Universidad Autónoma de Madrid

UAM-CSC AGREEMENT

LIST OF 1-YEAR PhD PROPOSALS

FACULTY OF ECONOMICS

Proposal number 1	
Name and Surname	**Email**
Maria del Pilar Poncela Blanco	pilar.poncela@uam.es
web	
MACROFOR	
Title of the proposal	
Interpretable Deep Learning (Neural Networks) for Economic Analysis and Forecasting	
Abstract	
This research project aims to develop new methodologies to improve the interpretability of deep learning models in economic applications. While deep learning methods have demonstrated strong predictive performance, their black-box nature limits their usefulness for understanding economic relationships and supporting policy decisions. The project will investigate methods to identify the contribution of individual variables, uncover the economic information captured by internal representations, and assess the stability and robustness of model explanations. Particular attention will be devoted to economic time series, macroeconomic forecasting, and the analysis of complex nonlinear relationships in economic data. By combining statistical and econometric principles with advances in machine learning, the research seeks to develop interpretable deep learning models that balance predictive accuracy, transparency, and economic insight.	

Universidad Autónoma de Madrid

FACULTY OF EDUCATION SCIENCES

Proposal number 2	
Name and Surname	**Email**
Javier Manuel Valle Lopez	jm.valle@uam.es
web	
https://www.gipes-uam.com/	
Title of the proposal	
Supranational Education: Current global educational policies impact on Asia.	
Abstract	
The aim is to carry out an exhaustive research, from the perspective of Supranational Education, on the impact that global trends in education (PISA, SDG4, Competency-Based Learning, etc.) established by international education organisations (UNESCO, PISA, WORLD BANK, etc.) have on the education systems of Asian countries, such as China, South Korea and Singapore, among others.	

Universidad Autónoma de Madrid

FACULTY OF MEDICINE

Proposal number 3	
Name and Surname	**Email**
Maria Isabel Sanchez Perez	is.perez@uam.es
web	
https://surl.li/bgtioz	
Title of the proposal	
Targeting Cancer Stem Cells and Metabolic Vulnerabilities in Gastrointestinal Cancer: Novel Therapeutic Strategies	
Abstract	
Gastrointestinal cancers remain a major clinical challenge due to therapeutic resistance, tumor recurrence, and metastasis. Cancer stem cells (CSCs) play a critical role in these processes through their capacity for self-renewal, metabolic adaptation, and epithelial-to-mesenchymal transition (EMT). This project aims to investigate novel therapeutic strategies targeting CSCs and metabolic vulnerabilities in gastrointestinal cancer, particularly gastric and pancreatic tumors. The research will focus on evaluating the antitumor activity of selected compounds, including metal-based agents, and characterizing their effects on cell viability, CSC-associated properties, metabolic pathways, and EMT-related mechanisms. Using established cancer cell models and molecular and cellular approaches, the project will explore potential mechanisms underlying therapeutic response and resistance. The expected results will contribute to identifying promising therapeutic strategies to overcome treatment resistance and improve the targeting of aggressive tumor cell populations.	
Proposal number 4	
Name and Surname	**Email**
David Ramiro Cortijo	david.ramiro@uam.es
web	
https://portalcientifico.uam.es/es/ipublic/researcher/319346	
Title of the proposal	
Identification of biomarkers of cardiometabolic health in perimenopausal women.	
Abstract	
Menopause is characterized by physiological changes associated with unpleasant symptoms and cardiometabolic alterations. Identification of women at higher cardiometabolic risk is desirable to start preventive measures. In the perimenopausal period early signs of low-grade-inflammation, oxidative disbalance and vascular dysfunction can be identified through plasma biomarkers. Alterations in heart rate variability (HRV) and arterial elasticity may also potentially serve to identify women at risk. AIM: to identify biomarkers of cardiometabolic risk in the perimenopausal period for future design of a predictive algorithm. METHODS: a cohort of women attending the	

perimenopausal service of Hospital Universitario La Paz (Madrid) will be evaluated. The student will learn non-invasive techniques to assess HRV, body composition arterial elasticity, and the methods for biochemical evaluation of plasma biomarkers. This proposal is open to co-tutele joint PhD supervision and possible collaborations in the field of menopause with Chinese partners.

Proposal number 5	
Name and Surname	**Email**
Miguel Saenz de Pipaon Marcos	miguel.saenzdepipaon@uam.es
web	
https://www.idipaz.es/areasCientificas/MaternoInfantilAdolescente/Neonatologia#Actividades	
Title of the proposal	
Infant nutrition and neurodevelopment	
Abstract	
This twelve-month scholarship will investigate associations between early infant nutrition and neurodevelopment, while providing focused training in nutritional epidemiology and developmental assessment. Using an existing infant cohort with available dietary and developmental data, the project will examine whether feeding patterns and nutrient intakes during the first year are associated with cognitive, language, and motor outcomes. Following ethics approval and confirmation of data access, months one to three will encompass methodological training, protocol refinement, and data harmonisation. Months four to eight will involve dietary characterisation and multivariable analyses accounting for gestational age, growth, socioeconomic circumstances, and parental education. Months nine to twelve will focus on sensitivity analyses, interpretation, manuscript preparation, and dissemination. Expected outputs include a reproducible analytical framework, a manuscript submitted for publication, and preliminary evidence to inform future prospective research. The scholarship will strengthen the applicant's research independence and establish foundations for subsequent studies of infant nutrition and developmental outcomes.	

Proposal number 6	
Name and Surname	**Email**
Maria Isabel Sanchez Perez	is.perez@uam.es
web	
https://l1nq.com/zmyaz3x	
Title of the proposal	
Targeting Cancer Stem Cells and Metabolic Vulnerabilities in Gastrointestinal Cancer: Novel Therapeutic Strategies	
Abstract	
Gastrointestinal cancers remain a major clinical challenge due to therapeutic resistance, tumor recurrence, and metastasis. Cancer stem cells (CSCs) play a critical role in these processes through their capacity for self-renewal, metabolic adaptation, and epithelial-to-mesenchymal transition (EMT).	

Universidad Autónoma de Madrid

This project aims to investigate novel therapeutic strategies targeting CSCs and metabolic vulnerabilities in gastrointestinal cancer, particularly gastric and pancreatic tumors. The research will focus on evaluating the antitumor activity of selected compounds, including metal-based agents, and characterizing their effects on cell viability, CSC-associated properties, metabolic pathways, and EMT-related mechanisms.

Using established cancer cell models and molecular and cellular approaches, the project will explore potential mechanisms underlying therapeutic response and resistance. The expected results will contribute to identifying promising therapeutic strategies to overcome treatment resistance and improve the targeting of aggressive tumor cell populations.

Universidad Autónoma de Madrid

POLYTECHNIC SCHOOL

Proposal number 7	
Name and Surname	**Email**
Marcos Escudero Viñolo	marcos.escudero@uam.es
web	
https://scholar.google.com/citations?user=i4U5duMAAAAJ&hl=en	
Title of the proposal	
Fair continual adaptation of medical foundation models	
Abstract	
Medical foundation models are rarely trained from scratch. Hospitals and researchers usually adapt them at will, to new tasks, equipment, and patient populations, for instance when a model pretrained on Western cohorts is deployed in Asian hospitals or vice versa. Each adaptation is focused on enlarging performance on the target dataset but silently changes how the encoded clinical and demographic concepts are encoded, and the degree at which some concepts are forgotten, especially for some populations. Building on our WACV2027 paper on fairness under one-step adaptation, this thesis studies continual adaptation of medical vision-language models across tasks, hospitals and imaging modalities. It asks how concept encoding drifts across steps and whether forgetting affects some patient subgroups, including intersectional ones, more than others. Our hypothesis is that underrepresented subgroups are forgotten first, and that their concept encoding is a proxy to this behavior. The thesis aim at designing adaptation methods that protect these subgroups, mitigating these effect, and releasing an open benchmark. Co-supervised with Catarina Barata, from IST.	

Universidad Autónoma de Madrid

FACULTY OF PSICHOLOGY

Proposal number 8	
Name and Surname	**Email**
Eduardo Estrada Alonso	eduardo.estrada@uam.es
web	
https://scholar.google.com/citations?hl=en&user=tA99DYgAAAAJ	
Title of the proposal	
Modeling Change: Dynamic, Latent Variable Methods for Longitudinal Data in Psychology, Health and Education	
Abstract	
My research focuses on statistical methods for studying how psychological, health, and educational processes change over time. I work with longitudinal models that combine dynamic and latent variable approaches (e.g. latent change score models, continuous-time structural equation models, or state-space models, among others). This work involves proposing new methods, validating them, applying them to empirical problems, and providing practical guidance for applied researchers. A related line of work addresses how to design longitudinal studies in different contexts. I also work on psychometric questions in longitudinal designs, such as measurement quality and the interpretation of change scores. Applications range from large-scale educational panel studies to intensive longitudinal and dyadic data in clinical and health settings. Visiting PhD students would join a methods-oriented environment and could work on method development, study design, or applying longitudinal models to their own data, using R and open-source tools.	
Proposal number 9	
Name and Surname	**Email**
Cristina Nombela Otero	cristina.nombela@uam.es
web	
https://www.uam.es/psicologia/investigacion/grupos-de-investigacion/detalle/f1-629	
Title of the proposal	
Neuroplasticity, Cognitive Aging and Non-Invasive Brain Stimulation: A Multimodal Neuropsychological, Motor and EEG Approach	
Abstract	
Population aging is one of the major societal challenges worldwide. This project aims to investigate the neural mechanisms underlying cognitive and motor plasticity in older adults using a multimodal approach that combines neuropsychological assessment, motor performance measures and electroencephalography (EEG). The research will be carried out within ongoing studies examining the effects of transcranial Direct Current Stimulation (tDCS) on cognition, motor function and brain activity. The doctoral candidate will contribute to the analysis of behavioral, neuropsychological and electrophysiological datasets to identify biomarkers associated with healthy aging and stimulation-induced changes. Particular emphasis will be placed on integrating cognitive, motor and neural measures to better understand individual variability in intervention outcomes. Depending on the candidate's interests, the project may also	

include the analysis of developmental datasets from typically developing children, allowing comparison of neuroplasticity processes across the lifespan. The project provides extensive training in neuropsychology, neuroscience and advanced data analysis.

Universidad Autónoma de Madrid

FACULTY OF SCIENCES

Proposal number 10	
Name and Surname	**Email**
Carlos Mora Corral	carlos.mora@uam.es
web	
https://matematicas.uam.es/~carlos.mora/carlos.mora/About_Me.html	
Title of the proposal	
Nonlocal gradients	
Abstract	
Study of nonlocal gradients and the related functional spaces: modelling and applications, functional analytic inequalities, Sovolev-type inmersions, relation with classical gradients, calculus of variations based of those gradients.	
Proposal number 11	
Name and Surname	**Email**
Silvia Cabrera Herranz	silvia.cabrera@uam.es
web	
https://josealemanlara.wixsite.com/froncat	
Title of the proposal	
DEVELOPMENT OF PHOTOACTIVE MATERIALS AND THEIR EVALUATION IN PHOTO-MEDIATED ORGANIC REACTIONS	
Abstract	
The development of efficient photoactive materials is essential for advancing sustainable chemical synthesis. Our research focuses on the design, synthesis, and characterization of organic and porous photocatalytic materials with tailored optical and electronic properties. By establishing structure-property-performance relationships, we aim to optimize light harvesting, charge transfer, and catalytic activity under visible-light irradiation. These materials are evaluated in a wide range of photo-mediated organic transformations, including photoredox catalysis, hydrogen atom transfer (HAT), halogen atom transfer (XAT), and carbon-carbon and carbon-heteroatom bond-forming reactions. Particular attention is devoted to mechanistic investigations and the identification of factors governing activity, selectivity, and stability.	
Proposal number 12	
Name and Surname	**Email**
Fatima Aparicio Hernandez	fatima.aparicio@uam.es
web	
https://msmnlab.wixsite.com/dgrlab	
Title of the proposal	
Functional Water-soluble Self-assembled Nanotubes	
Abstract	
The mosaic tobacco virus and the aquoporin protein are fascinating examples of self-assembled functional systems found in Nature. Driven by their nanometer dimensions,	

scientists are increasingly being attracted to the challenge of designing related nanoscale assemblies. Potential applications of these materials include molecular sieving for advanced separation, selective encapsulation, catalysis, sensing, and biomedical uses as transporters or ion channels. We are particularly interested in creating functional water-soluble tubular nanostructures with tunable pore size from π-conjugated monomers equipped with complementary binding units. Noncovalent interactions between these groups yield supramolecular macrocycles that stack on top of each other affording self-assembled nanotubes.

Proposal number 13	
Name and Surname	**Email**
Lucia Abad Gil	lucia.abad@uam.es
web	
https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-180	
Title of the proposal	
Innovative sustainable analytical procedures for tracking pollutants in the environment	
Abstract	
One of the major challenges in modern analytical chemistry is designing efficient and environmentally friendly methods that align with the principles of Green Analytical Chemistry. This project aims to develop innovative and sustainable analytical procedures for detecting emerging pollutants such as metal nanoparticles, pesticides, or antibiotics using advanced tools based on the combination of novel sample treatment approaches and nanostructured electrochemical sensors. Special emphasis will be placed on the use of non-toxic alternative solvents, particularly deep eutectic solvents such as environmentally friendly media. Other advanced techniques, such as high-performance liquid chromatography (HPLC) or atomic absorption spectrometry (AAS), will be employed for validation purposes, nanomaterial characterization, and/or optimization of specific steps within the analytical procedure.	

Proposal number 14	
Name and Surname	**Email**
Fernando Aguilar-galindo Rodriguez	fernando.aguilar-galindo@uam.es
web	
https://www.molpm.es/	
Title of the proposal	
Modeling the Dynamics of Molecular Ionization Experiments	
Abstract	
In modern molecular physics experiments, energetic photons and particle collisions induce molecular ionization and excitation. Coincidence detection of the resulting particles provides valuable information about the evolution of these systems. However, theoretical simulations are often essential to unravel the underlying mechanisms and connect experimental observations with molecular dynamics. This 12-month research stay is aimed at PhD students with an experimental background who wish to complement their training with theoretical and computational methods. The candidate will learn to use electronic-structure calculations and molecular	

dynamics simulations to interpret experimental results and investigate the processes underlying the observed molecular response.
The specific project will be adapted to the candidate's PhD topic and, whenever possible, directly connected to their experimental work. The goal is to provide computational tools for interpreting their experimental results while promoting close interaction between theory and experiment.

Proposal number 15	
Name and Surname	**Email**
Adoracion Gomez Quiroga	adoracion.gomez@uam.es
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www.linkedin.com/in/adoracion-gomez-quiroga-947bb683	
Title of the proposal	
Quorum Sensing Regulation and Precision Biofilm Prevention Using Smart Composite Frameworks (QSAFE)	
Abstract	

This project aims to achieve precise regulation of quorum sensing and biofilm control through smart hybrid frameworks, directly addressing the practical pain points of biofilm control in the food industry. Centered on the core logic of "confinement stabilization + intelligent synergistic disruption", the project is dedicated to developing anti-biofilm technologies for food contact surfaces that feature high stability, multiple synergies, and green sustainability. The synergistic disruption will combine several effective antiquorum sensing agents with metal ions and framework and their ability to act as quenchers. The idea is to keep QS harmless state more than developing antibacterial. This holds significant scientific value and application prospects for enhancing the resilience, intelligence, and greenness of food processing systems.
-Jiaxin Cui, Xuan Gao, Jiangyue Yu, Shaochun Wu, Chaonan Jin, Min Jiang, Weiliang Dong, He Huang*, Michael J. Zaworotko*, Zhenjie Zhang, Yao Chen* Spontaneous efficient degradation of polyesters in soil by an enzyme@MOF platform, Nature communication, 2026, 17, 5716 (2026).
-Edward Loukopoulos, David Fabra, Jorge Melones-Herrero, Ana I. Matesanz, Carmen Viciana, Ana E. Platero-Prats, Isabel Sánchez-Pérez, Adoracion G. Quiroga; Structural features and antibacterial activity of Ni(ii) thiosemicarbazones in a zirconium metal-organic framework composite. Dalton Trans. 2026; 55 (13): 5130–5138.
-Yushu Zhang, Zelong Liang, Kaiyuan Wang, Peng Cheng, Yao Chen, Bin Zhao, ZhenjieZhang, Microenvironment Engineering Vinylene-Linked Covalent OrganicFrameworks for Highly Efficient CO2 Photoreduction, JACS, (2026) 148 (15): 16107–16118.

Proposal number 16	
Name and Surname	**Email**
Maria Pilar Amo Ochoa	pilar.amo@uam.es
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nanomater.es	
Title of the proposal	
Porous Ionic Compounds and Cu(I)-halide based Coordination Polymers as photocatalytic systems for CO2 reduction and water remediation	
Abstract	
This project aims to advance fundamental research on novel metalorganic materials for sustainable energy conversion and environmental remediation. The proposal focuses on two interconnected objectives: (1) the photocatalytic reduction of CO2; into value-added chemicals, and (2) the development of multifunctional luminescent and semiconducting coordination polymers (CPs) for the detection and degradation of hazardous water pollutants. Both objectives address frontier scientific questions in materials design, electronic structure control, and structure function relationships. In our previous research we have demonstrated that Porous Ionic Crystals (PICs) and Cu(I)Halides CPs are highly promising alternatives to traditional photocatalytic systems based on TiO2;. PICs are based on the combination of cationic and anionic metal-oxide clusters and act as efficient electronhole generators through ordered ionic heterojunctions, while Cu(I)Halides CPs excel in CO2; activation and selective reduction to alcohols. Both families outperformed benchmark materials such as CuO-modified TiO2; under comparable conditions, and the team developed a custom scale up photoreactor capable of isolating the condensable reaction products. These advances established the foundation for deeper exploration and optimization. We want to improve the photocatalytic performance of both PICs and CPs by tuning their electronic structure through rational ligand design, alternative metal centers, and controlled assembly of hybrid photocatalysts. Preliminary results already show that Ti(IV)-based PICs surpass Zr based analogues by an order of magnitude and can even promote water photolysis, while optimized pyridine-based Cu(I)I CPs operate under visible light and exhibit excellent stability. A second line of research leverages the rich photoluminescent behavior of Cu(I)I CPs to create dual-function materials capable of both sensing and degrading pollutants such as antibiotics. Recent patented and published results confirm that selected systems can display near-unity quantum yields, high sensitivity in real water samples, and efficient photocatalytic degradation. Their ability to form stable suspensions enables the fabrication of portable devices via drop-casting, 3D printing or nebulization. Together, these research lines pursue fundamental understanding while laying the groundwork for future technological applications in CO2 valorization and water purification. By integrating materials synthesis, photophysical studies, mechanistic analysis, and device processing, the project is expected to generate significant scientific knowledge and enable the discovery of new metalorganic platforms that combine sustainability, scalability and multifunctionality	

Proposal number 17	
Name and Surname	**Email**
Emiliano Martinez Periñan	emiliano.martinez@uam.es
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https://www.uam.es/psicologia/investigacion/grupos-de-investigacion/detalle/f1-245	
Title of the proposal	
Covalent Organic Frameworks-Based Nanomaterials for Oxygen Reduction Reactions (ORR) electrocatalysts development.	
Abstract	
The Oxygen Reduction Reaction (ORR) is fundamental to energy conversion, biological respiration, and hydrogen peroxide generation. Although Platinum Group Metal (PGM) electrocatalysts have traditionally dominated ORR, their scarce global reserves, high production costs, and large material requirements for cathode fabrication severely limit widespread commercial application. As a promising solution, Covalent Organic Frameworks (COFs) have emerged as powerful, highly tunable structural platforms. This 12-month predoctoral project aims to design innovative COF-based nanomaterials and synthesize metal-free ORR electrocatalysts. The developed materials will be applied and evaluated in next-generation fuel cell architectures, advancing sustainable and cost-effective energy conversion technologies.	

Proposal number 18	
Name and Surname	**Email**
Filip Lim	filip.lim@uam.es
web	
https://fuam.es/grupos/biotecnologia-basada-en-vectores-herpesvirales-y-lentivirales/	
Title of the proposal	
HSV-1 Gene Transfer Vectors	
Abstract	
Gene transfer vectors hold an enormous potential in diverse applications such as nanofabrication of new materials, engineering cells and organisms with novel functions, and molecular medicine. In this biotechnological revolution, herpesvirus amplicon vectors, devoid of all viral genes, are one of the most promising platforms since they can carry up to 10 times larger genomic cargo than other viral vectors and have negligible toxicity. However, extensive use of this increased coding capacity in biotechnology is currently limited by the difficulty of their largescale production without their contamination with viral genomes. Thus, together with our collaborations to advance herpesvirus vector-mediated therapies in cancer, neurogenic bladder dysfunction and skin diseases, we are using mathematical modelling and fluorescently labelled mutant viruses to identify key parameters of herpesvirus vector growth dynamics to devise scaleable strategies for amplicon vector production.	

Proposal number 19	
Name and Surname	**Email**
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https://www.cmam.uam.es/	
Title of the proposal	
Advanced Laser/Ion Processing and Optical Characterization of Materials at the The Centre for Micro Analysis of Materials (CMAM)	
Abstract	
This 12-month research stay at the Centro de Micro-Análisis de Materiales (CMAM), Universidad Autónoma de Madrid, will enable PhD students to advance their doctoral research through the controlled modification and comprehensive characterization of advanced materials. Participants will have access to specialized ion beam analysis (IBA) techniques, in particular RBS, for investigating elemental composition, depth profiles, and irradiation-induced changes in materials. The programme could also explore laser–matter and ion–matter interactions as complementary strategies to tailor material properties. Processing approaches, including ultrafast laser irradiation and ion irradiation with high energy heavy ions, or swift heavy ion irradiation, will be used to induce controlled modifications and investigate their effects on structural, surface, and optical properties. Advanced optical characterization will provide further insight through spectroscopic ellipsometry, reflectance and transmittance spectroscopy, complemented by profilometry for surface topography and modification-depth analysis. Combining ion beam analysis, laser and ion processing, and optical characterization will establish links between processing parameters, material structure, and functional properties, providing valuable experimental results and expertise to support the successful completion of the doctoral thesis.	
Proposal number 20	
Name and Surname	**Email**
Samuel Cires Gomez	samuel.cires@uam.es
web	
https://www.researchgate.net/profile/Samuel-Cires	
Title of the proposal	
Exploring the potential of photosynthetic microorganisms from extreme environments for bioproducts and environmental biotechnology	
Abstract	
This project aims to explore the bioproduct potential of cyanobacteria and microalgae from hot deserts and cryospheric ecosystems. Selected strains from our collections and ongoing projects are available for culture-based and molecular approaches (genomics and transcriptomics under stress conditions). The work could focus on exopolysaccharides, pigments or lipids of potential interest for cosmetics, environmental biotechnology and bioenergy. The results will provide a foundation for	

future functional validation and bioprocess optimization while offering the visiting researcher an opportunity for interdisciplinary training in microbial cultivation, molecular analysis and biotechnological data interpretation. References https://doi.org/10.1016/j.algal.2024.103817 https://doi.org/10.1038/s41598-024-60499-4 https://doi.org/10.3389/fbioe.2020.00051
Proposal number 21

Name and Surname	**Email**
Mario Mencia Caballero	mario.mencia@uam.es

web
https://www.cbm.uam.es/index.php/scientific-programs/interactions-with-the-environment/microbes-in-health-and-welfare/biotechnology-and-genetics-of-extreme-thermophiles/
Title of the proposal
Engineering a Two-Hybrid System in Thermus thermophilus for the Identification and Evolution of Thermoresistant Protein Interactions
Abstract
Designing thermostable protein-protein interactions at temperatures above 60°C remains a major challenge in biotechnology. Such interactions are of considerable applied interest because they could enable the development of highly robust diagnostic reagents, next-generation therapeutic proteins, and industrial biocatalysts. The overall objective of this project is to establish the first versatile two-hybrid platform operating in the thermophilic bacterium Thermus thermophilus for the detection, quantification, selection, and evolution of thermostable protein-protein interactions. The resulting complementation will generate easily measurable outputs, such as fluorescence, antibiotic resistance or enzymatic activity enabling both quantitative analysis and high-throughput selection of interacting protein pairs under thermophilic conditions. Once established, the platform will be applied to the evolution of thermostable binding by many proteins of biotechnological interest including, nanobodies, DARPins, peptide-binding domains, and AI-designed binders generated using state-of-the-art computational approaches. The most interesting binders will be studied for their possible application in biotechnology.
Proposal number 22

Name and Surname	**Email**
Ferry Prins	ferry.prins@uam.es

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www.ferryprinslab.com
Title of the proposal
Visualising Energy Flow in Perovskite and Nanocrystal Films with Transient Microscopy
Abstract
Metal-halide perovskites and colloidal nanocrystals are transforming optoelectronics, offering low-cost, solution-processed routes to highly efficient solar cells and light-

emitting diodes. Yet their performance remains limited by how energy moves through these materials: excitons and charge carriers diffuse, get trapped at defects and grain boundaries, or are lost before they can be extracted or emitted. During this 12-month research stay, you will use state-of-the-art transient microscopy, developed in our laboratory at IFIMAC-UAM, to directly visualise how excitons and charges move through perovskite and nanocrystal films on picosecond timescales. You will map diffusion lengths, trap-state landscapes and recombination dynamics across a range of compositions and structures, linking these transport properties to material design and device performance. Embedded in an ERC-funded team, the stay offers hands-on training in ultrafast spectroscopy and microscopy, and a strong basis for joint publications and continued collaboration with your home group.

Proposal number 23	
Name and Surname	**Email**
Beata Maria Szydlowska	beata.szydlowska@uam.es
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https://szydlowskalab.com	
Title of the proposal	
2D-Enhanced Ceramics for Next-Generation Biomedical Applications	
Abstract	

This project aims to develop innovative ceramic-based composites incorporating two-dimensional (2D) materials for next-generation biomedical applications. By integrating graphene, transition metal dichalcogenides (WS_2), and other emerging 2D nanomaterials into ceramic and polymer–ceramic matrices, the research will explore strategies to enhance mechanical properties, structural integrity, and X-ray visibility.
The visiting researcher will investigate composite fabrication, filler dispersion, and the influence of nanomaterial concentration on material performance. Advanced characterization techniques, including microscopy, spectroscopy, mechanical testing, and X-ray imaging, will be employed to establish relationships between composition, microstructure, and functionality.
Particular emphasis will be placed on developing radiopaque composites with potential applications in biomedical implants, tissue-engineering scaffolds, and medical devices. The project combines materials chemistry, nanotechnology, and biomedical engineering, offering interdisciplinary training and opportunities to contribute to scientific publications while advancing the design of multifunctional materials for future healthcare technologies.

Proposal number 24	
Name and Surname	**Email**
Ana Isabel Matesanz Garcia	ana.matesanz@uam.es
web	
https://www.facebook.com/BIoActiveMeUnits/	
Title of the proposal	
Novel Platinum(IV) Prodrugs for Nanocarrier-Based Anticancer Therapy and Theranostic Applications	
Abstract	
Our research group has extensive expertise in the synthesis, characterization and biological evaluation of platinum-based compounds with anticancer activity. We offer a 12-month research project focused on the preparation of versatile platinum (IV) prodrugs designed for their incorporation into nanocarrier systems. This approach aims to improve biocompatibility and enable controlled drug release within the tumor microenvironment. Furthermore, it offers the potential to incorporate additional therapeutic agents or imaging probes, paving the way for synergistic combination therapies and theragnostic applications. The target compounds will be carefully designed according to the specific objectives and research needs of the student's PhD project from a series of Pt(II) precursors previously developed in our group to ensure well-controlled speciation. References: Q. Wang et al., J. Med. Chem. 2025, 68, 20340−20359 X. Song et al., J. Med. Chem. 2025, 68, 387−404	

Proposal number 25	
Name and Surname	**Email**
Jose Ramon Ares Fernandez	joser.ares@uam.es
web	
https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-280	
Title of the proposal	
Exploring Hydrogen-Metal Interactions at Very High Pressures Using In Situ Optical Microscopy	
Abstract	
Investigating hydrogen-material interactions at ultra-high pressures (>100 bar) and the subsequent formation of hydrides is crucial for advancing technologies like hydrogen storage, protective coatings, energy storage, and superconductivity [1,2]. This one-year fellowship offers the opportunity to study these phenomena via high-pressure optical microscopy, allowing for the in situ visualization of nanometer-thick films of diverse compositions. To complement this, the host group provides access to specialized thin-film characterization tools, such as ion beam techniques, spectroscopy, and high-resolution electron microscopy. Joining this program means working within a dynamic academic community where you can easily connect with other doctoral researchers and learn from their work.	

[1] Q. Wang et al, doi: 10.1016/j.joule.2020.02.008. [2] D. Abejón et al. doi:10.1016/j.jma.2024.09.019	
Proposal number 26	
Name and Surname	**Email**
Rocio Gomez Lencero	rocio.gomez@uam.es
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https://www.uam.es/ciencias/facultad/dpto-biologia/gomez-lencero-rocio	
Title of the proposal	
Collaboration on Human spermatogenesis	
Abstract	
This collaboration aims to investigate the role of primary cilia and associated cell signaling pathways in human spermatogenesis, with particular emphasis on spermatocytes and male infertility. Through established collaborations with hospitals and human biobanks, we have access to human testicular samples that will allow us to characterize primary cilia and centrosomal structures using advanced imaging and molecular biology techniques. We will investigate the major signaling pathways associated with primary cilia, combining in silico analyses with experimental studies on human samples to explore their potential involvement in germ cell development and male infertility. This one-year research stay will provide the visiting PhD student with the opportunity to set up bioinformatics approaches to human reproductive biology and gain experience in translational research, contributing to a better understanding of the molecular mechanisms underlying male infertility.	
Proposal number 27	
Name and Surname	**Email**
Sonia Bruña Fernandez	sonia.brunna@uam.es
web	
https://www.pimpamchemistry.com/	
Title of the proposal	
Redox-Active Ferrocene-Based Hybrid Polymers for Photocatalytic Water Remediation	
Abstract	
The growing presence of persistent pollutants in wastewater poses a major environmental challenge. Heterogeneous photocatalysis offers a sustainable approach to water remediation, although developing efficient visible-light-active materials remains challenging. This project aims to develop hybrid materials combining conjugated, nitrogen-rich organic polymers with redox-active ferrocene derivatives. The reversible ferrocene/ferricenium redox couple will facilitate electron transfer, potentially enhancing their optical and electrochemical properties. The student will synthesize molecular building blocks, prepare ferrocene-functionalized hybrid polymers, and characterize their structural, optical and electrochemical properties through different experimental techniques. The materials will be evaluated as heterogeneous photocatalysts for degrading organic pollutants, including dyes and pharmaceuticals, and for reducing heavy metals. This research will contribute to innovative photoactive	

materials for sustainable environmental remediation. The project will be conducted within UAM's PiMPaM research group, specializing in porous materials, functional polymers and photocatalysis, offering valuable opportunities for scientific and professional development.	
Proposal number 28	
Name and Surname	**Email**
Alvaro Artiga Folch	alvaro.artiga@uam.es
web	
https://nanobig.eu/	
Title of the proposal	
MicroRNA-Functionalized Lanthanide Nanoparticles for Macrophage Reprogramming and Antitumour Immunotherapy	
Abstract	
Tumour-associated macrophages contribute to tumour progression and immune suppression, making their reprogramming a promising strategy for cancer immunotherapy. This 12-month PhD project aims to develop and evaluate microRNA-functionalized lanthanide-doped nanoparticles (LanNPs) to promote pro-inflammatory, antitumour macrophage responses and assess their therapeutic potential in preclinical tumour models. First, LanNPs conjugated with miR-155 and miR-223 will be prepared and optimised, individually and in combination. Their cellular uptake, biocompatibility and ability to induce macrophage polarisation will be investigated in vitro using phenotypic markers, including CD80 and CD86, and pro-inflammatory cytokine measurements. Subsequently, the most promising formulations will be evaluated in a syngeneic subcutaneous tumour model to assess nanoparticle distribution, macrophage activation and immune-cell infiltration. Tumour progression will be monitored to explore associations between immune modulation and therapeutic outcomes. This project will contribute to the development of nanoparticle-based strategies for macrophage-targeted cancer immunotherapy and establish experimental foundations for subsequent therapeutic optimisation and response-monitoring studies.	
Proposal number 29	
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-546	
Title of the proposal	
Elementary microkinetic modeling of the electrochemical response of the air electrodes for Solid Oxide Electrolysis Cells.	
Abstract	
The optimal electrochemical performance of Solid Oxide Electrolysis Cells (SOEC) is mainly hindered by the sluggish kinetics occurring at the electrolyte/air electrode interfaces. This project aims to investigate interfacial electrochemical reactions by coupling elementary micro-kinetic mechanisms with first-principles simulations based on Density Functional Theory (DFT). A physically-based model will be developed to	

elucidate how interfacial microstructure influences the electrochemical response and to identify the rate-limiting step. The results will help to develop optimal microstructures for improved performance of the SOECs.	
Proposal number 30	
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Title of the proposal	
Design of multifunctional metal-organic frameworks for electrochemical environmental water remediation and environmental sensing	
Abstract	
This project aims to develop multifunctional metal-organic frameworks (MOF) for electrochemical water remediation and environmental sensing. Different MOF families, including monometallic, bimetallic and luminescent frameworks, will be synthesized and characterized to establish relationships between their structural, electronic and functional properties. Particular attention will be devoted to tailoring their composition and functionality to enhance electrocatalytic activity, stability and luminescent response. Two complementary applications will be investigated: (i) electrochemical oxygen reduction for hydrogen peroxide generation and subsequent degradation of emerging contaminants through advanced oxidation processes; and (ii) the development of electrochemical and electrochemiluminescent sensing platforms for the sensitive and selective determination of endocrine-disrupting compounds in aqueous environments. Combining expertise in materials chemistry, electrocatalysis, and analytical chemistry, this interdisciplinary research will explore the potential of MOF-based materials as versatile platforms for sustainable water treatment and environmental monitoring.	
Proposal number 31	
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Title of the proposal	
Gut-to-brain transport and biotransformation of coffee and cocoa by-product bioactives for precision neuro-nutrition.	
Abstract	
This one-year research proposal explores the expanding field of precision neuro-nutrition and circular bioeconomy through the sustainable valorization of coffee pulp and cocoa shell as neuroactive ingredients. The research transversally integrates the green microwave-assisted extraction of bioactives, the study of their gastrointestinal biotransformation and bioaccessibility via the INFOGEST protocol, the characterization of digestion-derived fractions, and their in-depth mechanistic evaluation using	

advanced in vitro cellular models. Through continuous sequential cell co-cultures simulating the gut-endothelial-neuroglial axis (Caco-2/HT29-MTX, HBMEC, BV2/P19), the study will assess compound transport and alterations in oxidative stress, neuroinflammation, and neuroplasticity, while measuring barrier integrity (TEER) and compound transport. Designed for high-impact scientific output, this proposal provides comprehensive training in AI-driven data science, predictive chemometrics, high-resolution metabolomics, and state-of-the-art cell co-culturing. It directly addresses global sustainability goals, offering highly motivated candidates a frontier platform to lead innovative research at the interface of food technology and neuro-nutrition.

Proposal number 32

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Title of the proposal

Photolithographic DNA Patterning for Functional Liposome Biochips

Abstract

Liposomes are lipid-bilayer nanoparticles widely used in drug delivery, vaccine development, and cell-mimicking bioreactors. Their aqueous cores encapsulate biomolecules and nanomaterials, while their membranes can be functionalised with carbohydrates or proteins to tailor biological interactions. However, conventional liposome applications rely on colloidal suspensions, which limits spatial control, parallel analysis, and integration into biochips.

This project aims to develop a photolithography-based DNA-directed patterning platform for the precise and selective immobilization of functional liposomes on glass substrates. Spatially patterned single-stranded DNA will serve as a molecular target for hybridization with complementary DNA-functionalized liposomes, enabling the assembly of organized, multiplexed microarrays. By combining photolithographic fabrication, DNA hybridization, and lipid nanotechnology, the research will investigate pattern resolution, immobilization stability, and the preservation of liposome functionality.

The resulting platform could enable the high-throughput characterization of membrane-associated processes and biomolecular interactions, establishing a versatile interface between nanofabrication and biotechnology for applications in biosensing and biomimetic systems.

Proposal number 33

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Title of the proposal

Mechanics of RNA assemblies: a physical test for compartmentalization in an RNA world

Abstract
Recent cryo-EM work shows that short RNAs (<200 nt) self-assemble into icosahedral cages, finite oligomers and extended filaments, architectures traditionally associated with proteins. However, the physical properties of these RNA-only assemblies remain unexplored. Here we propose to investigate the biomechanics of individual assemblies with atomic force microscopy (AFM) in liquid, following the approach we have developed for virus particles. Nanoindentation, mechanical fatigue and mechanical tomography will reveal the stiffness, breaking force and self-healing ability of the 60-subunit manA cage, to be compared with protein capsids of similar size. The bending rigidity of kink-turn RNA filaments will be contrasted with that of tobacco mosaic virus. We will further determine how Mg^{2+} and the kissing-loop interfaces modulate stability and disassembly. These experiments will test whether RNA shells withstand the mechanical demands of cargo protection, providing a physical benchmark for compartmentalization in an RNA world and guidelines for designing RNA nanoparticles.
Proposal number 34

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Title of the proposal	
Conductive Graphene Oxide and Nanocarbon-Based Membranes for the Nanofiltration of Emerging Contaminants	
Abstract	
How can nanomaterials help secure clean water for the future? This project explores graphene oxide (GO) and other nanocarbon materials as building blocks for a new generation of high-performance nanofiltration membranes. Their adjustable surface chemistry, nanoscale channels, and electrical properties offer exciting possibilities for selectively removing emerging contaminants while limiting membrane fouling. The selected candidate will fabricate and characterize conductive GO-based, hybrid, and composite membranes, and evaluate their water permeability, contaminant rejection, fouling behaviour, and operational stability. The project will also examine how membrane structure, composition, and electrical stimulation affect filtration performance, providing insights into transport and fouling-control mechanisms. By connecting materials design with environmental applications, this research aims to develop more efficient and sustainable technologies for water purification. The project offers interdisciplinary training at the interface of membrane science, nanotechnology, materials characterization, and environmental engineering, while contributing to two major research priorities: functional nanomaterials and clean water solutions.	
Proposal number 35

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Universidad Autónoma de Madrid

Title of the proposal
Electron Interferometry in Quantum Hall-Superconductor Nanostructures
Abstract
In this theory project we explore electron interferometry in quantum Hall-superconductor nanostructures as a platform for coherent quantum circuits [1] and engineered topological phases [2]. Interferometers are build using chiral edge channels as electron waveguides and quantum point contacts as beam splitters. Then, propagating charges act as flying qubits encoding information in their quantum state. Extending scattering approaches we describe time-dependent Andreev processes, thermoelectric transport [3,4], and emergent topological phases. By designing interferometric circuits we aim to detect entangled electron pairs, probe topological superconductivity, and optimize flying qubit architectures, thus paving the way for future hybrid topological-superconductor quantum technologies. [1]. P. Burset, B. Roussel, M. Moskalets, C. Flindt, “Tunable Andreev-Conversion of Single-Electron Charge Pulses.” Phys. Rev. Lett. 135, 246303 (2025) https://doi.org/10.1103/lfsm-z1sl [2]. Y. Baba, A. Levy Yeyati, P. Burset, “Emergent topology by Landau level mixing in quantum Hall-superconductor nanostructures.” Phys. Rev. Lett. 136, 176601 (2026) https://doi.org/10.1103/v68s-tgxs [3]. L. Arrachea, A. Braggio, P. Burset, E. J. H. Lee, A. Levy Yeyati, and R. Sánchez, “Thermoelectric Processes of Quantum Normal-Superconductor Interfaces.”ANNALEN DER PHYSIK (2025): e00197. https://doi.org/10.1002/andp.202500197
Proposal number 36

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Title of the proposal
Statistics of quantum controlled Maxwell demons
Abstract
Under the effect of continuous quantum monitoring and conditional feedback, a quantum dot system provides a simple model of a Maxwell demon [1]. Local violations of the second law of thermodynamics can be probed by measuring the average particle and heat currents. Recent generalizations of master equations describe the dynamics of the system + control apparati in a compact form, giving access to the transport fluctuations [2]. This theoretical project consists on investigating the fluctuation properties of the monitored quantum dot Maxwell demon with the aim of relating the thermodynamic performance to the noise statistics of the output currents as well as considering the noise of the information flows between the system and its demon. [1] L. Trigal and R. Sánchez, Noninvasive and nonadiabatic quantum Maxwell demon, Phys. Rev. B 113, L121403 (2026) [2] J. Lu, C. Wang, Feedback-Enhanced Quantum Metrology and Clock Precision under Thermodynamic Uncertainty, arXiv:2609.00622

Proposal number 37	
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Title of the proposal	
Integrating Theoretical Tandem Mass Spectra into LC-MS/MS Workflows for Small-Molecule Identification	
Abstract	
Structural identification of unknown compounds remains a major challenge in untargeted metabolomics and related LC-MS/MS applications. Computational prediction of tandem mass spectra (MS/MS) can provide valuable complementary information for interpreting experimental spectra and identifying unknown compounds. This project aims to evaluate the potential of theoretical MS/MS spectra, obtained from molecular dynamics simulations, to support compound identification in experimental LC-MS/MS workflows. Using computational tools already developed in our group, we will simulate the MS/MS spectra of selected compounds (below 1000 Da) relevant to the visiting PhD student's research. Theoretical and experimental spectra will be compared to assess their usefulness in identifying unknown compounds, discriminating between candidate structures, and distinguishing structural isomers. Fragmentation mechanisms may also be investigated to support spectral interpretation. The collaboration will combine experimental LC-MS/MS expertise with computational mass spectrometry to explore the practical value of theoretical spectra in small-molecule identification.	