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fax [+ 351] 234 370 004

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PAULO JORGE FERREIRA
University of Aveiro

A WORD FROM THE RECTOR

Few times in our history have we faced such a complex situation as the one we are in today. Europe and the world are going through rapid and profound changes that make it increasingly difficult to anticipate the future. When facing challenges of unusual proportions, it is crucial to be resilient and creative and to focus our attention on opportunities and solutions. We must be prepared to act, react, and respond effectively to the unexpected.

In this context of unpredictability, the importance of innovation and creativity emerges clearly and enhances our ability to find solutions to complex problems. Creativity – so often associated with unpredictability – imagination and reasoning are essential in this process. They are tools that promote experimentation, reflection, and interpretation and as such they will play an important role in the difficult times ahead. It is essential to promote a reconciliation of artistic, intuitive and interpretive knowledge with scientific and technological knowledge, if we want to strengthen our ability to innovate and adapt to change.

ARTUR SILVA
University of Aveiro

MESSAGE FROM THE VICE-RECTOR

We have been living times of trouble, unprecedented in more than a century, without having a global conflict as the root-cause. There is no doubt about it, regardless of the perspective. The sheer number of people affected, all across the world, in an almost simultaneous way, no matter their sex, age, nationality, occupation, or income level, is there to prove it, even acknowledging some differences between specific cohorts.

In times of trouble, we tend to react, to adapt, and to resist. During a health-related crisis, we firstly turn to life- and health-related sciences, in search for understanding, and, foremost, for feasible and expedite solutions. Then, people may realize the need for engineering and other technological domains, enabling not only production, but also mass-production. Furthermore, when large-scale distribution is at stake, logistics and economics come into play; as does the provision of health-care and social-support structures, the role of public bodies, private instances and the civil society.

However, let us not forget that, during the current pandemic, the first and most decisive response relied mostly on individual and on social behaviour, to mitigate spread and to buy time for scientists and innovators. Behaviour bringing together past experiences, knowledge, communication, trust and mistrust, under a context of asymmetrical consequences of the decisions being taken.

Taking a step back, all that described above is still a rather short-term and utilitarian view of knowledge. For the current knowledge and technological capacities are the result of past research efforts, both curiosity-driven and problem solving oriented, from the observation of the planets, that enabled the development of a communication satellite networks, to the digging of the earth, enabling access to raw-materials. Moreover, the current social fabric is the result of evolution across time, with its own tensions, balances and imbalances.

The very same holds true for the arts, in their diverse forms and formats. Much more than reflecting a moment in time, which artistic creations eloquently do, arts intersect past, present and futures to be. Making use of human experiences, of limitations and opportunities, of new materials and tools, of looking back and looking ahead, of memories and dreams.

Some of the transformative effects of social distancing and social mediating technologies, across all domains, from working models to tourism, from education to research, from media to entertainment, from performative arts to culture access, are yet to be seen.

For sure, the current crisis put science on the limelight, moving beyond the knowledge itself into the interface between scientists and policy-makers, media and the public. Even 20 years into the XXI century, and in face of a more well-educated global population than ever, issues such as the comprehension of the research process, with its limitations and trial-and-error, science literacy, the understanding of uncertainty, critical thinking, media literacy, the boundaries between science and policy, and even science denial, are constantly raised. This goes further beyond the focus on science and innovation in themselves, highlighting the importance of excellent science communication, as a requisite for trust in science.

All together, these are issues at the very heart of a comprehensive university as our own University: creating new knowledge, fostering interdisciplinary bonds, providing an inclusive educative experience from undergraduates to learners of all ages – as the most effective impact multiplayer a University may have are its students – developing awareness and critical thinking, disseminating throughout society, embracing open discussions.

The sense of urgency under which we have been living for more than a year, triggered by immediate and dire consequences, and a global scale without safe spots, enabled response at a pace not seen before in other major challenges, and somewhat subdued competition.

Furthermore, not all troubles are the same and not all troubles, be they individual or collective, will primarily be addressed by science, technology, and innovation. The backlog is long, and not necessarily new: rising inequalities, human rights, war and conflicts, terrorism, the displaced population, amounting to a staggering 80 million fellow humans.

Times of troubles, whichever their nature, are times to think anew, to imagine futures, to challenge the status quo, and to decide which path to take. After the initial moment focused on response, more than on adaptation or prevention, the questions start to emerge. Should we quickly retrace on our footsteps to the comfort of the past, or venture into the unknown of the future? Which one of the possible futures should we choose, or better said, should we attempt to make? Which are the common aspirations and the divisive options? How to build a sense of belonging and direction?

Questions that concerns us all and that require our full commitment!

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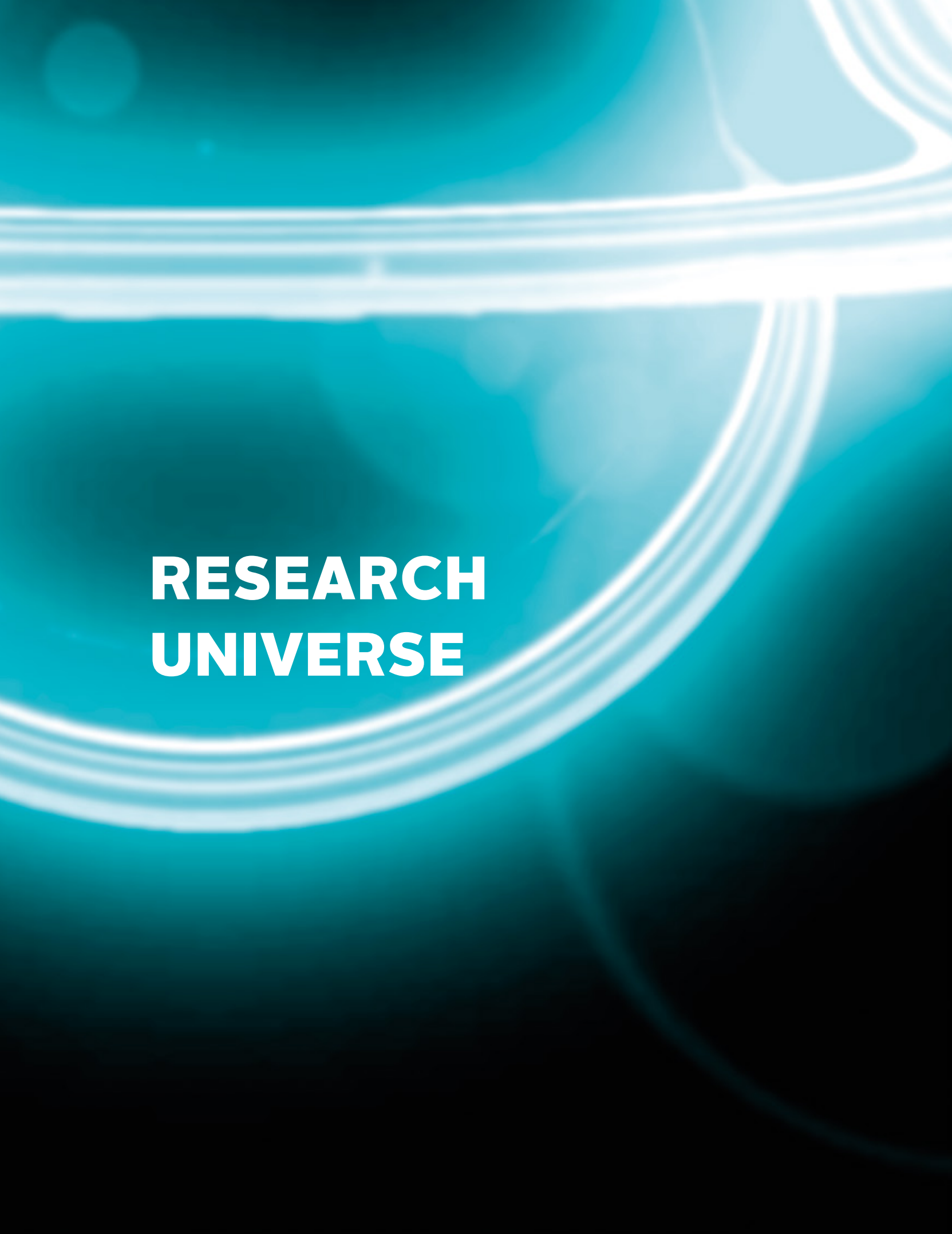

RESEARCH
UNIVERSE

Interdisciplinary research centres and facilities

The research matrix of the University of Aveiro is the basis of an interdisciplinary and transdisciplinary research, based on the sharing of experiences, the exchange of information, the improvement of practices and the promotion of joint projects among researchers from the different scientific areas at the campi. This integrated structure permits the articulation and harmonization of the teaching and research environments, as well as the association with innovative science outreach activities.

Furthermore, the continuous capacity-building effort in terms of infrastructure (buildings and scientific equipment) and lines of research, including human resources and people, has been essential to improve its competitiveness and thus ensure a better future and a greater and more effective contribution to regional development.

The University of Aveiro hosts 20 research units, from which 100% have been classified as very good or excellent in the last evaluation process promoted by the National Foundation for Science and Technology.

Research centres

CESAM
Centre for Environmental and Marine Studies

CESAM's interdisciplinary expertise on environmental and marine sciences enables an active contribution to science-based knowledge supporting socio-ecological systems sustainable management and smart specialization.

Unit coordinator: Ana Lillebø

Research areas: Atmospheric Processes and Modelling, Environment Processes and Pollutants, Functional Biodiversity, Ecotoxicology, Stress Biology, Adaptation Biology and Ecological Processes, Marine and Estuarine Ecology, Oceanography and Marine Geology, Coastal Zone Planning and Management

http://www.cesam.ua.pt

CLLC
Centre for Languages, Literatures and Cultures

The Centre for Languages, Literatures and Cultures, based in the Department of Languages and Cultures, is an intercultural research unit in the Humanities, with an inter and transdisciplinary orientation.

Unit coordinator: Anthony David Barker

Research areas: Between Texts – Literary Hermeneutics; Between Cultures – Cultural Hermeneutics; Between Languages – Variation, Translation, Learning.

http://www.ua.pt/cllc

CICECO
Aveiro Institute of Materials

CICECO's mission is to develop the scientific and technological knowledge necessary for the innovative production and transformation of materials for a sustainable development and the benefit of society (from ceramics to soft matter and hybrids).

Unit coordinator: João Rocha

Research areas: Inorganic Functional Nanomaterials and Organic-Inorganic Hybrids, Multifunctional Ferroic Ceramics and Nanostructures, Carbon Materials, Composites and Functional Coatings, Biorefineries, Biobased Materials and Recycling, Biomedical and Biomimetic Materials and Computer Simulation and Multiscale Modeling

http://www.ciceco.ua.pt

CIDMA
Center for Research and Development in Mathematics and Applications

CIDMA is a R&D unit hosted at DMat-UA with the main goal of carrying out fundamental and applied research in Mathematics and to prepare new researchers through postgraduate and advanced education.

Unit coordinator: Delfim Torres

Research areas: Algebra and Geometry, Complex and Hypercomplex Analysis, Functional Analysis and Applications, Gravitational Geometry and Dynamics, History of Mathematics and Mathematical Education, Optimization, Graph Theory and Combinatorics, Probability and Statistics, and Systems and Control

http://cidma.ua.pt

CIDTFF
Research Centre on Didactics and Technology in the Education of Trainers

Founded in 1994, CIDTFF has a mission anchored in the responsibility of research in education: to produce knowledge able to contribute to educated, qualified and critical citizens.

Unit coordinator: Maria Helena Araújo e Sá

Research areas: Education; Multiliteracies and Sustainability; Diversities and Curriculum; Professional and Human Development; Educational Policies, Quality and Evaluation; Multimodal Educational Resources; Professional and Organizational Practices.

http://www.ua.pt/cidtff

CINTESIS
Center for Health technology and Services Research

CINTESIS.UA is a multidisciplinary research unit mostly focused on Ageing Issues and Health Care Provision. It includes researchers from the Department of Education and Psychology and Health School.

Pole coordinator: Óscar Ribeiro

Research areas: Clinical & Health Services Research, Ageing & Neurosciences Research, Diagnosis, Disease & Therapeutics Research and Data & Methods Research

http://www.cintesis.eu

CIPES
Center for Research in Higher Education Policies

CIPES's mission is to engage in scholarly research in order to advance critical thought and promote informed understanding about the vital policy issues confronting higher education at both the national and international arenas.

Pole coordinator: Teresa Carvalho

Research areas: Higher Education, System Level Policies, Institutional and Organisational Analysis and Resources, Performance and Human Capital

http://www.ua.pt/cipes

DigiMedia
Digital Media and Interaction

Interdisciplinary research centre focused on media innovation and interaction design, working in three lines: Digital Studies, Digital Experience and Digital Contents.

Unit coordinator: Nelson Zagalo

Research areas:Media Technology, Media Arts and Communication

https://digimedia.web.ua.pt

GEOBIOTEC
GeoBioSciences, GeoTechnologies and GeoEngineering

Focusing on Geo-Resources/Geo-Environment, GeoBioTec works with the most important national mining projects, with skills and resources on industrial minerals, geostatistics, geochemistry, geophysics, mineralogy, medical geology and geomaterials.

Unit coordinator: Fernando Rocha

Research areas: Lithospheric Evolution, Complex Environmental Systems, Georessources, Geotechnics and Geomaterials

http://www.ua.pt/geo/PageText.aspx?id=17534

GOVCOPP
Governance, Competitiveness and Public Policies

GOVCOPP's mission is to produce research and knowledge that contribute to economic efficiency and good governance practices in specific territorial contexts, with a particular focus on the Centro region.

Unit coordinator: Anabela Botelho

Research areas: Competitiveness, Innovation, Sustainability, Public Policy, Institutions, Decision Support Systems, Territory, Development and Tourism

http://www.ua.pt/govcopp

IBIMED
Institute of Biomedicine

IBiMED´s mission is to improve life quality and reduce health care costs through advanced biomedical and clinical research focused on personalized medicine and biomarkers of healthy aging.

Unit coordinator: Manuel Santos

Research areas: Human ageing, protein aggregation, epigenome, ageing related diseases, systems biomedicine, clinical studies

http://www.ua.pt/ibimed

Research Institute for Design, Media and Culture [ID+]

ID+ is a multidisciplinary R&D Consortium that aims to develop, legitimise and communicate design and artistic research and practices in academic, social, cultural and economic contexts.

Pole coordinator: Vasco Branco

Research areas: Design, Art, Media and Culture

http://www.idmais.org

IEETA
Institute of Electronics and Informatics Engineering of Aveiro

IEETA is mainly a Computer Science and Engineering RU, with a strong multidisciplinary character, organized in three groups: Biomedical Informatics and Technologies; Intelligent Robotics and Systems; Information Systems and Processing.

Unit coordinator: Armando Pinho

Research area: Information Processing, Information Systems, Biomedical Informatics, Biomedical Tecnologies, Intelligent Robotics, Intelligent Systems

http://www.ieeta.pt

I3N – Institute for Nanostructures, Nanomodelling and Nanofabrication

I3N/Aveiro focus on micro & nanofabrication, green & clean energy, nanomaterials & functional interfaces, biomedical devices & systems & theoretical and computational studies.

Pole coordinator: Ricardo Dias

Research areas: Modelling of materials behaviour, Nanofabrication and micro-technologies and exploit of their multi-functionalities, Physical characterization of self-assembled nanostructures, Development of (opto)electronics and photonics devices and systems.

https://www.i3n.org/

IT
Instituto de Telecomunicações

Instituto de Telecomunicações (IT) is a research unit that is in the front line fostering (nurturing) new ideas and emerging technologies for increasingly agile and easy ways to access ubiquitous information.

Pole coordinator: José Carlos Pedro

Research areas: Wireless Technologies; Optics and Photonics; Networks and Services; Information and Data Sciences; and Basic Sciences and Enabling Technologies

http://www.it.pt

LAQV-REQUIMTE
Associated Laboratory for Green Chemistry

The vision of LAQV is for a world in which Sustainable Chemistry is used as a powerful and dynamic tool to tackle the societal, economic, and environmental challenges of modern life, contributing to a World Sustainable Development.

Pole coordinator: Francisco Amado

Research areas: Organic Chemistry, Natural Products, Food Science /Biochemistry and Mass Spectometry

https://laqv.requimte.pt/

RISCO
Aveiro Research Centre for Risks and Sustainability in Construction

RISCO aims to promote the development of sustainable and resilient cities through safe, environmentally friendly, efficient and durable construction solutions and through built heritage conservation.

Unit Coordinator: Romeu Vicente

Research areas: Mitigation of risks in the built environment; Resilient and sustainable built environment; Built heritage safeguarding, conservation and retrofit.

https://www.ua.pt/en/risco/

TEMA
Centre for Mechanical Technology and Automation

TEMA follows the natural evolution of the mechanical engineering for the future, developing research on two mobilizing domains: sustainable manufacturing solutions and technologies for the wellbeing.

Unit coordinator: António Bastos

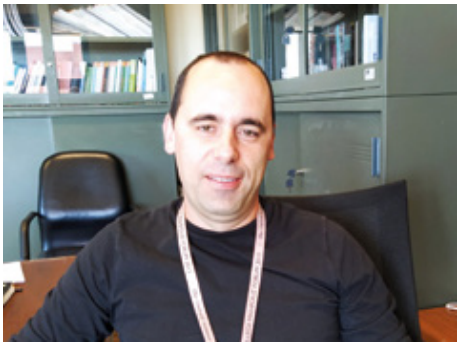
Research areas: Advanced Mechanical Engineering and Fracture Mechanics, Applied Energy, Biomechanics, Nanoengineering, Transportation Technology and Simulation Software Research and Development

https://www.ua.pt/tema

WJRC
William James Research Centre

The core mission of the WJCR is to advance research and training in psychology with a broad interdisciplinary approach, including neurosciences, social and cognitive psychology, psychobiology, psychometrics, and statistical modeling.

Pole coordinator: Marco Vasconcelos



Research areas: Cognition, Social Cognition and body odors, Health, Social development

https://williamjamescr.org/

INET-Md
Institute of Ethnomusicology – Research Centre on Music and Dance

INET-md carries out transdisciplinary research on music and dance, using current perspectives from a broadening spectrum of musical, sound, and dance disciplinary fields, as tools both for fundamental research and for developing actions of social responsibility.

Pole coordinator: Susana Sardo

Research groups: Ethnomusicology and Popular Music Studies; Historical and Cultural Studies in Music; Dance Studies; Creation, Performance and Artistic Research; Education and Music in Community; Musical Acoustics and Sound Studies

http://www.inetmd.pt

Strategic projects

Amniogel – Extracellular matrix derived products from human placenta to engineer bone microtissues for in vitro disease models

18 months; € 150K

The research team led by João F. Mano, full professor from the Department of Chemistry, and researcher at CICECO – Aveiro Institute of Materials, has been awarded for the second time with a Proof of Concept grant by the European Research Council (ERC-PoC). This grant, created to support ideas with commercial potential capable of achieving economic or social benefits will provide the team with 150,000 euros to develop the AMNIOGEL project during 18 months.

Based on the knowledge that resulted from the ERC Advanced Grant (ERC-AdG) ATLAS, the goal of this project is to develop highly personalized osteosarcoma microtissues for in vitro disease modelling and drug screening. Osteosarcoma is a rare but devastating bone tumor very resistant to therapy, that mainly affects children, adolescents and elderly.

In AMNIOGEL the research team will use proteins obtained from perinatal tissues, namely the amniotic membrane, that is normally discarded after childbirth. The proteins are used to prepare fully human based biomaterials that will support cell culture and mimic the tumor microenvironment. The human based nature of the biomaterials proposed in AMNIOGEL will improve the predictive value of the effect of anticancer drugs, accelerating new therapies development. AMNIOGEL will address current challenges in 3D cell culture with human protein based products as substrates that do not require extra functionalization steps that can be time consuming and costly, are mechanically tuneable and do not carry associated animal contamination issues and ethical concerns being also versatile and easy to manipulate.

The project could have a considerable impact, as the proposed innovative products for cell culture have the capacity to replace animal testing, accelerating drug screening and reducing associated costs.

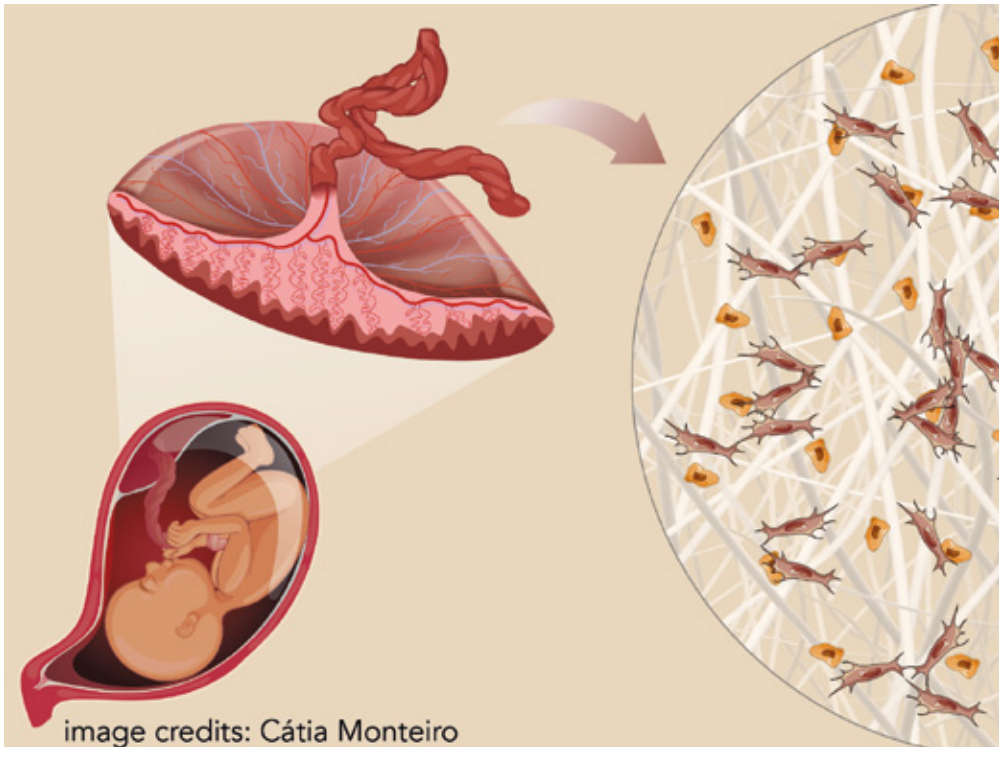


image credits: Cátia Monteiro

This project has received funding from the European Union Horizon 2020 – ERC, under grant agreement ID: 957585

More information
https://cordis.europa.eu/project/id/957585

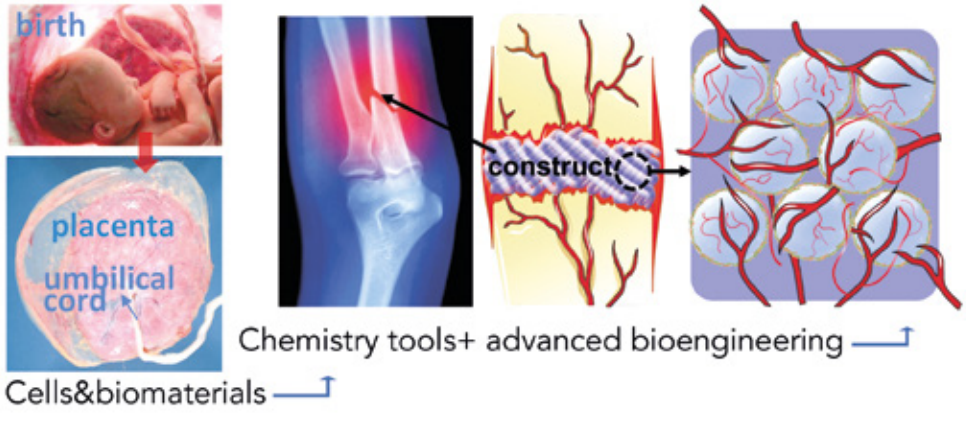
REBORN: Full human-based multi-scale constructs with jammed regenerative pockets for bone engineering.
60 months; € 2.5M

Advanced Grants from the European Research Council (ERC-AdG) are awarded after the application in extremely competitive calls, in which the unique evaluation criterion is the scientific excellence. The assessment includes the analysis of the scientific track record of the researcher, which must be at the top level of researchers working in Europe, as well as the quality of the project to be carried out, its degree of risk and the radically innovative approach adopted in the proposed work programme.

João F. Mano, full professor from the Department of Chemistry, and researcher at CICECO – Aveiro Institute of Materials, has been awarded, for the second time in a row, with such a prestigious grant.

The ERC-AdG grant will allow, for 5 years, to develop cutting-edge work in the field of bioengineering of human tissues and advanced biomaterials, namely in the creation of strategies for the regeneration of bone tissue, which may have a clinical impact in cases of massive loss or extensive bone fractures. One of the innovations of the project is the use of proteins obtained from tissues collected during childbirth, normally disposable, namely the amniotic membrane and the umbilical cord. These will serve as a basis for the construction of highly hierarchical devices, from the nano-scale to the macro-scale, with a high capacity to generate mineralized bone tissue and promote its vascularization. From these perinatal tissues it will be also possible to collect and use cells that will play a fundamental role in the construction of tissues in vitro. The cells will be encapsulated into small artificial "placentas" that will provide appropriate biochemical and mechanical signals and will promote the formation of functional micro-tissues in a completely autonomous manner. The agglomeration of these "regenerative pockets" in a controlled spatial way will allow the development of three-dimensional tissues at the scale-length of real bone defects, with high geometric precision.

In addition to direct therapeutic applications involving implantation, these innovative devices may also serve as models of diseases with dimensions and specifications similar to those of real tissues, in order to test new drugs and therapies; those can be seen as an alternative solution to animal tests or clinical trials.



This project has received funding from the European Union Horizon 2020 - ERC, under grant agreement ID: 883370

More information
https://cordis.europa.eu/project/id/883370

EpiViral – Viruses and Epitranscriptomics: seeking novel targets for antiviral therapy

36 months; € 878K

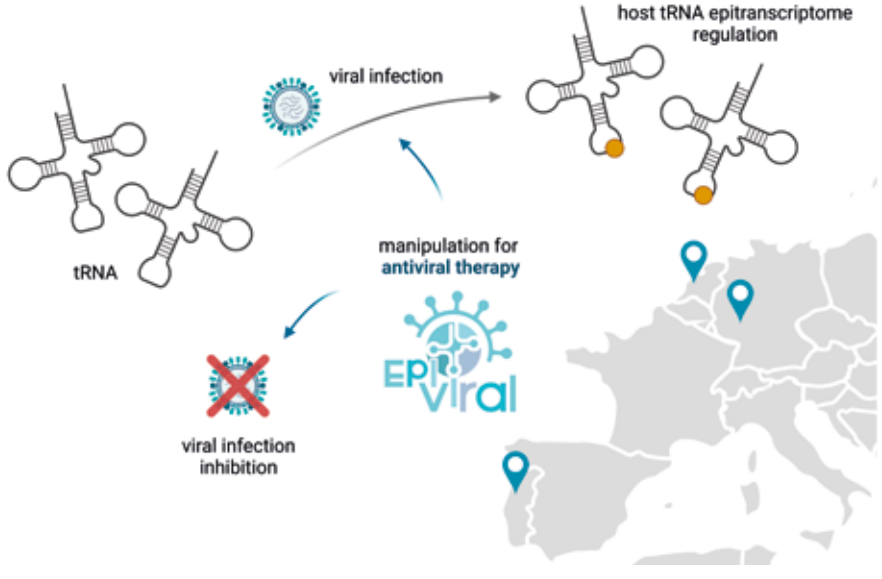
EpiViral is a Coordination and Support Action (CSA) – Twinning – from the H2020 program, aiming at intensifying, increasing and consolidating the scientific research on Virology and RNA-modification biology (epitranscriptomics) at the Institute of Biomedicine, University of Aveiro (iBiMED-UAVR), by partnering with two leading institutions in these research fields, namely the Leiden University Medical School (LUMC) and the Goethe University Frankfurt (GUF).

Viral infections are one of the most prominent and persistent threats to human health, resulting in high mortality rates and tremendous impact on the economy. The frequent mutations and common emergence of new viral species undermines a large part of the existing therapeutics, which are mainly directed at specific viruses or strains, and emphasizes the importance of the discovery of novel broad-spectrum antiviral combat strategies. The EpiViral consortium believes that the basis for such therapeutics may be unraveled by investigating common mechanisms shared by different viruses, e.g. as part of their life cycle or interaction with their host cells. More specifically, EpiViral is committed to study how the host epitranscriptome, in particular the tRNA epitranscriptome, is regulated upon infection and how it can eventually be manipulated for antiviral therapy.

As viruses are completely dependent on the host-cell translation machinery to translate their own genomes, they have to efficiently hijack host tRNAs, which are the effector molecules of translation. However, host tRNA pools are optimized to efficiently recognize and translate host mRNAs and not viral mRNAs. The EpiViral consortium hypothesizes that, upon infection, viruses reprogram host tRNA modification patterns to facilitate viral mRNA translation. The EpiViral consortium aims at enabling a series of state-of-the-art studies to further understand virus- and host-mediated tRNA epitranscriptomic changes and its regulation during infection, as well as to evaluate the host epitranscriptome as a new therapeutic target against viral infections.

EpiViral will coordinate and promote networking activities between all the partners, knowledge dissemination and transnational access of iBiMED-UAVR researchers to state-of-the art infrastructures available at LUMC and GUF.

EpiViral will be pivotal to place iBiMED-UAVR at the forefront of state-of-the-art research on the interface of virology and epitranscriptomics.



This project has received funding from the European Union Horizon 2020, under grant agreement ID: 952373

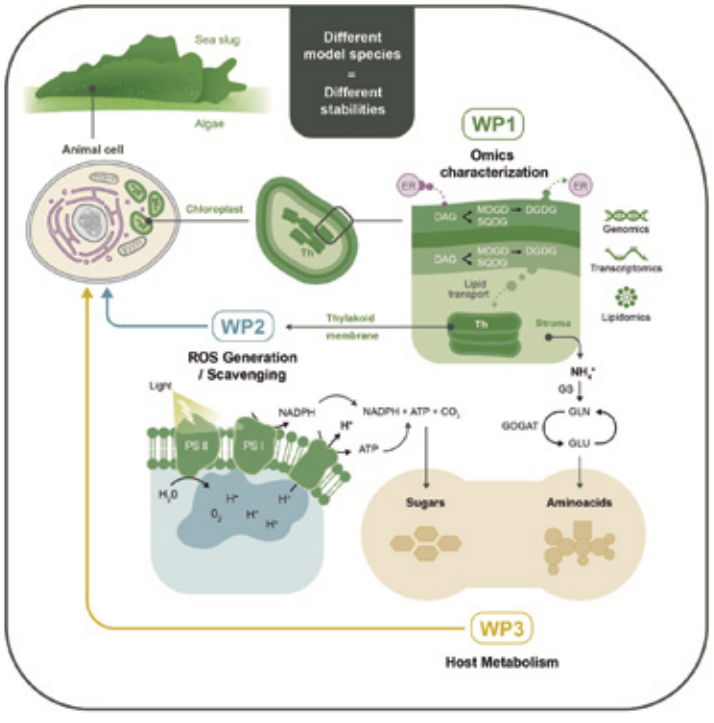
More information
https://cordis.europa.eu/project/id/952373
www.epiviral.eu

KleptoSlug – Kleptoplasty:
The sea slug that got away with stolen chloroplasts
60 months; € 2.2M

KleptoSlug is an European Research Council (ERC) funded project to resolve some of the long-standing questions regarding the maintenance of photosynthetically active chloroplasts in animal cells and produce crucial insights about long-term kleptoplasty in sacoglossan sea slugs.

Photosynthesis is almost exclusively restricted to algae and plants, with the exception of some protozoans, flatworms and marine slugs that acquire chloroplasts from algae. In metazoans, the capacity to incorporate functional chloroplasts (kleptoplasty) for long periods of time has only been described in sacoglossan sea slugs. Some species retain kleptoplasts photosynthetically active for several months that persist without access to algal gene products and despite the release of potentially dangerous metabolites, including reactive oxygen species. While kleptoplasty is intriguing from an evolutionary perspective, there are many unresolved questions on how the algal organelle is incorporated into the metabolism of an animal cell and what the host-associated benefits are.

This proposal aims at unravelling the cellular mechanisms supporting the sequestration and maintenance of functional chloroplasts inside metazoan cells and determining the host benefits of harboring kleptoplasts. The project will compare a wide range of different animal-alga associations in their response to chloroplast incorporation and variable ability to functionally maintain them. Lipidomic and transcriptomic analyses will unravel in a comparative approach the species-specific maintenance strategies underlying kleptoplasty. In addition, the impact of cytotoxic compounds produced by active kleptoplasts, in particular the reactive oxygen species accumulated due to photosynthesis and respective scavenging, will be explore. Finally, the project will determine the fate of inorganic carbon and nitrogen in the animal metabolism to explore the contribution of photosynthesis-derived compounds to the physiology of the host. New equipment, such as gas chromatography combustion isotope ratio mass spectrometry (GC-IRMS), will be implemented at the University of Aveiro/CESAM for highly specialised analysis of the relative ratio of light stable isotopes of carbon (13C/12C) and nitrogen (15N/14N) in individual compounds.



KleptoSlug summary. Five model species with variable capacities for retention of functional chloroplasts will be used to address in a comparative and in depth approach the main molecular interactions between host and kleptoplasts. The project comprises 3 workpackages: The perfect match – Unravel sacoglossan mechanisms to maintain functional chloroplasts (WP1); Living with the enemy – Linking reactive oxygen species (ROS) to kleptoplastidic abilities (WP2); and Stashing the loot – Determining the benefits of kleptoplasty (WP3).

This project has received funding from the European Union Horizon 2020 -ERC, under grant agreement ID: 949880

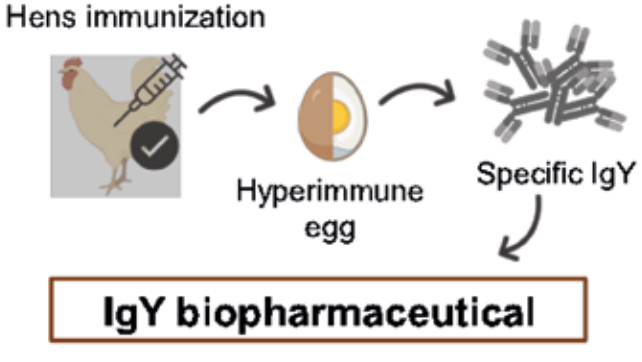
More information
https://cordis.europa.eu/project/id/949880
http://www.cesam.ua.pt/index.php?menu=&language=pt&tabela=projectos detail&projectid=1681

PureIgY-Towards the use of IgY antibodies as alternative therapeutics

18 months; € 150K

Thanks to European Research Council (ERC) with the funding scheme of ERC-POC-LS, activities developed by researchers already awarded with a previous ERC grant can be supported to address their commercial and societal potential. Based on the knowledge acquired and technology developed during the ERC Starting Grant IgYPurTech, Dr. Mara G. Freire and her team, from CICECO-Aveiro Institute of Materials and the Department of Chemistry of University of Aveiro, have been working in the scope of the ERC-PoC PureIgY to apply immunoglobulin Y (IgY) antibodies as alternative therapeutics to tackle the antimicrobial resistance (AMR) scenario. Despite the wide therapeutic applications of IgY antibodies, the research team is dedicated on using the developed innovative IgY purification platform to create therapies for antimicrobial-resistant pathogens since they are an economic and societal challenge of high priority. AMR is responsible for 33,000 deaths per year, bringing €1.5 billion per year in healthcare costs and productivity losses to the EU. Novel alternatives to antibiotics are highly expensive or are in a very early-stage of development. Therefore, low-cost and relatively low time-to-market alternative therapeutics must be pursued.

IgY, present in hen's egg yolk, is a potential alternative to antibiotics that can be obtained by a non-invasive method at high amounts from a renewable matrix. However, given the complex nature of egg yolk, the current purification technologies are multi-step and mainly based on chromatography, which are highly expensive and lead to low yields. Within the IgYPurTech framework an innovative and cost-effective platform to purify IgY was developed, enabling the production of high-quality IgY in higher amounts and significantly lower cost than other currently commercialized biotherapeutics. In the PureIgY PoC Action it is aimed to scale-up the developed purification technology, to address the biological features of specific IgY from hyperimmnune eggs to tackle the AMR critical scenario, to work on the business plan development and business development, and to create an early-stage drug development start-up (RYAPURTECH, created in March 2020).



This project has received funding from the European Union Horizon 2020 – ERC, under grant agreement ID: 899921

More information
https://cordis.europa.eu/project/id/899921

SMART-ER – The ECIU University Research Institute for Smart European Regions

36 months; € 1,99M; 12 Partners

The ECIU University Research Institute for Smart European Regions (SMART-ER) is a research, innovation and education strong alliance, enabling all 12 member universities to jointly address complex societal challenges under the framework of the UN SDG11 (Make cities inclusive, safe, resilient and sustainable), identified by the ECIU University.

Along 36 months, SMART-ER will design, develop and implement research, value-capture and deliver solutions to current and future UN SDG11 challenges. Activities will be implemented by bringing together scientific and management research capacities at the member institutions in a challenge-based approach.

Together with diverse stakeholder groups at a local, national and international level, SMART-ER will work according to a shared Research and Innovation Agenda. Jointly, the institutions will pilot capacity building programmes (Seed Programme and SMART-ER Academy) and citizen science initiatives that will be used as a testbed to put into practice all the mechanisms and structures built.

Strategic SMART-ER initiatives

- Develop a common research and innovation agenda and convergence action plan, sharing infrastructures and resources, in synergy with education strategies and regional engagement.
- Develop and implement strategies for strengthening human capital and collaborations in research and innovation.
- Embed citizens and society, involving and engaging citizens, civil society and authorities in research and innovation.

The SMART-ER Research Institute will implement a new research and innovation model without walls while promoting the dialogue with society, overcoming the limitations of disciplines, sectors and countries, based on a virtual collaborative environment.

https://cordis.europa.eu/project/id/101016888

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101016888

research institute for smart European regions
ECIU SMART-ER university


4

SPOTLIGHT ON RESEARCH DISSEMINATION

Research Summit 2020

The 3rd edition of the Research Summit was an important forum of discussion on the theme of *Sea* and *Sustainability*, attended globally by over 800 people during these 3 days. Though online, it brought the research community together!

The Rector, Paulo Jorge Ferreira, and the *Vice-rector for Research, Innovation and 3rd Cycle, Artur Silva*, opened the summit on Wednesday and were followed by the intervention of the *Minister of Maritime Affairs, Ricardo Serrão Santos*, with an interesting perspective on the efforts of Portugal to help the research community in the area of maritime affairs. The *NRP Sagres Comandante Maurício Murilo* allowed the audience to discover more about Sagres, with his presentation entitled "NRP SAGRES, 58 years showing the Portuguese Flag around the World". With the support of the American Corner of UA and the US Embassy, *William Gerwick*, University of California, San Diego, provided the audience with a deep insight on the work developed at his laboratory. Of high interest to UA community was the participation *of Annapaola Migani*, from Elsevier, whose presented us with an example of application for the recently acquired SciVal – "Mapping the University of Aveiro Research in the" Life below Water "Sustainable Development Goal".

One of the main goals of Research summit is to foster the inter-and transdisciplinary work among UA researchers, which was materialized with 16 presentations by Research Units, after which naturally contacts among researchers with mutual interests established. Day 2 and 3 was highly attended, with over 800 intervenients, along the 7 simultaneous rooms each day, with 48 doctoral programmes, 641 PhD students and 160 professors involved in the jury, as all pitches were evaluated by a jury.

Very relevant to point out in this Research Summit was the participation of 1st and 2nd Cycle students, under the scope of the PIIC-UA (Scientific Research Incentive Program). 78 students pitched the activities developed under this initiative to promote their enrolment in science during the 1st and 2nd cycle of training.


5

RESEARCH HIGHLIGHTS

Simulated solar radiation under continuous flow mode as a way to rapidly decrease the input of antibiotics into the aquatic environment

Carla Patrícia Silva[1], Cindy Oliveira[1], Ana Ribeiro[2], Nádia Osório[2], Marta Otero[3], Valdemar I. Esteves[1], Diana L.D. Lima[1]

1 – Department of Chemistry & CESAM, University of Aveiro
2 – Instituto Politécnico de Coimbra, ESTeSC-Coimbra Health School
3 – Department of Environment and Planning & CESAM, University of Aveiro

Antibiotics are amongst the most used drugs, undeniably playing a critical role in health and life expectancy. However, they also pose a potential threat due to the induction of antimicrobial resistance. This fact requires an urgent multisectoral action including to achieve the United Nations Sustainable Development Goals (SDGs). Their presence in the environment, due to the discharge of effluents of different origins, is of great concern and photodegradation appears as an alternative and sustainable process for their removal. This is the basis of the REM-AQUA Project – Photosensitized degradation as a remediation process for the removal of pharmaceuticals from aquaculture effluents (PTDC/ASP-PES/29021/2017). Regarding an industrial application of the photodegradation under solar radiation, it is important that the process runs continuously. Flow photochemistry in a microreactor has many advantages in comparison to batch systems, like large surface area-to-volume ratio, uniform irradiation and rapid photon transfer.

Therefore, the assessment of the photodegradation of an antibiotic (sulfamethoxazole, SMX) was performed, using simulated solar irradiation in continuous flow mode (Fig. 1a). Obtained results showed that, compared with batch operation, the irradiation time needed to reach SMX half-life time was sharply decreased from 7.54 h to 1.5 h. Moreover, the interrelation between SMX removal, mineralization and antibacterial activity was evaluated. Although mineralization was slower than SMX removal, bacterial activity increased after SMX photodegradation. Such an increase was also verified in environmental waters. Thus, this study has proven that photodegradation is an efficient and sustainable process for both the remediation of waters contaminated with antibiotics and minimization of bacterial resistance.

Next steps of the REM-AQUA Project rely on the use of a small-scale reactor for the photodegradation of antibiotics by using natural sunlight (Fig. 1b).

Link to this article
https://doi.org/10.1016/j.chemosphere.2019.124613

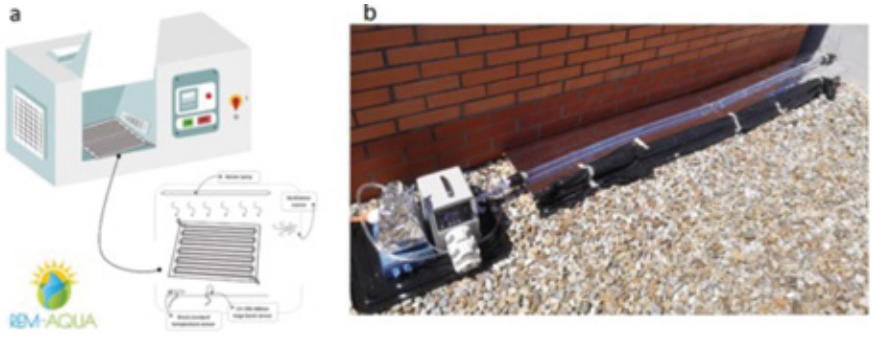


FIGURE 1
Experiments within REM-AQUA Project: (a) Scheme of the apparatus used to study SMX photodegradation in continuous flow mode under simulated solar radiation; (b) Small-scale reactor for photodegradation under natural sunlight.

Wetland and waterbird conservation take centre stage

José A. Alves[1], Maria P. Dias[2]

The United Nations decade on Biodiversity under the theme *Living in Harmony with Nature* should have culminated in 2020 with "*a crunch year for the biodiversity and climate emergencies*". Instead, the UN's Convention on Biological Diversity reported that year that none of the 20 Aichi Biodiversity targets from the Strategic Plan for Biodiversity 2011-2020 had been achieved, although six were reported to have been partially achieved. At the beginning of that same year, when Lisbon celebrated its status as European Green Capital, the Portuguese environmental authority issued a favourable license for the location of the new Lisbon airport in a peninsula at the heart of the Tagus estuary, the largest wetland in the country, holding the highest national concentrations of migratory waterbirds using the East Atlantic Flyway.

In a letter published in Science, we made a plea for the conservation of habitats and biodiversity in the most important Portuguese wetland for birds. The issuing of a favourable environmental license for the construction of a new international airport in the Tagus estuary, and despite imposing conditions, is clearly at odds with current national and international sustainability and conservation objectives, as outlined by the National Strategy for Nature Conservation and Biodiversity, the European Green Deal and the United Nations' 2030 Agenda for Sustainable Development. More recently, together with other researchers we argued that the COVID-19 pandemic, which brought global aviation to a halt, could serve as an invaluable opportunity to reassess mobility and to properly evaluate the need for new infrastructure, in order to better align future development with biodiversity and climate targets. Threatening protected areas with infrastructures that impact the natural environment well beyond its physical location, will further limit our capacity to reverse biodiversity declines, a global target that we are currently and very dramatically failing to achieve.

1 – Department of Biology & CESAM, University of Aveiro
2 – Birdlife International

FIGURE 1
Flock of thousands of black-tailed godwit that use the Tagus estuary to refuel on their migratory journeys between Africa and the breeding areas at northern latitudes.
Limosa limosa flock by Verónica Méndez Aragón.

On the art of stealing chloroplasts

Paulo Cartaxana[1], Felisa Rey[2], Ricardo Calado[1], Rosário Domingues[2], Sónia Cruz[1]

1 – Department of Biology & CESAM, University of Aveiro
2 – Department of Chemistry & CESAM, University of Aveiro

It is a common perception that animal cells do not have chloroplasts, the organelles responsible for photosynthesis. Yet, a small number of sea slugs from the order Sacoglossa are able to perform photosynthesis using chloroplasts sequestered from the macroalgae they feed upon, which are integrated in their cells (hence termed kleptoplasts). These photosynthetic sea slugs have been frequently termed 'crawling leaves' or 'solar-powered' sea slugs (Cruz et al. 2013). We have shown that photosynthesis plays an important role in sea slug survival and fitness over periods of food scarcity (Cartaxana et al. 2017) and that these animals possess photoprotective mechanisms that can mitigate oxidative stress resulting from the uptake of algal chloroplasts (Cruz et al. 2015, Cartaxana et al. 2019). Advanced lipidomic tools have allowed us to infer the relevance of lipids in long-term functional kleptoplasty (Rey et al. 2020), while state-of-the-art imaging techniques demonstrated translocation of photosynthates from kleptoplasts in the sea slug's digestive gland to other tissues in its body (Cruz et al. 2020). Recently, the European Research Council funded in 2.25 million euros the project KleptoSlug, developed to continue the studies on this remarkable association between a metazoan and an algal-derived organelle. This project will enable us to unravel the cellular mechanisms supporting the sequestration and maintenance of functional chloroplasts inside animal cells, as well as to comprehend the role(s) of photosynthesis in sea slugs.

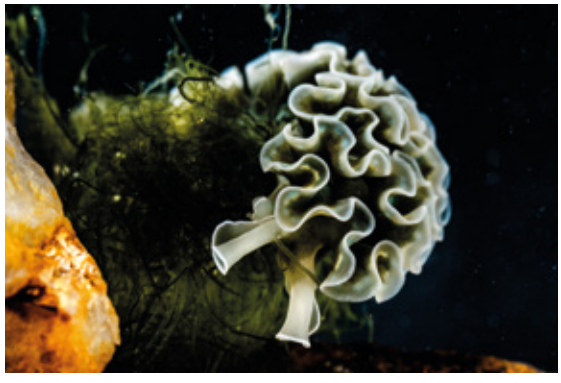


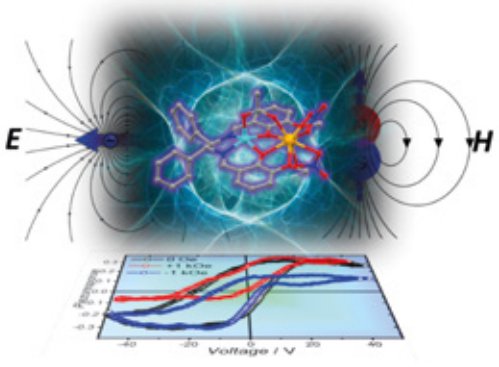
FIGURE 1
Photosynthetic Sacoglossa sea slugs:
Elysia viridis;
Elysia crispata.

Room temperature magnetoelectric coupling in a molecular ferroelectric ytterbium(III) complex

Jérôme Long[1], Maxim S. Ivanov[2], Vladimir A. Khomchenko[2], Ekaterina Mamontova[1], Jean-Marc Thibaud[1], Jérôme Rouquette[1], Mickaël Beaudhuin[1], Dominique Granier[1], Rute A. S. Ferreira[3], Luís D. Carlos[3], Bruno Donnadieu[4], Marta S. C. Henriques[2], José António Paixão[2], Yannick Guari[1], Joulia Larionova[1]

Magneto-electrical (ME) materials combine magnetic and electric polarizabilities in the same phase. Such systems offer a basis for developing high-density data storage, spintronic or low consumption devices owing to the possibility to trigger one property by the other. Such objectives require a strong interaction between the constitutive properties, a criteria which is rarely met in classical inorganic ME materials at room temperature. We have demonstrated room temperature magnetoelectric control of ferroelectric domains in a molecule-based material [1], Fig. 1. Thus, in the Yb^{3+}-based chiral compound R,R-1, the combination of ferroelectric behavior with a magnetostrictive effect generates a strong ME coupling observed at room temperature and with a relatively low magnetic field. These properties are useful for practical device application including non-volatile memory where information would be stored as electrically detectable and controllable by Yb^{3+} paramagnetism. More generally, such features appear particularly unique in single-phase materials and confirm that the genuine chemical design of multifunctional molecular materials may provide an alternative strategy to usual solid-state compounds for engineering ME devices.

[1] Long et al., Science 367, 671–676 (2020) 7. 10.1126/science.aaz2795



1 – Institut Charles Gerhardt Montpellier, UMR 5253, Université de Montpellier, ENSCM, CNRS, France.
2 – University of Coimbra.
3 – Department of Physics & CICECO, University of Aveiro.
4 – Fédération de Recherche Chimie Balard–FR3105, Université de Montpellier, France.

FIGURE 1
Molecular structure of the dinuclear Zn^{2+}-Yb^{3+} complex [1] in the presence of an applied electrical (E) and magnetic (H) fields. (bottom) Switching spectroscopy force microscopy (SS-PFM) hysteresis loops obtained at zero and under applied magnetic field of ±1 kOe.

Layered Coordination Polymer with Remarkable Proton Conductivity

Ricardo F. Mendes,[1] Paula Barbosa,[2] Eddy M. Domingues,[2] Patrícia Silva,[1] Filipe Figueiredo,[2] Filipe A. Almeida Paz[1]

1 – Department of Chemistry, CICECO – University of Aveiro
2 – Department of Materials & Ceramic Engineering, CICECO – University of Aveiro

As energy consumption and demand increases new alternative energy technologies are required. In recent years, new materials with improved proton conduction have been investigated for the incorporation into Fuel Cells. The structural and chemical nature of Metal-Organic Frameworks (MOFs) and Coordination Polymers (CPs) are expected to boost their proton conductivity, ultimately supported by the ability to tailor pores or channels with specific conductive species such as water or ions. To this end, we investigated the effect of a whole structural modification of a CP on its proton conductivity. $[Gd(H_4nmp)(H_2O)_2]Cl{\cdot}2H_2O$, a charged layered material counter-balanced by chloride anions, suffers a structural transformation at high humidity and temperatures into $[Gd_2(H_3nmp)_2]{\cdot}xH_2O$ (**2**) (x = 1 to 4) (see Fig. 1). This modification is accompanied by the exchange of chloride ions with water leading to a significant increase in conductivity, from 1.23 x 10^{-5} $S{\cdot}cm^{-1}$ to 0.51 $S{\cdot}cm^{-1}$, being to date one of the highest values ever reported for proton conducting CPs. While this conductivity is only observed after the structural transformation, this constitutes a remarkable "proof of concept" to explore in the future other types of transformation to further improve the conductivity of these hybrid materials.

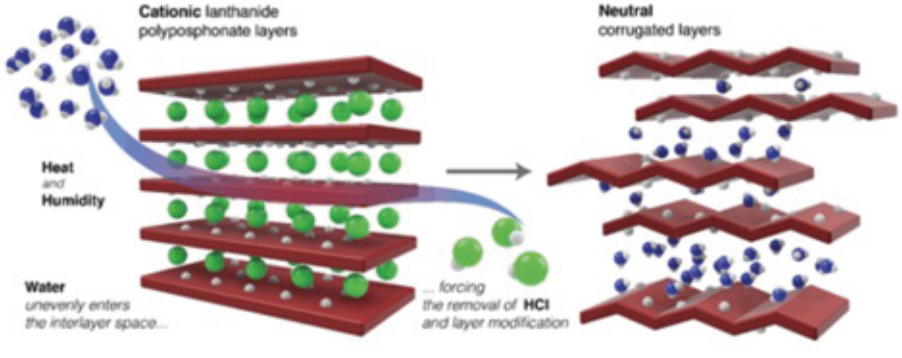


FIGURE 1
Schematic representation of the structural transformation of $[Gd(H_4nmp)(H_2O)_2]Cl{\cdot}2H_2O$ (*left*) into $[Gd_2(H_3nmp)_2]{\cdot}xH_2O$ (*right*) (x = <1 to 4) at high temperatures and humidity. The figure emphasizes the exchange of the Cl^- anion (released as hydrochloric acid) with water molecules.

Reference
Enhanced Proton Conductivity in Layered Coordination Polymers
Ricardo F. Mendes, Paula Barbosa, Eddy M. Domingues, Patrícia Silva, Filipe Figueiredo, Filipe A. Almeida Paz
Chemical Sciences, 2020, Volume 11, Pages 6305-6311
http://dx.doi.org/10.1039/D0SC01762K

Environmental behaviour and ecotoxicity of cationic surfactants towards marine organisms

Olga Kaczerewska[1], Roberto Martins[2], Joana Figueiredo[2], Susana Loureiro[2], João Tedim[1]

Cationic surfactants are surface-active compounds. These chemicals can be found in many products, including household and cleaning agents. Therefore, they tend to be discarded into water streams, ultimately ending up in freshwater and marine ecosystem. Despite this environmental issue, studies describing their effects towards marine species are still lacking. Data in literature reports ecotoxicity information mostly for freshwater species, leaving a gap of knowledge on their effects on marine ones. Nevertheless, the available toxicity data in freshwater shows that gemini surfactants are less toxic than their monomeric counterparts.

An assessment on the ecotoxicity and behaviour in seawater of two commercial monomeric surfactants (*N*-cetyl-*N,N,N*-trimethylammonium bromide – **CTAB**, and *N*-dodecyl-*N,N,N*-trimethylammonium chloride – **DTAC**), and three novel gemini surfactants (1,4-bis-[*N*-(1-dodecyl)-*N,N*-dimethylammoniummethyl]benzene dibromide – **QSB2-12**, 3-oxa-1,5-pentamethylene-bis(*N*-dodecyl-*N,N*-dimethylammonium) dichloride – **12-O-12**, and 3-oxa-1,5-tetramethylene-bis(*N*-dodecyl-*N*-hydroxyethyl-*N*methylammonium) dichloride – **MOH-12**) was firstly reported in this article (**Fig. 1**).

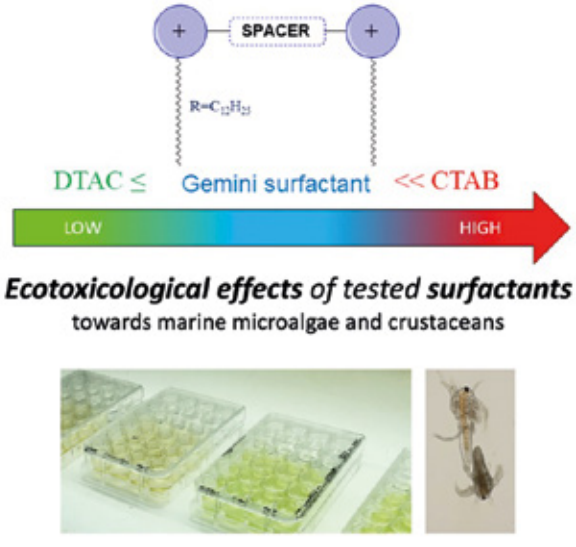
The surfactants were tested to evaluate their exposure effects on four marine species, the green microalgae *Nannochloropsis gaditana* and *Tetraselmis chuii*, the diatom *Phaeodactylum tricornutum,* and the crustacean *Artemia salina*. Furthermore, biodegradation and size distribution of the surfactants in artificial seawater were also studied by UV-Vis spectrophotometry and dynamic light scattering, respectively.

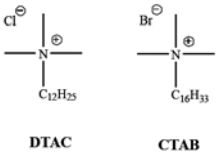
Ecotoxicity tests revealed that CTAB is toxic to all tested marine species while DTAC and QSB2-12 showed the lowest toxicity among the tested cationic surfactants (**Fig. 2**). Besides the novel insights regarding the effects caused by these five cationic surfactants, this work opens prospects for the replacement of commercially available surfactants by more environmentally friendly alternatives.

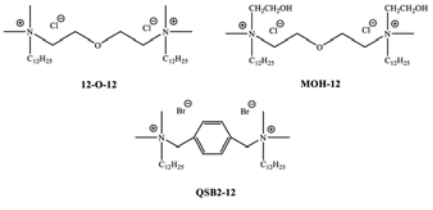
1 – Department of Materials and Ceramic Engineering & CICECO, University of Aveiro
2 – Department of Biology & CESAM, University of Aveiro

FIGURE 1
Structure of the tested cationic surfactants.

FIGURE 2
Graphical representation of the main findings and tested organisms.







Hypertopes

Maria Elisa Fernandes[1], Dimitri Leemans [2], Asia Ivić Weiss[3]

1 – Department of Mathematics & CIDMA, University of Aveiro
2 – Université Libre de Bruxelles
3 – York University of Toronto

In 2014, during a research visit to the Auckland University in New Zealand, Fernandes, Leemans and Ivić Weiss created the concept of a hypertope which generalizes the concept of a polytope while retaining its combinatorial structure.

The heart of the theory of (abstract) polytopes is its correspondence with groups. Abstract polytopes can be built from quotients of Coxeter groups with linear diagrams. The ideia was to consider other geometric structures covering all other Coxeter groups. The natural way to do this was to consider thin residually connected incidence geometries, which became known as *hypertopes*.

Hypertopes is a result of a joint work of researchers from three universities, Maria Elisa Fernandes from the University of Aveiro, Asia Ivić Weiss from the York University of Toronto and Dimitri Leemans from the Auckland University in New Zealand, and presently from Université Libre de Bruxelles.

The first publication on this subject, *Highly Symmetric Hypertopes*, was in 2016. While abstract polytopes had been thoroughly studied and much data is available in the literature, of course, very little is known about their extensions, the hypertopes. A lot of open problems emerged sparking the interest of other researchers. Since 2016 various authors decided to study this structures showing that this became an attractive line of research, especially for those interested in the study of highly symmetric geometric structures, one of the areas in the intersection of algebra, geometry and combinatorics.

In 2020, Fernandes, Leemans and Ivić Weiss gave a classification of the locally spherical regular hypertopes of spherical and euclidean type and investigate finite hypertopes of hyperbolic type. We consider that this is another remarkable contribution to Theory of Hypertopes which we believe makes the area even more interesting and shows how rich this subject is.

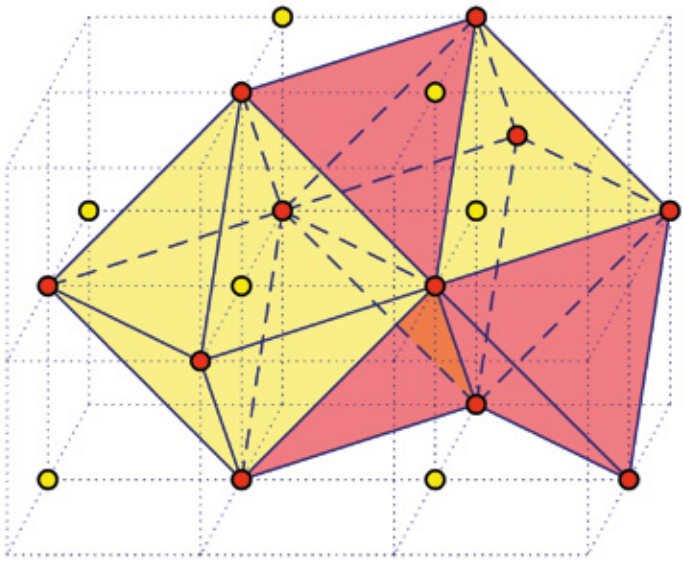


FIGURE 1
Hypertope of type $\left\{\begin{smallmatrix}3,4\\3\end{smallmatrix}\right\}$

Mathematical Modeling of the COVID-19 Pandemic

Ana P. Lemos-Paião[1], Faiçal Ndairou[1], Cristiana J. Silva[1], Delfim F. M. Torres[1], Houssine Zine[1]

Since the beginning of the COVID-19 pandemic, members of the CIDMA research unit have been engaged on the construction of adequate mathematical models, with the objective of preventing and estimating the spread of the SARS-CoV-2 virus and to develop strategies to control and mitigate COVID-19. The assumptions of the models are based on epidemiological, socioeconomic, cultural and educational publicly available data. The models are adjusted to fit the COVID-19 spread evolution of different regions/countries, namely, Portugal, Spain, Wuhan (China) and Morocco. In a second stage, these models have been used to find optimal strategies for the minimization of the number of active infected cases with less social and economical cost, by applying the mathematical theory of optimal control to the developed epidemic models. This investigation was the basis of the research project "Optimal Control and Mathematical Modeling of the Covid-19 Pandemic: contributions to a systemic strategy for community health intervention", supported by the Portuguese Foundation for Science and Technology (FCT), in the scope of the "RESEARCH 4 COVID-19" call RESEARCH 4 COVID-19 (1ª Edição) created by FCT and by the Agência de Investigação Clínica e Inovação Biomédica (AICIB) and coordinated by Cristiana J. Silva. The scientific papers are available via CIDMA's official web page at: https://cidma.ua.pt/covid_19

1 – Department of Mathematics & CIDMA, University of Aveiro

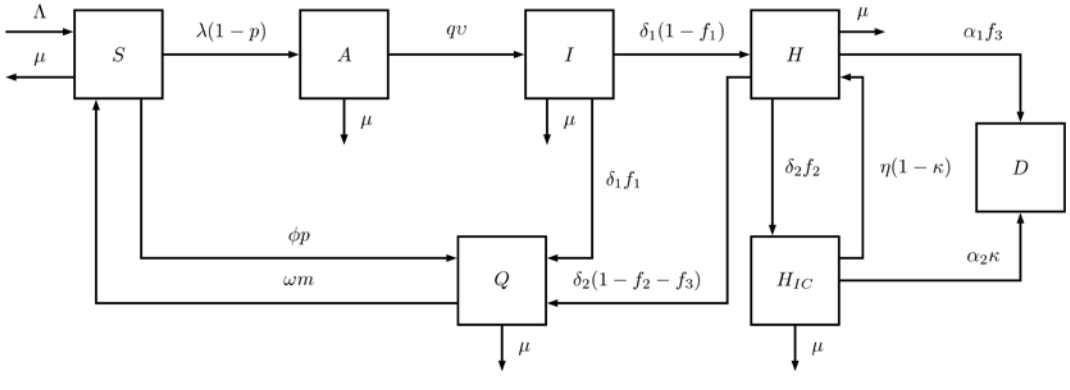


FIGURE 1
Diagram of COVID-19 mathematical model.

KAMILALA: A creative project for social inclusion open to languages and cultures

Rosa Maria Faneca[1], Ana Isabel Andrade[1], Ana Raquel Simões[1], Ângela Espinha[1], Bruna Batista[1], Cristina Manuela Sá[1], Filomena Martins[1], Francisco Silva[1], Helena Araújo e Sá[1], Maria João Silva[1], Susana Pinto[1], Valentina Piacentini[1]

1 – Department of Education and Psychology & CIDTFF – University of Aveiro

The growing linguistic and cultural plurality in schools underlines the need for innovative, integrative and flexible pedagogical approaches and practices aimed at developing plurilingual and intercultural competences. It is therefore important that educational actors (institutions, teachers, trainers, ...) may get support to integrate a pedagogy of linguistic and cultural diversity in teaching practices. The research carried out within "KAMILALA: A creative project for social inclusion open to languages and cultures" (www.kamilala.org), comprising a group of researchers coming from 4 European countries, intends to support educational actors in this endeavour. Besides organising the Multilingual Kamishibai Competition, which offers 3 to 15-year-old children the opportunity to create a story according to the kamishibai[1] format using at least four languages (including the children's heritage languages), the partnership created various resources in different languages: a booklet to guide the development of a Multilingual Kamishibai project, a hybrid training course aimed at educational actors and a report to support the organisation of a Multilingual Kamishibai Competition. Since 2018, the Portuguese team has organised several competitions at national level involving hundreds of students, their teachers and schools. In 2020, the international competition was won by a Portuguese participant. Within a perspective of articulation between education, research, and extension to the community, this research has given rise to several research projects (8 bachelor, 9 master, 1 doctoral and 1 post-doctoral) whose results have underlined the potential of this didactic resource to: foster social inclusion and respect for diversity in educational settings; develop several transversal competences; enhance children's motivation towards learning.

This resource is an output of the ongoing Erasmus+ project KAMILALA[2] (2019-1-FR01-KA201-062903) led by five partners, including the University of Aveiro.

[1] Kamishibai is a word of Japanese origin which literally means "paper theater", kami (paper) and shibai (theater).

[2] KAMILALA – "A creative project for social inclusion open to languages and cultures" is a three-year Erasmus+ project (reference 2019-1-FR01-KA201-062903) between five institutions: DULALA in France (coordinator), The Aristotle University of Thessaloniki in Greece, the Autonomous region of Aosta Valley in Italy, the University of Paris 8 in France and the University of Aveiro in Portugal.

FIGURE 1
A butai (kamishibai box), in which the storyteller inserts and removes boards as he exposes the narrative.

FIGURE 2
Multilingual Kamishibai Competition and the dimension of social responsibility.

The LoCALL App: learning to "read" the world while playing with linguistic landscapes

Mónica Lourenço[1], Sílvia Melo-Pfeifer[2], Alexandra das Neves[3], Ana Isabel Andrade[1], Ana Raquel Simões[1], Bruna Batista[1], Filomena Martins[1], Francisco Parrança da Silva[1], Lúcia Pombo[1], Margarida M. Marques[1], Maria Helena Araújo e Sá[1], Maria José Loureiro[4], Raquel Carinhas [1,5], Rosa Faneca[1], Susana Pinto[1], Susana Senos[4], Dionísia Laranjeiro[1,6]

Linguistic Landscapes (LL) are visible signs of multilingualism that pervade our everyday lives. They include public and commercial shop signs, street and place names, and advertising billboards, but also images, colors, sounds and smells in the physical surroundings. Research conducted in the school context shows that effectively exploring LL can contribute to language learning, foster multimodal learning experiences and text-to-world connections, and help students (and teachers) develop critical thinking, while engaging in meaningful conversations about their own identities.

Drawing on these principles, in 2019, a group of researchers from five European universities started the LoCALL project[1] to collaboratively create pedagogical resources that use LL to bridge in and out-of school learning. One of the outputs of the project, conceived by the University of Aveiro team with the support of the multimedia and design company Criamagin, is the LoCALL App, an educational resource that invites students, teachers and the community to "read" and explore LL, while playing a multiple-choice question game. This resource includes:

- a web platform that allows users to create routes with several points of interest associated with LL, build questions about these points of interest, as well as to add answer options and feedback.
- an App that runs on a mobile device where users can play the games created for a given route.

The App is currently being tested by students and teachers in the project's partner cities and is already available on Google Play and Apple Store.

[1] LoCALL – "Local Linguistic Landscapes for Global Language Education in the School Context" is a three-year Erasmus+ project (reference 2019-1-DE03-KA201-060024) between five universities: the University of Hamburg in Germany (coordinator), the Autonomous University of Barcelona in Spain, the University of Aveiro in Portugal, the University of Groningen in the Netherlands, and the University of Strasbourg in France.

1 – Department of Education and Psychology & CIDTFF, University of Aveiro
2 – University of Hamburg (Germany), CIDTFF
3 – Department of Languages and Cultures & CLLC, University of Aveiro
4 – Department of Education and Psychology & ccTIC, University of Aveiro
5 – Universidad de la República (Uruguay), Camões, I.P.
6 – Criamagino

FIGURE 1
The "I love Aveiro" stairway: an example of the city's linguistic landscape.

FIGURE 2
Launch screen of the LoCALL App. To download the App to a mobile phone, please use the following address: http://locallproject.web.ua.pt/LoCALL.apk

I want to be a mother! And now? Exploring the reproductive concerns of young women diagnosed with breast cancer

Ana Bártolo[1], Isabel M. Santos[2], Sara Monteiro[3]

1 – School of Health Sciences & CINTESIS, University of Aveiro
2 – Department of Education and Psychology & WJRC, University of Aveiro
3 – Department of Education and Psychology & CINTESIS, University of Aveiro

Breast cancer registered the highest incidence rate in women of reproductive age (aged 15 to 49) in 2020, both in Portugal (32.6/100.000) and worldwide (56.8/100.000). Young women are typically diagnosed with invasive carcinoma and studies are consensual in demonstrating that future fertility is at risk due to treatments such as chemotherapy (e.g. alkylating agent exposure). Thus, many women are "forced" to narrow their window of opportunity for family-building projects in favor of life-saving oncology treatments. In this context, members of the Psycho-Oncology Research Group of the Department of Education and Psychology recently developed a project focused on the reproductive concerns of young adult women (aged 18 to 40) diagnosed with breast cancer. This work showed that fertility and motherhood are major concerns among these women[1], who, in the face of uncertainty about their reproductive ability, seem to mirror the emotional response of non-cancer infertile women[2]. However, breast cancer survivors presented worse outcomes in terms of health-related quality of life, namely in physical functioning, possibly due to the sequelae of anticancer treatments.

One of the studies conducted by the team also suggested that young women who reported a more negative view of a childless life and more need to start or complete their family had a higher risk of experiencing depressive symptoms. Furthermore, the greater importance of parenthood in women's lives was also associated with increased reproductive concerns and, consequently, they reported a poorer health-related quality of life[3]. Altogether, these results encourage the development of programs for younger female cancer survivors at risk of infertility and strongly suggest reproductive health concerns as a potential target for intervention.

[1] Bártolo A, Santos IM, Monteiro S. Toward an understanding of the factors associated with reproductive concerns in younger female cancer patients: Evidence from the literature. Cancer Nurs. doi: 10.1097/NCC.0000000000000822.
[2] Bártolo A, Neves M, Carvalho B, Reis S, Valério E, Santos IM, Monteiro S. Fertility under uncertainty: exploring differences in fertility-related concerns and psychosocial aspects between breast cancer survivors and non-cancer infertile women. Breast Cancer. 2020;27(6):1177-1186. doi: 10.1007/s12282-020-01124-w.
[3]Bártolo A, Santos IM, Valério E, Monteiro S. Depression and Health-Related Quality of Life among young adult breast cancer patients: The mediating role of reproductive concerns. J Adolesc Young Adult Oncol. 2020;9(3):431-435. doi: 10.1089/jayao.2019.0144.

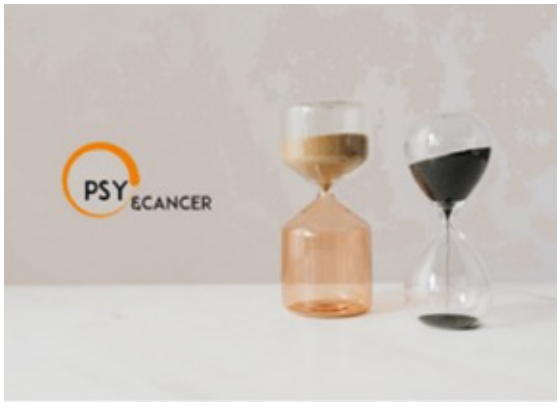


FIGURE 1
Psy&Cancer: Psycho-Oncology Research Group.

FIGURE 2
Path analysis: Mediating role of reproductive concerns.

Music effects on phonological awareness in children

Maria Manuel Vidal[1], Marisa Lousada[2], Marina Vigário[3]

The relation between music and language has been extensively studied in recent years. Research has revealed that both domains engage similar processing mechanisms, including auditory processing and higher cognitive functions, and recruit partially overlapping brain structures. It has been argued that both are related in child development and that linguistic functions can be positively influenced by music training above 4-years-old. Our aim was to study music influence in phonological awareness at ages prior to those already investigated, specifically, in 3-year-olds.

In this randomized control study, 44 children (3–4 years old) were included. All participants were from two different kindergartens from Aveiro. The experimental group had weekly music classes, 45 min/class (n = 23, mean age = 3;5 years old), and the control group (n = 21, mean age = 3;6 years old) had weekly visual arts classes, 45 min/class.

When comparing pre- and post-assessment, results showed significant differences in both groups, but music classes' children outperformed the control group, showing larger differences between the beginning and the end of the intervention.

Improvement in both groups is expected due to general developmental factors. However, the fact that children following music classes show greater improvement, indicates that music lessons has influenced phonological awareness.

Our results support the hypothesis that music training may promote language abilities, specifically phonological awareness, prior to the ages previously studied. This finding is particularly relevant considering that phonological awareness is a fundamental skill for early reading success. By promoting phonological awareness, music lessons may help reading and writing learning.

In 2020, this study was published in one of the most relevant journals in the areas of linguistics, speech and hearing and psychology.

1 – Center of Linguistics (CLUL), University of Lisbon
2 – School of Health Sciences & CINTESIS, University of Aveiro
3 – School of Arts and Humanities & Center of Linguistics (CLUL), University of Lisbon

FIGURE 1
Music classes.

FIGURE 2
Cover page of the issue of the journal Applied Psycholinguistics where the paper was published (2020).

Performance indicators for research and cultural creation activities in polytechnic higher education institutions: a consensus building approach

Ana I. Melo[1], Ricardo Biscaia[2], Maria J. Rosa[3], Hugo Figueiredo[4], Isabel Machado[5], Paula Rocha[6]

1 – School of Technology and Management & CIPES, University of Aveiro
2 – School of Technology and Management & CIPES, University of Aveiro
3 – Department of Economics, Management, Industrial Engineering and Tourism & CIPES, University of Aveiro
4 – Department of Economics, Management, Industrial Engineering and Tourism & CIPES, University of Aveiro
5 – IPAM – Marketing School for Business & CIPES, University of Aveiro
6 – Department of Social, Political and Territorial Sciences & CIPES, University of Aveiro

The interest for assessing performance in higher education led to the incorporation of performance indicators (PIs) in the management of higher education institutions (HEIs). Recently, there have been political attempts addressing the possibility of introducing research performance in HEIs' funding. Within this scenario, and considering the specificity of the polytechnic mission in the Portuguese context, this research aimed at developing a set of PIs for managing the performance of research and cultural creation activities and their impact on the regional context, in Portuguese polytechnic HEIs.

Five theoretical dimensions have been proposed and empirically validated (through interviews and focus groups with polytechnic representatives) to frame the diversity of the aforementioned activities: *Knowledge Transfer*, comprising activities involving a high level of entrepreneurialism and a low level of connectedness (e.g. start-ups); *Service Provision*, involving activities highly linked to the environment and very entrepreneurial (e.g. consultancy); *Collaborative Research*, integrating activities low in entrepreneurialism and highly connected to the environment (e.g. projects with non-academic partners); *Scientific and Artistic Production*, comprising activities that are not highly linked to the environment nor very entrepreneurial (e.g. scientific publications); and *Societal Impact*, reflecting the impact of these activities in the region.

A set of PIs was then defined for each dimension (totalising 29) and the Delphi echnique was applied to reach consensus among specialists (polytechnic HEIs' presidents) regarding the PIs. Two rounds of this technique led to a final list of 23 indicators.

This final set of PIs emerged as a valid instrument, which can be used by polytechnic HEIs, not only as a self-assessment tool to improve their performance, but also as a management tool, allowing them to establish goals, define their own profile and the strategies to achieve it.

FIGURE 1
Dimensions of Analysis for organizing research and cultural activities in polytechnics and their societal impact.

Nomination vs. election: do they influence women's access to institutional decision-making bodies?

Sara Diogo[1], Teresa Carvalho[2], Zélia Breda[3]

The lack of women in leadership positions across higher education (HE) as a result of the well-known phenomenon of vertical segregation has been problematized in the literature. Vertical segregation is defined as the tendency to find women's concentrated in clerical and low-level management. This study analyses if and how the way decision-making bodies are constituted, influence the gender balance of their members. Recently, within the New Public Management context, higher education institutions (HEIs) have been subjected to external pressures to create a new organisational environment, aiming at substituting the collegial model of governance with a managerial one. A trend to replace the election by the nomination as the dominant process to occupy decision-making positions has been observed.

Methodologically, quantitative and qualitative approaches were triangulated through several stages. Data about the gender constitution of the decision-making bodies of all 14 Portuguese public universities and the processes of accessing these bodies–elections vs. nomination–were scrutinised through consultation of universities' websites (cf. Table 1) and content analysis of legal documents describing the mission of the decision-making bodies. This was then cross-compared with an in-depth analysis of the university selected as a case study with content analysis of 12 interviews with institutional key-actors of the case-study institution. It is argued that the nomination process tends to be more advantageous to women than the election. However, although it is possible to conclude that the gender balance decreases with the increasing importance of the decision-making body, it is not accurate to say that there is a direct relationship between the way actors are chosen to these bodies and their gender balance. Institutional culture, gender awareness and even the lack of both self and institutional empowerment are also relevant to understand the low number of women in these positions.

1 – Department of Social, Political and Territorial Sciences & CIPES & GOVCOPP, University of Aveiro
2 – Department of Social, Political and Territorial Sciences & CIPES, University of Aveiro
3 – Department of Economics, Industrial Engineering, Management and Tourism & GOVCOPP, University of Aveiro

Table 1. Female participation in Portuguese universities' governance structures (segregating data according to both the election and the nomination procedures).

University	Rector %	Rectoral team %	Board of Trustees %	General council			Management board %	Total %
				Election %	Co-option %	Total %		
ISCTE–University Institute of Lisbon[1]	100	50	40	48	40	42	0	42
Universidade Aberta[2]	100	20	–	56	40	52	40	47
University of the Azores	0	78	–	n.a	n.a	29	33	44
University of Algarve[a]	0	60	–	52	20	43	40	43
University of Aveiro[a]	0	33	20	29	40	32	20	29
University of Beira Interior	0	40	–	29	13	24	40	28
University of Coimbra	0	30	–	n.a	n.a	21	0	
University of Évora[a]	100	44	–	38	14	36	75	44
University of Lisbon	0	13	–	60	30	51	n.a	43
University of Madeira[a]	0	43	–	50	0	38	0	38
University of Minho[a]	0	33	40	45	33	42	n.a	39
Nova University of Lisbon	0	40	40	53	50	52	0	43
University of Porto	0	36	40	24	33	26	25	28
University of Trás-os-Montes and Alto Douro[a]	0	25	–	39	29	36	0	29

Source: Own construction based on the information collected on the website of each university
[a]Includes polytechnic schools; n.a. information not available; [1]University institute; [2] Distance learning university

Dystopian Dark Tourism: Affective Experiences in Dismaland

Maria Sofia Pimentel Biscaia[1], Lénia Marques[2]

1 – Department of Languages, Literatures and Cultures & CLLC, University of Aveiro
2 – Department of Arts and Culture Studies/ Erasmus Research Centre for Media, Communication and Culture, Erasmus University Rotterdam

In dark tourism affects are generated in a relational manner by the tourists and the locations visited by them. Exploring affective meanings of Banksy's Dismaland via socio-spatial theories of emotion and affect is a way to contribute to the understanding of dystopian tourism. The dystopian touristic experience of Dismaland evolves from the interaction of a dystopian atmosphere, a displacement strategy and productive negative intensities. Whilst the affects produced vary according to the artist's intentions, through innovative and politicised forms of dystopian dark tourism, Banksy creates atmospheres where productive negative intensities are able to be developed. In spite of the shades of dystopia and darkness in the artist's work, a hopeful form of tourism could be generated. The implications are that affect in the dark tourism context has different layers of meaning where the materialising dystopian experiences, as simulacra, range from pure attraction to social change. Dismaland's dark tourism experience reveals the role that political and ethical matters play in socio-affective encounters as exemplified by the commodification of the tourism industry, the Mediterranean refugee crisis and the glorified/sorrowful death of Diana, princess of Wales.

FIGURE 1
"Mediterranean Boat Ride" (2015), installation from *Dismaland* by street artist Banksy (identity unconfirmed).

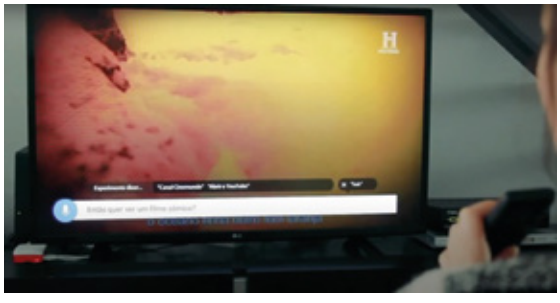
Natural Language interaction with the Television

Jorge Abreu[1], Pedro Almeida[1], Pedro Beça[1], Juliana Camargo[1], Tiffany Marques[1], Rita Santos[1], Telmo Silva[1]

Under the CHIC mobilizing project (pilot B3 – 24498), the ITV Social Research Group of DigiMedia Research Unit developed, in partnership with Altice Labs, a complete Natural Language Interaction (NLI) solution for interactive television. This solution aims to optimize the user experience (UX), namely at the interaction level while searching for audiovisual content, overcoming the need of inserting text using a remote control. In addition, by adopting a conversational approach rather than simple voice commands, it was possible to achieve a more intuitive and natural mode of interaction, since users do not need to navigate between complex menus and interfaces.

The key performance indicators (KPI) of this solution focused on its suitability to the television lexicon, robustness to noise, provided UX, and on the implementation in Set-Top Boxes of the IPTV service of MEO allowing a dynamization of a Field Trial (FT). To ensure good efficiency of the NLI system, a continuous improvement process was adopted, divided into two phases of the FT, in which problems/bugs were identified and fixed and natural and diversified utterances were collected to train the Natural Language Understanding (NLU) module. During the FT, the training process of the NLU involved the collection of a total of 3969 utterances, from a total of 13.000 interactions with the developed system.

The team of the University of Aveiro had a strong involvement in the Field Trial, in the training process, and in the implementation of UX promoting features: conversational dynamics, creation of decoys, disambiguation of requests, supporting of trending TV content, and creation of scenarios for the continuity of the viewer experience, in which the system interacts proactively, for example when a user fell asleep watching a TV show.



1 – Department of Communication and Art & DigiMedia, University of Aveiro

FIGURE 1
User interacts with the system from an application that accepts voice commands.

FIGURE 2
The system also allows interaction by voice using a TV remote control.

miOne – CoDesigning an "Online Livable Community" for Active Ageing

Ana Isabel Veloso[1], Óscar Mealha[1], Carlos Santos[1], Liliana Costa[1], Vania Baldi[1], Liliana Sousa[2], Sónia Ferreira[3], Fernanda Martins[4], Fernando Zamith[4], Cláudia Ortet[1], Francisco Regalado[1], Henrique Silva[1], Jesse Filho[1], Tânia Ribeiro[1]

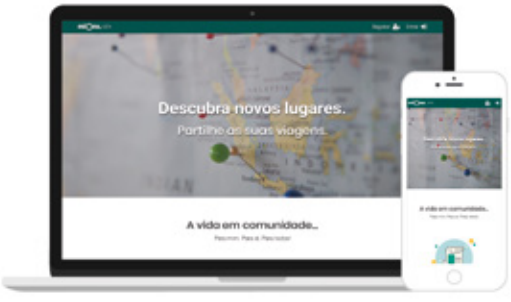
1 – Department of Communication and Art & DigiMedia, University of Aveiro
2 – Department of Education & Psychology & CINTESIS, University of Aveiro
3 – School of Education, Center for Studies in Education and Innovation, Polytechnic of Viseu
4 – Faculty of Arts and Humanities & CITCEM, University of Porto

In times of pandemic influenza in which social distancing has been adopted as a measure and an increasing dependence on digital media has been observed, online communities have played a key role to help senior citizens to maintain social interactions and ensure a necessary routine to active ageing. Although there has been a boom of the "technologies for active ageing", most of the products tend to focus on the health dimension, overlooking other equally important dimensions such as a sense of security, participation in society, and life-long learning.

The aim of this research, developed under SEDUCE 2.0 project, is to (a) assess the psychosocial variables and Online Sociability of senior citizens through the use of Information and Communication Technologies, and (b) contributing to the growing development of the miOne community with the participation of senior citizens.

miOne (mione.altice.pt) is an online livable community for active ageing in the sense that gathers people of all ages, encouraging civic and social engagement, and in which socio-techno-ethical dimensions are very present to provide an open and safe space. This social platform follows a community-centered design approach, and the following themes are under focus: online news, health, and (cyclo) tourism. Participation is also encouraged through the use of gamification.

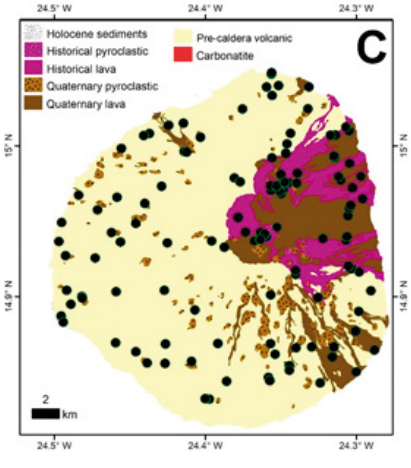
The activities within the miOne online community involved a total of seven Universities of the Third Age, a total of 13 sessions *in situ,* and eleven online activities. During these sessions, some of the lessons learned were: delineate a strategy for motivating the participants' attendance in sessions, plan group dynamics and iteratively access participants' expectations towards the developed product and involve the coordinators or caregivers in online sessions to facilitate the interaction. Good practices in designing and assessing Senior Online Communities have emerged, including self-expression challenges and the need to instil a routine over community activities.



Mars and Lunar Regolith Simulants – A New Terrestral Analogue Site

Marina Cabral Pinto[1], Rui Moura[2], Fernando Almeida[1], Andreia Santos[1], Fernando Tavares Rocha[1], Helena Maria Mendes da Silva[3], Eduardo Ferreira da Silva[1]

Fogo Island is a good analogue for both the Moon and Mars due to its rocky, dusty and un-vegetated terrains. Volcanoes and volcanic landforms and processes can be studied such as vents; lava flows (both basaltic and differentiated); unconsolidated pyroclastic deposits; hydrothermal alteration; lava tubes and caves; dykes; channels and valleys; basaltic rift system and ridges; and astrobiology of volcanic environments. The red, oxidised, basaltic, tephra from Fogo has optical properties that resemble the established simulant of the bright regions of Mars. Geochemistry and mineralogic studies show a great similarity of the old pre-Caldera geological unit and the MGS1 Mars Global Simulant, evidenced by a relative depletion in mobile elements (e.g., Na, Ca, Mg) and an enrichment in non-mobile elements (e.g., Ti, Fe, Sc, Al), the decomposition of the most labile minerals (olivines), and the enrichment in secondary components (phyllosilicates and some Fe-oxides). The Historical geological units (recent eruptions) showed similarity with the JSC-1 Lunar simulant. As JSC-1 Lunar simulant, in the younger units of the Fogo Island sample, the basalts comprise an abundant volcanic-glazed landmass. In terms of composition, the mineral grains laid down in this groundmass are enriched in plagioclase and Fe-Mg minerals, which are more vulnerable to weathering than most of the silicates that constitute silica-rich rocks. Beyond geochemical and mineralogical characterization, the JSC-1 Lunar simulant was also characterized by determining seismic, magnetic and thermal properties, density with degrees of compaction, as well as some other parameters. To determine the thermal properties of JSC-1, a numerical model was developed with an inversion routine. The thermal conductivity obtained was 0.26W/mK, specific heat 701J/KgK and density 1352Kg/m^3. The seismic velocities determined in microgravity campaigns were lower than in 1g environment. These geophysical findings of the simulant will also be verified in Fogo Island materials as well as in the know Mars simulants.



1 – Department of Geosciences & GeoBioTec, University of Aveiro
2 – DGAOT, Faculty of Sciences, University of Porto & INESC-TEC
3 – DGAOT, Faculty of Sciences, University of Porto & ICT

FIGURE 1
Photo by Eduardo Ferreira da Silva.

New data on the petrogenesis of the lithiniferous pegmatites from Montalegre (northern Portugal)

Miguel Ângelo Faria[1], António Silva[1], José Francisco Santos[1], Sara Ribeiro[2]

1 – Department of Geosciences & GeoBioTec, University of Aveiro
2 – Central Laboratory of Analysis & GeoBioTec, University of Aveiro

Samples of pegmatites from a lithium prospect area close to Montalegre (northern Portugal), as well as samples of spatially related lithologies (metasediments and granites), were studied in the scope of this work.

The studied metasediments include garnet and andalusite-bearing metapelites, belonging to the Pelite-Greywacke Formation (with probable Lower Silurian deposition age). Sr-Nd isotope compositions, calculated to an age compatible with the generation of Variscan granitic magmas, show variations of $^{87}Sr/^{86}Sr$ from 0,7227 to 0,7314, and of εNd from -11,4 to -10,7.

The sampled granites were emplaced in relation with the Variscan D3. They display peraluminous (A/CNK between 1,21 and 1,28), ferroan and alkali-calcic compositions, revealing that they are S-type granites. Initial $^{87}Sr/^{86}Sr$ and εNd values range from 0,7164 to 0,7198, and from -5,4 to -8,4, respectively, which agree with the S-type fingerprint. However, there is no overlap with the isotopic signature of the metasediments, which may be due either to the small number of analysed metasediment samples, or to the occurrence of the anatectic processes in a different lithostratigraphic unit.

Pegmatite samples are clearly of the LCT family, being formed of albite, quartz, petalite, K-feldspar. In smaller amounts, muscovite, biotite, apatite, montebrasite, cassiterite and sphalerite were also identified. LCT pegmatites are usually considered as extreme differentiates from peraluminous S-type granitic magmas, emplaced during late stages of orogenies. Rb-Sr isotopic data point to an age of 300 ± 14 Ma (Ludwig's age model 3) to the emplacement of the main pegmatite body in the Montalegre prospect area; the initial Sr-Nd isotopic signature of this body has values around $^{87}Sr/^{86}Sr$ = 0.718 and εNd = -8.4. Therefore, the available evidence suggests that this pegmatite had a parental granitic magma very similar to the studied granites, and that this magma formed and evolved during late stages of the Variscan orogeny.

FIGURE 1
Rb-Sr isochron diagram for samples from the main pegmatite body of the Montalegre prospect area.

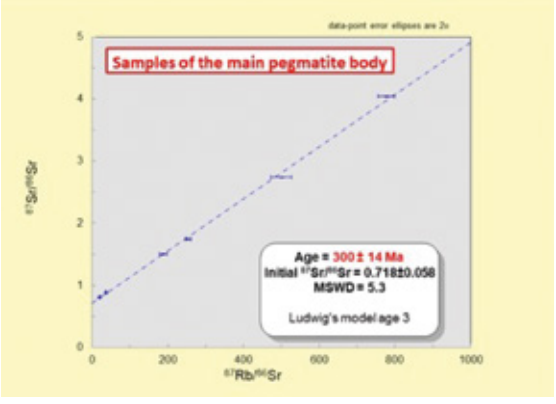
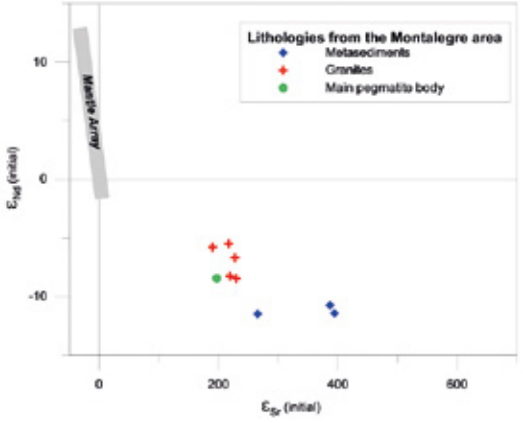


FIGURE 2
Nd-Sr isotope correlation diagram for lithologies from Montalegre region, considering initial (for the age of magma emplacement) isotope compositions.



An empirical analysis of the relationship between supply chain strategies, product characteristics, environmental uncertainty and performance

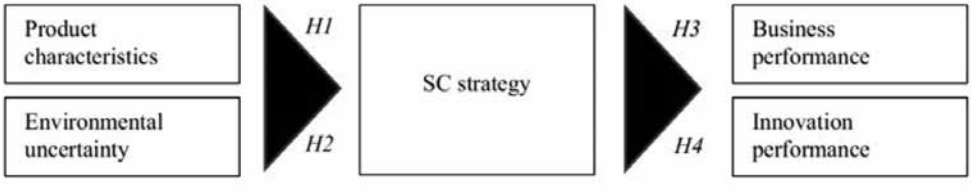
Ricardo Zimmermann[1], Luís Miguel D.F. Ferreira[2], Antonio Carrizo Moreira[3]

This paper aims to investigate supply chain (SC) strategies, analyzing the adoption of lean, agile, leagile and traditional SC strategies with respect to product characteristics, environmental uncertainty, business performance and innovation performance. The paper presents an empirical analysis carried out on a sample of 329 companies from Portugal and Brazil. Cluster analysis was applied, based on lean and agile SC characteristics, to identify patterns among different SC strategies. One-way analysis of variance of different constructs by types of SC clusters was conducted to test the research hypotheses.

The cluster analysis indicates that the companies studied adopt four types of SC strategies – lean, agile, leagile and traditional. The differences between the clusters are identified and discussed, highlighting that companies adopting a leagile SC strategy present the highest performance, while those that adopt a traditional SC present the lowest; companies adopting an agile SC compete in the most complex and dynamic environments, while companies with a lean SC present a clear predominance of functional rather than innovative products.

This paper provides empirical evidence of the antecedents and consequences of the adoption of different SC strategies. As a limitation, the results are based on a survey research with a limited sample size. Based on the analysis of the relationship between constructs that have not been addressed previously, the paper adds to the knowledge regarding the role of SC strategies, as well as the antecedents and consequences of their adoption. The results may support managers in the difficult task of choosing the "right" SC strategy.

1 – Manufacturing Systems Engineering Unit, INESC TEC, Porto
2 – Department of Mechanical Engineering, University of Coimbra, Coimbra
3 – Department of Economics, Management, Industrial Engineering and Tourism & GOVCOPP, University of Aveiro



Population Growth and the Local Provision of Services: The Role of Primary Schools in Portugal

João Lourenço Marques[1], Muhammad Tufail[2], Jan Wolf[1], Mara Madaleno[3]

1 – Department of Social, Political and Territorial Sciences & GOVCOPP, University of Aveiro
2 – Department of Economics, School of Social Sciences and Humanities, National University of Sciences and Technology, Pakistan
3 – Department of Economics, Management, Industrial Engineering and Tourism & GOVCOPP, University of Aveiro

The shrinking population has led to a debate on the relation between the local provision of services of general interest and the demographic growth of different territories. Primary schools have been a frequent focus of this debate, given the significant number of school closures in recent years, as well as their social, economic, and symbolic importance for local communities. The relationship between primary schools and population growth at the local scale has not been clearly established and is a challenging subject given the potential circular causality between them. This paper analyses this relationship for the mainland municipalities in Portugal between 1999 and 2016, considering three variables – total fertility rates, net migration rates and the number of primary schools – in a panel vector autoregressive (PVAR) model. It was possible to conclude that, although there is a mutual influence between these variables, the impact of school closures on the growth prospect of a municipality is limited. Changes in the number of Primary Schools are positively and, significantly, related to changes in Net Migration Rates in only one of the four-time lags. The same occurs with total fertility rates, where the impact is restricted to the fourth lag. The adjustment of the number of schools to population changes does also not show a very clear pattern. Results mean that the number of primary schools is a limited tool for influencing the fertility or migration rates at the municipal scale. Thus, primary schools play an important role in communities, but changes in their number seem not, by themselves, capable of significantly influencing ongoing trends in population growth. The main goal of policy decisions regarding the provision of primary schools should, therefore, be the quality of life of local communities, and not so much their role in countering depopulation.

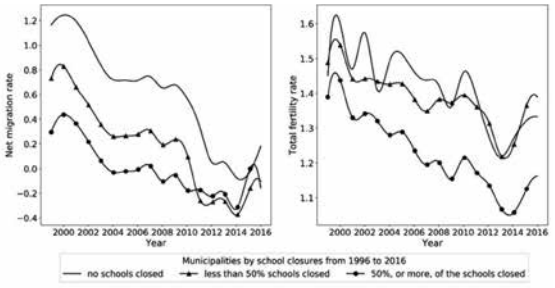


Figure 1 – Total fertility and migration rates by changes in primary schools, 1999–2016 (smoothened). Data Source National Statistical Institute.

Table 1 – Granger causality.

VAR Granger Causality/Block Exogeneity Wald Tests			
Dependent variable: Primary schools (FD)			
Excluded	χ^2	df	Prob.
Total fertility rate	8.2115	4	0.0842
Net migration rate	20.901	4	0.0003
Dependent variable: Total fertility rate			
Excluded	χ^2	df	Prob.
Primary schools (FD)	43.889	4	0.0000
Net migration rate	27.934	4	0.0000
All	84.002	8	0.0000
Dependent variable: Net migration rate			
Excluded	χ^2	df	Prob.
Primary schools (FD)	33.633	4	0.0000
Total fertility rate	12.013	4	0.0173
All	44.059	8	0.0000

Notes: No. of obs = 3614; No. of panels = 278; Ave. no. of T = 18.000.
Sample: 1999-2016; FD = forward orthogonal deviation was applied.

Global hyperactivation of enhancers stabilizes human and mouse naive pluripotency through inhibition of CDK8/19 Mediator kinases

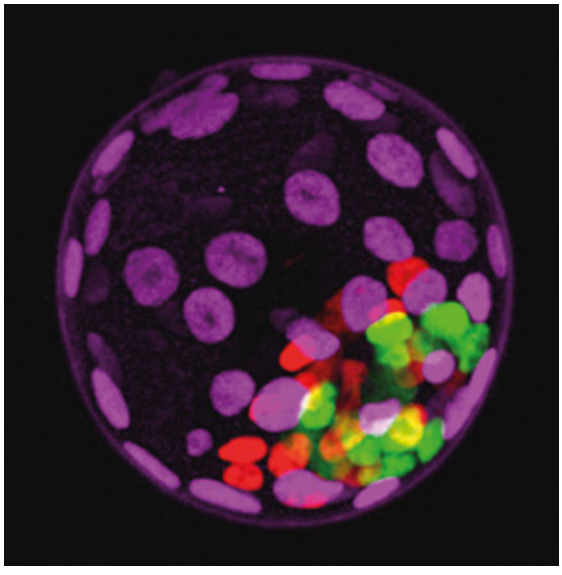
Cian J. Lynch[1,2], Raquel Bernad[1,2], Ana Martínez-Val[1], Marta N. Shahbazi[3,4], Sandrina Nóbrega-Pereira[5], Isabel Calvo[1,2], Carmen Blanco-Aparicio[1], Carolina Tarantino[6], Elena Garreta[6], Laia Richart-Ginés[7], Noelia Alcazar[1,2], Osvaldo Graña-Castro[1], Gonzalo Gómez-Lopez[1], Irene Aksoy[8], Maribel Muñoz-Martín[1,2], Sonia Martinez[1], Sagrario Ortega[1], Susana Prieto[9], Elisabeth Simboeck[9], Alain Camasses[9], Camille Stephan-Otto Attolini[2], Agustin F. Fernandez[10], Marta I. Sierra[10], Mario F. Fraga[10], Joaquin Pastor[1], Daniel Fisher[9], Nuria Montserrat[6,11,12], Pierre Savatier[8], Javier Muñoz[1], Magdalena Zernicka-Goetz[3,13] and Manuel Serrano[1,2,12]

Cell plasticity is a property by which a cell can acquire different and reversible identities. This is essential for embryonic development and is also exploited in several pathologies including cancer, as tumor cells use this property to evade therapy and colonize distant organs. Pluripotent stem cells (PSCs) can transit between different cell plasticity states in vitro, reflecting developmental changes in the early embryo. Until now, PSCs could be stabilized in the so called naïve pluripotent state by methods that include inhibition of external differentiation stimuli, particularly FGF–MEK signaling.

In this work, the authors showed that multiple features of the naïve state in human and mouse PSCs can be recapitulated solely by chemical inhibition of the CDK8 and CDK19 kinases. Mechanistically, inhibition of CDK8/19 removes their ability to repress the Mediator complex, which increases the recruitment of RNA polymerase II to promoters and enhancers and stabilizes the naïve gene expression program.

This groundbreaking study revealed for the first time that internal regulation of the profound mechanisms that regulate gene expression programs can drive naïve pluripotency in stem cells and inhibition of the CDK8/19 kinases is key to this process. These principles may apply to other contexts of cellular plasticity and have future implications in regenerative biology and cancer.

This work was headed by the laboratory of Dr. Manuel Serrano at IRB, Barcelona, in collaboration with researchers from several international centres, including the participation of Sandrina Nóbrega Pereira from the Department of Medical Sciences & iBiMED, University of Aveiro, and was published in the prestigious journal Nature Cell Biology in October 2020.



1 – Spanish National Cancer Research Centre (CNIO), Spain
2 – Institute for Research in Biomedicine (IRB Barcelona), Institute of Science and Technology (BIST), Spain
3 – Department of Physiology, Development and Neuroscience, University of Cambridge, UK
4 – MRC Laboratory of Molecular Biology, Cambridge, UK
5 – Department of Medical Sciences & iBiMED, University of Aveiro, Portugal
6 – Institute for Bioengineering of Catalonia (IBEC), BIST, Spain
7 – Institut Curie, France
8 – Stem Cell and Brain Research Institute, University Lyon, France.
9 – IGMM, University of Montpellier, France
10 – Nanomaterials and Nanotechnology Research Center, Universidad de Oviedo, Spain
11 – Centro de Investigación Biomédica en Red en Bioingeniería, Biomateriales y Nanomedicina, Spain
12 – Catalan Institution for Research and Advanced Studies (ICREA), Spain
13 – Division of Biology and Biological Engineering, Caltech, Pasadena, CA, USA

FIGURE 1

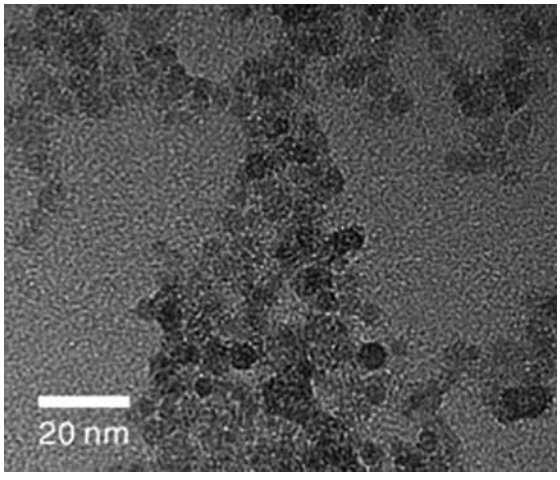
Capturing naïve stem cell pluripotency with CDK8/19 kinase inhibitors. Mouse blastocyst at embryonic day E3.5-4.5 stained for the pluripotency markers GATA6 (red), NANOG (green) and CDX2 (magenta). Photo courtesy of Cian J. Lynch, IRB Barcelona, Spain.

Size-dependent critical transition in the origin of light emission from core–shell Si–SiO_2 nanoparticles

Bruno P. Falcão[1], Joaquim P. Leitão[1], Maria R. Soares[2], Joana Rodrigues[1], Lídia Ricardo[3], Hugo Águas[3], Rodrigo Martins[3], Rui N. Pereira[1]

1 – Department of Physics & i3N, University of Aveiro
2 – Central Laboratory of Analysis, University of Aveiro
3 – Department of Materials Science & CENIMAT/i3N, NOVA School of Science and Technology, NOVA University Lisbon

Nanosilicon is a promising environmentally friendly nanomaterial for future electronic, optoelectronic and biomedical applications. An important feature of nanosilicon is its ability to emit light under different external excitations, e.g. illumination or electric fields, which is useful for various nanotechnologies such as energy-efficient light emitting devices or medical imaging. The origin of light emission from nanosilicon systems, such as crystalline silicon nanoparticles (Si-NPs), has been an intensively debated issue, with seemingly contradicting studies pointing to different mechanisms. In this work, we established the origin of the photoluminescence (PL) from application-grade Si–SiO_2 core–shell NPs with different sizes and synthesized with an industrially scalable high-yield nonthermal plasma method. Through a comprehensive study of PL spectra measured for a well-characterized set of Si-NP samples, we unveiled a strong dependence of the origin of the luminescence on NP size. We found that the commonly observed PL from Si-NPs originates, in general, from two processes: (i) recombination of charges (photo-excited electrons and holes) within the Si core of the NPs and (ii) recombination involving the oxide shell. The photon energies of both emissions increase with decreasing NP size. Importantly, a NP size dependence of the relative contribution of the two processes (i) and (ii) to the overall PL was established. For large (small) Si-NPs, the luminescence is dominated by the core (oxide-shell) emission. Interestingly, the transition between these two regime limits occurs within an extremely narrow NP size range of only ~0.5 nm. This critical transition, in combination with the close photon energies of the emissions (i) and (ii), is responsible for the common observation of only a single unstructured PL band for Si-NPs and for the seemingly conflicting assignments of the origin of this luminescence found in the literature for apparently similar Si-NPs.



FIGURES 1
Transmission electron microscopy image of our Si-NPs (Si–SiO_2 core–shell NPs).

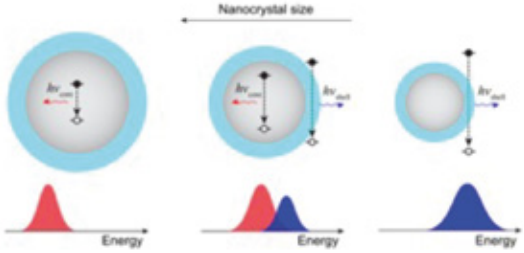
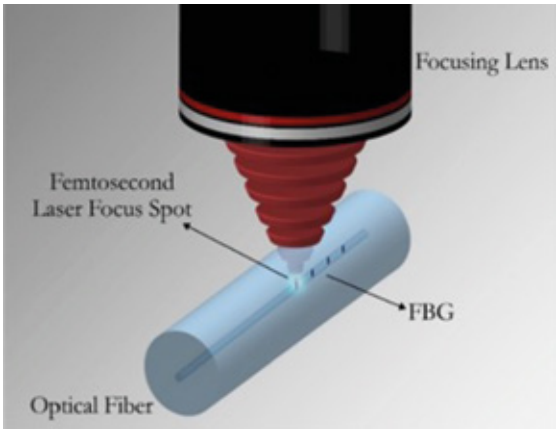


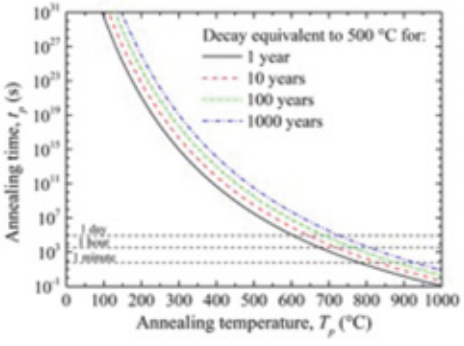
FIGURE 2
Scheme depicting the origin of light emission from the Si-NPs and the qualitative evolution of the relative contributions of the core- and shell-related emission components and corresponding energies on NP size.

Resonant wavelength thermal stability of fiber Bragg gratings produced by femtosecond laser

Tiago Paixão[1], Luís Ferreira[2], Francisco Araújo[2], Paulo Antunes[1]

In the last years, fiber Bragg gratings (FBGs) have gain popularity within several areas of industry, mainly due to their inherent advantages, such as lightweight, flexibility, multiplexing capability, electric isolation and immunity to external electromagnetic fields. To work under harsh conditions, FBGs must have a stable response in terms of the reflective peak power, but most importantly in terms of their resonant central wavelength. In this work, we performed an extensive study on the thermal stability of FBGs inscribed by a femtosecond laser (FSL), proposing a novel approach to explain the FBGs' permanent refractive index decay under high temperatures, based on the study of their central resonant wavelength shift. The developed theoretical model can predict the refractive index decay over periods of up-to 1000 years, and allows to extrapolate the optimized FBGs' annealing conditions to guarantee long lifetimes. Furthermore, an experimental method was demonstrated, where the FBGs were submitted to continuous and stepped annealing regimes up-to a maximum temperature of 800 °C. The experimental results highlighted the potential of using FSL based FBGs in harsh environments, if proper pre-treatments are used to maximize FBGs thermal stability.





1 – Department of Physics & i3N, University of Aveiro
2 – HBK FiberSensing, S.A., Maia, Portugal

FIGURES 1
Schematic representation is presented of FBGs' inscription using the point-by-point method with the femtosecond laser.

FIGURE 2
Annealing conditions required to stabilize a FBG that would work at 500 °C, for a time span of up to 1000 years.

Bringing atom-thick materials to the millimeter scale

Alexandre F. Carvalho[1], Bohdan Kulyk[1], António J.S. Fernandes[1], Florinda M. Costa[1]

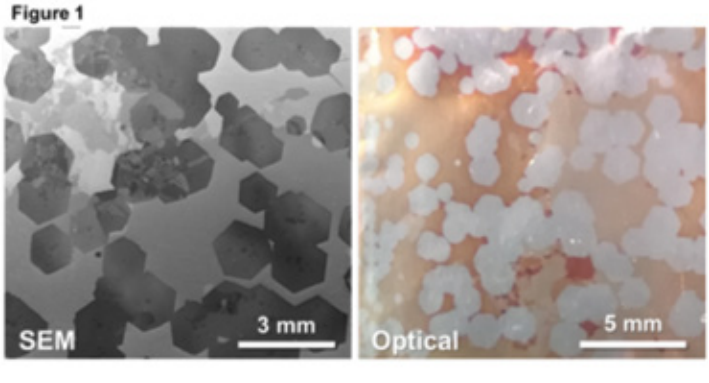
1 – Department of Physics & i3N, University of Aveiro

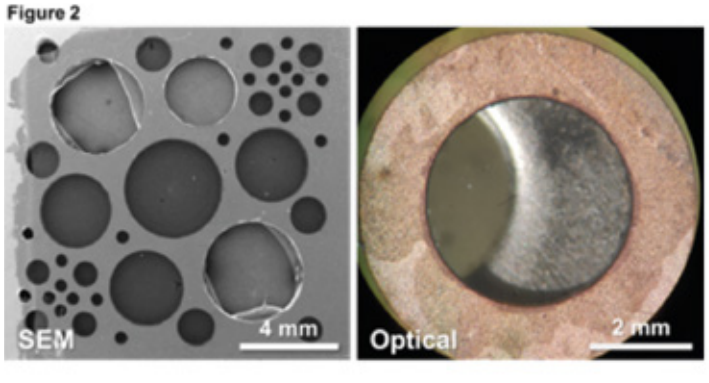
Graphene, the 2D single layer of carbon atoms arranged in a honeycomb pattern, is one of the most studied materials nowadays due to its outstanding properties and its role as a platform to study new physics phenomena. To provide practical applications of this material, upscaling of both the production methods and transfer techniques is required. To this end, in 2020, the I3N | Carbon-based Materials and Laser Processing Group has published two works regarding the synthesis and processing of graphene at the millimeter scale, pursuing two distinct strategies. In the first one, the role of oxygen in the pre-treatment of copper substrates for chemical vapor deposition (CVD) of graphene and its impact on the crystalline quality and crystal domain dimensions was explored [1]. By a simple in-situ prior oxidation and subsequent reduction of the substrate before growth, >2-mm-wide single-layer graphene crystals were obtained (**Fig. 1**), through removal of carbon impurities from the copper bulk. This, along with an optimized synthesis recipe, allowed to achieve improved electrical transport properties compared to the synthesis without an oxidation/reduction approach. In the second strategy, a novel transfer technique has been developed, enabling the suspension of few-layered graphene films over 4-mm-wide cavities (**Fig. 2**), doubling the previous literature record for suspended area per number of layers [2]. This is equivalent to suspending a sheet as thin as regular office paper over an area the size of a football field, made possible by exploiting a new approach to remove the graphene transfer supporting layer in vacuum. These suspended membranes were then used to build a prototype condenser microphone with an enhanced specific response. Overall, both these strategies have advanced the state of the art in the synthesis and transfer of graphene, paving the way for future application in a wide range of fields, such as electronic, photonic and sensor applications.

FIGURE 1
Secondary electron scanning electron microscopy (SE-SEM) and optical images of graphene grown on oxidation/reduction treated copper, showing millimeter-sized hexagonal crystals of single-layer graphene.

FIGURE 2
SE-SEM and optical images of free-standing few-layered graphene membranes obtained by the newly developed method, showing the increased difficulty of the transfer process for diameter membranes and an optically clear 4-mm-wided transparent graphene film.

[1] Bohdan Kulyk, Alexandre F. Carvalho, António J.S. Fernandes, Florinda M. Costa., *Millimeter sized graphene domains through in situ oxidation/reduction treatment of the copper substrate*, Carbon, 169 (2020) 403-415. DOI: 10.1016/j.carbon.2020.08.002.
[2] A. F. Carvalho, António J.S. Fernandes, Mohamed Ben Hassine, Paulo Ferreira, Elvira Fortunato e Florinda M. Costa, *Millimeter-sized few-layer suspended graphene membranes*, Appl. Mater. Today, 21 (2020) 100879. DOI: 10.1016/j.apmt.2020.100879.





Eileen Gray and the Semiotics of her Unique Modern Design

Fátima Pombo[1], Anna Marie Fisker[2]

This title mirrors the research the authors have been carrying out for a couple of years regarding the study of Eileen Gray (1878-1976) iconic home E-1027 (1926-1929) and her concept for dwelling, addressing the pioneering modernism in disagreement with Le Corbusier's oft-quoted line about a house being *a machine à habiter.* E-1027 is a place full of ingenious thinking, leading down mystically from a small staircase to a brilliant view over the Mediterranean Sea and Monte Carlo. She designed many of her most famous furniture pieces, including the low-slung *Transat* armchair and the iconic *Satellite* mirror as response to specific needs and purposes of this space. The interior is a vivid combination of comfortable and inventive design, articulating several functions in a large open plan, a dining area, a place for tea, a place for siesta. Beds fold into walls, a table becomes a desk, and the hall has her written instructions for visitors – *Entrez Lentement* and the ironic *Défense de Rire*. (Fig. 1) In effect, our *in loco* research also focused on what we denominated *the semiotics of her own* through the interpretation of words spread indoors, in particular the sentences close to furniture, by calling the categories of icon, index and symbol distinguished by Pierce. The nautical map in the living room wall stencilled with the quote of Baudelaire *Invitation au Voyage* (Fig. 2) forms the centrepiece of the main room, requesting the visitor to resonate with the stay at her home. It comes into our articles' arguments that Eileen Gray's legacy is the evidence that a pure intellectual response falls short of emotion and beauty. If there are recognized common features to modernist architecture, the emancipation and impact of house E-1027 relies upon the unveiling of the realm of art, design and architecture as a privileged crossroad to access the notion of identity. Gray expressed her contribution to space´s plurality and flexibility of use by creating gender-free working and living sceneries.

1 – Department of Communication and Art & ID+, University of Aveiro
2 – Department of Civil Engineering, Aalborg University

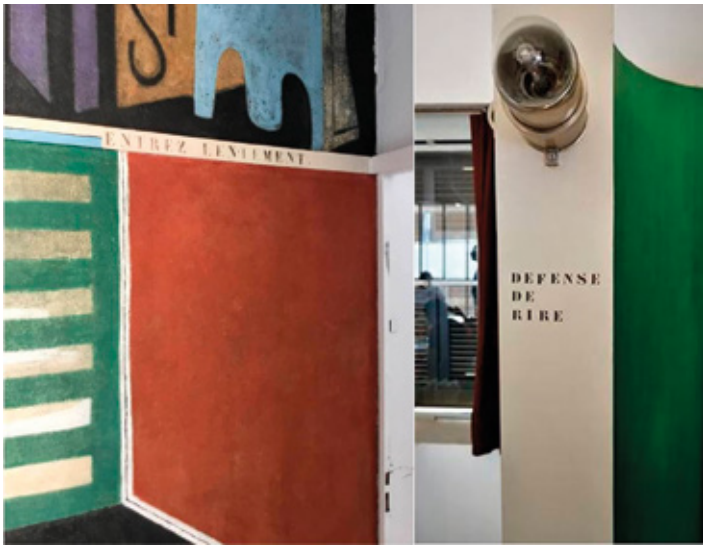


FIGURE 1
Words of Eileen Gray ©F. Pombo

FIGURE 2
Nautical Chart Collage ©A. M. Fisker

Multimodal Emotion Evaluation: A Physiological Model for Cost-Effective Emotion Classification

Gisela Pinto[1], João M. Carvalho[1], Filipa Barros[2], Sandra C. Soares[2], Armando J. Pinho[1], Susana Brás[1]

1 – Department of Electronics, Telecommunications and Informatics & IEETA, University of Aveiro
2 – Department of Education and Psychology & WJCR & CINTESIS, University of Aveiro

Emotional responses are associated with body alterations and are crucial to foster adaptive responses, well-being and survival. Emotion identification may improve peoples' emotion regulation strategies and interaction with multiple life contexts. Several studies have investigated emotion classification systems, but most of them are based on the analysis of isolated physiological signals. Understanding how informative the individual signals are and how their combination works allow to develop more cost-effective, informative, and objective systems for emotion detection, processing, and interpretation. In the present work, electrocardiogram (ECG), electromyogram (EMG) and electrodermal activity were processed in order to find a physiological model of emotions. Both unimodal and multimodal approach were used to analyze what signal, or combination of signals, may better describe an emotional response, using a sample of 55 healthy subjects. The system was evaluated considering: subject/ emotion independent, subject dependent/ emotion independent, subject/ emotion dependent conditions in a 30- and 60-seconds time frames. The method was divided in: signal preprocessing; feature extraction; classification using random forest and neural networks. Results suggest that the ECG signal is the most effective. The use of facial EMG in emotion is dependent on monitoring two (or more) muscles, allowing to identify facial expression changes by corresponding muscular contractions. Yet, the combination of all signals provides the best emotion identification performance, with all signals providing crucial information for the system. This physiological model of emotions has important research and clinical implications, by providing valuable information about the value and weight of physiological signals for emotional classification, which can critically drive effective evaluation, monitoring and intervention regarding emotional processing and regulation, considering multiple contexts.

FIGURE 1
Multimodal emotion classification workflow.

A hybrid pipeline for reconstruction and analysis of viral genomes at multi-organ level

Diogo Pratas[1,2], Mari Toppinen[2], Lari Pyöriä[2], Klaus Hedman[2,3], Antti Sajantila, Maria F Perdomo[2]

Background: Advances in sequencing technologies have enabled the characterization of multiple microbial and host genomes, opening new frontiers of knowledge while kindling novel applications and research perspectives. Among these is the investigation of the viral communities residing in the human body and their impact on health and disease. To this end, the study of samples from multiple tissues is critical, yet, the complexity of such analysis calls for a dedicated pipeline. We provide an automatic and efficient pipeline for identification, assembly, and analysis of viral genomes that combines the DNA sequence data from multiple organs. TRACESPipe relies on cooperation among 3 modalities: compression-based prediction, sequence alignment, and *de-novo* assembly. The pipeline is ultra-fast and provides, additionally, secure transmission and storage of sensitive data.

Findings: TRACESPipe performed outstandingly when tested on synthetic and *ex vivo* datasets, identifying and reconstructing all the viral genomes, including those with high levels of single-nucleotide polymorphisms (Fig.1). It also detected minimal levels of genomic variation between different organs.

Conclusions: TRACESPipe's unique ability to simultaneously process and analyze samples from different sources enables the evaluation of within-host variability. This opens up the possibility to investigate viral tissue tropism, evolution, fitness, and disease associations. Moreover, additional features such as DNA damage estimation and mitochondrial DNA reconstruction and analysis, as well as exogenous-source controls, expand the utility of this pipeline to other fields such as forensics and ancient DNA studies. TRACESPipe is released under GPLv3 and is available for free download at https://github.com/viromelab/tracespipe.

1 – Department of Electronics, Telecommunications and Informatics & IEETA, University of Aveiro
2 – Department of Virology, University of Helsinki
3 – HUSLAB, Helsinki University Hospital
4 – Department of Forensic Medicine, University of Helsinki
5 – Forensic Medicine Unit, Finnish Institute of Health and Welfare

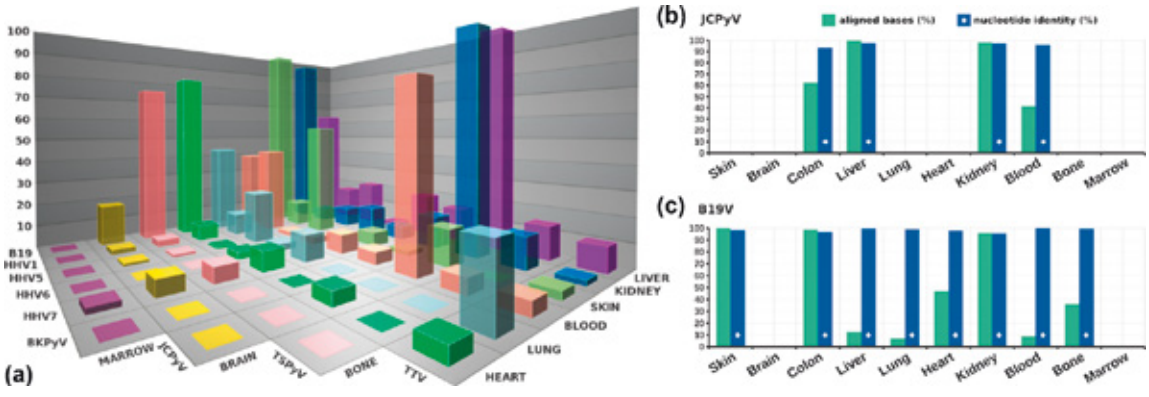


FIGURE 1
a) Breadth coverage percentage (z-axis) of the (real) mapped reads against the best reference virus for each organ sample. The plot is restricted to viral types with a minimum similarity of 10% in ≥1 of the organs. The bottom corner had shallow values, which due to space constraints were not included. (b,c) Percentage of aligned bases (green) and nucleotide identity (blue) between the best reference and reconstructed genomes of JCPyV and B19V, respectively, calculated using dnadiff. Low breadth coverages may not have corresponding aligned-data values as they may have fallen under the minimal quality or similarity thresholds. The latter was set before the run to exclude noise.

“Para Andrés Segovia”: Francisco de Lacerda’s Goivos Suite

Pedro Rodrigues[1]

1 – Department of Communication and Art & INET-md, University of Aveiro

The present work is dedicated to the Suite Goivos of the Portuguese composer Francisco de Lacerda (1869-1934), which is an output of Lacerda’s contact with Andrés Segovia in Paris during 1924. It consists of a brief Lacerda biography, considerations about musical symbolism, a contextualization of the meeting between the two musicians and the description of their lifelong continuing contact, the description of the Suite Goivos première and subsequent performances in 1924 and 1925, a proposal to re-signify the importance of the Suite in the early commissioning movement of new works demanded by Segovia to non-guitarist composers, a description of the origin and analysis of the Suite’s available manuscripts, a confrontation of musical sources and identification of innovative technical and musical symbolistic elements in this specific work. This analysis allowed an idiomatic reconfiguration of the work and allows the consequent insertion of it in the guitar repertoire. It reveals itself not only as one of the first-ever examples of symbolist literature for guitar, but also as the first work written for guitar by a Portuguese non-guitarist composer. Finally, this work seeks to contribute to the knowledge of the guitar history of the 1920s. Lacerda belongs to the first tide of composers who decided to contribute to the enrichment of the guitar repertoire joining Torroba, Turina, Pedrell, Roussel, Ponce, among so many composers who offered a simple instrument, pages of imperishable beauty. The fact that he was not one of the composers favoured by the publication of his guitar work condemned the divulgation of the Suite. Consequently, Lacerda joins, on the other hand, a talented group of composers such as Esplá, Petit, Breville or Migot who, in failing to fulfil the dedicator’s aesthetic designs, suffered an unfair public unfamiliarity.

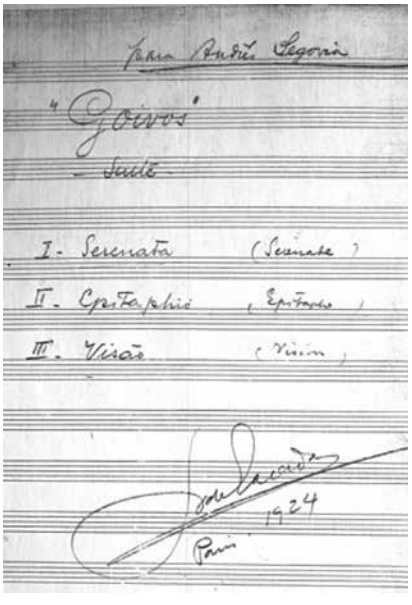
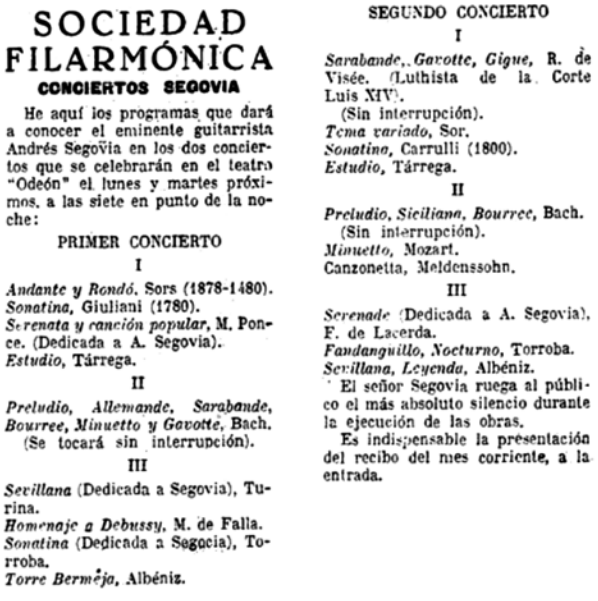


FIGURE 1
Suite Goivos Manuscript Cover MAH4740 (Source: Angra do Heroísmo Museum).



SOCIEDAD FILARMÓNICA

CONCIERTOS SEGOVIA

He aquí los programas que dará a conocer el eminente guitarrista Andrés Segovia en los dos conciertos que se celebrarán en el teatro “Odeón” el lunes y martes próximos, a las siete en punto de la noche:

PRIMER CONCIERTO

I

Andante y Rondó, Sors (1878-1480).
Sonatina, Giuliani (1780).
Serenata y canción popular, M. Ponce. (Dedicada a A. Segovia).
Estudio, Tárrega.

II

Preludio, Allemande, Sarabande, Bourree, Minuetto y Gavotte, Bach. (Se tocará sin interrupción).

III

Sevillana (Dedicada a Segovia), Turina.
Homenaje a Debussy, M. de Falla.
Sonatina (Dedicada a Segocia), Torroba.
Torre Bermeja, Albéniz.

SEGUNDO CONCIERTO

I

Sarabande, Gavotte, Gigue, R. de Visée. (Luthista de la Corte Luis XIV).
(Sin interrupción).
Tema variado, Sor.
Sonatina, Carrulli (1800).
Estudio, Tárrega.

II

Preludio, Siciliana, Bourree, Bach.
(Sin interrupción).
Minuetto, Mozart.
Canzonetta, Meldenssohn.

III

Serenade (Dedicada a A. Segovia), F. de Lacerda.
Fandanguillo, Nocturno, Torroba.
Sevillana, Leyenda, Albéniz.

El señor Segovia ruega al público el más absoluto silencio durante la ejecución de las obras.

Es indispensable la presentación del recibo del mes corriente, a la entrada.

FIGURE 2
Andrés Segovia Vigo’s concert programs of December 29th and 30th, 1924 (Source: El Pueblo Gallego 28/12/1924, p.6).

Experimental recreation practices: Restaging Constança Capdeville's musical theatre work *Don't, Juan*

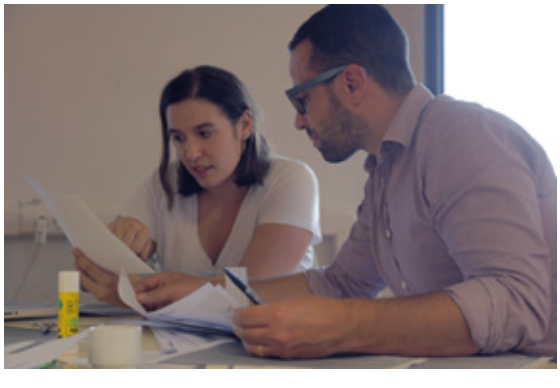
Helena Marinho[1], Mónica Chambel[1], Alfonso Benetti[1], Luís Bittencourt[1]

The recreation or re-enactment of 20th-century avant-garde musical theatre works involves a set of epistemological and methodological issues that can be addressed through practice-based procedures informed by archaeological, ethnographic and experimental perspectives. This article presents a discussion about the relevance of integrating these perspectives, departing from their application in a specific case study, an experimental musical theatre work by Constança Capdeville (1937–92), one of the most influential Portuguese composers of the second half of the 20th century, and a key figure in the creation of the staged avant-garde. The work selected for recreation was *Don't, Juan* (1985), an 'anti-opera' for an ensemble of 4 musicians, choreographic instructions for two-stage performers (mime artist and dancer), light design, and pre-recorded vocal and instrumental music. Our recreation was undertaken in 2018, as a collective project by the Xperimus Ensemble, a group of artist-researchers and independent performers, and developed tools and strategies that could be applied and support similar attempts at rediscovering performances deemed unique, generating new and unique assemblages. We proposed an interdependent model based on *immersion – dispersion – consolidation*: immersion as the interaction between archaeology and preliminary ethnography and its impact on the performers' view of the available contents; dispersion as a performative in-betweenness – chaotic yet creative – resulting from immersion and experimentation at its most basic, but also most necessary stage; and consolidation as a state of acquired knowledge that empowers and enables the performers. In this sense, the blending of archaeology with the living experience of performance might be appropriate in a reconstruction project, with methods such as performative ethnography, experimental practice and embodied knowledge through performance operating as effective tools to reshape the past into the future.

1 – Department of Communication and Art & INET-md, University of Aveiro

Article: Marinho, Helena, Mónica Chambel, Alfonso Benetti, and Luís Bittencourt. 2020. "Experimental recreation practices: Restaging Constança Capdeville's musical theatre work *Don't, Juan*." *Studies in Musical Theatre*

Funding: Research funded by the project "Experimentation in music in Portuguese culture: History, contexts and practices in the 20th and 21st centuries", co-funded by the European Union through the Operational Programme Competitiveness and Internationalization, in its ERDF component, and by national funds, through the Portuguese Foundation for Science and Technology.



Load Insensitive Power Amplifier

Cristiano Ferreira Gonçalves[1], Filipe Miguel Barradas [1], Luís Cótimos Nunes[1], Pedro Miguel Cabral[1], Telmo Reis Cunha[1], and José Carlos Pedro[1]

1 – Department of Electronics, Telecommunications and Informatics & Institute of Telecommunications, University of Aveiro

In the upcoming fifth generation (5G) networks, multiple-input multiple-output (MIMO) systems are expected to be massively deployed and each transmitter composed of hundreds of active antenna elements. This enables narrow and more precise radiation beams, which saves a huge amount of energy directing the electromagnetic power directly to the intended mobile receivers.

However, these closely spaced antenna elements suffer from mutual coupling, which is perceived by the antenna feeding amplifiers as a load impedance change, degrading the amplifiers' efficiency, output power and linearity. Thus, it is necessary to prevent the undesired coupled waves from reaching the amplifiers' output port, which, unfortunately, requires too bulky and expensive magnetic isolators, compromising the miniaturization of MIMO transmitter arrays.

Therefore, within the scope of a research project with the company Ampleon Netherlands B.V., an RF power transistor manufacturer, an automatic system that can dynamically restore the output power and efficiency of the amplifier operating under variable loading scenarios was developed. This is accomplished by dynamically adapting the supply voltage of the amplifier according to the sensed load impedance, by following a developed theoretical model.

A proof of concept amplifier was designed and implemented, for operation at 3.6 GHz and using the Doherty architecture – commonly seen in telecommunication applications due to its high average efficiency with modern telecommunication signals. The load impedance is measured using a miniaturized impedance meter that was specifically conceived for this purpose, with very low losses and the capability to generate a load-dependent signal that controls the supply voltage of the amplifier. The laboratory tests have been performed for various non-optimal loads, achieving an output power improvement of 1.4 dB (1.38x) and an average efficiency increase of more than 10 % in the worst-case scenario.

FIGURE 1
Photography of the final complete system featuring an output stage based Doherty power amplifier, a real time load impedance tracking system, and an adaptive supply voltage and input signal control.

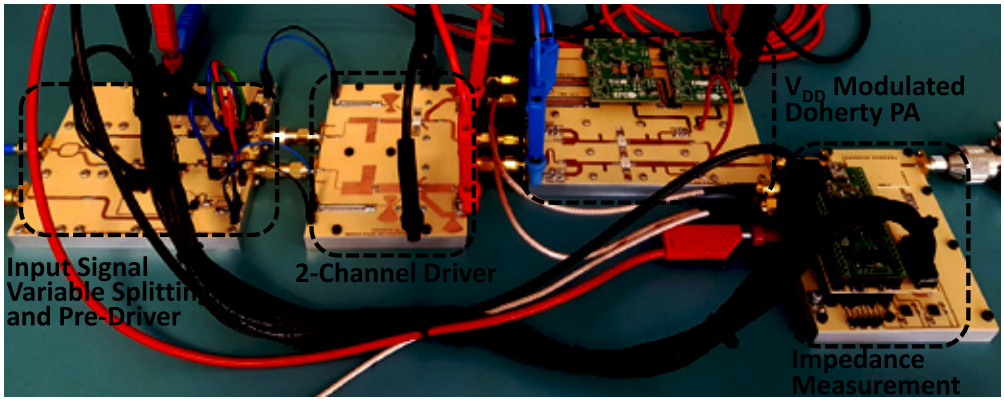
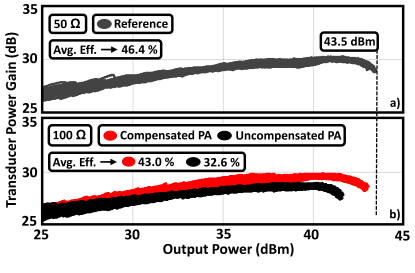


FIGURE 2
Measured gain, output power and average efficiency of the proposed system when operated with modern telecommunication signals.



Quantum random number generation from vacuum state fluctuations

Nuno A. Silva[1], Maurício Ferreira[1,2], Nelson J. Muga[1], Ana Rita Bastos[1], and Armando N. Pinto[1,3]

Random numbers are a prime requisite in many areas of science and information technologies. Standard (classical) random number generators (RNGs) only generate numbers that are statistically random. On the other hand, the output of a quantum random number generator (QRNG) is statistically random and unpredictable. This unpredictable is essential in applications such as cryptography.

The performance of a RNG is directly dependent on the quality of its entropy source. In that sense, quantum technologies offer an ideal solution to implement those devices as they exploit the inherent randomness of quantum mechanics, leading to high values of entropy. Consequently, we can explore such high-value entropy sources to implement QRNGs operating at very high bit rates. Vacuum fluctuations are an example of a quantum physical process that can be explored as an entropy source for the generation of information-theoretical randomness. Additionally, it is possible to establish a minimum value for the quantum entropy source that is not susceptible to a decrease. This is in clear opposition to the standard (classical) random number generators, where the entropy source used cannot be theoretically provable, and its value is potentially manipulated by an attacker.

The QuRUNNER (http://qurunner.av.it.pt/) and the QuantumPrime (http://quantumprime.av.it.pt) projects, running at Instituto de Telecomunicações – Aveiro, are exploiting quantum photonic effects as a source of entropy to implement a QRNG. Those projects aims to provide a practical and reliable solution to distribute random numbers and prime random numbers to the scientific community. Our implementation provides, in real-time, strings of random numbers at high bit rates (150 Mb/s), with the quality of the random numbers being complemented by performing on-demand statistical tests.

Description of figures

A hardware-based random number generator, such as the one depicted in Fig. 1, can be divided into two main blocks: (1) the entropy source; and (2) the post-processing block. The entropy source imposes limits to the performance of the random number generator since it is associated with the uncertainty of the source. In particular, we are focusing on the quadrature fluctuations of optical quantum vacuum states, which can be measured using a laser and a homodyne detector, see Fig. 1. Note that each measurement performed in the quantum state returns a random value. The post-processing block is used for randomness extraction and eliminates the contributions of the different classical noise sources, as the hardware is intrinsically imperfect.

In 2020, the research team performed a first demonstration of the random number generator at Aveiro Techdays event, see Fig.2. To the best of our knowledge, this was the first demonstration in Portugal of a true random number generator exploiting the intrinsic probabilistic nature of the quantum physics.

1 – Institute of Telecommunications, University of Aveiro
2 – Department of Physics & Institute of Telecommunications, University of Aveiro
3 – Department of Electronics, Telecommunications and Informatics & Institute of Telecommunications, University of Aveiro

FIGURE 1
Schematics of the random number generator demonstrator.

FIGURE 2
Photograph of the demonstration of a random number generator at Aveiro Techdays.

Aveiro Tech City Living Lab

Susana Sargento[1], Pedro Rito[1], Miguel Luis[2], Nuno Borges Carvalho[1], Arnaldo Oliveira[1], Christian Gomes[2], Ricardo Torres[1], Rodrigo Rosmaninho[1], Andreia Figueiredo[1], Tomás Freitas[1], Gonçalo Vítor[1], André Mourato[1], Pedro Teixeira[1]

1 – Department of Electronics, Telecommunications and Informatics Engineering & IT, University of Aveiro
2 – Institute of Telecommunications, University of Aveiro

In the framework of the EU project Aveiro STEAM City, researchers in the University of Aveiro and the Institute of Telecommunications, have been deploying an advanced, large-scale communications infrastructure, spread throughout the city of Aveiro, that will be at the service of researchers, digital industries, startups, scale-ups, R&D centers, entrepreneurs and other stakeholders interested in developing, testing or demonstrating concepts, products or services.

Supported by state-of-the-art fiber link technology (spread across 16km in the city), reconfigurable radio units, 5G-NR radio and 5G network services, the access infrastructure covers 44 strategic points in the urban area of Aveiro, in the form of smart lamp posts or wall boxes on building facades with communications technologies, edge-based computing units and sensors. The communications infrastructure integrates a communication network with radio terminals, multiprotocol, spread throughout the city, connected by fiber optics to a data processing centre, located at Institute of Telecommunications. Buses and garbage collection vehicles have also been equipped with sensors, which currently record mobility and environmental data, making a complete live map of these parameters in the city, and providing the required data for traffic monitoring and safe driving systems.

All these points combine and interconnect a set of sensors, such as mobility sensors (GPS, radars, lidars and video cameras) and environmental sensors (such as temperature, humidity, pollution) with remote data collection units throughout the city, providing enough data to support a wide range of services and applications: from IoT and internet access to citizens, to mobility and intermodal services, smart parking, assisted driving, intelligent transportation systems, environmental monitoring, distribution of information and multimedia content, emergency, safety and health services, among others.

FIGURE 1
Aveiro Tech City Living Lab Concept.

FIGURE 2
City of Aveiro connected through 16 Km of fiber (red lines) and 44 smart lamp posts and wall boxes on building facades with communication, computation and sensing equipments: “green home” buldings, “green pins” smart lamp posts, “blue pins” gateways LoRa/LoRaWAN, “pink pins” UA residences.

FIGURE 3
Smart lamp post in Cais da Fonte Nova

Recovery of technology-critical elements from secondary sources through living marine macroalgae

Bruno Henriques[1], Cláudia Lopes[1,2], Elaine Fabre[1,2,3], João Pinto[1], José Pinheiro-Torres[4], José Soares[1], Lina Carvalho[5], Marcelo Costa[1,4], Mariana Dias[1], Nicole Ferreira[1], Thainara Viana[1], Eduarda Pereira[1,5]

The shortage of critical raw materials (CRM) for key-emerging technologies (e.g. clean energy) and daily high-tech products (e.g. smartphones), and the negative environmental impact of mining, led EU to encourage joint efforts to find supply alternatives. Obtaining CRM from secondary sources, such as end-of-life products and wastewaters (urban mining) represents a huge opportunity (50 M tons/year of e-waste are generated, worth € 55 billion), yet poorly explored due to technologies constraints.

In this pioneering research, we highlighted the potential of different living macroalgae, such as the cosmopolitan *Ulva* sp. or *Gracilaria* sp. to capture, concentrate, and recover Technology-Critical Elements (TCE), particularly rare earths, from water. With bioconcentration factors up to 3500, the contents of TCE in macroalgae directly cultivated, for 3 days, in aqueous media containing the elements, reach values like those found in common apatite ores (primary TCE source). Findings emphasize macroalgae-enriched biomass as an alternative source of TCE for the technological industry. The knowledge has been proven in mono- and multi-contamination scenarios, at different water ionic strengths, in absence or co-existence with common potentially toxic elements (e.g. Hg, Pb, Ni). Besides contributing to a mining-free circular economy, and to a true independence from China exports, this macroalgae-based technology will also help to reduce carbon footprint (cultivation of 1 ton of macroalgae consumes approximately 1.5 tons of CO_2).

This work has been a successful case of collaboration between the academia (University of Aveiro) and business (company N9VE – Nature, Ocean and Value, Lda), leading to the provisional patent application nº20191000043519 of 08/28/2019 – "Processes and systems for recovery of rare earth elements and/or lithium by marine macroalgae", and more recently to the Co-development TR&D project N9ve-REE (1/6/2020-30/03/2023), approved with a total funding of € 1.1 M.

1 – Department of Chemistry & LAQV-REQUIMTE, University of Aveiro
2 – Department of Chemistry & CICECO, University of Aveiro
3 – Department of Chemistry & CESAM, University of Aveiro
4 – N9ve – Nature, Ocean, and Value, lda., Porto
5 – Central Laboratory of Analysis, University of Aveiro

FIGURE 1
Schematic representation of a circular economy of Technological-Critical Elements (TCE), based on their recovery from end-of-life products and wastewaters (urban mining) through living marine macroalgae, allowing their reuse by the manufacturing industry.

Valorization of Portuguese Natural Resources

Diana C. G. A. Pinto[1], Maria Celeste Dias[2], Mark A. M. Simões[1], Bruno M. R. Neves[3], Maria V. Faustino[1], Artur M. S. Silva[1]

1 – Department of Chemistry & LAQV-REQUIMTE, University of Aveiro
2 – Department of Life Sciences & LAQV-REQUIMTE, University of Coimbra
3 – Department of Medical Sciences & iBiMED, University of Aveiro

In the last year, some of our research involved: i) corroboration of the medicinal value of a traditionally used plant, *Genista tridentata* L., and ii) analysis of the climate-change impact on an economically important species, *Olea europea* L..

Regarding the points mentioned above, we highlight that the medicinal use of plants is growing in Portugal. However, in many cases, the validation of their health benefits is far from being established. In that context, *G. tridentata* is a case study due to its use in Portuguese traditional medicine to treat various inflammation-related health problems. In that regard, we established the plant antioxidant activity at the cellular level and significantly inhibited the LPS-triggered NO production by downregulating Nos2 gene transcription and consequently iNOS expression. Additionally, root and stem extracts decreased the LPS-induced transcription of the pro-inflammatory genes *Il1b*, *Il6*, and Ptgs2. Thus, the results support the anti-inflammatory properties attributed to *G. tridentata* preparations. Moreover, their richness in flavonoids (Fig. 1), compounds associated with anti-inflammatory properties, was proved, and among the isolated flavonoids, a unique natural compound, the 3-methoxymundulin, was isolated.

Olea europea is recognized as one of the most economically important species, and the climate change effect on its development is unknown. In that regard, we demonstrate the adjustment of the *O. europaea* antioxidant system and the modulation of its phenolic and lipophilic compounds (Fig. 2). So, it seems that the species is adapting to the climate-change and maintaining its nutritional value.

So, we contribute to confirm some of the benefits attributed to plants growing in Portugal, establishing their biological properties and their chemical profile. In doing so, we contribute to their valorization as a source of bioactive compounds or exciting ingredients to be included in the formulation of smart foods or natural medicines.

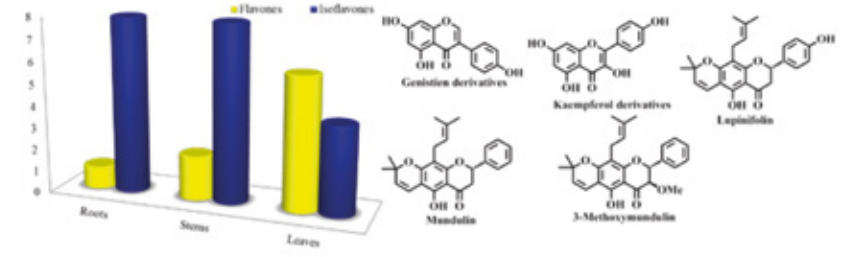


FIGURE 1
A) Flavonoid profile of the *Genista tridentata* L. ethanolic extract; B) Type of flavonoids identified and the new natural compound isolated, 3-methoxymundulin.

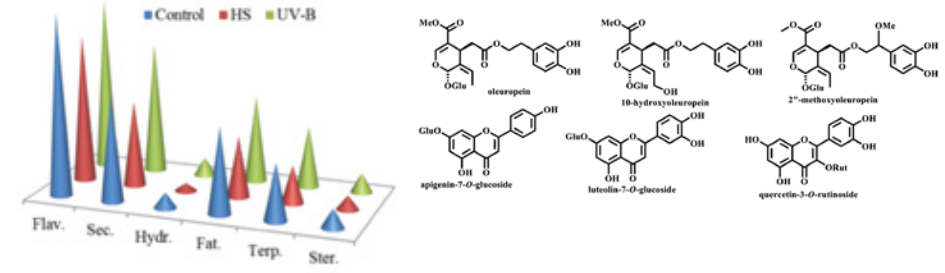


FIGURE 2
A) Lipophilic and phenolic composition of olive leaves; Flav. – flavonoids; Sec. – secoiridoids; Hydr. – hydroxycinnamic acid derivatives; Fat. – fatty acids; Terp. – terpenes; Ster. – sterols; B) Important secondary metabolites involved in *O. europea* response to stress; Glu = glucose; Rut= rutinose.X

Association of GPR30 transcript abundance in human spermatozoa with outcomes of assisted reproduction

Sara C. Pereira[1], Inês F. Esperança[2], Soraia Pinto[3], Alberto Barros[3,4,5], Mário Sousa[1,3], Marco G. Alves[1], Pedro F. Oliveira[6]

The DNA of spermatozoa is highly condensed, leading to the arrest of almost all transcription activity. Interestingly, mature spermatozoa carry into the oocyte a pool of mRNAs, which origin and function remain to be understood. Among these, the presence of G protein-coupled receptor for estrogen 30 (*GPR30*) mRNA in human spermatozoa has already been reported, although its relevance to sperm function and early embryo development remains unclear. This receptor mediates on-genomic rapid effects of estrogens. We hypothesized that *GPR30* mRNA abundance in human spermatozoa is associated with sperm quality and with the outcome of medical assisted-reproduction treatments (ART). We collected sperm samples of men from couples seeking for ART. Sperm quality was accessed by conventional methods following World Health Organization guidelines. *GPR30* mRNA abundance in spermatozoa was also accessed. Early pregnancies were evaluated by assessing serum β-human chorionic gonadotropin levels and clinical pregnancies determined by fetal heartbeat detection. Overall, our data indicate that even though *GPR30* mRNA abundance does not appear to be correlated with sperm quality, it may have an important role during pregnancy development. There is no correlation between the abundance of *GPR30* with paternal BMI, age nor with sperm quality parameters. Interestingly, we observed that higher levels of *GPR30* mRNA abundance in spermatozoa were correlated to the achievement of biochemical pregnancy and clinical pregnancy (P <0.05) by couples under treatment. Our results highlight the role of sperm RNA cargo in offspring development, suggesting that spermatozoa mRNA content can influence ART success.

1 – Department of Anatomy, UMIB, ICBAS, University of Porto
2 – Colégio Internato dos Carvalhos
3 – Centre for Reproductive Genetics Professor Alberto Barros
4 – Department of Genetics, FMUP, University of Porto
5 – i3S – Instituto de Investigação e Inovação em Saúde, Universidade do Porto
6 – Department of Chemistry & LAQV-REQUIMTE, University of Aveiro

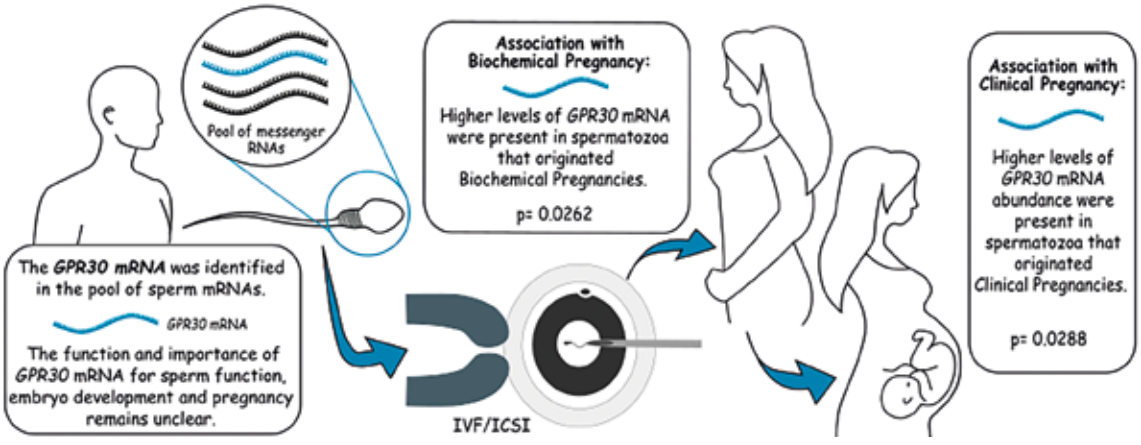


FIGURE 1

From the initial 81 couples that participated in this study, embryo transfer was performed in 60 women. 28 women were classified with a Biochemical Pregnancy, when serum βHCG concentration surpassed the value of 20 mIU/mL, 12 day after embryo transfer. Higher levels of *GPR30* transcript were present in spermatozoa that originated biochemical pregnancies (1.63 ± 0.27 arbitrary units). Accordingly, lower levels of *GPR30* transcript were found in spermatozoa whose embryos failed to implant in the uterus (1.13 ± 0.17 arbitrary units), p=0.0262. 22 biochemical pregnancies evolved to clinical pregnancies (identified by the fetal heartbeat). The spermatozoa that originated clinical pregnancies had a higher abundance of *GPR30* mRNA (1.68 ± 0.33 arbitrary unit). Spermatozoa associated with no-pregnancy (failed embryo implantation and abortions) had lower levels of *GPR30* mRNA abundance (1.13 ± 0.16 arbitrary units), p=0.0288, than the clinical pregnancy group. Statistical analysis was performed by two-tailed Student's t-teste for parametric data (confidence interval of 95%). Values of *P<0.05 were considered as statistically significant. Values are represented as mean ± SEM.

Light Steel Framing construction in the southern European context: indoor thermal environment challenges

Eduardo Roque[1], Romeu Vicente [1], Ricardo Almeida[2], Vitor Ferreira[1]

1 – Department of Civil Engineering & RISCO, University of Aveiro
2 – Department of Civil Engineering, Polytechnic Institute of Viseu

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, namely the masonry and reinforced concrete construction (HBM). Acknowledging the relevance of experimental studies for this matter, a long-term monitoring campaign was established. This campaign is founded on monitoring two identical experimental test cells (Fig. 1), representing the two constructive systems. The experimental campaign encloses four different set-ups: i) free-running conditions; ii) introduction of an insulation layer on the floor slab; iii) introduction of internal gains during a predefined occupancy period; and iv) measurement of the heating demand to achieve a pre-established temperature setpoint.

The comparison between the LSF and HBM test cells revealed that the indoor thermal environment of the former responds closer to the outdoor conditions, demonstrating higher indoor temperature fluctuations and more expressive maximum and minimum peak values (Fig. 2). LSF buildings have a limited capacity to store energy into the building fabric, constituting a possible drawback compared with traditional construction with a higher level of thermal inertia. Therefore, LSF buildings may be more prone to overheating during warmer months and discomfort due to overcooling during the winter.
On the other hand, the obtained results reveal significant opportunities for the LSF constructive system. In terms of energy efficiency, it was found that LSF buildings can provide sound advantages in reducing energy consumption for heating the indoor environment, if an intermittent use of the heating systems is considered. Moreover, the faster response of LSF to internal gains can be valued and contribute to improved thermal comfort.

a)

b)

c)

FIGURE 1
Experimental test cells: (a) External frontal view; (b) LSF test cell under construction; HBM test cell under construction.

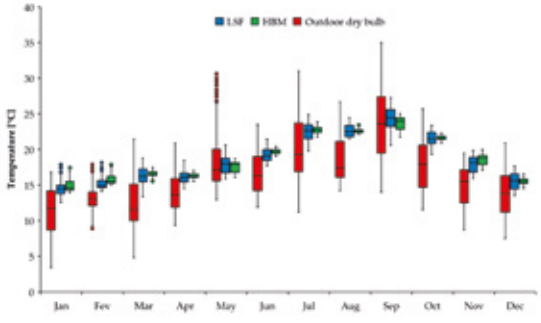


FIGURE 2
Monthly indoor air temperature profiles in both experimental test cells and outdoor dry bulb temperature profiles.

Thermally enhanced mortars towards high-end efficient buildings

Filipe Rebelo[1], António Figueiredo[1], Romeu Vicente[1], Victor M. Ferreira[1]

The European Green Deal sets ambitious measures to tackle climate change, achieving climate neutrality and a green economy in Europe by 2050, stressing the importance of research in innovative solutions. Incorporating Phase Change Materials (PCMs) into building applications is a promising strategy for achieving indoor thermal comfort while promoting energy efficiency in a sustainable way. Targeting the reduction of overheating in lightweight construction whilst promoting indoor passive thermal regulation, two microencapsulated PCMs with different operating temperature ranges were selected for the development of two innovative thermally enhanced mortars. The mortars are suitable for indoor applications in new and existing buildings, able to compensate the lack of thermal inertia of lightweight construction as well as the loss of thermal mass related to the common application of thermal insulation as the most inner surface of the envelope walls, due to architectural constraints in retrofit design.

Experimental research was performed for: microstructure evaluation; mechanical and thermal properties characterization and thermal conductivity. Additionally, real scale lightweight demonstrators were built in the scope of the SUDOKET project (INTERREG SUDOE) and continuous monitoring of indoor temperatures and energy consumption was performed.

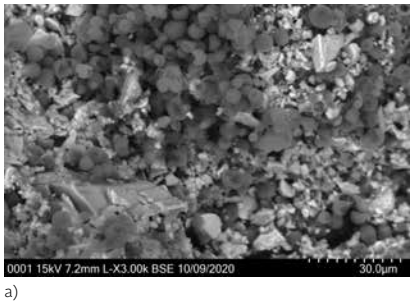
Results revealed a reduction in mechanical properties, however suitable for coating applications. Regarding thermal analysis, the monitored data from the real scale applications revealed lower temperature fluctuations for summer and shoulder seasons with indoor temperatures reduced up to 3°C and a time delay of 1.5h during the cooling period.

The developed PCM enhanced mortar increases thermal storage allowing the mortar to discharge energy for longer periods, attenuating indoor temperature fluctuations promoting energy savings, revealing high potential for this solution to be used as indoor coating towards high-end efficient buildings.

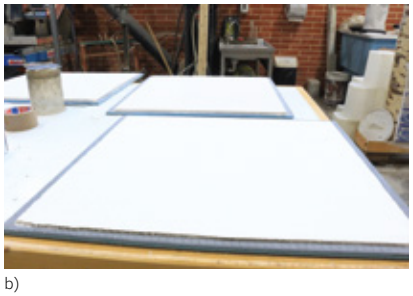
1 – Department of Civil Engineering & RISCO, University of Aveiro

FIGURE 1
Thermally enhanced mortar: (a) SEM image of the microstructure; (b) development and application of the mortar in support panel.

FIGURE 2
Thermally enhanced mortar: (a) applied as indoor coating of the real scale demonstrator; (b) thermal conductivity evaluation in the hot box setup.



a)



b)

a)

b)

Design of mechanical heterogeneous specimens using topology optimization

Bruno Barroqueiro[1,2], António Andrade-Campos[2], João Dias de Oliveira[2], Robertt Valente[2]

1 – Active Space Technologies, Actividades Aeroespaciais S.A.
2 – Department of Mechanical Engineering & TEMA, University of Aveiro

Nowadays, the development and design of new parts require an increasing knowledge of the materials' behaviour. Additionally, for the current sophisticated numerical modeling tools, accurate material characterization is critical for the correct calibration of their constitutive models. The constitutive behaviour of a material can be characterized via macroscopic mechanical tests. However, the full material characterization is expensive due to a large number of required tests. Therefore, there is a need to reduce the number of tests by increasing (quantitatively and qualitatively) the information available on a single test. To this end, heterogeneous strain field specimens can provide an answer. In the scope of this work, an innovative numerical methodology to design heterogeneous specimens using Topology Optimization (TO) is presented, together with its formulation and implementation. Numerous designs are presented and assessed through a performance indicator that evaluates the uniformity of the equivalent stress maps and the presence of various stress states (tension, compression and shear) in the specimen. Finally, the most adequate design is redrawn, analyzed and evaluated in an elastoplasticity framework. Validation of the test is also made by comparison.

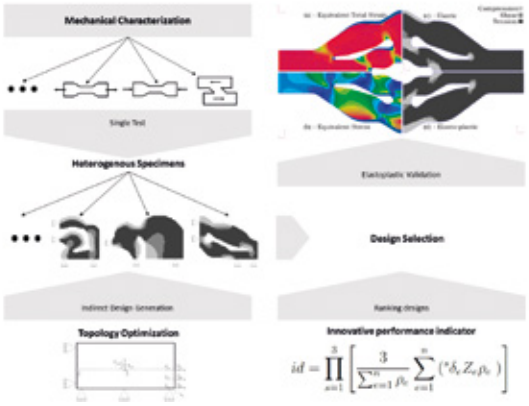


FIGURE 1
A systematic methodology for designing heterogeneous specimens has its foundations on mechanisms synthesis theory, and uses an indicator to estimate their heterogeneity performance. The proposed design, when subject to a tensile loading, is seen to be capable of providing an interesting diversity of stress states when extended to elastoplasticity and is capable replacing several classical mechanical tests to characterize the material's behavior.

3D Reduced Graphene Oxide Scaffolds with a Combinatorial Fibrous-Porous Architecture for Neural Tissue Engineering

André F. Girão[1,2], Joana Sousa[1], Ana Domínguez-Bajo[2], Ankor González-Mayorga[3], Igor Bdikin[1], Eulalia Pujades-Otero[4], Nieves Casañ-Pastor[4], María Jesús Hortigüela[1], Gonzalo Otero-Irurueta[1], António Completo[1], María Concepción Serrano[2], Paula A.A.P. Marques[1]

Graphene and its based materials will almost certainly integrate the next generation of neural regenerative therapies due to their remarkable proficiency to (1) work as building blocks for constructing bioactive tissue engineering scaffolds; (2) directly influence the response of both neurons and glia; (3) facilitate the delivery of drugs; and (4) boost the recording and propagation of neuronal signals.

Thus, in this study (*ACS Appl. Mater. Interfaces 2020, 12, 35, 38962–38975*), we present a 3D graphene-based scaffold able to efficiently promote the development of complex neuronal circuits *in vitro* by supporting the accommodation and infiltration of embryonic neural progenitor cells within a porous system, while enhancing the outgrowth of neurites via nanofibrous cues. Briefly, the fabrication of the scaffold relied on the manipulation of the attractive/repulsive interactions generated between the negatively charged reduced graphene oxide nanosheets and the positively charged electrospun nanofibres, leading to the formation of a hydrogel like structure suitable for rearranging a 3D fibrous-porous architecture after lyophilization. Importantly, by varying the chemical composition of the nanofibres, it was possible to adjust key features of the final construct such as its mechanical compliance, pore size distribution and structural integrity. This feasible customization could be decisive to adapt the therapeutic potential of the scaffold to the properties of the targeted neural microenvironment (*e.g.* spinal cord). Indeed, preliminary results concerning scaffold biocompatibility showed its notable capacity to guarantee high cell viability up to 14 days in culture, during which these neural progenitors preferentially differentiated into neurons able to establish highly interconnected networks.

Based on these reported findings, the research team is currently projecting *in vivo* investigations aiming to injured spinal cord regeneration.

1 – Department of Mechanical Engineering & TEMA, University of Aveiro
2 – Instituto de Ciencia de Materiales de Madrid (ICMM), Consejo Superior de Investigaciones Científicas (CSIC), Spain
3 – Laboratory of Interfaces for Neural Repair, Hospital Nacional de Parapléjicos, SESCAM, Spain
4 – Instituto de Ciencia de Materiales de Barcelona (ICMAB), CSIC, Spain

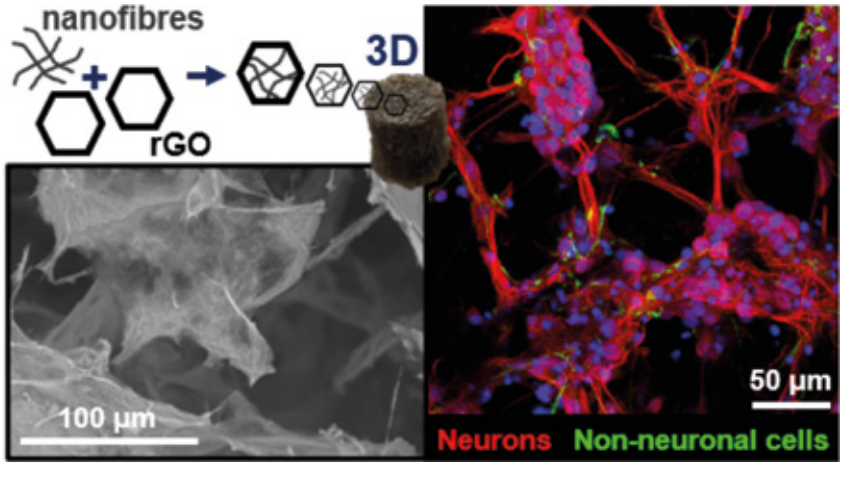


FIGURE 1
Representative scanning electron microscopy image of the 3D fibrous-porous scaffold (bottom left). Neural progenitor cells differentiation on the 3D scaffold after 14 days in culture (right): Neuronal cells labeled for MAP-2 (red), non-neuronal cells including glial cells labeled for vimentin (green) and cell nuclei labeled with DAPI (blue).

Driving aggressiveness in hybrid electric vehicles: Assessing the impact of driving volatility on emission rates

Paulo Fernandes[1], Ricardo Tomás[1], Elisabete Ferreira[1], Behnam Bahmankhah[1], Margarida Coelho[1]

1 – Department of Mechanical Engineering & TEMA, University of Aveiro

Hybrid electric vehicles (HEV) have demonstrated energy benefits to road traffic networks, but a deeper understanding the correlation of driving volatility with their energy use and pollutant emissions is rather rare. This paper introduces an approach based on driver volatility measured by vehicle acceleration and vehicular jerk (first derivative of the acceleration) to estimate HEV emissions rates. Dynamic emission models represented by nine driving behaviors associated with vehicular jerk classification and considering the on/off state of the internal combustion engine (ICE) are proposed. To assess real-world emission performance, data were collected from one vehicle using a portable emissions measurement system.

Results indicated that proposed models using engine speed as input were good predictors of carbon dioxide and particulate matter (R^2 ranged from 0.72 to 0.96, depending on the pollutant and vehicular jerk type) for both internal combustion engine on/off states. However, the predicted emissions of nitrogen oxides resulted in values of R^2 lower than 0.57, mostly due in part to the proportion of measured concentrations lower than the instrument detection limit (~47%). Driving volatility-based models accurately characterized measured carbon dioxide (with 1–16% of measured value) and yielded lower relative mean square errors than the traditional vehicle specific power modal approach.

These results suggest that vehicular jerk classification can be useful to reduce instantaneous emission impacts during different driving regimes. For instance, these models can be integrated into electronic car units to provide feedback about emission rates associated with volatile driving and into warning systems that could detect/prevent unsafe maneuvers. These classifications would allow for better energy efficiency and eco-efficient driving behavior controls for automated vehicles.

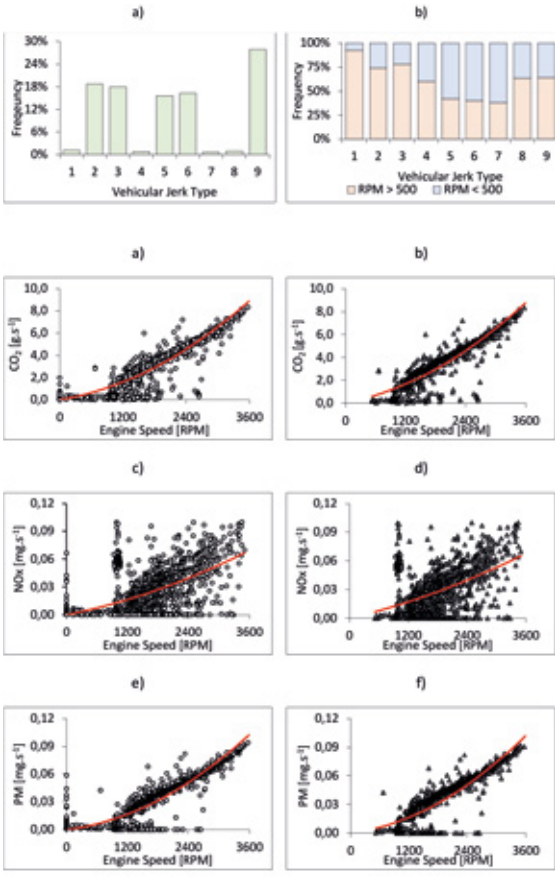


FIGURE 1
(upper) Time distribution by vehicular jerk type using the training dataset: a) percentage of time using all ICE on/off data (on – RPM above 500, off – RPM below 500); and b) percentage of time using separated ICE on/off data. (bottom) Speed counter map for vehicular jerk type 9 (cruise speed): a) RPM versus CO_2 with ICE on/off data; b) RPM versus CO_2 with ICE on data; c) RPM versus NOx with ICE on/off data; d) RPM versus NOx with ICE on data; e) RPM versus PM with ICE on/off data; and f) RPM versus PM with ICE on data.

Giving meaning to the social world in autism spectrum disorders: Olfaction as a missing piece of the puzzle?

Filipa Barros[1], Sandra C. Soares[1]

Human olfaction constitutes a valuable mean to communicate and obtain information about the opportunities and threats present in the environment. Olfactory cues can influence how we think, feel, and behave in an effortless and subliminal way, and have been suggested to play a significant role in social communication. For instance, the chemosignals present in human body odor can communicate crucial information about their sender, such as the emotional state, which has been suggested to modulate social interaction. Moreover, odors interact with information from other senses to provide a better understanding and response to social demands. The role of olfaction in visual processing has been particularly explored, by showing that both social and non-social odors influence face perception and emotional processing, for instance. Notwithstanding the role of olfaction in how we make sense of the world, this sensory system is still underexplored, even in conditions where social cognition is altered – as it is the case of Autism Spectrum Disorder (ASD). This neurodevelopmental condition is characterized by atypical social interaction and communication, as well as by restricted and repetitive patterns of behavior and interests. Importantly, decreased social attention, atypical face processing and difficulties in emotional processing have been reported across the spectrum. However, these difficulties have been explored in a unimodal perspective, mainly considering the visual system. Since olfaction can be an important mean to provide socioemotional information, it could be a potential mitigator of social and emotional difficulties in ASD. Yet, studies underlying olfactory processing in ASD are still scarce and inconsistent. In this work, we reviewed and discussed the role of olfaction in social cognition, and how studying this sensory system may be relevant for ASD, especially considering the observed difficulties in sensory and social processing, as well as in social behavior.

1 – Department of Education and Psychology & WJCR & CINTESIS, University of Aveiro

FIGURE 1
Example of the experimental setting of a task with social visual and olfactory stimuli. While the participant is exposed to an olfactory stimulus, facial emotion expressions are presented, one at a time. The objective is to understand if an olfactory cue facilitates the processing of visual social stimuli (e.g., observed through an increase in response speed of emotional categorization).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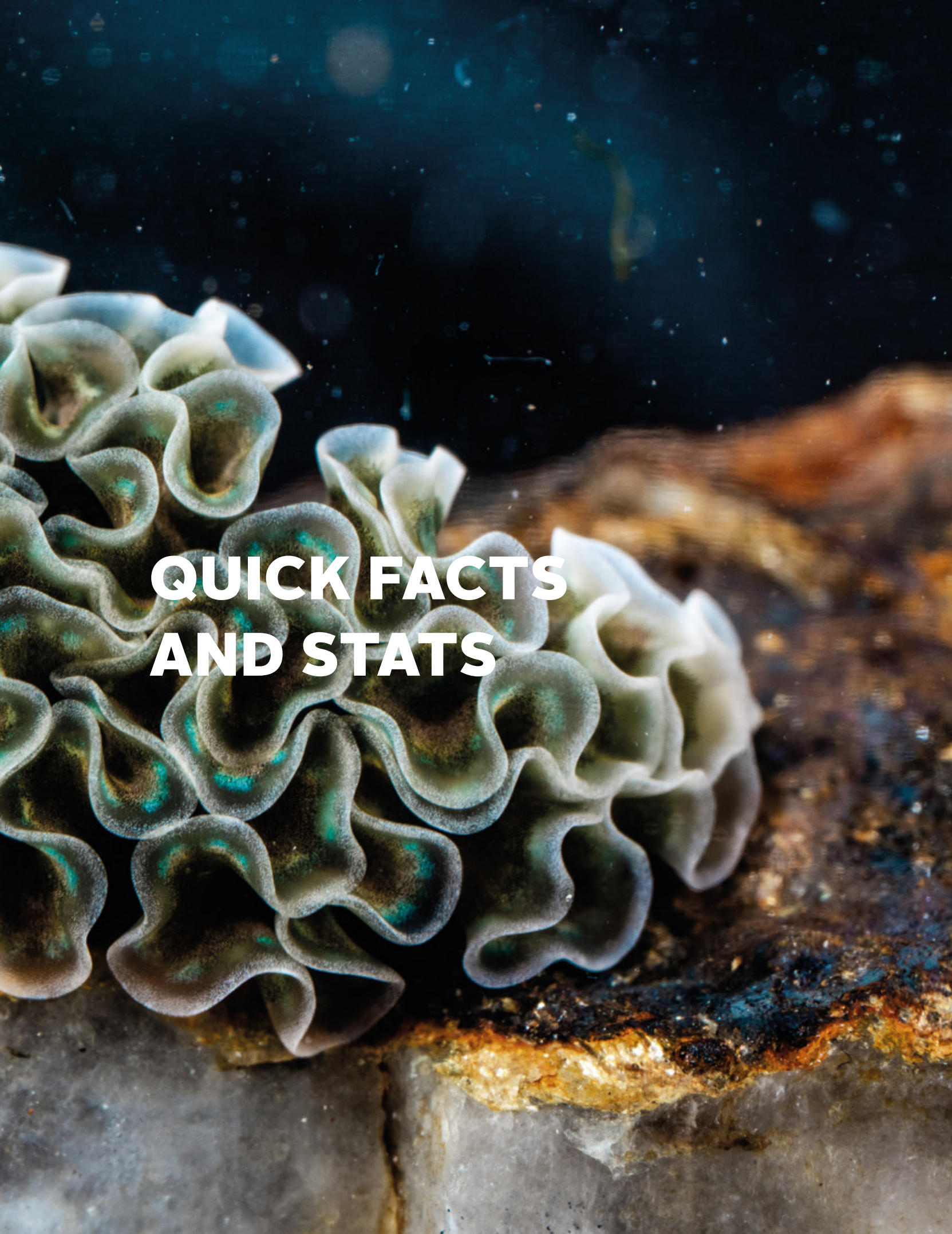


QUICK FACTS AND STATS

People

FACULTY BY DEPARTMENT

	FACULTY (FTE)			
	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
UNIVERSITY	**2019**	**2020**		
Department of Biology	32,50	31,10	41%	
Department of Chemistry	44,30	43,90	44%	4%
Department of Civil Engineering	16,45	16,55	27%	
Department of Communication and Art	74,60	85,50	28%	6%
Department of Economics, Management, Industrial Engineering and Tourism	53,05	52,15	65%	4%
Department of Education and Psychology	38,95	39,85	64%	3%
Department of Electronics, Telecommunications and Informatics	77,00	77,20	8%	
Department of Environment and Planning	13,00	15,00	67%	
Department of Geosciences	14,30	14,30	42%	
Department of Languages and Cultures	44,30	46,65	63%	20%
Department of Materials Engineering and Ceramics	15,00	14,00	50%	
Department of Mathematics	56,30	57,80	48%	7%
Department of Mechanical Engineering	29,60	31,10	14%	
Department of Medical Sciences	22,50	24,35	61%	5%
Department of Physics	46,00	49,00	18%	6%
Department of Social Sciences, Policy and Planning	19,00	19,60	33%	
POLYTECHNIC SCHOOLS				
Águeda School of Technology and Management	60,65	60,75	46%	0%
Aveiro Institute of Accounting and Administration	70,70	76,00	54%	0%
School of Design, Management and Production Technologies of Aveiro North	32,10	31,60	34%	0%
School of Health Sciences	54,15	51,50	58%	0%
TOTAL	**814,45**	**837,90**	**42%**	**3%**

RESEARCHERS BY DEPARTMENT

	RESEARCHERS (FTE)			
	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
UNIVERSITY	**2019**	**2020**		
Department of Biology	116,00	114,00	68%	13%
Department of Chemistry	145,00	132,00	67%	12%
Department of Civil Engineering	7,00	8,00	38%	13%
Department of Communication and Art	17,00	16,00	56%	25%
Department of Economics, Management, Industrial Engineering and Tourism	3,00	3,00	67%	33%
Department of Education and Psychology	18,00	18,00	94%	6%
Department of Electronics, Telecommunications and Informatics	21,00	14,00	50%	7%
Department of Environment and Planning	49,00	42,00	67%	21%
Department of Geosciences	10,00	10,00	70%	20%
Department of Languages and Cultures	1,00	1,00	100%	0%
Department of Health Sciences	21,00	40,00	40%	33%
Department of Materials Engineering and Ceramics	41,00	9,00	33%	22%
Department of Mathematics	9,00	31,00	39%	42%
Department of Mechanical Engineering	30,00	22,00	77%	5%
Department of Physics	74,00	64,00	30%	39%
Department of Social Sciences, Policy and Planning	21,00	14,00	79%	14%
POLYTECHNIC SCHOOLS				
Aveiro Institute of Accounting and Administration		1,00		
School of Design, Management and Production Technologies of Aveiro North	1,00	1,00	100%	
School of Health Sciences	2,00	2,00	100%	
TOTAL	**586,00**	**542,00**	**59%**	**20%**

STAFF BY CATEGORY

		FTE		
	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
UNIVERSITY	**2019**	**2020**		
Full Professors	56,10	59,15	14%	3%
Assotiated Professors	123,60	147,00	39%	3%
Assistant Professors	380,80	373,95	43%	5%
Lecturer	19,25	24,00	15%	2%
Other Teaching Staff	17,10	13,95	85%	24%
Researchers	428,00	431,00	61%	16%
Post-Doctoral Students	158,00	111,00	52%	35%
POLYTECHNIC SCHOOLS				
Coordinator Professors	18,90	27,90	57%	
Adjunt Professors	145,25	146,60	49%	
Lecturer	53,45	45,35	46%	
TOTAL	**1400,45**	**1379,90**	**49%**	**10%**

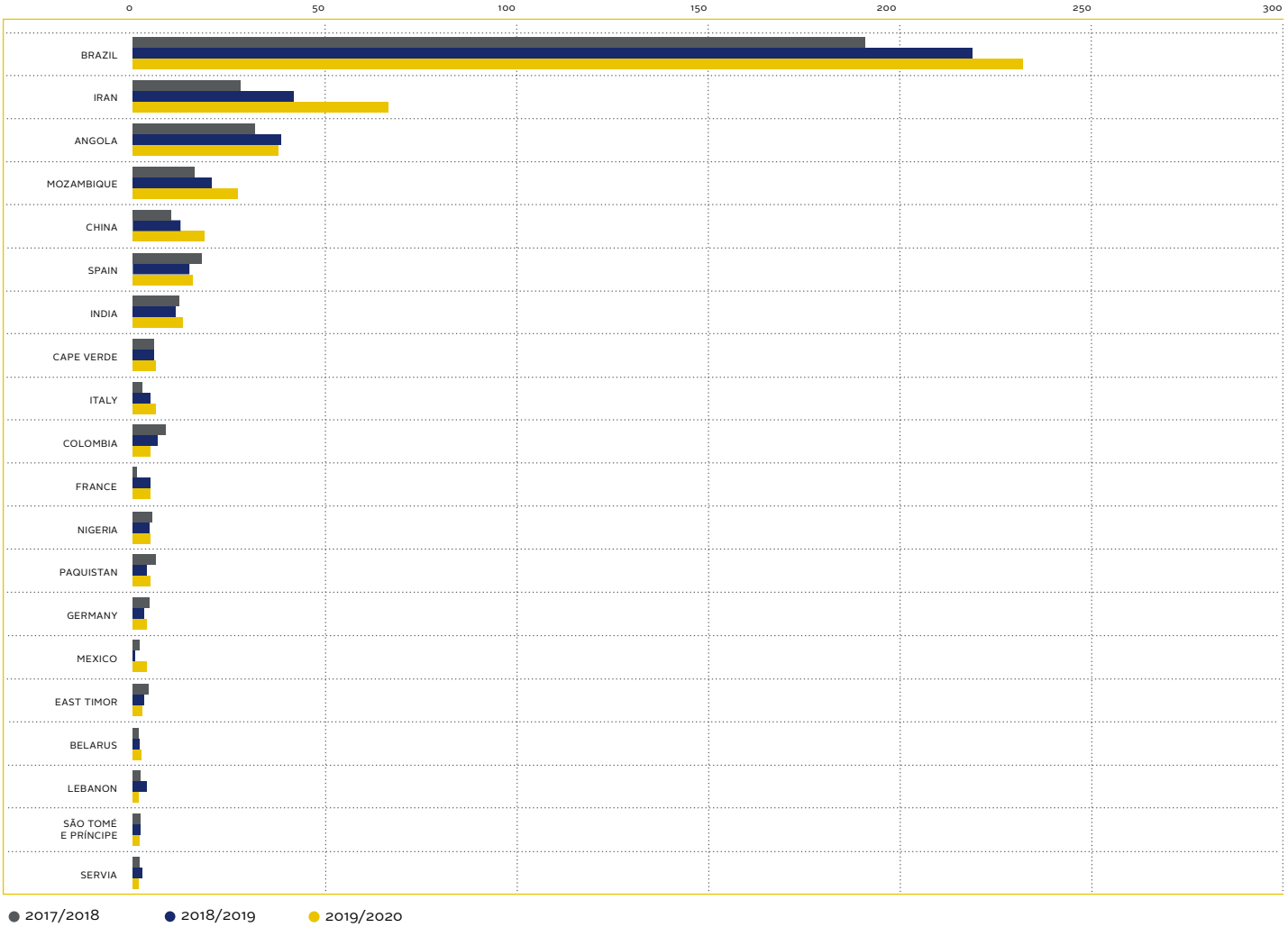
PHD STUDENTS BY DEPARTMENT

	PHD STUDENTS				
	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS	PERCENTAGE OF NEW STUDENTS
DEPARTMENT	2018/2019	2019/2020			
Department of Biology	139	135	70%	24%	19%
Department of Chemistry	225	236	66%	14%	33%
Department of Civil Engineering	57	67	22%	46%	36%
Department of Communication and Art	244	233	48%	52%	20%
Department of Economics, Management, Industrial Engineering and Tourism	251	313	47%	47%	35%
Department of Education and Psychology	257	279	73%	41%	28%
Department of Electronics, Telecommunications and Informatics	119	154	23%	29%	29%
Department of Environment and Planning	73	95	40%	51%	45%
Department of Geosciences	11	15	20%	60%	73%
Department of Languages and Cultures	59	85	60%	49%	48%
Department of Materials Engineering and Ceramics	81	95	42%	29%	27%
Department of Mathematics	30	36	44%	36%	44%
Department of Mechanical Engineering	67	86	35%	21%	33%
Department of Medical Sciences	60	84	76%	5%	36%
Department of Physics	93	119	39%	21%	29%
Department of Social Sciences, Policy and Planning	85	93	40%	53%	31%
TOTAL*	**1.621**	**1.840**	**52%**	**36%**	**31%**

* The students of joint doctoral studies are considered in each participating department. Therefore, the sum of the students by department is superior to the total.

Top 20

FOREIGN PHD STUDENTS BY NATIONALITY



FOREIGN PHD STUDENTS BY CONTINENT

- Africa (17%)
- Asia (23%)
- America (49%)
- Europe (11%)

MSC THESES

- Arts and Humanities (18%)
- Health Sciences (8%)
- Engineering and Technology (34%)
- Life Sciences (19%)
- Social Sciences (18%)
- Exact Sciences (3%)

PHD THESES

- Arts and Humanities (11%)
- Health Sciences (5%)
- Engineering and Technology (27%)
- Life Sciences (17%)
- Social Sciences (26%)
- Exact Sciences (14%)

SCI Papers

TOP 10 SUBJECT AREAS FOR PAPERS PUBLISHED IN 2020	RECORD COUNT	% OF 2,634
Environmental Sciences	364	13.819 %
Materials Science Multidisciplinary	291	11.048 %
Chemistry Multidisciplinary	233	8.846 %
Chemistry Physical	158	5.998 %
Physics Applied	156	5.923 %
Engineering Electrical Electronic	137	5.201 %
Biochemistry Molecular Biology	124	4.708 %
Energy Fuels	102	3.872 %
Engineering Chemical	93	3.531 %
Food Science Technology	81	3.075 %

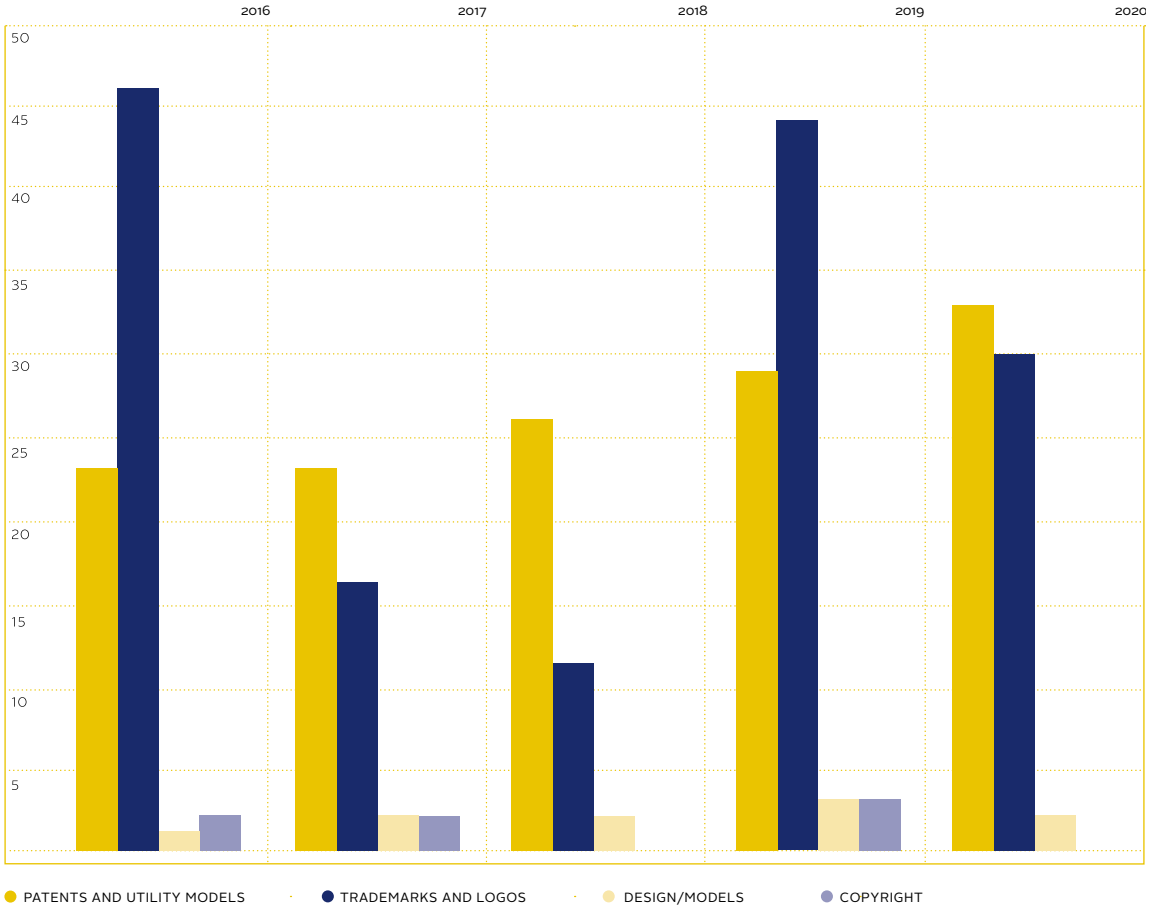
* Data retrieved from ISI Web of Knowledge SM (Thomson Reuters) on 20th May 2021

TOP 10 CITED PAPERS	TOTAL NR CITATIONS (2016-2020)
Klionsky, DJ; Abdelmohsen, K; Abe, A; Abedin, MJ; Abeliovich, H; Arozena, AA; et al (2016). Guidelines for the use and interpretation of assays for monitoring autophagy (3rd edition). AUTOPHAGY, 12: 1-222	2.947
Kunkle, BW; Grenier-Boley, B; Sims, R; Bis, JC; Damotte, V; Naj, AC; et al (2019). Genetic meta-analysis of diagnosed Alzheimer's disease identifies new risk loci and implicates A beta, tau, immunity and lipid processing. NATURE GENETICS, 51: 414-430	329
Sims, R; van der Lee, SJ; Naj, AC; Bellenguez, C; Badarinarayan, N; Jakobsdottir, J; et al (2017). Rare coding variants in PLCG2, ABI3, and TREM2 implicate microglial-mediated innate immunity in Alzheimer's disease. NATURE GENETICS, 49: 1373-1384	291
Ventura, SPM.; e Silva, FA; Quental, MV; Mondal, D; Freire, MG; Coutinho, JAP (2017). Ionic-Liquid-Mediated Extraction and Separation Processes for Bioactive Compounds: Past, Present, and Future Trends. CHEMICAL REVIEWS, 117: 6984-7052	280
da Costa, JP; Santos, PSM; Duarte, AC; Rocha-Santos, T (2016). (Nano)plastics in the environment - Sources, fates and effects. SCIENCE OF THE TOTAL ENVIRONMENT, 566: 15-26	239
de Sa, LC; Oliveira, M; Ribeiro, F; Rocha, TL; Futter, MN (2018). Studies of the effects of microplastics on aquatic organisms: What do we know and where should we focus our efforts in the future?. SCIENCE OF THE TOTAL ENVIRONMENT, 645: 1029-1039	217
Maes, J; Liquete, C; Teller, A; Erhard, M; Paracchini, ML; Barredo, JI; et al (2016). An indicator framework for assessing ecosystem services in support of the EU Biodiversity Strategy to 2020. ECOSYSTEM SERVICES, 17: 14-23	210
Wainwright, M; Maisch, T; Nonell, S; Plaetzer, K; Almeida, A; Tegos, GP; Hamblin, MR (2017). Photoantimicrobials-are we afraid of the light?. LANCET INFECTIOUS DISEASES, 17: E49-E55	204
Rocha, J; Brites, CDS; Carlos, LD (2016). Lanthanide Organic Framework Luminescent Thermometers. CHEMISTRY-A EUROPEAN JOURNAL, 22: 14782-14795	201
Justino, CIL; Comes, AR; Freitas, AC; Duarte, AC; Rocha-Santos, TAP (2017). Graphene based sensors and biosensors. TRAC-TRENDS IN ANALYTICAL CHEMISTRY, 91: 53-66	184

Intellectual Property

INTELLECTUAL PROPERTY RIGHTS REGISTRATION

	2016	2017	2018	2019	2020
Patents and Utility Models	23	23	26	29	33
Trademarks and Logos	46	16	11	44	30
Design/Models	1	2	2	3	2
Copyright	2	2	0	3	0



International Projects

EU-FUNDED PROJECTS STARTED IN 2020

HORIZON 2020 – PROJECTS COORDINATED BY UA	ACRONYM	PROJECT COORDINATOR
Unveiling CO_2 chemisorption mechanisms in solid adsorbents via surface-enhanced ex(in)-situ NMR	NMR4CO2	LUÍS MAFRA
Extracellular matrix derived products from human placenta to engineer bone microtissues for in vitro disease models	AMNIOGEL	JOÃO MANO
Purification of specific IgY antibodies to fight antibiotic-resistant pathogens	PureIgY	MARA FREIRE

HORIZON 2020 – MONOBENEFICIARY PROJECT	ACRONYM	PROJECT COORDINATOR
Thermoelectric oxide composites: design through controlled interactions	TEOsINTE	ANDREI KAVALEUSKI

HORIZON 2020	ACRONYM	LOCAL COORDINATOR
European Plate Observing System Sustainability Phase	EPOS SP	FERNANDO ROCHA
Evaluation, control and Mitigation of the EnviRonmental impacts of shipping Emissions	EMERGE	ALEXANDRA MONTEIRO
Innovative physical/virtual sensor platform for battery cell	INSTABAT	JOÃO LEMOS PINTO
Sustainable Plant Protection Transition: A Global Health Approach	SPRINT	NELSON ABRANTES
Towards effective radiation protection based on improved scientific evidence and social considerations – focus on radon and NORM	RadoNorm	JOANA LOURENÇO
Towards harmonised test methods for nanomaterials	NanoHarmony	SUSANA LOUREIRO

ERASMUS + - PROJECTS COORDINATED BY UA	ACRONYM	PROJECT COORDINATOR
Creativity in HEIs through a game design approach	UNLOCK	MARTA FERREIRA DIAS
Gamers4Nature: Reconnecting with Nature Through the Creation of Digital Games	G4N: Mission earth	PEDRO BEÇA
Overcoming Gender Bias in Career Opportunities	O'Bias Your Future	MARLENE AMORIM
Rethinking Music Performance in European Higher Education Music Institutions	REACT	JORGE SALGADO CORREIA
Towards HEInnovate 2.0: from assessment to action	THEI2.0	BÁRBARA GABRIEL

ERASMUS + EUROPEAN UNIVERSITIES	ACRONYM	LOCAL COORDINATOR
ECIU University		ARTUR SILVA

ERASMUS +	ACRONYM	LOCAL COORDINATOR
BOT-Learning as a modern teaching method of GEN Z	MELES - BOT	TATIANA CORDEIRO
Co-education in Green		MARTA FERREIRA DIAS
Digital Citizenship Education and Foreign Language Learning	DiCE.Lang	ANA RAQUEL SIMÕES
Ecological sustainability in project management	Think twice!	MARLENE AMORIM
Educational Development for Sustainable and Eco-friendly Cork Composites in Aerospace Applications	ECOCORK	FÁBIO FERNANDES
Fair Food for a Smart Life	FairFood	CLÁUDIA SANTOS
Master's programme in Family Business Management	FAB	MARTA FERREIRA DIAS
Mixed Reality on Universal Design's Secret Service	Mr.UD	MARIA ELISABETH PEREIRA
My Career Our Game	MCOG	MARLENE AMORIM
Social Enterprise through Virtual Environments and Remote Entrepreneurship	SEVERE	TERESA FRANQUEIRA
Stregthening Research and Innovation in Young Universities for Regional Development in Latin America	I2LATAM	ARTUR SILVA
Structured indicators to manage HEI Quality System	SMART-QUAL	M JOÃO PIRES DA ROSA
Vocational education and training for speech and language therapists and parents for rehabilitation of children with cochlear implant on how to speak	VOICE	ISABEL COSTA
COMPASS: enhancing motivation of older learners to learn through cultural materials	COMPASS	MARLENE AMORIM

RESEARCH FUND FOR COAL AND STEEL (RFCS) – PROJECT COORDINATED BY UA	ACRONYM	PROJECT COORDINATOR
Toward virtual forming and design: Thermomechanical characterization of advanced high strength steels through full-field measurements and a single designed test	VForm-xSteels	GIL ANDRADE CAMPOS

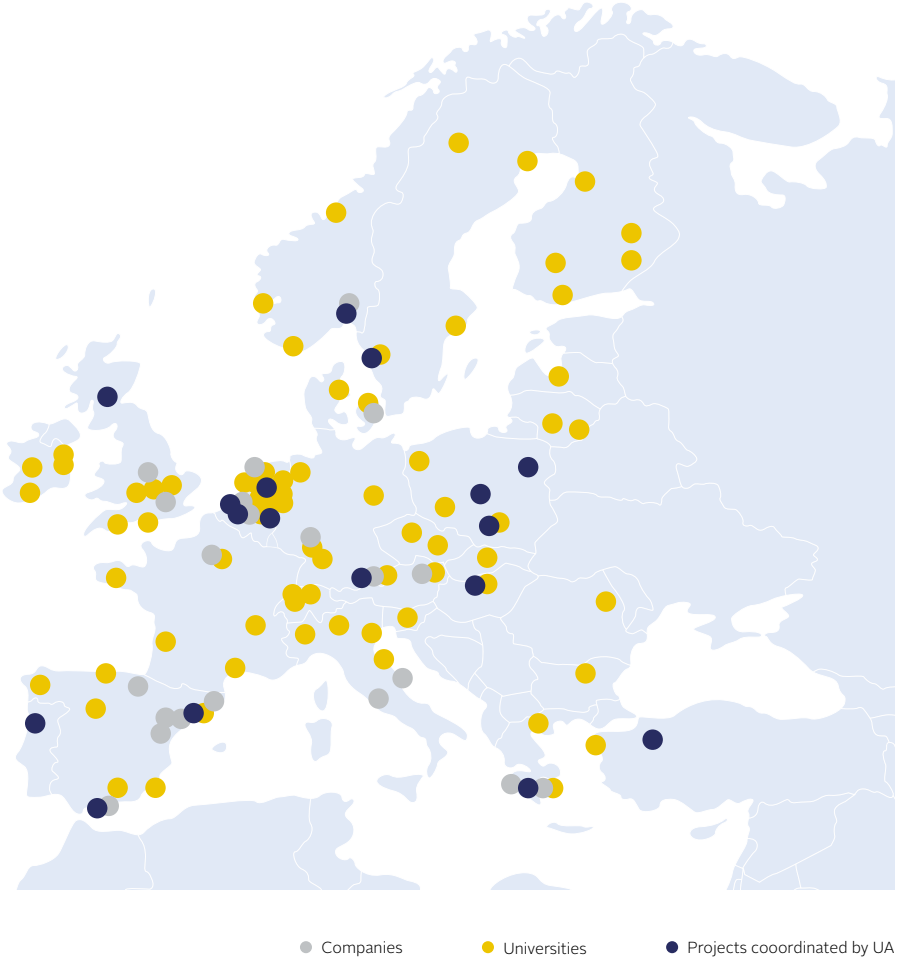
COST ACTION – PROJECT COORDINATED BY UA	ACRONYM	PROJECT COORDINATOR
Pan-European Network in Lipidomics and EpiLipidomics	EPILIPID	ROSÁRIO DOMINGUES

INTERREG SUDOE	ACRONYM	LOCAL COORDINATOR
Economia Circular e Turismo Sustentável em Destinos do espaço SUDOE	GREENTOUR	ANA CLÁUDIA DIAS
Laboratorios de Inteligencia Colectiva y Tecnología Sociosanitaria para combatir el aislamiento y la soledad de las personas mayores	MOAI LABS	ÓSCAR RIBEIRO

LIFE +	ACRONYM	LOCAL COORDINATOR
Eggshell: a potential raw material for CEramic wall tiles	LIFE EggshellenCE	PAULA SEABRA

NETWORK OF EUROPEAN UNIVERSITIES AND COMPANIES WORKING WITH UA IN EU PROJECTS STARTED IN 2020

AUSTRIA AAL APH-ALARM
BELGIUM BLUECC, I2LATAM, NanoHarmony, RadoNorm, SMART-G, SMART-QUAL, SPRINT, VForm-xSteels
BULGARIA MELES - BOT
CZECH REPUBLIC RadoNorm, SPRINT
DENMARK SPRINT, UNLOCK
ESTONIA Mr.UD
FINLAND EMERGE, MELES - BOT, RadoNorm, REACT, THEI2.0
FRANCE INSTABAT, RadoNorm, SEVERE, SPRINT, VForm-xSteels
GERMANY DiCE.Lang, INSTABAT, MELES - BOT, NanoHarmony, RadoNorm, SPRINT, UNLOCK
GREECE EMERGE, FAB, O'Bias Your Future, SMART-G, Think twice!
HUNGARY AAL APH-ALARM
IRELAND DiCE.Lang, SPRINT, THEI2.0
ITALY EMERGE, FairFood, SMART-QUAL, SPRINT, Think twice!, VForm-xSteels
LATVIA DiCE.Lang
LITHUANIA ECOCORK, UNLOCK
NORWAY BLUECC, EPOS SP, RadoNorm, REACT
POLAND ECOCORK, EPOS SP, MELES – BOT, Mr.UD, SMART-G
ROMANIA VOICE
SLOVAKIA RadoNorm
SLOVENIA SPRINT
SPAIN COMPASS, FairFood, GREENTOUR, I2LATAM, LIFE EggshellenCE, MOAI LABS, O'Bias Your Future, RadoNorm, SEVERE, SMART-QUAL, SPRINT, UNLOCK
SWEDEN BLUECC, EMERGE, EPOS SP, RadoNorm, REACT
SWITZERLAND EPOS SP, RadoNorm, SPRINT
THE NETHERLANDS EPOS SP, RadoNorm, SPRINT, UNLOCK, VForm-xSteels, VOICE
TURKEY ECOCORK
UNITED KINGDOM SEVERE, Think twice!, EMERGE, I2LATAM, NanoHarmony, RadoNorm, SPRINT



Budget

TOTAL BUDGET OF THE PROJECTS STARTED IN 2020 BY RESEARCH CENTRE AND FUNDING AGENCY*

RESEARCH CENTRE	EUROPEAN UNION	FOUNDATION FOR SCIENCE AND TECHNOLOGY	INNOVATION AGENCY	OTHERS INTERNATIONAL	OTHERS NATIONAL	2019	2020
CESAM	1.163.750	1.018.378	646.393	29.790	1.187.992	2.604.109	4.046.303
CIC.DIGITAL						319.241	
CICECO	2.711.386	184.975	5.627.630			2.891.147	8.523.991
CIDMA	44.780	77.981					122.761
CIDTFF	62.520					351.525	62.520
CINTESIS	181.489					723.750	181.489
CIPES	18.724					38.737	18.724
DIGIMEDIA	61.500		178.545				240.045
GEOBIOTEC	30.869	74.300					105.169
GOVCOPP	548.353					401.371	548.353
I3N	344.669	42.500	535.825	46.000		413.087	968.993
IBIMED		30.000	385.547		220.000	489.606	635.547
ID+	69.257						69.257
IEETA		190.934	1.477.235			366.250	1.668.169
INET-MD	43.664					6.651	43.664
IT	1.661.661	1.783.545	4.460.118	946.420		4.632.971	8.851.744
NOT INTEGRATED**	76.176	43.578	3.722.372	1.386.542	3.162.812	2.417.128	8.391.480
QOPNA						228.225	
REQUIMTE			1.155.543				1.155.543
RISCO		239.764		96.853		133.150	336.617
TEMA	728.260		1.021.496		61.644	1.421.929	1.838.860
TOTAL	**7.747.057**	**3.685.956**	**19.210.704**	**2.505.605**	**37.781.769**	17.438.877	37.809.229

* Contracts with industry and multiannual budget of research centres not included
** Projects not integrated in research centers

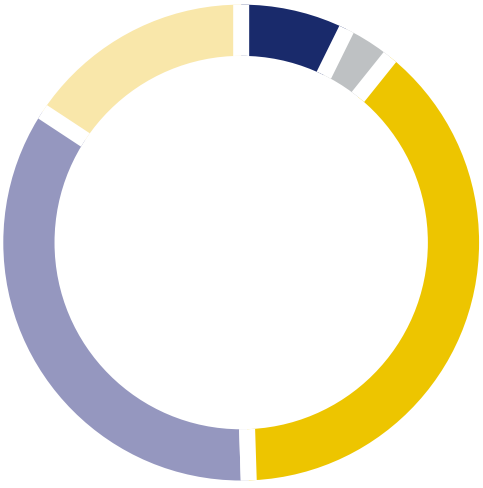
in euros

APPROVED BUDGET UNDER EU-FUNDED PROJECTS*

EUROPEAN PROGRAMMES	2019	2020
H2020 – ERC CoG		1.999.793
H2020 – ERC PoC		300.000
H2020 -FETOPEN	1.114.705	
H2020 – ITN-ETN	777.224	
H2020 – RISE	437.000	540.500
H2020 – IF		147.815
H2020 – NMBP	323.375	54.668
H2020 – ICT	504.000	1.067.109
H2020 – ECSEL	240.000	
H2020 – SC1	780.605	
H2020 – RUR	299.014	
H2020 – INFRAIA	34.000	
H2020 – INFRADEV		30.869
H2020 – SFS		537.971
H2020 – LC-BAT		344.669
H2020 – MG		405.316
H2020 – BBI-JTI	299.925	
H2020 – NFRP		11.250
COST ACTION	186.346	54.540
RFCS		514.558
erasmus +	1.335.116	1.231.423
life+	268.020	263.778
INTERREG SUDOE		242.798
INTERREG ATLANTIC AREA	170.128	
INTERREG EUROPE	307.224	
INTERREG ESPAÑA-PORTUGAL	110.000	
EMFF	191.043	
TOTAL	**7.377.724**	**7.747.057**

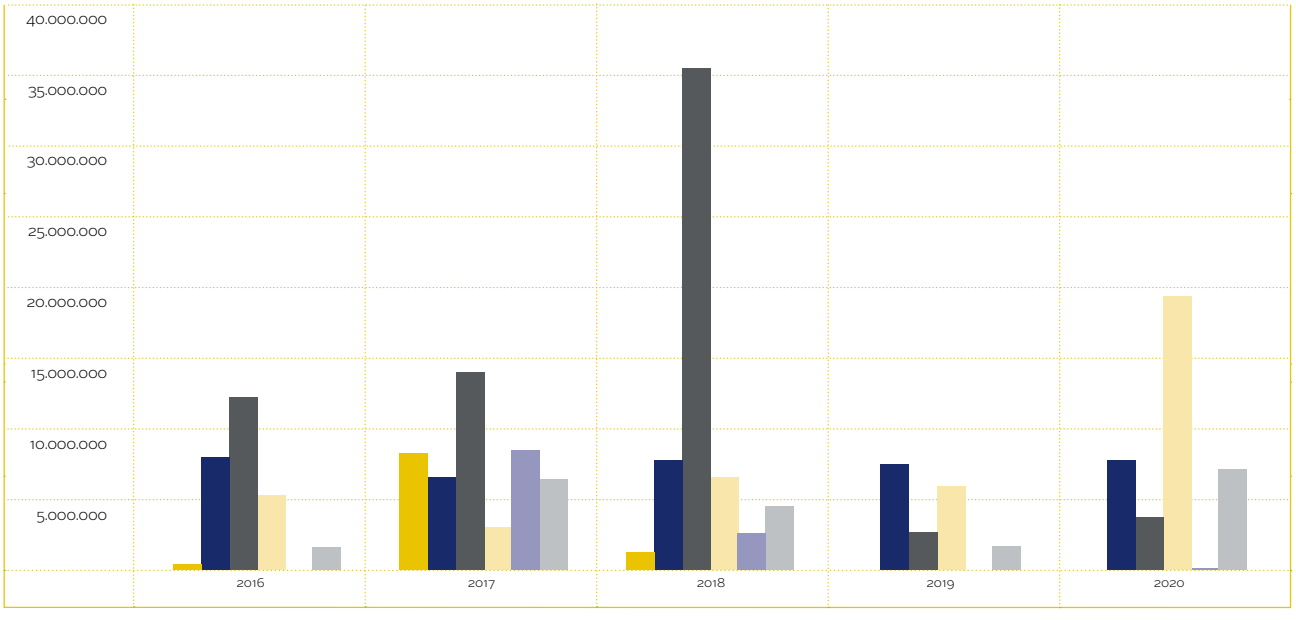
* in euros

DISTRIBUTION OF RECEIVED FUNDS BY FUNDING AGENCY*



* Contracts with industry and multiannual budget of research centres not included

TOTAL BUDGET OF THE PROJECTS STARTED PER YEAR AND FUNDING AGENCY*



* Contracts with industry and multiannual budget of research centres not included


7

RESEARCH SUPPORT

Research Support Office

The University of Aveiro has achieved a significant position amongst higher education institutions in Portugal, being one of the top universities regarding the quality of its infrastructures, the strength of its research and the excellence of its staff.

During 2020, 574 research and technology transfer projects have been active in the University of Aveiro, of which 44 funded by ERASMUS+ and 43 by Horizon 2020. The projects are developed in the scope of the 20 research centres hosted by the university, acting in different scientific areas. All research centres have been classified as very good or excellent in the last evaluation process promoted by the National Foundation for Science and Technology.

The Research Support Office works as the main contact point and interface unit for Research Units and Associated Laboratories, researchers, funding agencies and other relevant stakeholders in the research and innovation ecosystem. The office provides high quality advisory, administrative, technical, contracting and financial services to researchers of all disciplines at the University, assisting the research community in its efforts to secure external funding (national, regional, international; grants, awards and prizes).

Formed by skilled officers with mixed backgrounds, the main action lines of the office are 1) Research development; 2) Strategy support and implementation and 3) Research grants and contracts. The office thus covers most of the life-cycle of the projects, working closely with faculty and researchers in order to identify funding opportunities and bring together interdisciplinary groups of researchers with common interests; disseminating funding information, partnership opportunities, as well as training events; supporting and co-ordinating strategic activities/ projects; providing advice on costing and submission of grant applications as well as University's authorization for submission; supporting negotiations of contract terms with funders and collaboration agreements with other HEIs and public sector collaborators and formalizing of contracts and agreements.

RESEARCH SUPPORT OFFICE
https://www.ua.pt/en/research-support
research@ua.pt

universidade de aveiro theoria poiesis praxis

www.ua.pt

Universidade de Aveiro
Campus Universitário de Santiago
3810 - 193 Aveiro
Portugal

tel (+351) 234 370 200
email research@ua.pt