adjustment of the selected companies have been optimum. But there is no significant relationship between the growth opportunities of the company and systemic risk and cash holdings adjustment. There is a significant relationship among the control variables, financial leverage, Level of cash holding of the last year and the short-term debt with adjusted cash holding.

Accounting

Attracting foreign investment in intangibles and innovation - effectiveness of tax benefits

Paulo Figueiredo, Carla Manuela Teixeira de Carvalho, Cidália Maria Da Mota Lopes, Jorge Humberto Fernandes Mota

To achieve the right economic growth, governments tend to create tax incentives to attract intellectual and innovative investments. Multinational enterprises (MNEs) frequently relocate their intangible and R&D investments to countries with more favorable tax conditions. How to set the right tax bundle to attract investment avoiding international base erosion profit shifting has been a delicate issue worldwide.

The project thesis Attracting foreign investment in intangibles and innovation - effectiveness of tax benefits will measure the level of intangibles and R&D investments in OECD countries, considering the different tax bundles, between 2018 and 2020, allowing the prediction of the best tax incentives package to promote the attraction of these kind of foreign investments.

Accounting

Implications of blockchain technology and disclosure for taxation

Rafael Helena, Rui Marques, Graça Azevedo, Jonas Oliveira

The approach to taxation in the digital age has become even more forceful as taxation systems were created in an era in which the economy assumed a national role. Thus, the challenges associated with fair taxation of the digital economy were identified as the main focus of the OECD's Base Erosion and Profit Transfer (BEPS) project. The main objective of the OECD is to reduce the misalignment between declared profits and real economic activities.

Developments like blockchain seem to be the next step in the digital age and could reshape the way we do business. According to several authors, technological tools are expected to have major impacts on business. Implications of the blockchain for taxation, as this technology can represent an innovative approach in this area and can fundamentally change tax information exchange practices

Thus, it is intended to understand the impact that blockchain technology will have on taxation, namely, benefits and challenges, how the technology can influence the level of tax disclosure and also if companies that use the technological tool approximate their profits according to the real activity.

Accounting

Status of implementation and report of the 2030 Agenda in the Public Sector: the case of local authorities

Regina Soares, Doutora Augusta Ferreira

The role of the public sector in fulfilling the 2030 Agenda SDGs, understanding how the sustainable development agenda is moving from the global to the local level and how concern with the SDGs influences financial performance and proximity to citizens, checking levels of implementation and reporting. The main objective of this project is to verify the level of implementation and reporting of the SDGs in Portuguese municipalities. For this, the development of an index that combines aspects of implementation and reporting becomes crucial. The quantitative and qualitative analysis between 2015 and 2021 allows us to assess the impact that the last two years, years of the Covid-19 pandemic, had on the fulfillment of the SDGs.

Accounting

RELATO INTEGRADO NOS MUNICÍPIOS PORTUGUESES: A necessidade de um framework ajustado

Sérgio Fernandes, Augusta Ferreira

A acessibilidade à informação financeira ou não financeira dos municípios está dispersa por muitos documentos (diversos relatórios e/ou documentos oficiais) e é heterogénea, com exceção dos relatórios de gestão e dos relatórios de sustentabilidade (quando existem). A homogeneização do relato poderá ser conseguido através do relato integrado. Porém, alguns autores (Manes-Rossi, 2018; Manes-Rossi e Orelli, 2019) consideram que o framework do relato integrado não é suficiente para organizações do setor público (incluindo a administração local). Por

isto, com a realização deste trabalho, pretende-se contribuir para a investigação, já existente, identificando as eventuais fragilidades do <IR> para os municípios portugueses e propondo, se necessário, um ajustamento ao seu framework.

Accounting

Environmental taxes - Portugal & Spain

Susana Patrão

The aim of this study is to analyse the evolution of taxation in favour of the environment, in Portugal and Spain, for the last 20 years. This objective comes from gaps found in the interconnection of environmental issues with the progress of taxes, that is, this matter is dispersed, not providing an immediate view on the concern for the environment.

According to the scope of the theme, it will be important to answer the following research questions: 1. Has the evolution of green taxes been favourable to the environment? 2. Are environmental taxes seen as a way of protecting the environment, or just another source of tax revenue? 3. Which country has done the most for the environment? How? 4. Will environmental taxes be a priority in the future?

Investigation results may help reaching a better understanding of the direct impact of environmental taxes on the actual mitigation of climate change.

Accounting

International Public Sector Accounting Standards (IPSAS) Implementation in Emerging Economies: Evidence from Metropolitan, Municipal and District Assemblies (MMDAs) of Ghana.

Eric Attefah, Professor Augusta Ferreira, Professor Agostinha Patrícia da Silva Gomes

This piece of work aims to determine the contributing factors of compliance level of the reform and transition towards the International Public Sector Accounting Standards' (IPSASs') accrual accounting and its implementation in the public sector of Ghana. Secondary data in the form of annual financial statements of the Metropolitan, Municipal and District Assemblies (MMDAs) of Ghana and primary data from a considerable representative sample of officials from local government organizations and institutions and members of public. The study seeks to analyze the collected data using descriptive statistics. The findings are expected to contribute positively to emphasize its importance for improving accountability, transparency and financial management and building public confidence in information and the country's macro-fiscal sustainability position and to improve decision-making process and the use of public funds.

Accounting

Auditoria Financeira no Setor Público com Process Mining e Business Intelligence

Jonatas Araujo, Helena Coelho Inácio, Rui Pedro Figueiredo Marques

A utilização massiva de sistemas de informações tem aumentado o volume e a variedade dos dados produzidos nas organizações, forçando os auditores a encontrarem métodos mais eficazes e eficientes para enfrentar estes desafios. As auditorias anuais em que a amostragem é usada nas evidências de auditoria não são suficientes no ambiente moderno. Assim sendo, a auditoria contínua é a resposta a esse paradigma. Dentre as várias técnicas utilizadas para a implantação de auditorias contínuas, os acadêmicos e profissionais vem demonstrando o potencial do process mining, principalmente na identificação e avaliação dos riscos de auditoria. O objetivo do process mining é descobrir, monitorar e melhorar processos reais, extraindo conhecimento dos logs de eventos prontamente disponíveis nos sistemas (Van der Aalst, 2016). Para facilitar a gestão dos riscos de controle e coleta das evidências de auditoria é relevante apresentar os resultados do process mining em uma ferramenta de business intelligence. Deste modo, o objetivo deste trabalho é demonstrar como as técnicas de process mining e business intelligence podem ser aplicados no processo de auditoria contínua das demonstrações financeiras do setor público. Espera-se, que o uso de process mining e business intelligence melhore a identificação, avaliação e resposta aos riscos de auditoria, bem como reduza os custos com recursos humanos utilizados nos processos de auditoria. O presente estudo também contribuirá com o processo de implantação das normas de auditoria financeira aplicada ao setor público nos Tribunais de Contas regionais brasileiros, melhorando a confiabilidade das demonstrações financeiras apresentadas pelos governos subnacionais.

Accounting

An approach to implementing the blended learning in accounting higher education institutions

Susana Queirós, Graça Azevedo, Jonas Oliveira

The investigation aims to present an approach for the adoption and implementation of BL in accounting higher education institutions with the specification of a methodology and its validation.

For this purpose, will be carried out four essays, three of them with a qualitative approach and one with qualitative and quantitative approaches.

It is hoped that this research will contribute to the construction of a "roadmap" that can serve as a basis for decision-making by administrators of institutions for the effective and efficient implementation of BL. The aim is also to create didactic tools that can be useful to teachers in the context of higher education in accounting.

Accounting

Are smart cities willing to report transparently?

Sónia Barbosa, Augusta Ferreira

The recent challenges faced by Public Sector entities, in terms of reporting non-exclusively financial aspects, have led us to inquire about the type of information should be provided to citizens by Portuguese local governments, in particular at the Smart Cities level. In this sense, the purpose of this research work is to come to design, for these special entities, a schematic, appealing, understandable and accessible reporting model aimed at the citizen, in other words, a kind of Popular Reporting.

Key words: Popular Reporting, local governments, Smart Cities and citizens*Accounting*

Essays on ESG Controversy

Michele Oliveira, Graça Azevedo, Jonas Oliveira

Environmental, social and governance (ESG) information has been recurrent around the world. The literature demonstrates that, although emerging countries are still at an early stage on sustainability issues, stakeholders are increasingly demanding and judicious in choosing their investments. The search for solid, inclusive and sustainable companies makes market participants sensitive to the linguistic style reported by companies and the media, which could penalize companies in the market. In this conception, the adoption of the principles and best practices of corporate governance is an important determinant of reliability and assessment of companies. Thus, it is essential to respond to global appeals and try to understand the impacts that ESG Controversy have on companies based in a country where there is no strong engagement on ESG issues. This study aims to analyze the determining factors that enhance the performance of sustainability risks, relating them to the economic situation and ESG measures, specifically ESG Controversy. The study is based on the scores of the ESG ranking from the Bloomberg database and the sample comprises 84 Brazilian companies on the Ibovespa. Data will be analyzed using econometric statistics. The results of this study will contribute both to drive emerging countries to develop ESG strategies to attract investors and, consequently, increase their market value as well as contribute to a better world.

Accounting

DBI - Doctorate in Business innovation

Solving the Mystery of Digitization – Develop a Systematic to derive a dedicated Transformation Roadmap „Digitization Journey

Thorsten Schölver, Leonor Teixeira, Marco Pimpão

(Multinational-) Companies/SMEs are faced different global market trends:

- VUCA - volatility , uncertainty , complexity, ambiguity

- Disruption of Business Models

- Agile Organisation/SCRUM methods

- Adapted "work-life" balance of employees/talents

…and all that comes along with I4.0/ Digitization

I4.0/Digitization is in many companies still a buzz-word and only partially filled with content.

Assuming that the level of Digitization is defined the main question is:

What does the Digital Journey look like, what is the Transformation Roadmap and the inderdependencies.

DBI - Doctorate in Business innovation

Development of a maturity model to evaluate the digital transformation for the operational unit in SMEs (production, logistics and the associated administration).

Kim Häring, Leonor Teixeira, Carina Pimentel

During the intensive processing of this systematic literature analysis, one thing became very clear: how little prepared many companies, especially SMEs, are for the influences of Industry 4.0. Too little informed, poorly trained, no strategy, high costs without defined and measurable success. For small- and medium-sized enterprises (SMEs), an entry into the VUKA world (volatile, uncertain, complex, ambiguous). Industry 4.0 means a paradigm shift and is uncharted territory for both the management and the players in the economic-productive interaction of a company. But the predicted benefits of Industry 4.0 make it necessary for companies, and increasingly SMEs as well, to address the issue and for management to inform itself accordingly and take a position on how it wants to strategically align the company. Maturity models promise a good approach here. By means of a more- or less comprehensive (self-) assessment, the company is analyzed in terms of its Industry 4.0 maturity. A roadmap with implementation projects can then be derived from the comparison with an Industry 4.0 target level. A large number of available maturity models have been identified so far, but these are primarily aimed to large companies. In addition, only very few maturity models have been extensively validated. SMEs therefore have no real benefit. This research project aims to develop an Industry 4.0 maturity model for manufacturing SMEs that relates to their core competence, namely the operational unit (production, logistics and related administration). The specifics of SMEs, such as scarcity of resources (including money, skilled workers, lack of strategic experience) are taken into account. For this purpose, the current state of science is first determined with a systematic literature analysis and presented in a meta-analysis and a specific analysis on maturity models in relation to SME specifics. The findings are then used to develop and validate an Industry 4.0 maturity model.

DBI - Doctorate in Business innovation

Design Thinking and Innovation in SMEs: A Systematic Literature Review in terms of barriers and best practices

Fatma Demir, Irina Saur-Amaral, Daniel Ferrreira Polónia

All over the world, SMEs are considered as a key part of the economic fabric. Once limited to their domestic markets, since the late 1990´s they have been exposed to a globalized marketplace, with more demanding customers and fierce competition. This exposure has become a significant challenge to SMEs, since most of them have limited resources and capabilities that frequently lack the ability to create and maintain a structured innovation management system. With this background, this paper performs a systematic literature review on the relationship between the Design Thinking, innovation and competitiveness in SMEs. 308 papers published between 1998 and 2021 were obtained after searching ISI Web of Science – Current Contents, and they were analysed using Endnote 20 and NVivo 20 from the bibliometric and content perspective. A final sample

of 70 papers directly linked to the research question were obtained after applying all exclusion criteria. Results point to the need to develop an innovation framework for SMEs, integrating Design Thinking processes and aligned with corporate strategy.

DBI - Doctorate in Business innovation

Intelligent Comfort for Smart Homes

Rodrigo Almeida, Pétia Georgieva, Nelson Martins

According to World Health Organization (WHO) indicators, people spend around 90% of their time enclosed in buildings. These indicators are now stressed out by the latest pandemic crisis, as most of the employers and employees had to reinvent their work methodology to perform their responsibilities remotely from their own homes.

For these reasons, more than ever, it is crucial that residential Heating, Ventilation and Air Conditioning (HVAC) systems can provide tailored solutions, focusing on the home occupants' thermal comfort. In that sense, these systems must support the well-being and productiveness throughout the day and the working hours, without compromising the system energetic sustainability. Based on the widespread IoTization, and leveraging the growing paradigm of Artificial Intelligence of Things (AIoT), Smart Homes market is aiming for more integrated, autonomous, and intelligent products, that can leverage home sensing information to provide human-centered solutions able to cope with individual thermal sensations and profiling.

Relying on collected user data from households in Europe, this work aims to understand the thermal preferences of the residents and assist them to adopt optimized behaviors, having in mind the energy efficiency of the system. To this end, a data-driven solution is being explored, grounded by the constraints of the sensed data, for further implementation and evaluation in a real residential scenario. The target solution aims to contribute with innovative advances, in the way that HVAC systems and smart thermostats ensure the customers thermal comfort and energy savings, promoting their satisfaction.

DBI - Doctorate in Business innovation

Retail investors attitude on sustainable investments _ do men and women think alike

Laura Grumann, Mara Madaleno, Elisabete Vieira

Recent and still ongoing regulatory efforts of the European Commission have made sustainable investments a relevant topic for a broader public. Likewise, the economy itself, the financial markets within the European Union are in transition to support the overall goal of climate neutrality by 2050. Scientific research mostly focusses professional or institutional investors, hardly retail investors. This study aims to determine the attitude of retail investors on sustainable finance. Specifically, it investigates whether there are significant gender differences between women and men.

The research is based on a survey data from a survey conducted by the Portuguese Comissão do Mercado de Valores Mobiliários (CMVM) end of 2020, containing a general section on investments in securities and a section dedicated to sustainable investments. To test the hypothesis of equalness chi 2 Testing is used.

The results suggest that more significant differences can be found in attitude, behaviour and knowledge about investments in securities in general than regarding sustainable investments in specific.

Keywords

#sustainableinvestments #ESGinvestments #retailnvestor #gender

DBI - Doctorate in Business innovation

An integrated safety engineering approach for risk management and requirements engineering for deep neuronal networks in safety-critical autonomous systems in accordance to safety standards such as ISO 26262 and SOTIF.

Lucas Bublitz

Machine and deep learning algorithms are the key ingredient for the development of self driving vehicles. These self-learning advanced SW algorithms form the base for artificial neural networks, which have to be proven to be the crucial approach for the accomplishment of critical and complex tasks such as object recognition, decision making and planning of (driving) strategies. While these self-learning abilities of ANNs are a great strength on one side, on the other side the fact that they behave as black boxes for humans poses a great challenge for the current state-of-art techniques in the development of an safe and reliable self-driving SW, which has to used to ensure functional safety (ISO 26262) and the safety of the intended functionality (SOTIF ISO PAS 21448) in E/E systems such as autonomous vehicles.

The conference contribution reviews the current obstacles on the left side of the V-procedure model from the feature definition to the definition of the safety SW requirements for deep neuronal networks. It shows the dependencies of ML/DL on the risk management from the impact analysis to the HARA and highlights the new approaches in the definition of the system architecture and the management of requirements of ANNs. Furthermore the contribution propose a framework to evaluate the technology maturity in combination with an additional ML/DL checklist in order to deliver an early phase design verification in compliance with the relevant norms (i.e. ISO 26262, SOTIF, UN ECE ALKS and ASPICE) for autonomous vehicles.

Keywords: artificial neural networks, machine learning, deep learning, autonomous

DBI - Doctorate in Business innovation

Industrial engineering and management

Sustainable Development of Marine Renewable Energies Supply Chain Management in Portugal

Seyedasghar bayatghiasi, Professor Fatima Lopes Alvez, Professor Joao Carlos de Oliveria Matias, Dr.Mohamadreza Kamali

Marine renewable energies (MREs) can play a significant role in reaching sustainable development goals due to their abundance and being environment friendly. This proposal aims to answer four questions: (i) What are the main technical, economic, social, and environmental constraints and criteria that can influence the promotion of MREs sustainable supply chain (SSC) in Portugal? (ii) What are the most effective optimization methodologies for the technical parameters to promote the MREs-SSC in Portugal? (iii) What are the effects of socio-economic parameters on the commercialization of MREs? (iv) What are the relevant environmental impacts of MREs and the most sustainable methods to mitigate the identified subsequent environmental impacts of development of these technologies. Based on the results achieved in this study, the general aim is to develop a framework which includes the essential requirements and recommendations for the development of sustainable supply chain management in MRE in Portugal.

Industrial engineering and management

Human Factor in the Fourth Industrial Revolution: A framework to foster Operator 4.0 working engagement

Juliana Salvadorinho, Leonor Teixeira, Carlos Ferreira

Since 2015, when Industry 4.0 emerged, the progress of technology has urged companies to increase their technological capital. This improvement, which is exhaustive and still without properly standardized guidelines, has underestimated the role of the human factor. Companies will have their processes digitalized, but they will not stop having people and, it is essential to adjust the new processes to the human resources that, in fact, will be at the center of innovation. Thus, since we are moving towards the globalization of the workforce, it is opportune to think about retaining the workforce and capital related to organizational knowledge. This project focuses on proposing a framework that encompasses the conceptualization and design of methods and an application aimed at assessing the engagement of employees, while promoting it, with a view to repositioning the human resource in the environment of the digital paradigm.

Industrial engineering and management

Accelerating Towards the Circular Economy: The consumer role

Rui Carreira, José António de Vasconcelos Ferreira

The concept of waste it is an invention of humanity, unknown from the nature, and with the scarcity of resources that is increasing, the transition from linear economy to circular economy seems increasingly imperative and a solution to assure sustainability. This transition to the circular economy can be understood by the consumer and be one of his requirements as a requirement for the quality of the services or products, or it can be a requirement of society as a solution to a common problem. The goal that is intended to be achieved seems similar, but the paths trodden to implement the circular economy will be substantially different.

First, this research aims to analyse the state of the art both in Portugal and in the rest of the Word, and understand how consumers demand and pay for the sustainability of the planet. It is intended to study some successful cases in the implementation of the circular economy, namely in some Portuguese companies, and understand why they advanced to this model of economy. Then, some guidelines are expected in order to accelerate towards circularity.

It is expected with this investigation, understand how we can implement the circular economy from the client's request, which will always be a stronger form of implementation, than the legal imposition of such requirements. "

Industrial engineering and management

deepeia - Improving Foreign Market Entry Decisions: Designing, developing and testing a sophisticated strategic decision support system

Nuno Calheiros-Lobo, José António de Vasconcelos Ferreira, Manuel Au-Yong-Oliveira

The aim is to confirm, and satisfy, needs the authors perceive are felt by firms (especially SMEs) in their global efforts, namely, to always make the best choice and gain as much international sales as possible, with the available resources. In the age of IoT and Big Data, automating the internationalization decision process seems to be the optimal way to help managers decide. The authors identified a research gap in the market for a sophisticated solution capable of improving Foreign Market Entry Decisions, since today's tools base their offers on hard to harmonize criteria, instead of an in-depth literature review in the relevant fields. Main challenges will be: identifying all the key variables, why SMEs really choose one market over another, and the contribution will be developing a real-time, self-actualizing, Industry 4.0 platform or conceptual model, that suggests the best available foreign market, according to the state-of-the-art. A sustainable spin-off would also be a desirable possibility.

Industrial engineering and management

Chemical engineering

Analysis and modelling of degradation processes of transformer's insulating materials

Miguel Teixeira, Carlos Manuel Santos da Silva, Maria Inês Purcell de Portugal Branco, Shanika Matharage

The assessment of the ageing status of transformers' insulating materials is essential not only for their proper operation but also for the prediction of failures and the coordination of intervention actions thus extending their useful lifetime.

The methodology proposed for the PhD incorporates an initial bibliographic research on transformers, key parameters and characterization techniques to assess the state of the insulating oils, and the identification of proper accelerated aging tests. Subsequently, the insulating materials will be aged and their oils analysed, to finally develop predictive models for the degradation processes.

The work carried out so far encompasses a vast review of patents and the scientific literature focusing transformers' insulating materials and their testing – a review article is being prepared. Chromatography has been selected for the identification and quantification of dissolved gases and furanic compounds in (aged) oils – the definition and optimization of the analytical methods is underway. In the following months we plan to start the accelerated aging tests of insulating materials, analysis of the oils and the development for diagnosis models of the aging stage.

Chemical engineering

Non-volatile solvents as a promising strategy to improve indoor air quality

Ricardo Pais, Pedro Carvalho, Ana Catarina Sousa

Air pollution is a serious threat to human health, being responsible for around 7 million deaths per year. This mortality is associated with several yutants with both ambient and household emissions, such as gases, particulate matter, and volatile organic compounds (VOCs). As poor air quality is responsible for various diseases, improving indoor air quality (IAQ) must be a priority. Despite the existing guidelines to guarantee IAQ, other strategies should be employed whenever possible, including the reduction of pollutants at their source, both ambient and household, air ventilation, and, if necessary, indoor air treatment. The combination of non-volatile solvents and membrane technology is here proposed as a technology to remove hazardous pollutants from indoor air, acting as a greener alternative to overcome the traditional technologies limitations, such as high energy consumption, waste generation, and harmful by-products production. Non-volatile solvents, like ionic liquids, will be evaluated as media for the removal of indoor air pollutants, like gases and VOCs, taking advantage of their properties through the combination of absorption with membrane technology.

Chemical engineering

Challenges and opportunities facing the flexible foams industry

Raquel Silva, Ana Margarida Madeira Viegas de Barros Timmons

Polyurethane foams (PUF) have had a rapid development and growth over the years, and flexible polyurethane foam (PUF-F) is one of the most popular. PUF-F has numerous applications that play vital roles in various areas. However, the production of PUF-F used so far is dependent on fossil raw materials, namely isocyanates and polyols.

This project aims at establishing a set of innovative, cost-effective, and sustainable solutions, to improve the resource efficiency of PUF-F manufacturing and recycling processes, targeting the sustainability of PUF- F industry. To do so, a literature survey was first carried out to consolidate information regarding the present situation and gather information about alternative more sustainable solutions to produce PUF-F. Furthermore, tools to assess the sustainability of the options have been surveyed namely life cycle assessment (LCA) and Life Cycle Cost Assessment (LCCA) and a work plan established.

This thesis project starts by outlining the goal, objectives, and work plan in Chapter 1. Next the information collected from the literature survey is presented in the state of the art (Chapter 2) and the main methods required to carry out the work plan are outlined in Chapter 3. Finally, in Chapter 4 some final remarks are made.

The work plan proposed includes the LCA and LCCA studies for the conventional manufacturing process and the identification of the most promising alternative(s) of the most sustainable economic and environmental alternatives reported in the literature. The most promising option will be used to develop and optimize formulations towards PUF-F sustainable production. For this, the design of experiments tool and subsequent statistical analysis of the results will be used to find the best solutions. Such conditions will later be submitted to validation at pilot scale and final LCA and LCCA studies will be carried out.

The result of this project will be a contribution to the environmental and economic sustainability of the PUF-F industry.

Chemical engineering

Novel strategies based on aqueous biphasic systems for the encapsulation of Immunoglobulin G antibodies

Bojan Kopilovic, Prof. Dr. Mara G. Freire, Prof. Dr. João A.P. Coutinho, /

Biopharmaceuticals, such as immunoglobulin G (IgG), can be used in the treatment of several diseases. However, these antibodies easily lose stability and therapeutic efficiency, requiring efficient delivery strategies. Water-in-oil and solid-in-oil-in-water emulsions have been used for their encapsulation, requiring however volatile organic solvents that may compromise safety and stability. In this PhD a novel type of encapsulation is proposed, using aqueous biphasic systems (ABS) as water-in-water emulsions and using phase-forming components with gelling ability. ABS formed by polymers, salts and/or ionic liquids (ILs) will be initially investigated, using oppositely charged polyelectrolytes (PEs) to be able to create capsules.

After ensuring IgG stability in ABS, further improvements will be achieved by avoiding PEs, i.e. by using polymers with gellification nature in which temperature changes can be applied to directly create gellified capsules. Microfluidics will be used to decrease their surface area, and the IgG encapsulation, delivery and stability will be determined.

Chemical engineering

Purification of therapeutic proteins using hybrid processes involving ionic liquids

Leonor Castro, Mara G. Freire, Augusto Q. Pedro

The introduction of biopharmaceuticals in current medicine brought enormous benefits to the treatment of life-threatening diseases such as cancer, diabetes and neurodegenerative disorders. However, biopharmaceuticals represent a considerable share of healthcare expenditures due to the lack of cost-effective purification strategies. Although significant advances at the upstream have been faced, current purification strategies are unable to cope with high product concentrations in a cost-effective approach. Therefore, this PhD plan foresees the development of sustainable downstream processes of protein-based biopharmaceuticals by combining ABS and SILs (hybrid technologies) for the capture and purification of IFNα-2b from Pichia pastoris broth.

Chemical engineering

Modulating the biodegradability of 3D printing filaments using food byproducts

Carolina Martins, Ana Margarida Madeira Viegas de Barros Timmons, Idalina José Monteiro Gonçalves

Agri-food waste is a significant economic and environmental concern that needs to be minimized. As alternative, instead of simply being discarded, agri-food byproducts-derived biomolecules are being used for developing sustainable value-added material. On the other hand, fused deposition modeling (FDM) has been recognized as an important technology to contribute to minimize plastic waste while promoting 3D thermoplastic materials development. In this context, this PhD thesis project aims to generate new scientific knowledge about the feasibility of using agri-food byproducts on thermoplastic formulations suitable for FDM with increased biodegradability.

Diverse sources of tomato by-products, such as tomato pomace, mature and immature tomato fruit, will be used as fillers to enhance the biodegradability of polypropylene (PP)-based filaments. After characterization, tomato byproducts will be mixed with PP via melt-mixing, extruded as filaments, and then processed by FDM. Optimization of process parameters will be carried out, to achieve the best correlation possible between filament's performance and environmental and costs of production. Considering the well-known bioactive compounds of tomato, the most promising formulation(s) will be used in the 3D printing of active finger splint(s) as proof of concept, envisaging to study the possibility of developing a biomedical device with antimicrobial, anti-inflammatory properties, moisture sorption, mechanical resistance, and a controlled porosity for possible drug delivery systems.

Once the framework of this PhD thesis project is presented, a literature review regarding the main scientific areas is discuss, its objectives are highlighted, the methodology to be followed is outlined, and some preliminary results are presented and briefly discussed.

Chemical engineering

Novel Deep Eutectic Systems For Sustainable Engineering Applications

Gabriel Santos, João Coutinho, Olga Ferreira

The vision of this work is to create novel Deep Eutectic Solvents (DES), a new class of green tuneable solvents, using safe, inexpensive and sustainable compounds as source materials. Three types of barely explored eutectic systems were selected for their potential applications in the areas of drug-delivery and extraction of biomolecules, according to the target compounds included in the mixtures: 1) Fatty acids salts-based DES; 2) Betaine or acetylcholine-based DES; 3) Phenolic compounds-based DES. The molecular-level mechanisms that govern the formation of DES are still poorly understood, and their design often consists of costly trial and error experiments.

A strategy combining experimental solid-liquid phase diagrams and computational methods (COSMO-RS, PC-SAFT and CALPHAD models) will be implemented, allowing an easier extension from binary to the underreported ternary and quaternary mixtures, and the design of DES to be directly used as ingredients in food, cosmetics and pharmaceutical formulations. This presentation will briefly introduce the thesis project alongside preliminary results already obtained.

Chemical engineering

Síntese e caracterização estrutural e fotofísica de materiais dendrímeros-lantaanídeos em WOLED

António Ribeiro, Dra. Mariela Martins Nolasco, Professora Vera Silva, Professor Artur Manuel Soares da Silva

This research proposal explores a new concept for achieving white light emission in WOLED applications by avoiding the self-quenching of lanthanide ions by neighboring complexes. This is accomplished through the development of Ln3[TAP(Gn=0-2)]9(TMB/TMMB/TMEB) dendritic architectures [Ln=Eu3+(red), Tb3+(green), Tm3+(blue)] for white-light luminescence from a high-site isolation single-component with 3 different Ln centers emitting simultaneously the 3 primary colors. Light antenna harvesting and high site-isolation of Ln3+ is achieved by surrounding the Ln3+ ion with dendritic shells of thenoylacetophenone (TAP) moieties with increasing generations of poly(benzyl-aryl-ether) dendrons arranged in a supramolecular assembly, provided by different 1,3,5-tris-[2-(2′-pyridyl)benzimidazolyl]benzene starburst ligands with different 1,3,5-trisubstituted benzene core (TMB, TMMB-methyl benzene and TMEB-ethyl benzene). In addition, these neutral ligands still have a triplet value capable of sensitize mainly the Tm3+ luminescence apart from displaying phosphorescent emission in the blue region. This last feature is very important to minimize the possible difficulty associated with the sensitization of blue emission of Tm3+ by the antenna process. To accomplish this proposal, an interdisciplinary theoretical-experimental approach will be performed. A systematic computational study of Ln[TAP(Gn=0-2)]3 dendrimers with different sizes will precede experiment, initiating a rational quest for the most favorable conditions for energy transfer between dendritic b-diketonate ligands and Ln3+ ions (Ln=Eu3+, Tb3+, Tm3+), reducing beforehand the number of expensive synthesis experiments

Chemical engineering

Information and communication in digital platforms

Evaluation of Gamification Strategies' Impact in the Information and Communication Services of Cyclotourism for Senior Citizens

Cláudia Ortet, Ana Isabel Veloso, Liliana Vale Costa

A global demographic turn is observed with an ageing population increasing in number, resulting on active and healthy ageing concerns. Also, in the current information and communication society, senior citizens are becoming better consumers of digitally mediated products, leading to a growing need to satisfy their requirements and preferences. That culminates into challenges and opportunities for creating engaging tools, such as gamified gerontechnology, to promote senior citizens' interest, motivation, and changes in behaviour to certain activities.

The aim of this research is to test, conceptualize and implement a set of gamified information and communication services to promote active and healthy ageing, through cyclotourism, at national and international level. Participants aged 55 years or older will be recruited, following a non-randomized process, and divided into an experimental group and a comparison group to assess the impact of gamification strategies on cyclotourism for senior citizens. It is intended to acknowledge if there are differences between groups in changes of sociability and behaviours in active and healthy ageing and their perception of quality and satisfaction in tourism.

This exploratory mixed-method research that includes a quasi-experimental study has its scientific contribution aligned with the goals of the Sustainable Development Agenda of the United Nations for 2030 (SDG 3 – good health and wellbeing; SDG 10 – reduce inequalities; SDG 11 – sustainable cities and communities), the objectives of the Portuguese National Strategy for Active and Healthy Ageing (ENEAS) and the Portuguese National Strategy for Active and Cycling Mobility (ENMAC). Furthermore, this thesis proposal presents the motivation for carrying out the investigation, the methods used to achieve the research aims and goals, the literature review, the expected results, and the contribution to the field of social sciences.

Information and communication in digital platforms

Public policies

A integração de Estrangeiros nas Instituições de Ensino Superior Portuguesas

Monica Amaro

O presente projeto de tese procura sintetizar o trabalho que nos propomos desenvolver no âmbito do Programa Doutoral em Políticas Públicas versando objetivamente sobre as políticas do ensino superior, mais concretamente sobre a internacionalização das Instituições de Ensino Superior Portuguesas.

Public policies

A Inovação Social e os desafios da qualificação das Políticas Públicas de Desenvolvimento

Ana Pereira

O objetivo desta investigação é contribuir para uma análise crítica e prospetiva sobre a introdução dos méritos das abordagens à inovação social no cerne da formulação na qualificação da política pública de desenvolvimento.

Public policies

The role of Academic Engagement in a Knowledge Society: a global comparative analysis on aims, trends, and policy implications

Anabela Queirós

This thesis aims to contribute to the discussion on the role of academic engagement in a Knowledge Society. In this regard, we propose a comparative analysis on the influence of the European political discourse on academic's attitudes regarding knowledge transfer and collaboration with society. For this purpose, we will follow a quantitative approach based on a unique international survey that enables the creation of comparable indicators.

Public policies

Motivação, Valores e Personalidade dos Profissionais de Saúde Portugueses: uma Análise de base à Formulação de Políticas Públicas

Alexandre Fernandes

A compreensão dos determinantes motivacionais na atração e manutenção de profissionais no Sector Público, mais especificamente na área da saúde, tem sido alvo de investigação multidisciplinar, com destaque para o estudo sistemático da Public Service Motivation (PSM) (Belrhiti et al., 2019; Perry & Wise, 1990; Brewer & Selden, 1998; Rainey & Steinbauer, 1999). A este respeito, um dos aspetos por explorar, mormente no contexto português, é a relação entre fatores motivacionais, sistemas de valores e características da personalidade dos profissionais de saúde. Este estudo pretende contribuir para mapear esta tríade, a nível nacional, e, concomitantemente, perceber se e de que forma as políticas de saúde em Portugal têm abordado esta questão.

Public policies

Políticas Públicas de habitação em Portugal: A justiça social enquanto objetivo moldado pela governação multinível

João Vicente

A análise de políticas públicas (PP) aponta para que o seu fim seja a melhoria da qualidade de vida dos cidadãos, sobretudo dos mais vulneráveis. Todavia, a formulação e a implementação de PP com pressupostos de justiça social são complexas, resultado da intervenção de vários níveis de governo e da participação de atores com responsabilidades e expectativas diferenciadas. As políticas de habitação, inclusive em Portugal, tendem a refletir este contexto. Esta investigação, para responder à complexidade acima identificada, visa perceber i) como são integrados os princípios de justiça social, ii) os desafios decorrentes da governança multinível e iii) que soluções e indicadores podem melhorar a efetividade das referidas políticas. Para o efeito, a metodologia adotada envolve i) a realização de processos de auscultação a atores locais e a aplicação de inquéritos à comunidade de vários municípios portugueses, e ii) a realização de uma sessão de validação das soluções e indicadores, junto da mesma comunidade, permitindo, combinar noções normativas e percecionadas de justiça social.

Public policies

Angola: Impacto Das Políticas Fiscais na Redução da Pobreza: Uma Proposta de Reformulação

Elias Gomes

Amplamente desencorajada pelas instituições de Bretton woods, a intervenção do governo nos mercados mesmo por razões de justiça social é um tema controverso que divide várias escolas do pensamento económico e suas doutrinas divergentes. O presente estudo objectiva examinar o impacto das políticas fiscais, qual instrumento de política macroeconómica do Estado, na pobreza em Angola.

Public policies

As Alterações nas Normas Orçamentais e seu Impacto na Distribuição do Gasto Público: Análise dos Municípios do Brasil e Portugal

Isaac Seabra

O orçamento público é a etapa de implementação de políticas públicas dos Governos. Sob o pretexto de reduzir o déficit fiscal nos governos, Portugal e Brasil efetuaram alterações em suas normas orçamentais nos anos de 2015 e 2016, respectivamente. O presente trabalho busca analisar os impactos na dívida pública e nos gastos sociais dos municípios acima de 50.000 habitantes do Brasil, em específico no Estado de Pernambuco, e de Portugal, durante os períodos anteriores à alteração (2013-2015 em Portugal, e 2014-2016 no Brasil) e posteriores à alteração (2016-2018 em Portugal, e, 2017-2019 no Brasil).

Public policies

A(s) política(s) de ordenamento e expansão dos Portos de Angola: análise e metodologia de execução. O caso do porto de Luanda

Alberto Bengue

O objetivo deste trabalho consiste em perceber como determinar o sistema de ordenamento e expansão do porto de luanda, como ponto de partida, bem como a definição de politicas que orientam a efetivação dos espaços molhados e terrestres, uma vez que com o plano de desenvolvimento do porto, há toda uma necessidade para a sua expansão.

Public policies

Limitação de Mandatos e Sustentabilidade Financeira dos Municípios Portugueses

Tânia Maia

A literatura que versa sobre o papel das eleições na determinação do comportamento do eleito, numa democracia representativa, tem sido marcada por argumentação teórica controversa e evidências empíricas paradoxais. Através de uma análise de dados em painel para os 308 municípios portugueses, a presente investigação pretende avançar com esse conhecimento ao introduzir a limitação de mandatos na explicação da condução de políticas públicas locais de sustentabilidade financeira. Assim, formula-se como objetivo central desta tese de doutoramento aferir de uma relação de causalidade unidirecional entre a limitação de mandatos e a sustentabilidade financeira dos municípios portugueses.

Public policies

Políticas para o ensino remoto em tempos de COVID-19: um estudo no IFNMG e UA na perspectiva das Representações Socais

Mara Pimenta

A pandemia da COVID-19 afetou as Instituições de Ensino em todo o mundo devido ao isolamento social compulsório (necessário para manter o distanciamento social) que ocasionou o fechamento dessas instituições em todos os níveis de educação, impondo adaptação do ensino presencial ao formato remoto (on-line). O presente trabalho tem como proposta analisar o que dizem as representações sociais dos/das docentes sobre o ensino remoto, as políticas públicas e institucionais construídas no período pandêmico, dadas as necessidades (instrumentais, emocionais, cognitivas,) dos(as) docente do ensino em nível superior, a partir de dados recolhidos no Instituto Federal do Norte de Minas Gerais (IFNMG) e Universidade de Aveiro (UA).

Public policies

A Gestão da Ética Inserida na Administração Pública: Um Estudo em Duas Universiaddes Públicas - BRASIL e PORTUGAL

Priscilla Sousa

A pesquisa abordará a gestão da ética pública pelas instituições do Estado, compreendendo que diferentes modelos de gestão vão sendo criados, em diálogo com as características dos contextos nacionais, com vistas a promover e proteger os valores e os princípios que regem a Administração Pública. Considerando que a Administração Pública se materializa por meio de diferentes órgãos e instituições, que variam conforme a área ou tema de interesse público, a pesquisa concentrará esforços analíticos nas instituições de ensino superior, buscando identificar e caracterizar os modelos de gestão de ética pública adotados.

Public policies

A Implementação e Judicialização Da Política Pública Previdênciária: O Caso de um Tribunal no Centro da América do Sul

Vinicius Arantes

Esse projeto de tese tem por objetivo verificar a relação entre as falhas na implementação da política pública previdenciária no Brasil e o aumento da sua judicialização. A proposta é identificar as principais causas de judicialização previdenciária, analisar a política pública a partir de uma avaliação de implementação e relacionar as causas do aumento da judicialização às falhas na implementação eventualmente identificadas.

Public policies

Governação local: Desafios e oportunidades da colaboração participativa entre os atores

Antunes Muaquesse

Procura-se, com esta tese, dar resposta a questão de saber se, e como, a administração do bem comum no governo local tem efetivamente em conta os desejos manifestados pelos cidadãos e outros membros da sociedade civil. Quais os pontos menos positivos da não inclusão dos cidãdãos do processo de formulação e tomada de decisão de uma política pública? Muito se perde pela não inclusão dos cidadãos na gestão do bem público e a «exclusividade» (Wilson, 2000) do poder político permite maior manobra deste como os seus adeptos partidários e parceiros políticos, atrasando desta feita a plena realização da satisfação das necessidades dos cidadãos.

Public policies

Mobilidade internacional de estudantes de mestrado e doutoramento angolanos: fuga de cérebros e políticas públicas

Emilio Ladislau,

Nesta investigação vamos procurar perceber quais os incentivos que são oferecidos pelo governo (angolano) para melhorar as qualificações dos estudantes e como é que os estudantes de mestrado e doutoramento avaliam estes incentivos (como avaliam as políticas que estão a ser implementadas).

Public policies

Energy systems and climate change

An Integrated Assessment of Road Traffic Noise and Pollutants Critical Hotspots through Advanced Models

Antonio Pascale, Margarida Coelho, Claudio Guarnaccia

The Ph.D. Research plan entitled “An Integrated Assessment of Road Traffic Noise and Pollutants Critical Hotspots through Advanced Models” seeks to estimate road traffic noise and exhaust emissions in an integrated way. Although common variables influence noise and tailpipe emissions (such as vehicle speed, acceleration, vehicular jerk – i.e., acceleration time derivative, road gradient, road surface, vehicle type, tires-related pressure and dimensions) their effect on them is not the same. Moreover, only a few studies focus on the combined evaluation of traffic noise and pollutant emissions, making necessary further and more detailed investigations on this topic.

The main objective of this Doctoral plan is the development of a Noise Emission Model (NEM) called Vehicle Noise Specific Power (VNSP). Following the idea behind the Vehicle Specific Power (VSP) methodology, it will allow estimating the sound power level (Lw) for different categories of vehicles (namely, passenger cars, vans, motorcycles, and heavy-duty vehicles) by considering the above-mentioned variables as inputs. The plan also aims to answer the following research questions: 1) Is it possible to neglect the difference in noise emissions for vehicles belonging to the same category but with different motorization? 2) How does the variability of driving style affect road traffic flow-related pollutant and noise emissions estimation? 3) Are pollutant and noise-related critical hotspots the same, and how do they impact the road traffic externalities? Therefore, the specific objectives of the plan are to: 1) Introduce in the VNSP a classification based also on vehicle motorization (gasoline, diesel, hybrid or electric), to capture the noise emissions variability in the low speed range (below 40 km/h) where the engine noise contribution is predominant; 2) Develop a Road Traffic Noise Microscopic Model (RTNMM) based on the VNSP able to estimate the equivalent continuous sound power level (Leq) produced by the road traffic flow in different time ranges, by considering the source-receiver distance, the vehicle typology and motorization, microscopic kinematic variables and road parameters; 3) Develop noise and pollutants maps built on integrate use of RTNMM, VSP methodology, and VISSIM which in turn could allow to: i) detect critical hotspots in terms of noise and pollutants; ii) evaluate the number of people exposed to noise levels and pollutants concentration exceeding the limits; iii) compute and internalize traffic-related external costs; iv) help the policymaker in the in the enaction of action plans; v) create paths completely dedicated to micromobility users (e.g. pedestrians, cyclists and e-scooters users) located far away the hotspots.

Energy systems and climate change

Comparative study of gasification of Portuguese forest biomass in fixed bed and fluidized bed in gas production with potential to power generation

Victor Mantilla, Luís António da Cruz Tarelho, Miguel Lienhard Mendonça

The potential of power generation from gasification depends on the characteristics of the process to obtain a gas with higher heating value. This gas can be used e.g., in internal combustion engines or gas turbines, for this, the gas must be conditioned. The quality of the gas is influenced by the design of the reactor, the biomass, and the operating parameters of the gasifier. A previous treatment step is necessary to eliminate contaminants at levels low enough to comply with environmental regulations and the tolerance of gas conversion systems. This work aims to compare the gasification of forest biomass in fixed bed integrated with internal combustion engine and fluidized bed integrated with gas turbine. The experimental evaluation will be carried out by developing tests on the prototypes of the University of Aveiro and the gas treatment system will be developed. The theoretical evaluation will be developed with technical economic analysis.

Energy systems and climate change

Integrated Impact Assessment of Shared, Automated and Electric Mobility

Mariana Vilaça, Margarida Coelho, Gonçalo Correia

The transport sector represents the most challenging sector of the world's energy consumption and greenhouse gas emissions. To face this, the convergence of shared mobility, vehicle automation, and electrification has been promised to drastically reduce road transportation impacts. Notwithstanding, to support a road transport transition is of utmost importance to holistically understand environmental, social, and economic implications. This research plan intends to understand and quantify the potential impacts of shared, fully automated, and electric mobility. An integrated research framework will be applied to address energy and environmental challenges within shared autonomous and electric vehicles (SAEVs). The impact of SAEVs in the road network considering presence, routing, location and access to charging stations and scheduling will be addressed. Hence, automated driving decisions and distinguishing normal from recurring driving patterns are required to develop a framework for generating an automated mobility service. A fundamental understanding of the upstream and downstream environmental impacts of a product and a system considering SAEVs fleet adjusted to different travel demands will be conducted in a life cycle assessment (LCA) approach. Attention will be given to the application of SAE mobility both at urban and inter-urban scales. Results of the research intend to combine into a feasibility study to assess the environmental, economic, and consumer perspective viability of the examined systems. The main research questions of this study are:1) Which routing strategies should be adopted for energy-efficient driving decisions?; 2) What are the impacts of SAEVs systems through a life cycle concept?; 3) What is the potential of SAEVs to manage traffic demand at urban and interurban scales?

Energy systems and climate change

Decision support system for accessing costs and risks of connected and autonomous vehicles as mobility service in urban contexts

Mónica Rodrigues, Jorge Bandeira, Maria Conceição Lopes

A predicted increase of connected autonomous vehicles (CAVs) in our roads paved the way for new opportunities and challenges towards the promotion of sustainable mobility. However, the impacts of CAVs on road environment and their implications are widely dependent on technological choices and public policy.

Therefore, the main objective of this research is to develop a decision support system (DSS) that allows assessing the costs and risks of implementing CAVs in urban contexts (vide diagram). First, the candidate intends to determine how CAVs will affect economic, environmental, and time-value costs by assessing the risk of their implementation in different Portuguese cities. Second, the candidate will address what criteria should be considered to define a predictive model to determine, in real conditions, the impacts of implementing CAVs. The results achieved will integrate a DSS that will support transport systems' planning and implementation of urban strategies for the introduction of CAVs.

Energy systems and climate change

Platooning optimization with mixed vehicle arrangements based on performance and environmental indicators

Micael Rebelo, Jorge Bandeira, Sandra Rafael

In the future, connected systems need to work together to achieve sustainable mobility. The proposed work aims to optimise platooning formations that encompass light and heavy-duty vehicles that travel the highways. This optimisation will be based on road externalities, including environmental indicators and different platooning characteristics. These platooning characteristics will involve vehicle order in the platoon and the overall speed of the vehicles. Numerical and physical modelling will be used to support the development of an autonomous control system for platoons. This system, defined as “Platune”, will communicate with highways' information signs. The system will be supported by a machine learning technique that will estimate vehicle consumption, traffic emissions, and local air quality in near real-time. In this regard, the "Platune" system will automatically advise the formation of platoons with specific data (order, speed and number of vehicles) to minimise road traffic externalities and to improve people’s quality of life.

This preliminary work will focus on a set of different platooning formations, with cars and trucks and cars. The Vehicle Specific Power (VSP) modelling approach will be used to analyse the influence of drag coefficient (Cd) as it is the variable most influenced by driving in a platoon formation. Vehicle emissions of NOx, CO2 and CO are calculated using VSP models for each platoon simulated using OpenFOAM. Savings of 25% are achieved for cars driving in mixed platoons with trucks, making platooning the future of more efficient transport systems.

Energy systems and climate change

Assessing circular economy in the food sector in Porto Metropolitan Area

Pedro Santos, Myriam Lopes, Aristide Athanassiadis, N.A.

Considering that 80% of food will be consumed in cities by 2050, cities can significantly influence the way that food sector will shift to the circular economy. Realizing that this transition will require a global systems-level change effort across the food sector value chain, involving public and private actors and a set of public policies, it will be critical to develop new tools and methodologies of measuring and assessing the circularity of the food sector. In this proposal of PhD work, the author will adapt and apply the Sector-Wide Circularity Assessment (SCA) Model, developed in CityLoops Project (co-funded by the Horizon 2020 Programme), to assess circularity in the food sector in Porto Metropolitan Area (case study). It will be defined different scenarios considering a mix of measures implemented, taking into consideration the current European and national policies aiming to accelerate the transition to a more circular food sector, and it will be evaluated the impact of these scenarios in the circularity of the food sector in the Porto Metropolitan Area. During the PhD work it will be also performed an analysis of the strengths and limitations of the use of SCA models to measure the circularity in the food sector. Finally, the author will develop a methodological proposal for a Circularity Monitoring & Assessment Framework for the Food Sector, adapted to the Statistical Portuguese reality.

Keywords: food sector; circular economy; urban metabolism; sector-wide circularity assessment; Porto Metropolitan Area.

Energy systems and climate change

Development and optimization of novel Phase Change Materials based on gels of inorganic salts emulsified with oils

Carlos Almeida, Ana Barros Timmons, Jorge Frade

With the goal of contributing to the production and use of more sustainable energy, this Thesis aims to develop and optimize novel PCM, with suitable properties for the storage of energy in the form of cold, based on gels of inorganic salts emulsified with oils. The main properties of this PCM will be optimized by (i) the addition of graphite, graphene or silicon carbide to improve the thermal conductivity, (ii) the gelification to stabilize the form and (iii) the emulsification of the gels with oils to minimize the volume changes during the phase changes. This optimization will be based on an iterative process and supported by the mathematical modeling of the emulsified systems. So far, some promising experimental results have been obtained. Indeed, compared to a reference PCM, the addition of 8% of graphite lead to an increase of the thermal conductivity by 15% and a reduction of the freezing time by 26%.

Energy systems and climate change

An empirical multi-objective optimization of road traffic externalities considering human road stress based on vehicle activity data

Ricardo Tomás, Margarida Coelho, Eloisa Macedo, José Fernandes

Road mobility is evolving and several methodologies for road traffic distribution optimization have been developed considering different criteria, but scientific research has still to address driver/passenger stress levels on the vehicle impacts.

This PhD proposal is motivated by the need to relate human physiology with road traffic-related externalities (RTE), namely: pollutants and noise emissions, energy consumption and road safety. The research main objective is to relate human road stress, inferred from heart rate, with RTE. More specifically, the heart rate estimative, resultant from a multi-variate function based on vehicle activity data, is connected to a road stress level that can be correlated with RTE.

This research work aims to provide a methodology to be applied either by researchers or practitioners that will allow to perform an empirical multi-objective optimization of RTE considering human road stress based on vehicle activity data acquired through real-world driving or simulation.

Energy systems and climate change

Telecommunications MAP-tele

Waveforms for LiDAR

Daniel Bastos, Miguel Drummond, Arnaldo Oliveira

Light detection and ranging (LiDAR) is a key sensor for the future deployment of self-driving vehicles with higher levels of autonomy. State-of-the-art LiDARs are based on short pulses and threshold methods, which are sub-optimum and non-resilient to interference. This PhD research looks into alternative LiDAR waveforms and techniques that can improve both the performance and robustness to inteference of an automotive LiDAR system, while employing a simple and cheap architecture.

Telecommunications MAP-tele

Photonic techniques for high-capacity phased array antennas

Rui Oliveira, Miguel V. Drummond, Rogério N. Nogueira

Telecommunication's systems face ever-increasing pressure to increase capacity whilst maintaining the systems other parameters in check, namely power consumption and physical dimensions. Microwave-range, beamformed antenna arrays are expected to play a major role in achieving this goal, as they are the only means to achieve dynamic spatial-division multiplexing. However, traditional electronics techniques have failed to provide solutions for large or massive scale beamformed arrays, leaving microwave-photonics has a strong contender in this area. This field is rapidly evolving and there are still open questions on fundamental architecture problems. The thesis being pitched tackles these problems, bringing forward a new architecture for microwave-photonics beamforming, based around the use of wavelength-division multiplexing and a programable photonics processor based on a liquid-crystals on silicon panel. This architecture has the potential to handle hundreds of RF beams over an area about a centimetre square and to keep power consumption in check. The work has the potential to greatly impact the telecommunication satellites, flat-panel antennas, and the latest-generation cellular markets.

Telecommunications MAP-tele

Tourism

The 4.0 paradigm in tourism: reality or a conceptual issue

Vitor Rodrigues, Zélia Breda, Carlos Rodrigues

O turismo enfrenta, hoje, um novo desafio relacionado com digitalização do setor. Impulsionado pela quarta revolução industrial e respetivas abordagens inovadoras, emergiu o conceito de Turismo 4.0. Conceitos como big data, blockchain, internet of things, inteligência artificial, realidades aumentada e virtual começam a dominar a discussão sobre o presente e o futuro do turismo. Vários desafios e oportunidades têm sido identificados, particularmente a nível das pequenas e médias empresas. Contudo, são poucos os desenvolvimentos que refletem sobre as implicações da digitalização no seio do novo ecossistema 'inteligente', nomeadamente no que diz respeito à gestão e operacionalização dos destinos turísticos e à comparação entre distintas bases territoriais. Paralelamente, são também escassas as evidências sobre o verdadeiro impacte das políticas públicas na digitalização do turismo, em que medida essas estratégias se encontram alinhadas com os desígnios dos destinos turísticos e empresas que neles operam, e se os esforços desenvolvidos procuram garantir que as regiões periféricas são envolvidas equitativamente no processo. O presente estudo procura, assim, dar resposta às lacunas identificadas através de um modelo de investigação misto e agregador das diferentes perspetivas e realidades.

Tourism

Understanding eWOM and its contribution to enhance tourism destination competitiveness

Ana Sofia Apolónia, Prof. Dr. Carlos Costa, Prof. Dra. Cristina Eusébio, Prof. Dra. Belém Barbosa

Tourism destination competitiveness (TDC) is a holistic and multidimensional concept that has been vastly studied for the past twenty years. On the other hand, the literature in the tourism context demonstrates that eWOM impacts destination image and destination choice, which contribute to TDC by inducing tourists to differentiate and choose to visit a certain destination compared to its competitors.

Additionally, the TDC models and definitions emphasise the importance of the destinations' ability to provide unique, significant and memorable experiences to their visitors.

Without surprise, one main focus of destination management and marketing is having satisfied visitors, which is expected to have several outcomes, including word-of-mouth communication. Then, tourists' behavior on sharing experiences, recommendations, and opinions on the destination in online platforms, i.e., eWOM, should be considered by destination management due to its importance on TDC.

However, this topic has not yet been adequately investigated by extant literature. To fill this gap, this research aims to analyse the impact of eWOM in TDC.

Tourism

Indicators to support Decision-Making in Management & Territorial and Economic Development

Silvana Serrão, Professor Doutor Rui Augusto da Costa, Professor Doutor António Carrizo Moreira

Perceiving tourism as an instrument for the development of territories is an essential condition in contemporary societies. As a result of the new dynamics that characterize the sector, the definition and use of indicators are central to the planning and management process of tourist destinations. However, the existing information does not fully satisfy the needs of organizations in the territory in search of competitive advantages to achieve sustainable economic prosperity. Based on this premise, this study proposes to develop tools in order to assess metrics to support decision-making in the context of management and territorial and economic development. In this sense, the proposed methodology is based on a mixed approach, in which the application of qualitative methods is complemented with quantitative methods. As main contributions, we highlight the development of a framework to support decision-making by organizations in order to enhance tourist destinations, resulting in an increase in scientific knowledge in an under-explored area.

Tourism

Coopetição e Criatividade para a sustentabilidade do turismo urbano.

Arturo Sousa, Prof. Filipa Brandão, Prof. Carlos Costa

The theme of sustainability of cities is a very current and interdisciplinary topic that leads to a series of interests and influences. Urban sustainability has a clear importance and interest in tourists/visitors, host populations, tourism companies and local/national governments.

Coopetition and creativity can be key-factors to produce sustainability in the cities. It will be tested with a mixed approach the importance of these areas to produce sustainability in urban tourism, integrating the supply and offer side of the tourist activity.

Tourism, as a type of mobility, leisure, practice, economic, cultural, social phenomenon, can directly and/or indirectly promote the sustainability of cities, therefore, it is proposed to explore and verify the sustainability of portuguese cities for tourism. As national case studies the objective is to present the main cities in Portugal - Porto, Coimbra, Lisbon, Faro, Ponta Delgada and Funchal.

Tourism

TAX FREE : OS EFEITOS NO CONSUMO E NA ATRATIVIDDE TURÍSTICA DE UM DESTINO. UM ESTUDO APLICADO AO BRASIL

Otavio Leite, Carlos Costa, Zelia Breda

O presente trabalho foi elaborado no âmbito da disciplina de Preparação de Projeto de Tese, do Programa de Doutorado em Turismo da Universidade de Aveiro e tem como objetivo apresentar um esboço do que será desenvolvido ao longo do período de investigação do autor. Por meio deste estudo objetiva-se analisar os resultados alcançados por destinos que instituíram o Tax Free (restituição ao turista internacional dos valores relativos ao tributo incidente sobre a compra e venda de mercadoria, em geral, IVA).

Será realizado um levantamento de experiências já vividas por países que entenderam ser esta medida um componente de fortalecimento do seu turismo receptor bem como um elemento que alimenta sua cadeia de comércio local. Como operacionalmente se apresenta este modelo ? Serão observadas as inovações tecnológicas que, por sua vez, vêm gerando facilidades de procedimentos tanto para o consumidor diretamente tal qual para os orgãos fazendários, afinal os ritos e programas on line, ensejam velocidade, praticidades para este tipo de transação.

O Tax Free é ou não é um elemento adicional de atratividade turística ? Que mutações e ou adaptações este programa tributário/turístico por assim dizer, haverá de receber em face do novo cenário do turismo mundial pós-pandemia? Que alterações comportamentais e atitudinais brotarão no consumidor viajante mercê do " caldo de cultura" que resultará deste difícil e complexo momento por que passa a humanidade?

Tourism

Tourist-arrivals Forecast based on Improved EEMD model and (S)ARIMA model (Application on Jiuzhai Valley National Park)

xin lei, Filipa Brandão

In the traditional econometrics study, the time series were analyzed using the ARIMA and Garch models.

Whereas, with the rapid development of data science, many scholars applied machine learning to time series, especially predictions made by neural networks. My initial idea is to conduct a hybrid model of improved EEMD and (S)ARIMA model. It is a trial that combined the signal decomposition and improved econometrics models. Furthermore, the comparison analysis to the current quantitative models will be conducted to show the priority.

Tourism

PIIC

The association between the perception of control and treatment (non)adherence in patients undergoing in-centre haemodialysis

Jaime Oliveira, Helena Sousa, Ana Bártolo, Daniela Figueiredo, Óscar Ribeiro

In-centre haemodialysis (IHD) is the most common renal replacement therapy for patients with end-stage renal disease (ESRD). This treatment is highly demanding as it involves adhering to a strict dialysis regimen and the management of various self-care behaviours (e.g., dietary and fluid restrictions, and medication intake). Adherence to these requirements causes important life disruptions that can compromise patients' autonomy, routines, and life goals. Previous research has suggested that health-related results are associated with patients' perceptions of control. However, the association between patients' illness perceptions of personal control and adherence in ESRD has never been systematically reviewed. This study aimed to conduct a systematic review on the association between these variables. The search was performed on PubMed, Scopus, CINAHL, Web of Science, and ProQuest, in June 2021. Seven studies were included comprising a total of 983 patients. The perception of personal control was significantly associated with adherence to diet restrictions (r=0.27), medication intake (r=0.27), exercise (r=0.24), and overall treatment adherence (Adjusted OR = 4.16 (1.39-12.5). These results seem to suggest that patients undergoing IHD who believe that they can exert control over the course of the illness and influence treatment efficacy, may be more adherent to different self-care behaviours. This hypothesis goes in line with Bandura's self-efficacy theory, which represents the judgements of how well one can execute the action required in different situations. However, more research is needed to better understand the influence of personal control on adherence in ESRD.

To map the outcomes of the Reminiscence Functions Scale with older persons: A systematic review

Carolinne A. Marques, Sofia F. Dias, Liliana X. M. Sousa

Reminiscence is the act of remembering personal past events. The Reminiscence Functions Scale (RFS) is the most applied instrument used with older persons to measure which of the eight functions of reminiscence they remember most. The data of the utilization of this instrument and its clinical implications had not been systematically organized yet, which explains the importance of implementing a systematic review.

A total of 1659 articles were found in different databases, and after implementing the inclusion criteria (articles with older persons, all kind of methodological designs, with the empirical utilization of the RFS, published in English, Portuguese or Spanish languages at indexed peer-reviewed journals) and exclusion criteria (other publications types and with no utilization of the RFS), only 51 left. At the moment, the authors are extracting the data of the articles, and the next step is the quality appraisal with the Mixed Methods Appraisal Tool (MMAT).

Some preliminary findings show that the majority of the studies are quantitative; the total frequency of reminiscence is positively correlated with negative outcomes as PTSD symptoms and emotional lability; besides that, some reminiscence functions (identity, problem-solving, and death preparation) indicates higher levels of mental health adjustment like psychological well-being while other functions (bitterness revival, boredom reduction, intimacy maintenance) showed lower levels of psychological well being and coping strategies; lastly, some models of reminiscence emerged.

Eyes on the pandemic: Photovoice reports on the reinvention of practices in residential care facilities

Sofia F. Dias, Carolinne Marques, Lia Araújo, Liliana Sousa

After one year of the COVID-19 pandemic and with the vaccination starting point in Portugal, this study aimed to identify personal perspectives of front-line gerontological professionals, namely social workers about the future in ageing contexts. This study is a contribution to professional formation and practice in a public health crisis. Being part of a wider 6-session Photovoice programme ("Eyes on the pandemic"), this exploratory study employs a participative qualitative method of research – photovoice -, taking advantage of photography and voice to describe experiences. 12 participants/co-researchers – social educators working in residential care facilities described the taken photographs considering the following questions: what they may foresee in the future, how can they prepare themselves (in short-, medium- and long-term future) and what/who can help them. The session was video-recorded, and later transcribed and submitted to thematic analysis. Three major themes were identified: 1) (professional and personal) growth, related to the recognition of new life perspectives with the valorisation of small things and revaluation of professional functioning as well as increased resilience; 2) reinvention, related to emotions management, teamwork and union of these professionals to surpass the outbreaks along with new ways of intervening; and 3) eyes on the future with hope, related to the professionals'

concern about the pandemic repercussions. Participants referred to the importance of daily planning due to the uncertainty related to the future, despite the vaccination. The COVID-19 pandemic was an opportunity for professionals to revaluate their action and practices.

Raising awareness to linguistic and cultural diversity

Carla Marisa de Jesus Pereira, Susana Pinto

Relationship with society within the activities of LabELing (a CIDTFF Lab): workshops to raise awareness to linguistic and cultural diversity aimed at students attending

different school years.

- Review and update for online teaching 4 existing workshops (scripts, activity sheets, resources).

- Design 2 new workshops (one for 1st graders and another for 2nd graders).

- Collaborate in the dynamization of workshops aimed at diverse audiences.

UA Informa: a science project for the community

Filomena O. Guimarães, Lúcia Pombo, Margarida M. Marques

“UA Informa” é um projeto pioneiro de articulação entre a Educação, a Formação e a Investigação, que surge na sequência do projeto EduPARK e que se enquadra no Smart Knowledge Garden (SKG), Projeto Programático do CIDTFF da UA que fomenta atividades de extensão para a comunidade. A principal finalidade do “UA Informa” é promover a imagem da UA, assim como a sustentabilidade do seu Campus e da cidade. Para tal, estão a ser criados recursos educativos abertos, sob a forma de QR Codes a serem espalhados pelo Campus da UA, dando acesso a páginas da subweb UA Informa, integrada no portal da UA, com curiosidades, conteúdos educativos interdisciplinares e informações úteis sobre sustentabilidade. O projeto terá especial interesse para os estudantes da UA, bem como para visitantes e toda a comunidade. Neste trabalho apresenta-se um exemplo de recurso desenvolvido com vista a melhor elucidar sobre o conteúdo do projeto.

Science cartoon and Math Education: a STEAM task design

Daniela Marques, Cecília Guerra

Em plena “Década da Ciência Oceânica para o Desenvolvimento Sustentável” é crucial pensar formas de Comunicar e Educar Ciência colocando a “Divulgação Científica sobre os Oceanos” nas agendas das instituições de formação (universidades e escolas), visando contribuir para o aprofundamento do conhecimento científico sobre o Oceanos. O Cartoon intitulado “À descoberta dos poliquetas da plataforma continental ao largo de Aveiro”, concebido por uma equipa multidisciplinar da Universidade de Aveiro para celebrar o “Dia Mundial dos Oceanos”(8 de junho), que este ano tem como mote o tema lançado pelas Nações Unidas: "The Ocean: Life and Livelihoods”.

O cartoon utiliza como ponto de partida um artigo científico resultante de uma expedição oceanográfica que estudou a comunidade bentónica de invertebrados marinhos existente numa área limitada entre a costa e o bordo da margem continental ao largo de Aveiro.

Effects of chronotype and time-of-day on recognition of famous faces

Talles Barroso, Pedro Bem-Haja, André Silva, Catarina Rosa, Diâner Queirós, Luiza Quinália Cerri, Miguel Alves

This study is included in a FCT funded project entitled "DORIAN - Do you recognize me? The impact of chronotype and time-of-day on face recognition" (Refª PTDC/PSI-GER/31082/2017).

The present study aims to explore the relation between chronotype, time-of-day preferences, and performance in a facial recognition task from dynamic stimuli. The analysis is focused on possible synchrony and asynchrony effects. We expect to find a facilitation of performances during optimal times in comparison to non-optimal times, in terms of recognition response time. The online data collection follows GPDR guidelines concerning privacy and management of participant information. The task consisted of a series of video clip transitions, from an unknown average face to a famous face. Firstly, two average faces, one female and another male, were produced from 24 unknown faces using the PsychoMorph software. Then, a series of video clips were produced by interpolating 180 pictures of transitions between the aforementioned averages and 24 famous faces (12 female), which were selected as the most recognizable ones in a previous pilot study. The participant should stop the video as soon as the famous person was recognized, providing the name or sufficient information for unequivocal identification. Data collection is still ongoing and thus there are still no preliminary results.

Rumination Room: Ruminative tendencies in university students: The role of executive control in rumination and academic procrastination.

Mónica Marques, Catarina Rosa, Mariana Ferreira, Pedro Bem-Haja, Isabel Santos

Academic procrastination has been defined as a tendency to voluntarily postpone academic tasks regardless of the consequences that may come and can be seen as a self-regulatory failure. Recent research has highlighted the relationship between academic procrastination and two types of rumination, namely, self-critical and brooding. Procrastinating students are prone to have a chronic tendency to ruminate about their dysphoric feelings and past procrastination. Moreover, students that ruminate on academic procrastination are more susceptible to experience distress, due to executive control deficits that impair their ability to ignore emotional information. This study intend to adapt an experimental paradigm that proved to be effective in reducing rumination by training individuals to exert executive control when exposed to negative stimuli. A total of 80 participants will be randomly assigned to one of two training conditions. In the experimental group activation of executive control will be followed predominantly by the presentation of procrastinatory cognitions, whereas in the control group it will be followed predominantly by neutral cognitions. We predict that participants in the experimental group will show reduced procrastinatory related rumination, as well as lower procrastination, compared with those in the control group.

The transfer of knowledge from experimental procedures to a more ecological clinical strategy focused on negative automatic thoughts in procrastinators seems to be a promising avenue to personalize the intervention and expand its potential for effectiveness.

Effects of explicit and implicit racial attitude discrepancy: Implementation of intentions to reduce implicit racial bias and rumination

Inês Fonseca, Catarina Rosa, Maria Ferreira, Pedro Bem-Haja, Isabel Santos

The roots of implicit social cognition set upon automatic or implicit processing and controlled or explicit processing. The fact that racial bias can be manifested automatically in the unconscious mind was a major discovery, explaining why individuals who consciously reject prejudice nevertheless show evidence of bias in their non-deliberative behaviours (as assessed by the Implicit Association Test, IAT). The experience of discrepant explicit and implicit self-constructs is related to several negative consequences, such as negative self-directed affect, dissonance-based discomfort, and rumination. Research suggest that implicit bias can be unlearned through repeated exposure to bias-inconsistent content. In this way, counter-conditioning an alternative incompatible response to the cue(s) that trigger a habit can be an effective way to decrease rumination. The aim of this study is to replicate a counter-conditioning procedure which proved to be effective in reducing implicit racial bias, and further explore if this reduction has an impact on attitude discrepancy related rumination. Our results will allow to deepen the knowledge about the automatic and controlled processes of rumination.

Facial Expression Recognition Task

PROJECT: "Dorian – Do you recognise me? The impact of chronotype and time-of-day on face recognition"

Miguel Fradinho Alves, Pedro Bem-Haja, André Silva, Catarina Rosa, Diâner Queiroz, Luíza Cerri, Talles Barroso

This study is included in a FCT funded project entitled "DORIAN - Do you recognize me? The impact of chronotype and time-of-day on face recognition" (Refª PTDC/PSI-GER/31082/2017).

The present study aims to explore the relation between chronotype, time-of-day preferences, and performance in an emotion recognition task from dynamic stimuli. The analysis is focused on possible synchrony and asynchrony effects. We expect to find a facilitation of performances during optimal times in comparison to non-optimal times, in terms of emotion recognition response time. The online data collection follows GPDR guidelines concerning privacy and management of participant information. The task consisted of a series of 15s videos depicting six actors (three male, three female) transitioning from a neutral face to one of six emotional expressions (Happiness, Anger, Sadness, Fear, Disgust, Surprise). The faces were selected based on their global emotional recognition percentage based on norming studies, and the videos were produced using FantaMorph, interpolating a 100% neutral face with a 100% full expression face, in 1% steps. The participant's task was to stop the video as soon as they recognized the emotion being displayed, followed by selecting the identified emotion from a list of the six possible choices. Data collection is still ongoing and thus there are still no preliminary results.

Famous Face Recognition Memory Task

PROJECT: "DORIAN - Do you recognise me? The impact of chronotype and time-of-day on face recognition"

Luíza Quinália Cerri, Pedro Bem-Haja, André Silva, Catarina Rosa, Diâner Queiroz, Miguel Alves, Talles Barroso

This study is included in a FCT funded project entitled "DORIAN - Do you recognize me? The impact of chronotype and time-of-day on face recognition" (Refª PTDC/PSI-GER/31082/2017).

The present study aims to explore the effect of chronotype and time-of-day on the performance in a famous face recognition task (reaction times and response accuracy) and explore the psychophysiological correlates of those effects by measuring ERPs, eye tracking patterns and pupillometry. The analysis is focused on possible synchrony and asynchrony effects between the time when the task was performed (morning or evening) and the participants' individual preferences (based on their chronotype: morning- or evening-types). We expect to find a facilitation of performance during optimal times in comparison to non-optimal times, in terms of recognition response time and accuracy. The data collection follows GPDR guidelines and COVID-19 safety measures. Participants take part in three experiments during the laboratory sessions. This presentation is about the Famous Faces Recognition Memory Task. Participants are presented 48 famous faces and 48 unfamiliar faces (24 of each gender). This block of 96 faces is repeated twice, in a total of 192 trials. For each face, participants have to indicate, through a key press, whether it is a famous or unfamiliar person. EEG, eye movements and pupil dilation are monitored simultaneously. Participants perform the task twice, once at 7:30 am and a second time at 7:30 pm. Data collection is still ongoing and thus there are still no preliminary results.

GLASGOW FACE MATCHING TASK

PROJECT: "Dorian - do you recognise me? The impact of chronotype and time-of-day on face recognition"

Diâner Felipe L. Queiroz, Pedro Bem-Haja, André Silva, Catarina Rosa, Luíza Cerri, Talles Barroso, Miguel Alves

This study is included in a FCT funded project entitled "DORIAN - Do you recognize me? The impact of chronotype and time-of-day on face recognition" (Refª PTDC/PSI-GER/31082/2017). The present study aims to explore the effect of chronotype and time-of-day on the performance in Glasgow Face Matching Task (GFMT) and explore the psychophysiological correlates of those effects by measuring ERPs, eye tracking patterns and pupillometry. The analysis is focused on possible synchrony and asynchrony effects (based on accuracy and time response) between the time when the task was performed (morning or evening) and the participants chronotype. The data collection follows GPDR guidelines and also follows COVID-19 safety measures. Participants take part in three experiments during the laboratory sessions. This presentation is about the GFMT. Each trial will start with a fixation cross for 500ms, followed by the first image of the pair for 1000ms. A second fixation cross will appear (500ms) and the second image of the pair will then be displayed (1000ms). Finally, an instruction will appear, asking the participant to respond, without time

limit, whether the second face in each pair was the same or a different person from the first. After this response, another trial will follow (total of 168 pairs). Face-pairs will be presented in random order, as will the first and second image in each pair. Participants perform the task twice, once at 7:30 am and a second time at 7:30 pm. Data collection is still ongoing and thus there are still no preliminary results.

Smart Educational Communities: changing teaching practices and learning spaces on campus

Lúcia Aidos, Gabriela Reses

O projeto visa investigar a conceção, dinamização e monitorização de novos espaços flexíveis de aprendizagem na UA, que facilitem a implementação de estratégias de ensino e aprendizagem centradas no aluno e promotor de aprendizagens ativas. No sentido de se incentivar a adoção destas práticas pedagógicas pretende-se propor, aos docentes, ofertas formativas, com o contributo dos estudantes no desenho das mesmas, e monitorizar a utilização destes espaços do ponto de vista educativo.

Os objetivos do projeto são, de uma forma geral: investigar a conceção, dinamização e monitorização de novos espaços flexíveis de aprendizagem na UA, que facilitem a implementação de estratégias de ensino e aprendizagem centradas no aluno e promotor de aprendizagens ativas; e propor, aos docentes, ofertas formativas, com o contributo dos estudantes no desenho das mesmas, e monitorizar a utilização destes espaços do ponto de vista educativo.

As tarefas em curso são: o apoio na conceção de oferta formativa a realizar-se no LMEA; a monitorização de espaços de aprendizagem ativos e de inovação pedagógica; a realização de uma proposta de workshop (objetivos, conteúdos, recursos...); e a conceção de uma proposta de um instrumento de monitorização/avaliação.

LoCALL: LOcal Linguistic Landscapes for global language education in the school context

Mª Beatriz Santos, Rosalba Graterol

Apresentação do nosso trabalho de iniciação à investigação, como PIC-Edus integrantes do projeto LoCALL: LOcal Linguistic Landscapes for global language education in the school context. Vamos abordar os seguintes tópicos: o projeto e seus objetivos, as tarefas desenvolvidas, as competências que adquirimos e os desafios que tentámos superar e os passos que queremos dar no futuro.

Para além disso, vamos explicar de que forma este projeto contribuiu para a criação de um projeto sobre a Paisagem Linguística no âmbito da nossa Prática Pedagógica, no 1º Ciclo do Ensino Básico.

Bando das Gaitas in Times of Trouble

Ines F. Costa, Isa C. Colaço, Mafalda P. Pinto

A investigação alicerça-se sobretudo na criação de um podcast, que permite abordar o tema de uma forma mais pessoal e direta. Pressupõe-se ainda um conhecimento prévio da entidade entrevistada em questão, o grupo musical Bando Das Gaitas, na elaboração de uma introdução e questões coerentes. Este grupo, que se apresentava regularmente em público, no contexto de pandemia, teve de se reinventar e são as estratégias por ele adotadas o principal foco deste trabalho de investigação.

An artist's education during the pandemic

Telma Fontes, Cristiano Bragança, Inês Neves, Rodrigo Nunes

Trabalho sobre a educação de um artista durante a pandemia.

Covid-19 Times in the Musical Theater World

Rodrigo Calais, Jasmim Lester, Bruna Rafaela, Mariana Inácio

A PodCast about how one of the performative arts branch has been affected by the Covid-19 pandemic and how it has been able to survive despite the impossibility of making live in-person performances.

The evolution of philharmonic bands at the time of the New State.

Gonçalo C. Almeida, Alexandre B. M. A. S. Baptista, Daniel M. Serôdio, David J. P. Flamengo

The reason for focusing on this theme is because we as a group understand that philharmonic bands do not have the value they should have, given the limited offer of music schools, philharmonic bands, especially during the Estado Novo period, played a preponderant role in the scope teaching wind and percussion instruments. However, at that time the adequacy of teaching was reduced because even the trainers had little theory due to the delay that was felt. Due to the totalitarian regime, there were very few music schools in the country, and those that did exist were only possible for those who had the economic power to do so, that is, the large minority of society.

'Som da Rua': times of trouble

Luís F. B. Dias, Sara B. D. Fernandes, João F. F. S. Vieira, Margarida M. Rocha

Som da Rua é um projeto que nasceu em 2009, no Porto, através do Serviço Educativo da casa da música. É proposto pelo criador deste projeto, Jorge Prendas, que a pratica social em grupo traz benefícios sociais e cognitivos, aumentando as competências sociais e aprendizagens. Maioritariamente constituído por pessoas sem-abrigo, institucionalizadas e marginalizadas pela sociedade seja por problemas de toxico-dependência, alcoolismo ou outros, ao projeto só há, realmente, interesse na criatividade artística e na música que estes fazem. Na realização do projeto fazem parte diversos elementos essenciais: há vários músicos amadores com formação em intervenção social que colaboram com os participantes do projeto, mas, também, equipas de agentes sociais que tratam da assistência aos participantes, do transporte, se necessário, e, inclusive, de incentivar à participação no projeto. Os objetivos do Som da Rua passam por: Incluir os mais excluídos de todos; garantir que a participação é coletiva, dando espaço às ideias criativas dos participantes; e desenvolver competências sociais no grupo, reabilitando problemas de auto-estima e afirmação social que muitas destas pessoas carregam.

Longing From Afar, a Distant Solution

Rui Camões, Francisco Ribeiro, Luís Silva

"Longing from afar" is a orchestral piece created by the composer Dai Fujikura as a solution to the impossibility of music ensembles playing during the COVID-19 pandemic. "Longing from afar" consists of a type of music that is intended to play in an online voice-chat platform such as Zoom. However, zoom has some limitations such as delay that makes a normal piece unperformable in these conditions, therefore Dai Fujikura created "Longing from afar", an ensemble piece that is not influenced by delay due to the way it's written and can be performed by any group of musicians even if they are a world apart from each other. Also, due to the piece's low difficulty it can also be played by children which contributes for their musical development.

The Survival of Mulheres do Minho

Daniela Lima, Gabriela Almeida, João Santos, Maria João Vieira Leite

Este trabalho de investigação insere-se no tema do Research Summit 2021: Arte, Ciência e Inovação em tempos de crise", onde se explora de que forma é que um grupo de cantares polifónicos do Minho, As Mulheres do Minho, constituído maioritariamente por mulheres acima dos 60 anos, conseguiu adaptar-se às dificuldades da pandemia e sobreviver a esta época difícil, onde a área da Música ficou tão afetada.

Interferência: the beginning of a journey in times of trouble

Camila Menino, Ana Raquel Tavares, Maria Inês Nunes, Ariana Neves

In this investigation we seek to better understand the transition between school and the professional world. Interferência is a recent association founded by two young composers and musicians dedicated to the creation and teaching of contemporary music. In the podcast episode we talked with the founders - Manuel Brásio and José Tiago Baptista - about the creation of Interferência and the difficulties they have had in its path. Culture is one of the sectors most affected not only by the pandemic. Manuel and José told us about their journey in times of trouble in cultural scene.

"Plataforma do Pandemónio" - an artistic association created during pandemic

Rodrigo Oliveira, Ana Isabel Freitas, Ana Regina Domingues, Teresa Cabral Marques

The pandemic was accentuated by the decline of a lot of departments and the culture was not an exception.

We witnessed to the closing of concert halls and to artists being forced to stop their activity. As a response to that situation, the solution went through innovation and reinvention. That was the case of the Plataforma do Pandemónio, that was born from the willing of wanting to do more for the arts and the artists.

In this episode of Innov'art's podcast, we aimed to understand the importance of the merger of the three segments of the cultural action in the same association and which repercussions it had in pandemic times.

Music activity during pandemic in Aveiro

David Marques, João Santos, Luís Caetano, Rodrigo Sarabando

O impacto da pandemia de Covid-19 na produção musical da região de Aveiro. Soluções encontradas por grupos que se viram obrigados a interromper a sua atividade regular e desafios associados. Diferenças entre o 1º e 2º confinamentos. Recurso criativo a novas tecnologias. Importância deste continuar da atividade na comunidade em que se insere.

ReintegrArte- Art in science

Eva Senra, Alice Vieira, Filipa Costa, Pedro Santos

Podcast que provém de uma investigação cujo tema é "a arte na ciência". Para isto fomos ao encontro de um projeto "ReintegrArte" que investiga e proporciona a execução de pequenas peças e obras de arte com indivíduos institucionalizados num determinado lar e respetiva instituição social. Queremos, com este pequeno podcast, mostrar as conclusões que tiramos da problemática que questiona se a música, e artes em geral, ajudam de alguma forma os idosos, e não só, quer seja como terapia e até mesmo como combate à solidão e até onde estes estes recursos podem chegar num determinado desenvolvimento do individuo. Para além disto acabamos de perceber que os próprios artistas têm que se adaptar e até mesmo ter formações para lidar com casos particulares.

Art in general during the Second World War

Márcio Ferreira, Telmo Pinheiro

In this investigation, we want to understand how war changed the art world.

Teaching and Music, in time of trouble.

Francisca Fiel, Sara Pissarro, José Pereira, Gustavo Rebelo

O trabalho foca-se nas dificuldades de ensino da música à distância, e a evolução do mundo da música em si nos últimos dois anos.

Stage Anxiety

Maria Milheiro, Mariana Rebelo, José Dumas, Carlos Fernandes

No âmbito da cadeira Domínios do Estudo da Música, lecionada pela prof. Susana Sardo e pelo prof. Pedro Aragão, pretendemos quebrar um dos maiores tabus na área da performance em palco, a anxiedade. A anxiedade é algo que todo o artista lida com diariamente, porém não consegue falar abertamente sobre isso. Estivemos à conversa com o professor, compositor e maestro Luís Carvalho para tentar desmistificar este tabu.

Social Media in Loneliness

Inês S. Ferreira, Marta M. Barbosa, Teresinha R. G. Nunes

This work focuses on an extremely common and at the same time extremely sensitive theme: loneliness. Everyone feels lonely at some point in their life. Fernando Pessoa wrote: "Loneliness is man's inevitable condition." This empirical truth took on new meanings in the Covid19 pandemic. It was and is a time when all people distanced themselves physically and emotionally and the way people had to communicate was through social networks. Online concerts, comedy, dance and music shows, masses, weddings where thousands and thousands of people gathered and where communities of people suffering from the same problem and finding comfort in each other were formed. And perhaps most important of all,

social media served to bring families together. They served to unite the parents and grandchildren of the grandparents who had to be quarantined and under extra care.

An artist's education during the Covid-19 pandemic

Telma Fontes, Cristiano Bragança, Inês Neves, Rodrigo Nunes

By engaging with fellow music students like ourselves we got a hold on how most of us felt about and dealt with the online learning situation. We did the same with a visual arts student and compared in which aspects our situations converged and how we overcame it in different ways.

1920 and 2020 – the life of musical performers and composers in times of pandemic.

Miguel Lopes, Rúben Sobral, Nicola Scalise

Comparation between two different decades (1920 and 2020).

Belief Propagation on Ising Model Graphs

Joana Dirce Santos Martins

Variables mutual dependencies/constraints play a crucial role in many problems of several fields of science. This work is focused on systems that can be represented by a graphical arrangement of variables following an Ising model behaviour, even if approximately. One of the most common methods for studying the behaviour of

such systems is the Monte Carlo algorithm. However, given its limitations, such as the long runtime required in order to produce good results, the belief propagation (BP) algorithm is presented as a more efficient way of studying the behaviour of such systems in various conditions.

Development of an epididymal organoid: an innovative strategy to study and modulate sperm function

Daniela Patrício, João F. Mano, Margarida Fardilha

Infertility is a disease from the reproductive system where ~50% of the cases are attributed to a male cause. The reduced sperm motility and poor interaction between sperm cells and the oocyte are the main causes of male infertility.

The spermatozoa are immotile after spermatogenesis, and it is through the journey in the epididymis that sperm maturation and motility acquisition occur. Although the importance of the epididymis on sperm maturation is accepted, the role of epididymis in sperm physiology is not

fully understood. Moreover, it is known that PP1γ2 becomes inactive from the caput to the cauda and epididymal cells produce small vesicles (epididymosomes) that interact with the sperm membrane, becoming maturation.

The ability to mimic the epididymal environment in a laboratory setting, deepen the knowledge on sperm maturation is a challenge. Organoids' technology has been essential to model organogenesis, organ function, disease, or drug response in many tissues. On the male reproductive system, organoids and organotypic cultures have been developed for testis, but the epididymis remains almost forgotten.

To overcome the lack of knowledge on the epididymis role, we propose to develop, for the first time, a three-dimensional (3D) epididymis and blood-epidydimal barrier (BEB) organoid using hollow tubes technology. Hollow tubes were obtained by building-up multilayers of marine-derived polysaccharides (chitosan and alginate) on sacrificial tubular templates using layer-by-layer technology. Cell from bovine epididymis were isolated and it will be cultured in the inner side and the endothelial cells in the other side of the tube. The ability of the organoid to maturate sperm will be determined by access sperm motility, morphology, and proteomic profile. A successful in vivo 3D epididymis and BEB organoid will allow as to study the epididymis-sperm interaction, unraveling possible targets to modulate sperm function.

Induced Pluripotent Stem Cell-based cancer immunotherapy

Mariana C. Pinheiro, Francisco Santos, Bruno B. de Jesus, Bruno Neves

Cancer is still one of the main causes of death worldwide, mainly due to its resistance to current treatments. Recent studies have shown that both embryonic stem (ES) and tumor cells share common characteristics, such as similar antigens, angiogenic growth factors and subvert apoptotic cell death. This may suggest that ESC could be used as immunizing agents to promote anti-tumor responses.

The main objective of this work is to create a patient-specific iPSC-based treatment in order to increase immune responses to destroy cancer cells.

We work with TNGA cells that were subjected to 3 different conditions: cells treated with LIF during 24 and 48 hours, and cells treated with LIF and 2i for 24 hours. LIF and 2i are two factors that are responsible for the maintenance of cells pluripotency.

With our results we confirm that the morphology changes between the cells, being in a naïve state when treated with LIF and 2i, and in a primed state when treated only with LIF. We also perform some RT-qPCR to analyze the expression of different genes, whose were chosen because they demonstrated relevance as potential (novel) cancer antigens in previously RNA sequence results. And, finally, we perform a Western-Blot analyses to prove the presence of the Nanog gene in our different cell conditions.

In conclusion, we confirm the data that are available in this study area, and in the future, we aim to perform some knockdowns of the genes analyzed in RT-qPCR, immunotherapeutic assays, and also proteome analyses.

Human Fibroblasts and FTIR spectroscopy: new insights on Aging

Beatriz F. Almeida; Rafaella S. Coelho, Ana Rocha, Sandra Magalhães, Alexandra Nunes

The increase in life expectancy drew attention of the scientific community to events that characterize the aging process, and raised questions about the applications for the discoveries in this field. Cell lines are promising models for studying aging, since it allows for the observation of the behavior of biomolecules in cells with different ages.

The main objective of this study is to characterize changes in protein conformation of samples from three lines of human fibroblasts with different ages (22, 49 and 69 years old), using FTIR spectroscopy and principal component analysis (PCA).

PCA applied to the protein spectroscopic region of spectra revealed that there is a marked increase in α-helix content in older fibroblasts comparing to young and middle-aged fibroblasts. Additionally, samples of middle-aged fibroblasts seem to have more structures with antiparallel β-sheets, β-turns and intermolecular β-sheets.

This pilot study is a good starting point to open the discussion into proteins as possible therapeutic targets for the prevention of diseases associated with aging.

Flexible piezoelectric KNN based composites for energy harvesting applications

Tomás Rosado, Rui Pinho, M. Elisabete Costa

Electronic devices are powered by batteries, which require high level of maintenance and such limitations aren´t feasible[1]. Thus, small sized and long-lifespan power sources are needed. Due to the recent developments in electronics towards low power consumption devices, harvesting environmental vibrational energy is a possible solution [1][3]. One of the simplest ways to convert mechanical energy into electrical energy is the piezoelectric effect [3]. In this work, piezocomposites of PDMS + KNN were prepared with different amounts of KNN powder and aligned via dc electric field prior and during PDMS cure. The piezocomposites were then characterized by Berlincourt and power generation. Our findings show an increase in the electric output of the composite proportional to the used particle, presenting a maximum value for 30 %V/V, in good agreement with literature. These results strengthen the possibility of using piezocomposites as energy harvesters while stepping closer to its viable commercialization.

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"Capacitive Sensors Simulation for Additive Manufacturing"

Tomé Silva, Paula M. Vilarinho, Martinho Lima

Additive manufacturing of electronic components on plastic is meant to be study. Simulations of electric potential, electric field, and capacitance regarding different designs of capacitive sensors were made using COMSOL Multiphysics. Different designs will affect the electric properties to be study. Simulations are meant to prevent wastes of time and material, while making lab time and sensors obtained more efficient.

Secure Visible Light Communications based on Wavelength Division Multiplexing.

Gonçalo V. Figueiredo

Visible light communications (VLC) have become one of the promising future wireless communication technologies, mainly since they transmit a higher bit rate than more radio conventional communication systems. Considering that these systems consist of light-emitting diodes (LEDs) and, consequently, are energy efficient and have a low implementation cost, improving the transmission security in VLC is highly desirable. In this work, a secure visible light communications system based on Wavelength Division Multiplexing (WDM) has been proposed, enabling the transmission of multiple data streams from three LEDs with distinct wavelengths emitting simultaneously, where a hyperchaotic map will be applied to encode the generated symbols. The results show a three-dimensional constellation of symbols read by a smartphone, of the signals emitted by the three LEDs.

As future work, it is also proposed the development of a smartphone app that detects the signals emitted and decodes the encrypted symbols, enabling the implementation of secure link in indoor networks.

Cosmic discriminator for low activity real-time tritium detector

D. Prado, C. D. R. Azevedo, J.F.C.A. Veloso

Nuclear power plants produce tritium that is released in water. Tritium in high quantities is a concern for safety reasons in water intended for human consumption. In this regard, the E.U. Council Directive 2013/51/Euratom limits the activity for tritium in water to a value lower than 100

Bq/L. However, this low limit is just ensured with laboratory analysis which can take up to three days from sample collection until the result. As tritium in water can be used for pre-alert systems for anomalies in the power plant, a real-time tritium detector is a tool for problem mitigation.

The challenge imposed in tritium detection is mostly due to the low energy β particles emitted, and to the fact that most tritium is released in the form of titrated water. A passive lead shield is mandatory to achieve the required minimum activity due to environmental radiation background, but still insufficient to cope with the goal of 100Bq/L. With the passive shield, the Minimum Detectable Activity found is 5kBq/L, being limited by the cosmic background. Therefore, an active shield is being developed to lower the MDA to the required level by rejecting the cosmic background. The discriminator system consists of four scintillating plates surrounding the tritium detector whose signals are in anticoincidence with the prototype discriminator through a 200ns time window. These signals correspond to the cosmic background radiation and must be vetoed from the counts of the detector. The active discriminator is expected to lower the MDA to the legal limit established.

Poeiras de estrada em ambiente urbano: caracterização do risco para a saúde humana

Lara Almeida, Carla Candeias, Fernando Rocha

Com o crescente interesse pelas questões ambientais, a avaliação do impacte dos produtos geogénicos e antropogénicos na saúde humana tem cada vez maior importância. As poeiras de estrada, um caso particular da Geologia Médica, são compostas por partículas sólidas que se acumulam em materiais externos e impermeáveis, que não permanecem depositadas no mesmo lugar por um longo período de tempo. Este tipo de poeiras representa uma mistura heterogénea de materiais que inclui partículas de origem biogénica e minera. O presente estudo passa pela caracterização da componente geoquímica de poeiras de estrada colhidas na envolvente exterior de escolas públicas. A determinação da componente biodisponível de elementos selecionados permite calcular o potencial risco que estes materiais representam para a saúde humana. Os dados preliminares aqui apresentados servirão de base para um estudo mais completo a desenvolver.

The role of Vaccination on COVID-19 mortality and transmission

Ana Sofia Marralheiro Tedim, Vera Afreixo, Sofia J. Pinheiro, Tiago Pinho Bandeira, Regina Sá, Dr. Cristiana J. Silva

Vaccination has been used as a strategy to mitigate the effects of the COVID-19 pandemic. However, even if vaccinated, some individuals may become infected. Even so, vaccination has a positive impact by reducing the risk of severe diseases and mortality, thus decreasing the number of patients in intensive care units and the stress on the health care system. Furthermore, vaccination might also lead to a reduction in the number of secondary cases generated by vaccinated individuals. This work aims to study the effect of vaccination, considering the population of infected individuals on two outcomes: mortality and number of secondary cases generated by an infected individual. The comprehension of the real impact of vaccination is important to develop the best strategy to mitigate the pandemic and can guide prevention measures at local and regional levels.

An anonymized database with the infected individuals in the Aveiro region, collected by the local public health units, between the first day of vaccination in the region until the 24th of May 2021, was used. To determine the effect of vaccination in each of the outcomes, a regression model was adjusted to other demographic variables. Results show vaccination has a protective effect on both outcomes.

Finding SNPs associated with Alzheimer's Disease – Penalized Regression Models

Leonor Rodrigues, Vera Afreixo, Ana H. Tavares

Alzheimer's disease (AD) is a progressive neurologic disorder and the most common cause of dementia in the world. In Portugal 20 in every 1000 person is reported to have dementia, ranking 4th in Europe, and is estimated that 60 to 70% of those correspond to AD. AD is characterized by a continuous decline in thinking, behavior, and social skills and has a severe impact on life quality. The lack of available treatment for this disease makes its early-stage diagnosis vital to prevent AD progression. Single nucleotide polymorphisms (SNPs) are the most common type of genetic

variation among people and they correspond to the substitution of a single nucleotide at a specific position in the genome and detecting some combinations of SNPs can be used for AD diagnosis. Given this, the main goal of this work is to find a consistent method that identifies a correlation between some SNPs and AD in a structure with a huge number of potential predictor variables. A high-dimensional genomic data from Alzheimer's Disease Neuroimaging Initiative (ADNI) public database was used for this work. To achieve this, penalized regression methods (LASSO and Elastic-net) were applied in a combined way with methods based on Akaike's information criteria to evaluate the importance of potential predictors.

Solar driven photocatalysis as a way to eliminate antibiotics from aquaculture effluents

Valentina Silva, Carla Patrícia Silva, Marta Otero, Diana L. D. Lima

Aquaculture exploitation has been growing over the last 30 years, with an associated increase in the consumption of antibiotics, such as sulfadiazine (SDZ) and oxolinic acid (OXA). The inefficiency of aquaculture to remove these compounds from the effluent leave the environment at risk. The utilization of solar driven photocatalysis may be a solution to remove SDZ and OXA from effluents and materials such as titanium dioxide (TiO2) and carbon quantum dots (CQDs) may be interesting for this purpose. Therefore, composites of TiO2/CQDs were synthesized and tested as photocatalysts for SDZ and OXA photodegradation in different matrices (0.001 mol/L phosphate buffer (PB) and 30 g/L synthetic sea salts (SSS)). Furthermore, the effect of photocatalyst concentration on the photodegradation rate of SDZ and OXA were also studied. Results showed that 500 ppm of TiO2/CQDs obtained using citric acid (TiO2/CQDs-CA) 4% (w/w) and of CQDs using citric acid and urea calcinated (CQDs-CAUC) were the most efficient conditions for SDZ photodegradation in PB and in SSS, respectively. While 500 ppm and 1000 ppm of TiO2/CQDs-CA 4% (w/w) were the most efficient conditions for OXA photodegradation in PB and in SSS, respectively. Kinetics studies were also performed and showed the drastic decrease of the half time of SDZ and OXA photodegradation, from 9.76 h to 8.56 min for SDZ in PB, from 13.4 h to 13.6 min for SDZ in SSS, from 54.3 min to 4.74 min for OXA in PB and from 3.18 h to 38.3 min for OXA in SSS.