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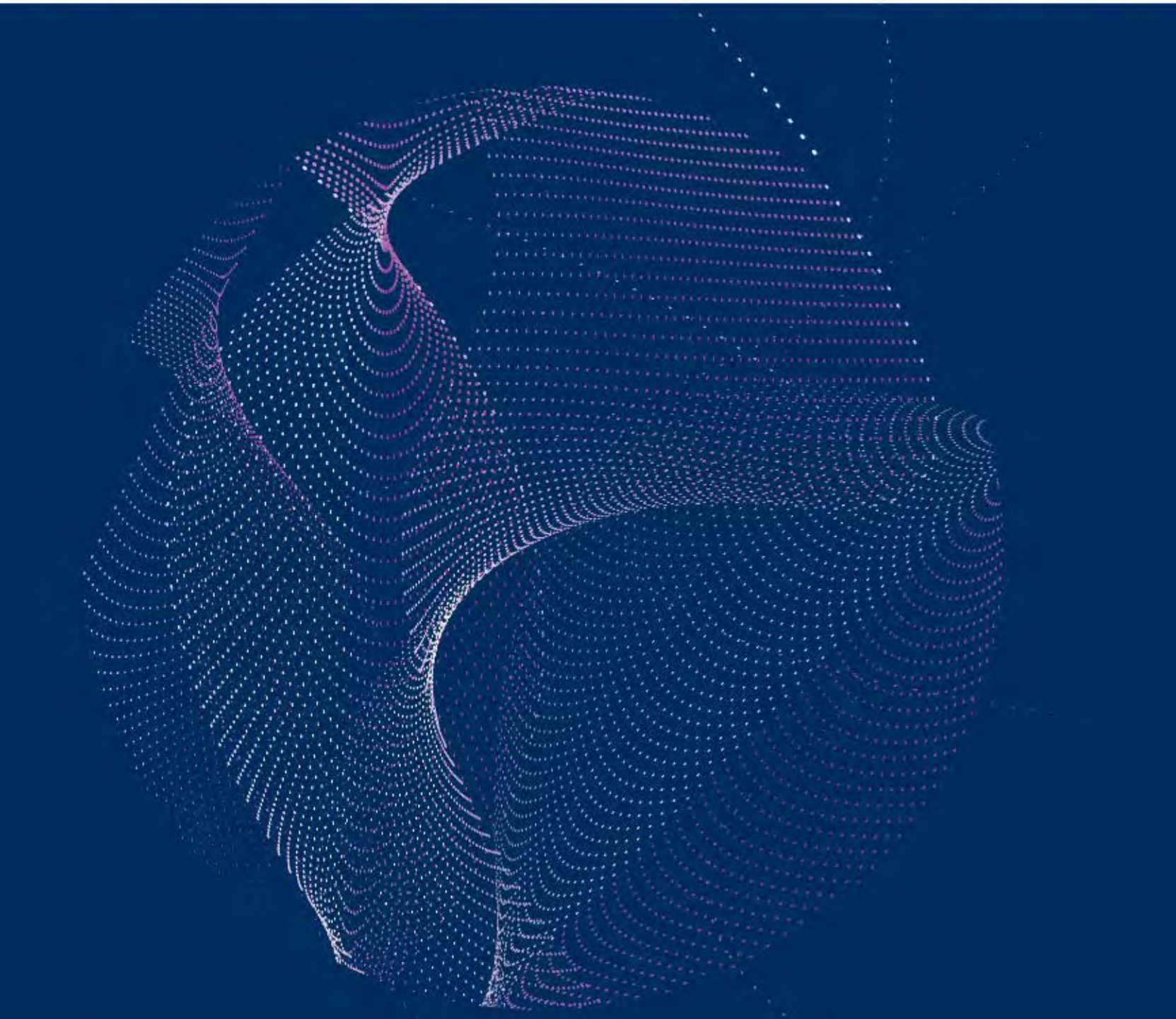

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PAULO JORGE FERREIRA
University of Aveiro

A WORD FROM THE RECTOR

50 Years of Research at UAveiro: Challenges for the future

The research university emerged at the beginning of the 19th century with von Humboldt and the University of Berlin. It was an ivory tower, where people created and thought in isolation. Gradually, the gap between research universities and society has decreased, and with it the capacity of academia to promote innovation, economic growth and social development.

Today, in the midst of the knowledge economy, the centrality of universities in science and knowledge, and their impact on the economy and development of countries, is unequivocal.

Universidade de Aveiro was born focused on the creation, transmission and application of knowledge. The importance of research and participation in solving regional problems was prominent in its founding vision.

After five decades, the creation of knowledge remains at the heart of our activity. We are among the 100 best in the world for research, and in some parameters, far above any other national institution, and far above institutions with significantly greater resources.

The future is full of complex challenges, but also unlimited possibilities. We can safely say, without false modesty, that what we have achieved in these five decades instills confidence and optimism for the future.

ARTUR SILVA
University of Aveiro

MESSAGE FROM THE VICE-RECTOR

We are celebrating fifty years of this successful journey we call UA. And so it seems appropriate to look back while keeping our sights on the journey ahead, the unchartered paths, the thrills of knowledge creation and use, and the challenges we jointly face.

It all started not long before the April revolution, and way before Portugal entered the European Economic Community. Then, hard borders were the norm, mobility was reduced, information was difficult to access, resources were scarce, personal computer power was yet to be unlocked, and the World Wide Web was still fifteen years away.

The very first doctorates were awarded by UA in 1980. By comparison, more than two hundred were awarded in the last academic year alone, one third of which concerning non-Portuguese students from 22 nationalities. A structural change resulting from nation-wide scholarship programs, such as Ciência and Praxis XXI, internal UA scholarship programs, and the attractiveness of the research, teaching, and ambiance at UA.

This structural change also impacted the teaching and research careers. To create the UA, staff with different paths were brought in. Their doctorates have been obtained at other national, and often international, universities, and they were simultaneously the teachers and the only researchers at UA. And this was so for quite a few years.

Today, teaching and research careers coexist at UA, and it is possible to make the whole career at a single institution. Additionally, the pace of transformation greatly accelerated in recent years, fostered by national scientific employment policies. The number of researchers at UA multiplied by 4.5 in the last decade, reaching 521 researchers in 2023, and representing 19% of UA's total staff.

Needless to say, the management of such a diverse workforce requires a different approach, encompassing the attraction of outstanding professionals, the retention of the best, the recognition and valorization of individual performance, and improved group dynamics.

All of this may be extended to the research support staff. Along this line, there has been a reinforcement of support structures in recent years, both at central and research unit level. Furthermore, a Science & Technology manager career has been created, now counting with circa thirty staff dedicated solely to science management activities.

In terms of organization, the structures are now larger and more diverse. From small research groups with limited funding, back in the 1970's, to a core of more than twenty research units at UA, some with the statute of Associated Laboratory. All of them were rated Excellent or Very Good in the last national research assessment exercise. It is worth noting that a new national research assessment exercise is now ongoing, and while expecting fair recognition of the work that has been done, we will make good use of this renewed external look to project the future.

Late generation equipment and infrastructure is another fundamental pillar for doing research at the forefront, requiring a significant and recurring investment. This remains a pressing need that should be addressed at the system level. Unfortunately, there are no regular scientific reequipment programs. Furthermore, the aperiodic nature, in practice, of the evaluation of the research units, the reliance on short-term project-based funding, and the shortcomings in the funding of universities, makes it a hard-to-solve problem. This is further compounded by the increasing demand for adequate data infrastructures, compatible with high information volume, access and computational speed, appropriate safeguards, data protection, and cybersecurity.

In this context, we have been relying on strategic choices, attraction of funds, and allocation of centralized funds coupled with internal cost sharing mechanisms. As an example, we were able to inaugurate the Portuguese Centre for Nuclear Magnetic Resonance in our main campus, just a couple of months ago.

We must make the most of what we have at our disposal, by perfectioning management, increasing sharing, and complementing investments within different research units and different projects. Collaboration, articulation, and coordination are paramount. And this will be the focus for the Research Institute, a new structure foreseen under the revision of UA's statutes.

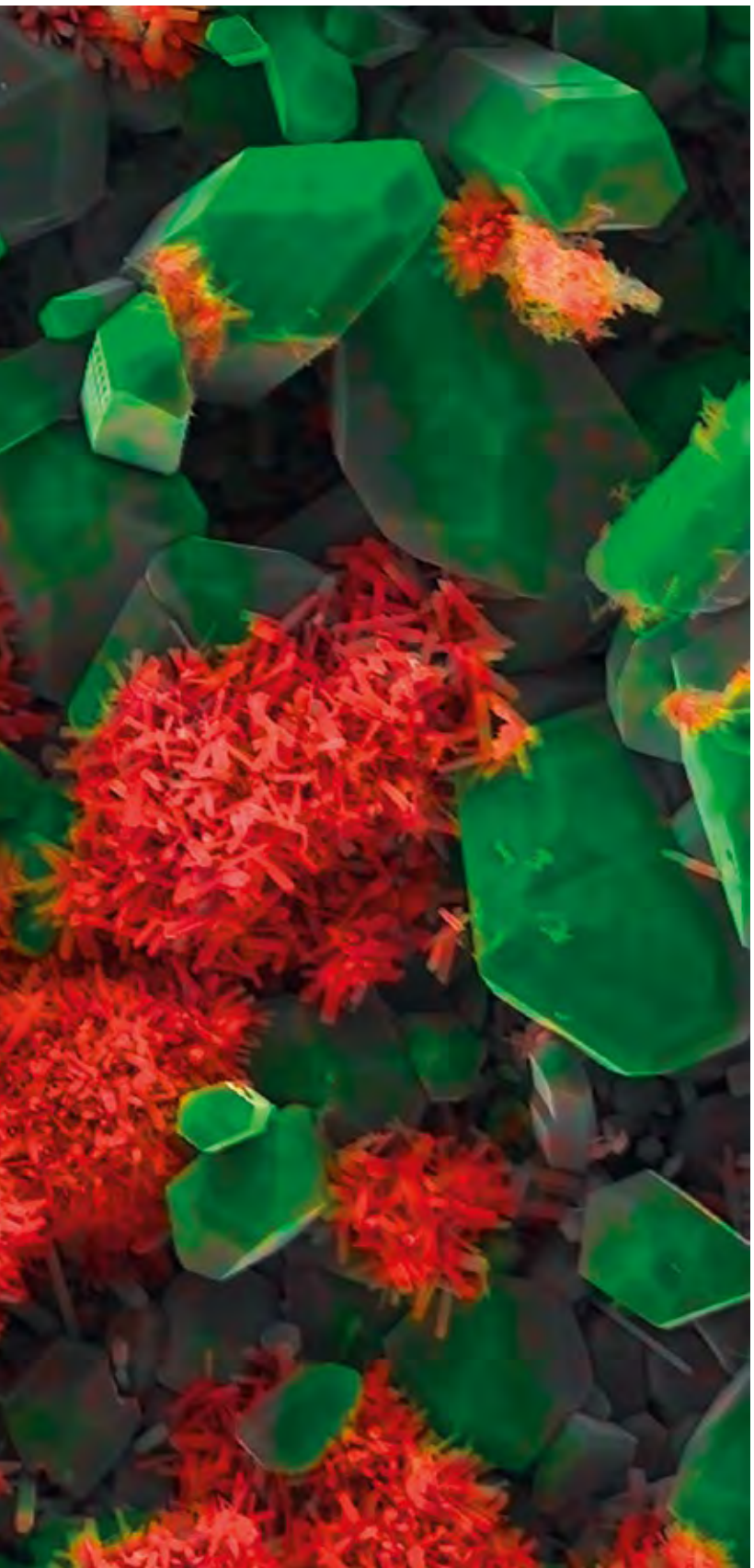
Many other aspects of this first half century could have been highlighted, such as the creation of a yearly award to the best researcher, promoting recognition and enhancing visibility, the hosting of grants from the European Research Council and ERA-Chair, the coordination of European projects, highly cited researchers, or the recent UA contributions under the Recovery and Resilience Plan.

All this has been made possible through the dedication of so many throughout this past half century. Much more will be made possible by those at UA today, and by those that will join the journey.


3


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, all classified as very good or excellent in the last evaluation process promoted by the National Foundation for Science and Technology.

Eight of these research units were labelled or integrate Associated Laboratories.

As in 31st December 2023

Research centres

CESAM
Centre for Environmental and Marine Studies

We aim to develop multidisciplinary and transdisciplinary international research of excellence, supporting the private and not-for-profit sectors and contributing to the development of public policies, nationally and internationally.

Unit coordinator: Amadeu Soares

Research areas: we address the challenges posed by global change, with a focus on social, economic and environmental sustainability, and cover the continuum of atmosphere, land, oceans, and aquatic resources, from the catchment to the deep sea. We are guided by the One-Health Approach, caring for the future.

www.cesam-la.pt

CLLC
Centre for Languages, Literatures and Cultures

CLLC focuses on the Humanities with an inter and transdisciplinary orientation. In recent years, it has explored themes of literary, cultural and linguistic mobility, and more recently, its objective is to develop research in the area of Critical Digital Humanities.

Unit coordinator: Maria Manuel Baptista

Research areas: Literary Studies (Between Texts Group – literary hermeneutics); Cultural Studies (Between Cultures Group – Cultural hermeneutics); Language Sciences (Between Languages Group – Variation, Translation, Learning).

www.ua.pt/en/cllc

CICECO
Aveiro Institute of Materials

Its mission is to create and disseminate scientific and technological knowledge to develop, process and apply materials that will anticipate and address the challenges of a global society.

Unit coordinator: João A.P. Coutinho

Research areas: Porous Materials and Nanosystems; Photonic, Electronic and Magnetic Materials; Electrochemical Materials, Interfaces and Coatings; Renewable Materials and Circular Economy; Biomimetic, Biological and Living Materials; Virtual Materials and Artificial Intelligence.

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.

https://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 and promote skills with the potential to contribute to the education of qualified and critical citizens, and to the creation of a better world.

Unit coordinator: Maria Helena Araújo e Sá

Research areas: Policies, management and evaluation of education; Digital technologies and learning environments in education; Curriculum, didactics and literacies; Diversities, equity and inclusion in educational contexts; Sustainability of education research.

www.ua.pt/en/cidtfff

CINTESIS@RISE
Center for Health Technology and Services Research at the Associate Laboratory RISE, Health Research Network

It's a multidisciplinary research unit that includes researchers from the Department of Education and Psychology and from the School of Health Sciences.

Pole coordinator: Óscar Ribeiro

Research areas: social and behavioral gerontology, clinical gerontology and geriatrics, mental health, chronic disease management, and health care provision.

https://cintesis.eu

CIPES
Centre 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: system level policies, institutional and organisational analysis, and economic and social relevance of Higher Education.

www.cipes.pt

DigiMedia
Digital Media and Interaction

Interdisciplinary research centre focused on media innovation supported by three research pillars – Media Experience and Engagement Design; Technology-Enhanced Learning and Wellbeing; and Digital Culture and Change.

Unit coordinator: Nelson Zagalo

Research areas: Human-Computer Interaction, Interaction Design, and Media Studies

https://digimedia.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.

www.ua.pt/en/geobiotec

GOVCOPP
Governance, Competitiveness and Public Policies

GOVCOPP's research focusses on place-based policy and governance, producing knowledge that responds to the particular needs, perspectives, challenges and resources of specific contexts.

Unit coordinator: Varqá Carlos Jalali

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

https://govcopp.ua.pt

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: Bruno Jesus

Research areas: Human ageing, epigenome, non-communicable diseases, systems biomedicine, pre-clinical models of disease, clinical studies and personalized non-pharmacological interventions.

www.ua.pt/en/ibimed

ID+
Research Institute for Design, Media and Culture

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.

https://idmais.org

IEETA
Institute of Electronics and Informatics Engineering of Aveiro

IEETA aims to pioneer in data science, artificial intelligence, computing methods, human-centered computing, robotics, and other cutting-edge technologies, to make tangible impacts in the industry, enhance the quality of life, and help to address societal challenges.

Unit coordinator: José Luís Oliveira

Research areas: Computer Science, Information Processing, Intelligent Systems, Biomedical Technologies.

www.ieeta.pt

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

Transdisciplinary research on music and dance, using perspectives from a broad spectrum of musical, sound, and dance disciplinary fields, as tools both for fundamental research and for developing actions of social responsibility and artistic relevance.

Pole coordinator: Helena Marinho

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

www.inetmd.pt/index.php/en

I3N
Institute for Nanostructures, Nanomodelling and Nanofabrication

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

Pole coordinator: José Fernando Mendes

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.ua.pt/en/i3n

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.

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
Risks and Sustainability in Construction

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

Unit Coordinator: Romeu da Silva Vicente

Research areas: Assessment and mitigation of risks in the built environment, Sustainable and resilient solutions for the built environment, Built heritage safeguarding, conservation, renovation and retrofit.

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: Manufacturing Processes and Simulation, Nanomanufacturing, Bio-inspired Manufacturing, Manufacturing for Circ. Economy; Multiscale Tech. and Devices for Medicine, Environment, and Energy, Innovative Tech. for Smart and Resilient Cities; and Intelligent Systems.

www.ua.pt/en/tema

WJRC
William James Center for Research

The WJCR core mission is to advance research in distinctive fields of psychology, engage and inspire young scientists, integrate fundamental research with applications, and increase transparency and visibility in the scientific and public eyes.

Pole coordinator: Josefa N.S. Pandeirada

Research areas: Cognition, Social Cognition and Body Odors, Health, Social Development, and Social Cognitive and Applied Neuroscience.

https://williamjamescr.org

Strategic projects

DESignSX – Hydrophobic Eutectic Solvents for Tailored Metal Separation and Recycling

60 months; €1,5M

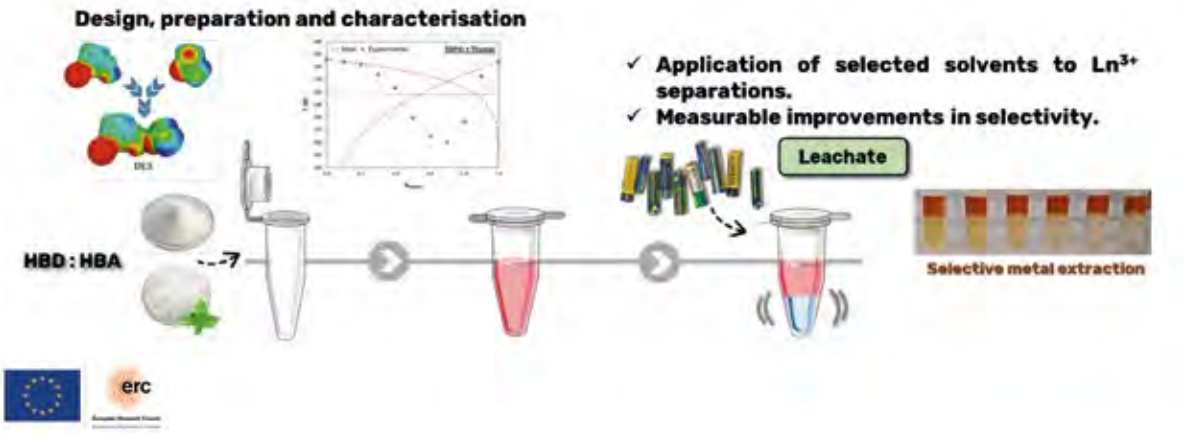
DESignSX is an European Research Council funded Starting Grant project (ERC-StG), aiming for the design, understanding, and application of alternative solvents for the separation of critical metals.

In the face of growing anthropogenic environmental pressure, societies are re-evaluating the current linear consumption model of "take-make-dispose" and shifting towards a more holistic circular economy framework. Metals are primary, yet finite, commodities, cornerstone of human history and ubiquitous in modern society, placing sustainable metallurgy at the forefront of the circular economic transition. However, the mining rates of most metals are at a historical maximum whilst the average ore grade has decreased over the last hundred years for both base and precious metals. The need to produce more from increasingly dilute and varied raw materials as lead to separation and purification processes consuming an estimated – 15% of global energy use. Conversely, electronic waste is the fastest growing global waste stream and is an important challenge due to inherent value, heterogeneity, and potential environmental impact. Sustainable metallurgy stands uniquely poised to reduce the environmental impact of existing processes whilst recovering the metal value in end-of-life devices, thereby closing the resource loop.

Over the next 5 years, DESignSX will develop novel bio-inspired hydrophobic eutectic solvents (DES) for their application to the solvent extraction separation of lanthanide cations. Despite their growing demand and geopolitical criticality, lanthanide separation remains technologically challenging due to the small monotonic variation in their properties, negatively affecting the economics of their recycling. DESignX seeks to exacerbate the steric factors defining the interactions between lanthanide and ligands, dictating the ensuing complex geometries and mutual separation selectivity, through the inclusion of complexing agents as DES components. Through careful manipulation of the DES composition, the energetic landscape of solvent may be rationally adjusted to increase the selectivity towards a given cation. Given that the separation of adjacent lanthanides occurs over dozens of extraction stages, even seemingly small increases in the separation factors yield measurable environmental and economic gains. DESignSX outcomes are expected to be transferable to other critical solvent extraction separations.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N.º 10.3030/101116461

More information
https://cordis.europa.eu/project/id/101116461



CURIOSOIL – Awakening Soil Curiosity to Catalyse Soil Literacyn

48 months; €6M (UAveiro: €1,2M)

CURIOSOIL is a four-year (2024-2028), EU co-funded project focused on enhancing soil education, aligned with the EU Mission "A Soil Deal for Europe." Led by Universidade de Aveiro (Sónia M. Rodrigues, DAO-UA), the project is constituted by a consortium of 14 partners from across Europe: Gaia Education Europe and ECOLISE in Belgium; REVOLVE in Spain; Faculty of Environmental Protection in Slovenia; Wageningen University, ISRIC – World Soil Information and the European School Heads Association in The Netherlands; Universita degli Studi di Palermo in Italy; University of Natural Resources and Life Sciences (BOKU) in Austria; Norwegian Institute of Bioeconomy Research (NIBIO) in Norway and European Science Communication Institute (ESCI) in Germany; and IUCN and Zurich University of the Arts in Switzerland.

CURIOSOIL has the overarching objective of understanding how to trigger Soil Curiosity and create connections between people and soil. The project aims to contribute for the integration of soil health into EU school curricula by 2030, fostering awareness, knowledge, and behavioural changes for a more resilient future.

The project will co-create with the education community a set of educational products, and course materials, and develop a "Soil Curiosity Kit" using multisensorial Soil Experiences to raise soil literacy and build a Soil Optimism narrative. The project will also co-create guidelines, and teacher's training programmes to integrate soil education in formal and non-formal education across the EU and to ensure a comprehensive approach to soil health among students. Using hands-on Soil Experiences CURIOSOIL will deepen public comprehension of soil dynamics, establishing a connection between individuals and soil.

By working in ten European countries CURIOSOIL is in an excellent position to provide materials and recommendations that are context specific and relevant for the national context of these countries. The geographical influence of the project will be further expanded by the work with the Communities of Practice (CoPs), contributing to engage a total of 16 EU and HE AC countries in the piloting of education materials.

CURIOSOIL will contribute to improve soil literacy in society aligned with the EU Soil Mission target to embed soil health in schools and educational curricula of all EU Member States by 2030 as well as lead to citizen, policy and practice increased knowledge and awareness to sustainably manage soil.

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N.º 101112875

More information
https://curiosoil.eu
www.linkedin.com/company/curiosoil-project/?originalSubdomain=pt
www.linkedin.com/newsletters/7192085339451142146/

LIFE SeagrassRIAwild – mariculture for ria de aveiro subtidal seagrass rewilding

84 months; €3.4 M (UAveiro: €2.1 M)

Funded by the European Commission through the LIFE Programme, it gathers a consortium of 11 European partners from 4 countries led by the University of Aveiro, under the scientific coordination of João Pedro Coelho, Assistant Researcher at DBIO/CESAM.

LIFE SeaGrassRIAwild aims at taking decisive steps to reverse the current conservation status of *Zostera marina* habitat in the Ria de Aveiro and Portugal through the co-development of cost-efficient and policy relevant NbS (Nature-based Solutions).

Subtidal seagrass beds are critically endangered at the European Atlantic Coast, and in urgent need of restoration, as stated in the forthcoming EU Nature Restoration Law. *Z. marina* is presently the most endangered seagrass species in Portugal, facing extinction if measures are not taken to assure the protection of the last remaining populations. In Ria, its presence was not recorded for 10 years, but recently resurged in small intertidal patches, making this the momentum for active restoration measures implementation.

LIFE SeagrassRIAwild proposes a paradigm shift in seagrass restoration, enabling large-scale restoration programs with negligible effects on existing natural meadows, through the development of seagrass mariculture to support the plant and seed needs for rewilding. It follows a transdisciplinary approach involving academia, authorities, management agencies, local administration, end-user associations and citizens in the co-design, prioritization and implementation of restoration actions, at a large scale and using targeted and adaptable Citizen Science initiatives and synergies with other national and EU initiatives.

LIFE SeagrassRIAwild will further explore innovative NbS to potentiate synergistic effects of seagrass conservation efforts and system management needs which, if proven effective, have the potential to become an innovative management service/product for port authorities, private marinas and management agencies. These NbS will potentiate the sustainability of the project, supported by tailor-made capacity building actions and the infrastructure legacy, which will perdure in time and be made available for national restoration programmes, with the supervision of the national competent authorities.

This project has received funding from the European Union's LIFE Programme under grant agreement N.º 101114362

More information
https://life-seagrassriawild.web.ua.pt

Co-funded by the European Union


4

SPOTLIGHT ON RESEARCH DISSEMINATION

Research Summit 2023

Under the theme "Inclusive, innovative and sustainable societies", the 2023 edition of the Research Summit has once again brought together faculty, researchers and students at the Universidade de Aveiro, strengthening networking among all, fostering sustainable research partnerships, and providing a forum for sharing of know-how and expertise.

The research community was challenged to critically reflect on the university's contribution to inclusiveness, innovation, and the way forward towards more sustainable societies, through research as well as through action, setting our university as an example.

On the 1st day of the event, 12th July, Maria Lúcia Leitão, from the Banking Conduct Supervision Department at Banco de Portugal, delivered a very interesting presentation entitled "Inclusive, innovative and sustainable societies – the contribution of financial consumer protection and financial literacy". The presentation focused on how financial consumer protection took the stage with a global financial crisis and the subsequent development of new policies aiming at protecting consumers of financial services, increasing consumer trust and confidence in the financial system and contributing to fairer, more sustainable and inclusive growth and financial system stability. In the midst of an ever-increasing digital world, ideas on digital financial literacy and its role on consumer decision, choices and behavior, ultimately promoting financial resilience, were discussed.

The 20 research units of the Universidade de Aveiro had the opportunity to showcase the most recent research carried out under the theme of the Research Summit 2023, ranging from extended reality, responsible electronics, sustainability challenges or healthy aging to food additives and insects and sustainability.

The event also counted on the participation of Laura Roman, Policy Officer at the Industry 5.0 Unit, Directorate-General for Research and Innovation of the European Commission. The presentation "Invited systemic change in the research and industry environments from the lens of adoption of AI and new technologies and the industry 5.0 human-centric, resilient and sustainable approach" focused on how Artificial Intelligence is paving its way in research, as well as the role of Industry 5.0 in leading industry to achieve societal goals beyond jobs and growth, to become a resilient provider of prosperity, by making production respect the boundaries of our planet and placing the wellbeing of the industry worker at the center of the production process, while providing an overview of the European Commission policies and engagement opportunities in these topics.

Following the plenary session, days 2 and 3 were highly attended. The PhD pitch sessions aim at providing PhD students the opportunity to pitch their work, encouraging them to improve communication and networking skills. Apart from the hundreds of PhD pitches, through 12 parallel sessions, around 20 students pitched the activities developed under the scope of PIIC@UA (Scientific Research Incentive Program) to promote their enrolment in science during the 1st and 2nd cycle of training.

The expected outcomes of this Research Summit shall be reflected on the institutional engagement towards an Inclusive, innovative and sustainable society, shedding light on the significant contribution of our university's community to current and future challenges and existing divides. The projects and outputs discussed under the Research Summit 2023 are the display of how a customized and adaptable pooling of the best people and resources, provided by the university's underlying matrix structure, contribute to tackle ever-evolving research challenges.

Academia de Verão

SUMMER ACADEMY

The Summer Academy is an initiative of the University of Aveiro (UA) that every year provides a first contact with academic life and a diverse set of scientific, sports and leisure activities, especially for students from the 5th to 12th grades. In 2023, the event held its 17th edition, and counted on the participation of 432 students.

The scientific activities are organized by both the organic and research units of UA – in a total of 16 departments, 3 polytechnic schools and 20 research units, each proposing activity programs for each Summer Academy edition.

UA's organizational culture has always been committed to the promotion of the public acknowledgment of science, the concern in communicating the scientific advances at UA and the development of "science for all" initiatives. Since its foundation, UA promoted an Open Day, later transforming it into an Open Week, and recently creating the Summer Academy, which is dedicated to strengthening the ties between society and the scientific world and promoting the scientific areas and the different offer of study cycles. The creation of a dedicated communication structure for UA, in the mid-1990s, and the Fábrica – Live Science Centre, in 2004, were very innovative and pioneer initiatives in the context of Portuguese universities. Nowadays, these structures develop permanent activities and are devoted to the global university community.

UA's concerns about science outreach and public engagement with scientific and technological issues is also seen as an opportunity of improvement of the citizenship and welfare of our society. This is an all-year round premise that is also laid in the Summer Academy objectives.

Children and young students are welcome and challenged to join scientific and cultural activities proposed by the UA, especially during the summer period, and also other initiatives during the academic year.

Encontro Ciência 2023 Science and Ocean beyond the horizon

The Encontro Ciência is the largest science event in Portugal and aims to contribute to the promotion of a broad debate on the main topics and challenges of the scientific agenda, stimulating participation and interaction between researchers, sector and the general public in a large forum, awaited every year with expectation by the scientific community. It is promoted by the Foundation for Science and Technology, in collaboration with Ciência Viva, with the institutional support of the Government through the Ministry of Science, Technology and Higher Education, as well as the Parliamentary Committee on Education and Science.

For the first time in 2023, it was organized in a decentralized way (from Lisbon to Aveiro) and focused on a single theme. The University of Aveiro agreed to receive at the Campus of Santiago the Encontro Ciência 2023 on July 5, 6 and 7, under the theme "Science and Ocean beyond the horizon".

During the three days of the meeting, plenary sessions were organized, with themes as diverse as climate, sea economy or food, and the parallel thematic sessions that focused on topics such as blue, circular and sustainable economy, biotechnology, renewable energy, health, among many other topics. More than 260 speakers included names such as Emanuel Gonçalves of the Oceano Azul Foundation, Eva Calvo of the Institute of Marine Sciences, Spyros Kouvelis of the Institute for Sustainable Development of the European Public Law Organisation, Joana Xavier, from CIIMAR and Estrela Matilde, from Fundação Príncipe. On July 6, there was also a session, especially aimed at the city's public, with the exhibition of an award-winning documentary on research and rescue of marine species, followed by a lecture entitled "From the bottom of the sea to the bottom of the plate!" by researchers Ana Hilário and Ricardo Calado, from CESAM – Centre for Environmental and Sea Studies.

With about 3.300 entries, almost 2.000 participants were registered in the plenary and thematic sessions, with 260 speakers, 40 demonstrations and a set of 950 posters, which proved to be very positive for a first decentralized Encontro Ciência.


5

RESEARCH HIGHLIGHTS

How can a pathogen infect humans and plants? The role of omics in deciphering the cross-kingdom behaviour of the fungus *Lasiodiplodia hormozganensis*

Ana Cristina Esteves[1], Carina Félix[2], Rodrigo Menezes[3], Micael Gonçalves[1], Tânia Melo[4], Jesus Jorrín-Novo[5], Yves van de Peer[3], Maria do Rosário Domingues[4], Artur Alves[1]

1 – CESAM & Department of Biology, University of Aveiro.
2 – MARE & Polytechnic Institute of Leiria.
3 – VIB-UGent Center for Plant Systems Biology; Ghent University, The Netherlands.
4 – CESAM & Department of Chemistry, University of Aveiro.
5 – Department of Biochemistry and Molecular Biology, Universidad de Córdoba, Spain.

Back in the beginning of the XX century, the fungus *Lasiodiplodia theobromae* was described for the first time [1]. In 2008 [2], strain CBS 339.90 (the star of this story) was included in the species *L. theobromae*. It is a geographically widespread species, infecting nearly 500 plant hosts leading to disease and death. But CBS 339.90 was recognized as the causative agent of a human infection [3]. In early 2024 [4], we reassigned CBS 339.90 to the species *Lasiodiplodia hormozganensis*.

Human body temperature is one of the main barriers preventing most fungi from infecting humans, so we investigated the effect of temperature on this cross-kingdom pathogen.

Genome analysis of CBS 339.90 revealed that it has the machinery to infect both plants and humans. At optimal temperature (25°C) or "human" temperature (37°C), different proteins & transcripts are expressed: at 25°C, proteins related to primary metabolism, while at 37°C, proteins related to pathogenesis. Notably, plant cell wall degradation proteins are more expressed at 25°C, while pathogenesis-related proteins dominate at 37°C.

L. theobromae strains isolated from plants induce mammalian cell death at 25°C, but only temporarily. In contrast, *L. hormozganensis* consistently causes 90% mammalian cell mortality during fungus growth [5].

L. hormozganensis alters its metabolism to cope with increased temperature, expressing lipids that decrease membrane fluidity at 37°C. But also, increased temperature leads to an increase in the accumulation of lipids known as essential players during fungal infection of humans.

L. hormozganensis, has the molecular mechanisms that allow it to infect both plants and humans, demonstrating its 'cross-kingdom pathogen' nature. We showed that higher temperatures lead to a higher expression of proteins and lipids related to pathogenicity.

As environmental temperatures rise due to climate change, fungal behaviour, particularly in the case of *L. hormozganensis*, may enhance human pathogenesis.

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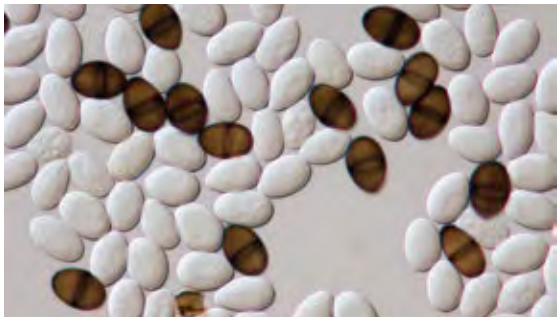

FIGURE 1
Asexual spores of *Lasiodiplodia* spp. in different stages of maturation, young (colorless and aseptate) and mature (brown with 1 transverse septum).

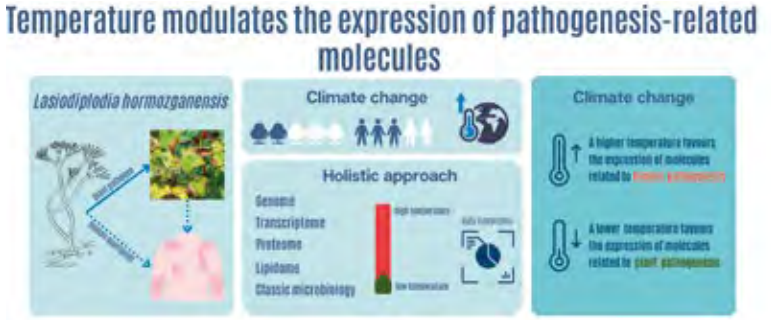

FIGURE 2
Schematic representation of the effects of temperature on the fungus *Lasiodiplodia hormozganensis*. Adapted from Félix et al (2024) https://doi.org/10.1016/j.scitotenv.2024.171917

Ria de Aveiro: a reference socio-ecological system and a platform for excellence in research

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The Ria de Aveiro, a coastal lagoon in Portugal's Centro region, is renowned for its natural and socioeconomic importance, forming part of the Natura 2000 Network. It features diverse habitats, including sand dunes, seagrasses, saltmarshes, sand and mudflats, and reed beds, supporting high biological diversity. This environment serves as a natural laboratory, providing ecosystem services vital to both the environment and human well-being, and it is a platform for education and training. The lagoon's activities stimulate the regional economy and are part of the cultural identity and lifestyle of local communities.

For more than 10 years, research projects have contributed to the Long-Term Socio-Ecological Research (LT_SER) platform Ria de Aveiro. These transdisciplinary projects involve regional, national, and international participants, reflecting the lagoon's global significance and collaborative efforts to address societal challenges.

These research initiatives aim to develop innovative and transformative solutions for climate change mitigation and adaptation, biodiversity conservation and restoration, sustainable resource consumption, and cultural heritage preservation. They bridge the gap between science, policy, and community engagement. Ria de Aveiro also holds historical and cultural significance, supporting traditional activities such as artisanal salt production, fishing, shellfish collecting, bait digging, seagrass and seaweed harvesting, agriculture, waterfowl hunting, the Marinhoa cattle breed, and unique architectural styles. These activities are economically important and culturally embedded in the region. The balance of traditional practices with modern sustainable development exemplifies potential for economic growth alongside environmental stewardship.

The Ria de Aveiro serves as a significant platform for high-quality research on sustainable socio-ecological systems, with several collaborative projects showcasing international collaboration and excellence.

1 – ECOMARE, CESAM & Department of Biology, University of Aveiro.
2 – CESAM & Department of Biology, University of Aveiro.
3 – Rectorate & CIDTFF, University of Aveiro.
4 – CESAM & Department of Environment and Planning, University of Aveiro.

FIGURE 1
A participatory moment with the interested parts at the LT_SER platform Ria de Aveiro, bridging local and european initiatives.

FIGURE 2
Composition with the logo of the LT_SER platform Ria de Aveiro plus 10 transdisciplinary projects covering the 2011-2030 period as an example of international collaboration and excellence in research.

Wildfires: from risk to smoke, air quality and health impact

Alexandra Monteiro[1], Célia Alves[1], David Carvalho[2], Alfredo Rocha[1], Myriam Lopes[1], Teresa Nunes[1], Joana Ferreira[1], Diogo Lopes[1], Ana Ascenso[1], Carla Gama[1], Helder Relvas[1], Isilda Menezes[1], Michael Russo[1], Silvia Coelho[1], Susana Cardoso[1], Tobias Oswald[1], Ana Isabel Miranda[1]

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Although wildfires already constitute a major problem for Portugal, climate changes project a warmer and dryer country that will increase the vulnerability of forests to wildfires. Additionally, wildfires have the potential to release significant amounts of atmospheric pollutants, which can severely impact air quality and human health. Providing information on the susceptibility of forest areas to wildfire risk, smoke and pollutant concentrations is crucial to safeguard the forest and the well-being of communities.

Over the years, the University of Aveiro has made notable scientific progress in assessing fire risk understanding fire and smoke behavior and its effects, through field measurements and modelling systems. Numerous sampling campaigns of wildfire smoke have been conducted under real conditions to improve emission inventories and source apportionment models, and also to measure short-term health effects of smoke on firefighters.

Additionally, an assessment of the (eco)toxicity of the particulate matter emitted has also been undertaken. Chemical transport models have been developed to properly simulate smoke and calculate air pollutant levels in the air.

Today, the University of Aveiro is successfully simulating fire risk and its propagation potential in present and future climate scenarios, smoke emissions, dispersion and chemistry to evaluate their impact on air quality and human health.

FIGURE 1
Measuring firefighter's exposure to air pollution.

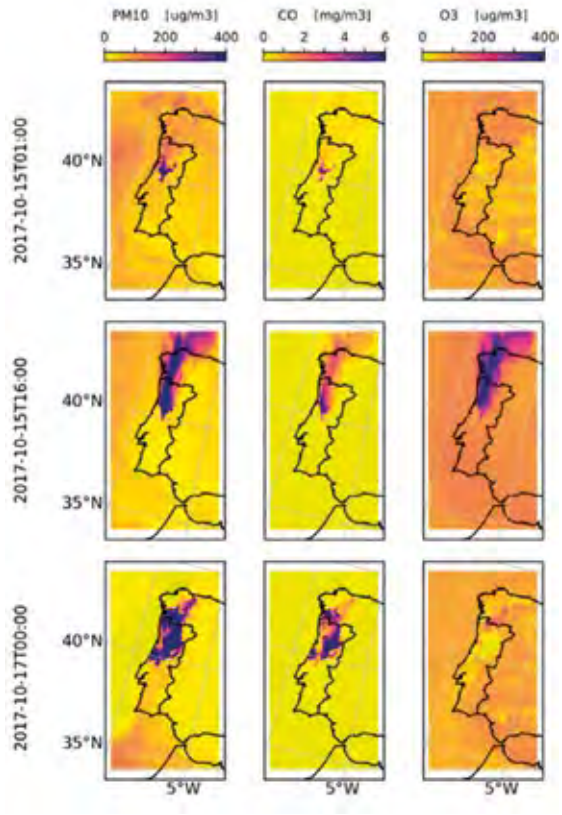

FIGURE 2
PM10, CO and O_3 hourly simulated concentrations during the 2017 October wildfire events in the centre of Portugal.

Unveiling the Drive: What makes citizens adopt citizen science apps for coastal environment monitoring

Mariana Cardoso-Andrade[1,2*], Frederico Cruz-Jesus[3], Jesus Souza Troncoso[4], Henrique Queiroga[1], Jorge M.S. Gonçalves[2]

The world faces severe environmental threats, namely climate change and the biodiversity crisis. Mitigating environmental degradation requires collective action, reliant on thematically and geographically comprehensive scientific datasets. States must report environmental data on the areas under their national jurisdiction to comply with their environmental commitments. However, this process is often costly and time-consuming, resulting in heterogeneous data availability.

Citizen science (CS) is a powerful tool fostering large datasets (through continuous, cost-effective data collection and processing over large area extensions), data transparency, and public engagement and participation. However, engaging and retaining citizens in long-term voluntary participation poses challenges. This study addresses this issue by unveiling the drivers of the adoption of CS apps, focusing on coastal environment monitoring, an activity supported by numerous CS initiatives.

Our methodology combined four theories in a tailor-made conceptual model for investigating the adoption and use of CS apps for coastal environment monitoring: UTAUT 2, Citizen Empowerment, Green self-identity and Hofstede's cultural dimensions (described in Cardoso-Andrade et al., 2022). The research design is presented in Figure 1.

The findings of our conceptual model, which were based on responses to an online questionnaire addressing the constructs of the model, highlight key drivers such as habit, citizen empowerment, facilitating conditions, and environmental performance expectancy (Figure 2). Moreover, collectivist societies and individuals with a green self-identity (who adopt pro-environmental behaviors) are more prone to adopt these apps. Based on these findings, we propose guidelines to improve citizen engagement and retention in CS projects for coastal environment monitoring through their apps (Cardoso-Andrade et al., 2022).

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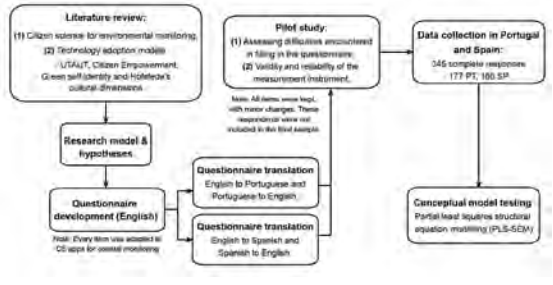

FIGURE 1
Data collection and analysis process.

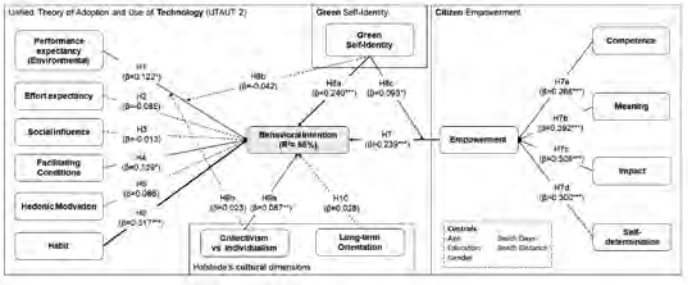

FIGURE 2
Figure 2. Structural model results. (Notes: *Significant at .05; **Significant at .01; ***Significant at .001.)

Spotlight on Luminescence Thermometry: Basics, Challenges, and Cutting-Edge Applications

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3 – Inorganic Photoactive Materials, Institute of Inorganic Chemistry and Structural Chemistry, Heinrich Heine University Dusseldorf, Germany.

Luminescence (nano)thermometry is a remote sensing technique that relies on the temperature dependency of a phosphor's luminescence features (e.g., peak energy or intensity) to measure temperature. This technique provides precise thermal readouts with superior spatial resolution in short acquisition times and has experienced significant growth since the turn of the twenty-first century, driven by the increasing technological demands of various fields, such as micro- and nanoelectronics, photonics, energy, catalysis, and nanomedicine.

Examples of thermographic probes include organic dyes, proteins, molecular beacons, chelate complexes, nanodiamonds, quantum dots, gold nanoclusters, and luminescent nanoparticles.

Over the last five years, there has been a notable shift in the focus of (nano)luminescence thermometry. While many studies have sought to identify new phosphors with improved thermographic properties, the scope of research has broadened considerably. Recent efforts have concentrated on developing comprehensive theoretical frameworks and standardization procedures, including data acquisition, processing, and measurement methodologies. In addition, the reliability, repeatability, and reproducibility of the technique have been scrutinized, leading to the adoption of algorithms to improve data analysis.

This work reviews the latest trends in the field, including the establishment of a comprehensive theoretical background and standardized practices. The reliability, repeatability, and reproducibility of the technique are also discussed, along with the use of multiparametric analysis and artificial intelligence algorithms to enhance thermal readouts. In addition, examples are provided to underscore the challenges that luminescence thermometry faces, alongside the need for a continuous search and design of new materials, experimental techniques, and analysis procedures to improve the competitiveness, accessibility, and popularity of the technology.

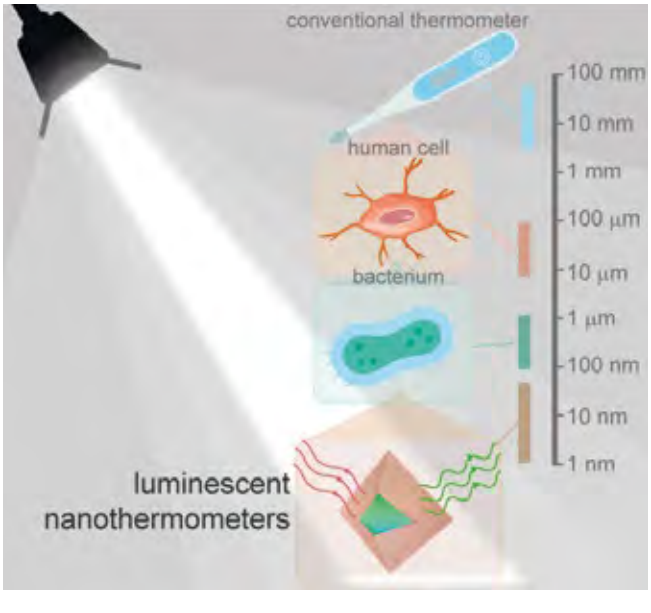

FIGURE 1
Typical sizes of conventional thermometers and luminescent nanothermometers. The size of a bacterium and human cells are also presented to illustrate the different scales of the thermal probes.

Metakaolin/red mud-derived geopolymer monoliths: Novel bulk-type sorbents for lead removal from wastewaters

João Carvalheiras[1], Rui Novais[1], João Labrincha[1]

In recent years, the exploration of the use of metakaolin and red mud in developing alkali-bulk-type activated materials (AAMs) as adsorbents for heavy metal removal from wastewaters has been gaining attention. The capacity to produce highly porous samples showing suitable compressive strength to assure integrity upon use in the wastewater treatment is crucial. Moreover, porous AAMs represent a cost-effective and sustainable option, as they can be produced at near-room temperature while using industrial waste as solid precursors, aligned with the principles of the circular economy, and offering a pragmatic approach to material recycling.

The current research showcases the viability and effectiveness of this approach, presenting an innovative method for tackling heavy metal removal from industrial effluents. By recycling hazardous industrial waste such as red mud, the research demonstrates the potential to transform it into valuable sorbents for environmental remediation applications.

Figure 1 shows the samples shape and their typical porous microstructure.

This innovative approach has yielded promising outcomes, with the monoliths demonstrating a maximum lead removal capacity of 30.7 mg/g (at pH 5, C_0 = 600 ppm, 6 h), which, to date, stands among the highest values reported for bulk-type AAMs. Figure 2 illustrates some results.

Furthermore, desorption tests performed to evaluate the feasibility of regeneration and reuse the sorbents multiple times have proven very promising indications. Indeed, the present study shows that the sorbents can be successfully regenerated and reused without a significant decrease in performance if a suitable regeneration agent is employed. Specifically, the results indicate that the usage of EDTA-2Na as a desorption agent, rather than a nitric acid solution, is preferred as it preserves the sorbents' performance after regeneration: the cumulative uptake after five sorption cycles with the EDTA-2Na treated samples reaches 61.8 mg/g, compared to 27.8 mg/g for the samples treated with nitric acid. This can also be observed on figure 2.

The study highlights the potential of employing AAMs in wastewater treatment systems while encouraging a sustainable approach from multiple perspectives: recycling hazardous waste while creating a new material that can be regenerated and reused numerous times for wastewater treatment.

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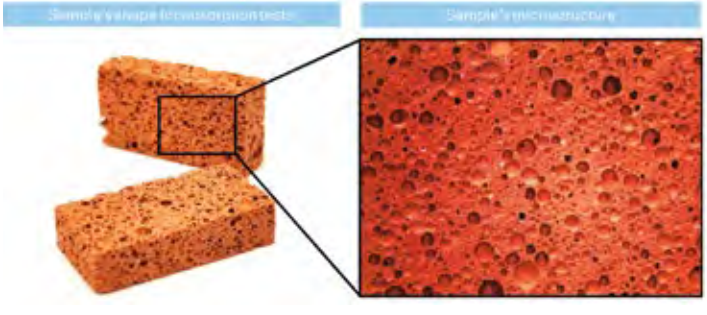
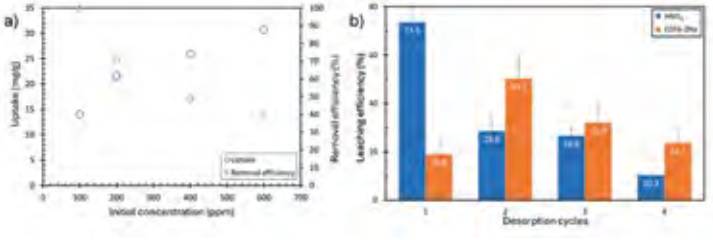
FIGURE 1
Samples shape and microstructure.

FIGURE 2
Results of adsorption a) uptake and efficiency for different lead concentrations; and b) efficiency after various desorption cycles using HNO_3 or EDTA-2Na.





Everything You Wanted to Know about Deep Eutectic Solvents but Were Afraid to Be Told

Dinis O. Abranches[1], João A.P. Coutinho[1]

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From chemical synthesis to the extraction of value-added materials, solvents are ubiquitous in chemistry. Until recently, though, only liquids could be used as solvents. Deep eutectic solvents (DESs) shattered this status quo. A DES is a liquid mixture formed by physically mixing a solid hydrogen bond donor (HBD) and a solid hydrogen bond acceptor (HBA). There is no chemical reaction involved: the liquid phase of the DES arises due to solid-liquid equilibrium (SLE) that leads to a severe melting temperature depression.

While DESs are liquid mixtures of solids, not all liquid mixtures of solids are DESs. Thus, we composed a working definition of eutectic and deep eutectic solvents, grounded on thermodynamics, that can be summarized as:

> *"A eutectic solvent is a eutectic-type system that is a liquid at a given desired temperature where at least one of its components would, otherwise, be a solid unfit to be applied as a solvent. A deep eutectic solvent is a eutectic solvent whose components present enthalpic-driven negative deviations from thermodynamic ideality."*

We also formulated heuristic rules to anticipate which mixtures display negative deviations from ideality and, thus, yield DESs. These occur when intermolecular interactions across mixture components (A-B) are stronger than those between any of the pure components (A-A or B-B). Interactions of the A-B type can be maximized using asymmetric HBDs (compounds with little HBA capability, usually due to electron withdrawing effects from motifs such as aromatic rings) and/or lone HBAs (compounds without any HBD functional groups). A typical example of each class of compounds is given in Figure 1.

Leveraging the framework developed in this work, materials of interest, from powerful chelants such as trioctylphosphine oxide [2] or phenanthroline [3] to active pharmaceutical ingredients [4], can be readily liquefied and applied under the umbrella of DESs using cheap and sustainable asymmetric HBDs or lone HBAs.

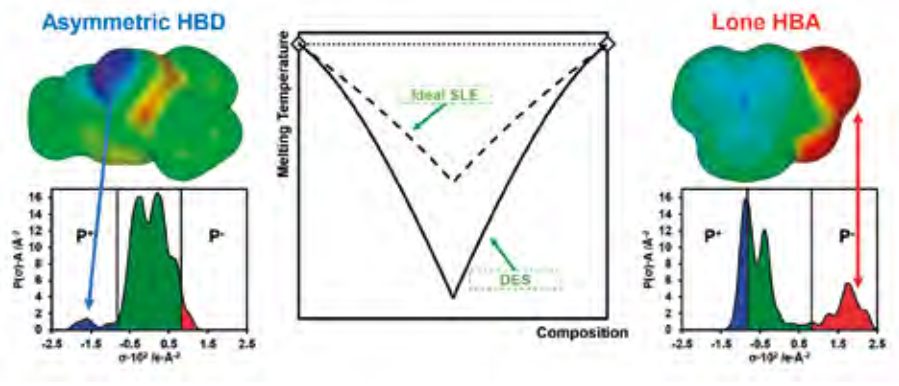

FIGURE 1
Example of an asymmetric HBD (thymol, left) and a lone HBA (betaine, right), highlighting their corresponding excess polarities, and the resulting SLE phase diagram (full line, middle).

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Assessing CO_2 Capture in Porous Sorbents via ssNMR-Assisted Adsorption Techniques

Marina Ikaeva[1], Ricardo Vieira[1], João M.P. Pereira[1], Mariana Sardo[1], Ildefonso Marín-Montesinos[1], Luís Mafra[1]

Our group has recently explored solid-state (ss) NMR methodologies to collect adsorption data, profiting from the numerous advantages offered by standard high-resolution ssNMR techniques, such as high-field magnet and Magic-Angle-Spinning (MAS). These features are crucial for recording comprehensive adsorption isotherms of confined non-protonated gas molecules, such as CO_2. This work gathers all methodologies developed in our previous studies, wherein we applied variable pressure ssNMR for assessing CO_2 adsorption mechanisms on mesoporous silicas. Altogether, these ssNMR methodologies allow the acquisition of CO_2 adsorption isotherms enabling the identification and quantification of distinct chemisorbed and physisorbed CO_2 species.

Figure 1 contains a schematic illustration of the various methodologies applied to record full gas adsorption isotherms, using $^{13}CO_2$ adsorbed on amine-modified mesoporous silicas (APTES@SBA-15). Our approach, has the advantage to differentiate between physisorbed and chemisorbed CO_2 fractions, allowing the identification of six distinct types of confined CO_2 species. This work represents a major contribution to the adsorption research community, as traditional techniques like volumetric or gravimetric adsorption can not distinguish between different CO_2 species. Moreover, it seamlessly integrates spectroscopic and gas adsorption measurements, enabling a comprehensive characterization of the CO_2 adsorption processes in porous materials at the molecular scale. Our group is currently applying this methodology to a wider range of materials, including zeolites, porous carbons, covalent organic frameworks (COFs) and metal-organic frameworks (MOFs), demonstrating its potential to obtain deeper structural insight into gas adsorption mechanisms and separation processes, which will ultimately contribute towards the development of improved solid adsorbents.

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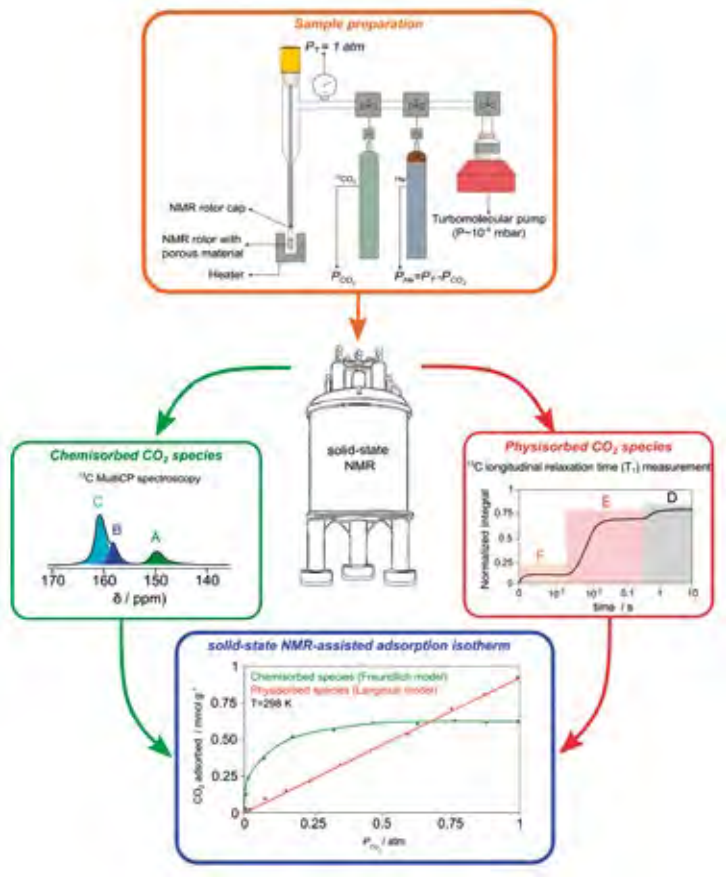
FIGURE 1
Schematics describing the methodology used to perform qualitative and quantitative characterization of different chemi- (A, B and C) and physisorbed (D, E and F) CO_2 species formed at different gas partial pressures in APTES@SBA15.



Black holes and impostors

Pedro V.P. Cunha[1], Carlos A.R. Herdeiro[1], Eugen Radu[1], Nicolas Sanchis-Gual[2]

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The large majority of the scientific community accepts black holes as real and important players in the (astro) physical Universe. But this idea had a very difficult birth. For the first half of their century old history, black holes – as mathematical solutions of General Relativity – were not properly understood and considered by most experts as a mathematical curiosity without astrophysical reality. The black hole hypothesis came to be accepted slowly and largely by virtue of the *astrophysical data*, which could not be explained by any other viable theoretical alternative.

The black hole *hypothesis* has, however, far reaching theoretical consequences. As Penrose showed (and for which he was awarded half of the 2020 Nobel Physics prize), black holes in General Relativity and with reasonable matter/energy imply the existence of singularities in their interior, hence the doom of General Relativity itself. Additionally, the marriage of black holes with quantum mechanics has led to the famous information paradox, questioning what happens to information when it forms a black hole and the black hole evaporates due to quantum effects.

These challenges led to a lingering suggestion in the scientific literature that the astrophysical objects regarded as black holes may be something different. For instance some sort of dark matter star which, albeit dark, needs not trap light, the defining property of black holes. This work, published as Editors Suggestion in Physical Review Letters, provides evidence that any such theoretical *black hole impostor* that could imitate some key observable properties of a black hole, and that has a plausible formation mechanism, is unstable and therefore unviable as a contender to explain astrophysical observations.

The key point is that the instability afflicting black hole foils is triggered by the very same property that seems mandatory in order for the impostor to *appear* a black hole – its ability to curve the paths of light into close orbits called light rings.

Even though the imitation game is not closed, this work hammers another nail on the coffin of black hole impostors, thus corroborating the need to accept the physical reality of the mysterious celestial bodies we dub black holes.

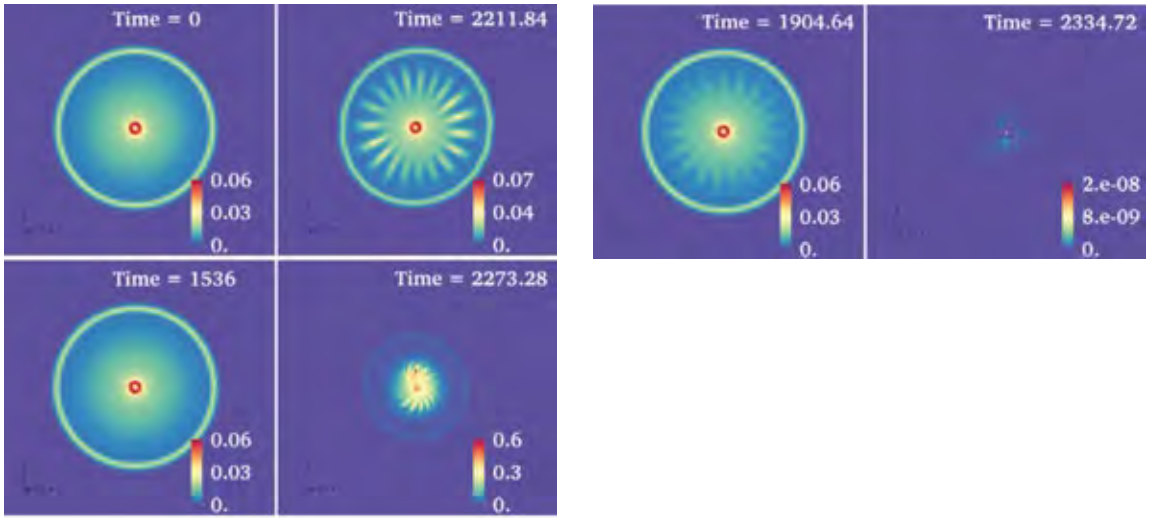

FIGURE 1
Numerical evolution of a black hole impostor showing that it decays... into a black hole!

An integral boundary fractional model to the world population growth

Om Kalthoum Wanassi[1], Delfim F.M. Torres [1]

Mathematical modeling is the process of describing a real world problem in mathematical terms, usually in the form of equations, and then using such equations both to help understand the original problem, and also to discover new features. Currently, applications and activities related to fractional (non-integer order) models have appeared in many fields of science, engineering and medicine, such as in HIV modeling and fluid dynamics. Fractional calculus has emerged as one of the most important interdisciplinary subjects in Mathematics, Biology, and Engineering. It has been shown that differential equation models involving fractional derivatives describe certain phenomena better than traditional integer-order differential equation models.

Many analytical and numerical methods have been proposed in the literature to describe the world population growth. In this work, we formulate a new mathematical model that consists of a fractional (non-integer order) differential equation of order between two and three, involving a psi-Caputo fractional derivative subject to initial conditions on the unknown function and its first-order derivative as well as an integral boundary condition that depends on the unknown function. We find a non-integer order alpha and a simple function psi for which the solution of our fractional model describes given real data better than available models.

First we proved the existence and uniqueness of solution to the proposed model. Our proof is constructive and an explicit formula for the solution is given, which depends on the fractional order alpha and the arbitrary smooth function psi. By using real data, we have proved that describing the population growth by a psi-fractional differential equation subject to an integral boundary condition is more accurate than all the previous classical and fractional models available in the literature.

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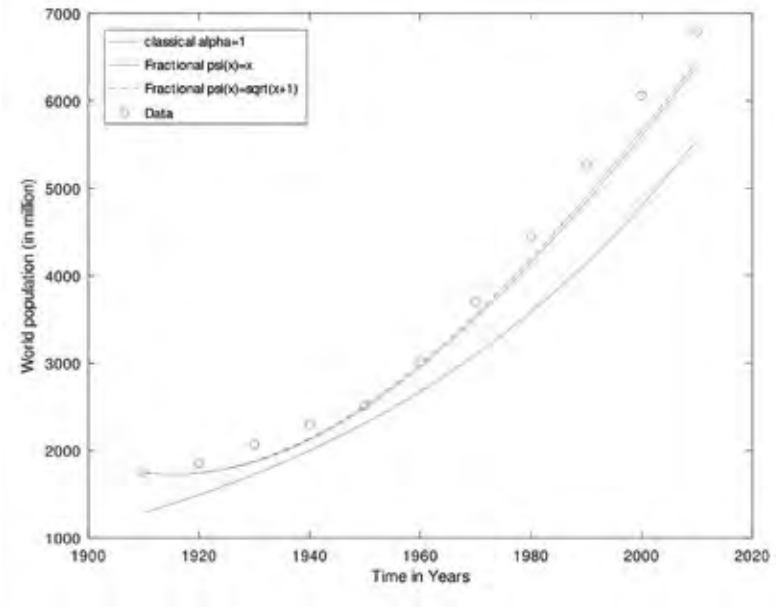

FIGURE 1
Real data versus classical integer-order model (particular case of our model with alpha=1) versus standard fractional model (particular case of our model with psi(x)=x) versus the new proposed psi-fractional model with psi(x) = sqrt(x+1). Figure taken from https://doi.org/10.1016/j.chaos.2023.113151.

EvoKE & EuroScitizen: bridging the gap between research and practices to foster evolution literacy in Europe

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EvoKE is a transdisciplinary research network that aims to contribute to a world where people understand evolution and use scientific knowledge and skills to address societal problems. EvoKE builds on the success of the EuroScitizen COST Action which leveraged the strengths of academic and non academic stakeholders to develop approaches to improve evolutionary literacy. EuroScitizen and EvoKE events fostered effective transdisciplinary and international collaborations resulting in a network, with 315 members – researchers in evolution, science education and communication, educators in formal and non-formal contexts and science journalists – from 36 countries. These members joined their complementary expertise to produce scientific knowledge essential to understand and address the problem of low evolution literacy in Europe. Research from this network shows that European university students accept evolution but lack substantial knowledge about it (https://bit.ly/4aMjAY1), that many European curricula and textbooks do not include key concepts in evolution (https://bit.ly/4aLbWx0; textbook analysis submitted) and that, after engaging in effective educational activities, elementary school students learn about evolution (https://bit.ly/4c5sz04). The network co-constructed resources including (but not limited to) courses, books and guidelines for developing and evaluating citizen science projects (https://bit.ly/4c6bk6m), to empower researchers to do science communication (https://bit.ly/3yDhH2j and https://bit.ly/4bzy3rr), for museum staff to develop and assess exhibitions (https://bit.ly/3Kr41tV) and for educators to teach about evolution (https://bit.ly/3Vaq7WN) and assess students' evolution understanding and acceptance (https://bit.ly/3Kq3l8n). Resources are freely available on-line (https://shorturl.at/msFHX) and are being used to empower researchers, teachers and educators in non-formal contexts to further contribute to public evolution literacy in Europe. The produced knowledge is also being used to inform changes in the curricula, textbooks and other educational resources and teacher training actions.

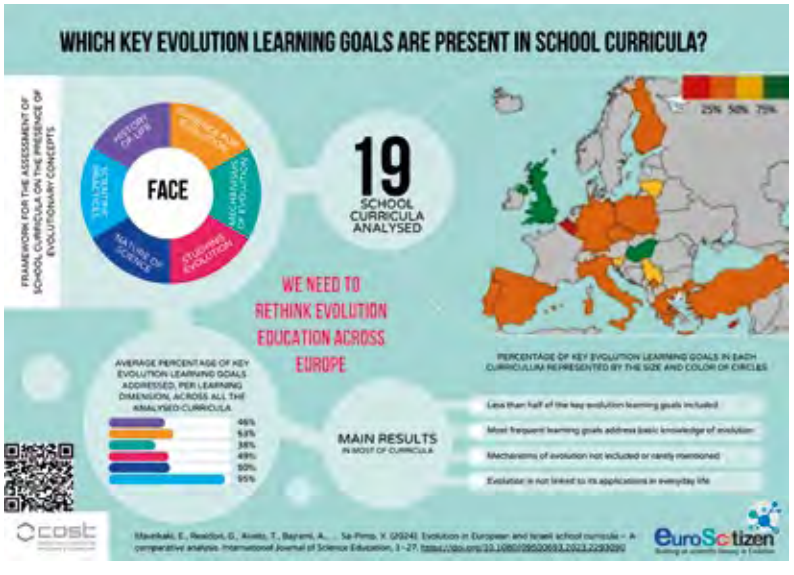

FIGURE 1
Infographics produced to present the results of the curricula analysis to diverse educational stakeholders and promote policy changes to foster public literacy in evolution.

Mitigation of Urban Solid Waste in Lubango (Angola): Looking for the impact and sustainability of an international collaborative project

Nilza Costa[1], Betina Lopes[2], Rui Vieira[2]

Despite positive changes in Angola environmental policies, urban solid waste (USW) is still a major problem in the country. This scenario sustains a project (2022-2024) coordinated by the Institute of Education Sciences of Huíla (ISCED-Huíla) who has been collaborating with CIDTFF/UAveiro over 10 years, mainly in postgraduate activities.

The project, financed by the Ministry of Higher Education, Science, Technology & Innovation of Angola (40000 USD), has as its main goal the design of educational activities, in cooperation with schools and surrounding communities, concerning USW (e.g., school cleaning campaigns, waste separation, development of pedagogical gardens and compost bins). These activities are being monitored in order to evaluate their impact, and to understand how project sustainability can be enhanced. The main audience are six schools and management bodies, teachers (around 300), pupils (around 3000, from 1st to 9th year of schooling) and local communities.

Data gathered by different instruments along the project (e.g., written and photographic records, questionnaires, interviews – Figure 1) show changes at the schools' yards (e.g., construction of a place for composting, development of pedagogical gardens), and in pupils' behavior – Figure 2.

Questionnaires answered by the research team (15 members, 3 from CIDTFF and 13 from Angolan institutions) and diary notes of the CIDTFF team have shown a very positive attitude towards the project work, as a whole, and, also, the need to develop investigative competences. Notice that almost all Angolan partners answered that they had not participated in an educational research project before.

Three lines of action have been identified to enhance the projects' sustainability: involve further school actors in monitoring activities (e.g., make them responsible for this kind of activities); empower team members (e.g., on academic writing); and improve researchers' autonomy towards new activities about USW, and between them and schools and local communities (e.g., organize regular meetings to discuss how to maintain the actions implemented in the project).

More information at: https://lubcidsust.isced-huila.ed.ao/sobre; https://www.facebook.com/LubCidSustRs and https://www.ua.pt/file/79962.

1 – CIDTFF, University of Aveiro.
2 – CIDTFF & Department of Education and Psychology, University of Aveiro.

FIGURE 1
Monitorization activities in a school to understand and improve the composting process.

	SCHOOL YARD	PEDAGOGICAL GARDEN	COMPOSTING SITE
THEN...	4 schools show USW, which were burned inside school. Public defecation inside some school yards.	0 schools with pedagogical garden. In 5 schools employees use land inside school to cultivate for own consumption.	0 schools had a composting site.
...NOW	In these 4 schools less UWS is observed. Sensibilization need to be continued.	All 6 schools identified a place to initiate a pedagogical garden (near to the other garden for individual use) and 2 of them schools have already started to cultivate the pedagogical garden.	All 6 schools have a composting site. Educational session to collect and separate organize waste are being organized involving the surrounding community.

FIGURE 2
What is changing? Describing the project's impact.

DanceMove: ideation, development, and assessment of a step-based digital solution for promoting physical and cognitive activity

Ana Isabel Martins[1], Ceci Diehl[2], Telmo Silva[2], Jorge Abreu[2], Gonçalo Santinha[3], Óscar Ribeiro[4], Nelson P. Rocha[5], Anabela G. Silva[1]

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2 – Digital Media and Interaction Research Centre (DigiMedia) & Department of Communication and Art, University of Aveiro, Aveiro, Portugal.
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4 – Center for Health Technology and Services Research (CINTESIS@RISE) & Department of Education and Psychology, University of Aveiro, Aveiro, Portugal.
5 – Institute of Electronics and Informatics Engineering of Aveiro & Department of Medical Sciences, University of Aveiro, Aveiro, Portugal..

In the past years, the number of people aged 65 and over has increased drastically and is expected to double to 1.5 billion by the year 2050 (1). With the increase in the number of older adults and the average life expectancy, it is essential to find ways to preserve and improve the functional capacities of those reaching advanced age (2). Among the interventions aiming to promote active and healthy aging, cognitive training and physical activity are widely recommended (3). Step-based digital solutions enable the simultaneous combination of physical and cognitive activities. This study describes the process of i) designing and developing and ii) testing the usability and effectiveness of a step-based digital solution aiming to promote physical and cognitive training (DanceMove) by community-dwelling older adults in a multiple-step mixed methods study design. The development process was subdivided into four phases: i) concept and ideation, ii) design and development of the prototype, iii) testing of the functional mock-ups, and iv) testing of the prototype in the laboratory and the real context of use involving an interdisciplinary team of researchers (n=8), health professionals (n=5) and older adults (n=14). After the four steps of development were finished a fully functional solution was available. The effectiveness of this version of the solution was assessed in a mixed methods randomized and controlled trial involving 70 older adults. Access to the DanceMove and to a dancing mat was given to each participant to use at home for 8 weeks without any direct supervision, but weekly telephone contact with the researchers. Results suggest that DanceMove was an enjoyable means of promoting physical and cognitive activity that can be used at home without direct supervision and no reported adverse events.

This work was developed was supported by the SHAPES (Smart and Health Ageing through People Engaging in Supportive Systems) project funded by the Horizon 2020 Framework Program of the European Union for Research Innovation (grant agreement 857159 – SHAPES – H2020 – SC1-FA-DTS – 2018-2020).

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Gavelin, H. M. *et al.* Combined physical and cognitive training for older adults with and without cognitive impairment: A systematic review and network meta-analysis of randomized controlled trials. *Ageing Res Rev* 66, 101232 (2021).

FIGURE 1
DanceMove user interface.

Family functioning, digital devices and language development in preschool children: What do we know?

Maria Inês Gomes[1], Marisa Lousada[2], Daniela Figueiredo[2]

Digital devices, like smartphones or tablets, have become part of family life during the last decade. There is growing evidence that the use of traditional media (TV) and the new digital media might influence children's cognitive and social development. Some studies have highlighted the positive effects of digital devices' use, mainly through suitable design apps, which help to increase children´s vocabulary, creativity and concepts of mathematics and science. At the same time, the overuse of such devices can have negative effects on child sleep quality, social interactions and cognitive development. Family can play a major moderate role between the use of digital devices and children's development. Parental guidance, such as setting limits on the device time usage or consumed contents, is crucial to prevent the harmful effects of over-usage on child development. This study aimed to analyse the relationship between family functioning, digital device use and language development in preschool children.

Ninety-three dyads of parent-child have participated in cross-sectional, observational descriptive-correlational study. The average age of the children was 4.75 (SD=0.828) years old. The main findings showed that the majority of the parents (>70%) used the TV and the smartphone between 0 to 3 hours/day, outside the working hours. The same tendency was observed for children. Statistically significant correlati ons were found between the amount of time parents use some digital devices (tablets, smartphones, TV) and the amount of time of children´s usage. Also, a statistically significant correlation between children's time spent on digital devices and language development (more time usage ~ poorer language) and between family cohesion and satisfaction and children's time usage (less cohesion/ satisfaction ~ more time usage) was found. This work was awarded with the best oral communication in a scientific congress and received great attention from the mass/social media.

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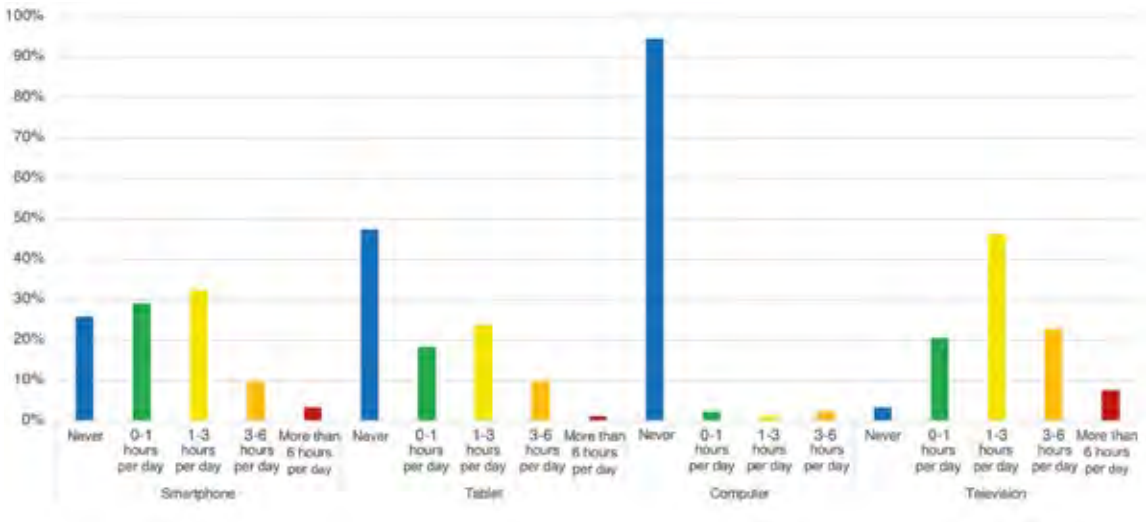
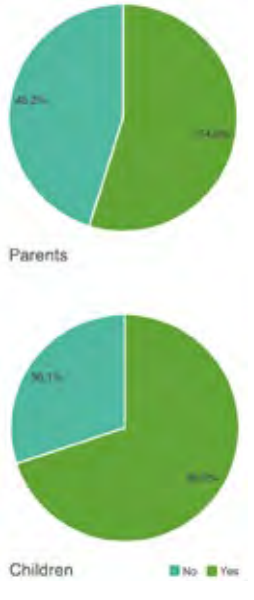
FIGURE 1
Time spent by children using digital devices at the weekend.

FIGURE 2
The time spent using digital devices has increased due to the COVID-19 pandemic?





Internationalization of Portuguese Academia: the impact on academic engagement and collaboration with society

Anabela Queirós[1], Teresa Carvalho[1], Maria João Manatos[1], Sara Diogo[1]

1 – CIPES & Department of Social, Political and Territorial Sciences, University of Aveiro.

FIGURE 1
Dimensions of academic engagement.

The paper explores how academic internationalization affects engagement, emphasizing research over education practices (Table 1). Using 2019 APIKS survey data from Portuguese academics, the findings confirm the positive effects of embracing internationalization practices on knowledge transfer and engagement with society. In this regard, participation in research collaboration or international-funded projects redirects the research focus towards addressing complex societal issues that require a multi and transdisciplinary perspective.

However, the benefits of internationalization on academic engagement would dry up if linkages with local partners and institutions were not promoted and established. Moreover, high pressure on publishing internationally to improve scientific productivity may deviate the research agenda towards topics less related to regional and local demands.

This study has some policy implications. Policymakers should consider internationalization as a transversal strategy for all universities' missions, acknowledging its capacity to enhance the creation and dissemination of knowledge. In this sense, academics more international-oriented in research activities may contribute to bridging global sources of knowledge with local needs, connecting the local to the global. This is particularly relevant in the Portuguese context, considered a semi-peripheral country, in order to bridge the gap with other European member states. Furthermore, given the positive effects on academic engagement, this study highlights the need to strengthen institutional policies that encourage the internationalization of research. Policymakers should also pay attention to the role of these two dimensions in academic career development. On the one hand, encouraging faculty members to engage in both internationalization practices and academic engagement activities may increase the academic workload, considering the several demands to which the academics are exposed. On the other hand, we recommend balancing the importance placed on international scientific publications with the role of academic engagement for career progression purposes. In this regard, HE policies should encourage diversified career paths and increased knowledge transfer to society to enhance both the economy and the knowledge-based society.

Formal research collaboration	Informal dissemination of knowledge	Commercialization of knowledge	Teaching-related activities
Consultancy	Evaluation (of policies and developments of companies, governments, regions, countries, etc.)	Patenting and licensing	Curriculum development for external agencies
Contract Research	Writing publications for a broader range of readers	Spin-off/Start-up creation	Supervision of student internships and/or student
	Participation in external board(s) and committee(s)	Use of infrastructures and (technical) equipment	Joint supervision with industry
	Public lectures and speeches	Test and construct prototypes	Executive, contract tailor-made programs and courses
	Volunteer-based work/consultancy in an honorary capacity	Work in research laboratory, science incubator organization, and/or science park	

Early Career Gender Wage Gaps among University Graduates in Russia

Victor Rudakov[1, 2], Margarita Kiryushina[2], Hugo Figueiredo[3, 5], Pedro Nuno Teixeira[4, 5]

This work estimates early career gender wage gaps among university graduates in Russia, monitors their evolution and drivers. It is based on a comprehensive and nationally representative survey of university graduates, carried out by the Russian Federal State Statistics Service in 2016. Russia is an interesting case for the international literature on this topic since it combines high gender pay inequality with some the fastest growing enrolment rates in tertiary education in the world prior to the COVID-19 pandemic, particularly among women. The study uses mean- and quantile-based decomposition techniques to study differences in gender wage gaps across the wage distribution and gives special emphasis to horizontal segregation (the unequal distribution of men and women across fields of study and industries) as a driver of such trends.

The results show significant gender differences in the salaries of university graduates immediately after graduation, with differences as high as 21% and increasing throughout early career years (close to 28% six years after graduation). The results also show that women's concentration in specific fields of study and low pay industries is a major driver of such differences. Such drivers explain close to 90% of *compositional* differences. More than half of the difference (57%), however, remains unaccounted for when considering differences in observed characteristics. On the contrary, traditional explanations of gender pay differences such as maternity, work experience, vertical segregation and long working hours are much less important, an unusual result in the literature. Estimations across the wage distribution also show, however, that gender pay gaps are much higher in highly paid jobs providing evidence, therefore, of both *sticky floors* (due to educational and first employment choices) and *glass ceilings* (due to the lower likelihood of accessing highly paid jobs) in early career years.

The results of the paper have important policy implications. Above all, increasing access to tertiary education does not automatically result in a reduction of the gender wage gap if pre-market choices, influenced by norms, values and institutional discrimination are not accounted for. Policies related mainly to the elimination of gender discrimination at work or the promotion of further participation in the labour force through flexible jobs or human capital accumulation may provide insufficient to address the root causes of gender pay differences.

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2 – Center for Institutional Studies, HSE – National Research University, Moscow, Russia.
3 – Department of Economics, Management, Industrial Engineering and Tourism, University of Aveiro.
4 – Faculty of Economics, University of Porto.
5 – CIPES – Centre for Research in Higher Education Policies.

FIGURE 1
Evolution of the Gender Wage Gap by Years After Graduation and Work Experience.

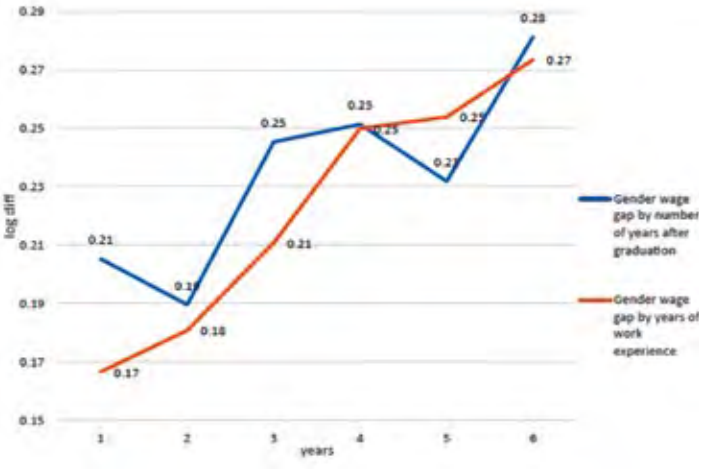

FIGURE 2
RIF-Decomposition Results.

Quantile	0.25	0.5	0.75
Males	9.850*** (0.0100)	10.18*** (0.0100)	10.47*** (0.0114)
Females	9.657*** (0.00703)	9.917*** (0.00797)	10.23*** (0.00941)
Difference	0.193*** (0.0122)	0.267*** (0.0128)	0.237*** (0.0148)
Explained	0.0457*** (0.00531)	0.0449*** (0.00596)	0.0414*** (0.00700)
Unexplained	0.147*** (0.0124)	0.222*** (0.0136)	0.195*** (0.0162)
Unexplained %	76.2%	83.1%	82.3%

Note(s): Robust standard errors in parentheses, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

(In)visible Interstices: Double-Consciousness and the Gutter in Brazilian Jefferson Costa's *Rosebush, Medal, Plantation and Other Stories*

Edmilson Miranda Jr.[1], David Callahan[1]

1 – CLLC & Department of Languages and Cultures, University of Aveiro.

This article explores the relations between W.E.B. Du Bois's concept of "double-consciousness" and the gutter, a specific component of the language of comics and graphic narratives in general, in order to read the graphic novel *Rosebush, Medal, Plantation and Other Stories* by the Brazilian author and illustrator Jefferson Costa. To make the connection, the article further uses the themes of a "crossroads" and "spiraling time" associated with the Brazilian theorist Leda Maria Martins, Homi Bhabha's espousal of "in-between spaces," and Umberto Eco's notion of the "unsaid." Bringing these conceptual areas together helps to approach Costa's work in terms of its support for his Afro-Brazilian roots, and in such a crossing, the gutter becomes a metaphor for counter-hegemonic, identity-producing discursive practices associated with Afrofuturism. In this way, the text plays with the power of graphic strategies, both brought together and separated by the gutter, in the service of leading the reader through the various time periods which make up the narrative. As with all stories, it has been constructed in constant tension between what Costa has decided to show and what he hopes may be imagined by the reader. This link, between what is shown and what might be perceived, complies with a point of view proposed by Afrofuturist thought, in that it does not situate time as linear – past, present and future – but rather as circular and interdependent. Time is also both continuous and discontinuous, performing an erratic relation which approaches the constructions of identity as mixture and indeterminacy explored by Homi Bhabha. Indeed, graphic narratives in general may be said to evidence well this ambivalent relation with discourses of identity, emerging out of the dynamic flows and tensions among their basic mixture of graphic and verbal resources.

FIGURE 1
360º VR cyclotourism experience (while one participant was testing, the others observed).
Cover of the first edition published in Brazil in 2019.

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[*Inks: Journal of the Comics Studies Society* 7(3), 2023: 213-237. https://doi.org/10.1353/ink.2023.a916791]

MEO4ALL – MEO Android service accessible to visually impaired users

Rita Oliveira[1], Daniel Alves[1], Luísa Júlio[1], Herlander Santos[2]

For most viewers, using Interactive Television (iTV) services does not involve significant difficulties, however, for visually impaired persons, this task becomes complex or impossible. The MEO4ALL project, funded by AlticeLabs@UA [1], answers this problem because it involves the development of an iTV solution in the MEO Android service that improves the experience of blind and low-vision viewers, benefiting people with low digital literacy or difficulties handling the remote control.

To identify users' needs and expectations to shape the functional and technical requirements of the iTV solution, a questionnaire survey was carried out, which confirmed the need to improve the accessibility of Portuguese iTV services [2]. Results suggest that enhancing accessibility in TV content and technology for visually impaired individuals is crucial to improving their television experience. One of the main weaknesses identified is the lack of a native voice assistant that can efficiently respond to users' voice commands.

Next, the iTV solution was implemented through three strategies: Voice Control (supported by MEO BOTSchool [3] and Natural Language Processing – NLP), Voice Over (integrated with TalkBack [4]), and Contextual Assistance (combined with Voice Control).

To develop this, Kotlin programming language and its packages are used, given their compatibility with the MEO application.

At the same time, a benchmarking analysis was carried out on the three predominant voice assistants on the market, with the aim of evaluating a multitude of core elements in terms of User Interface (UI) and User Experience (UX). The analysis made it possible to catalogue the established practices in the market and identify potential opportunities for innovation.

The MEO4ALL project not only addresses immediate technical challenges, but also contributes to broader advances in the field of digital accessibility by integrating innovative AI solutions.

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

2 – Altice Labs

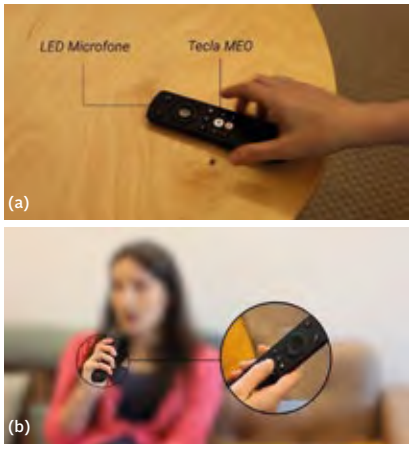


FIGURE 1
MEO Android remote control: MEO4ALL access key and location of the integrated microphone (a). Voice interaction with the MEO4ALL solution (b).

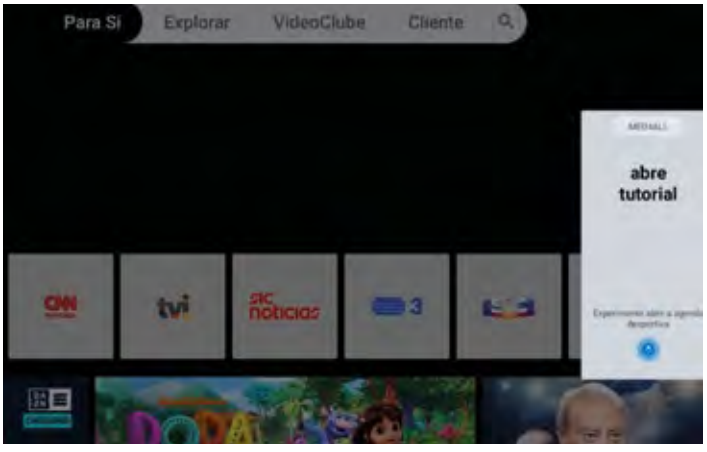


FIGURE 2
MEO4ALL solution interface (right sidebar) integrated into the MEO Android service (main menu view).

FlavourGame – a hybrid board game with digital and edible components for childhood nutrition

Nelson Zagalo[1], Ana Patrícia Oliveira[1], Mário Vairinhos[1]

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

FIGURE 1
Children tasting food earned during the game (above).
The table board (hexagons) and the tablet application, which acts as an assistant that guides the game's tasks (below).

FIGURE 2
Final Prototype of the Smart Food Tweezers.

FlavourGame (http://flavourgame.web.ua.pt) is a project in the intersection of arts, technology, communication, and health [1]. It is aimed at kids aged 10-12, the age at which food neophobia (resistance to new foods) is most prevalent. The hybrid game comprised one table board, a digital application, real food, and smart tweezers, mixing fictional and digital worlds through merging physical interactions and rich sensory experiences in search of behavior change.

FlavourGame is a cooperative hybrid board game for up to 3 players. Kids work together to explore a fantastical world, encountering challenges and learning about healthy eating through the story and special food-themed cards. Players choose characters with unique abilities and travel across hexagons representing different environments (Figure 1). They might taste real food during their journey and earn rewards, but will also face setbacks they must overcome together [2].

The research team worked on the creation of a hybrid game model based on a TUI — tangible user interface. The tangible object created was the Smart Food Tweezers (national patent application No. 118774) which has sensors to recognise food in hybrid ludic environments (Figure 2). The Smart Tweezers were invented for new mechanics involving tasting real food. The research for its creation was grounded in the need for a new interaction approach, requested by the game hybridity.

The DigiMedia research unity coordinated the project in collaboration with a team on Nutrition from the Portuguese Catholic University (Porto) and a Communication team from the University of Minho. All the user-centered experiences with kids to evaluate the hybrid game were conducted at PROBRANCA-CATL (a Leisure-time Activities Center in Albergaria-a-Velha) and College "Paulo VI" (Porto).

The results were disseminated through the publication of various articles in international journals and conferences, being also covered by reference media – RTP, LUSA, Antena 1 – through 13 news stories.

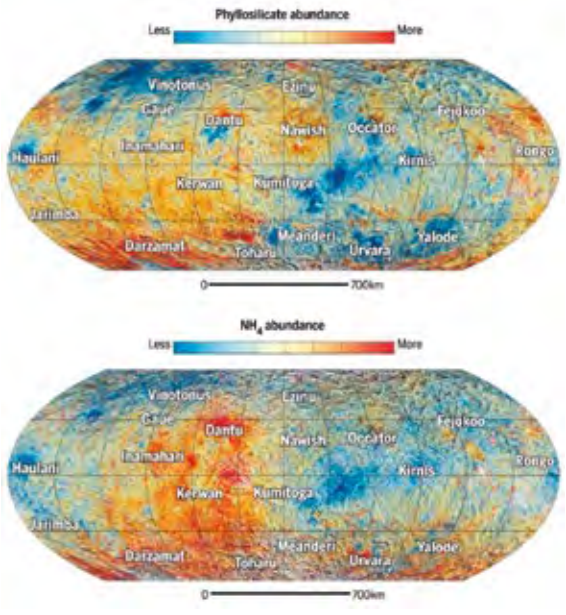
Reference

[1] Oliveira et al., 2020 – https://doi.org/10.1109/SeGAH49190.2020.9201838
[2] Zagalo et al., 2023 – https://doi.org/10.24140/ijfma.v8.n1.03

Clays as a tool to inform origin of life on Mars

Slavka Andrejkovičová[1], Fernando Rocha[1], Janice L. Bishop[2], Helena Pálková[3]

Ammonia is present on Ceres and other Solar System bodies. Remote sensing of planet Ceres and other asteroids has observed spectral features due to NH4+ bands associated with phyllosilicates. Ammonia may be present on Mars as well, but has not, to date, been detected in surface materials at Gale Crater, Mars, using the Sample Analysis at Mars (SAM) instrument suite on the Mars Science Laboratory (MSL) Curiosity Rover. Our team studies NH4-montmorillonite as a potential source of NO evolution in SAM analyses of martian samples. We prepared multiple NH4-smectites using a variety of dioctahedral Fe-bearing smectites to probe the influence of smectite chemistry and structure on the spectral features due to NH4. We have collected reflectance spectra of a large suite of NH4+-treated smectites in order to characterize these spectral bands for comparison with spectra of Ceres and other planetary bodies, where it has already been detected using the Visible and InfraRed Mapping Spectrometer (VIR) using Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) spectra from orbit and NIR spectra on landed missions. Identifying and characterizing ammonia in our Solar System will help define the availability of N for prebiotic chemistry, uncover the N cycle on other planetary bodies, and inform the origin of life. Spectral properties of these NH4+-smectites vary depending on the environmental conditions during measurement. Our experiments indicate significant reduction in the hydration features and enhancement of the NH4+ features for spectra of ammoniated smectite measured under dry air or vacuum conditions.



1 – GeoBioTec & Department of Geosciences, University of Aveiro.
2 – SETI Institute, Mountain View, CA, USA.
3 – Slovak Academy of Sciences, Bratislava, Slovakia.

FIGURE 1
Distribution of phyllosilicates and ammonium across the surface of Ceres.

Hydrodynamic Processes Revealed in Baixo Vouga Lagunar Sediment Profile

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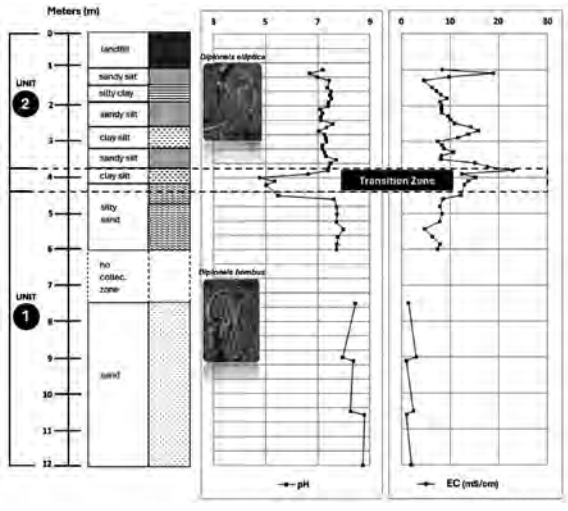
2 – Department of Water, Mining and Environment, Scientific and Technological Centre of Huelva, University of Huelva, Spain.
3 – Sustainable Mining Engineering Research Group, Department of Mining, Mechanic, Energetic and Construction Engineering, Higher Technical School of Engineering, University of Huelva, Spain.

The Baixo Vouga Lagunar (BVL) forms part of the Aveiro coastal lagoon-barrier system, originating in the 10th century and largely becoming isolated from the Atlantic Ocean by the mid-18th century due to sand accretion and the development of a sandbar.

This study aims to investigate coastal evolution mechanisms and evaluate depositional dynamics within the BVL, utilizing sedimentological and geochemical analyses of a sediment core collected from the area (Figure 1). The study considers the natural and/or anthropogenic factors that could influence these processes. Analysis of sediment samples along the vertical profile reveals two primary units (Figure 2). The lower unit (unit 1) is sand-dominated, exhibiting pH values ranging from 5.0 to 8.8, low electrical conductivity, and minimal concentrations of Al, Fe, Mn, and K, indicating direct marine influence during deposition. Unit 1 likely corresponds to ancient or remobilized beach sediments predating lagoon formation. In contrast, the upper unit (unit 2) features generally lower pH values (4.7-7.7) and higher electrical conductivity, indicative of reduced marine influence and the establishment of barrier/lagoon conditions with less energetic deposition under tidal dynamics. A transitional unit between the two is characterized by a significant decrease in sediment grain size (predominantly silt and clay fractions) alongside an increase in terrestrial elements, notably Al, K, Fe, and Mn. The identification of diatoms in some samples distributed along the profile confirms the observed results. These diatoms, linked to their respective habitats, highlight the alternation of marine, freshwater, and brackish water influences throughout the profile. Specifically, they indicate a dominance of marine influence in unit 1, an alternation between freshwater, brackish, and marine conditions in the middle part of the profile, and a freshwater influence consistent with the high salt marsh environment in the upper part of the profile (Figure 2).

FIGURE 1
Simplified geological map of the study area showing the location of the sampling point circled in red.

FIGURE 2
Variation in pH and EC, granulometry and transition zone between unit 1 and 2 in vertical profile. a) diatom typical of a freshwater environment; b) diatom typical of a marine and brackish environment.



A dynamic connectedness analysis between rare earth prices and renewable energy

Mara Madaleno[1], Dilvin Taskin[2], Eyup Dogan[3], Panayiotis Tzeremes[4]

There is an undeniably important role of rare earth minerals in renewable energy technologies. This study aims to infer the relationship between rare earth, clean energy, renewable energy technologies, and carbon emissions, using daily stock price index data and applying the novel quantile time-frequency connectedness model, and the cross-quantilogram dependence approach during 2012–2022. Results evidence spillovers among rare earth minerals and renewable energy, dependent on market conditions, time horizons, and analyzed quantiles. They also highlight the net receiver role of rare earth, especially in the short term. Given the promises of many countries to net zero emissions, a rapid transition to renewable energy and renewable energy technologies is essential. Rare earth minerals are indispensable for these technologies, their prices remain a dominant factor in diminishing carbon emissions. Investigation of the performances of the rare earth companies to other related industries is of crucial significance both from a global perspective to mitigate emissions and from the investors' perspective as a significant asset class. The paper includes the COVID-19 pandemic period, which had significant impacts on renewable energy technology, renewable energy investments, and financial markets. To the best of the authors' knowledge, this is the first paper that considers the associations between the investments of rare earth and strategic minerals and the sustainability-related indices. Policymakers need to recognize the importance of rare earth minerals to mitigate carbon emissions and improve strategies to reduce the risks associated with their limited availability and regional disparities in distribution. Findings might help investors understand diversification benefits and support policymakers in developing strategies for lessening import dependence on rare earth metals, as important as they are for renewable technology adoption to ensure green growth.

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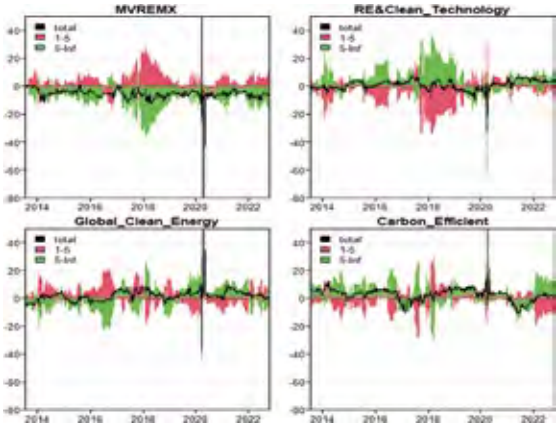
Madaleno, M., Taskin, D., Dogan, E. & Tzeremes, P. (2023). A dynamic connectedness analysis between rare earth prices and renewable energy. *Resources Policy*, 85 (Part B), 103888. https://doi.org/10.1016/j.resourpol.2023.103888



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4 – Department of Accounting and Finance, University of Thessaly, Greece.

FIGURE 1

Short- and long-term and overall net total directional connectedness (at the 5th quantile). Findings are based on a QVAR model with a 200-day rolling window size, a lag length of order one (BIC), and a 100-step-ahead GFEVD. The black area represents the time dynamic connectedness values while the green and red areas depict the long and short-term findings.

Sustainable Supply Chain Management Model for Residual Agroforestry Biomass Supported on a Web Platform

João Matias[1], Carina Pimentel[2], Ana Luísa Ramos[1], Helena Carvalho[3], Leonel Nunes[1,4], Leonor Teixeira[5], Margarita Robaina[1], Marta Ferreira Dias[1], Radu Godina[3], Susana Garrido[6]

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The accumulation of biomass fuel loads in forests and the traditional practice of burning forestry and agricultural leftovers on-site are among the major causes and increased severity of rural fires in Portugal. In this context, the objective of BioAgroFloRes project is to present solutions to valorate Agroforestry Residual Biomass (BAFR – Biomassa Agroflorestal Residual, in Portuguese) in the generation of energy or as a raw material for other industries (e.g., wood pellets, biochar, or green chemicals, among others), while promoting the reduction of rural fire risk. These solutions should meet the difficulties and interests of everyone involved in the value chain: farmers/owners, potential users, transportation companies, or agro-forestry biomass collecting companies. A database of Portuguese biomass was prepared, with the availability and characterization of its properties, and the procedures and practices associated with residual agroforestry biomass, specifically, the traditional practices, and the value chains already implemented (biomass plants, pellet factories, manure production, vegetable charcoal, among others). Environmental problems associated with the use/energy recovery of biomass, such as gaseous emissions from its combustion, particle emission, ash deposition, were also identified.

A proposal for sustainable business models for agro-forestry biomass waste was prepared, through the identification of barriers and motivations for valuing it, the identification of supply chain configurations and the selection of economic, environmental, and social performance indicators.

Finally, the research contemplates the design and development of a functional prototype of an intelligent Web platform called W@BioAgroFloRes (Figure 1) that will help to bring BAFR supply and demand closer, enhancing the exchange of information in real time and support the decision-making process (Figure 2). Future actions consist in testing and validating the prototype in a real environment.

FIGURE 1
Some mockups of the Web Platform prototype of the Residual Agroforestry Biomass (mobile version).

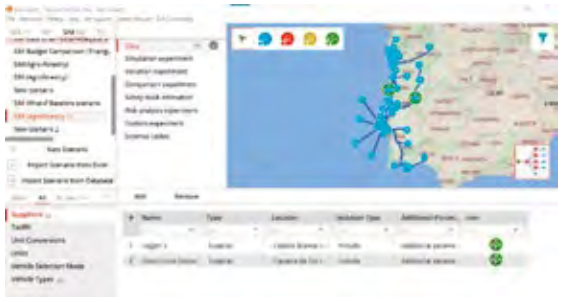

FIGURE 2
Simulation model for analysis of different supply chain configurations.

Statistics of remote regions of networks

João Gama Oliveira [1], Sergey Dorogovtsev [1], José Fernando Mendes [1]

We explore the statistical properties of regions within complex networks that are distant from vertices with high centralities, such as hubs or highly connected clusters. These remote regions play a pivotal role in shaping the asymptotic behaviors of various spreading processes and the features of associated spectra. Our study focuses on the probability distribution of the number of vertices located at a certain distance or beyond from a randomly chosen vertex in an undirected network. Previous work by Dorogovtsev, Mendes and Samukhin (2003) theoretically derived this distribution and its large-scale asymptotics for undirected uncorrelated networks.

We extend this analysis by employing numerical simulations and examining empirical data to explore a wide range of real undirected networks and their models, including both tree-like structures and networks with loops. We find that the inverse square law, which describes the probability distribution, remains valid even for networks with strong correlations. This law is observed in networks that exhibit the small-world effect and contain vertices with a degree of one, commonly referred to as leaves or dead ends.

We also identify specific classes of networks where the inverse square law does not hold. These include finite-dimensional networks and networks embedded in finite-dimensional spaces, where the structural constraints alter the expected distribution. Additionally, we observe that long chains of nodes in networks can reduce the range over which the inverse square law is applicable. Notably, we detect the presence of such long chains in the remote regions of the undirected projection of a large web domain, highlighting the complexity and variability in network structures.

Our comprehensive analysis underscores the importance of considering network topology when examining statistical properties and spreading processes, providing new insights into the behavior of complex networks far from central hubs.

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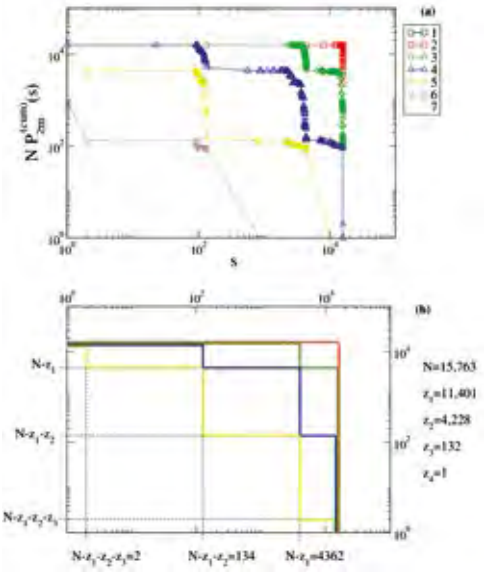

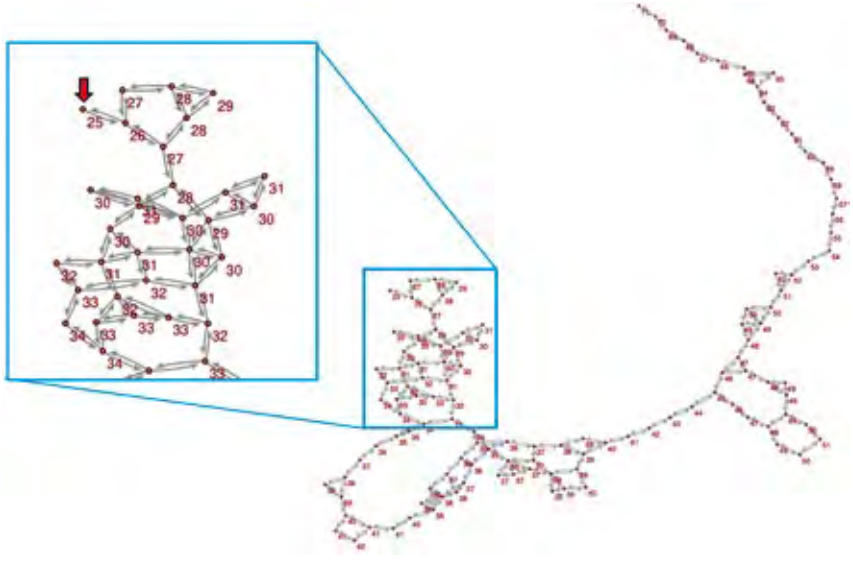

FIGURE 1
A network of hyperlinks between pages within Google's sites.

FIGURE 2
Stanford Web clusters formed by the vertices at a distance m = 25 or beyond from the largest hub in the undirected projection of the network, and edges between them.

Extensive Investigation on the Effect of Niobium Insertion on the Physical and Biological Properties of 45S5 Bioactive Glass for Dental Implant

Imen Hammami[1], Sílvia Rodrigues Gavinho[1], Ana Sofia Pádua[2], Maria do Carmo Lança[3], João Paulo Borges[3], Jorge Carvalho Silva[2], Isabel Sá-Nogueira[4,5], Suresh Kumar Jakka[1], Manuel Pedro Fernandes Graça[1]

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Dental implants have been widely recognized as a reliable and predictable therapeutic option in oral surgery. However, failure cases are reported due to the formation of bacterial biofilms on the implant surface. This study aims to address this issue by developing a biomaterial for implant coatings utilizing 45S5 Bioglass® modified by the insertion of different amounts of niobium pentoxide (Nb_2O_5), from 0 to 8 mol%. Structural analysis using XRD and FTIR indicated that incorporating Nb_2O_5 did not alter the structure of the glass. Raman spectroscopy identified the presence of NbO_4 and NbO_6 structural units associated with the incorporation of Nb_2O_5. Since the bioglass demonstrated the ability to be polarized, enhancing its osseointegration effectiveness, the electrical properties of the prepared bioglasses were investigated using impedance spectroscopy. The Fractional conversion of NbO_6 network modifier units into NbO_4 network formers affects the electrical properties of the glasses and leads to a reduction in bioactivity and antibacterial effects. The bioglass with 2 mol% of Nb_2O_5 exhibited the highest percentage of NbO_6 units, resulting in a higher dissolution rate and, consequently, superior bioactivity demonstrating a maximal growth of Ca-P rich layer on its surface within the first 24h of Simulated body fluid immersion. Furthermore, the antibacterial properties of the bioglass containing 2 mol% of Nb_2O_5 against Gram-positive and Gram-negative bacteria revealed the most significant antibacterial effect. Therefore, it is considered the ideal coating material for dental implants without being harmful to mammalian cells.

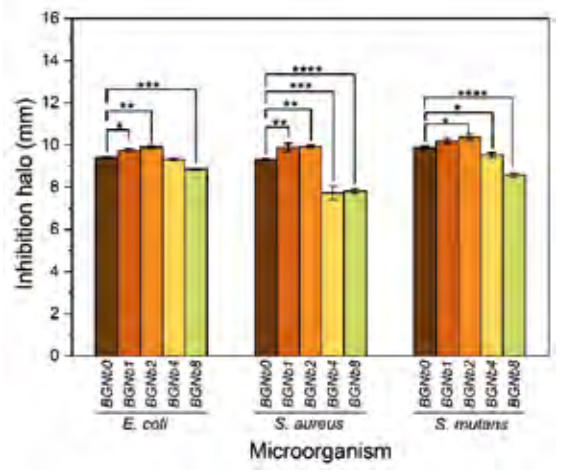

FIGURE 1
Measurements of inhibition halo diameter of the Bioglasses against E. coli, S. aureus, and S. mutans bacteria.

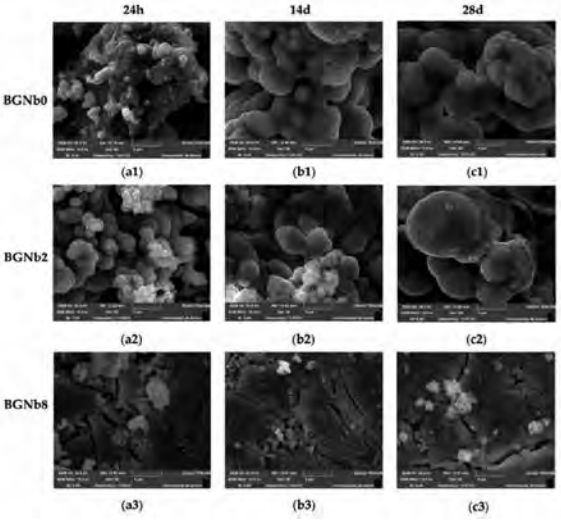

FIGURE 2
SEM micrographs of the surface of bioglasses after immersion in SBF.

Design of laser-induced graphene electrodes for water splitting

Daniela Lopes[1], Nuno Santos[2], Jorge Moura[2], António Fernandes[2], Florinda Costa[2], Andrei Kovalevsky[1]

Hydrogen production has become an attractive alternative for clean energy due to its high calorific value, meeting the increasing worldwide energy needs. However, the most common hydrogen production route is still from fossil fuels, provided by low cost and high hydrogen production rates. Water electrolysis is gaining attention as a greener H_2 production route, with the possibility of being powered by renewable energy systems. Therefore, efficient energy storage from intermittent renewables can rely on the conversion of temporary energy excess by alkaline electrolysis, yielding oxygen and green hydrogen, which can be stored and used on demand.

Electrodes made of laser-induced graphene (LIG) materials emerge as an alternative to the traditional electrocatalysts, originating from a laser-scribing process on carbon-based substrates using a laser with wavelengths spanning from UV to mid-IR regions. LIG offers many advantages over the traditional graphene processing routes, due to inherent simplicity, low cost-benefit and ease of scalability to mass production.

LIG electrode performance towards water splitting in alkaline media was evaluated as a function of the laser processing parameters. Promising guidelines were obtained for hydrogen production through the favourable formation of high structural quality multilayer graphene with uniform porous microstructures, showing high electrochemical activity and promising hydrogen evolution reaction (HER) performance.

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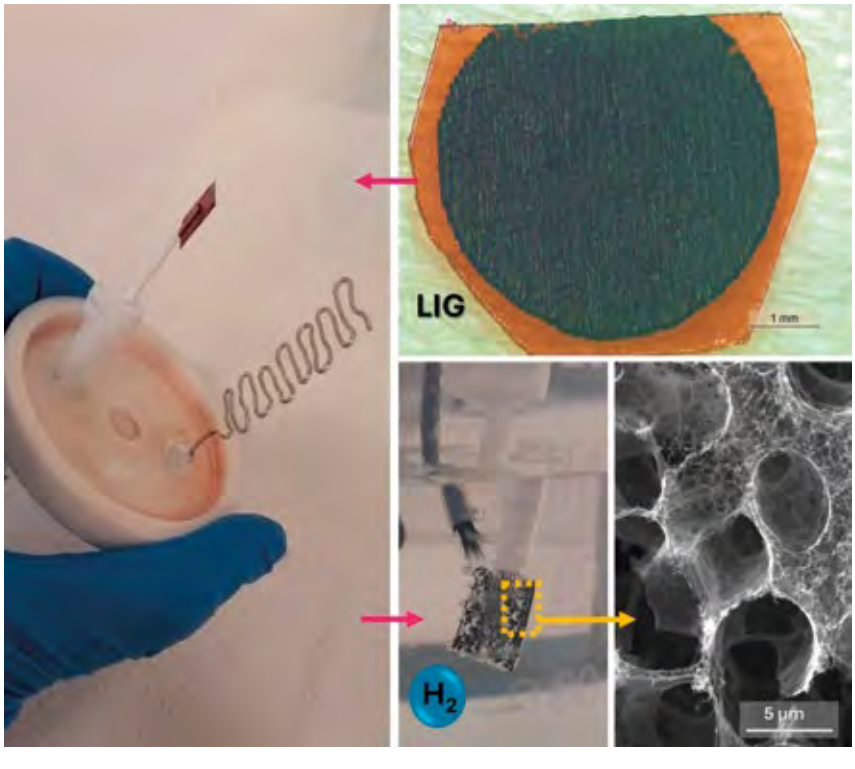

FIGURE 1
Scheme of the electrochemical cell and LIG electrode configuration with an image of three-dimensional and porous LIG microstructure.

European Respiratory Society Clinical Practice Guideline: Palliative care for people with chronic obstructive pulmonary disease or interstitial lung disease

Daisy J.A. Janssen[1], Sabrina Bajwah[2], Michele Hilton Boon[3], Courtney Coleman[4], David C. Currow[5], Albert Devillers[6], Chantal Vandendungen[6], Ron Flewett[7], Magnus Ekström[8], Sarah Greenley[9], Mai-Britt Guldin[10], Cristina Jácome[11], Miriam J Johnson[12], Geana Paula Kurita[14,15], Matthew Maddocks[2], Alda Marques[15], Hilary Pinnock[16], Steffen T. Simon[17], Thomy Tonia[18], Kristoffer Marsaa[19]

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FIGURE 1
Methodology used for development of the European Respiratory Society clinical practice guideline. Abbreviation: PICO= Patient, Intervention, Comparison, Outcome.

Chronic respiratory disease (CRD), such as chronic obstructive pulmonary disease (COPD) or interstitial lung disease (ILD), are a leading cause of death (3rd) and disability (6th) worldwide, with high burden for individuals, families and society[1-3]. Even under optimal pharmacological treatment these people still present many pulmonary (e.g. severe dyspnea), extra-pulmonary (e.g., muscle weakness) and behavioural/lifestyle/risk-factors (e.g., poor family and social support) manifestations[4]. They often present palliative care needs in physical, psychological, social and spiritual/existential domains, equal to or greater than people with cancer.[5-10] Informal carers, i.e., relatives, partners and friends in unpaid roles[11] are their main source of support but often feel low priority and abandoned by healthcare professionals[12-20]. The CRD population typically does not have access to the palliative care available to people with cancer. The main focus of palliative care is to control symptoms and improve quality of life of people with serious health-related suffering, and to support their informal carers. Therefore, this European Respiratory Society taskforce aimed to provide recommendations for initiation and integration of palliative care into the respiratory care of adult people with COPD or ILD.

The panel was composed of 20 members. Eight questions were formulated, four in the 'Population, Intervention, Comparison, Outcome' format and four narrative, tackled as described in Figure 1.

We provided a definition for palliative care and the following recommendations for people with COPD or ILD and their informal carers: consider palliative care when physical, psychological, social, or existential needs are identified through holistic needs assessment; offer palliative care interventions, including advance care planning, in accordance with such needs; integrate palliative care into routine COPD and ILD care.

Cardio-Oncology Rehabilitation for Cancer Survivors With High Cardiovascular Risk: The CORE Trial

Sofia Gonçalves Viamonte[1,2], Ana Vieira Joaquim[2], Alberto Jorge Alves[2,4], Eduardo Vilela[2,5], Andreia Capela[2,3], Cristina Ferreira[6], Barbara Fresco Duarte[2], Nuno Dias Rato[2,4], Madalena Pinheiro Teixeira[5], Aida Tavares[7], Mário Santos[8], Fernando Ribeiro[9]

Cardiovascular diseases pose a significant threat to cancer survivors, making it crucial to find effective ways to reduce cardiovascular risk. The CORE trial investigated whether a center-based cardiac rehabilitation program compared with usual care encompassing community-based exercise training is superior for improving cardiorespiratory fitness and controlling cardiovascular risk factors among cancer survivors with high cardiovascular risk. The trial enrolled adult cancer survivors who had undergone treatments with potential cardiovascular impacts, such as certain cancer medications or prior heart disease. The cardio-oncology rehabilitation program comprised core components (e.g. exercise training, cardiovascular risk factor management, diet and nutrition counseling, physical activity counseling, psychological support) of an outpatient cardiac rehabilitation program delivered by a multidisciplinary rehabilitation team. Participants in the 8-week cardio-oncology rehabilitation program demonstrated clinically superior enhancements in cardiorespiratory fitness, health literacy, quality of life, and cardiovascular risk factors. Despite higher costs, the cardio-oncology rehabilitation model proved to be a cost-effective intervention. Overall, the findings suggest that integrating a cardio-oncology program has the potential within the established infrastructure of cardiac rehabilitation to be incorporated in the standard care of this population with complex and challenging needs. The CORE trial's results were published in high-impact journals like JAMA Cardiology and the European Journal of Preventive Cardiology, and were presented at various conferences. The trial had a significant scientific and societal impact, receiving multiple awards at national and international congresses.

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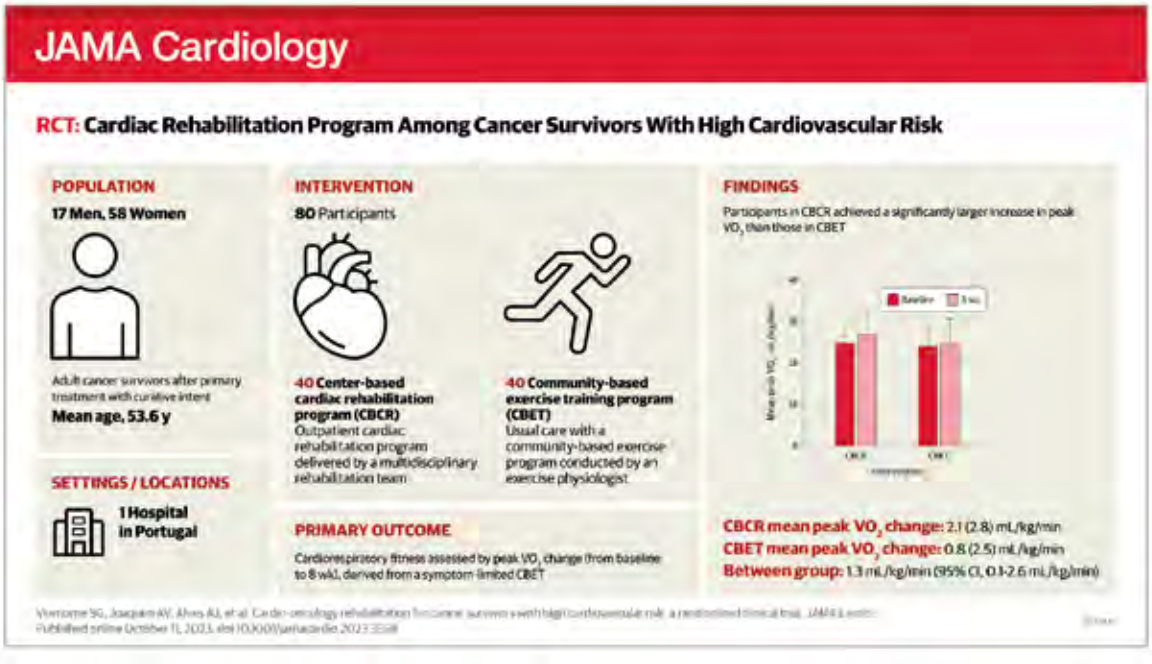

FIGURE 1
Summary of the CORE trial design and results of the primary outcome measure.

Viruses and peroxisomes: uncovering novel targets for host-directed antiviral therapy

Mariana Marques[1], Bruno Ramos[1], Vanessa Ferreira[1], Jéssica Sarabando[1], Alexandre Nunes[1], Markus Islinger[2], Jonathan Kagan[3], Hans Waterham[4], Daniela Ribeiro[1]

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3 – Boston Children's Hospital and Harvard Medical School, USA.
4 – Amsterdam University Medical Center, University of Amsterdam, Netherlands.

Peroxisomes are subcellular organelles that play a central role in human health, by catalyzing a range of unique metabolic functions.

During viral infections, specific host cell organelles, such as peroxisomes, are exploited by both the virus (pro-viral) and the cellular immune system (antiviral), becoming central players in the intricate virus-host interplay.

In cooperation with mitochondria, peroxisomes contribute to the establishment of the antiviral immune response: specific cytosolic receptors recognise viral RNA and interact with the peroxisomal and mitochondrial protein MAVS, which oligomerizes and activates a downstream signalling cascade leading to the production of antiviral effectors (Figure 1).

Different viruses have been shown to interfere with peroxisomal functions to evade the antiviral response and/or promote infection (Figure 1). The group led by Daniela Ribeiro from the Institute of Biomedicine (iBiMED) has significantly contributed to demonstrate the importance of this organelle in the context of several viral infections and, in collaboration with an international network of experts, has recently published two major high-impact and highly respected review manuscripts (PMIDs: 35951481 and 34696946), discussing the recent advances in the study of the diverse roles of peroxisomes during viral infections, from animal to plant viruses, and from basic to translational perspectives. Her team has furthermore recently discovered the mechanistical reasoning for the kinetical differences observed between peroxisomal and mitochondrial antiviral signalling, as well as the relevance of peroxisome dynamics and interaction with the endoplasmic reticulum for the establishment of an efficient antiviral response (Figure 2). The advancements in this emerging area will certainly contribute to the discovery of novel peroxisome-related targets for the development of innovative broad-spectrum host-directed antiviral therapeutics.

FIGURE 1
Schematic representation of the Antiviral and Pro-viral interplay between peroxisomes and different viruses, throughout their life-cycle.

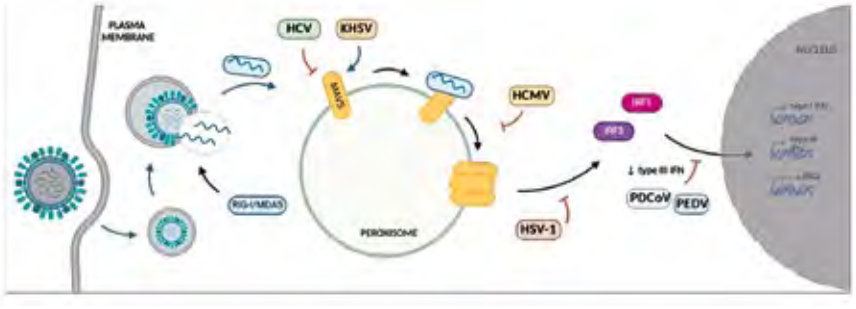
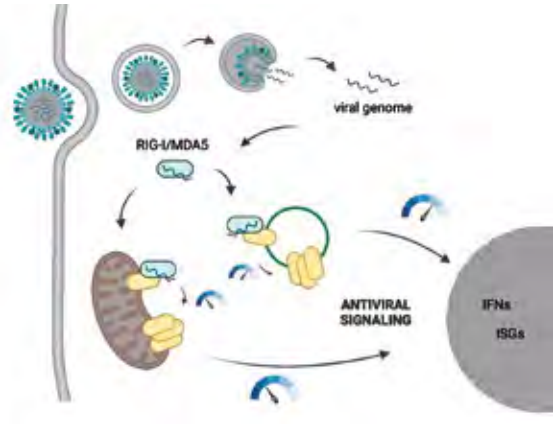


FIGURE 2
Schematic representation of the mechanisms by which peroxisomes (kinetics of MAVS oligomerization, morphology and interaction with the ER) influence the antiviral response.



Elisabeth de Lestrieux's Exploration of Vernacularized Modernism

Florencia Fernández Cardoso[1], Fátima Pombo[2], Hilde Heynen[1]

This research focuses on the work of the Dutch Elisabeth de Lestrieux (1933-2009) who made a successful career as designer setting a trend of converting out-of-use Dutch farmhouses in houses to live in. She contributed to the recognition of the vernacular tradition in her quest of transforming the spaces instead of destroying them. De Lestrieux considered that the vernacular tradition interpreted through the modernist approach to dwell confers a vivid sense of belonging to the experience of inhabiting the spaces. She was a pioneer, exploring design possibilities, always prioritizing the co-presence of nature, the interconnection between indoor and outdoor and the balance between simplicity and abundance. De Lestrieux highly personal aesthetics received recognition during her lifetime, once her statements about modern dwelling and her exploration of solutions as a designer were broadcasted in diverse media and influenced the lifestyle options of many of readers, namely in The Netherlands.

In this article, the authors discuss five of her homes as case studies of her responses to interior design problems, including one in Loulé, in the south of Portugal (Figure 1) where she spent the last 14 years of her life. When living in Portugal, De Lestrieux accepted commissions to design interior spaces as a restaurant for Dutch clientele, family houses and the landscaping of a private home. Her own house in Loulé was all white, on top of a hill with an extensive garden area also delineated by white walls in a sign of acknowledging the local culture. This article was published in a book about Documents and Histories (Rotterdam: nai010 publishers, 2023) of women's designers and architects and is receiving particular attention and interest considering its contribution to the studies of a vernacularized modernism in the spaces to dwell. This investigation enlightens the role of a designer addressing, during decades, topics as sustainability, nature balance, and materials authenticity which inspires further research about core challenges for the design in the present time.

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FIGURE 1
Location of de Lestrieux five homes: four in the Netherlands and one in Loulé, Portugal. Number 6 is the location of her tomb.

Embroidering behavior. The power of storytelling in patient activation

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In a world shaped by narratives, stories are a universal source of knowledge and insight. Amid life's changes and challenges, our brains constantly seek meaning, especially when facing the daunting experience of chronic illness like cancer. Patient-Centered Care recognizes the power of storytelling in healthcare practice. Through *resonance* — "a form of world-relation, in which subject and world meet and transform each other" (ROSA, H.) —, stories can facilitate behavioral change and empower patients.

Storytelling plays an important role in medicine, reflecting the human experience and fostering emotional connections through persuasive communication. This process unfolds between two plans: the *acting* plan — encompassing Aristotle's rhetorical triangle —, where *incorporation* occurs as the public embodies the story through *resonance*, allowing for emotional connection that fosters appropriation as individuals take ownership of the story through imagination and reach the *behavior* plan, where *recognition* happens through truth and trust. Stories have the power to turn patient actions into behaviors (fig. 1). This creates collaboration opportunities between designers and health professionals.

Design, particularly Health Design Thinking, offers a creative pathway for leveraging storytelling in healthcare since its process and human centred approach of observation (design's *poetic observation* (FULTON SURI, J.) that contains already the genesis of creation), conversation, research, and collaboration can help identify patients' needs that go beyond treatment. Designers have the capacity for projective anticipation and their very *own* way of thinking and acting in search of innovative and creative solutions. As natural image creators operating on the narrative nature of visual discourse, from these words designers uncover, create, and project stories into the future – allowing for the creation of compelling narratives that can guide behavior towards engagement and transformation.

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FIGURE 1
Resonance imprint tetrahedron.

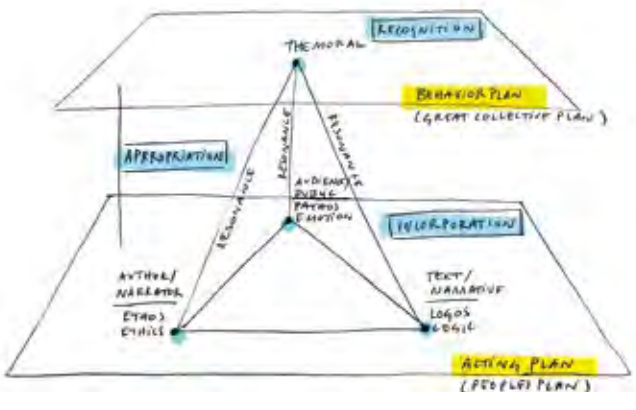

FIGURE 2
Embodiment.

Statistical modelling of space-time series of counts

Ana Martins[1], Manuel Scotto[2], Christian Weiß[3], Sónia Gouveia[1]

AutoRegressive and Moving Average (ARMA) models are fundamental tools in time series analysis, designed to capture the dynamics of time-dependent real-valued data. The ARMA models extend into the Spatial Temporal ARMA (STARMA) models, to handle data exhibiting both spatial and temporal dependencies. For non-negative integer-valued data, the INARMA counterpart mimics the ARMA structure while keeping the integer nature of the data. This is achieved by replacing the multiplication with a discrete operator (such as the binomial thinning) and using a discrete distribution for the innovation process.

This research introduces a new class of statistical models for space-time series of counts. The novel class is addressed as STINARMA and connects with existing ARMA-based classes. On one hand, it is an integer counterpart of the STARMA based on the binomial thinning operator and, on the other hand, it is a STARMA-type extension of the INARMA class. The work established the theoretical properties of the new models, including first- and second-order moments, and defined estimation approaches (like moment-based and conditional maximum likelihood) with evaluation in finite samples. The STINARMA models are broadly applicable to fields using space-time count data. One ongoing application focuses on analysing the daily number of hospital admissions across Portugal. These models integrate meteorological and environmental covariates to assess their impact on admissions, shedding light on the distributive (environmental) justice within our country.

This work has been disseminated in several scientific conferences (2023 European Meeting of Statisticians, 2023 European Young Statisticians Meetings, 2023 Congresso da Sociedade Portuguesa de Estatística, 2024 Workshop on Stochastic Models, Statistics and Their Applications and 2024 Bernoulli-IMS World Congress in Probability and Statistics) and journal publications (Electronic Journal of Statistics, DOI: 10.1214/23-EJS2183).

1 – IEETA & Department of Electronics, Telecommunications and Informatics, University of Aveiro.
2 – CEMAT & IST, University of Lisbon.
3 – Helmuth-Schmidt University, Germany.

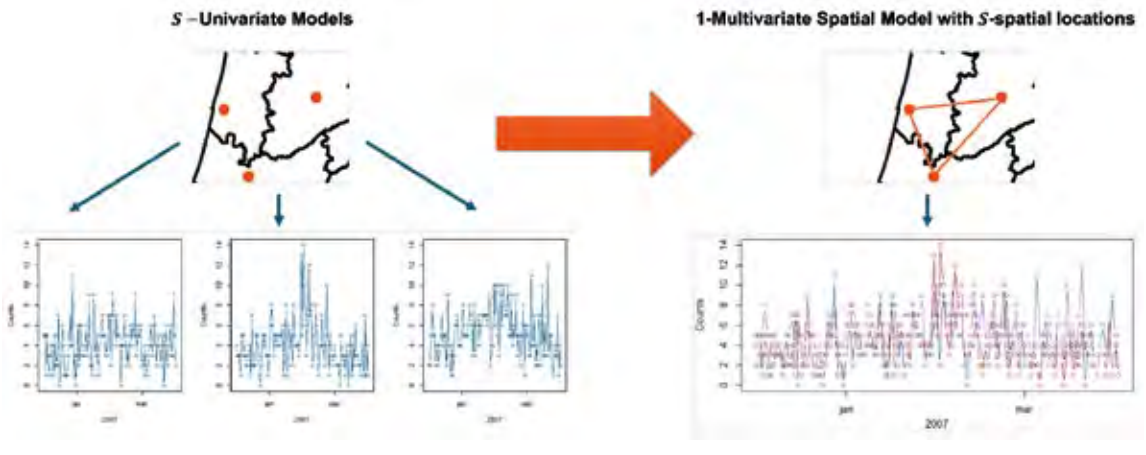

FIGURE 1
Scheme representing the univariate (left) and the multivariate spatial (right) modelling approaches.

MMIR: an open-source software for the registration of multimodal histological images

Rodrigo E. D. Guerrero[1,2], José Luís Oliveira[1], Jurguen Popp[2], Thomas Bocklitz[2]

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2 – Leibniz Institute of Photonic Technology, Germany.

Multimodal histology image registration involves aligning two or more images from different microscopy modalities into a common coordinate system. This combination of information can enhance the understanding of tissue specimens, aiding in more accurate diagnoses and improved research insights. However, it presents challenges due to the inherent differences in characteristics and the need for tailored optimization algorithms for each modality. To address these challenges, we developed an open-source cloud-based system called MMIR. The software architecture includes a project manager, an algorithm manager, and an image visualization system. The project manager handles project management tasks, while the algorithm manager ensures the integration and execution of registered algorithms. The image visualization system efficiently displays high-resolution images using a pyramidal organization without overloading the users' memory. MMIR supports multiple annotation formats and offers flexibility in loading annotations using different methods.

The tool was designed to simplify image registration tasks with a user-friendly approach. It helps manage multiple algorithms, provides responsive web interfaces, supports multi-resolution images, and enables batch image registration. Additionally, its modular architecture allows for the integration of custom algorithms, ensuring alignment with specific requirements for each modality combination. In addition to image registration, the software facilitates the conversion of segmented annotations from one modality to another.

MMIR provides precise alignment and integration of multimodal data enabling more accurate and comprehensive tissue analysis.

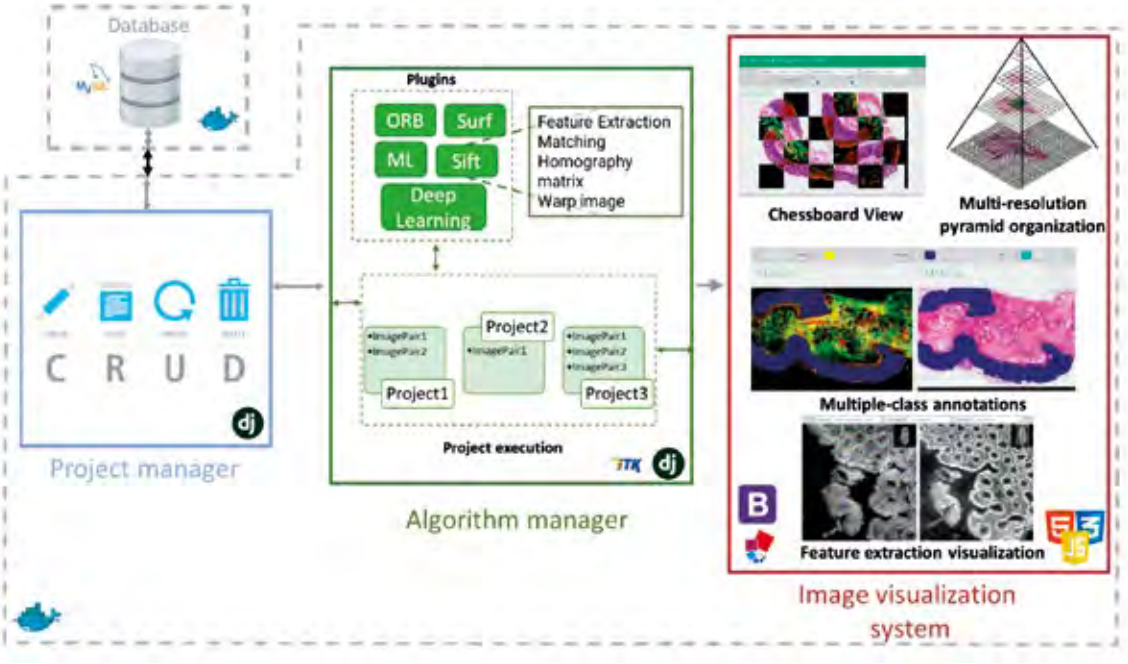

FIGURE 1
MMIR software architecture, with three main components: a project manager, an algorithm manager, and an image visualization system, which allows the images to overlap and the comparison of multiple registration algorithms.

Music Performance Anxiety in Adolescents (MUS-A) explores the impact of performance anxiety on young musicians.

Sofia Serra[1], Pedro Dias[2,3], Lurdes Veríssimo[2], Patrícia Oliveira-Silva[2], Nádia Moura[4]

Classical music training is highly competitive. Young musicians face unique challenges mastering complex motor and cognitive skills. The demands of pursuing a professional level of musicianship within a conservatory can significantly impact their personal and professional lives. Both professional musicians and students often experience high levels of anxiety, with Music Performance Anxiety (MPA) affecting up to half of music students aged 12 to 15 [1]. Many of these students do not recognize their limitations or have access to therapies to mitigate the harmful effects of MPA, leading some to abandon their musical aspirations.

MPA affects individuals on psychological, cognitive, emotional, and behavioral levels, making it difficult to define. According to Dianna Kenny [2], MPA is the experience of marked and persistent anxious apprehension related to musical performance, arising from specific anxiety conditioning experiences. Despite the critical neurobiological basis of psychological disorders, current treatment approaches often neglect these aspects, focusing only on psychological or pharmacological treatments.

This study aims to diagnose and characterize anxiety levels in a group of 430 music students aged 12 to 14 within music conservatories. It also addresses the need for comprehensive therapeutic interventions using both traditional and innovative protocols of Cognitive Behavioral Therapy (CBT), Neurobiological feedback and Meditation. The project's goal is to assess the effects of these interventions on the participants' MPA levels, and, consequently, musical performance quality. This project brings together institutions and researchers from various fields, including Music Psychology, Music Performance, Clinical Psychology, Educational Psychology, and Neurosciences. Their common purpose is to combine knowledge from different disciplines to design, implement, and validate an innovative intervention, beneficial for music students and teachers at an early stage of music development.

This project is funded by the Scientific Research and Technological Development Projects in All Scientific Domains from the Foundation for Science and Technology (2022.05771.PTDC).

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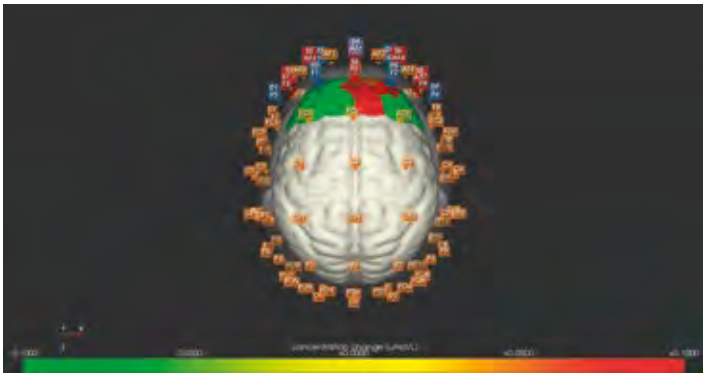
FIGURE 1
Neuroscience data collection during a musician's performance.

FIGURE 2
Prefrontal cortex view of a musician during performance, captured with Aurora fNIRS.

FIGURE 3
Whole-head NirsCap with prefrontal channel layout.



TransVariations: Beethoven in the age of AI

Alfonso Benetti[1], Øyvind Brandtsegg[2], Trond Engum[2], Francisco Monteiro[3]

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2 – Department of Music Technology, Norges Teknisk-Naturvitenskapelige Universitet.
3 – School of Education, Polytechnic Institute of Porto.

What if...Beethoven were here today? In the context of Western-Art Music, performance has been intimately linked to interpretation based on the idea of authenticity in relation to a certain musical text. This tendency normally excludes interaction with contemporary technological tools, circumscribes the musical piece as an element of the past, and isolates the performance as a secondary and imperfect entity in relation to a particular work. *TransVariations* address the use of innovative technological approaches to problematize the relationship between artistic creation and interpretation in the context of Western-Art Music. It includes the exploration of resources associated with modern timbral shaping in the context of Beethoven's piano repertoire using feedback and adaptive processing methods as modes of experimentation. Techniques include the analysis of sound features departing from real-time playing and the use of extracted expressive control signals to adjust electronic processing. Expressive features to be extracted include amplitude, rhythmic patterns, timbral sharpness, spectral density; and processing includes reverberation, convolution techniques, granular processing, spectral shaping, freezing and time modification. This approach enables the (re)creation of past artistic works and the production of new outputs through the use of contemporary technological interfaces; the improvement of new technologies related to artistic creation; the reshape of the idea of expressivity in music; and the dissemination new resources, technological tools and practical related strategies for artistic interpretation and creation. Thus, a new idea of authenticity emerges based on a perception of the past through innovative contemporary means: a new reality is reconstructed according to current mechanisms of understanding where, in practice, the original exists within a specific context and temporal space as part of the present.

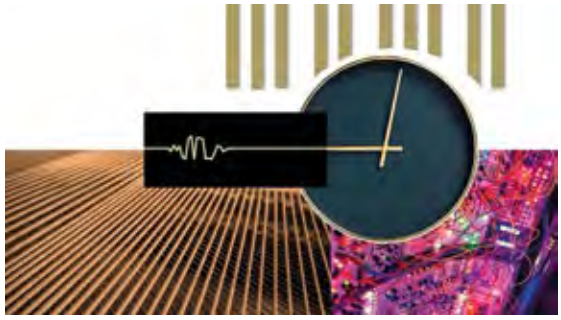

FIGURE 1
TransVariations: conceptual image.

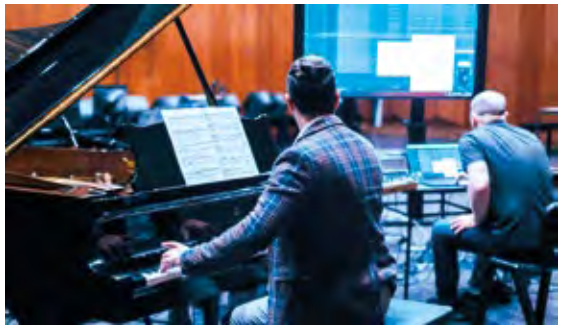

FIGURE 2
Artech Residency at University of Aveiro, November 2023.

Wireless Power Transfer in a Novel Solar Power Satellite System Architecture

Ricardo A.M. Pereira[1], Helena Ribeiro[1], Henrique Chaves[1], Ricardo Figueiredo[1], Amit Baghel[1], Sandra F.H. Correia[1,2], Hélder Morais[3,4], J. Martinho M. Oliveira [2,3], Paulo S. André[2], Rute André[2], Nuno Borges Carvalho[1]

Solar power satellite (SPS) systems can revolutionize energy distribution by capturing solar energy in space and wirelessly transmitting it to ground receivers [1]. This method promises a continuous and reliable power supply, mostly unaffected by weather or day-night cycles. However, the vast distance between the satellites and the Earth presents a challenge, requiring large and precise infrastructures to be built and maintained in space. William Brown's work on wireless power transfer (WPT) by microwaves paved the way, while highlighting the complexities of achieving high-efficiency over such distances [2].

Researchers at the University of Aveiro have proposed an innovative system architecture that addresses several of these challenges [3]. The main novelty is the addition of an energy storage subsystem, allowing power supply even if there is no direct sunlight, such as lunar bases on the dark side of the moon. Additionally, to enhance the WPT's efficiency and reduce the system's dimensions, quasioptical techniques focus the beam of energy, done here mostly with lenses [4, 5, 6]. Finally, solar concentrators increase the energy generation efficiency [7].

This project has achieved significant milestones, having won an European Space Agency Ideas call, for the development of a large-scale ground demonstrator. Preliminary results have shown a beam transfer efficiency of 43%, surpassing the state-of-the-art.

Key developments in the beam transfer include new corrugated horn antennas and miniaturized Fresnel zoned lenses. The former can be additively manufactured directly in metal without supports, while providing excellent radiation performance. The miniaturized Fresnel lens significantly reduces the lens' thickness and overall system weight, dimensions and costs.

In summary, this research represents a major advancement in SPS systems, addressing key technical challenges, bringing us closer to realizing SPS as a viable energy solution.

I employ AI for text development purposes.

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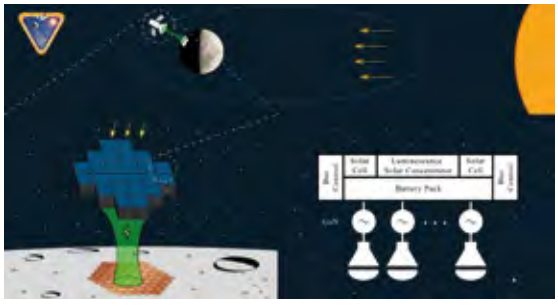

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3 – CICECO, University of Aveiro.
4 – Department of Electrical and Computer Engineering and Instituto de Telecomunicações, Instituto Superior Técnico, University of Lisbon.

FIGURE 1
Scheme of the models from BIM to EFM.

FIGURE 2
Influence of the out-of-plane (OOP) resistance.

Achieving Multi-Terabit FSO Capacity with Coherent WDM Transmission over a 1.8 km Field Trial

Manuel M. Freitas [1], Marco A. Fernandes [1], Gil M. Fernandes [1], Bruno T. Brandão [1], Paulo P. Monteiro [1], Fernando P. Guiomar [1]

1 – Instituto de Telecomunicações and University of Aveiro.

FIGURE 1
Field trial of multi-Terabit WDM coherent transmission over a 1.8 km FSO between IT-Aveiro and PCI-Ílhavo.

FIGURE 2
Electrical SNR per channel obtained from multi-terabit WDM transmission over a 1.8 km FSO-link.

Free-space optics (FSO) is becoming popular for next-generation wireless networks, bringing virtually unlimited bandwidth in an unlicensed spectrum, improved security due to high beam directivity and immunity to electromagnetic interference. However, this technology requires tight and precise alignment. Moreover, direct optical fiber coupling makes the receiver sensitive to angle-of-arrival fluctuations. In outdoor weather-exposed wireless optical links, the interplay between pointing errors and atmospheric turbulence can lead to strong scintillation and power losses[1].

Tackling the deployment of terrestrial optical wireless links, we have conducted a field trial in Aveiro, Portugal, connecting two buildings with a 1.8 km FSO-link. This trial was established through an international collaboration with Aircision BV, a Dutch start-up that developed a set of FSO optical heads capable of automatic beam alignment and direct air-to-fiber coupling (https://www.aircision.com/unique-technology). Exploiting automatic optical gain adjustment at the receiver side, we demonstrate effective mitigation of atmospheric turbulence effects, achieving a reduction of one order of magnitude in the measured Rytov variance. Moreover, resorting to coherent optics and wavelength division multiplexing (WDM), and using soft-decision forward correction (FEC) codes, we found the optimum FEC overhead that maximizes the overall system throughput[2,3].

With this methodology we were able to demonstrate 4 Tbps (10 x 400 Gbps) transmission over a 1.8 km FSO channel (between IT-Aveiro and PCI-Ílhavo), establishing a new record on the experimentally demonstrated FSO capacity using commercial FSO optical heads for terrestrial applications. To better grasp the impact of the obtained results, consider that the achieved 4 Tbps would enable the simultaneous streaming of 80 thousand 4K videos, the transmission of 420 holographic videos or downloading all currently available YouTube videos in less than 3h.

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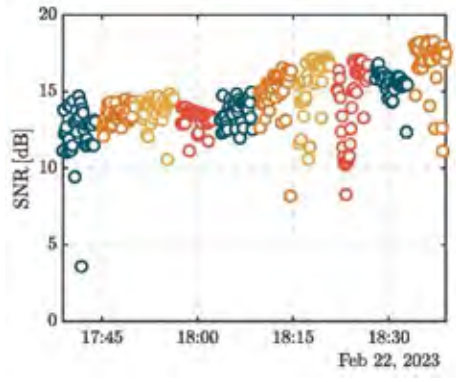
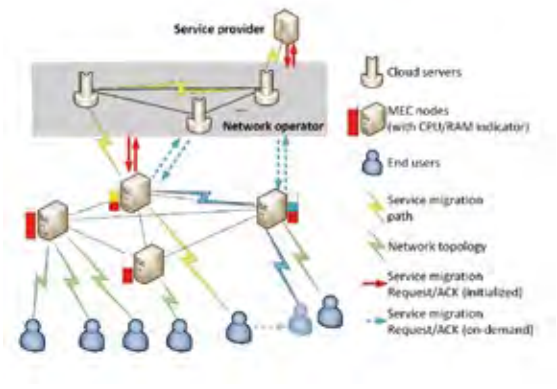
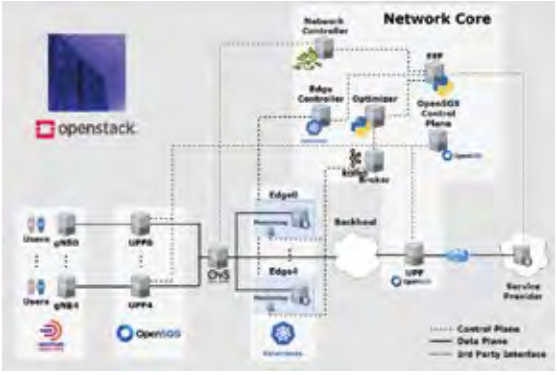


Multi-Criteria Dynamic Service Migration for Ultra-Large-Scale Edge Computing Networks

Hao Ran Chi[1], Rui Silva[1,2], David Santos[1,2], José Quevedo[1], Daniel Corujo[1,2], Osama Abboud[3], Ayman Radwan[1], Artur Hecker[3], Rui L. Aguiar[1,2]

Multi-access edge computing service migration is a technology whose key objective is to support ultra-low-latency access to services. However, the complex ultra-large-scale edge service migration problem requires extensive research efforts, regarding the foreseen ultra-densified edge nodes in 5G and beyond. In this paper, we propose a novel dynamic service migration optimization architecture for ultra-large-scale multi-access edge computing networks. We develop a new multi-criteria decision-making algorithm: Technique for Order of Preference by Similarity to Ideal Solution with Attribute-based Niche count, named TOPANSIS, which showcases its strength to provide an optimal solution for service migration in large-scale deployments towards optimal data rate, latency, and load balancing. We further decentralize the operation of TOPANSIS to release the traffic burden from central datacenters by leveraging local decision making by edge nodes, while relying on central cloud coordination to account for the overall network information. Simulation results showcase that the proposed architecture outperforms the selected benchmarks with an average improvement of 39.41% for latency, 2.92% for data rate, as well as 10.53% and 6.26% for RAM and CPU load balancing, respectively. Moreover, the feasibility of the proposed solution is validated by means of a proof-of-concept implementation and experimental assessments.





1 – Instituto de Telecomunicações.
2 – Department of Electronics, Telecommunication and Informatics, University of Aveiro.
3 – Huawei Technologies Duesseldorf GmbH.

FIGURE 1
The proposed service migration optimization architecture.

FIGURE 2
Scenario Evaluation Setup.

Contributions to Greener Cellular Networks: From Device Physics to System Level

Luís Cótimos Nunes[1], Filipe Miguel Barradas[1], Pedro Miguel Cabral[2], Telmo Reis Cunha[2], José Carlos Pedro[2]

1 – Instituto de Telecomunicações.
2 – IT & Department of Electronics, Telecommunications and Informatics, University of Aveiro.

Cellular networks waste huge amounts of energy in their base stations that connect to the surrounding phones and devices, being the power amplifier of each base station the main culprit for such an energy waste. Each of these amplifiers radiates tens or even hundreds of Watt, at the expense of an equivalent amount of power (or more) dissipated as heat, corresponding to an excess operation expenditure supported by the network operators. This fact led the telecommunications' industry to invest in research for new amplifier architectures and techniques that provide a significant improvement on the overall energy efficiency of cellular network transmitters.

The research group "Wireless Circuits – Av" from the Instituto de Telecomunicações, Aveiro, has been working towards this goal, within a long-term collaboration project with the multinational company Huawei Technologies. The strategy is to first understand the physical behaviors of the core building block of the power amplifier circuit – the transistor – to then model such behaviors through mathematical formulations, enabling highly accurate circuit design level simulations. Moreover, the overall input-output behavior of complete amplifier circuits is also modeled, for an efficient analysis of the amplifier characteristics, from output signal fidelity to energy efficiency. This original holistic strategy of linking knowledge from intrinsic transistor behavior up to the overall amplifier system-level operation has produced relevant contributions to the improvement of cellular base station transmitters. These received the recognition from both our academic peers, through highly reputed publications, and from the industry, namely Huawei Technologies, which, in 2023, attributed to this collaboration the annual prize of "Excellent Technical Cooperation Project", with the mention: "in Recognition of Outstanding Research Contributions from IT Aveiro", referring to all the world-wide cooperations the company had in 2022.

FIGURES 1 AND 2
Prize attributed by Huawei Technologies to the "Wireless Circuits – Av" group.

Sex-specific trajectories of striated muscle aging

Alexandra Moreira-Pais[1], Alessandro Nuccio[1], Rui Vitorino[2], Francisco Amado[1], Rita Ferreira[1]

Sex bias in research poses a significant concern, as most studies tend to focus primarily on males, often neglecting potential sex-specific alterations. Given the well-documented sex differences in the incidence, progression, and treatment response of chronic diseases like cancer and cardiovascular diseases, and of the aging process, it becomes imperative to consider biological sex when tailoring treatment strategies to optimize outcomes.

Aging presents a notable challenge, marked by declining quality of life and premature mortality, and understanding the sex-specific differences in age-related striated muscle remodeling, particularly regarding mitochondrial dynamics, is essential to refine anti-aging interventions. At the cardiac level, males tend to exhibit more pronounced age-related cardiac hypertrophy and fibrosis compared to females, despite no apparent age-related differences in the sex hormone signaling. Conversely, at the skeletal muscle level, females demonstrate a heightened susceptibility to age-related muscle wasting, which was correlated with decreased levels of 17β-estradiol. This muscle wasting in females was further associated with an age-related impaired mitochondrial functionality, contributing to a more severe loss of skeletal muscle mass compared to males. The discovery of sex hormone receptors on skeletal muscle mitochondria underscores the influence of sex hormones in modulating mitochondrial activity. Specifically, the observed decline in mitochondrial activity and increased susceptibility to oxidative damage in the skeletal muscle of old females were associated with decreased mitochondrial levels of the ERα receptor.

Importantly, our research demonstrated, for the first time, the uneven impact of aging on the skeletal muscle mitochondrial proteome according to the biological sex. These findings underline the need of sex-tailored approaches to manage maladaptive striated muscle remodeling, and of mitochondrion-related therapeutics research.

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2 – iBiMED & Department of Medical Sciences, University of Aveiro.

FIGURE 1
Age-induced sex-specific remodeling of the skeletal muscle, highlighting the higher susceptible of females than males to the adverse effects of aging (more information in FRBM (2024) 218:68-81).

Promoting the circular economy through eco-friendly resource recovery from electronic waste

Eduarda Pereira[1], Daniela Tavares[1], João Pinto[1], Bruno Henriques [1]

1 – LAQV-REQUIMTE & Department of Chemistry, University of Aveiro.

The scientific advancements achieved during 2023 strongly contributed to improving resource recovery and circular economy practices. Using sorption-based methods for retrieving Technology-Critical Elements (TCEs) from electronic waste (e-waste) addresses the critical shortage of TCEs but also helps mitigate the environmental and health risks associated with conventional mining and e-waste disposal. The use of sorbents such as synthetic materials, biosorbents derived from plants, algae, or agricultural waste, coupled with recovery optimization through surface response methodology, can significantly reduce the EU's dependence on imports and promote resource recycling (Figure 1). In 2023, we have successfully published works on these topics in high-impact journals (IF > 14) [1, 2], demonstrating the relevance of this research. Studies on the recovery and recycling of natural resources, especially those whose supply chain is at risk (such as TCEs), represent a major contribution to sustainable management and development. Additionally, our work on the ecotoxicological impacts of e-waste and TCEs also provided relevant information for policy makers on the impacts of unregulated disposal of e-waste in aquatic systems, especially under the influence of other anthropogenic pressures such as climate change (in collaboration with Rosa Freitas from UAveiro's Department of Biology). These were also published in renowned specialist journals (IF > 10) [3]. Overall, these advances pave the way for a more sustainable approach to resource management, aligned with the UN's Sustainable Development Goals. Promising results have been achieved by our research group, which is now dedicated to improving the selectivity of these materials to facilitate post-sorption refinement procedures and improve the purity of the elements for reuse. Once achieved, sorption-based TCEs recovery will be an important factor in reducing constraints on the supply chain of these elements and lessen the reliance on primary ore mining.

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FIGURE 1
Potential for resource circularity of Technology-Critical Elements (TCEs) recovery through sorption-based methodologies (synthetic sorbents and biosorbents).

The circularity of brewer's spent yeast – from beer to food ingredients and biomedical applications

Rita Bastos [1], Sofia F. Reis [1], Susana Messias [1], Vítor J. Martins [1], Lisete M. Silva [1], Pedro A. R. Fernandes [1], Manuel A. Coimbra [1], Elisabete Coelho [1]

It is a common practice of brewing industry to reuse the yeasts in serial fermentations. *Saccharomyces pastorianus*, used to produce Lager beer, is widely reused without affecting its fermentation performance. However, *S. cerevisiae*, used to produce Ale beer, is usually not reused due to its poor performance upon recycling. When yeast recycling is not able to keep the quality of the beer, these are discarded as brewer's spent yeast (BSY). Therefore, all breweries are also yeast biomass producers. During fermentation, yeasts modulate their glycogen and cellulosic-like polysaccharide structures in different ways[1], resulting in materials with distinct structural characteristics for food and biomedical applications[2]. For example, as an emulsifying ingredient for a vegan mayonnaise formulation[3], and an oral delivery system[4] able to be recognized by the human Dectin-1 immune receptor even after digestion. After digestion, their spherical shape was preserved and the released material was able to interact with the immune receptors Dectin-1, DC-SIGN, and Dectin-2, important to develop tailored applications. The immunomodulatory activities of yeast β-glucans have been gathering increasing attention as therapeutic agents or immune adjuvants. Because they can be specifically recognized by immune cells, yeast β-glucans are a promising option as carriers for the targeted delivery of immunotherapies. Some of the most recent biomedical applications for yeast polysaccharides include their use as anti-tumoral agents, bone implants and tissue repair, vaccine adjuvants, and drug delivery systems[2]. Also, BSY polysaccharides possess thickening and emulsifying properties able to replace egg yolk and modified starch in a mayonnaise formulation. β-Glucans and *O*-linked mannoproteins were found to contribute to emulsion stability by preventing Ostwald ripening[3]. BSY polysaccharide modifications that arise from the brewing process can potentiate their food and biomedical applications, namely, as emulsifying ingredients and oral delivery systems recognized by human immune receptors.

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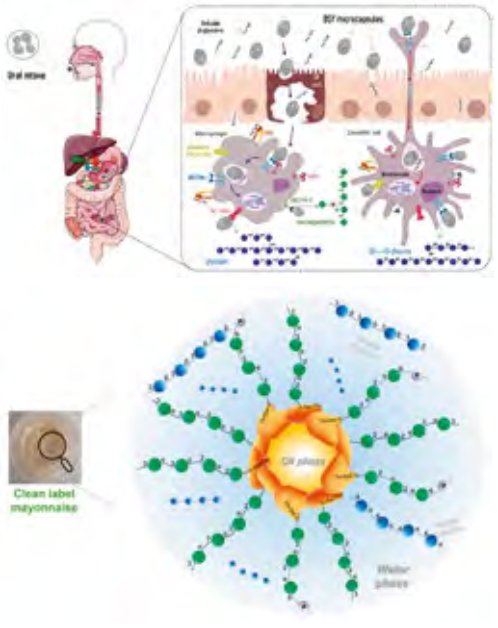

1 – LAQV-REQUIMTE & Department of Chemistry, University of Aveiro.

FIGURE 1
Overview of brewer's spent yeast derived microcapsules as targeted oral carriers and its innate immune response.

FIGURE 2
Proposed emulsion stabilization model of brewer's spent yeast cell wall polysaccharides in a mayonnaise formulation.

Porphyrinoids Power: From Water Purification to Light-Activated Therapies

Ana S. Joaquinito[1], Nuno M.M. Moura[1], Leandro M.O. Lourenço[1], Idalina Gonçalves[2], M. Graça P.M.S. Neves[1], M. Amparo F. Faustino[1]

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2 – CICECO & Department of Materials and Ceramic Engineering, University of Aveiro.

The rise of antimicrobial resistance, increasing cancer incidence, and water pollution significantly impact public health and ecosystems globally. Porphyrins and their analogs are versatile compounds suitable for both medical and environmental applications. The chemical fine-tuning these macrocycles allows them to address critical issues as photosensitizers (PS) in photodynamic therapies and as ligands in adsorption processes.

The incorporation of a positively charged porphyrin into starch-based films resulted in improved physical and mechanical properties. These films effectively killed *Escherichia coli* bacterial cells when exposed to light. Even more promisingly, *in vitro* studies using human microvascular endothelial cells (HMEC) and human dermal fibroblasts (HDF) indicated the films' potential for enhancing wound healing without light requirement. This paves the way for the development of biocompatible wound dressings with both antimicrobial and healing properties.

The incorporation of thioglycerol moieties into the core of porphyrin and chlorin derivatives has resulted in the development of new and efficient photodynamic therapy (PDT) agents. These PS were evaluated against the human bladder cancer cell line UM-UC-3, suggesting that the singlet oxygen generation capability and subcellular localization of the PS play key roles in the photodynamic approach.

Porphyrins with thiopyridyl binding anchors were grafted onto the surface of silica particles allowed for the preparation of new and efficient adsorbents. These organic-inorganic hybrids demonstrated significantly improved adsorption capabilities for metal cations, particularly Cu(II), a harming human health and environment metal at high levels (> 1.3 ppm). The adsorption capacity of these prepared adsorbents is remarkably higher compared to other ligands supported on silica-based adsorbents, even in complex matrices such as industrial wastewater.

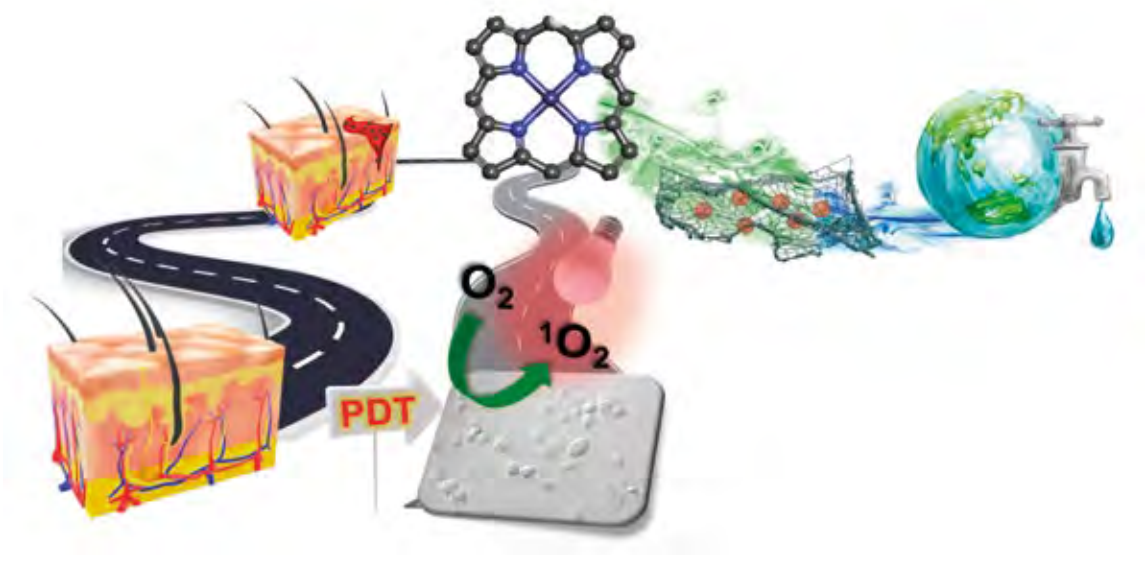

FIGURE 1
Porphyrin derivatives as versatile photosensitizers for light-activated therapy approaches and as ligands for water remediation.

An ANN-based Earthquake Ground Motion Model for Southwest Iberia

Amir Taherian[1], Vitor Silva[2], Petros Kalakonas[3], Romeu Vicente[1]

A ground motion model (GMM) is essential for assessing seismic hazard and risk in any region. These models determine the distribution of earthquake intensity across various sites, factoring in earthquake magnitude, source-to-site distance, and soil conditions. In regions characterized as Active Shallow Crustal (ASCR) or subduction tectonic zones, the abundance of ground motion data has led to the development of numerous empirical models. However, for Stable Continental Regions (SCR) like Southwest Iberia, lower seismic activity and limited ground motion recordings pose challenges to developing empirical models. To address this data scarcity, stochastic simulations have been employed since the 1980s to generate synthetic ground motion records suitable for these regions.

This study presents the first GMM tailored for Southwest Iberia, encompassing mainland and offshore Portugal and the southwest of Spain. This area, located near the Azores-Gibraltar plate boundary, has a history of significant seismic events despite its relatively low seismicity. Notable events include the 1755 M~8.5 Lisbon earthquake and the 1969 M7.8 Algarve earthquake.

To address these needs, we divide Western Iberia into inland and offshore zones. We collect ground motion records from the Portuguese and Spanish seismic network databases and calibrate modelling parameters for stochastic simulations, resulting in two sets of parameters with associated aleatory variability. Ground motion simulations estimate spectral acceleration values on rock for various hypothetical earthquake scenarios. These synthetic records train, verify, and test an Artificial Neural Network (ANN) to predict ground shaking with high accuracy. The model's results are compared with existing GMMs for other SCRs and recordings from past regional earthquakes, demonstrating the effectiveness of our approach in enhancing seismic hazard and risk assessment for Southwest Iberia.

1 – RISCO & Department of Civil Engineering, University of Aveiro.
2 – Faculty of Science and Technology, University of Fernando Pessoa, Porto.
3 – Zurich Insurance Group, Zurich, Switzerland.

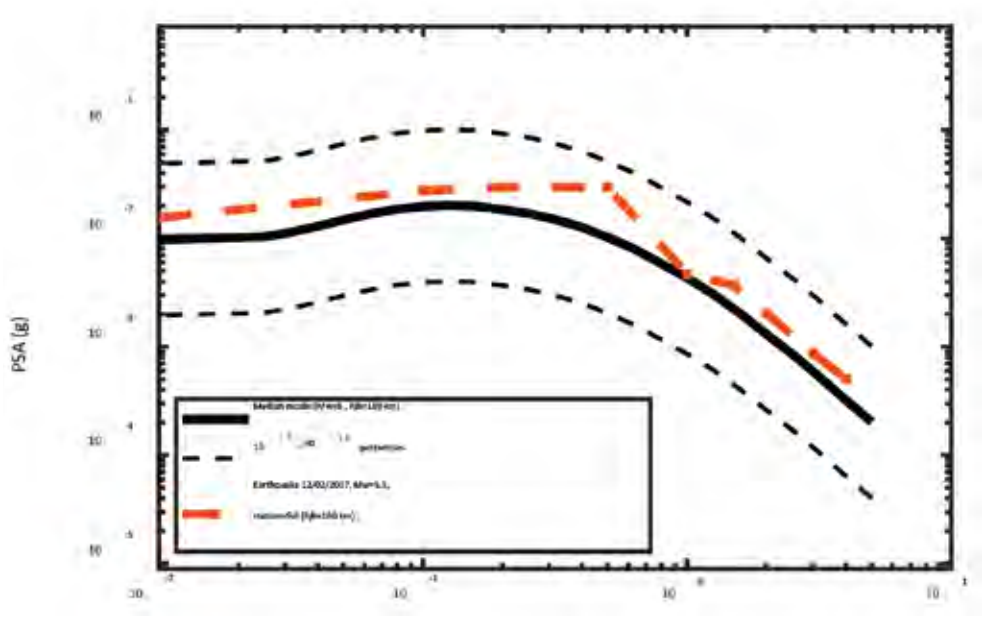

FIGURE 1
Comparison of median acceleration response spectra computed using the offshore model for Mw=6.0 with two empirical data from two events recorded at four different distances.

Participatory approaches and cost-benefit analysis in coastal management

Carlos Coelho[1], Márcia Lima[1,2], Ana Margarida Ferreira[1], Blanca Mendiguren[1], Frederico Romão[1], Joaquim Pais-Barbosa[1,3]

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2 – Lusofona University – Porto University Center (CUP).
3 – ProMetheus, Instituto Politécnico de Viana do Castelo.

The negative impacts of coastal erosion have urged measures to mitigate shoreline retreat and protect regions and their communities. INCCA (Integrated coastal climate change adaptation for resilient communities), COAST4US (Application of the COAST tool to the Portuguese coast) and AX-COAST (Cross-shore features and internationalization of the COAST) projects represented a step forward in participatory approaches to define coastal management strategies together with different stakeholders, supported by cost-benefit assessments and improved capacity to represent shoreline evolution projections.

Proactive coastal zone planning leads to increasingly effective coastal management. The involvement of stakeholders in participatory processes and decision-making is essential for delineating coastal management policies with greater acceptance and collective benefit (Figure 1). The decision on the most relevant coastal interventions should be weighed, keeping in mind the social potential and economic benefits of beaches and urban areas, as well as the ecological value of coastlines ecosystems in each region. Additionally, intervention costs should be defined to allow rigorous cost-benefit analyzes and adequate representativeness to the specificity of each location. Cost-benefit analysis provides crucial data to help responsible entities make strategic decisions for effective and sustainable coastal management, emerging as an indispensable component for defining intervention priorities in the coastal zone, enabling greater technical and economic sustainability in decision-making.

A participatory governance model, dynamic, iterative, flexible and supported by adequate tools, prepared to perform cost-benefit assessments, will be a growing need, bringing technologies, knowledge and stakeholders at the various stages of thinking, reflecting, planning, implementing and assessing strategies and measures to mitigate and adapt coastal zones (Figure 2).

FIGURE 1
A participatory session, developed in the aim of the INCCA project.

FIGURE 2
Books with the description of results, recommendations and conclusions of the projects were published and presented in the final seminars.

Decellularized extracellular matrix-based 3D nanofibrous scaffolds functionalized with polydopamine-reduced graphene oxide for neural tissue engineering

Daniela M. da Silva[1], Nathalie Barroca[1], Susana C. Pinto[1], Ângela Semitela[1], Bárbara M. de Sousa[2], Patrícia A.D. Martins[3,4], Luís Nero[3,4], Iratxe Madarieta[5], Nerea García-Urkia[5], Francisco-Javier Fernández-San-Argimiro[5], Andrea Garcia-Lizarribar[5], Olatz Murua[5], Beatriz Olalde[5], Igor Bdikin[1], Sandra I. Vieira[2], Paula A.A.P. Marques[1]

One of the exciting prospects of using decellularized extracellular matrices (ECM) lies in their biochemical profile of preserved components, many of which are regeneration permissive. Herein, a decellularized ECM from adipose tissue (adECM) was explored to design a scaffolding strategy for neural tissue engineering. Targeting the recreation of the nano-scaled architecture of native ECM, adECM was first processed into nanofibers by electrospinning to produce bidimensional platforms. These were further shaped into three-dimensional nanofibrous constructs by gas foaming. The conversion into a 3D microenvironment of nanofibrous walls was assisted by blending the adECM with lactide-caprolactone copolymers, which allow to fine tune the 3D nanofibrous constructs, that exhibit structural stability, adequate microporosity and mechanical compliance with soft neural tissues.

In culture, neural stem cells (NSCs) responded differently depending on the adECM-based architecture: nanofibrous 2D or nanofibrous 3D design. Although broadly exploited, 2D membranes are hardly effective platforms to test neural stem cells response in a physiological-like environment. Gas foaming emerges as a straightforward technique to produce 3D nanofibrous constructs, so that when testing novel biomaterials, it readily provides a 3D microenvironment, that reveals biomaterial-induced effects which otherwise could remain unperceived. Indeed, the 3D spatial arrangement of the adECM-based nanofibers – induced by gas foaming – exhibited a remarkable effect on NSCs' phenotype determination and neurite formation, thereby reinforcing the critical importance of engineering scaffolds with multiple length-scale architecture.

In view of boosting their performance to guide neural stem cell fate, adECM-based platforms were doped with a bioinspired surface modification relying on polydopamine-functionalized reduced graphene oxide (PDA-rGO), which significantly promoted neuronal differentiation and neuritogenesis.

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3 – Department of Electronics, Telecommunications and Informatics, University of Aveiro.
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5 – TECNALIA, Spain.

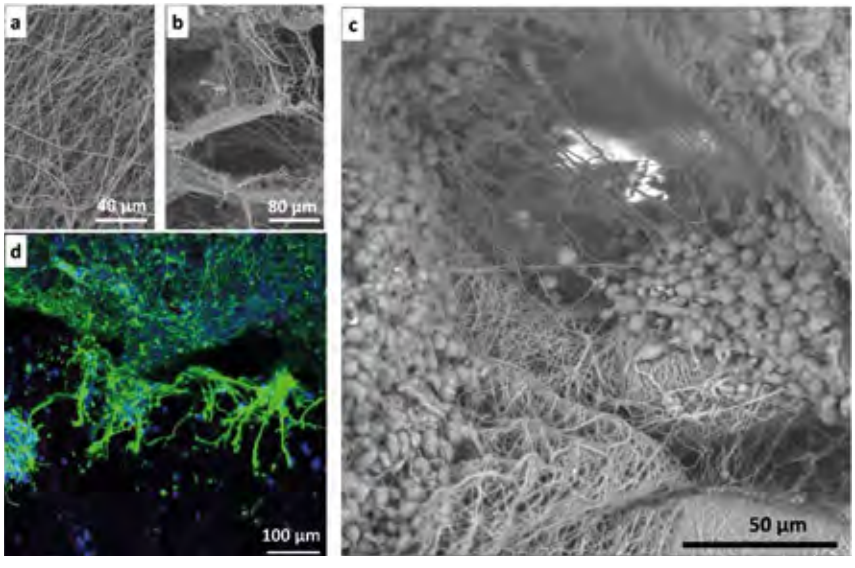

FIGURE 1
a) SEM of 2D nanofibrous adECM-based membrane; b) SEM of 3D nanofibrous construct; c) SEM showing NSC migration and growth within the 3D constructs; and d) confocal imaging of neuronal differentiation.

Mechanical micro-drilling of glass and carbon fibre reinforced polymer (GFRP and CFRP) composites

Norbert Geier[1], Karali Patra[2], Ravi Shankar Anand[3], Sam Ashworth[4], Barnabás Zoltán Balázs[1], Tamás Lukács[1], Gergely Magyar[1], Péter Tamás-Bényei[5,6], Jinyang Xu[7], João Paulo Davim[8]

1 – Faculty of Mechanical Engineering, Department of Manufacturing Science and Engineering, Budapest University of Technology and Economics, Hungary.
2 – Department of Mechanical Engineering, Indian Institute of Technology Patna, India.
3 – Department of Mechanical Engineering, Birla Institute of Technology, India.
4 – North of England Robotics Innovation Centre, The University of Salford, United Kingdom.
5 – Faculty of Mechanical Engineering, Department of Polymer Engineering, Budapest University of Technology and Economics, Hungary.
6 – ELKH–BME Research Group for Composite Science and Technology, Hungary.
7 – School of Mechanical Engineering, State Key Laboratory of Mechanical System and Vibration, Shanghai Jiao Tong University, PR China.
8 – TEMA & Department of Mechanical Engineering, University of Aveiro.

Considering that minimising resources and materials are key priorities of the circular economy encouraged by the EU, the miniaturisation of geometric features in high-strength fibre-reinforced polymer (FRP) composites will come to the fore. In addition, micro-holes are beneficial in various FRP applications such as in the miniaturised polymeric composites in microelectronic systems, biomedical filters, composite panel absorbers, to improve aerodynamic properties, micro-perforated panels in FRPs to improve acoustic absorption and noise control, etc. Although the macro-machineability of FRPs is becoming known thanks to the extensive research in this area, these experiences cannot be directly adopted to the micro-scale. The micro-machining of FRPs combines the challenges of macro-machining of FRPs (abrasive tool wear, delamination and burr formation, fibre dependency, etc.) and micro-machining (size-effect, tool deflection, size limitations, etc.), making the technology planning even more difficult.

We collected and systematised our own experience and others' published expertise on the micro-drilling of glass and carbon fibre-reinforced polymer composites for critical review. We reviewed chip removal mechanisms of micro-drilling of FRPs and compared them to conventional-sized technologies. Furthermore, the micro-drilling-induced geometrical defects and the cutting energetics are also discussed. Moreover, the future aspects and research directions are highlighted. The following aspects were addressed as room for improvement and development in the future: machine tools and equipment, peck cycles, cooling, chip removal and ultrasonic vibration assistance; advanced cutting tool geometries should be implemented in micro-scales; develop specific FRP testing regime for micro-drilled holes to analyse effects of multiple micro-holes on mechanical performance; and further exploration of machine tool, tool geometry, tool coating, cutting parameters and cooling.

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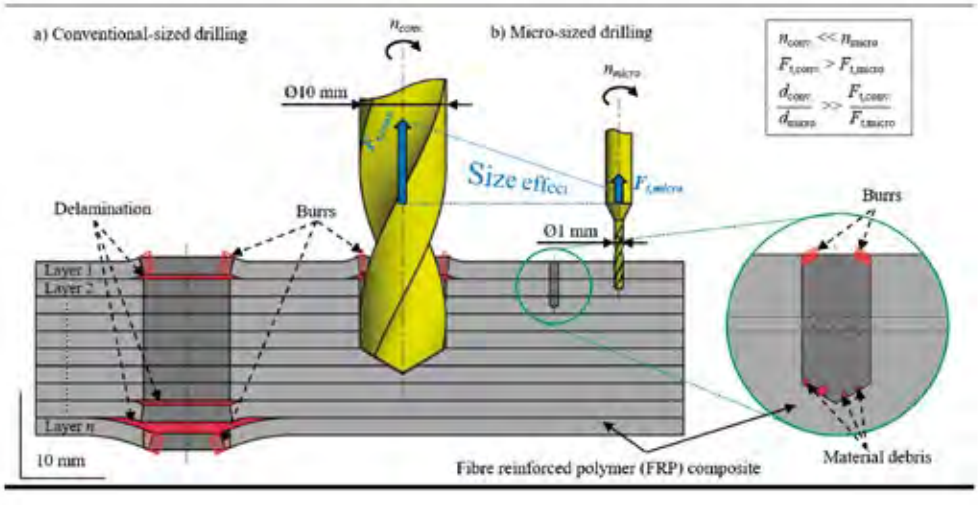


FIGURE 1
A schematic illustration of macro and micro-drilling of FRPs [1]: (a) conventional-sized and (b) micro-sized drilling, where n denotes the spindle speed, F_t is the thrust force, and d denotes the hole diameter.

A combined framework of Biplots and Machine Learning for real-world driving volatility and emissions data interpretation

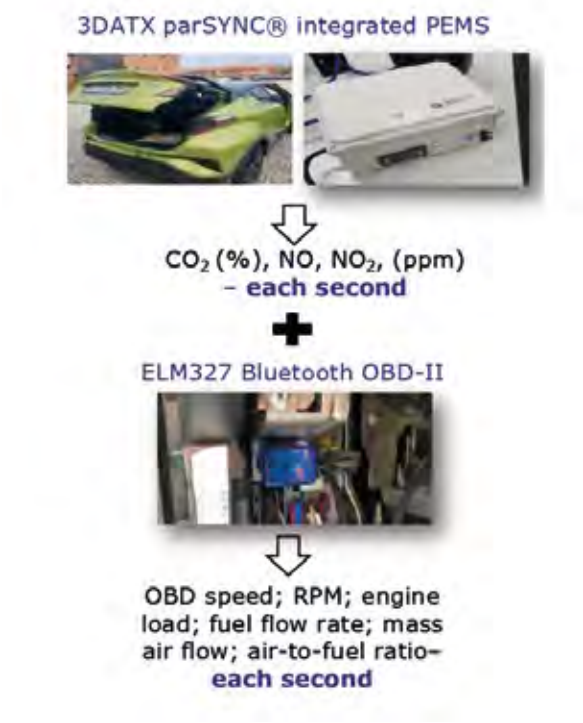
Elisabete Ferreira [1,2], Eloísa Macedo [1,2], Paulo Fernandes [1,2], Margarida Coelho [1,2]

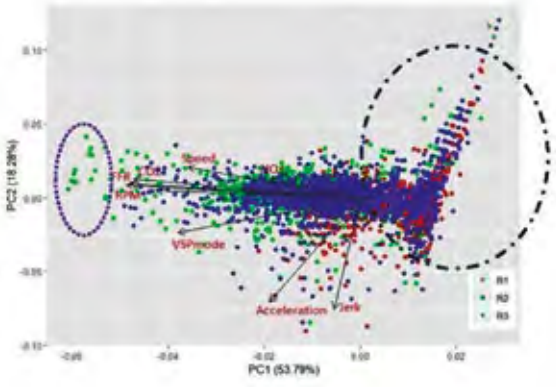
Advanced visualization techniques can be useful for a better understanding of driving behavior and vehicle emissions in real-time.

This study used classic and sparse HJ-biplots to examine the relationship between driving behavior, vehicle engine, exhaust emissions, and route type variables. Different Machine Learning classifiers were applied.

Second-by-second vehicle dynamic, engine, and emissions data were collected from three light-duty vehicles (hybrid electric (HEV), diesel, and gasoline) along three routes (one national (N109) road and two highways (A29 and A1). The dataset included a sample of 12,150 s of speed, acceleration, vehicular jerk (first derivate of acceleration), engine speed, engine load, fuel flow rate, vehicle-specific power mode, and carbon dioxide (CO_2) and nitrogen oxides (NOx) emissions.

The proposed methodology not only enables the distinction of driving styles, road types, and emissions profiles but also allows for revealing the correlation of variables in a single plot. The Random Forest algorithm showed to present the highest accuracy. This study can be useful in the context of road traffic emissions monitoring since it identifies hidden relationships in input data and reduces the redundancy in input parameters without compromising information.





1 – TEMA & Department of Mechanical Engineering, University of Aveiro.
2 – LASI – Intelligent Systems Associate Laboratory, Guimarães.

FIGURE 1
Passenger cars were equipped with an Integrated Portable Emission Measurement System (iPEMS), on-board diagnostic readers (OBD-II), and a Global Navigation Satellite System (GPS) data-logger.

FIGURE 2
Classical biplot for HEV, with 72% of the total explained variance, showing higher emissions values on R2 (A29), separation of acceleration and jerk from other variables.

The breadth of animacy in memory: New evidence from prospective memory

Sara B. Félix[1,2], Marie Poirier[2], James S. Nairne[3], Josefa N.S. Pandeirada[1]

1 – WJCR & Department of Education and Psychology, University of Aveiro.
2 – Department of Psychology, City, University of London, United Kingdom.
3 – Department of Psychological Sciences, Purdue University, USA.

The animacy effect describes a memory phenomenon where animate entities (e.g., animals, people) encoded in a past event are remembered better than inanimate things (e.g., objects). This effect has been widely replicated in multiple languages, encoding procedures, and to-be-remembered materials (e.g., words, pictures). It was hypothesized that, from an evolutionary perspective, it would have been adaptive for humans to better remember animate (vs. inanimate) things, as animates have a higher potential to influence survival and reproductive success (e.g., animates can be predators, prey, potential partners). Although it is widely assumed that memory primarily concerns past events, memory functioning is foremost future-directed. Indeed, most daily tasks involve future-oriented intentions, such as remembering to deliver a message to a friend or to take medication at the appropriate time. This type of memory is known as "prospective memory". Following the same evolutionary framework, we hypothesized that prospective memory should also be sensitive to the animacy dimension of targets (i.e., those that signal the need to implement an intention). Across a series of three studies, participants engaged in an ongoing task while being presented with words corresponding to animate and inanimate things; however, whenever specific animate and inanimate words were presented (e.g., bottle and dancer), participants should remember to undergo a specific task (i.e., to press a different keyboard key; prospective memory task). These studies were conducted with both Portuguese and English participants and used various procedures. Our findings revealed, for the first time, that animate targets also improve the execution of future intended actions (Figure 1). Besides the theoretical importance of this novel finding, potential applications are to be explored. Who knows whether using animate (vs. inanimate) cues in our daily lives would improve our prospective memory performance?

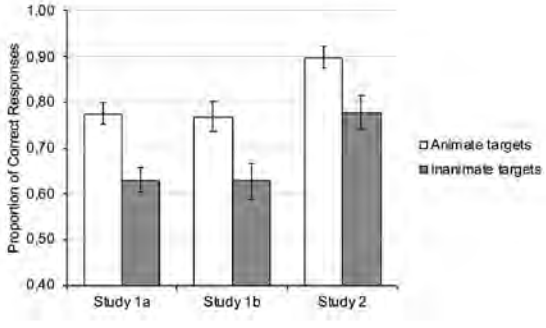


FIGURE 1
Mean Proportion of Prospective Memory Correct Responses for Animate and Inanimate Targets, Across Studies. Error Bars Represent Standard Errors of the Mean.

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Automatic attention to sexual stimuli: Exploring the role of neuroticism and sexual excitation/inhibition through event-related potentials

Joana Carvalho[1], Isabel M. Santos[1], Sandra Aguiar[2], Mariana L. Carrito[2]

Neuroticism, a personality trait highly related to the lack of psychological adjustment, is considered a critical etiology and/or maintenance factor for male and female sexual dysfunction (e.g., psychogenic erectile dysfunction, sexual arousal, or sexual desire disorders) and is expected to play a role in the attentional processing of sexual stimuli. Yet, the neuroticism-attention chain underpinning human sexual functioning still lacks empirical support. The current study[1] aimed to test the mediating role of sexual excitation and sexual inhibition propensities in the neuroticism-automatic attention toward visual erotica relationship. It further aimed to unveil the neuroelectric correlates of that process. Fifty-eight participants (30 women and 28 men) were enrolled in a modified oddball paradigm containing romantic (focus on non-sexual intimacy) and sexually explicit pictures (focus on genital interaction), while event-related potentials (ERPs) were recorded. The experiment took place at the NeuroLab (DEP-UAveiro). Findings from parallel mediation analyses supported sexual inhibition due to the fear of sexual performance failure as a mediator of the neuroticism-automatic attention (ERP component N2) to visual erotica relationship (both regarding romantic and sexually explicit pictures). From a clinical perspective, findings suggest that visual erotica is perceived as threatening by high-level neuroticism individuals. Accordingly, therapeutic strategies aimed at decreasing hyperarousal and demands of sexual performance are recommended in the context of sex therapy.

1 – WJCR & Department of Education and Psychology, University of Aveiro.
2 – Center for Psychology at the University of Porto, University of Porto.

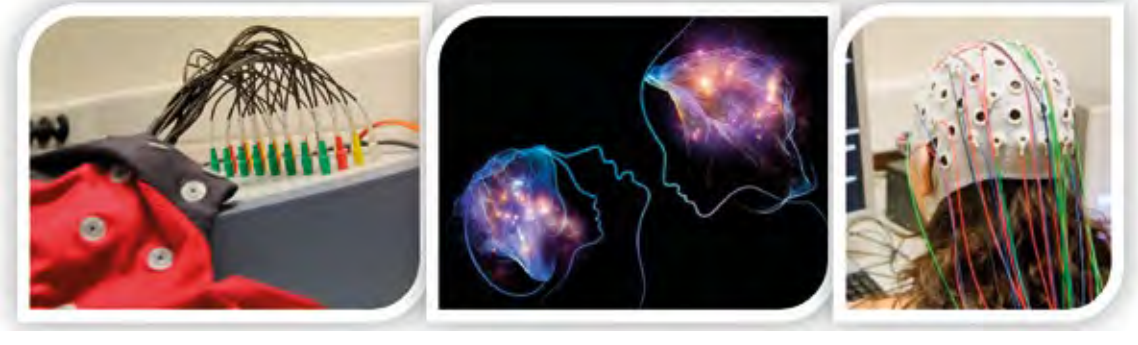

FIGURE 1
Illustration of the experimental setup during the laboratory task.

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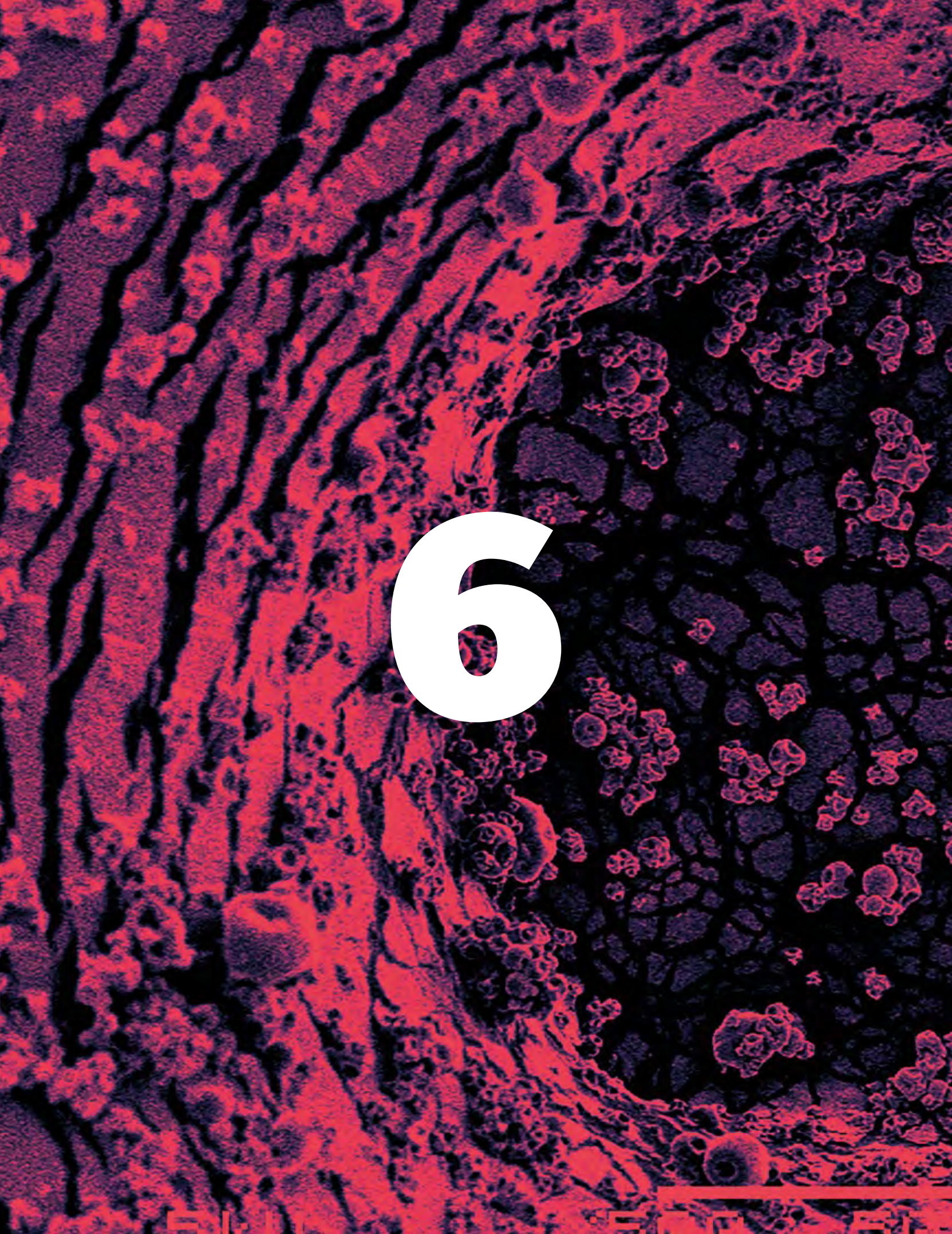
[1] Aguiar, S., Carvalho, J., Carrito, M.L., & Santos, I.M. (2023). Automatic attention to sexual stimuli: exploring the role of neuroticism and sexual excitation/inhibition through event-related potentials. The journal of sexual medicine, 20(3), 367–376. https://doi.org/10.1093/jsxmed/qdac048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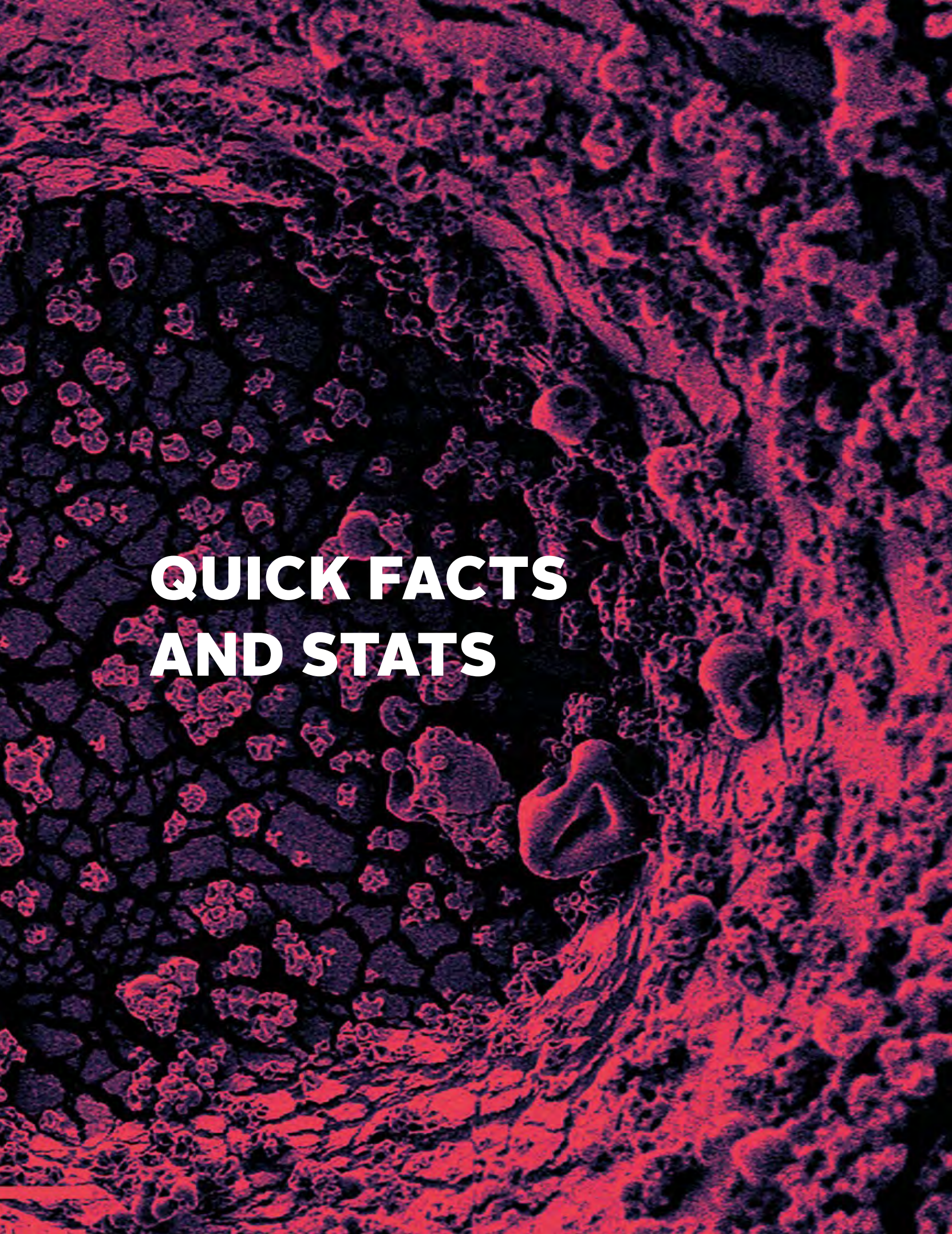


QUICK FACTS AND STATS

People

FACULTY BY DEPARTMENT

	FACULTY (FTE)			
	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
UNIVERSITY	**2022**	**2023**		
Department of Biology	33,7	32,7	45%	
Department of Chemistry	41,3	41,3	47%	
Department of Civil Engineering	16,7	15,1	23%	
Department of Communication and Art	88,7	90,0	29%	4%
Department of Economics, Management, Industrial Engineering and Tourism	55,8	52,0	63%	4%
Department of Education and Psychology	42,6	45,7	66%	2%
Department of Electronics, Telecommunications and Informatics	81,5	78,6	8%	
Department of Environment and Planning	16	16,0	69%	
Department of Geosciences	13,6	15,3	33%	
Department of Languages and Cultures	50,5	49,1	63%	26%
Department of Materials Engineering and Ceramics	13	12,0	42%	
Department of Mathematics	58,4	57,2	48%	7%
Department of Mechanical Engineering	32,4	36,4	14%	
Department of Medical Sciences	27,1	26,0	59%	2%
Department of Physics	45	48,0	23%	6%
Department of Social, Political and Territorial Sciences	19,9	19,9	36%	
POLYTECHNIC SCHOOLS				
Águeda School of Technology and Management	66,7	70,0	43%	
Aveiro Institute of Accounting and Administration	77,7	79,8	51%	
School of Design, Management and Production Technologies of Aveiro North	35,1	39,6	31%	2%
Aveiro School of Health	57,8	61,7	61%	
TOTAL	**873,5**	**886,3**	**42%**	**3%**

RESEARCHERS BY DEPARTMENT

	RESEARCHERS (FTE)			
	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
UNIVERSITY	**2022**	**2023**		
Department of Biology	104	103	67%	16%
Department of Chemistry	106	122	60%	20%
Department of Civil Engineering	5	11	27%	9%
Department of Communication and Art	14	14	79%	14%
Department of Economics, Management, Industrial Engineering and Tourism	2	3	100%	
Department of Education and Psychology	19	20	70%	25%
Department of Electronics, Telecommunications and Informatics	12	14	29%	21%
Department of Environment and Planning	30	36	64%	25%
Department of Geosciences	6	6	83%	17%
Department of Languages and Cultures	3	3	67%	33%
Department of Health Sciences	37	34	47%	15%
Department of Materials Engineering and Ceramics	19	17	35%	47%
Department of Mathematics	25	30	47%	30%
Department of Mechanical Engineering	18	16	63%	
Department of Physics	52	49	27%	29%
Department of Social, Political and Territorial Sciences	7	9	67%	22%
POLYTECHNIC SCHOOLS				
Águeda School of Technology and Management				
Aveiro Institute of Accounting and Administration				
School of Design, Management and Production Technologies of Aveiro North	2	3	67%	
Aveiro School of Health	1			
TOTAL	**462**	**490**	**56%**	**20%**

STAFF BY CATEGORY

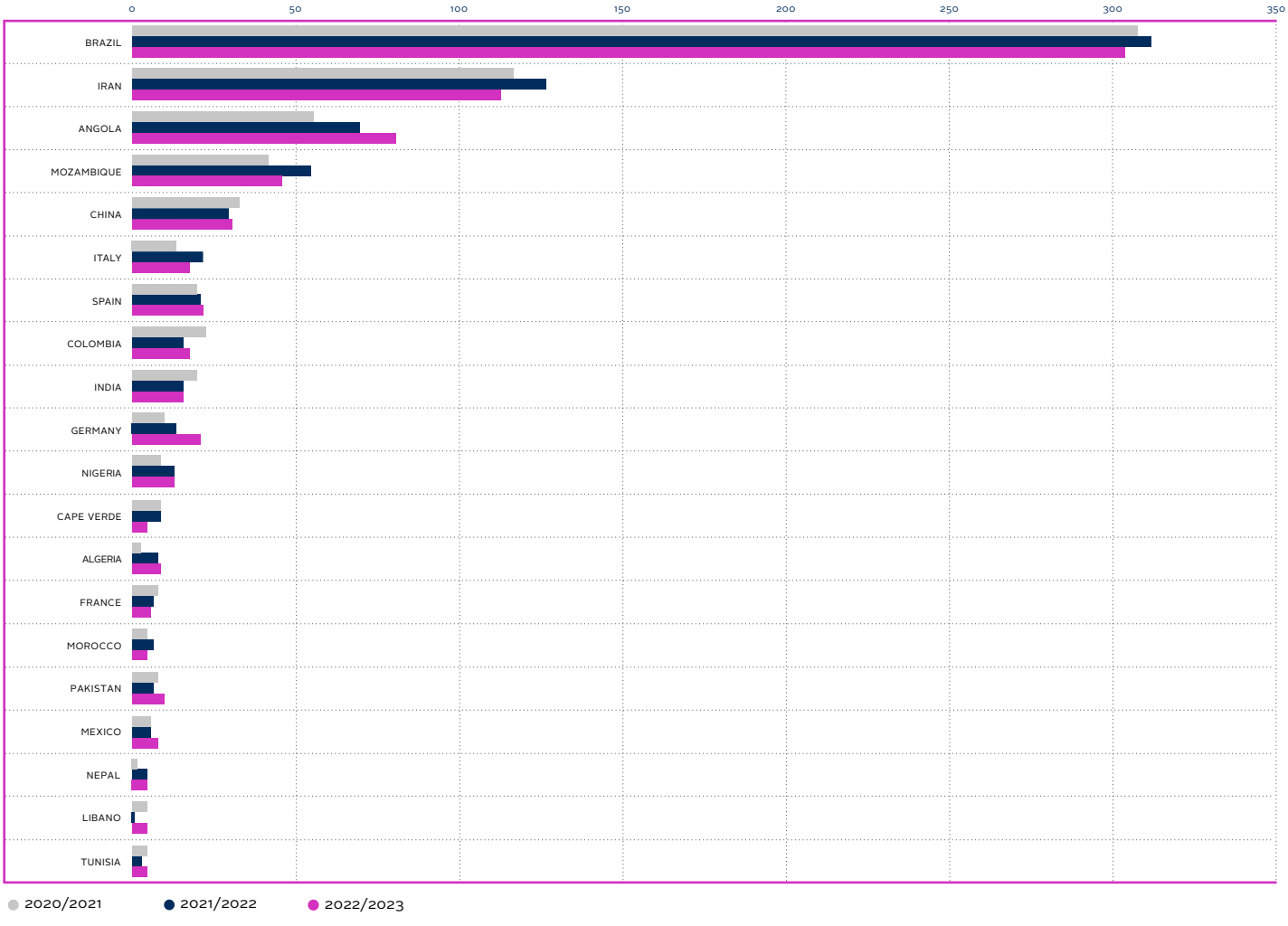
		FTE		
	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
UNIVERSITY	**2022**	**2023**		
Full Professors	51	59	22%	3%
Associate Professors	144,5	179,3	41%	2%
Assistant Professors	398,2	353,6	40%	5%
Lecturers	21,1	20,5	20%	
Other Teaching Staff	21,3	22,9	83%	27%
Researchers	414	461	56%	18%
Post-Doctoral Students	48	26	50%	58%
POLYTECHNIC SCHOOLS				
Coordinator Professors	28,9	43,9	59%	
Adjunct Professors	158,3	149,1	47%	0,4%
Lecturers	50,1	58	44%	
Researchers		3	67%	
TOTAL	**1335,5**	**1376,3**	**47%**	**9%**

PhD STUDENTS BY DEPARTMENT

		PHD STUDENTS			
	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS	PERCENTAGE OF NEW STUDENTS
DEPARTMENT	**2021/2022**	**2022/2023**			
Department of Biology	151	151	70%	25%	19%
Department of Chemistry	274	280	60%	19%	26%
Department of Civil Engineering	88	81	37%	62%	21%
Department of Communication and Art	266	255	55%	42%	27%
Department of Economics, Management, Industrial Engineering and Tourism	376	350	49%	41%	23%
Department of Education and Psychology	282	258	76%	35%	23%
Department of Electronics, Telecommunications and Informatics	145	155	24%	37%	17%
Department of Environment and Planning	118	121	40%	50%	30%
Department of Geosciences	20	15	40%	47%	
Department of Languages and Cultures	103	97	61%	58%	22%
Department of Materials Engineering and Ceramics	115	123	46%	37%	24%
Department of Mathematics	51	38	32%	55%	37%
Department of Mechanical Engineering	85	89	30%	30%	24%
Department of Medical Sciences	115	111	72%	10%	16%
Department of Physics	89	90	40%	31%	24%
Department of Social, Political and Territorial Sciences	122	117	44%	45%	28%
Doctoral School	29	26	27%	58%	31%
TOTAL*	**2.222**	**2.279**	**53%**	**36%**	**25%**

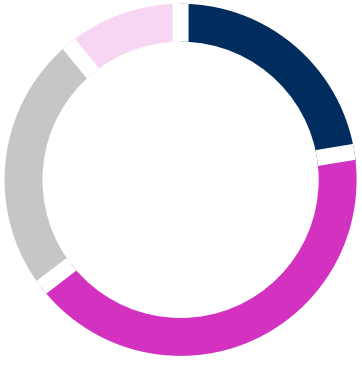
* The students of joint doctoral studies are considered in each participating department. Therefore, the sum of the students by department is superior to the total.

FOREIGN PhD STUDENTS BY NATIONALITY (TOP 20)



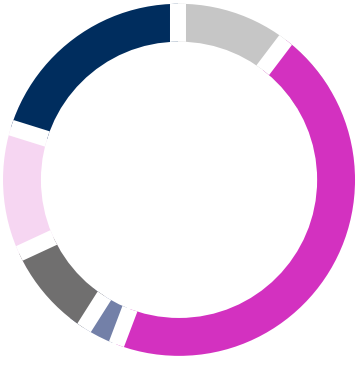
MSc and PhD theses

FOREIGN PHD STUDENTS BY CONTINENT



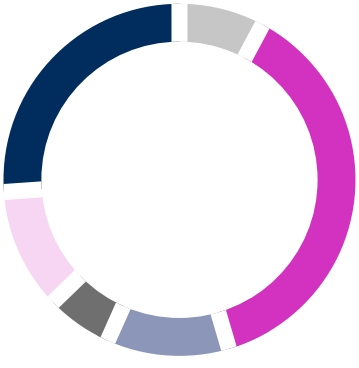
- Africa (22%)
- Asia (24%)
- America (42%)
- Europe (11%)

MSc THESES IN 2023 PER AREA



- Arts and Humanities (11%)
- Health Sciences (9%)
- Engineering and Technology (45%)
- Life Sciences (12%)
- Social Sciences (20%)
- Exact Sciences (3%)

PhD THESES IN 2023 PER AREA



- Arts and Humanities (8%)
- Health Sciences (6%)
- Engineering and Technology (38%)
- Life Sciences (11%)
- Social Sciences (26%)
- Exact Sciences (11%)

SCI Papers

TOP 10 SUBJECT AREAS FOR PAPERS PUBLISHED IN 2023	RECORD COUNT	% OF 3,147
Environmental Sciences	360	11,439
Materials Science Multidisciplinary	269	8,548
Chemistry Multidisciplinary	216	6,864
Engineering Electrical Electronic	209	6,641
Physics Applied	174	5,529
Chemistry Physical	151	4,798
Telecommunications	150	4,766
Biochemistry Molecular Biology	118	3,750
Green Sustainable Science Technology	109	3,464
Engineering Chemical	93	2,955

* Data retrieved from ISI Web of Knowledge SM (Thomson Reuters) on Apr 12th, 2024

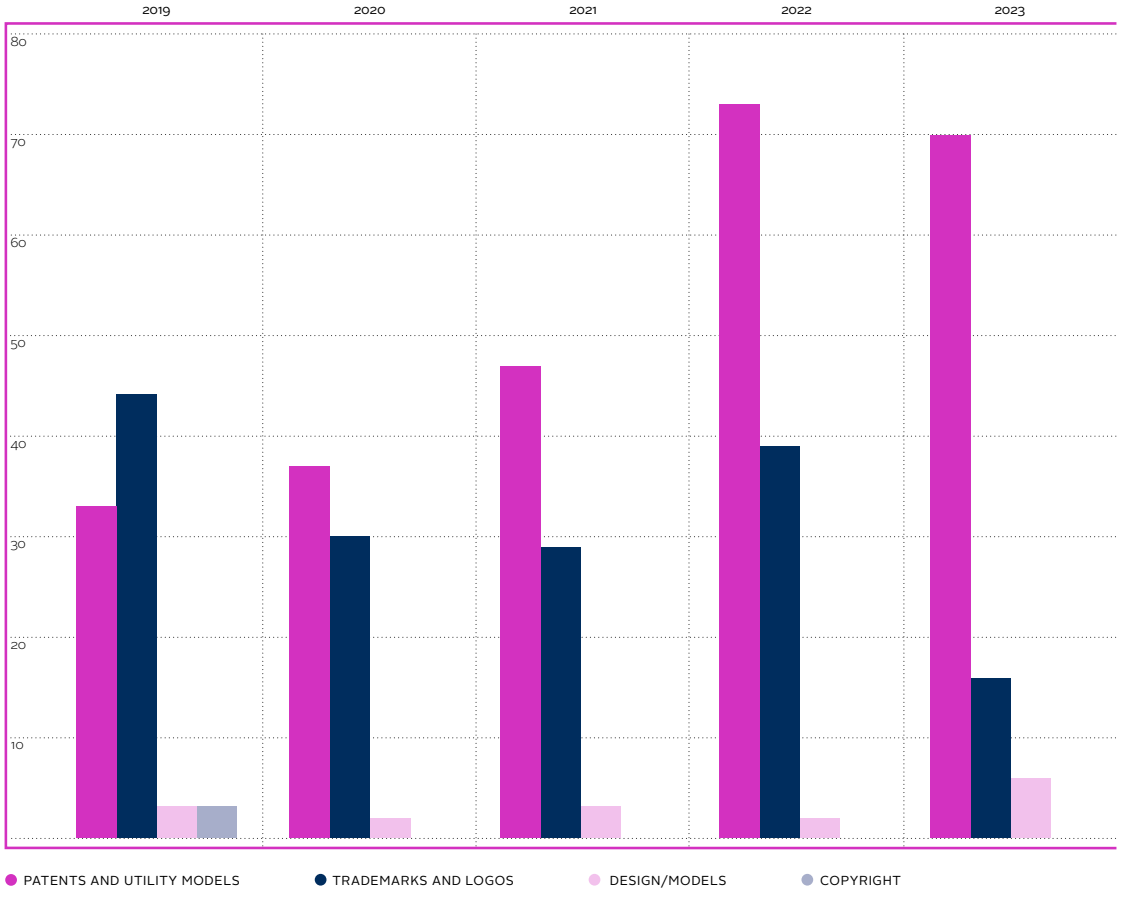
TOP 10 CITED PAPERS	TOTAL NR CITATIONS (2019-2023)
Brodkorb, A; Egger, L; Alminger, M; Alvito, P; Assuncao, R; Ballance, S; et al. (2019). INFOGEST static in vitro simulation of gastrointestinal food digestion. NATURE PROTOCOLS, 14 (4): 991-1014	1.578
Kunkle, BW; Grenier-Boley, B; Sims, R; Bis, JC.; Damotte, V; Naj, AC; et al. (2019). Genetic meta-analysis of diagnosed Alzheimer's disease identifies new risk loci and implicates Aβ, tau, immunity and lipid processing. NATURE GENETICS, 51 (3): 414	1368
Abbott, R; Abbott, TD; Acernese, F; Ackley, K; Adams, C; Adhikari, N; et al. (2023). GWTC-3: Compact Binary Coalescences Observed by LIGO and Virgo during the Second Part of the Third Observing Run. PHYSICAL REVIEW X, 13 (4)	949
Prata, JC; da Costa, JP; Lopes, I; Duarte, AC; Rocha-Santos, T. (2020). Environmental exposure to microplastics: An overview on possible human health effects. SCIENCE OF THE TOTAL ENVIRONMENT, 702	857
Klionsky, DJ; Abdel-Aziz, AK; Abdelfatah, S; Abdellatif, M; Abdoli, A; Abel, S; et al. (2021). Guide-lines for the use and interpretation of assays for monitoring autophagy (4th edition). AUTOPHAGY, 17 (1), 1-382	796
Brites, CDS; Balabhadra, S; Carlos, LD. (2019). Lanthanide-Based Thermometers: At the Cutting-Edge of Luminescence Thermometry. ADVANCED OPTICAL MATERIALS, 7 (5)	592
Martins, MAR; Pinho, SP; Coutinho, JAP. (2019). Insights into the Nature of Eutectic and Deep Eutectic Mixtures. JOURNAL OF SOLUTION CHEMISTRY, 48 (7): 962-982	541
Silva, ALP; Prata, JC; Walker, TR; Duarte, AC; Ouyang, W; Barcelo, D; Rocha-Santos, T. (2021). Increased plastic pollution due to COVID-19 pandemic: Challenges and recommendations. CHEMICAL ENGINEERING JOURNAL, 405	513
Prata, JC; Silva, ALP; Walker, TR; Duarte, AC; Rocha-Santos, T. (2020). COVID-19 Pandemic Reper-cussions on the Use and Management of Plastics. ENVIRONMENTAL SCIENCE & TECHNOLOGY, 54 (13): 7760-7765	509
Prata, JC; da Costa, JP; Duarte, AC; Rocha-Santos, T. (2019). Methods for sampling and detection of microplastics in water and sediment: A critical review. TrAC-TRENDS IN ANALYTICAL CHEMISTRY, 110: 150-159	494

* Data retrieved from ISI Web of Knowledge SM (Thomson Reuters) on Apr 12th, 2024

Intellectual Property

INTELLECTUAL PROPERTY RIGHTS REGISTRATION

	2019	2020	2021	2022	2023
Patents and Utility Models	33	37	47	73	70
Trademarks and Logos	44	30	29	39	16
Design/Models	3	2	3	2	6
Copyright	3	0	0	0	0



International Projects

EU-FUNDED PROJECTS STARTED IN 2023

HORIZON EUROPE – PROJECTS COORDINATED BY UAveiro	ACRONYM	PROJECT COORDINATOR
Modelling RESTORAtion of wEtlands for Carbon pathways, Climate Change mitigation and adaptation, ecosystem services, and biodiversity, Cobenefits	RESTORE4Cs	ANA LILLEBO
FOstering Nitrogen Deposition Assessment over Portugal	FONDA	ALEXANDRA MONTEIRO
Unlocking the scientific excellence and innovation capacity of the University of Aveiro in supramolecular multicomponent biomaterials for enabling advanced biomaterials for healthcare	SUPRALIFE	JOÃO BORGES
Fundamental Fields and Compact Objects: new opportunities	NewFunFiCO	CARLOS HERDEIRO
Piezoelectricity in 2D-materials: materials, modeling, and applications	Piezo2D	ANDREI KHOLKINE

HORIZON EUROPE – MONOBENEFICIARY PROJECTS	ACRONYM	PROJECT COORDINATOR
Rationale design of sustainable porous organosilicas for optimal CO_2 uptake from biogas	GRACE	MIRTHA LOURENÇO

HORIZON EUROPE	ACRONYM	LOCAL COORDINATOR
Innovative tools to treat and model complex cancer environments	TheraTools	JOÃO MANO
Sustainable Surface Treatments of Complex Shape Components for Transsectorial Industrial Innovation	SURE2COAT	JOÃO TEDIM
New system-driven bioremediation of polluted habitats and environment	NYMPHE	JOANA PEREIRA
Microscale enabled advanced flow and heat transfer technologies featuring high performance and low power consumption	Micro-FloTec	MÓNICA OLIVEIRA
Emerging nanoscopy for single entity characterisation	ENSIGN	ALEXANDER TSELEV
Biodiversity Building Blocks for policy	B3	HELIANA TEIXEIRA
Paving the way for an ABS recycling revolution in the EU	ABSolEU	ANDREIA SOUSA
Printed Symbiotic Materials as a dynamic platform for Living Tissues Production	PRISM-LT	JOÃO MANO
Preventing, avoiding and mitigating environmental impacts of fishing gears and associated marine litter	NETTAGPlus	CRISTINA PITA
Training young researchers on developing innovative, circular solutions for waste sludge	INCLUE	ISABEL CAPELA
Developing Trustworthy Artificial Intelligence (Ai)-Driven Tools to Predict Vascular Disease Risk and Rogression	VASCUL-AID	RITA FERREIRA
Rewilding and Restoration of InterTidal sediment Ecosystems for carbon sequestration, climate adaptation and biodiversity support	REWRITE	ANA ISABEL SOUSA
Personalized Cancer Primary Prevention research through Citizen Participation and digitally enabled social innovation	4P-CAN	ANA SANTOS

ERASMUS+ – PROJECTS COORDINATED BY UAveiro	ACRONYM	PROJECT COORDINATOR
Schools against Fake News for a cooler future	SchoolFaN	ALEXANDRA SÁ PINTO
Virtual Exchanges of Active Citizens	VirtuEU	MANUEL OLIVEIRA

ERASMUS +	ACRONYM	LOCAL COORDINATOR
Green Education and Transition – A Higher Education Digital Buddy	GET-AHED	BÁRBARA GABRIEL
Promoting professional education and students engagement through comprehensive mentoring and tutoring system at HEIs	PROMENT	ALBERTO COSTA
Alliance of Centres of Excellence in Vocational Training for Sustainable Habitat	HABITABLE	ROMEU VICENTE
A European Status for ECIU University	ESEU	ARTUR SILVA
ESC-tension 2 – Accelerating ESC Adoption in the EEA	ESC-tension 2	GRAÇA AZEVEDO
Best practices for high-immersion experiences design	Abraxas	RUI RAPOSO
Emprendimiento en solitario en la Europa pospandémica	SELF	ANA TORRES
Open universal steam for all	OpenUS4ALL	PEDRO POMBO
Connecting Universities and local governments to implement urban agendas	URBAN IMPRINT	JOSÉ CARLOS MOTA
Empowering higher education through citizen science and innovative future-oriented learning strategies	ENHANCE	ANA DANIEL
Exposoma y Cambio Climático en el Audiovisual Escolar con el Enfoque "One Health" de la OMS	EduCO2Health	PEDRO POMBO

PROGRAMME FOR THE ENVIRONMENT AND CLIMATE ACTION (LIFE) – PROJECTS COORDINATED BY UAveiro	ACRONYM	PROJECT COORDINATOR
Mariculture for Ria de Aveiro subtidal seagrass Rewilding	SeaGrassRIAwild	JOÃO PEDRO COELHO

PROGRAMME FOR THE ENVIRONMENT AND CLIMATE ACTION (LIFE)	ACRONYM	LOCAL COORDINATOR
Conservation of the Black-tailed Godwit along the flyway	LIFE Godwit Flyway	JOSÉ ALVES

DIGITAL	ACRONYM	LOCAL COORDINATOR
Advancing key digital skill capabilities in the SME Sector	DigiAdvance	SANDRA SOARES

EUROPEAN MARITIME, FISHERIES AND AQUACULTURE FUND (EMFAF) – PROJECTS COORDINATED BY UAVEIRO	ACRONYM	PROJECT COORDINATOR
Women in Blue Economy Intelligence Gathering and Capacity Boosting	WIN-BIG	HELENA VIEIRA

INTERNAL SECURITY FUND – POLICE (ISFP)	ACRONYM	LOCAL COORDINATOR
Prevention to Reduce Incidence Of Sexual Abuse by Reaching Individuals Concerned About Their Risk to Young People	PRIORITY	JOANA CARVALHO

EUROPEAN INSTITUTE OF INNOVATION & TECHNOLOGY (EIT) – PROJECTS COORDINATED BY UAveiro	ACRONYM	PROJECT COORDINATOR
Deep Tech in HEIs and Ecosystems through Entrepreneurial Education+	SFFDeepT+	BÁRBARA GABRIEL
Developing, Connecting and Digitising Regional Innovation Valleys	EUFORIA 2.0	BÁRBARA GABRIEL

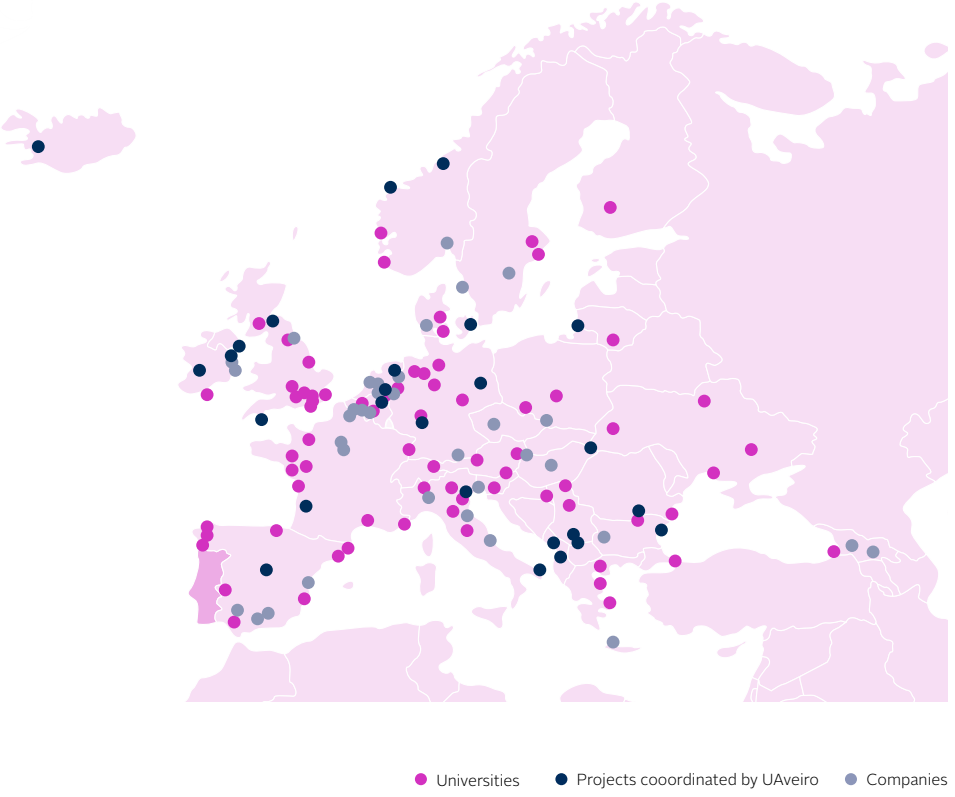
INTERREG EUROPE – PROJECTS COORDINATED BY UAveiro	ACRONYM	PROJECT COORDINATOR
intErconnecting MoBility acRoss europeAn CitiEs and subuRbs	EMBRACER	JORGE BANDEIRA
Green and Socially resPOnsible ciTy Logistics InnovaTions	SPOTLOG	JORGE BANDEIRA

INTERREG ATLANTIC AREA	ACRONYM	LOCAL COORDINATOR
Smart Clusters for Maritime Decarbonisation	SMARTDEC	HELENA VIEIRA

PROGRAMA DE COOPERAÇÃO TRANSFRONTEIRIÇA ESPANHA – PORTUGAL (POCTEP)	ACRONYM	LOCAL COORDINATOR
Gestión sostenible de playas y humedales ibéricos: con-servación del Chorlitejo patinegro como herramienta para compatibilizar usos humanos y biodiversidad	IBERALEX	ANTÓNIO LUÍS
Neutralidad climática: papel del Carbono Azul en la costa de Portugal y Galicia	CAPTA	ANA ISABEL SOUSA
Redes de Alerta Tempranas, para la Teledetección de Riesgos Derivados del Cambio Climático, por Satélites de Observación de la Tierra, para Respuesta de Protección Civil	RAT_EOS_PC	PEDRO FONSECA

NETWORK OF EUROPEAN UNIVERSITIES AND COMPANIES WORKING WITH UAveiro IN EU PROJECTS STARTED IN 2023

ALBANIA VirtuEU
AUSTRIA GET-AHED, HABITABLE, PROMENT, URBAN IMPRINT
BELGIUM INCLUE, NYMPHE, REWRITE, VASCUL-AID, WIN-BIG
BULGARIA B3, GET-AHED, SFFDeepT+
CROATIA EUFORIA 2.0, SFFDeepT+
CZECHIA NYMPHE
DENMARK ABSolEU, Ensign, LIFE22-NAT-PT-SeaGrassRIAwild, Piezo2D, REWRITE
FINLAND EMBRACER, ENHANCE, ESEU, SPOTLOG
FRANCE ABSolEU, ESC-tension 2, INCLUE, Micro-FloTec, RESTORE4Cs, REWRITE, SUPRALIFE, URBAN IMPRINT
GEORGIA HABITABLE, PROMENT
GERMANY B3, Ensign, ESEU, FONDA, NewFunFiCO, NYMPHE, PRIORITY, RESTORE4Cs, REWRITE, SFFDeepT+, SURE2COAT, WIN-BIG
GREECE EUFORIA 2.0, HABITABLE, NYMPHE, REWRITE, SchoolFaN, VirtuEU
HUNGARY Ensign, REWRITE, WIN-BIG
ICELAND GRACE
IRELAND DigiAdvance, ENHANCE, ESEU, GET-AHED, NETTAGPlus, REWRITE, SFFDeepT+, WIN-BIG
ITALY B3, EduCO2Health, Ensign, ESEU, Micro-FloTec, NYMPHE, PRISM-LT, PROMENT, RE-STORE4Cs, SELF, SURE2COAT
KOSOVO VirtuEU
LITHUANIA ENHANCE, ESEU, RESTORE4Cs
MONTENEGRO VirtuEU
NORWAY Transvariations, ABSolEU, ESEU, GRACE, VASCUL-AID, WIN-BIG
POLAND Abraxas, Ensign, ESEU, Piezo2D, PROMENT, SURE2COAT
ROMANIA B3, EduCO2Health, RESTORE4Cs
SERBIA VASCUL-AID
SLOVAKIA NYMPHE, SELF
SLOVENIA SURE2COAT
SPAIN Abraxas, CAPTA, DigiAdvance, EduCO2Health, ESEU, IBERALEX, INCLUE, LIFE22-NAT-PT-SeaGrassRIAwild, NETTAGPlus, NewFunFiCO, NYMPHE, OpenUS4ALL, RAT_EOS_PC, RESTORE4Cs, REWRITE, SchoolFaN, SELF, TheraTools, URBAN IMPRINT
SWEDEN ABSolEU, ENHANCE, ESEU, INCLUE, PRIORITY, PRISM-LT
SWITZERLAND SURE2COAT
THE NETHER-LANDS ABSolEU, ENHANCE, ESEU, INCLUE, LIFE22-NAT-DE-LIFE Godwit Flyway, NYMPHE, PRISM-LT, RESTORE4Cs, REWRITE, SUPRALIFE, VASCUL-AID
TURKEY Micro-FloTec, OpenUS4ALL
UKRAINE Piezo2D, PROMENT
UNITED KINGDOM BAIT, Ensign, INCLUE, Micro-FloTec, NETTAGPlus, REWRITE, SFFDeepT+, VASCUL-AID



Budget

TOTAL BUDGET OF THE PROJECTS STARTED IN 2023 BY RESEARCH CENTER AND FUNDING AGENCY*

RESEARCH CENTRE	EUROPEAN UNION	FOUNDATION FOR SCIENCE AND TECHNOLOGY	OTHERS INTERNATIONAL	OTHERS NATIONAL	PRR	2022	2023
CESAM	6.230.793	1.566.926	555.311	520.200		7.666.445	8.873.229
CICECO	3.339.687	1.407.039	61.228			5.014.295	4.807.953
CIDMA	92.000	341.083				148.480	433.083
CIDTFF	79.085					513.000	79.085
CINTESIS		109.957				339.390	109.957
CIPES		235.056					235.056
DIGIMEDIA	92.640	210.091				216.728	302.731
GEOBIOTEC						2.917	
GOVCOPP	420.967	49.978				1.105.390	470.945
I3N		193.145				446.115	193.145
IBIMED		855.233	183.637			820.623	1.038.870
ID+		49.888				79.932	49.888
IEETA		234.001				373.139	234.001
INET-MD			17.668			7.500	17.668
IT	3.203.078	387.419	70.575		1.519.150	10.025.099	5.180.222
NOT INTEGRATED**	357.611	200.000		20.927	4.693.129	27.085.673	5.271.668
REQUIMTE-LAQV	121.830	243.546				244.706	365.376
RISCO	248.051	95.651				422.106	343.702
TEMA	1.072.304	1.255.475				1.026.187	2.327.779
WJCR	22.347	239.064				83.605	261.412
TOTAL	**15.280.393**	**7.673.554**	**888.418**	**541.127**	**6.212.279**	**55.621.328**	**30.595.771**

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

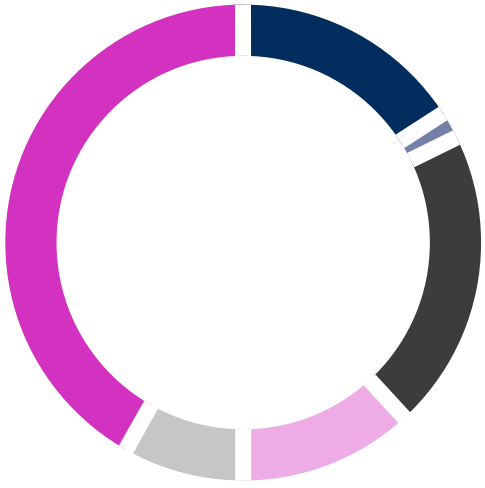
in euros

APPROVED BUDGET UNDER EU-FUNDED PROJECTS*

EUROPEAN PROGRAMMES	2022	2023
H2020 – ICT	50.000	
HORIZON ERC StG	1.498.619	
HORIZON ERC PoC	150.000	
HORIZON – CL1	1.195.975	
HORIZON – CL4	77.500	719.988
HORIZON – CL5	243.110	1.393.210
HORIZON – CL6	1.007.541	381.036
HORIZON – HLTH		121.830
HORIZON – SNS		1.347.000
HORIZON – JU		371.875
HORIZON – MSCA – CITIZENS	57.160	
HORIZON – MSCA – DN	659.606	996.036
HORIZON – MSCA – PF	329.397	
HORIZON – MSCA – SE		867.593
HORIZON – PATHFINDER OPEN	1.030.884	
HORIZON – TWINNING	814.571	1.688.675
HORIZON – HOP-ON		833.433
HORIZON – TALENTS		172.619
HORIZON MISS OCEAN	1.745.838	
ERASMUS +	1.811.223	1.002.921
LIFE2027		2.846.786
INTERREG ATLANTIC		276.792
INTERREG SUDOE	95.986	
INTERREG EUROPE		695.587
POCTEP	53.430	350.513
DIGITAL	600.995	765.050
EIT		175.850
EMFAF		251.253
ISFP		22.347
TOTAL	**11.421.836**	**15.280.393**

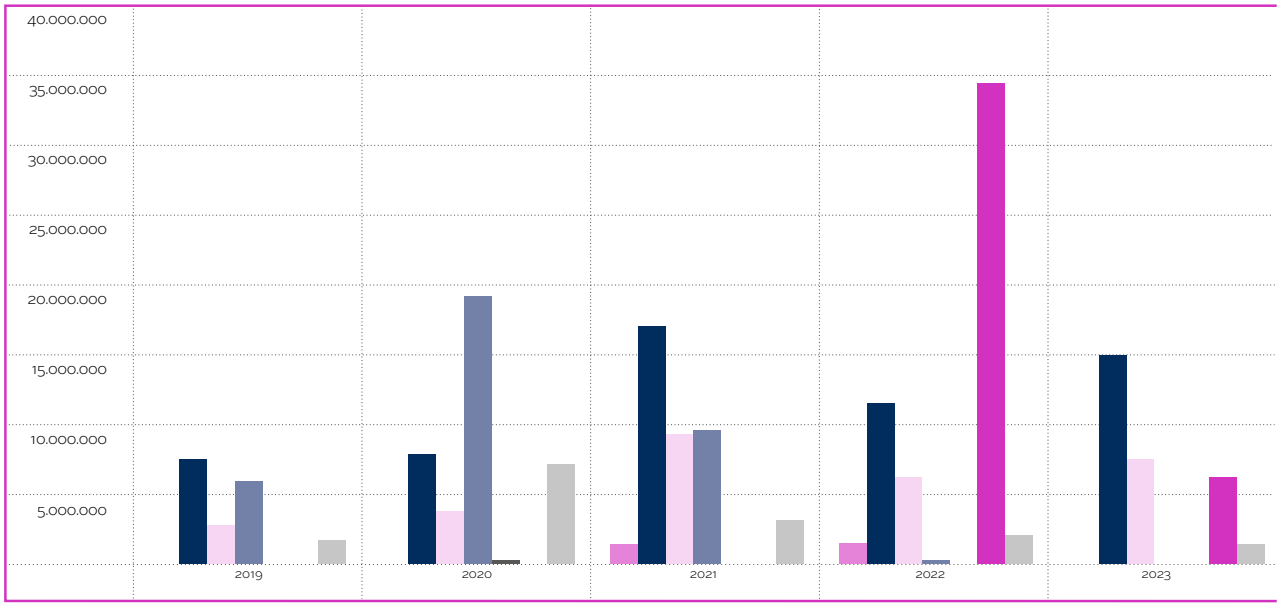
in euros

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*

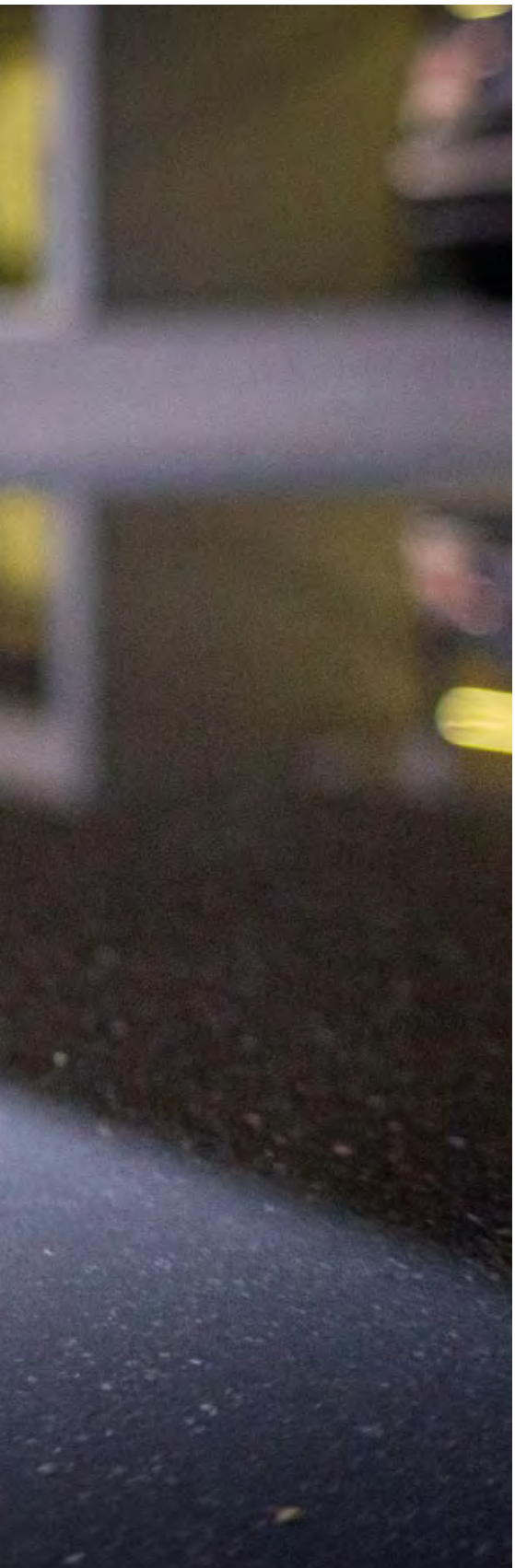


* Contracts with industry and multiannual budget of research centres not included


7

RESEARCH SUPPORT

Research Support Office



The University of Aveiro (UAveiro) is well-regarded as a research-driven institution, playing a significant role in advancing knowledge and innovation in various fields, with all 20 research centers classified as Very Good or Excellent in the last evaluation process promoted by the National Foundation for Science and Technology.

During 2023, 517 national and international research and technology transfer projects have been active in UAveiro, of which 61 funded by ERASMUS+, 39 by Horizon 2020, 37 by Horizon Europe and 11 by INTERREG. The UAveiro is the host institution of 12 ERC Grants and 1 ERA Chair, coordinates 4 Twinning projects and 2 HE projects aiming to contribute to the EU Missions, among other relevant and strategic European projects.

The excellence of its staff and quality of its infrastructures have been essential to carry out crosscutting research that contribute to the society – locally, nationally and internationally. Also, by supporting mobility across alumni, staff and the academic body and by fostering international research collaborations on the basis of individual academic interests, the University of Aveiro and its Research Support Office aim to deliver exceptional academics ready to face the challenges of globalization.

Aiming at creating a conducive environment for research excellence, innovation, and impactful contributions to knowledge and society, 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. Our extensive and ever-expanding network has a strong international character and a presence around the world which has served to boost several project proposals.

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 highly 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 coordinating 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
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research@ua.pt

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