research@ua

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PAULO JORGE FERREIRA
University of Aveiro

A WORD FROM THE RECTOR

Artificial intelligence is profoundly transforming the way we conduct research, formulate questions, find answers, and innovate. More than just a tool, it is now a driver of discovery – capable of analyzing vast amounts of data, predicting patterns, accelerating knowledge production, simulating complex scenarios, and virtually testing new products before they reach the market, across multiple sectors. Models such as AlphaFold2 and GNoME illustrate this potential. But integrating AI into science requires more than models, architectures and computing. It demands new skills – critical thinking, ethics, and multidisciplinarity – alongside regulation, global cooperation, a balance between innovation and safety, and ethical, responsible use. The challenge is to ensure that AI fosters research that is more collaborative, transformative, and impactful for society – not merely more automated.

ARTUR SILVA
University of Aveiro

MESSAGE FROM THE VICE-RECTOR

Artificial Intelligence in Research

The combination of fast-paced developments in the Artificial Intelligence (AI) field with increased digitalization, enhanced connectivity, and, especially, advanced natural language models, is making a wide variety of powerful tools available at your fingertips. This is not only profoundly impacting our world as it is paving the way for unprecedent change across all domains and daily tasks, in breadth, scale, and speed.

Few areas, if any, will remain unaffected, and research will not be one of them. In fact, research is at the very core of this process, driven by the massive investment of large corporations, incentivized by governments, and pursued by public higher education and research institutions. The University of Aveiro, as a comprehensive research university, takes an active stance in this process, and must not shy away from taking a cross-cutting and in-depth look at the ongoing developments and their implications, both complex and multifaceted.

To begin with, there is research 'in AI' specific fields, such as machine learning, neural networks, natural language processing, and expert systems, among others at the core of the AI capabilities and human-algorithm interactions.

Much vaster is the research that we could designate as 'for AI', that lays the scientific and technological grounds supporting AI developments and its increasing ubiquity. This includes fields that do not share the same spotlight, such as the earth sciences, crucial to determine the availability of the rare materials used in the semiconductor industry. The same goes for the fundamentals of condensed matter physics, at the very heart of the same industry. Or energy production, distribution, and storage systems required to feed the increasing energy demand; the AI use for materials science engineering, where it has catalysed the discovery of new materials, enhanced design simulations, influenced process control, and facilitated the operational analysis and prediction of material properties and behaviour; or improvements in the target selection and identification in drug discovery.

Taking a step away from the mere technological aspects of AI, we enter yet another dimension of AI-related research, that of research 'about AI', delving into its implications and impacts on all of us, as individuals, and the society. In here, virtually all areas of research at the University of Aveiro come into play, for a better understanding of the present, to challenge assumptions, and project futures. You can name almost any field, be it behavioural studies, improved medical care, employment and unemployment, decision making processes and citizen participation, social media and communication, arts and the boundaries of creation, global trade and geopolitics, local and global sustainability, among others.

These three facets – research in AI, for AI, and about AI – concern every area of research, and cover the specific contribution to AI development, its use, and its implications. In addition, there are other layers of special relevance for higher education institutions: the very use of AI in research and in higher education, and the impacts of this changing world in the training of researchers and teachers.

We have come a long way, in a not that long time, from when access to information in physical form was a critical factor hindering research, to widely accessible digital publications, where the adequate filtering of information became the main challenge. This has now evolved into access to information selected, curated, and hierarchized by third-party automated processes, with its advantages and perils.

Likewise, we have moved from data scarcity into big data, beyond sense and comprehension of the human brain, requiring machine-made intermediation and a new array of tools. This has been leading to significant progress in so many areas, not least in the biological and medical domains. Nonetheless, it also brings interrogations and considerations about their use, requires a new set of skills, and even a new way of questioning and building up on previous knowledge and data.

These developments are paralleled in the education domain. Soon, a generation that grew-up in an ambiance of widespread AI will be entering higher education, and, not long after that, the labour market, a new labour market. A generation that will most likely use AI tools as a second skin, without second thoughts. All this should make us question the role of the higher education for a future that is rapidly becoming present. How to better contribute to the individual development? What knowledge, abilities and competencies will be required? What new skills should teachers have? In all, what shape, or shapes, should higher education assume.
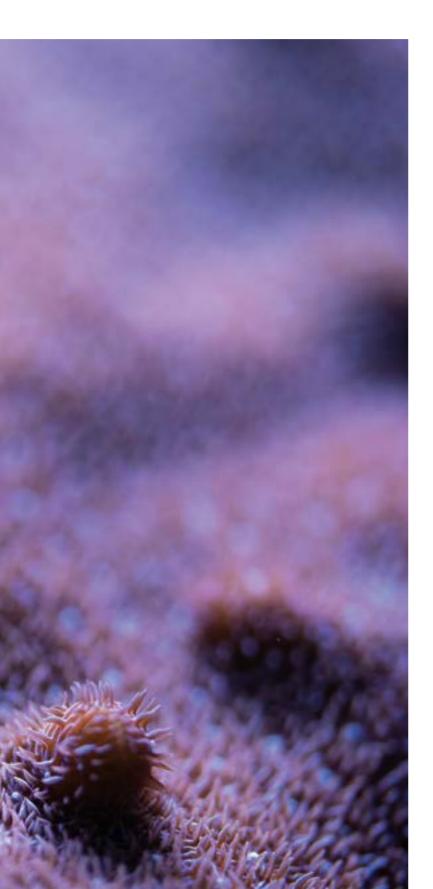
One thing remains certain in these rushed times, where, once more, the fascination of technological progress co-exists with caution, and even fear of its consequences, and a power struggle for control: Increased critical thinking and responsible AI practices are ever more important.

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RESEARCH UNIVERSE

Interdisciplinary research centres and facilities

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

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

The University of Aveiro hosts 20 research units, which were classified as Very Good or Excellent in the 2017-2018 evaluation process promoted by the National Foundation for Science and Technology. As far as the last evaluation period is concerned, concluded in 2025, 14 research units were classified as Excellent and 4 as Very Good, representing a very successful outcome.

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

As in 31st December 2024.

Research centres

CESAM
Centre for Environmental and Marine Studies

We aim to develop multidisciplinary and transdisciplinary international research of excellence, supporting the public, private and not-for-profit sectors and contributing to the development of 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, ocean, and other aquatic resources, from mountains top 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 is a research unit focusing 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: Mara Madaleno

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 Bernardes de Jesus

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

https://ibimed.web.ua.pt

ID+
Research Institute for Design, Media and Culture

With the mission of developing and promoting excellence in Design and Artistic research in convergence with science and innovation, ID+ contributes to the longevity of the legacy of Design and to the interpretation of the challenges of the contemporary world.

Pole coordinator: Fátima Pombo

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 funda-mental 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 of 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: Manuel A. Coimbra

Research areas: Organic Chemistry, Natural Products, Food Science/ Biochemistry and Mass Spectrometry
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: Paula A.A.P. Marques

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

WJCR
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

SAFERCOAT – A multidisciplinary and circular approach towards the development of innovative, safe-by-design, (bio) degradable multifunctional coatings

48 months: €703.8k (UAveiro €280,6€)

Despite the widespread use of polymeric coatings worldwide, their limited biodegradability and recyclability pose serious environmental and health concerns. The SAFERCOAT project brings together a multidisciplinary consortium of 10 partners from seven countries, including six universities and four industrial partners, to tackle this challenge. Coordinated by Roberto Martins (CESAM & DBio), the project also involves researchers from five departments (DAO, DBio, DFis, DEM, and DEMAC) and four research units (CESAM, CICECO, I3N, and TEMA) at the University of Aveiro, strengthening the interdepartmental and cross-disciplinary collaboration, and the university's commitment to scientific excellence and innovation.

Through the cross-sectoral staff exchange, SAFERCOAT aims to develop innovative, eco-friendly polymeric coatings with enhanced biodegradability at the end of their service life, targeting applications in the aeronautical, maritime, and cultural heritage sectors. The project focuses on synthesizing and modifying thermoplastic and thermosetting polymers to accelerate their degradation at end-of-life, optimizing and validating coating formulations, assessing environmental and health impacts, and upcycling end-of-life materials into value-added products. The project's novelty lies in its use of bio-sourced content and (nano)technologies to create or modify coatings that maintain high performance during use while being highly biodegradable after their service life. By fostering cross-sectoral mobility, knowledge exchange, and training, SAFERCOAT not only advances scientific innovation but also promotes industrial environmental responsibility and strengthens Europe's R&I human capital base. The project's outcomes (e.g., new coatings, eco-designed 3D products) will foster innovation in the polymers industry, establish an international R&D network dedicated to biodegradable coatings, and ultimately contribute to a future with zero pollution.

More information
https://www.safercoat.eu
https://cordis.europa.eu/project/id/101182588

ALTER-Q: Cr4+:YAG/Polymer nanocomposite as alternative materials for Q-switched lasers: properties, modeling, and applications

48 months, €584,2K (UAveiro €64,4K)

The operation principle of the Q-switched laser is based on the change of Q-factor of the resonator during the laser action. During Q-modulation, the Q-factor initially remains low due to high losses in the optical cavity to suppress generation and store energy inside the laser material. Therefore, the generation threshold and as result the inversion population threshold, are large. The operation principle of passive Q-switched lasers is based on the use of optical (phototropic) materials that change their transparency according to the absorbed energy. However, the properties of suitable phototropic materials for passive Q-switched lasers are not perfect. At the present stage the most popular methods for obtaining Cr^{4+}-doped garnets are based on bulk single crystals, single crystalline films or transparent ceramics technology. However, the main drawback of this approach is complicated technological requirements to the personnel and to the technology itself. Therefore, at the present moment there is demand for the cheapest alternative for Q-switched materials which won't have the drawbacks of transparent ceramics or single crystals technologies.
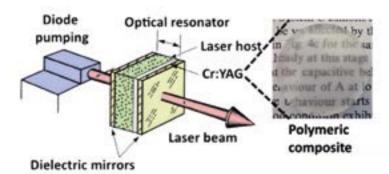
The objective of ALTER-Q, is to develop a new type of passive Q-switched materials based on composite structure of polymer matrix with the Cr^{4+}:YAG nano powders.

The ALTER-Q will focus on several tasks: understanding, predicting and controlling the mechanisms governing spectroscopic properties of Cr4+ ions; development of sintering procedure for preparing Cr4+-doped garnets nanopowders; advancing a methodology to prepare a composite structure of polymer matrices with Cr4+-doped nanogarnets inside; proof of the concept of possibility to develop a new type of Q-switched laser materials based on polymer composite structures with Cr4+-doped garnets nanopowders inside.

Proof of the concept of possibility to develop a new type of Q-switched laser materials

NET4MAT: Building knowledge and tools for the sustainable microbial fighting through sensing and responsive polysaccharide-based materials

48 months, €460 K (UAveiro: €155 K)

Plastic pollution and antimicrobial resistance are among the most critical global challenges. The NET4MAT project addresses both by developing biodegradable materials capable of detecting and neutralizing microbial threats, offering safer and more sustainable alternatives to petroleum-derived plastics.

The project is coordinated by Idalina Gonçalves, researcher at the Department of Materials and Ceramic Engineering of the University of Aveiro and CICECO – Aveiro Institute of Materials. Supported by the Marie Skłodowska-Curie Staff Exchanges program, NET4MAT brings together 12 partners from 6 countries in a multidisciplinary and intersectoral consortium that integrates academic research with industrial application.

NET4MAT focuses on the development of polysaccharide-based materials incorporating lanthanide glycoclusters and porphyrinoids. These biofunctional compounds provide the materials with microbial sensing and antimicrobial properties. University College Dublin (Ireland) is responsible for the synthesis of microbial sensing lanthanide glycoclusters. The University of Aveiro leads the synthesis of antimicrobial porphyrinoids and the processing of 3D functional structures. The Spanish National Research Council, Consejo Superior de Investigaciones Científicas (CSIC), contributes expertise in the extrusion of bionanocomposites. The Technical University of Denmark focuses on electrospinning processes, while INP Pagora (France) supports improvements in material processability using nanostructured polysaccharide formulations. The Hebrew University of Jerusalem (Israel) evaluates the antimicrobial activity, biodegradability, and biocompatibility of the materials developed.
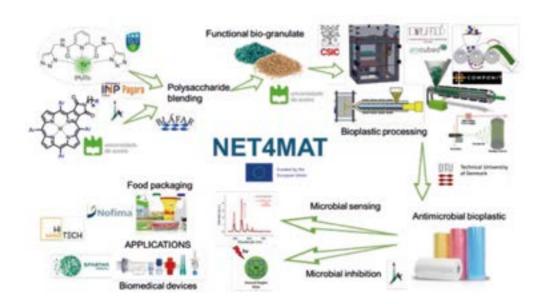
Industrial partners including SPARTHA MEDICAL (France), BLAFAR (Ireland), COLFEED4Print (Spain), and AMCUBED (Portugal) are involved in scaling and application. HISEEDTECH (Portugal), as an associated partner, supports knowledge valorization and entrepreneurship across the consortium.

Aligned with the objectives of the European Green Deal and the Circular Economy Action Plan, NET4MAT aims to deliver prototypes of smart bioplastics for food packaging and medical applications, advancing functional sustainable material technologies in Europe.

More information
https://cordis.europa.eu/project/id/101131205

SHORES: Exploring sound and music along Europe's shores

24 months, €182,1 K (UAveiro €89,6 K)

SHORES is a Creative Europe cooperation project involving musical creation and collaboration as a tool to raise awareness of the depletion, overuse and contamination that are negatively affecting lakes, rivers and oceans and their interaction with land and humans. SHORES is implemented by a consortium led by the University of Aveiro (Portugal), including as partners the Norwegian University of Science and Technology (Norway), the Vrije Universiteit Amsterdam (Netherlands), and Navalha Associação Cultural (Portugal) as associated partner. SHORES organizes workshops and artistic residencies that will engage both communities and artists, generating creative outputs and events, as well as online resources, that will disseminate the project's contribution transnationally, raising awareness of the problems impacting European shores.

SHORES aims to engage musical practices to raise awareness of fracturing environmental issues and promote sustainable modes of living. SHORES explores, activates and amplifies the artefacts, sounds and musics associated with in-between water and land spaces, as grounds to address goals of sustainability and transnational creation and circulation, encompassing the perspectives of performers/ composers/ sound artists and of local communities. The project partners combine their expertise in artistic research, capacity building and European networking as a connecting platform for environmentally-focused creation and collaboration. SHORES' artistic and dissemination work packages will highlight the relevance of artefact and sound fieldwork collection in shores locations, shared artistic practices, and capacity building and learning by artists and communities for participative sound/ music creation and performance.

More information
https://shores.pt/

TERRASAFE & TERRASAFE.PT – TErrestrial Resilience and RestorAtion Strategies for (semi) Arid and Fragile Ecosystems through a multi-actor Approach

60 & 36 months, €6,5M (UAveiro: €732K) & €311K (UAveiro: €248,9K)

TERRASAFE is one of two projects that is being funded under the Soil Mission Call topic "Innovations to prevent and combat desertification" (HORIZON-MISS-2023-SOIL-01-04), with co-funding of UKRI for its two UK partners. TERRASAFE.PT is a "child" project of TERRASAFE, funded by the La Caixa Foundation under the program "Promove. O futuro do interior 2024", to apply TERRASAFE's approach to a desertification-prone pilot area in Portugal and adapt it to the needs and opportunities of AFLOBEI's associates (Forest Producers Association of Beira Interior). Both projects are the most recent exponents of a long-standing research tradition at the University of Aveiro into environmental and socio-economic aspects of desertification, initiated and long-led by Professor Celeste Coelho of DAO, including through EU-funded projects such as MEDCHANGE (1997-2000) and MEDAFOR (1998-2001).

TERRASAFE has as overarching aim to empower local communities in southern Europe and northern Africa to confront the growing threats of desertification. To this end, TERRASAFE envisage a multi-actor approach in which the project partners support five contrasting desertification-prone communities to develop, implement, evaluate, demonstrate, disseminate, and promote the widespread adoption of innovative nature-based, technological and social solutions. A distinguishing aspect of TERRASAFE is, arguably, that its innovations are commercial solutions that are close-to or already on market. "TERRASAFE-certification" of the environmental effectiveness and economic viability of (some of) these solutions through field trials is foreseen to support ambitious future business plans of the "innovation partners". A second pathway for impact is envisaged to be the uptake by other communities of TERRASAFE's methodological frameworks for stakeholder engagement, analysis of desertification status and trends, innovation impact assessment, development of policy recommendations, and cross-community collaboration.

More information
https://terrasafe.eu & https://www.cesam-la.pt/projetos/
terrasafe-pt-terrestrial-resilience-restoration-strategies-to-combat-desertification-in-portugal/

SPOTLIGHT ON RESEARCH DISSEMINATION

Research Summit 2024

Under the theme "50 Years of Research at UAveiro: Challenges for the future", the latest edition of the Research Summit celebrated half century of University of Aveiro's history and challenged the participants to discuss the future.

The Research Summit 2024 served as a forum to foster important debates among UA's research community and to enhance collaboration, advancing the state of the art and boosting research efforts on campus.

With a wider program planned for the commemoration of the 50th annniversary, 6 UAveiro commissioners were invited to organize sessions on 6 topics: Materials and Energy, Information, Communication and Microelectronics, Environment and Ocean, Health and Society, Music and digital cultures and Education for the XXI Century.

The first day started with the session on Materials and Energy, chaired by Luís Carlos (Physics Department), in which themes such as innovative approaches to energy harvesting and storage, sustainability in energy solutions, and the role of materials in human evolution were explored. Invited speakers were Maria Helena Braga (Department of Physical Engineering, University of Porto), Fátima Montemor (Department of Chemical Engineering, Instituto Superior Técnico, University of Lisbon) and João Rocha (Department of Chemistry, University of Aveiro).

During the session on Information, Communication, and Microelectronics, chaired by Armando Pinho (Department of Electronics, Telecommunications and Informatics), discussions centered on Europe's role in the global data economy, fostering talent for

technological relevance, the implications of the AI era on technological independence and digitalization with purpose. Invited speakers were Hubert Tardieu (Independent Board Member of Gaia-X), José Epifânio da Franca (Instituto Superior Técnico, University of Lisbon), Paulo Novais (Centro ALGORITMI/ LASI, University of Minho) and Mário Campolargo (Former Secretary of State for Digitalisation and Administrative Modernisation).

In the afternoon, sessions started with the discussion on Environment and Ocean, chaired by Helena Vieira (Department of Environment and Planning), featuring perspectives on marine and environmental research at UAveiro, the EU's "Healthy Planet" initiative, and the future of ocean science and blue economy and biotechnology. Invited speakers were Henrique Queiroga (Department of Biology & CESAM, University of Aveiro), John Bell (EU Commission's "Healthy Planet" Director, DG-RTD, Belgium), Margaret Leinen (Vice Chancellor for Marine Science, USCS & Director of Scripps Institution of Oceanography, USA), Vitor Vasconcelos (Full Professor and Director CIIMAR, UPorto), Tânia Vinagre (Senior Project Manager, Blue Biotech Project, SFMS & Oceano Azul Foundation) and António Baldaque da Silva (Executive Director of the Center for Sustainable Finance, Professor at CATÓLICA-LISBON).

The session on Health and Society followed, chaired by Alda Marques (Aveiro School of Health), with topics on the "One Health" approach to disease control, personalized medicine, and the impact of immersive technologies and robotics on rehabilitation. Invited speakers were (Júlio Pedrosa, former Rector of the University of Aveiro), Raquel Duarte (Centro de Saúde Pública Doutor Gonçalves Ferreira, Instituto Nacional de Saúde Doutor Ricardo Jorge (INSA) & Instituto de Ciências Biomédicas Abel Salazar, University of Porto), and Martijn Spruit (Center of expertise for chronic organ failure (CIRO) & Maastricht University, Netherlands).

On the second day, the first session was dedicated to Music and Digital Cultures. Chaired by Susana Sardo (Department of Communication and Arts), the discussion delved into the intersection of music and digital cultures, exploring how digital technologies influence musical practices and cultural expressions. Invited speakers were Miguel A. García (University of Buenos Aires, Argentina), David Trippet (University of Cambridge, United Kingdom), Mónica Mendes (Faculty of Fine Arts, University of Lisbon), Miguel Castelo-Branco (University of Coimbra) and João Teixeira Lopes (University of Porto).

The session on Education for the XXI Century followed, chaired by Ana Rodrigues (Department of Economics, Management, Industrial Engineering and Tourism). Discussions focused on the evolution of education in the 21st century, addressing challenges and opportunities in modern educational practices. Invited speakers were Isabel P. Martins (Department of Education and Psychology, University of Aveiro), Luís Sebastião (Department of Pedagogy and Education, Universidade de Évora), Ana Maria Gonçalves Matos (School of Social Sciences and Humanities, Universidade Nova de Lisboa) and Neuza Pedro (Instituto de Educação da Universidade de Lisboa).

In the afternoon, the research units of the UAveiro had the opportunity to present their forward-looking trans/inter/multidisciplinary research activities, shaping future research paths and showcasing advances in their field.

Over the two subsequent days, PhD students, as well as first and second cycle students, presented their research, fostering an environment of knowledge exchange and collaboration. The event included the final roundtable "From PhD to…", during which invited speakers discussed their academic and professional pathways after concluding their doctoral studies: Francisco Santos (Vice-president of the Portuguese Foundation for Science and Technology), Pedro Ribeiro (Vice-president of Bosch Thermotecnologies), Tiago Brandão Rodrigues (Minister of education of the XXI and XXII governments) and Vera Eiró (President of the water and waste services regulation authority (ERSAR)).

A "Best Communication Award" was presented at the end of the summit to recognize outstanding presentations.

The Research Summit 2024 at the University of Aveiro successfully brought together a diverse community of researchers, students, and experts to reflect on the past 50 years of research at the institution and to discuss the challenges and opportunities for the future. Through a series of plenary sessions, thematic panels, and student presentations, the event highlighted the importance of interdisciplinary collaboration and the role of research in addressing global challenges.

Academia de Verão

Summer Academy

The Summer Academy is an initiative of the University of Aveiro (UAveiro) 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 2024, the event held its 18th edition, and counted on the participation of 450 students.

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

UAveiro's organizational culture has always been committed to the promotion of the public acknowledgment of science, the concern in communicating the scientific advances at UAveiro and the development of "science for all" initiatives. Since its foundation, UAveiro 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 UAveiro, 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.

UAveiro'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 UAveiro, especially during the summer period, and also other initiatives during the academic year.

5

RESEARCH HIGHLIGHTS

Rethinking the deep: collaborative and equitable approaches for deep-ocean science-policy engagement

Ana Hilário[1], Kerry Howel [2], Maria Baker[3]

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2 – Plymouth Marine Laboratory.
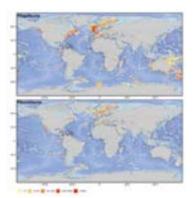3 – Deep-Ocean Stewardship Initiative, University of Southampton.

FIGURE 1

Open-access records in the Ocean Biodiversity Information Service (OBIS) for mega- and macrofauna below 200m depth.

FIGURE 2

Human capacity development. The first Deep-OceanTraining Expedition, onboard the research vessel B/O *Sarmiento de Gamboa*.

To most, the deep ocean is a remote, featureless, and inaccessible space. Yet it provides vital ecosystem services, from climate regulation to food security – and it's also a source of inspiration. Jules Verne's *Twenty Thousand Leagues Under the Sea* took generations on a journey aboard the Nautilus, a submarine ahead of his time; filmmakers have drawn on deep-ocean organisms to imagine iconic screen creatures; and scientists have explored the deep for over 150 years. Still, our ecological understanding of this vast biome remains limited due to logistical challenges, fragmented research, and strong spatial biases – most data come from the North Atlantic, Pacific, and Economic Exclusive Zone of economically developed nations. These gaps hinder our ability to address deep-ocean issues on a global scale and to support key policy efforts like the Agreement on Marine Biodiversity of Areas Beyond National Jurisdiction and the Kunming-Montreal Global Biodiversity Framework. The UN Decade of Ocean Science for Sustainable Development (2021–2030) offers a unique opportunity to globally advance deep-ocean science. At the onset of the Decade, the Deep-Ocean Stewardship Initiative, being mindful of international policy process knowledge requirements, proposed a shift from business-as-usual to a coordinated, global, community-led programme with the ability to advance our understanding of deep-sea marine life at unprecedented scale. The Challenger 150[1], formally endorsed by the Decade in 2021, aims to expand biological observations, share research capacity, build ecological knowledge, and embed deep-sea science in policy and management. Now at its midpoint, Challenger 150 hosts ten Decade projects[2], has promoted the creation of an active African Network of Deep-water Researchers[3], reviewed the current knowledge on deep-ocean biodiversity in the North[4], South and Central Atlantic[5] and in the Arctic Ocean[6] and endorsed over 30 research cruises to map deep-ocean life in all ocean basins.

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[5] Bridges et al. (2023). Oceanography and Marine Biology. 127–218. doi: 10.1201/9781003363873-5

[6] Ramirez-Llodra et al. (2024). The emerging picture of a diverse deep Arctic Ocean seafloor: From habitats to ecosystems. *Elem Sci Anth* 12. doi: 10.1525/elementa.2023.00140

EpiLipidNET_Pan-European Network in Lipidomics and EpiLipidomics Led by UA

Tânia Melo[1, 2], Felisa Rey[1, 2], Diana Lopes[2], Tiago Conde[1, 2], Tânia Dinis[3],
Pedro Domingues[1], Maria do Rosário Domingues[1, 2]

Lipids are essential for maintaining health, and their imbalance can lead to diseases. Lipidomics is emerging to explore the diversity of lipids in living organisms, their metabolic processes to identify markers of health and disease.

EpiLipidNET was established in 2020, under the COST Action (CA) 19105, as a pan-European multidisciplinary network aiming to advance knowledge and innovation in the fields of lipids, (epi)lipidomics, lipid biology, and related applications. The network led by Rosário Domingues, CESAM, accounts with +460 members from 52 countries and is making significant strides in the field.

EpiLipidNET has driven the development of advanced analytical solutions and bioinformatics tools for lipidomics, contributing to the standardization and harmonization of methodologies. The work of this CA spans diverse fields, including lipid metabolism, clinical research, food and nutrition, plant and algae studies, and microbiology. By partnering with organizations like LIPID MAPS, the International Lipidomics Society and fostering collaboration among researchers from academia, industry, and stakeholders, EpiLipidNET has been at the forefront of innovation in lipidomics research. This network has organized over 60 meetings, workshops, and conferences, and facilitated 120 conference grants and short research grants. Nearly 100 peer-reviewed papers have been published, with many co-authored by researchers from multiple countries. Young Researchers and Innovators have played a central role in the network, taking on leadership positions and contributing to organizing initiatives and events.

EpiLipidNET has also prioritized public outreach, developing educational videos and games to raise awareness and communicate the importance of lipids to society.

Looking forward, EpiLipidNET plans to continue its work, expanding into new interest areas such as food and nutrition, plant lipids, and epilipidomics. The network will continue collaborating to advance lipidomics research and support the next generation of scientists.

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2 – CESAM & Department of Chemistry, University of Aveiro.
3 – CICECO & University of Aveiro.

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FIGURE 1
EpiLipidNET network around the globe (https://www.cost.eu/actions/CA19105/).

FIGURE 2
Bridging lipids and society. Interest groups that will continue their work in the future (https://www.epilipid.net/).

Understanding Pesticide Risks to Ecosystems and Human Health: The SPRINT Project

Nelson Abrantes[1], Ana Ré[2], Joana Pereira[1], Fernando Gonçalves[1], Isabel Campos[2]

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2 – CESAM & Department of Environment and Planning, University of Aveiro.

FIGURE 1
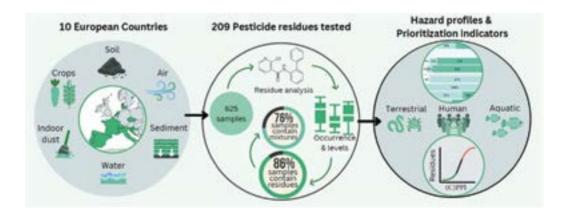Overview of SPRINT field monitoring.

The SPRINT (Sustainable Plant Protection Transition) project, funded by the EU Horizon 2020 programme, aims to assess the impact of pesticide residues on environmental, animal, and human health. In response to the urgent need for more sustainable agriculture, SPRINT provides robust real-world data to support policy decisions and societal efforts towards reduced pesticide reliance.

Monitoring took place in 11 case study sites – 10 in Europe and 1 in Argentina – covering both conventional and organic systems. Over 4,600 samples were collected from soil, crops, water, sediments, air, indoor dust, earthworms, and biological matrices from humans and animals. More than 200 active substances and metabolites were detected using advanced analytical methods.

Results showed widespread pesticide residues. 97% of soil samples contained residues, often as complex mixtures including banned substances. Surface waters and sediments showed contamination, with herbicides (e.g. glyphosate) and insecticides (e.g. lambda-cyhalothrin) exceeding thresholds. Crops also contained multiple residues, and all indoor dust samples were contaminated – often with insecticides at higher levels than herbicides and fungicides. Organic farms consistently had lower levels and fewer substances.

Biomonitoring results were concerning. Pesticides ranked among the top 20 for health risk were detected in human and animal samples, including known carcinogens, endocrine disruptors, and reproductive toxicants. Concentrations were higher in conventional systems.
Findings reveal significant ecological risks, particularly for aquatic species and earthworms, alongside the presence of persistent and banned substances such as DDT.
Additonaly, SPRINT supports the shift towards sustainable agriculture by identifying high-risk compounds, tracing exposure pathways, and promoting effective non-chemical alternatives. It also provides a prioritisation tool to guide risk-based monitoring and inform policy. As such, SPRINT delivers scientific insights that align with the EU's Farm to Fork strategy and contribute to global sustainability goals.

To know more about SPRINT project please visit: https://sprint-h2020.eu/

Detection of helical water flows in sub-nanometer channels

Pavel Zelenovskii[1], Márcio Soares[2], Carlos Bornes[3], Ildefonso Marin-Montesinos[2], Mariana Sardo[2], Svitlana Kopyl[1]; Andrei Kholkin[1], Luís Mafra[2], Filipe Figueiredo[1]

This study published in *Nature Communications* reveals a previously unknown behavior of water at the nanoscale. The team discovered that inside peptide-based nanochannels – structures below 1 nanometer in diameter – water flows in both traditional laminar and newly identified helical patterns. These nanochannels form when diphenylalanine-based peptides self-assemble into ring structures, which then align into long, tubular formations that can extend over several centimeters.
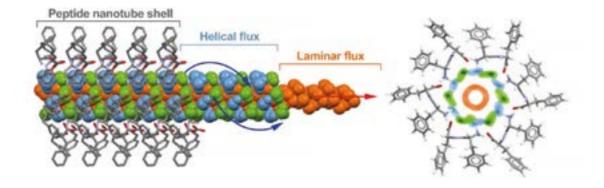
The researchers use a combination of solid-state nuclear magnetic resonance spectroscopy and water vapor sorption measurements to characterize the structure and dynamics of water within the nanotubes. Computational simulations provide further insight into the direction and nature of water flow, leading to the underlying dual-flow model of coexistent laminar and helical patterns within the nanochannels, moving at different speeds. The helical flow arises due to the screw-like arrangement of the ionic groups along the inner walls of the peptide channels. Remarkably, this flow type can be influenced by external water vapor pressure, introducing potential for precise control of nanoscale fluid dynamics.

This phenomenon mirrors natural occurrences of helical flows, such as blood circulation in the human aorta and vortex formations in superfluidic states, and suggests that similar helical flows might exist in other nanoporous systems such as zeolites and microporous polymers, which are used in catalysis, water purification, gas separation, energy technologies like fuel cells or batteries, and other nanofluidic applications. These findings may also shed light on cellular transport mechanisms and inspire novel approaches in biotechnology and medicine, because peptide nanotubes are model systems for ion transport in biological systems. The study was supported by the Foundation for Science and Technology (FCT), the European Research Council (ERC), and the Portuguese Recovery and Resilience Plan (PRR).

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3 – Department of Physical and Macromolecular Chemistry, Charles University in Prague.

FIGURE 1

Arrangement of water flows in the sub-nanometer peptide channel: (left) side view and (right) axial view.

Peptide nanotube shell
Helical flux
Laminar flux

Blowing unstable nanocrystals into being

Jincheng Tong[1], Nathan de Bruyn[1], Adriana Alieva[1], Elizabeth. J. Legge[2, 3],
Matthew Boyes[1], Xiuju Song[1], Alvin J. Walisinghe[4], Andrew J. Pollard[2],
Michael W. Anderson[1, 4], Thomas Vetter[5], Manuel Melle-Franco[6], Cinzia Casiraghi[1]

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4 – Curtin Institute for Computation,
School for Molecular and Life
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University of Manchester, UK.
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Chemistry, University of Aveiro.

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FIGURE 1
Schematic of the experimental
setup. Gas pressure and solution
concentration can be used to
tune the crystal morphology and
polymorph outcome.

FIGURE 2
Binding interactions depicted
as blue cylinders in glycine
polymorphs revealing strong 2D
and 3D interaction networks from
computer models.

Under different, thermodynamic and kinetic, conditions molecules may adopt different packings in the solid state. This phenomenon, known as polymorphism, is relevant for crystals used in, for instance, health and electronic applications, where producing selected polymorphs with enhanced properties may be a key to better performance. At the atomic level, molecules confined near surfaces may naturally arrange into layers. This can be used to access molecular layers and their distinct properties by producing molecular layered crystals. A method based on crystallization in ultra-thin puddles enabled by gas blowing was devised and tested. With this method, molecular layered crystals with, for instance,
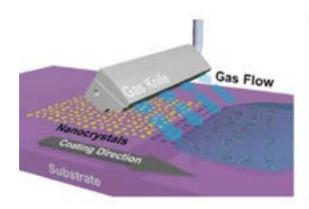
glycine, the simplest amino acid, are easily produced with thickness down to the monolayer, Figure 1. This finding was rationalized with the help of computer models from the *Advanced Modelling Laboratory* at CICECO which allowed us to analyze and compare the intermolecular interactions holding together molecules in glycine polymorphs. Overall, in α-glycine, bulk crystals are formed by loosely bonded 2D layers showing stronger intermolecular interactions while in β-glycine, these interactions form a 3D network crystalline form, Figure 2. This simple molecular picture accounts for how pressure can be successfully used to obtain the, otherwise, less likely polymorph, α-glycine, Figure 1.
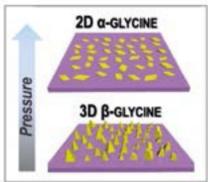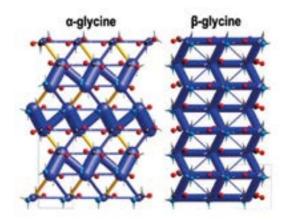
Magneto-Enzymatic Microgels for Precise Hydrogel Sculpturing

Maria C. Mendes[1], João A. Pereira[1], Ana S. SIlva[1], João F. Mano[1]

The incorporation of channels in artificial tissues has become an attractive strategy to facilitate the delivery of nutrients and oxygen to the cells within the material, thereby ensuring their viability and functionality for the repair process. However, the most commonly used methods for creating these channels heavily rely on microfabrication techniques that typically require substantial resources, lengthy fabrication times, complex chemistry protocols, and expensive, sophisticated equipment.

Herein, we propose a real-time, cost-effective, and easily implementable approach to sculpt channels in large-scale hydrogels, providing precise control over their trajectory, number, width, and formation timing throughout the hydrogel volume. This approach relies on the combination of magnetic nanoparticles with an enzyme selected for its ability to degrade the specific hydrogel matrix, resulting in magnetically responsive, enzyme-based microgels capable of sculpting channels in response to an externally applied magnetic field. The rate, number, width, and direction of channel formation can be controlled by adjusting the magnetic field parameters, nanoparticle concentration, and the number and size of the microgels.

The potential of this system was further demonstrated by its ability to sculpt hydrogels in the presence of cells, which remained viable due to medium perfusion through the formed channels. Moreover, the open channels generated within the hydrogel supported endothelial cell adhesion, mimicking key aspects of native vascular structures.

Overall, this approach offers an innovative and accessible alternative to conventional microfabrication techniques for developing functional *in vitro* tissues. This versatile approach can be applied to different hydrogel–enzyme systems, enabling precise, minimally invasive channel formation in complex soft biomaterials for the delivery of cells, drugs, or biomolecules.
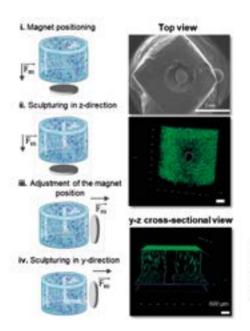
FIGURE 1

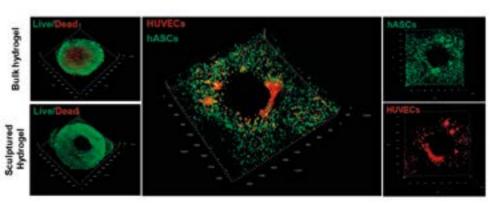Magnetically guided microgels sculpt channels in a cell-laden hydrogel, forming user-defined paths, as shown in micros.

FIGURE 2

Live/dead assay showing cell viability around the channel; and endothelial cells' adhesion to channel walls, followed by hydrogel invasion.

A New Sequence of Numbers – Counting Regular Polytopes

Peter Cameron[1], Maria Elisa Fernandes[2], Dimitri Leemans[3]

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3 – Département de Mathématique, Université Libre de Bruxelles.

FIGURE 1
Regular Polytope- 120-cell.

In her recent research, Maria Elisa Fernandes and her collaborators have discovered a new sequence of integers, now listed in the *On-Line Encyclopedia of Integer Sequences* (OEIS) as A359367: 1, 1, 7, 9, 35, 48, 135, …
This sequence emerges from the study of regular abstract polytopes whose automorphism groups is S_n. Using powerful computational algebra systems such as GAP and MAGMA, researchers can construct extensive atlases of algebraic structures, enabling the detection of patterns and the development of new mathematical insights. These tools play a central role in advancing mathematical knowledge by supporting both the formulation of new theories and the resolution of open problems.

Through extensive computational work, it was verified, up to $n = 16$, that:

. There is a unique polytope with group S_n and rank
  $r = n - 1$ ($n \geq 5$).
. There is a unique polytope with group S_n and rank
  $r = n - 2$ ($n \geq 7$).
. The number of polytopes with group S_n and rank
  $r = n - k$ remains constant for rank when $n \geq 2k + 3$.

These observations were rigorously proven for an arbitrary n and published in two articles in the journal *Advances in Mathematics*, the first in 2011 and the second in 2024. The sequence now cataloged as OEIS A359367 counts the number of regular abstract polytopes of a given rank with automorphism group S_n. The most recent term, corresponding to rank 11 and degree 17, was only recently computed. Unfortunately, algebraic computation has not allowed us to go beyond degree 17.

Finding a closed-form formula or recurrence for this sequence remains an open problem. Addressing this challenge requires optimizing existing algorithms and expanding the known terms of the sequence.
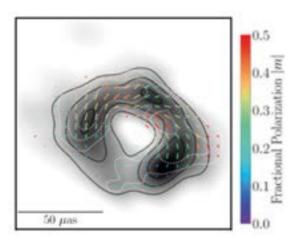
In recognition of her collaboration and research contributions, Maria Elisa Fernandes was awarded the Chaire Internationale IN of the Université libre de Bruxelles in both 2022 and 2025.
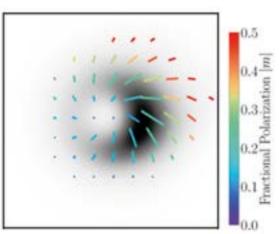
First Sagittarius A* Event Horizon Telescope Results. VIII. Physical Interpretation of the Polarized Ring

The Eventh Horizon Telescope Collaboration[1] (with Héctor R. Olivares Sánchez[2])

In 2017, the Earth-sized array of radio-telescopes known as the Event Horizon Telescope (EHT) observed for the first time two supermassive black hole (SMBH) candidates at sufficient resolution to observe their shadow (a prediction of general relativity). These were M87* (53 million light years away) and Sagittarius (Sgr) A*, located 27000 light years away at the center of our own Galaxy. These images captured not only the light intensity, but also its polarization. This publication from March 2024 is the eight part of a series on these observations, and presents the theoretical interpretation of the first image of Sgr A* in polarized light (Figure 1). To learn about the environment of this SMBH, observations were compared to a library of thousands of simulated models. These models simulate the behavior of the plasma and magnetic fields in the curved spacetime surrounding the black hole by solving the equations of general relativistic magnetohydrodynamics (GRMHD) and predict the observable emission by solving the equations of polarized general relativistic radiative transfer (GRRT). One of the GRMHD codes used for this study (BHAC) is maintained and used at the Department of Mathematics of the University of Aveiro. The comparison favors a rapidly rotating black hole (with spin parameter 0.94 of a maximum possible value of 1), an clockwise-rotating accretion disk, an inclination of the spin axis of 150° with respect to the line of sight, and very strong coherent magnetic fields capable of regulating accretion. This confirms previous findings that employed light intensity only. The paper also discusses how future observations at higher frequency and movies (planned for future campaigns of the EHT) can mitigate present uncertainties in the modeling.

FIGURE 1
Observed image of Sgr A*: total intensity (gray scale), fractional polarization (color), and polarization direction (tick angle).

FIGURE 2
Best-fit simulated model of Sgr A* (same plotting style as for Fig. 1).

Enhanced SSA-HJ-biplots
for time series with complex structure

Alberto Silva[1], Adelaide Freitas[2]

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FIGURE 1

The distance graph (right) suggests
a structural break at iteration
17 (1966) in the global temperature
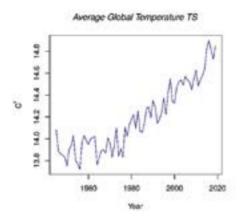series (1945–2019, left panel).

The biplot method is a multivariate technique that, when combined with Singular Spectrum Analysis (SSA), aids in visualizing and identifying patterns in univariate time series. We recently proposed the SSA-HJ-biplot, a graphical tool that simultaneously represents the rows and columns of the time series trajectory matrix with maximum quality on the same factorial axes. This enables exploratory visual analysis of time series components such as trends and periodicities. The position of points, as well as the size and direction of arrows in the SSA-HJ-biplot, can reveal key structural features of the time series.
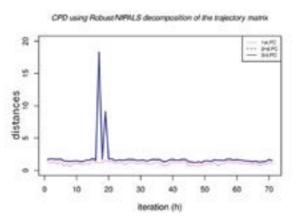
However, complex structures in the time series may blur the biplot, making visual interpretation challenging. A time series is defined as heterogeneous when a structural break occurs at a specific change point, interrupting the governing linear recurrent relation; then, after a short transition phase, a new recurrence regime governs the series. In this work, we propose a new structural change detection method for heterogeneous time series, aiming to segment them into homogeneous subseries and thereby improve the performance of the SSA-HJ-biplot. Some existing procedures based on SSA detect structural changes by comparing a single decomposition method applied on two trajectory matrices (base and test). In each iteration of the procedure, distances between selected eigenvectors and a suitable subspace are computed.

In our approach, the comparison – and the resulting distance – is based on applying two different decomposition methods (one robust and the other ordinary, both using the NIPALS algorithm) to the same trajectory matrix. These distances become more pronounced when there is a change in the direction of certain eigenvectors due to a disruption in the linear recurrent formula. Examples with synthetic and real datasets are presented.

This work received an honorable mention from the Portuguese Association for Data Classification and Analysis.

BOLD: Service-learning for linguistic and cultural diversity in higher education

Sílvia Melo-Pfeifer[1], Susana Pinto[2], Ana Ruiz[3], Andrea Ulhoa[2], Carolina Simões[2], Franziska Gerwers[1], Joana Duarte[4], Katerina Zourou[5], Lisa Marie Brinkmann[1], Madalena Teixeira[2], Maria Helena Araújo e Sá[2], Korina Defteraiou[5], Manuel Alcantara[3], Marcelo Kremer[2], Marisa Maia Machado[2], Mónica Lourenço[6], Nadia Gerritsen[4], Neli Heidari[1], Nuno Afonso[2], Pilar Aramburuzabala[3], Raquel Carinhas[7], Ricardo Torres[2], Sandra Sprenger[1], Stavros Samiotis[5], Sofia Papatsimpa[5], Stefania Oikonomou[5], Vânia Carlos[2]

BOLD (*Building on linguistic and cultural diversity for social action within and beyond European universities;* https://boldproject.eu/) is a European project that connects higher education institutions (HEI) and civil society organisations (CSO). Its aims to support partner HEI (in Germany, Greece, Portugal, The Netherlands and Spain) to expand the social relevance of their activities. It bridges the gap between pre-service teacher education and engagement with communities by (i) supporting pre-service teachers' professional development through civic engagement and social action, and (ii) promoting collaboration between HEI and CSO through the implementation of joint Service-Learning (SL) projects advocating for linguistic and cultural diversity.

SL is an educational approach that combines community service with academic instruction and activities involve students working in partnership with communities to address a social need. By embedding SL into the curriculum, HEI connect research and practice, translating academic findings into actionable insights.

Acknowledging that SL offers a diverse benefits for students, faculty, and the wider community, BOLD has embedded it into initial teacher education and several resources have been created: 10 specific-themed open access modules covering SL for enhancing activism regarding linguistic and cultural diversity in HE which have been integrated into teacher education curricula (in 20 master degrees, engaging about 400 student teachers in the consortium countries); service design principles that provide a framework for integrating SL initiatives in curricula; a toolkit for university students and staff that assists the planning, implementation and assessment of SL projects; a handbook to support the implementation of socially engaged teaching practices. Through these initiatives, BOLD fosters meaningful connections between academia and society and empowers teachers to become active agents of change.

PRINCIPLES FOR SERVICE-LEARNING

Learning in real world setting · Partnership · Offer adequate time frames · Civic learning · Sustainability · Meet actual real needs of stakeholders · Students' active participation · Reciprocity · Facilitate systematic student reflection · Defined goals · Value trans-disciplinarity · Link to curriculum · Include evaluation and documentation · Ensure support and coaching for students

Evaluate, Monitor, Document.

1 – University of Hamburg, Germany.
2 – CIDTFF & Department of Education and Psychology, University of Aveiro.
3 – Autonomous University of Madrid, Spain.
4 – University of Groningen, Netherlands.
5 – Web2Learn.
6 – CIDTFF & University of Coimbra.
7 – CIDTFF & School of Education of the Polytechnic Institute of Bragança.

FIGURE 1
Principles for Service-Learning towards linguistic and cultural diversity in Higher Education.

FIGURE 2
Design phases of a Service-Learning project.

VABIOLA: Digital European Language Portfolio – Enhancement of language biographies

Rosa Maria Faneca[1], Abdelilah Suisse[2], Cláudia Ferreira[2], Eugénia Pereira[2], Helena Araújo e Sá[1], Mónica Lourenço[3], Margarida Marques[1], Susana Pinto[1]

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3 – CIDTFF & Faculty of Arts and Humanities, University of Coimbra.

FIGURE 1
Pedagogical Guide: "Enhancement of language biographies".

FIGURE 2
Launch screen of the Vabiola App. To download the App to a mobile phone, please following address: https://app.highday.fr/vabiola.

In a mobile world, where the European Union is increasingly becoming an interconnected space with a common identity, the Council of the European Union calls for the construction of a European education area that "would not be hindered by borders." Spending part of one's education in another member state should become the norm. Multilingual skills are essential for competitiveness and social cohesion, making the effective use of digital technology strategic. In 2021, a group of researchers from five countries began modernizing the European Language Portfolio (ELP), which has proven useful, by giving it a digital dimension and creating a sustainable application that is more accessible, fun, and interactive. The three planned outputs of the project VaBioLa[1] have been achieved: the pedagogical guide has been published (http://dx.doi.org/10.48528/tf40-n706), technological advances have enabled the creation of the VABIOLA App, which has already tested by educators, students and teachers enhancing their learning experiences in a fun and interactive way. Teacher training for effectively using the app has been completed to better integrate linguistic skills into various subjects.

The project has received the European Label of Good Practice – an award granted by the French National Erasmus+ Agency – highlighting its significance and effectiveness. For more information, please visit the website: http://support.highday.fr, and download the VABIOLA App from the Google Play Store and the Apple Store at the following link: https://app.highday.fr/vabiola.

References

[1] VaBioLa – "Digital European Language Portfolio – Enhancement of language biographies" is a three-year Erasmus+ project (reference: KA220-SCH-BA2083C5) involving the following institutions: the University of Lyon 1 Claude Bernard in France, the Association D'Une Langue A L'Autre in France, the University of Aveiro in Portugal, the Rectorat of Lyon in France, the Regione Autonoma Valle d'Aosta in Italy, the Aristotle University of Thessaloniki in Greece, and Arteveldehogeschool in Belgium.

Valorisation des biographies langagières — Guide pédagogique

Screening for Psychological Distress in Nephrology: The Hemodialysis Distress Thermometers

Helena Sousa[1], Oscar Ribeiro[1], Daniela Figueiredo[2]

Worldwide, hemodialysis is the cornerstone treatment for kidney failure, and Portugal is the European country with the highest unadjusted prevalence of people receiving this kidney therapy[1]. Hemodialysis is extremely demanding and frequently associated with heightened psychological distress in those undergoing this life-sustaining treatment and their families, usually known as "hidden patients". Despite this awareness, the psychosocial needs of this population remain poorly understood and largely unaddressed, often due to the lack of pragmatic and psychometrically sound patient-reported outcome measures (PROMs) available for use in nephrology care contexts.

The *Hemodialysis Distress Thermometer for Patients* (HD-DT)[2] and the *Hemodialysis Distress Thermometer for Caregivers* (HD-DT-C)[3] are two easy-to-complete, clinically useful, valid, and reliable PROMs aiming to simplify the triage of psychological distress and its sources (physical, emotional, social/family, and dialysis-specific) among adults on hemodialysis and their informal caregivers. Both measures were developed by a research team from the University of Aveiro with a history of fruitful scientific collaborations and solid experience in investigating the psychosocial dimensions of kidney failure, and are published in highly recognized international scientific journals (*Psychology & Health* and *Quality of Life Research*).

Since made public, the HD-DT and the HD-DT-C have received several requests for translation and validation by clinicians and researchers from countries with an elevated prevalence of people on hemodialysis, such as Brazil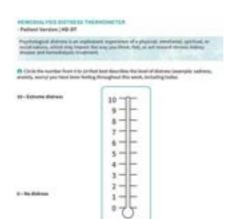, Türkiye, and China. This global outreach is an important step in raising awareness of the urgency of strengthening psychosocial screenings and interventions in dialysis units worldwide. To date, both European Portuguese and American English versions of the HD-DT and the HD-DT-C are available.

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FIGURE 1
The tripartite structure of the HD-DT and the HD-DT-C.

FIGURE 2
The front page of the HD-DT includes the definition of psychological distress and the distress barometer.

Deprescribing in Older Adults: Attitudes, Awareness, Training, and Clinical Practices Among Portuguese Physicians

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2 – iCBR, Faculty of Medicine, University of Coimbra.

FIGURE 1

Physicians' awareness, training, clinical practice in deprescribing, and use of criteria to identify Potentially Inappropriate Medications (PIMs).
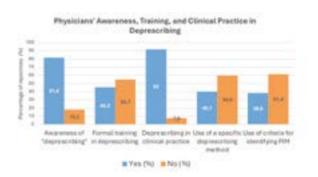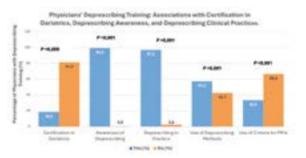
FIGURE 2

Associations between deprescribing training and physicians' awareness, certification in geriatrics, and clinical deprescribing practices.

The importance of deprescribing in clinical practice is growing, especially in aging populations with polypharmacy, making it a crucial issue in Portugal as one of Europe's most aged nations. Despite growing evidence, barriers at the level of professionals, patients, and systems hinder its implementation. This study explored Portuguese physicians' perspectives on deprescribing, focusing on their awareness, training, attitudes, and practices.

A nationwide online questionnaire distributed by the Portuguese Medical Association collected sociodemographic and professional data, along with insights into awareness, training, attitudes, and practices related to deprescribing. Descriptive statistics were used; inferential analysis employed Chi-square, Fisher's exact, and Mann-Whitney U tests ($p < 0.05$).

In total, 425 valid questionnaires were analysed. While 81.2% of physicians were familiar with deprescribing, 55.4% reported no deprescribing training. Most (91.9%) practiced it, but only 39.8% used structured methods, and 38.7% applied criteria to identify potentially inappropriate medications (PIMs).

Training in deprescribing was significantly associated with higher deprescribing awareness, use of specific deprescribing methods, use of criteria to identify PIM, and having certified Competence in Geriatrics by the Portuguese Medical Association. General practitioners showed higher deprescribing familiarity and training than hospital-based specialists and adopted deprescribing methodologies more often.

This study revealed a high awareness of deprescribing among Portuguese physicians, as well as considerable gaps in training and inconsistent practices. These findings underscore the urgent need for targeted education and structured policies to optimize medication management in older adults. They also reinforced the role of health policy and medical education in promoting safe deprescribing.
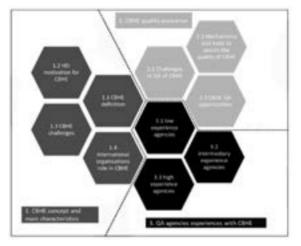

Physicians' Awareness, Training, and Clinical Practice in Deprescribing

Physicians' Deprescribing Training: Associations with Certification in Geriatrics, Deprescribing Awareness, and Deprescribing Clinical Practices.

Cross-border higher education in Europe and the role of quality assurance agencies

Nathan Carvalho[1], Maria J. Rosa[2], Alberto Amaral[3]

Over the years, with the increased internationalisation on the agenda of higher education systems and institutions, cross border higher education (CBHE) has gradually become present in the higher education scenario. CBHE can be defined as the offer of educational services in a country different from that where the higher education institution is based (UNESCO and OECD 2005).

This study discusses, from the perspective of the European quality assurance agencies (QAA), the development of CBHE in Europe and the challenges it entails, namely regarding its quality and how to assure it. Empirically, it is based on the material collected through interviews conducted with the responsible for QAA from 10 European countries: Estonia, Finland, Germany, Ireland, Italy, Lithuania, Netherlands, Portugal, Spain and the United Kingdom. Interview guidelines were drafted, with three main sets of questions organised around: i) CBHE conceptualisation and main characteristics; ii) CBHE quality assurance and iii) the agency's experience with CBHE quality assurance.

The results reveal that almost all QAA have at least partial experience with CBHE provision, mainly related to the evaluation of joint-degree programmes offered by European higher education institutions. The cooperation between countries and agencies emerges as one of the main challenges to the development of a common tool to enhance CBHE, which could facilitate the quality assurance process for all stakeholders. The development of policies at the European level to bind and raise the awareness of governments towards the particularities of the QA of CBHE could be a good solution to deal with this phenomenon and force actions to be put in place. The use of common guidelines specifically created for CBHE provision at the European level would contribute to increase the trustability of this type of educational offer.

FIGURE 1

Map of the main categories and subcategories resultant from the content analysis of the data collected in the interviews with QA agencies.

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References

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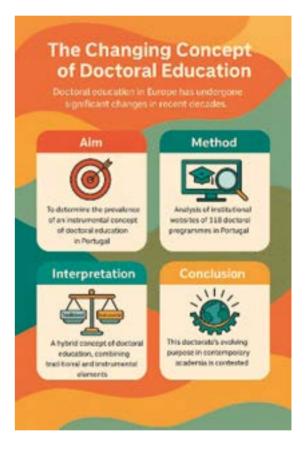
The changing concept of doctoral education: an insight from Portuguese universities

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Doctoral education in Europe has undergone profound transformations over the last two to three decades, influenced by broader reforms in higher education policy, growing demands for accountability, and changing academic labor markets. This paper investigates how these changes have shaped the concept of doctoral education in the Portuguese context, with particular focus on the extent to which an instrumental understanding of the doctorate has taken root. Using a systematic content analysis of institutional websites from 118 doctoral programmes – covering all scientific domains and representative of the national doctoral offer – the study assesses how doctoral education is framed and presented publicly by universities. The results reveal the prevalence of a hybrid conceptualization: in some cases, doctoral programmes align with a traditional model centred on individual research and academic apprenticeship; in others, they reflect an instrumental logic, emphasizing transferable skills, employability, and structured training. Most commonly, both logics coexist, resulting in mixed messages about the purpose and structure of the PhD. This hybridity suggests that Portuguese universities are navigating between academic traditions and external pressures – including academic capitalism and isomorphic influences – such as international standards, performance metrics, and stakeholder expectations. The article contributes to the understanding of how national doctoral systems adapt to global trends while maintaining local specificities, and highlights the tensions embedded in the evolving purpose of the doctorate in contemporary academia.

The Changing Concept of Doctoral Education

Doctoral education in Europe has undergone significant changes in recent decades.

Aim — To determine the prevalence of an instrumental concept of doctoral education in Portugal

Method — Analysis of institutional websites of 118 doctoral programmes in Portugal

Interpretation — A hybrid concept of doctoral education, combining traditional and instrumental elements

Conclusion — This doctorate's evolving purpose in contemporary academia is contested

"Boring,Crazy and Ill-Tempered": Theater Artists, Power and Gender

Helena Gonçalo Ferreira[1]

This study takes a provocative look at power relations in portuguese theater, questioning why women artists do not occupy positions of power (Table 1).

INSTITUTION	DIRECTOR	TENURE
Teatro Nacional D. Maria II	Agustina Bessa-Luís	1991-1993
Teatro Municipal São Luiz	Aida Tavares	2015-2022
Rivoli Teatro Municipal	Isabel Alves Costa	1993-2007
Teatro Municipal de Viseu – Teatro Viriato	Paula Garcia	2016-2020
Teatro Municipal de Viseu – Teatro Viriato	Patrícia Portela	Mar 2020 – Jan 2022
Teatro Municipal de Matosinhos	Luísa Pinto	2007-2015
Teatro Municipal do Porto	Cristina Palas Leitão and Drew Klein	2023 – July 2024
Teatro Municipal de Guimarães – Teatro Oficina	Sara Barros Leitão	2022
Teatro Municipa de Bragança	Helena Genésio	2003-2019
Teatro Municipal de Castelo Branco – Teatro Viriato	Maria da Luz Lopes	2013 – present
Fórum Municipal Luísa Todi	Patrícia Mauti	2020 – present
A Oficina	Fátima Alçada	2020-2022
Comédias do Minho	Fátima Alçada	2024

The research explores the trajectories of these women, the challenges they face, and the ways they create networks of resistance and alternative power. Grounded in Cultural Studies and poststructuralist feminism, the investigation proposes a reconceptualization of power in theater, not merely as something to be claimed but as a space to be reinvented.

Through archival analysis of the Experimental Theater of Porto (TEP) and interviews with eleven portuguese women artists, this research unveils persistent mechanisms of exclusion within theatrical institutions.

The archival examination reveals historical patterns in employment contracts, correspondence, and programming decisions that systematically marginalize women from decision-making roles. The conversational interviews allow participants to articulate their experiences of navigating and challenging rhizomatic patriarchal structures (Fig. 1).

The findings demonstrate that while institutional barriers continue to confine women to subordinate positions, these artists actively construct alternative frameworks of power and agency. Rather than seeking inclusion within existing hierarchies, they develop innovative collaborative practices that challenge traditional theatrical authority. These women create horizontal networks of support, establish independent creative spaces, and employ artistic practices that resist conventional power dynamics.

The study concludes by advocating for a fundamental restructuring of theatrical power relations, moving beyond tokenistic representation toward transformative change. It highlights how these women resist traditional hierarchies by forging new artistic and political paths that reimagine theater as a space of collective creativity and shared authority, ultimately proposing a more inclusive and democratized vision of cultural production.

TABLE 1
Women with directorship positions in Public Theaters in Portugal.

FIGURE 1
Patriarchal rhizome (Banana tree) according to the author [Drawing by Rosalina Silva at the author's request].

Learning to decode the media: Data Defenders, a playful response to crises

Ana Passos[1], Frederico Proença[1], Laura Martins[1], Marta Silva[1], Liliana Costa[1], Maria João Antunes[1], Oksana Tymoshchuk[1], Ceci Diehl[1], Nelson Zagalo[1]

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FIGURE 1
User playing Data Defenders

FIGURE 2
Data Analyzer

Data Defenders game is the main output of YO-MEDIA Project (https://yomedia.a-mcc.eu), led scientifically by the University of Aveiro and coordinated by the Portuguese Press Editors and Publishers Association, in collaboration with Aveiro Media Competence Center, the University of Vic – Central University of Catalonia, and the Catholic University of the Sacred Heart. The YO-MEDIA Project aimed to train students, educators, and media professionals to promote media literacy among young people during times of crisis, such as health emergencies and wars.

Data Defenders (https://yo-media.itch.io/data-defenders) is an immersive tower defense game for computer and mobile devices (iOS & Android), where players must defend servers from a global cyberattack led by AI-powered extraterrestrial robots. The game is aimed at young people between the ages of 12 and 18. It addresses the issue of fake news and misinformation, mainly spread through social media – the primary source of information for today's younger audiences [1, 2].

Data Defenders features two core mechanics: i) Data Analyzer, which allows players to analyze and evaluate media content in terms of its credibility and impartiality (Figure 2), and ii) Crisis Impact, which dynamically displays the level of misinformation on Earth, challenging players to manage the crisis while enhancing their media literacy skills. The game encourages young people to reflect on the power of the media, the immediacy of news, sensationalist journalism, conspiracy theories, and fake news, as well as to question the reliability of information sources.

In terms of impact, the YO-MEDIA Project organized design thinking sessions with over 150 students and led workshops across Europe with more than 80 participants. It created innovative educational tools, including the *Data Defenders* digital game and two physical games on media literacy (*Social Media Puppeteers* and *Social Media Fake News*). The project also developed a multilingual MOOC in four languages and established a Southern European media literacy network. It coordinated the International Conference on Crisis Media Literacy 2024 and delivered presentations at more than 10 major events. The project's results were disseminated through publications in international journals and conference proceedings.

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Playing with Music: Developing an Inclusive Digital Musical Game for Children with Cerebral Palsy

Lucius Vinicius-Filho[1], Oksana Tymoshchuk[2], Rita Oliveira[2], Davys Moreno[3]

Cerebral palsy (CP) is a condition often linked to physical limitations, and it is the most common cause of motor abnormalities seen in infants and children[1]. However, there is a lack of resources and opportunities to help those children learn music in an accessible environment[2]. The aim of this research was to investigate the use of eye-tracking devices to create an educational musical game that allows children with motor limitations (especially CP) to learn music while playing. The project was produced in collaboration with an Artistic School of the Music Conservatory in Portugal, which has a child student with CP and there was a need to more available material to support their music education. The eye-tracker device used was the *PC Eye 5: Tobii Dynavox*[3], provided by Altice labs[4].

The project followed a Design-Based Research method, collecting data through usability tests, interviews, and observations. The developed game "Playing with Music" is already being used in the children's classes in Conservatory of Music to assist in their classes. It was split into two different versions (Figure 1): (1) Play with Piano is similar to a simulator, where the player can interact with a virtual piano, create custom songs with notes appearing in a musical staff, perform musical challenges, play beats, change the instrument's sound, as well as the Beats Per Minute (BPM). (2) Musical Spaceship consists of a puzzle version, where the player needs to build a path for a ball to pass with objects that allow the game to play a song shown on the musical sheet. Both versions collaborate on the music teaching through creation, practice, exploration and creativity. The game was presented in Aveiro Tech Week 2024 for multiple people to play with their eyes (Figure 2). Analysis of comments and gameplay performance suggests eye-tracker devices offer a viable, accessible way to interact with applications. The project not only addresses the social need for this assistive technology, but also contributes to identifying the challenges when developing eye-gaze applications.

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3 – Research Center on Didactics and Technology in the Education of Trainers – CIDTFF, University of Aveiro.
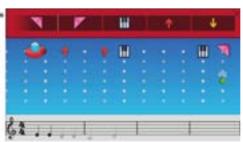
FIGURE 1
Play with Piano and Musical Spaceship, respectively.

FIGURE 2
Play with Music being presented in Aveiro Tech Week 2024.

Creating Emphatic Characters:
A Method A Creative toolkit for Designing Empathic Characters in Digital Games

Tânia Ribeiro[1], Ana Isabel Veloso[1], Peter Brinson[3]

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FIGURE 1
Creating Emphatic Characters: a Method – Final Prototype.

FIGURE 2
Creating Emphatic Characters: a Method: detail.

FIGURE 3
Creating Emphatic Characters: a Method: detail.

Creating Emphatic Characters: A Method is an analog toolkit designed to assist game designers in the early stages of character development, supporting the creation of complex, emotionally engaging, and narratively coherent playable characters. Developed over four years of doctoral research under a grounded theory approach, the tool is structured into four themed decks of instructional cards: Life Foundation, Personality, Appearance, and Path & Conflict.

Each card prompts the designer to reflect on key aspects of the character's identity, such as their psychological traits, emotional background, visual symbolism, and narrative trajectory. This structure encourages creative exploration and avoids reliance on clichés or archetypes. The tactile and visual design – featuring textured paper, folding cards, and translucent layers – further supports iterative ideation and layered storytelling.

The toolkit was awarded the Best Paper Award at the international HCI International 2024 conference, where it was recognized for its innovative approach to supporting creativity in character design and narrative development. The method has been tested in both academic and design education contexts, including an international case study at the University of Southern California, where students used the toolkit to develop characters later adapted into short films.

Positive feedback from future game designers, psychologists, and HCI experts highlighted the tool's clarity, usability, and creative potential. The results suggest the toolkit is particularly effective in promoting character consis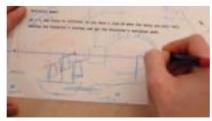tency and emotional depth – qualities essential to creating empathic connections with players. By fostering inclusive, hands-on, and narrative-rich design practices, *Creating Emphatic Characters: A Method* offers a valuable resource for game developers, educators, and researchers. It expands the toolkit available for character design in digital games, reinforcing empathy as both a design goal and a creative process. The project's development and impact have been disseminated through several peer-reviewed international publications:

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Ribeiro, T., Veloso, A.I., Brinson, P. (2024*). Empathic Characters for Digital Games: A Prototype Proposal*. In: HCII 2024 – HCI in Games. Springer. DOI: 10.1007/978-3-031-60695-3_17

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Characterization of salts from Portuguese saltpans for therapeutic applications

Lara Almeida[1], Fernando Rocha[1], Joana Fortunato[1], Rosana Neto[1], Carla Candeias[1]

Saltwater and dissolved salts have long been used for healing therapies. Evaporites are formed by seawater evaporation, leading to minerals like halite ($NaCl$), sylvite (KCl), gypsum ($CaSO_4 \cdot 2H_2O$) and anhydrite ($CaSO_2$). Halite has recognized different medical applications, such as an antiseptic in saline solutions for wounds. In dermal therapies, salts provide benefits such as exfoliation, hydration, detoxification, antimicrobial properties, inflammation reduction, and mineral absorption. Salts can penetrate skin cells, addressing inflammation and promoting skin health. Therapies using salts, offer an alternative to medications, such as in osteoarthritis, by enhancing bone health and reducing pain. However, improper use may cause dryness on sensitive skins. Pelotherapy uses muds and salts for inflammation relief and muscle relaxation. Iontophoresis enhances salt absorption through the skin using low electric currents, offering targeted pain relief. Although research on salts in dermatology and cosmetic applications remains limited, interest in their potential is growing. The present study serves as a starting point to evaluate the therapeutic applications of salts collected from saltpans in Portugal, specifically from the Ria de Aveiro and Ria Formosa lagoons, exploring their combined use in pelotherapy and iontophoresis treatments.

A comprehensive set of analyses was conducted, including mineral phases identification by X-ray diffraction (XRD), major elements composition by X-ray fluorescence (XRF), particle size distribution by Sedigraph, and particles morphological characterization and semi-quantitative chemical analysis using a scanning electron microscope (SEM-EDS). Physicochemical parameters (i.e., pH, electrical conductivity (EC), organic matter content (OM), moisture (M)) were determined, along with technological tests (abrasiveness index, oil absorption, Atterberg limits, specific surface area) and thermal properties (cooling time and specific heat).

FIGURE 1
(a) study areas location in Portugal;
(b) traditional saltpan in Aveiro;
(c) semi-industrial saltpan in Tavira.

The *Ph-UEL* project: a circular system-thinking for water hyacinth biomass transformation and valorization

Carla Patinha[1], Ignácio Pinheiro[2], Rodrigo Neves[2], Isabel Lopes[3], Cátia Venâncio[3]

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3 – CESAM, University of Aveiro.

FIGURE 1
Ph-UEL project's scientific and public outreach: showcase of water hyacinth research, educational facts, and the @novojacinto Instagram initiative.

Invasive plants pose a growing global challenge due to their damaging effects on ecosystems, biodiversity, and infrastructure such as dams and bridges. Among them, water hyacinth (WH) stands out as a prolific and problematic species. Controlling invasive plants represents a major financial burden, with European control efforts alone reaching €116 billion over the past 60 years. The *Ph-UEL* project has attempted to understand the potential of WH as a phosphorus-rich agricultural enhancer through its structural, biological, and chemical characteristics, aligned with a strong field component. Alongside, the *Ph-UEL* project recognizes the role of public engagement in environmental stewardship, prioritizing also raising awareness about the broader impacts of invasive species through its Instagram page *NOVOJACINTO*.

Preliminary analyses of WH biomass collected from four urban and agricultural areas revealed location-dependent accumulation patterns. Roots accumulated more heavy metals (As, Fe, Cd, Ni, Mn, Pb), while aerial parts concentrated essential nutrients (P, Ca, K, Mg, B). WH samples from intensively farmed areas showed elevated phosphorus content – alongside potentially toxic elements – highlighting the need for site-specific risk assessment. Additionally, structural analysis indicated high levels of recalcitrant biomass (48–63% lignin, hemicellulose, and cellulose), reinforcing WH's potential as a stable soil input. These findings suggest WH could serve as a sustainable phosphorus source in agriculture, provided its safe use is ensured through foundational studies like this one. As for the public engagement, *NOVOJACINTO* accounts with 107 followers, and more than 1,000 visualizations in which usuaries access to fact sheets about this invasive species, reinforcing the role of Ph-UEL in educational and outreach efforts to raise awareness about biological invasions.

Is there a trade-off between human well-being and ecological footprint in European countries?

Margarita Robaina[1], Sofia Rodrigues[2], Mara Madaleno[1]

Human development holds aspects such as health, education, standard of living, and general well-being, and is intrinsically linked to environmental sustainability. Studying the trade-off between these two aspects helps ensure that current needs are met without compromising the ability of future generations to meet their own. This study aims to understand whether there is a trade-off between the Ecological Footprint (EF) and the Human Development Index (HDI), for a panel of 42 European countries from 2006 to 2018. Other variables were also employed (Financial Development, Globalization, Human Freedom, Urban Population, Biocapacity, Renewable Energy) in two models, through several econometric tests (Interactive Fixed Effects, Common Correlated Effect Mean Group). Other models are used for robustness checks (GMM).

We conclude a trade-off between environmental quality and human well-being (EF and HDI are positively related, Fig. 2), which can compromise sustainable development.

Results evidence that renewable energy improves the environment and human development, and that the urban population improves human development but worsens the environment. The greater the biocapacity, the lower the human development, and the higher the EF, which may be linked to the "natural resource curse" theory.

This study is innovative as this trade-off has not been analyzed using these two variables for European countries (Fig. 1). Understanding is fundamental to developing effective policies, integrating approaches that consider social, economic, and environmental aspects. Policymakers must implement effective policies that promote economic growth but also motivate companies to be careful with environmental quality and pollution, namely, using renewable energies. Political decisions on urbanization are also important when orderly urbanization is put into practice. Consumer habits and lifestyle decisions can also play a significant role in the trade-off between EF and human well-being.

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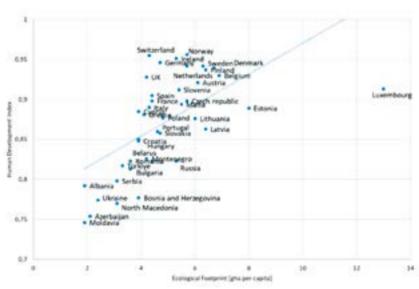
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Youth with clipped wings: bridging the gap from youth recruitment to representation in candidate lists

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FIGURE 1
Youth wing representation across the ladder of recruitment by party and total, 2002-2019.
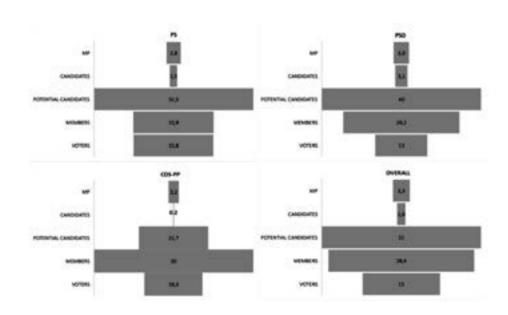
Young people are significantly underrepresented in global parliaments, with the most recent data pointing to less than 3 percent of parliamentarians being under 30 years of age (IPU, 2021: 7). This raises normative concerns, as democracy should not systematically exclude segments of the population (Stockemer and Sundström, 2022: 3). Youth underrepresentation may foster disengagement of younger cohorts from conventional democratic participation, potentially creating a "vicious cycle of political alienation" for young people (Stockemer and Sundström, 2022: 3).

This article examines the role of party youth wings in candidate selection. Despite being the "lifeblood" of party life (Trimithiotis, 2015: 167), their involvement in candidate selection remains largely overlooked, even though they are crucial for training future legislators and party leaders.

Results demonstrate that youth wings play an uneven role in candidate selection, generating an iceberg-shaped recruitment ladder. They supply parties with a sizeable proportion of young members and potential candidates. However, this does not translate to the visible part of the recruitment ladder, with the impact of youth wings sharply clipped when it comes to actual candidates and MPs.

Also, the number of youth wing candidates significantly increases with district magnitude, but they do not necessarily secure better list positions. More importantly, informal mechanisms and negotiations between youth wings and the mother party leadership emerge as a central factor in the ability of youth wings to influence candidate lists.

These informal dynamics often build fences around the young, rather than building bridges that could spur their inclusion as candidates and MPs. Strengthening party youth wings has been proposed as a strategy to enhance youth representation. Yet, as this research suggests, their formal empowerment may be severely hampered if informal practices within parties are not also addressed.

Towards smart and secure batteries: Linking pressure and temperature profiles with electrochemical behavior through hybrid optical fiber sensors
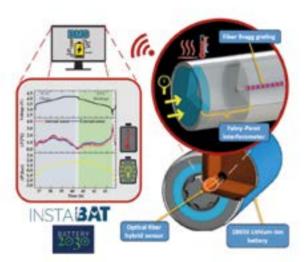
Lucca Matuck[1], João P. Santos[1], Fábio Freitas[1], Luís B. Fontes[2], Jörg Bierlich[3], Sylvie Geniès[4], João L. Pinto[1], Marta S. Ferreira[1], Olivier Raccurt[4], Micael Nascimento[1]

In response to the need for a compact technology capable of reducing the overall battery cost and determining with great accuracy factors such as critical parameters that will improve their safety and lifespan, the Battery 2030+ Research Initiative, financed by the European Union, was created. An essential aspect of this mission is the development of sensors for the meticulous monitoring of internal battery parameters. The *INSTABAT* project[1] was a member of this initiative and aimed to research smart lithium-ion batteries (LiBs) and develop smart methodologies to sense critical parameters within the battery cells. By employing an innovative hybrid sensing configuration based on fiber Bragg grating and intrinsic Fabry-Perot interferometer sensors, it was possible to decouple and monitor critical safety parameters (such as temperature and pressure) inside a cylindrical LiB, as shown in Figure 1. Thereby, by correlating this data with electrochemical events during the battery operation, it was possible to evaluate their performance under several cycles at different environmental temperatures and operating conditions[2]. Our findings challenge conventional wisdom, revealing that pressure dynamics within LiBs are associated with internal electrochemical events (such as the phase transitions of their materials) that occur during battery operation on the lithiation and delithiation processes and mainly behave as a "breathing profile" during the successive charge/discharge steps. This work represents a significant stride in enhancing the performance, safety, and understanding of lithium-ion batteries (LiB), ultimately contributing to the transition towards a more sustainable and secure energy future.

FIGURE 1
Operando monitoring of internal temperature and pressure variations of a LiB using tailored hybrid optical fiber sensors.

Reference

[1] "Instabat project – based on battery 2030+ group." https://www.instabat.eu/ .

[2] L. Matuck, et al., Chemical Engineering Journal, vol. 500, 156806, 2024, doi: 10.1016/j.cej.2024.156806.

Topological n-root Su–Schrieffer–Heeger models in photonic ring systems

David Viedma[1], Anselmo M. Marques[2], Ricardo G. Dias[2], Verònica Ahufinger[1]

1 – Departament de Física, Universitat Autònoma de Barcelona.
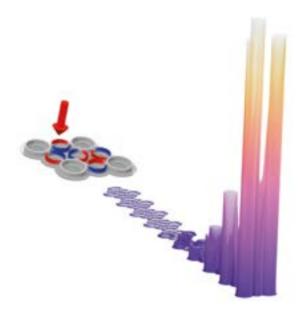2 – i3N & Department of Physics, University of Aveiro.

FIGURE 1

Unit cell showing asymmetric couplings via link rings with gain/loss modulation and an edge state localized at one end of the lattice.

Square-root topology and its extensions to roots of order 2^n have recently appeared in the field of topological insulators. Essentially, they exploit the relationship between the root and parent Hamiltonians via a power operation. Several interesting effects appear in the root systems, such as an increased amount of energy bandgaps and an inheritance of the topological protection of the parent.

We have gone one step further by developing the framework for designing general n-root topological insulators -for any positive integer n- and demonstrating the method using the SSH model as the parent system. To obtain the n-root system, one must generate an n-partite lattice, which we accomplished by employing loops of unidirectional couplings that make the system non-Hermitian. This coupling structure bestows the system with a generalized chiral symmetry, causing n separate and identical branches to appear in the complex energy-band spectrum. In each branch, n edge states appear within a ring gap on the complex plane – a novel type of gap that cannot be reduced to point or line gaps. For the implementation, we propose to employ a lattice of ring resonators coupled through antiresonant link rings. To achieve unidirectionality, the link rings feature a split gain–loss distribution, enhancing coupling in one direction while suppressing it in the other. We analyze the cubic root of the SSH model, including a detailed description of its symmetries, its topological characterization, and a comparison of its robustness against disorder with that of the parent model. Finally, we generalize the root method to arbitrary order n by extending the coupling-loop length through additional sites in the unit cell. We also describe in detail the implementation in ring resonators and present simulations for the roots of order 3, 4 and 5.

Reference

Viedma, D., Marques, A.M., Dias, R.G., & Ahufinger, V. (2024). Topological n-root Su–Schrieffer–Heeger model in a non-Hermitian photonic ring system. Nanophotonics, 13(1), 51-61. https://doi.org/10.1515/nanoph-2023-0590

Carbon Dots: Exciting New Frontiers for Anticounterfeiting

Raul Simões[1, 2, 3], Joana Rodrigues[2], Victor Neto[1, 3], Teresa Monteiro[2], Gil Gonçalves[1]

Counterfeit goods cost the global economy over $500 billion annually, according to the Organization for Economic Co-operation and Development (OECD) and the European Union Intellectual Property Office (EUIPO). This significant economic and societal burden underscores the urgent need to develop innovative product authentication and security solutions. Nanomaterials have become an effective alternative for developing advanced anti-counterfeiting applications. In particular, inorganic, organic, and hybrid luminescent tracers have shown great promise because of their unique optical properties. Carbon dots (CDs) have emerged as one of the most promising options due to their high chemical stability and optical versatility. CDs consist of a carbon-rich core and a surface domain rich in functional groups. These surface functional groups strongly influence the photoluminescence (PL) behavior of CDs, primarily due to surface-bound molecular fluorophores. This study explores how their chemical structure affects PL under different stimuli. While interactions between core and surface states are known to influence photophysical properties, the origin of PL is still debated. CDs' luminescence was found to be affected by various factors, including reaction precursors, synthesis conditions, purification methods, temperature, and pH. In addition, PL and decay times can be influenced by excitation and de-excitation processes, as up-conversion, delayed fluorescence, phosphorescence, and persistent luminescence. Customizable CDs can be engineered for anti-counterfeiting, product tracing, and information encryption due to their tunable luminescence. By selecting precursors and controlling reaction parameters, CDs with high quantum yield and versatile PL across the UV–VIS–NIR range can be created. This customization enables the development of CD-based nanocomposites for secure applications, showcasing their potential for future technological advancements.

Reference

[1] R. Simões, J. Rodrigues, V. Neto, T. Monteiro, G. Gonçalves, Carbon Dots: A Bright Future as Anticounterfeiting Encoding Agents. Small 2024, 20, 2311526. https://doi.org/10.1002/smll.202311526
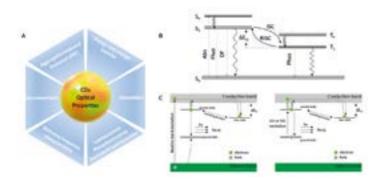
1 – TEMA & Department of Mechanical Engineering, University of Aveiro.
2 – i3N & Department of Physics, University of Aveiro.
3 – Intelligent Systems Associate Laboratory (LASI), Guimarães.

FIGURE 1

Schematic representation of (A) the main optical properties of CDs; (B) the optical transitions that may occur in CDs; and (C) persistent luminescence mechanisms in inorganic hosts.[1]

FIGURE 2

Potential applications of CDs as anti-counterfeiting agents.[1]

The injured axon: intrinsic mechanisms driving axonal regeneration

Diogo Tomé[1, 2], Ramiro D. Almeida[1, 2]

1 – iBiMED & Department
of Medical Sciences,
University of Aveiro.
2 – CNC, Center for Neuroscience
and Cell Biology, University
of Coimbra.

FIGURE 1

Growth cone (red), the precursor of axon regeneration, located at the tip of a rat hippocampal axon (blue).

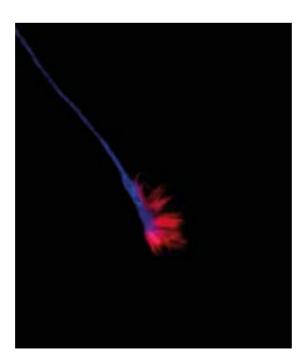Axonal injury in the adult central nervous system (CNS) often results in irreversible deficits due to the intrinsic inability of mature neurons to regenerate. In contrast, peripheral nervous system (PNS) neurons can activate a robust regenerative program. This review explores the intrinsic mechanisms that underlie axon regeneration, highlighting advances in axon-to-soma signaling, transcriptional and epigenetic reprogramming, local protein synthesis, and mitochondrial remodeling.

Following axonal injury, a rapid influx of calcium initiates a cascade of signaling events that travel retrogradely to the soma. These signals activate transcription factors such as STAT3, ATF3, and members of the KLF family, which together promote a growth-permissive gene expression profile. Epigenetic modifications, including histone acetylation and DNA demethylation mediated by HDAC5, PCAF, and TET3, are essential to unlock transcriptional programs required for regeneration.

Local translation within axons supports the synthesis of critical proteins near the injury site, such as importin-β, vimentin, and mTOR, which are vital for retrograde signaling and cytoskeletal dynamics. Ribosomes and mRNAs stored in stress granules are mobilized through mTOR-dependent mechanisms. Schwann cell-derived ribosomes may also contribute to this local translation machinery.

Mitochondrial transport and turnover are central to meeting the energy demands of regenerating axons. Proteins such as syntaphilin, MIRO1, ARMCX1, GRP75, and PAK5 facilitate the redistribution and tethering of mitochondria, restoring ATP production and calcium homeostasis. In CNS neurons, intrinsic inhibitors including PTEN, SOCS3, REST, and VGCC-associated synaptic proteins restrict regeneration by repressing pro-growth signaling and translation.

The article underscores the therapeutic potential of targeting multiple intrinsic pathways simultaneously to reprogram adult CNS neurons into a regenerative state and overcome current clinical limitations in neural repair.

Age-associated metabolic and epigenetic barriers during direct reprogramming of mouse fibroblasts into induced cardiomyocytes

Francisco Santos[1], Magda Correia[1], Rafaela Dias[1], Bárbara Bola[1], Roberta Noberini[2], Rita S. Ferreira[1], Diogo Trigo[1], Pedro Domingues[3], José Teixeira[4], Tiziana Bonaldi[2], Paulo J. Oliveira[4], Christian Bär[5], Bruno Bernardes de Jesus[1], Sandrina Nóbrega-Pereira[1].
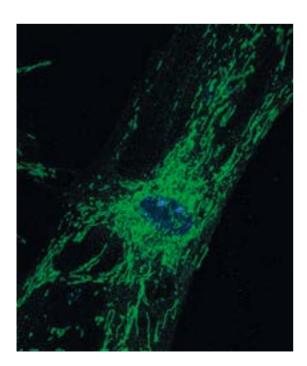
Heart disease is the leading cause of mortality in developed countries, and novel regenerative procedures are warranted. Direct cardiac conversion (DCC) of adult fibroblasts can create induced cardiomyocytes (iCMs) for gene and cell-based heart therapy, and in addition to holding great promise, still lacks effectiveness as metabolic and age-associated barriers remain elusive. Here, by employing MGT (Mef2c, Gata4, Tbx5) transduction of mouse embryonic fibroblasts (MEFs) and adult (dermal and cardiac) fibroblasts from animals of different ages, we provide evidence that the direct reprogramming of fibroblasts into iCMs decreases with age. Analyses of histone posttranslational modifications and ChIP-qPCR revealed age-dependent alterations in the epigenetic landscape of DCC. Moreover, DCC is accompanied by profound mitochondrial metabolic adaptations, including a lower abundance of anabolic metabolites, network remodeling, and reliance on mitochondrial respiration. In vitro metabolic modulation and dietary manipulation in vivo improve DCC efficiency and are accompanied by significant alterations in histone marks and mitochondrial homeostasis. Importantly, adult-derived iCMs exhibit increased accumulation of oxidative stress in the mitochondria and activation of mitophagy or dietary lipids; they improve DCC and revert mitochondrial oxidative damage. Our study provides evidence that metaboloepigenetics plays a direct role in cell fate transitions driving DCC, highlighting the potential use of metabolic modulation to improve cardiac regenerative strategies.

1 – iBiMED & Department of Medical Sciences, University of Aveiro.
2 – European Institute of Oncology (IEO) & Department of Experimental Oncology (IRCCS), Milan.
3 – LAQV/REQUIMTE & Department of Chemistry, University of Aveiro.
4 – Center for Neuroscience and Cell Biology (CNC-UC) & Center for Innovative Biomedicine and Biotechnology (CIBB), University of Coimbra.
5 – Institute of Molecular and Translational Therapeutic Strategies (IMTTS), Hannover Medical School (MHH) & Fraunhofer Institute for Toxicology and Experimental Medicine (ITEM).

FIGURE 1
Immunofluorescence of TOM20 (green) mitochondrial protein in mouse embryonic fibroblasts transdifferentiated into iCMs, nucleus in blue.

Patient-managed interventions in bronchiectasis: evidence, challenges and prospects

Arietta Spinou[1, 2], Annemarie L Lee[3, 4], Brenda O'Neil[5], Ana Oliveira[6, 7], Michal Shteinberg[8], Beatriz Herrero-Cortina[9]

1 – School of Life Course and Population Sciences, Faculty of Life Sciences and Medicine, King's College London.

2 – King's Centre for Lung Health, King's College London.

3 – Department of Physiotherapy, Faculty of Medicine, Nursing and Health Sciences, Monash University.

4 – Institute for Breathing and Sleep, Austin Health, Heidelberg, Australia.

5 – School of Health Sciences, Ulster University.

6 – Lab3R – Respiratory Research and Rehabilitation, Laboratory, School of Health Sciences (ESSUA), University of Aveiro.

7 – iBiMED – Institute of Biomedicine, Department of Medical Sciences, University of Aveiro.

8 – Pulmonology Institute and Cystic Fibrosis Center, Carmel Medical Center and the Technion Israel Institute of Technology, the B. Rappaport Faculty of Medicine, Haifa, Israel.

9 – Precision Medicine in Respiratory Diseases Group, Instituto de Investigación Sanitaria (IIS) & Universidad San Jorge.

FIGURE 1

Evolution of care models in bronchiectasis and key areas for future innovation.

Bronchiectasis is a chronic respiratory disease characterised by persistent cough and sputum production, and recurrent infections, leading to substantial symptom burden and healthcare utilisation. This narrative review explores the expanding role of patient-managed interventions, including airway clearance techniques (ACTs), hyperosmolar agents, exercise training, and self-management, in the treatment of adults with bronchiectasis. We argue for a shift from traditional clinician-led models to care approaches that actively engage patients as partners in managing their condition. While ACTs and pulmonary rehabilitation are supported by clinical guidelines and growing evidence, important gaps remain around treatment burden, long-term adherence, timing, delivery methods, and patient selection. Cough, although a hallmark symptom, remains under-addressed in intervention research. Self-management approaches show promise but lack consistency in design, delivery, and outcome reporting.

Emerging approaches such as combining ACTs with hyperosmolar agents, and integrating digital tools like web-based activity platforms, offer opportunities to reduce burden, enhance tolerability, and improve accessibility. Similarly, the use of behavioural and needs-based strategies, including goal setting, may empower individuals to manage their condition more effectively. These methods represent opportunities to align intervention design with patients' lived experience, motivation, and real-world context (figure 1).

By positioning patient-managed care as a core component of bronchiectasis treatment, rather than an optional add-on, this review presents a forward-looking framework for more personalised, scalable, and equitable care. It invites broader interdisciplinary collaboration to advance research and implementation, and to reimagine management strategies for this under-recognised and underserved population.

Past — Traditional clinical lead models
- Emphasis on pharmacological management
- One-size-fits-all approach
- Limited shared decision-making

Present — Patient-lead models
- Airway clearance techniques
- Exercise
- Pulmonary rehabilitation
- Self-management
- Hyperosmolar agents

Future — Challenges & Innovation
- Adherence and Treatment Burden
- Cough management
- Personalised Self-Management
- Combined & Digital Interventions

Questions of scale sensitivity, experience and branding culture in and beyond Hans Christian Andersen's House

Annette Svaneklink Jakobsen [1], Anders V. Munch[1], Fátima Pombo[2]

The article explores how scale, experience and branding design culture are balanced and argues that the museum of Hans Christian Andersen was created with a sensitivity towards different scales that form the relations with its contexts. How such scale sensitivity is connected to the materiality and experiences of the space is analysed through theories by Gilles Deleuze, Felix Guattari, Maurice Merleau-Ponty, and Celia Lury. The design of the new house was inspired by experiential qualities found in Andersen's fairy tales. Instead of giving answers, the fairy tales provoke questions and leave the reader to wonder about the meaning. (Figure 1). This performative aspect of Andersen's work was a source of inspiration in the spatial design of the museum and garden and key to a translation from literary to phenomenological experiences. The visitor is involved in the intertwining of content, material substance, shape, texture, colour, light, sound that by coalescing together, create the environment's temperament or atmosphere. Thus, the intention was to set up architectural spaces and exhibition installations that provoke questions by confronting differences and performatively *do as* in Andersen's fairy tales, instead of providing an institutional and curatorial version of truth *about* the author and his work. The museum complex consists of primarily round building volumes reaching above and below ground level. The multilevel garden flows between and on top of the building volumes. (Figure 2). The architecture and the urban garden form a focal point in the exhibition design but are also central elements in a larger transformation project in Odense. With a new museum, the Hans Christian Andersen's House, the Danish city Odense has intensified the relations between the 19th century author and son of the city and the architectural spaces of today. The museum opened in 2021 but has drawn much attention since 2016 when Kengo Kuma & Associates were announced winners of the competition for this new house of fairy tales. The combination of Andersen, a cherished author read worldwide, and Kuma, a world-famous architect, seemed a perfect match to secure attention from a wider public and attract local and international visitors.
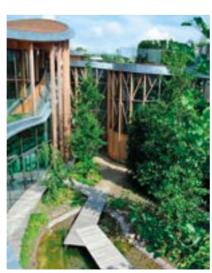
FIGURE 1
The fairy tale Nightingale by Hans Christian Andersen.

FIGURE 2
A view towards the underground 'secret' garden from the outdoor café area.

Three-dimensional matrices for enhanced coral settlement through design for additive manufacturing

Miguel Vieira[1, 2], Sérgio M.O. Tavares[2], Silvina L. Félix[1, 3]

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1 – ID+, University of Aveiro.
2 – TEMA & Department
of Mechanical Engineering,
University of Aveiro.
3 – School of Design, Management
and Production Technologies
Northern Aveiro (ESAN),
University of Aveiro.

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FIGURE 1

Samples printed with the paste-based extrusion (PBE) technique using porcelain and oyster.
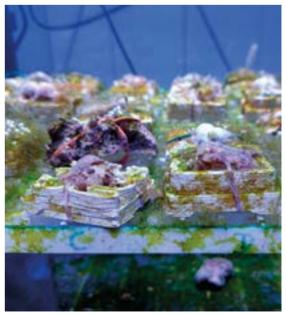
FIGURE 2

Coral settlement on samples in the ECOMARE aquarium.

The effects of climate change have contributed to the degradation of coral reefs. One approach to mitigating this damage is the use of artificial reefs. However, the most common artificial approaches, such as sunken vehicles and prefabricated cement reefs, do not allow adequate coral development. This research explores how designers can utilise additive manufacturing (AM) and Computational Design techniques to create artificial reefs that mimic natural reef structures, promoting better coral settlement. This project was carried out in collaboration with ECOMARE – Laboratory for Innovation and Sustainability of Marine Biological Resources of the University of Aveiro. It focuses on developing three-dimensional matrices using parametric and algorithmic modelling techniques to generate complex surface patterns fabricated using AM. A Nature-Centered Design approach was adopted, placing nature at the centre of the design process to enable the creation of reefs tailored to specific coral species and environmental conditions. Samples with different geometries and roughness, produced using paste-based extrusion with porcelain and porcelain with oyster shell, were tested in a controlled environment to investigate the settlement, survival, adaptation, and growth of soft corals. The AM of samples confirmed the corals' preference for settling on complex surfaces compared to smooth surfaces. Porcelain showed comparable results to Portland cement, suggesting further testing potential. This research proposes a new approach that combines additive manufacturing with coral's biological responses to enhance understanding of their surface settlement preferences. With additive manufacturing, computational design and a Nature-Centered Design approach it was possible to create an innovative working model that could be customized depending on the implementation area or intended coral species, validating the design approach as a method to support environmental conservation.

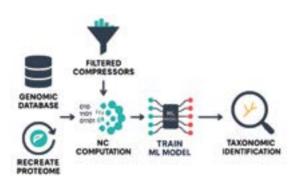# Enhancing metagenomic classification with compression-based features

Jorge Miguel Silva[1], João Rafael Almeida[1]

Metagenomics relies heavily on next-generation sequencing but efficiently classifying novel or complex microbial samples can be challenging, especially when relying on cumbersome, reference-based methods. In our study, we propose a streamlined, alignment-free strategy that captures how compressible each sequence is (both at the DNA and amino-acid level) as a predictive signature for taxonomic identification. By analyzing the "compression fingerprint" produced by 16 well-known data compressors, we effectively identify organisms across viruses, bacteria, archaea, fungi, and protozoa, achieving up to 95% classification accuracy. This unified approach saves significant computational effort by sidestepping extensive reference databases, and it also excels in low-coverage of highly diverse genomes (such as protozoa and unknown viruses) due to the use of data compression. The resulting compression-driven pipeline, validated on thousands of public-domain sequences, shows how the interplay of data compression, machine learning, and computational genomics can offer a robust new lens for metagenomic research.

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

FIGURE 1
Compression-Based Taxonomic Identification Pipeline.

Ten years of immersive education: a Virtual and Augmented Reality course at postgraduate level

Bernardo Marques[1], Paulo Dias[1], Beatriz Sousa Santos[1]

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

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FIGURE 1
A Glimpse of more recent editions of the virtual and augmented reality course, showcasing students while creating and testing their prototypes at the VAR Lab.

The Virtual and Augmented Reality course of DETI provides an overview of the main application areas, historical perspective, fundamental concepts, methods, and tools to design, implement, and evaluate VR/AR systems. Also, develop students' abilities to read and evaluate scientific literature, present research findings to an audience, and enhance teamwork skills.

Students enrolled, totaling nearly two hundred over the span of ten years, arrive with diverse backgrounds: master's students in informatics, computer and telematics, electrical and telecommunications engineering, industrial automation engineering, computational engineering, digital game development, as well as robotics and intelligent systems.

Essential to the course success is the VAR Lab[1], located at IEETA, offering students an infrastructure with state-of-the-art equipment, where students can design and develop their works, following a human-centered design methodology. The course's flexibility in proposing projects has fostered an engaging learning environment, motivating students to explore their interests (e.g., stroke rehabilitation, exposure therapy, industrial scenarios, training/education, cultural heritage, entertainment, human-robot interaction), leading to innovative projects, some of them published at conferences and winners of awards down-the-line.

Reference

[1] https://sites.google.com/view/varlab/

Sensor-agnostic Visuo-Tactile Robot Calibration Exploiting Assembly-Precision ModelGeometries

Manuel Gomes[1], Michael Görner[2], Miguel Oliveira[1], Jianwei Zhang[2]

Visual sensor modalities dominate traditional robot calibration, but when environment contacts are relevant, the tactile modality can provide another natural, accurate, and highly relevant modality. Most existing tactile sensing methods for robot calibration are constrained to specific sensor-object pairs, limiting their applicability. This research pioneers a general approach to exploit contacts in robot calibration, supporting self-touch throughout the entire system kinematics by generalizing touchable surfaces to any accurately represented mesh surface. The approach supports different contact sensors as long as a simple single-contact interface can be provided. Integrated into the ATOM calibration methodology, a generalized calibration approach, our work facilitates seamless integration of both modalities in a single approach. Our results demonstrate comparable performance to single-modality calibration but can trade off accuracy between both modalities, thus increasing overall robustness. Furthermore, we observe that utilizing a touch point at the end of a kinematic chain slightly improves calibration over touching the chain links with an external sensor but find no significant advantage of restricting touch to end-effector contacts when calibrating a dual-arm system with our method.

1 – IEETA & Department of Mechanical Engineering, University of Aveiro.
2 – Department of Informatics, Universität Hamburg, Germany.

FIGURE 1
The robot used: an altered PR2 with a Shadow Hand equipped with BioTac sensors on its right hand.

FIGURE 2
The author calibrating the robot.

A postcard from the shores of *Deep Listening, Deep Sea(ing)*

Paulo Maria Rodrigues[1]

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

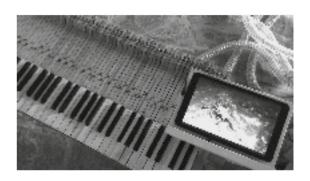**FIGURE 1**
A workstation at Pianoscópio workshops.

FIGURE 2
Performance "82ºN" at BlueNIGHTS/ Torreira.

"Imagining" the soundscapes of a barely known universe is a fascinating challenge. The deep ocean is one such universe: science is now beginning to uncover some of its secrets, yet we already understand its crucial relevance to our survival on the planet – and its increasing vulnerability. Artistic experiences can play a powerful role in raising awareness about important issues. They engage the senses and emotions, and can be both playful and enthralling – especially when they involve active creative participation. *Deep Listening, Deep Sea(ing)* brought together scientists and artists to develop ideas and actions for children, teenagers and the wider community. The journey began at the *Pianoscópio*, a contemporary interactive installation where we guided the creation of "imaginary soundscapes" that were later transformed into "audiovisual postcards" and "soundtracks" for images and films gathered in scientific missions to the deep ocean. The results were shared with both local communities and international audiences through events that included conferences by scientists and artists, training sessions for teachers, "workshops" and artistic performances held at Fábrica/ Aveiro, BlueNIGHTS/ Torreira, RESEO/ Paris, CMI-UFMG/ Belo Horizonte, and Serralves/ Porto. The collaborative artistic creations were made available online, along with a short documentary about the project.

The project was funded by the EEA Grants and involved the collaboration of Companhia de Música Teatral, University of Aveiro, University of Bergen, Fábrica Centro Ciência Viva de Aveiro and the Marvão International Academy for Music Arts and Sciences.

As many other projects where we "walk on the boundaries" of art, science and community, this was a journey that moved the people that came on board: experimenting, discovering, creating, imagining, collaborating, listening to others are experiences that lead to places of poetic resonance. That is, perhaps, what art can do best: open up minds and hearts.

Musical Lives of the Ocisumba: Study and Rescue of an Angolan Chordophone

Jorge Castro Ribeiro[1], Lucas de Campos Ramos[1]

The *ocisumba* (also *ocihumba* or *nsambi*) is a pluriarch-type chordophone of African origin, documented for over five centuries in the former Kingdom of Kongo and still known today in Angola. In that country, however, it is near extinction. To date, only one living master has been identified: Paulino Katimba, 82, residing in Caimbambo, Benguela Province, despite extensive efforts to locate others. The instrument was brought to Brazil during the transatlantic slave trade and appears in 19th-century naturalist paintings, though it has not survived there to the present day.

In Portugal, 23 ocisumba are preserved in five ethnographic museum collections dating from the late colonial period, though no historical use is record in the country.

Ethnomusicological research included literature review; mapping and organological study of 26 instruments (23 in Portuguese museums and 3 in Angolan museums); and fieldwork in Caimbambo to document the music making, repertoire, knowledge, and perspectives of the only living practitioner. His instrument was also studied in depth and a new one was built during the fieldwork. Local musical practices were observed, helping to understand the instrument's role within the local cultural ecosystem. The collected data were then analysed to shed light on the ocisumba's role and relevance.

The research aimed to expand knowledge of the instrument and its Atlantic circulation (fieldwork in Brazil is planned for next winter), and to contribute to its safeguarding through the study of its organology, acoustic features, and the living oral tradition in which it still plays a role in Angola.

There are prospects for deepening the knowledge about the ocisumba through two approaches: (a) the formation of a multidisciplinary team that includes, in addition to two ethnomusicologists, specialists in digital humanities, museology, art history, archaeology, and dendrology; (b) a new fieldwork trip by the team to the same region.

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

FIGURE 1
Sick Slaves (painting by Henry Chamberlain, 1822). Collection of the State Art Gallery of São Paulo, Brasil.

FIGURES 2 AND 3
Master Paulino Katimba playing his ocisumba (August 25, 2024) – Lucas de Campos collection.

Wireless Powered Flight: Charging Drones While in Operation

Ricardo A. M. Pereira[1*], Helena Ribeiro[1], Vinícius Oliveira[1], Amit Baghel[1], Paulo Capitão[1], Hélder Morais[2], J. Martinho M. Oliveira[2], Nuno Borges Carvalho[1]

1 – Instituto de Telecomunicações and University of Aveiro.
2 – CICECO, University of Aveiro

FIGURE 1
University of Aveiro team in Dubai, exhibiting the "Wireless Powered Flight" project at Prototypes for Humanity 2024.

FIGURE 2
Schematic of the wireless powered drone system with the transmitting antenna, dielectric lens, receiving antenna, rectifier and drone.

Wireless power transfer (WPT) can revolutionize energy distribution by eliminating the need for physical cables. This project advances WPT by developing a system to wirelessly power a drone while in operation, so that there is no need to interrupt missions for power charging, inspired by the pioneer work of William Brown[1, 2].

Here at the "Radio Systems – Av" group from Instituto de Telecomunicações – University of Aveiro, the research in WPT uses microwaves, where the energy propagates freely through space, enabling long-systems. By focusing the energy through quasioptics[3], the beam efficiency can be significantly increased[4], which is achieved in this project through dielectric lenses[5] and with an aerodynamic receiving antenna[6]. This innovation supports sustainable energy goals, offering potential for clean energy distribution, extending the range of aerial electric vehicles or even enabling uninterrupted operation, improving energy access in challenging environments, all of which are crucial in surveillance, delivery, and rescue missions, either in military or emergency scenarios.

A small-scale project was developed for focusing power at under 2 m, showing that a drone only turns on when the energy is focused directly on it. It was awarded the "Outstanding Student Design Demonstrator Award" at the IEEE Wireless Power Transfer Conference and Exhibition 2024 in Kyoto, Japan, and selected as one of 100 projects worldwide to be exhibited at Prototypes for Humanity 2024 in Dubai[7].

Reference

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Ultra-Reliable Wireless Transmission Over Dense Fog Conditions Enabled by Hybrid FSO-mmWave

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

Free-space optics (FSO) is the new frontier for broadband wireless communications. The most prominent benefits of FSO include the provision of fiber-like bandwidth, unlicensed spectrum, and immunity to electromagnetic interference. These key features make FSO a promising technology for 6G terrestrial, and satellite communications. However, the benefits of FSO systems come at the cost of increased sensitivity to weather conditions such as fog and turbulence, particularly for terrestrial links. In locations where fog occurrence is statistically relevant, the propagation loss can severely reduce the uptime of FSO systems. This poses a limitation on the maximum link length if a high availability standard is required. On the other hand, radio-frequency based links have always been known for their weather resilience, but lack the high data capacity of FSO due to their narrower available spectrum and regulatory constraints.

Thus, to address the high-bandwidth and reliability requirements for wireless links, we have proposed and implemented a hybrid FSO and millimeter-wave (mmWave) wireless link, bringing together both technologies' strengths. This hybrid system was subjected to the impact of fog, which was generated inside an atmospheric chamber developed in partnership with PIC-Advanced. By exploiting adaptive modulation on the FSO link, we maximized the system throughput while maintaining maximum reliability with extreme fog conditions.

With this work, we demonstrated transmission capacity ranging from 25 to 425 Gbps with 100% reliability and tolerating more than 50 dB of power attenuation which would be equivalent to a 50 km link with a visibility of 13km.
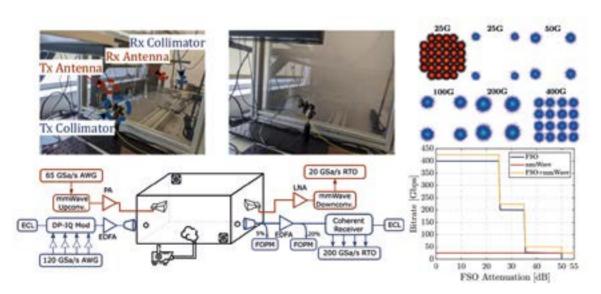
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FIGURE 1
Experimental setup of the hybrid FSO-mmWave transmission though dense fog exploiting adaptive modulation to maximize capacity and reliability.

From electron device physics to communication system impairments – Optimizing RF power amplifier linearity

Luís Cótimos Nunes[1], Filipe Miguel Barradas[1], José Carlos Pedro[2]

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2 – Instituto de Telecomunicações & Department of Electronics, Telecommunications and Informatics, University of Aveiro.
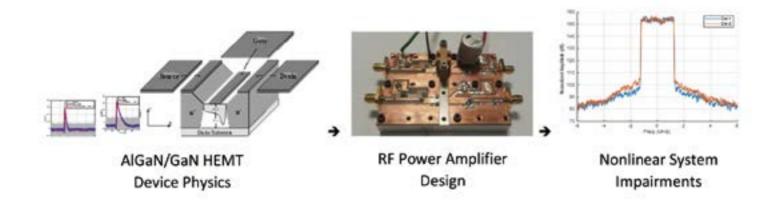
FIGURE 1
Design flow of telecommunication transmitters: from research at the physics level to the observed system level behavior.

As a result of a cooperation with a major transistor manufacturer and then with the world largest mobile communications base-station supplier, this work showed how a deep understanding of electron device physics, RF power amplifier (PA) circuit design and of wireless communications systems' impairments could be put together to demonstrate that emission time constants of GaN defects are responsible for the achievable linearity degradation of AlGaN/GaN HEMT-based PAs. It was shown that the most severe nonlinear communication impairments after digital correction arise when the emission rate is on the order of the signal bandwidth. Moreover, because of the strong temperature dependence of the emission time constants, self-heating was shown to play a major role in that linearity degradation. To demonstrate the importance of the coupling of electrothermal and trapping effects, two AlGaN/GaN HEMT dies with the same structure but different GaN defect activation energies were tested under nonlinear digital correction. Now, studies are being made to investigate which AlGaN/GaN HEMT physical parameters should be changed to optimize the achievable linearity.

Beyond several publications in the most respected journals and conferences of the field, this work received one of the most prestigious awards, the 2024 IEEE Microwave Prize.

AlGaN/GaN HEMT Device Physics → **RF Power Amplifier Design** → **Nonlinear System Impairments**

Innovative approaches in the evaluation of the spatial and temporal variability of grape varieties from the Portuguese Bairrada Appellation using innovative statistical tools: a study across five harvests

Sílvia M. Rocha[1], Cátia Martins[1], Jéssica Marques[1, 2], Hyoram Assunção[1], Alisa Rudnitskaya[3],
Ana Raquel Santos[2], José Pedro Soares[2]

Sustainable viticulture and winemaking continue to represent huge challenges, requiring deeper knowledge about the functional role of biodiversity in the vineyard ecosystems and the grape varieties' plasticity. Taking advantages of chemometric tools, this research aims to advances the analysis of interactions between climatic conditions, vineyard ecosystem and composition of grape varieties cultivated in Bairrada Appellation (Portugal). Grapes from five varieties (Arinto, Cercial, Bical, Maria Gomes, and Baga *Vitis vinifera* L.) sampled during 5 years were selected as case study. A combination of linear mixed models with Principal Component Analysis (LiMM-PCA) was applied to analyze effects of three factors, harvest, grape variety and vineyard on the physical-chemical parameters and both free and glycosidically bound potential aroma compounds of the grapes. LiMM-PCA allowed to analyze data set with underlying design, which included both fixed (harvest and variety) and random (vineyard) factors. The selected vineyards were representative of the Bairrada Appellation and treating the vineyard as a random factor permitted to draw conclusions about Bairrada region. All three factors and their interactions were found to be statistically significant. Moreover, this approach enabled to assess varietal adaptability to varying climatic conditions, revealing Arinto as the most resilient variety, while Bical and Baga were the most susceptible. Joint information in chemical parameters, aroma compounds and meteorological data was assessed using multi-block method – Common Dimensions (ComDim). This analysis identified the meteorological factors with the greatest impact on grape composition, emphasizing the critical role of maximum temperature and precipitation in August, as well as the number of cold hours per month throughout the year (Figure 1).

The proposed methodological framework offers a valuable tool for supporting vineyard and wine production management, amid current climate challenges.
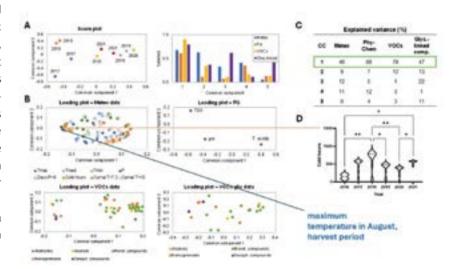
1 – LAQV & Department of Chemistry, University of Aveiro.
2 – Comissão Vitivinícola da Bairrada, Anadia.
3 – CESAM & Department of Chemistry, University of Aveiro.

FIGURE 1
ComDim model for Arinto white grape variety showing common information in four datasets: sample scores (A); variable loadings (B) related to meteorological data (Meteo), technological ripening parameters (FQ), free volatile fraction (VOCs) and glycosylated (Glyc-linked) of the grapes under study; saliences (C), i.e. contribution of each dataset to the common components, and number of cold hours per day (D), where * indicates statistically significant differences were observed (p < 0.05) and ** indicates statistically significant differences (p < 0.001).

maximum temperature in August, harvest period

Unveiling Biomarkers of Human Embryo Quality: Interplay Between Metabolomics and Sperm-Borne microRNAs in Assisted Reproduction

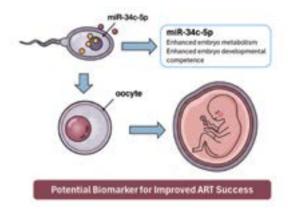Soraia Pinto[1], António Rocha[2] Alberto Barros[1, 3, 4], Marco G. Alves[1, 2], Pedro F. Oliveira[3]

1 – Centre for Reproductive Genetics Professor Alberto Barros, Porto.
2 – ICBAS—School of Medicine and Biomedical Sciences, University of Porto.
3 – Department of Pathology, Faculty of Medicine, University of Porto.
4 – i3S – Instituto de Investigação e Inovação em Saúde, University of Porto.
5 – Ibimed & Department of Medical Sciences, University of Aveiro.
6 – LAQV-REQUIMTE & Department of Chemistry, University of Aveiro.

FIGURE 1

miR-34c-5p in spermatozoa links to better embryo metabolism and development – potential ART biomarker.

Human embryo quality evaluation is critical for successful assisted reproductive technologies (ARTs). Traditional morphological assessments can be subjective, highlighting the need for new biomarkers for gamete quality and fertility potential. To improve the accuracy of embryo selection, we integrated metabolomics and sperm-borne microRNA analysis alongside morphokinetic evaluation. Metabolomic profiling of embryo culture media revealed that specific metabolite differentials (pyruvate, alanine, glutamine, and acetate) are discriminative of embryo quality. Good and Lagging embryos export and accumulate pyruvate and glutamine, suggesting more active metabolic activity compared to Bad embryos. Furthermore, sperm-borne microRNAs play a role in embryo development, with an impact on its metabolism. Specifically, higher levels of miR-34c-5p in spermatozoa were strongly associated with the consumption or release of key metabolites by developing embryos, particularly those linked with lipid and glucose metabolism, suggesting enhanced metabolic performance. Moreover, the abundance of miR-34c-5p in spermatozoa correlates not only with embryo developmental competence, but also with total sperm motility. Higher levels of miR-34c-5p were found in sperm samples that originated good embryos. These studies highlight the potential of combining metabolomics and sperm-borne microRNA analysis to provide a more comprehensive evaluation of human embryo quality, potentially leading to improved embryo selection and increased success rates in ARTs. Further research is needed to confirm these findings in larger groups and to understand the molecular mechanisms underlying microRNA effects on reproductive outcomes.

From marine metabolites to cosmeceuticals: Optimizing bioactive compounds for improved skin health

Gonçalo P. Rosa[1, 2], Ana M. L. Seca[1, 2], M. Carmo Barreto[2], Diana C.G.A. Pinto[1]

Marine macroalgae are an underexplored source of structurally diverse secondary metabolites. Their exposure to extreme and fluctuating environmental conditions has driven the evolution of complex metabolic pathways, leading to the biosynthesis of chemically unique compounds. These include phenolic acids, phlorotannins, terpenoids, sterols, etc., which serve, among others as UV protection, and oxidative stress mitigation, mechanisms also relevant to anti-aging skincare.

This work focused on two such underexploited species, *Gongolaria abies-marina* and *Caulerpa prolifera*, applying an integrated strategy of phytochemical profiling, optimized extraction, and structural modification of selected metabolites. While both yielded enzyme-inhibitory extracts, the most impactful results came from the semi-synthesis of key lipophilic constituents.

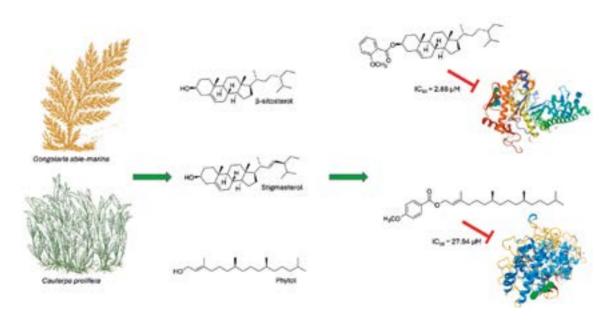Targeting enhanced bioactivity, phytol, β-sitosterol, and stigmasterol were selected for semi-synthesis. Ten ester derivatives of each molecule were obtained using benzoic, cinnamic, furanoic, and thiophene-carboxylic acids, yielding compounds with distinct substitution patterns. Several derivatives showed markedly enhanced inhibition of hyaluronidase and tyrosinase compared to parent compounds and controls (Figure 1). β-sitosterol 3-(2-methoxybenzoate) was the most potent hyaluronidase inhibitor (IC$_{50}$ = 2.88 μM), over nine times stronger than sodium aurothiomalate. Substituent positioning on the aromatic ring significantly influenced activity, highlighting key structure–activity relationships. For tyrosinase, phytyl 4-methoxybenzoate outperformed phytol with a 2.8-fold increase in potency (IC$_{50}$ = 27.94 μM).

These results show that strategic derivatization of macroalgal metabolites enhances their anti-aging bioactivity, especially enzyme inhibition. This work expands the chemical space of marine natural products and provides promising semi-synthetic candidates for future cosmeceutical applications.

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1 – LAQV-REQUIMTE & Department of Chemistry, University of Aveiro.
2 – cE3c-GBA & Faculty of Sciences and Technology, University of Azores.

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FIGURE 1
Schematic representation of the workflow for the semi-synthesis of derivatives from compounds of *Gongolaria abies-marina* and *Caulerpa prolifera*.

Study of radiant floor systems with phase change materials for improved performance

Filipe Rebelo[1], António Figueiredo[1], Romeu Vicente[1],
Ricardo M.S.F. Almeida[2, 3], Victor M. Ferreira[1]

1 – RISCO & Department of Civil Engineering, University of Aveiro.
2 – Department of Civil Engineering, Polytechnic Institute of Viseu.
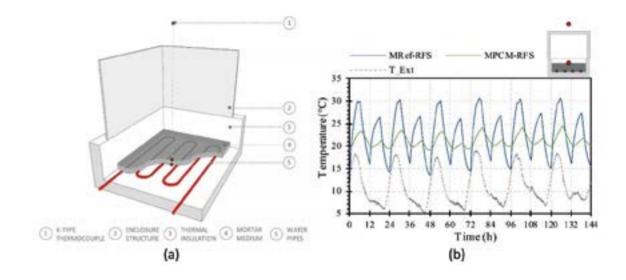3 – CONSTRUCT-LFC, Faculty of Engineering, University of Porto.

FIGURE 1
(a) 3D representation (without scale) of the setup; (b) temperature profiles of the sensors on the floor surface – heating strategy controlled by timer.

A promising pathway to contribute to the decarbonization of the building stock is through improving the thermal performance and energy efficiency of buildings. Combining materials with high energy density such as Phase Change Materials (PCMs), with indoor heating and cooling systems is a valuable strategy to achieve this goal. PCMs are able to store and release large amounts of thermal energy *per* unit volume during phase change process, within a narrow temperature range. Incorporating PCMs in radiant floors can improve the overall performance of these systems. However, when the heat transfer medium is a mortar, the incorporation of PCM often results in the reduction of thermal conductivity, posing a challenge to system performance. To evaluate the impact that the incorporation of a microencapsulated PCM (mPCM) in the mortar of a hydronic radiant floor system (RFS) has on its thermal and energy performances, an experimental setup was built and subjected to different heating scenarios. The apparatus consists of two comparable hydronic RFS specimens: one reference (Ref.) and another incorporating the mPCM in the mortar medium embedding the water pipes. The specimens were tested under intermittent heating strategies controlled by timer and floor surface temperature setpoints. The methodological approach was divided into: (i) analysis of the thermal performance of the RFS specimens; and (ii) assessment of energy performance based on the operating time of each specimen. The operating control strategy of the RFS proved to be key for an adequate performance, promoting the PCM phase change to occur, reducing temperature fluctuations and maintaining surface floor temperatures within comfort values. As major drawback, the PCM-RFS required longer operating times when the heat source is controlled by surface floor temperature setpoint, influenced by the thermophysical properties of the PCMmortar composition. Research available at: https://doi.org/10.1016/j.est.2024.114084.

(a)

(b)

Design and thermal performance analysis of a dynamic shading device incorporating phase change materials

Margarida Gonçalves[1], António Figueiredo[1],
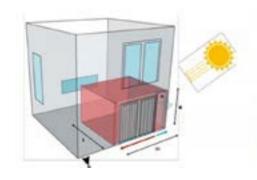Ricardo M.S.F. Almeida[2, 3], Romeu Vicente[1]

Recognizing the substantial carbon footprint of the building sector, there is a growing emphasis on decarbonization strategies that aim to improve the energy and thermal performance of the built environment, thereby reducing overall energy consumption and greenhouse gas emissions. Dynamic façades can play a crucial role in achieving this objective, as their adaptability to environmental changes can boost both energy efficiency and thermal comfort in buildings. Moreover, the increasing trend of integrating Phase Change Materials (PCM) into building envelopes highlights their considerable potential for improving thermal performance. In this framework, a novel dynamic shading device incorporating PCM (DS-PCM) was developed to mitigate overheating. The system operates by sliding the device from an indoor compartment (highlighted in red in the Figure) to a discharging chamber connected to the outdoor environment (highlighted in blue) to potentiate the PCM phase change and heat dissipation. A full-scale prototype was tested in two identical compartments: one equipped with a conventional curtain (REF), and the other with the DS-PCM device. An experimental campaign was conducted to assess the system's performance according to different operational strategies. The results showed that the DS-PCM device reduced indoor maximum peak temperatures by up to 2.1ºC, lowering the Degree-Hours Discomfort index by up to 20%, and decreasing overheating periods by up to 7%, thus improving indoor thermal comfort. Future research will focus on optimizing the system's operation to further enhance the compartment's thermal performance, by dynamically controlling the device's movement in response to the PCM's real-time temperature.
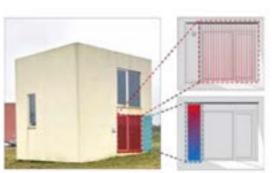
FIGURE 1
Schematic view of the operating principle of the DS-PCM device.

Nature-based Solutions for Water Resilience in Thriving European Urban Areas

Sara Bona[1], Ricardo Gomes[2], Armando Silva-Afonso[1, 3], Fernanda Rodrigues[1]

1 – RISCO & Department of Civil Engineering, University of Aveiro.
2 – INESC Coimbra & Department of Civil Engineering, Polytechnic University of Leiria.
3 – ANQIP & Department of Civil Engineering, University of Aveiro.

FIGURE 1

Methodological framework for identifying and analysing NbS for urban water management across European cities.

FIGURE 2

Distribution of green and blue NbS actions for urban water management by typology and implementation frequency.

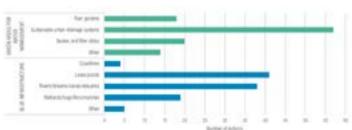Traditional engineering solutions are proving increasingly inadequate in the face of water-related challenges driven by climate change, urbanisation, and social inequalities. In this context, Nature-based Solutions (NbS) emerge as integrated and multifunctional alternatives that enhance ecosystem resilience while addressing key urban water issues. This study identifies and categorises NbS applied in 77 projects across 46 European cities, evaluating 216 specific actions at different spatial scales. Through content analysis, these actions were grouped according to their ecological functions and contributions to urban water management. Findings reveal four categories of blue infrastructure and three of green infrastructure as particularly impactful. Blue infrastructures include the regeneration of natural and semi-natural water bodies, river and coastal ecosystem management, and multi-species wetlands for ecological restoration. These contributed significantly to flood mitigation, stormwater management and aquifer recharge. Green infrastructures focused on pollutant reduction, expansion of permeable green areas, and hybrid systems integrating sustainable urban drainage, promoting decentralised water retention and quality improvement. The Mediterranean region, where water scarcity and extreme weather events are intensifying, showed the highest frequency of NbS implementation, underscoring their potential as a strategic response for climate adaptation. This research highlights how NbS contributes to transitioning towards water-sensitive cities, offering environmental, social and economic co-benefits. A broader adoption of such nature-inspired strategies is essential for strengthening urban water resilience and achieving sustainability goals across Europe.

Frequency-Domain Analysis of Vehicle Noise Emissions

Antonio Pascale[1, 2], Claudio Guarnaccia[3], Margarida C. Coelho[1, 2]

The increasing exposure of populations to hazardous road traffic noise has driven the scientific community to develop innovative mitigation strategies. While significant efforts have focused on real-time monitoring and predictive modeling in smart cities, less attention has been given to analyzing vehicle noise emissions in the frequency domain, particularly the impact of low-frequency components, which are known to have adverse health effects.

This study addresses this gap by investigating the sound power levels of a diesel and a Liquid Petroleum Gas-powered vehicle across a frequency range of 63 to 8,000 Hz. Controlled pass-by (CPB) tests were conducted on a private track following ISO 11819-1, ensuring the absence of external noise sources. Using a backward sound propagation model, frequency noise emissions in terms of sound power levels (Lw) were derived. Additionally, noise data were collected within the same frequency range at the exhaust system level, with the vehicle in neutral gear and the RPM increased using the throttle pedal.

Results from CPB tests indicate that low-frequency components (63-250 Hz) play a non-negligible role at low speeds, where engine noise dominates over tire-pavement interactions. The 1,000 Hz component was found to be predominant at all speeds, while the contribution of 8,000 Hz was negligible. A-weighting was applied to reflect human auditory perception, which de-emphasized low-frequency noise. Furthermore, resonance phenomena occurred at 63 Hz when the vehicle was stationary with the engine running.

These findings underscore the need for targeted noise reduction strategies in internal combustion engines and provide valuable insights for vehicle manufacturers seeking to isolate harmful low-frequency emissions. Moreover, the study lays the groundwork for future research on frequency-domain noise emissions from electric vehicles, which operate under different noise generation mechanisms and may alter the trends observed.

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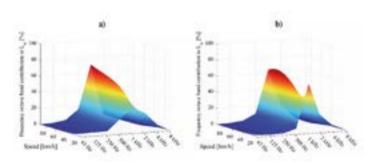1 – TEMA & Department of Environment and Planning, University of Aveiro.
2 – LASI – Intelligent Systems Associate Laboratory, Guimarães.
3 – Department of Civil Engineering, University of Salerno, Italy.

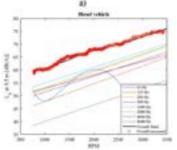..

FIGURE 1
Noise emission spectra for a) diesel vehicle and b) LPG vehicle.
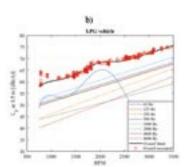
FIGURE 2
Exhaust sound pressure levels against RPM for a) diesel vehicle and b) LPG vehicle.

Title Shear thickening fluid (STF) in engineering applications and the potential of cork-STF-based composites

Gabriel F. Serra[1], Lídia Oliveira[1], Selim Gürgen[2], R.J. Alves de Sousa[1], Fábio A.O. Fernandes[1]

1 – TEMA & Department of Mechanical Engineering, University of Aveiro.
2 – Department of Aeronautical Engineering, ESOGU, Turkey.
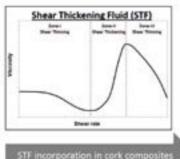
FIGURE 1
STF rheological behaviour and damping enhancement by reinforcing cork composite structures with STF.
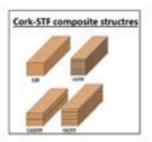
Shear thickening fluids (STFs) are remarkable materials that instantly transform from a fluid to a solid-like state when subjected to an impact force, only to return to their liquid form once the force is removed (Figure 1). This unique behaviour makes them exceptional at absorbing impact energy, reducing vibrations, and enhancing damping performance. By dispersing micro- and nanoparticles within a liquid medium, STFs unlock a new frontier in protective applications.
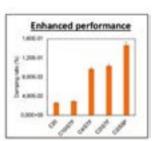
This study explores the science behind STFs, delving into their properties, classification, and the fascinating rheological mechanisms that drive their behaviour. Beyond theory, we highlight their real-world potential – from revolutionizing stab-resistant materials and impact protection to pioneering energy dissipation solutions in industries such as battery safety, vibration control, and adaptive structures.

A particularly exciting solution is the integration of STFs with cork – a sustainable, naturally resilient material. By combining the energy absorption capabilities of cork with the dynamic response of STFs, these hybrid materials and structures emerge as a game-changer for impact-resistant applications. This research showcases the versatility of STFs and calls for further innovation, unlocking new pathways for safer, more efficient, and sustainable protective solutions.

Amniotic membrane-derived multichannel hydrogels for neural tissue repair

Joana P.M. Sousa*[1,2], Inês A. Deus[2], Cátia F. Monteiro[2], Catarina A. Custódio[2,7], João Gil[1,3,4], Lina Papadimitriou[5], Anthi Ranella[5], Emmanuel Strataki[5], João F. Mano[2], Paula A.A.P. Marques*[16]

Neural tissue regeneration demands advanced biomaterials that recapitulate the structural, mechanical, and biochemical characteristics of native neural environments. In this work, we introduce multichannel 3D hydrogels derived from human amniotic membrane methacryloyl (AMMA), designed to support neural stem cell (NSC) functions and promote directional tissue regeneration. AMMA was synthesized from decellularized human amniotic membrane and photopolymerized into scaffolds with ~250 µm channels using a custom 3D-printed mold. These hydrogels exhibit low stiffness (~5 kPa), mimicking central nervous system (CNS) mechanical properties, and high-water content, supporting their application as soft tissue analogs.
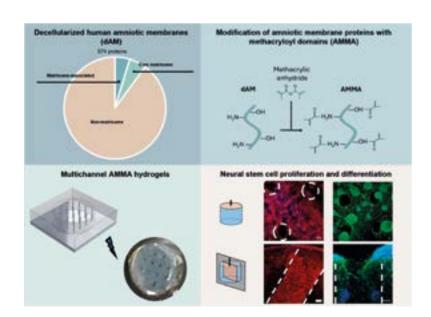
Under 2D conditions, AMMA hydrogels enabled uncoated NSC adhesion, proliferation, and neuronal differentiation, confirmed by TUJ-1 and GFAP expression. In 3D cultures, cells organized into neurospheres and longitudinal columns within the channels, establishing extensive neuronal networks. Synaptophysin staining confirmed the presence of synaptic vesicles, indicating functional connectivity. Importantly, the hydrogel structure allowed for efficient cell infiltration and neurite extension along channel axes, supporting both scaffold integration and guided regeneration.

Entirely human-derived, AMMA offers an ethical, bioactive, and highly customizable platform that overcomes limitations associated with animal- or synthetic-based scaffolds. These scaffolds can transport cells or therapeutic agents and be adapted to lesion-specific geometries, enhancing their clinical relevance. This study highlights the translational promise of AMMA as a next-generation biomimetic scaffold for CNS and peripheral nerve repair, bridging the gap between fundamental research and clinical application.

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2 – CICECO & Department of Chemistry, University of Aveiro.
3 – CDRSP, Polytechnic of Leiria, Marinha Grande, Portugal.
4 – INESC-MN – INESC Microsistemas e Nanotecnologia, Lisbon, Portugal.
5 – FORTH-IESL Heraklion, Greece.
6 – LASI – Intelligent Systems Associate Laboratory, Portugal.
7 – Metatissue, PCI Creative Science Park Aveiro Region, Ílhavo.

Twenty Years After "The Malicious Serpent": Revisiting Snake Detection in primates

Luiz Biondi[1], Nuno Gomes[1,2], Rafael S. Maior[3], Sandra C. Soares[1]

1 – WJCR & Department of Education and Psychology, University of Aveiro.
2 – WJCR & ISPA – Instituto Universitário, Lisbon.
3 – University of Brasilia, Institute of Biology, Department of Physiological Sciences, Laboratory of Neurosciences Metabolism and Behavior, Brasilia, Brazil.

Two decades after Öhman and Mineka's influential hypothesis on the evolution of snake detection in primates, our 2024 review revisits and critically evaluates this specialized threat response. Guided by five central questions, we synthesized recent findings that support the existence of subcortical mechanisms enabling rapid snake detection and attention. This work clarifies the state of the field, addresses common criticisms, and outlines key gaps to guide future research.

Our first question focused on neural specialization for snake detection. Although several studies highlight roles for the amygdala, superior colliculus, pulvinar, and visual cortex, we emphasize the complex interplay between cortical and subcortical systems in threat processing and their impact on outcomes.

Our second and third questions examined behavioral responses and their possible innate basis. Methodological issues in early studies led to new approaches—such as breaking-CFS, RISE, and research involving infants or lab-reared primates. Results from many experiments using these methods still support a privileged visual attention to snakes but suggest that fear may emerge from later cortical processes.

We also reviewed which visual features of snakes drive faster detection. Evidence points to elongated, curvilinear shapes with low area/border ratios as especially effective. Additional features – like scale patterns and cortical-subcortical interactions – may modulate attention.

Lastly, we addressed conceptual inconsistencies across studies. Definitions of "fear," "threat," and even "snake" vary, complicating data comparisons. Different snake stimuli may influence the activation of distinct perceptual mechanisms depending on visual features and study design.

In sum, evidence supports a specialized visual sensitivity to snakes in primates. Future research should explore temporal activity patterns, isolate key variables, and broaden comparative approaches across species and threat types.

Motion extrapolation in Sport Expertise: Representational Momentum and Representational Gravity in Volleyball Athletes

Mariana Maio Rodrigues[1], Nuno Alexandre De Sá Teixeira[1, 2]

The perceived offset location of a moving object which suddenly disappears has been found to be displaced forward, in the direction of motion, and downward, in the direction of gravity. These phenomena, coined respectively Representational Momentum (RM) and Representational Gravity (RG), are acknowledged to reflect internal models of physical invariants which aid in the extrapolation of future states of a dynamic event. Concurrently, Sports Sciences has consistently highlighted that at the core of sports expertise lie heightened perceptual and cognitive skills, rather than simply physical prowess. At least in some sports, where athletes are subjected to temporal pressures to successfully intersect fast moving balls, such expertise would presumably reflect on relevant perceptual phenomena such as RM and RG. This study aimed to explore these hypotheses by focusing on Volleyball as a context of expertise. Volleyball athletes and non-athletes performed a spatial localisation task to indicate the perceived offset location of a smoothly moving circular target. The latter depicted either a volleyball embedded in a background picture of a volleyball court or a neutral circle moving on an otherwise blank background (see Figure 1). Outcomes revealed for athletes, but not for their non-athletic counterparts, a significant trend to misperceive targets moving along the left diagonal (as revealed by a discrete Fourier decomposition procedure of the mislocalisations for the set of motion directions) to be further displaced forward, beyond what would be expected due to RM alone, but solely when the stimuli depicted a volleyball context (see Figure 2). This finding was discussed in relation to the natural statistics of Volleyball games, where crossed ball trajectories, particularly by the outside hitter, are more prevalent, fast, and offensive, requiring better anticipation to be efficiently dealt with.
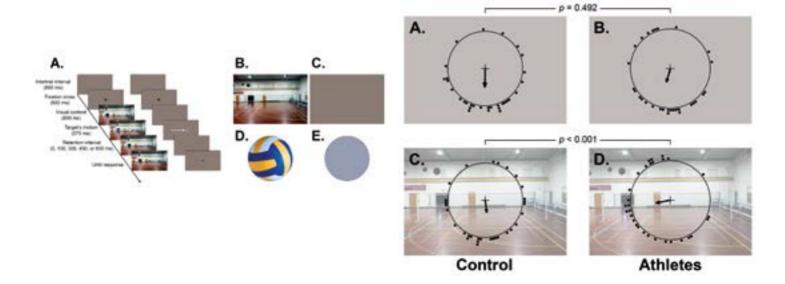
1 – Department of Education and Psychology, University of Aveiro.
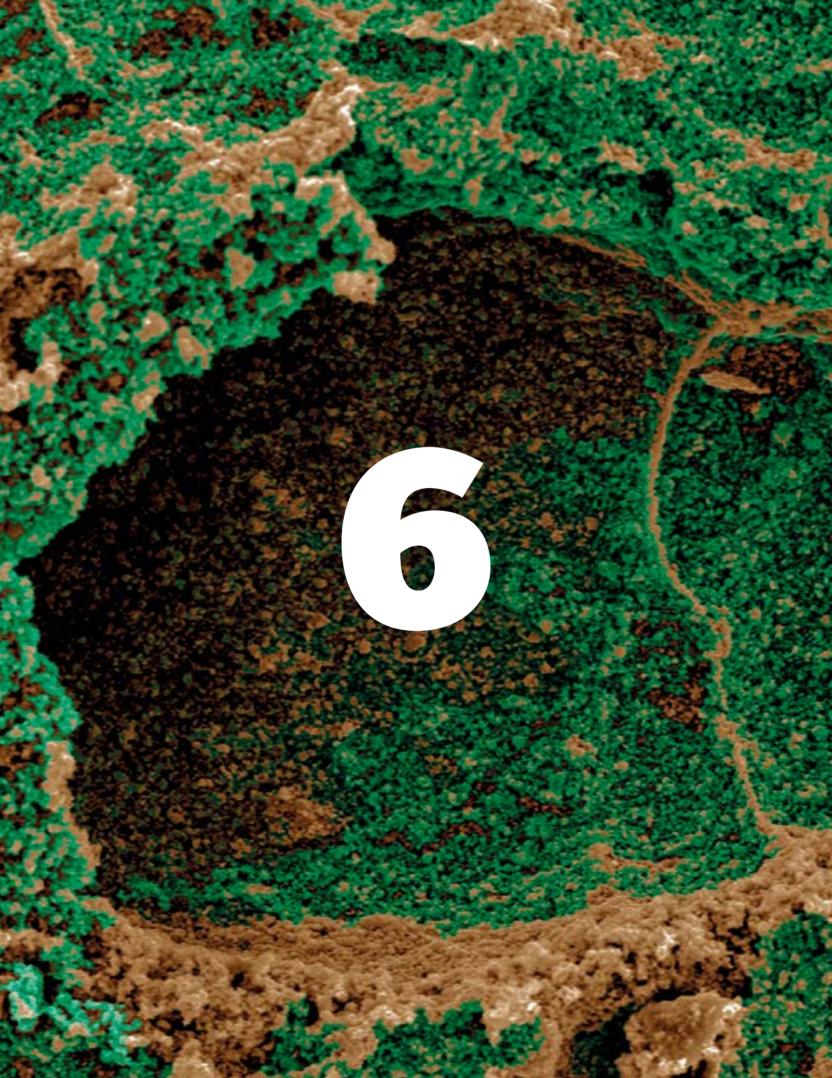2 – WJCR & Department of Education and Psychology, University of Aveiro.
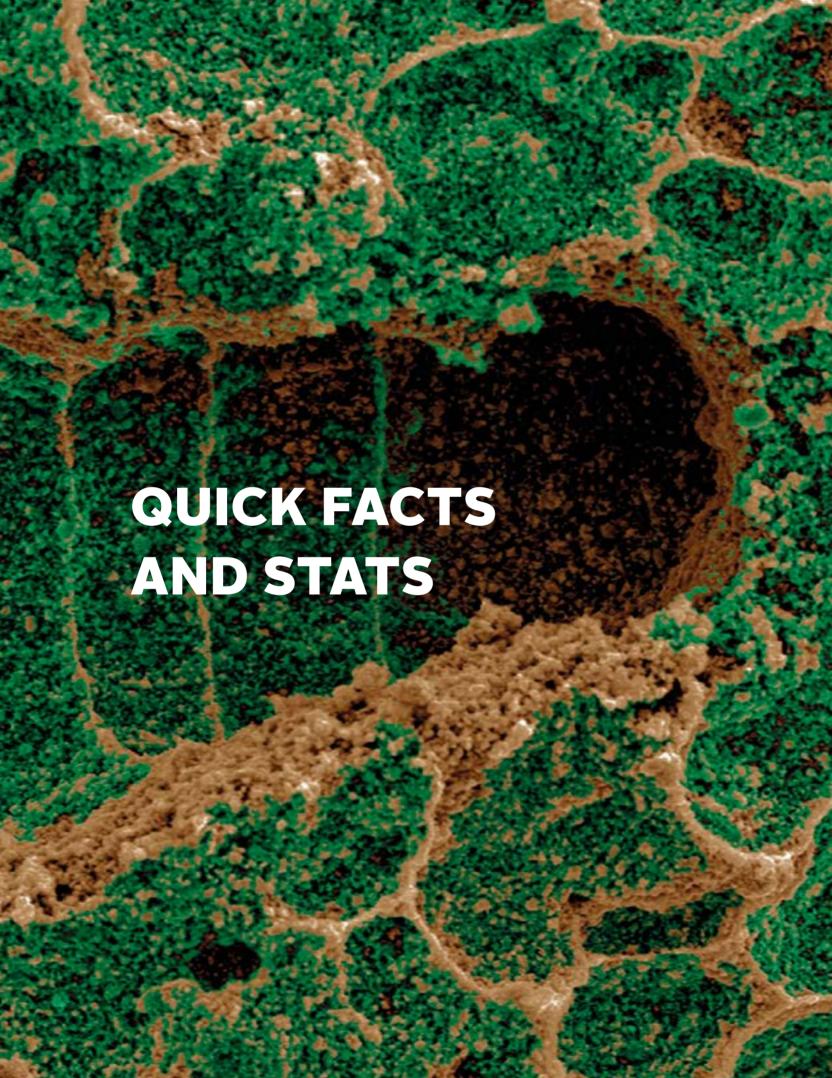
FIGURE 1
Schematic representation of the structure of trials, contextual backgrounds and target stimuli for both conditions.

FIGURE 2
Distribution and average direction of the individual fundamental terms for both contexts separately for athletes and non-athletes (control).

6

QUICK FACTS AND STATS

People

FACULTY BY DEPARTMENT

| | FACULTY (FTE) | | |
	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
UNIVERSITY	**2023**	**2024**		
Department of Biology	32,7	31,8	45%	
Department of Chemistry	41,3	43,3	45%	
Department of Civil Engineering	15,1	14,5	31%	
Department of Communication and Art	90	92,4	29%	3%
Department of Economics, Management, Industrial Engineering and Tourism	52	52,8	61%	4%
Department of Education and Psychology	45,7	44,5	70%	2%
Department of Electronics, Telecommunications and Informatics	78,6	82,6	7%	1%
Department of Environment and Planning	16	15,6	71%	4%
Department of Geosciences	15,3	14	36%	
Department of Languages and Cultures	49,1	50,7	65%	24%
Department of Materials Engineering and Ceramics	12	13	38%	
Department of Mathematics	57,2	57,9	46%	7%
Department of Mechanical Engineering	36,4	35,5	11%	1%
Department of Medical Sciences	26	39,3	63%	1%
Department of Physics	48	44	23%	7%
Department of Social, Political and Territorial Sciences	19,9	20,5	38%	
POLYTECHNIC SCHOOLS				
Águeda School of Technology and Management	70	75,2	43%	
Aveiro Institute of Accounting and Administration	79,8	82,5	57%	
School of Design, Management and Production Technologies of Aveiro North	39,6	41,7	28%	2%
Aveiro School of Health	61,7	62	61%	
TOTAL	**886,3**	**913,6**	**43%**	**3%**

RESEARCHERS BY DEPARTMENT

| | RESEARCHERS (FTE) | | |
	TOTAL	TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
UNIVERSITY	**2023**	**2024**		
Department of Biology	103	104	65%	13%
Department of Chemistry	122	121	63%	20%
Department of Civil Engineering	11	7	14%	
Department of Communication and Art	14	15	80%	20%
Department of Economics, Management, Industrial Engineering and Tourism	3	7	86%	43%
Department of Education and Psychology	20	17	76%	24%
Department of Electronics, Telecommunications and Informatics	14	14	43%	21%
Department of Environment and Planning	36	36	61%	28%
Department of Geosciences	6	5	80%	20%
Department of Languages and Cultures	3	3	67%	33%
Department of Health Sciences	34	38	53%	18%
Department of Materials Engineering and Ceramics	17	15	27%	47%
Department of Mathematics	30	35	46%	37%
Department of Mechanical Engineering	16	19,4	77%	2%
Department of Physics	49	51	27%	24%
Department of Social, Political and Territorial Sciences	9	8	63%	25%
POLYTECHNIC SCHOOLS				
Águeda School of Technology and Management				
Aveiro Institute of Accounting and Administration		4		25%
School of Design, Management and Production Technologies of Aveiro North	3	3	67%	
Aveiro School of Health				
TOTAL	**490**	**502,4**	**57%**	**21%**

STAFF BY CATEGORY
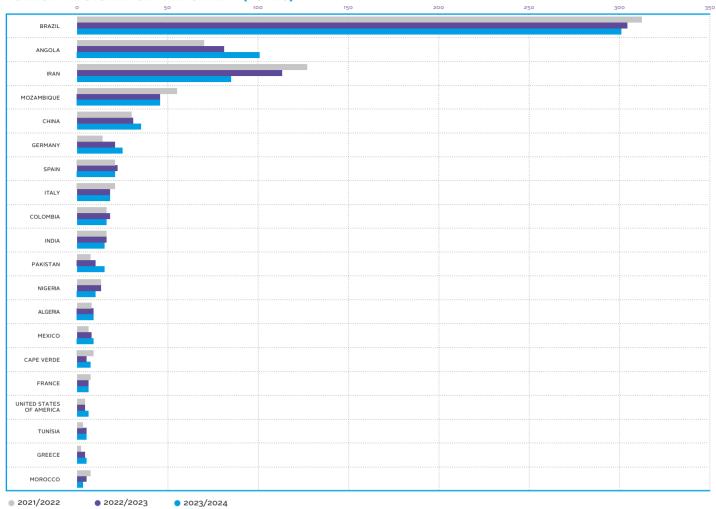
	TOTAL	FTE		
		TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS
UNIVERSITY	**2023**	**2024**		
Full Professors	59	74,5	28%	1%
Associate Professors	179,3	194,2	42%	2%
Assistant Professors	353,6	338,6	40%	5%
Lecturers	20,5	25,7	32%	
Other Teaching Staff	22,9	19,4	79%	31%
Researchers	461	479,4	57%	20%
Post-Doctoral Students	26	16	69%	50%
POLYTECHNIC SCHOOLS				
Coordinator Professors	43,9	51,6	52%	
Adjunct Professors	149,1	146,9	50%	1%
Lecturers	58	63	45%	
Researchers	3	7	29%	14%
TOTAL	**1.376,3**	**1.416,3**	**48%**	**9%**

PhD STUDENTS BY DEPARTMENT
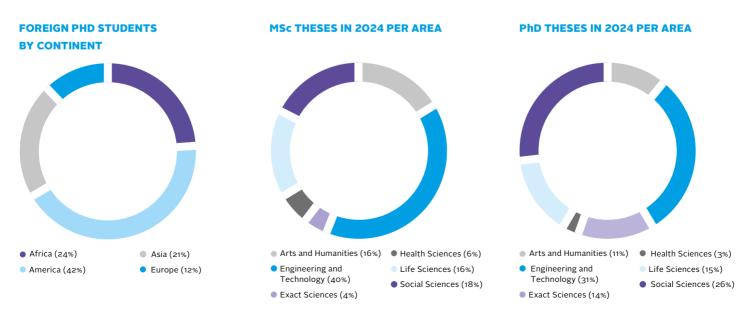
	TOTAL	PHD STUDENTS			
		TOTAL	PERCENTAGE OF WOMEN	PERCENTAGE OF FOREIGNERS	PERCENTAGE OF NEW STUDENTS
DEPARTMENT	**2022/2023**	**2023/2024**			
Department of Biology	151	144	67%	22%	15%
Department of Chemistry	280	291	65%	23%	29%
Department of Civil Engineering	81	89	38%	64%	27%
Department of Communication and Art	255	269	52%	40%	18%
Department of Economics, Management, Industrial Engineering and Tourism	350	393	51%	39%	24%
Department of Education and Psychology	258	300	71%	41%	21%
Department of Electronics, Telecommunications and Informatics	155	161	23%	35%	20%
Department of Environment and Planning	121	128	44%	48%	18%
Department of Geosciences	15	24	42%	33%	42%
Department of Languages and Cultures	97	95	61%	56%	12%
Department of Materials Engineering and Ceramics	123	133	47%	37%	26%
Department of Mathematics	38	34	47%	32%	38%
Department of Mechanical Engineering	89	102	30%	34%	32%
Department of Medical Sciences	111	118	69%	9%	20%
Department of Physics	90	110	36%	24%	45%
Department of Social, Political and Territorial Sciences	117	138	49%	41%	29%
Doctoral School	26	35	26%	77%	26%
TOTAL*	**2.279**	**2.354**	**53%**	**35%**	**24%**

* 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)

Legend: ● 2021/2022 ● 2022/2023 ● 2023/2024

Countries (top to bottom): BRAZIL, ANGOLA, IRAN, MOZAMBIQUE, CHINA, GERMANY, SPAIN, ITALY, COLOMBIA, INDIA, PAKISTAN, NIGERIA, ALGERIA, MEXICO, CAPE VERDE, FRANCE, UNITED STATES OF AMERICA, TUNÍSIA, GREECE, MOROCCO

MSc and PhD theses

FOREIGN PHD STUDENTS BY CONTINENT

- Africa (24%)
- Asia (21%)
- America (42%)
- Europe (12%)

MSc THESES IN 2024 PER AREA

- Arts and Humanities (16%)
- Health Sciences (6%)
- Engineering and Technology (40%)
- Life Sciences (16%)
- Exact Sciences (4%)
- Social Sciences (18%)

PhD THESES IN 2024 PER AREA

- Arts and Humanities (11%)
- Health Sciences (3%)
- Engineering and Technology (31%)
- Life Sciences (15%)
- Exact Sciences (14%)
- Social Sciences (26%)

SCI Papers

TOP 10 SUBJECT AREAS FOR PAPERS PUBLISHED IN 2024	RECORD COUNT	% OF 3,310
Materials Science Multidisciplinary	289	8,731
Engineering Electrical Electronic	265	8,006
Environmental Sciences	263	7,946
Chemistry Multidisciplinary	187	5,65
Physics Applied	177	5,347
Telecommunications	171	5,166
Chemistry Physical	166	5,015
Computer Science Information Systems	131	3,958
Computer Science Interdisciplinary Applications	118	3,565
Green Sustainable Science Technology	113	3,414

* Data retrieved from ISI Web of Knowledge SM (Thomson Reuters) on May 19th,2025

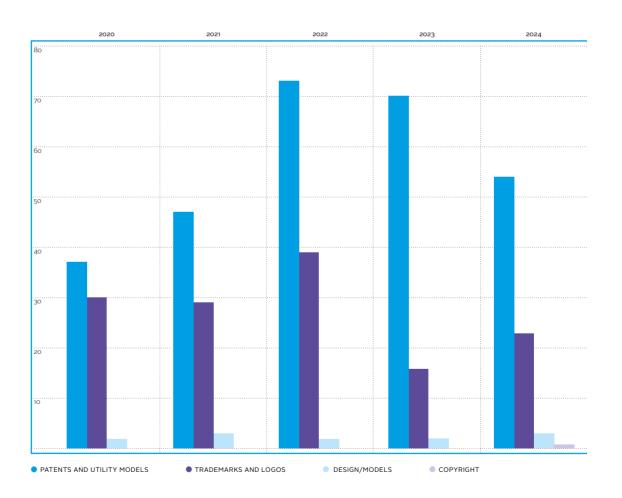| TOP 10 CITED PAPERS	TOTAL NR CITATIONS (2020-2024)
Klionsky, Daniel J.; Abdel-Aziz, Amal Kamal; Abdelfatah, Sara; Abdellatif, Mahmoud; Abdoli, Asghar; Abel, Steffen; et al. (2021). Guidelines for the use and interpretation of assays for monitoring autophagy (4th edition). AUTOPHAGY, 17 (1): 1-382	1.313
Prata, Joana Correia; da Costa, Joao P.; Lopes, Isabel; Duarte, Armando C.; Rocha-Santos, Teresa; et al. (2020). Environmental exposure to microplastics: An overview on possible human health effects. SCIENCE OF THE TOTAL ENVIRONMENT, 702 (): -	1.244
Prata, Joana C.; Silva, Ana L. P.; Walker, Tony R.; Duarte, Armando C.; Rocha-Santos, Teresa; et al. (2020). COVID-19 Pandemic Repercussions on the Use and Management of Plastics. ENVIRONMENTAL SCIENCE & TECHNOLOGY, 54 (13): 7760-7765	616
Silva, Ana L. Patricio; Prata, Joana C.; Walker, Tony R.; Duarte, Armando C.; Ouyang, Wei; Barcelo, Damia; Rocha-Santos, Teresa; et al. (2021). Increased plastic pollution due to COVID-19 pandemic: Challenges and recommendations. CHEMICAL ENGINEERING JOURNAL, 405 (): -	614
Dias, Maria Celeste; Pinto, Diana C. G. A.; Silva, Artur M. S.; et al. (2021). Plant Flavonoids: Chemical Characteristics and Biological Activity. MOLECULES, 26 (17): -	579
Barboza, Luis Gabriel A.; Lopes, Clara; Oliveira, Patricia; Bessa, Filipa; Otero, Vanessa; Henriques, Bruno; Raimundo, Joana; Caetano, Miguel, Vale, Carlos; Guilhermino, Lucia; et al. (2020). Microplastics in wild fish from North East Atlantic Ocean and its potential for causing neurotoxic effects, lipid oxidative damage, and human health risks associated with ingestion exposure. SCIENCE OF THE TOTAL ENVIRONMENT, 717 (): -	514
Kumar, Amit; Amit Kumar; Cabral-Pinto, M. M. S.; Chaturvedi, Ashish K.; Shabnam, Aftab A.; Subrahmanyam, Gangavarapu; Mondal, Raju; Gupta, Dipak Kumar; Malyan, Sandeep K.; Kumar, Smita S.; Khan, Shakeel A.; Yadav, Krishna K.; et al. (2020). Lead Toxicity: Health Hazards, Influence on Food Chain, and Sustainable Remediation Approaches. INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH, 17 (7): -	475
Ndairoua, Faical; Area, Ivan; Nieto, Juan J.; Torres, Delfim F. M.; et al. (2020). Mathematical modeling of COVID-19 transmission dynamics with a case study of Wuhan. CHAOS SOLITONS & FRACTALS, 135 (): -	412
Kapralov, Alexandr A.; Yang, Qin; Dar, Haider H.; Tyurina, Yulia Y.; Anthonymuthu, Tamil S.; Kim, Rina; St Croix, Claudette M.; Mikulska-Ruminska, Karolina; Liu, Bing; Shrivastava, Indira H.; Tyurin, Vladimir A.; Ting, Hsiu-Chi; Wu, Yijen L.; Gao, Yuan; Shurin, Galina V.; Artyukhova, Margarita A.; Ponomareva, Liubov A.; Timashev, Peter S.; Domingues, Rosario M.; Stoyanovsky, Detcho A.; Greenberger, Joel S.; Mallampalli, Rama K.; Bahar, Ivet; Gabrilovich, Dmitry I.; Bayir, Hulya; Kagan, Valerian E.; et al. (2020). Redox lipid reprogramming commands susceptibility of macrophages and microglia to ferroptotic death. NATURE CHEMICAL BIOLOGY, 16 (3): 278-+	385
Rodriguez-Mozaz, Sara; Vaz-Moreira, Ivone; Varela Della Giustina, Saulo; Llorca, Marta; Barcelo, Damia; Schubert, Sara; Berendonk, Thomas U.; Michael-Kordatou, Irene; Fatta-Kassinos, Despo; Luis Martinez, Jose; Elpers, Christian; Henriques, Isabel; Jaeger, Thomas; Schwartz, Thomas; Paulshus, Erik; O'Sullivan, Kristin; Parnanen, Katariina M. M.; Virta, Marko; Thi Thuy Do; Walsh, Fiona; Manaia, Celia M.; et al. (2020). Antibiotic residues in final effluents of European wastewater treatment plants and their impact on the aquatic environment. ENVIRONMENT INTERNATIONAL, 140 (): -	364

* Data retrieved from ISI Web of Knowledge SM (Thomson Reuters) on May 19th, 2025

Intellectual Property

INTELLECTUAL PROPERTY RIGHTS REGISTRATION

	2020	2021	2022	2023	2024
Patents and Utility Models	37	47	73	70	54
Trademarks and Logos	30	29	39	16	23
Design/Models	2	3	2	6	3
Copyright	0	0	0	0	1

● PATENTS AND UTILITY MODELS   ● TRADEMARKS AND LOGOS   ● DESIGN/MODELS   ● COPYRIGHT

International Projects

EU-FUNDED PROJECTS STARTED IN 2024

EUROPEAN RESEARCH COUNCIL (ERC) GRANTS	ACRONYM	PROJECT COORDINATOR
Hydrophobic Eutectic Solvents for Tailored Metal Separation and Recycling	DESignSX	NICOLAS SCHAEFFER

HORIZON EUROPE – PROJECTS COORDINATED BY UAVEIRO	ACRONYM	PROJECT COORDINATOR
Awakening Soil Curiosity to catalyse Soil Literacy	CURIOSOIL	SÓNIA RODRIGUES
TErrestrial Resilience and RestorAtion Strategies for (semi) Arid and Fragile Ecosystems through a multi-actor approach	TERRASAFE	JAN JACOB KEIZER
Cr4+:YAG/Polymer nanocomposite as alternative materials for Q-switched lasers: properties, modeling, and applications	ALTER-Q	KIRYL YASAKAU
Building knowledge and tools for the sustainable microbial fighting through sensing and responsive polysaccharide-based materials	NET4MAT	IDALINA GONÇALVES

HORIZON EUROPE – MONOBENEFICIARY PROJECTS	ACRONYM	PROJECT COORDINATOR
Source and Toxicological Profile of Airborne Particles in African Megacity	SO-TOX	CÉLIA ALVES
The Process of GaN-on-diamond with Si-based nanolayer SAB technology	GDSNL	GIL GONÇALVES
Building knowledge and tools to advance on promoting of freshwater urban ecosystems as nature based-solution for health and wellbeing in a changing word	StreamScape	SALOMÉ ALMEIDA

HORIZON EUROPE	ACRONYM	LOCAL COORDINATOR
CULTUral heritage in RurAL remote areas for creative tourism and sustainabilITY	CULTURALITY	FÁTIMA POMBO
Advanced Multidisciplinary Research for Antimicrobial Resistance	AMRAMR	HELENA OLIVEIRA
Accelerate the design and Insertion of nonCRM hard Materials for Next generation EXTreme applications	AIM-NEXT	ANA SENOS
Restoration of deep-sea habitats to rebuild European Seas	REDRESS	ANA HILÁRIO
Valorising and balancing the ecosystem service benefits offered by legumes, and legume-based cropped systems	LegumES	PETER ROEBELING
Development of a multifunctional biomaterial patch for buccal delivery of peptide-analogue treatments	BUCCAL-PEP	JOÃO MANO
Hybrid living bioengineered hierachical constructs with self-oxygenating capability for bone engineering	O2CELLS	JOÃO MANO
BIOcomposites in smart plastic transformation processes to pave the way for the large-scale UPTAKE of sustainable bio-based products	BIO-UPTAKE	ISABEL LOPES
Advancing Area-based Management Tools to Accelerate the Protection and Restoration of Marine Biodiversity across the European Sea Basins	BioProtect	ANA HILÁRIO
Building REsilience against MEntal illness during ENDocrine-sensitive life stages	Re-MEND	ROSÁRIO DOMINGUES
Biocatalytic membranes for micro/nano plastic degradation within waste water effluents	BMRex	HELENA OLIVEIRA
Enzymatic CO2 Capture in a Rotating Packed Bed and Electrocatalytic CO2 Reduction to Useful Products	REUSE	VALTER SILVA
Innovative Solutions across the MEDiterranean for mitigation of Climate change-related heaLth rIsks and enhancing systeM resilience	ISMED-CLIM	ALEXANDRA MONTEIRO
Clean and efficient cooling in vaccine transportation using Rotating Magnetocaloric Effect	MAGCCINE	JOÃO AMARAL
Alternative routes for basic chemicals production using hydrogen as feedstock	ALCHEMHY	ALEKSEY YAREMCHENKO
A bioprinting platform for the rapid, reliable, controlled and quantifiable patterning of cellular aggregates and microtissues into macroscale regenerative grafts with programmable architectures	m2M	JOÃO MANO
REcycling of low Value components using high purity pre-treatment, dIrecT recycling And green hydrometallurgical approaches for recycling of Lithium Ion and Sodium Ion BatteriEs	REVITALISE	JOÃO COUTINHO

ERASMUS+ – PROJECTS COORDINATED BY UAVEIRO	ACRONYM	PROJECT COORDINATOR
Security Education Center for Unified Resilience and Effective Communications	SECURE	RUI AGUIAR
Media for future	MediaforFuture	MARLENE AMORIM

ERASMUS+	ACRONYM	LOCAL COORDINATOR
Empowering Educators for AI-Integrated Learning	EduAI	RUI COSTA
Innovative Integration of Virtual Reality in Chemical Engineering Education	VRChem	MÁRIO VAIRINHOS
Valoriser les biographies langagières	VABIOLA 2	ROSA FANECA
Implementing Environmental Engineering Master Degrees through Sustainable Transition and Societal Change	GREENDT	CARLA GAMA
Research and Innovation in Higher Education	MARIHE	TERESA CARVALHO
Forensic Structural Engineering database for HEI and pilot course with innovative and interactive learning methods	RECONSTRUCT	UWE KAHLER
Climate change from the rivers and wetlands of southwestern Europe	eCO2rivers	PEDRO POMBO
Learn by Case Study using AI Chatbot in cybersecurity and data science	ChatToCaseStudy	PETIA GEORGIEVA
Advancing Cloud and Edge Computing Education in Western Balkans	WeB-Nimbus	MANUEL OLIVEIRA
Digital Manufacturing in 3D Printing for Eco-Friendly and Sustainable Aerospace Applications	DIGI3D	FÁBIO FERNANDES
Challenges Solving in Cybersecurity Study Program	Cyberchallenge	ANTÓNIO NEVES
Fit for the Future	F4F	MARLENE AMORIM
Development of a methodology and the model of a process chain for AI-supported course development and the associated seminar design for teaching and learning in vocational training in the Brandenburg hospitality industry	PROMPTS2TEACH	MANUEL OLIVEIRA

CREATIVE EUROPE – PROJECTS COORDINATED BY UAVEIRO	ACRONYM	PROJECT COORDINATOR
Exploring sound and music along Europe's shores	SHORES	HELENA MARINHO

RESEARCH FUND FOR COAL AND STEEL – PROJECTS COORDINATED BY UAVEIRO	ACRONYM	PROJECT COORDINATOR
Design of steel portal frames made of web tapered members with and without openings at normal temperature and fire conditions	TAPERFRAME	PAULO VILA REAL

PROGRAMME FOR THE ENVIRONMENT AND CLIMATE ACTION (LIFE)	ACRONYM	LOCAL COORDINATOR
Creating socioecological conditions for the expansion of Iberian wolf and Iberian lynx	LIFE22-NAT-PT-LUPI LYNX	RITA TORRES

EUROPEAN CIVIL PROTECTION AND HUMANITARIAN AID OPERATIONS (EU-ECHO)	ACRONYM	LOCAL COORDINATOR
Vulnerable Elements and Risk Assessment	VERA	ANA ISABEL MIRANDA

PROGRAMA DE COOPERAÇÃO TRANSFRONTEIRIÇA ESPANHA – PORTUGAL (POCTEP)	ACRONYM	LOCAL COORDINATOR
Tecnologias avançadas, inovadoras e digitais para o sector agroalimentar da EUROACE	TID4AGRO	ADELAIDE ALMEIDA

INTERREG SUDOE	ACRONYM	LOCAL COORDINATOR
Towards more Resilient, Sustainable, Competitive and Intelligent Electrochemical Surface Treatments	RESINSURF	JOÃO TEDIM
Start Therapeutic OPtimisazion and IATRogenesis prevention on Older People	STOP IATRO	TERESA HERDEIRO

NETWORK OF EUROPEAN UNIVERSITIES AND COMPANIES WORKING WITH UAVEIRO IN EU PROJECTS STARTED IN 2024

ALBANIA WeB-Nimbus
AUSTRIA CURIOSOIL, m2M, MARIHE, REUSE, TERRASAFE, V2G-QUESTS
BELGIUM CO2PED, CURIOSOIL, ISMED-CLIM, LegumES, VABIOLA 2
BULGARIA ChatToCaseStudy
CROATIA RECONSTRUCT
CYPRUS FIT FOR THE FUTURE, ISMED-CLIM, REDRESS, TERRASAFE
DENMARK BIO-UPTAKE, BMRex, BUCCAL-PEP, LegumES, NET4MAT, REUSE
ESTONIA CO2PED, CULTURALITY, Cyberchallenge, SEAFOODTURE, V2G-QUESTS
FINLAND m2M, MARIHE, Re-MEND
FRANCE AIM-NEXT, BIO-UPTAKE, BUCCAL-PEP, MAGCCINE, NET4MAT, QUIPACK, REDRESS, RESINSURF, REVITALISE, STOP IATRO, VABIOLA 2
GEORGIA SECURE
GERMANY AIM-NEXT, BioProtect, BMRex, BUCCAL-PEP, CURIOSOIL, FIT FOR THE FUTURE, m2M, MARIHE, MediaforFuture, QUIPACK, RECONSTRUCT, Re-MEND, REVITALISE
GREECE BioProtect, ChatToCaseStudy, EduAI, FIT FOR THE FUTURE, ISMED-CLIM, QUIPACK, REUSE, WeB-Nimbus
HUNGARY LegumES, MARIHE
ICELAND BioProtect
IRELAND AIM-NEXT, BioProtect, BIO-UPTAKE, BUCCAL-PEP, m2M, MediaforFuture, NET4MAT, REDRESS, REVITALISE, SEAFOODTURE
ISRAEL NET4MAT, REDRESS
ITALY AIM-NEXT, ALCHEMHY, ALTER-Q, AMRAMR, CULTURALITY, CURIOSOIL, FIT FOR THE FUTURE, ISMED-CLIM, LegumES, QUIPACK, RECONSTRUCT, REDRESS, Re-MEND, REUSE, SEAFOODTURE, TAPERFRAME, TERRASAFE, VRChem
KOSOVO WeB-Nimbus
LATVIA ChatToCaseStudy
LITHUANIA AIM-NEXT, Cyberchallenge, DIGI3D, SECURE
LUXEMBOURG TAPERFRAME
NORWAY BioProtect, REVITALISE, SHORES
POLAND ALTER-Q, CLEARNESS, CLEARNESS, EduAI, VRChem
REPUBLIC OF MACEDONIA LegumES, RECONSTRUCT
ROMANIA Cyberchallenge
SERBIA ISMED-CLIM
SLOVAKIA ALTER-Q
SLOVENIA ALCHEMHY, CURIOSOIL, MAGCCINE
SPAIN AIM-NEXT, ALCHEMHY, AMRAMR, BIO-UPTAKE, BMRex, CULTURALITY, FIT FOR THE FUTURE, GREENDT, ISMED-CLIM, LegumES, MAGCCINE, NET4MAT, QUIPACK, RESINSURF, SEAFOODTURE, SECURE, TERRASAFE, TID4AGRO, V2G-QUESTS, VERA, VRChem, WeB-Nimbus
SWEDEN AIM-NEXT, BIO-UPTAKE, REDRESS, Re-MEND, TERRASAFE
SWITZERLAND CURIOSOIL
THE NETHERLANDS BUCCAL-PEP, CO2PED, CURIOSOIL, m2M, REDRESS, SHORES, TERRASAFE, V2G-QUESTS
TURKEY CLEARNESS, DIGI3D, EduAI, QUIPACK, SEAFOODTURE
UKRAINE ALTER-Q, SECURE
UNITED KINGDOM AMRAMR, BUCCAL-PEP, CULTURALITY, LegumES, REDRESS, Re-MEND, REUSE, V2G-QUESTS

● UAveiro ● Universities ● Projects cooordinated by UAveiro ● Companies

Budget

TOTAL BUDGET OF THE PROJECTS STARTED IN 2024 BY RESEARCH CENTER AND FUNDING AGENCY*

| RESEARCH CENTRE	EUROPEAN UNION	FOUNDATION FOR SCIENCE AND TECHNOLOGY	INNOVATION AGENCY	CCDRC	PRR	OTHER INTERNATIONAL	OTHER NATIONAL	2023	2024
CESAM	4.807.016	443.258				55.000	697.390	8.873.229	6.002.664
CICECO	4.488.329	108.815	3.329.498			419.831		4.807.953	8.346.473
CIDMA	59.400							433.083	59.400
CIDTFF	37.402							79.085	37.402
CINTESIS	.							109.957	
CIPES	173.664							235.056	173.664
DIGIMEDIA	95.300							302.731	95.300
GEOBIOTEC	905.174							.	905.174
GOVCOPP	278.950	124.225						470.945	403.175
I3N		33.606	1.898.210			2.500		193.145	1.934.316
IBIMED	225.000					809.832		1.038.870	1.034.832
ID+	241.118	124.939						49.888	366.057
IEETA	145.800							234.001	145.800
INET-MD	89.604	83.828						17.668	173.432
IT	2.113.119		175.528		360.554	760.899		5.180.222	3.410.100
NOT INTEGRATED**	119.867		1.138.147	517.728	984.313		252.505	5.271.668	3.012.560
REQUIMTE-LAQV								365.376	
RISCO	430.932							343.702	430.932
TEMA	256.049							2.327.779	256.049
WJCR								261.412	33.682
TOTAL	14.466.723	918.671	6.541.383	517.728	1.344.867	2.081.743	949.895	30.595.771	26.821.010
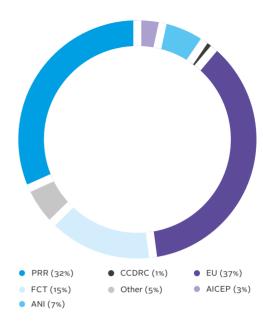
* Contracts with industry and multiannual budget of research centres not included
** Projects not integrated in research centres and institutional projects

in euros

APPROVED BUDGET UNDER EU-FUNDED PROJECTS*

EUROPEAN PROGRAMMES	2023	2024
HORIZON ERC StG		1.499.851
HORIZON – CL2		241.118
HORIZON – CL4	719.988	398.073
HORIZON – CL5	1.393.210	353.369
HORIZON – CL6	381.036	736.213
HORIZON – HLTH	121.830	400.944
HORIZON – SNS	1.347.000	1.490.250
HORIZON – JU	371.875	
HORIZON – MSCA – CITIZENS		
HORIZON – MSCA – DN	996.036	324.587
HORIZON – MSCA – PF		517.856
HORIZON – MSCA – SE	867.593	676.793
HORIZON – PATHFINDER CHALLENGES		302.388
HORIZON – TWINNING	1.688.675	
HORIZON – HOP-ON	833.433	2.212.823
HORIZON – TALENTS	172.619	156.779
HORIZON MISS OCEAN		382.088
HORIZON MISS SOIL		1.970.396
HORIZON MISS CLIMA		103.125
RFCS		430.932
ERASMUS +	1.002.921	1.069.151
CREATIVE EUROPE		89.604
LIFE2027	2.846.786	271.242
INTERREG ATLANTIC	276.792	
INTERREG SUDOE		658.082
INTERREG EUROPE	695.587	
POCTEP	350.513	53.330
DIGITAL	765.050	
EIT	175.850	
EMFAF	251.253	
ISFP	22.347	
ECHO		127.732
TOTAL	**15.280.393**	**14.466.723**

in euros
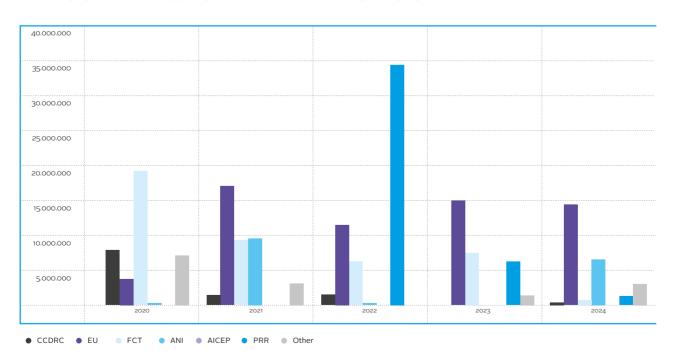
DISTRIBUTION OF RECEIVED FUNDS BY FUNDING AGENCY*

- PRR (32%)
- FCT (15%)
- ANI (7%)
- CCDRC (1%)
- Other (5%)
- EU (37%)
- AICEP (3%)

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

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

- CCDRC
- EU
- FCT
- ANI
- AICEP
- PRR
- Other

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

7

RESEARCH SUPPORT

Research Support Office

The University of Aveiro works continuously to become one of Europe's leading research institutions and a key player in the construction of the European Research Area. In this regard, it encourages researchers to establish links with colleagues in Portugal and in other countries, responding jointly to calls for proposals for national and international funding programmes, and has a dedicated office to support such activities.

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.

Over the last years, the Office has also been involved in identifying and acquiring tools to ease the research activity, as the access to SciVal, an Elsevier platform designed for performance evaluation and bibliometric analysis based on data from Scopus and to ResearchConnect, an IdoX platform that provides a curated, global database of research funding opportunities. Also, the active involvement of the Office in the application and creation of the Competence Center for Research Data Management (UAveiro RDM Center) will provide the UAveiro with the possibility to enhance and expand its existing capabilities in open science and research data management.

During 2024, 418 national and international research and technology transfer projects have been active in UAveiro, of which 59 funded by ERASMUS+ (KA2), 23 by Horizon 2020, 62 by Horizon Europe and 9 by INTERREG. The UAveiro is the host institution of 12 ERC Grants and 1 ERA Chair, coordinator of 4 Twinning projects and 3 HE projects aiming to contribute to the EU Missions, among other relevant and strategic European projects.

The research projects are developed under the 20 research units hosted by UAveiro in different scientific areas, 14 classified as Excellent and 4 classified as Very Good in the last evaluation process promoted by the National Foundation for Science and Technology. 8 of these research units were labelled or integrate Associated Laboratories. The excellence of its staff and quality of its infrastructures have been essential to the University of Aveiro to carry out crosscutting research that contribute to the society – locally, nationally and internationally.

RESEARCH SUPPORT OFFICE
research@ua.pt

Ai