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AYUDAS RAMÓN Y CAJAL – CONVOCATORIA 2025
TURNO GENERAL

Área Temática: **Biociencias y biotecnología**
Nombre: AVALOS PADILLA, YUNUEN
Referencia: RYC2025-055910-I
Correo Electrónico: yavalos@ibecbarcelona.eu

Título: Aggregation-driven mechanisms and vesicular trafficking in protozoan parasites: from molecular insights to therapeutic tools

Resumen de la Memoria:

Mi trayectoria científica se ha caracterizado por una progresiva consolidación de independencia, liderazgo y especialización en el estudio de la agregación proteica, los condensados biomoleculares y el tráfico vesicular en parásitos protozoarios, integrando enfoques de biofísica, biología celular, nanomedicina y parasitología. Durante mi doctorado en México, desarrollé un marco experimental pionero para desentrañar la función del complejo ESCRT-III en Entamoeba histolytica, combinando membranas sintéticas con microscopía avanzada. Este trabajo derivó en publicaciones como primera autora y en un periodo posdoctoral en el Instituto Max Planck de Coloides e Interfaces (Alemania), donde profundicé en biología de membranas y técnicas microfluídicas dentro del consorcio MaxSynBio. En esta etapa, consolidé colaboraciones internacionales, formé estudiantes y publiqué trabajos como autora correspondiente que sentaron las bases de una línea independiente centrada en la relación entre organización membranal y fisión vesicular.

Desde 2018 formo parte del grupo de Nanomalaria (IBEC/ISGlobal, España), donde inicié una transición estratégica hacia la biología de Plasmodium falciparum, integrando mi experiencia en biofísica con preguntas de alto impacto biomédico. Demostré que la maquinaria ESCRT-III participa en la formación de vesículas extracelulares en eritrocitos infectados y contribuí en el desarrollo de nanopartículas para transportar fármacos y modular reacciones tóxicas, mejorando su eficacia. En paralelo, participé en una línea centrada en estudiar la agregación proteica en parásitos, identificando el compuesto YAT2150 como inhibidor de agregación con actividad dual contra Plasmodium y Leishmania. Estos hallazgos revelaron una vulnerabilidad terapéutica no explorada y han generado interés en empresas como GSK y asociaciones como Medicines for Malaria Venture, reforzando el potencial traslacional de esta investigación. Como co-IP del proyecto PID2024-156230OB-I00, lidero actualmente la elucidación de dianas asociadas a agregación proteica en Leishmania, consolidando mi independencia científica.

La línea de investigación que propongo profundiza en el papel funcional de los condensados biomoleculares en Plasmodium y Leishmania, patógenos con proteomas enriquecidos en regiones desordenadas, que podrían controlar procesos críticos de adaptación al estrés y supervivencia mediante la formación de condensados. Mi objetivo es establecer el primer marco sistemático para identificar, caracterizar y modular condensados en protozoos mediante herramientas biofísicas, aproximaciones multi-ómicas y nanopartículas dirigidas, esta línea permitirá desvelar mecanismos clave de patogenicidad y desarrollar terapias innovadoras con menor riesgo de resistencia.

Los principales hitos de mi trayectoria son:

-Publicación de 23 artículos, con 9 como primera autora y 4 como autora de correspondencia.
-Liderazgo en proyectos nacionales e internacionales, incluyendo rol de co-IP.
-Desarrollo de herramientas biofísicas y nanotecnológicas con proyección terapéutica.
-Formación de estudiantes (grado, máster y doctorado) y creación de una línea independiente.
-Contribuciones relevantes a la salud global mediante propuestas de nuevas dianas y compuestos antiparasitarios.

Resumen del Currículum Vitae:

Mi trayectoria científica se centra en el estudio de los mecanismos que regulan el tráfico vesicular, la agregación proteica y la formación de condensados biomoleculares en parásitos protozoarios, integrando enfoques de biofísica, biología molecular, nanomedicina y biología sintética. Esta combinación de disciplinas me ha permitido abordar preguntas fundamentales sobre la organización celular y, al mismo tiempo, identificar vulnerabilidades terapéuticas en enfermedades de alto impacto social como la malaria y la leishmaniasis.

Realicé mi doctorado en el CINVESTAV (México), donde caractericé por primera vez el papel funcional del complejo ESCRT-III en la fagocitosis de Entamoeba histolytica, demostrando su participación directa en un proceso esencial de virulencia. Esta investigación se fortaleció mediante una estancia en el Instituto Max Planck de Coloides e Interfaces (MPIKG, Alemania), donde utilicé vesículas gigantes unilamelares para reconstruir los principios biofísicos que rigen la acción de ESCRT-III. Tras la tesis, fui seleccionada como investigadora posdoctoral del consorcio MaxSynBio y amplié estos estudios desarrollando modelos microfluídicos y nuevos métodos para analizar la remodelación de membranas, publicando varios trabajos como autora de correspondencia y estableciendo una línea independiente basada en la relación entre dinámica de membranas durante la acción de la maquinaria ESCRT-III.

Desde 2018 formo parte del grupo Nanomalaria (IBEC/ISGlobal), donde he realizado contribuciones clave en parasitología molecular y nanotecnología aplicada. Demostré que la ESCRT-III impulsa la biogénesis de vesículas extracelulares en eritrocitos infectados por Plasmodium falciparum, aportando un avance conceptual en la comprensión de los mecanismos de comunicación parásito-huésped. También participé en el desarrollo de nanopartículas para modular toxicidades farmacológicas o actuar en etapas del mosquito. Además, he contribuido de forma destacada en la identificación del compuesto YAT2150 como inhibidor de agregación con actividad dual contra Plasmodium y Leishmania, abriendo una nueva línea de investigación en quimioterapia dirigida a agregados proteicos. Este trabajo ha generado colaboraciones con GSK, Medicines for Malaria Venture y grupos internacionales de referencia.

Mi independencia queda reflejada en 23 publicaciones (9 como primera autora y 4 como autora de correspondencia) con 245 citas, liderazgo en proyectos experimentales multidisciplinares y en mi papel como co-IP del proyecto nacional PID2024-156230OB-I00. He dirigido tesis de grado y máster, una tesis doctoral finalizada y tres actualmente en curso. He recibido financiación competitiva internacional (CONACyT, programa posdoctoral BEST-H2020) y cuento con una amplia red de colaboraciones en Europa, África y América.

En conjunto, mi CV refleja una trayectoria internacional, multidisciplinar e independiente, orientada a generar conocimiento fundamental y soluciones biotecnológicas innovadoras para enfermedades parasitarias de relevancia global.

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AYUDAS RAMÓN Y CAJAL – CONVOCATORIA 2025
TURNO GENERAL

Área Temática: **Biomedicina**
Nombre: PANDEY , SHAMBHAVI
Referencia: RYC2025-056176-I
Correo Electrónico: shambhavi16@gmail.com
Título: Senior Researcher

Resumen de la Memoria:

I am currently a Senior Scientist at IQS-URL (Barcelona), leading the gene delivery team of the ERC-OBGate project and developing my independent research program under the Beatriu de Pinós fellowship. My scientific path spans India, South Korea, and Spain, shaped by interdisciplinary training and a track record in translational nanomedicine. After BS in Chemistry, MS in Biotechnology and early research experience at IGIB, CDRI, and Agilent, I received the Korean Government Scholarship to pursue my PhD at Seoul National University. There, I developed vitamin-B6 targeted and hyperosmotic polyol gene carriers for cancer therapy. One of the patents from my PhD work was commercialized as Xylifectamine, offering me early exposure to industry collaboration, scale-up, and product development. Following my PhD, I expanded into BBB-penetrating nanocarriers and CRISPR/siRNA therapies for glioblastoma stem cells (GSCs), gaining expertise in orthotopic GBM models and microfluidic BBB/BTB systems. Across Korea and Spain, about one-third of the competitive grants I have written have been funded, including Beatriu de Pinós as PI. I have authored 23 publications, eight patents, contributed to international collaborations, and supervised graduate students, further consolidating my scientific independence.

My research line for the Ramón y Cajal grant directly evolves from this trajectory but advances into a more ambitious and clinically relevant direction: conditionally active lipid nanoparticles (CAvLNPs) for immunoediting in GSCs. GBM remains one of the deadliest cancers, with relapse driven largely by therapy-resistant GSCs that evade immune surveillance. Current treatments do not sufficiently target this subpopulation, contributing to merely 14-15 month median survival. My proposed research addresses this gap by integrating immune checkpoint editing, GSC biology, and BBB-penetrating nanotechnology into a unified platform.

Central aim of the research line is to engineer CAvLNPs and later thermogel-based implantable brain patches that deliver anti-PD-L1 CRISPR/Cas9 specifically to GSCs, re-establishing immune recognition and reducing recurrence. Core strategy involves designing of CAvLNPs equipped with protease-responsive zwitterionic peptides for conditional activation, BBB-shuttle peptides for BBB crossing, and anti-PD-L1 antibodies for precise GSC targeting. These robust CAvLNPs will deliver CRISPR to knock out PD-L1 in GSCs and restore T-cell mediated immunity, therby shifting the tumor microenvironment toward long-term surveillance. Finally, validating therapeutic durability in orthotopic GBM and recurrence models, assessing whether immune re-activation delays or prevents relapse will provide proof of concept.

This research delivers a multi-layered immunomodulatory approach tailored to GSCs, something current GBM therapies do not address. Targeting GSCs has the potential to significantly improve patient survival and reduce relapse. The project is designed to generate high-impact publications, patents, and translational nanocarriers, drawing on my past experience with patents and commercialization in South Korea. This line of research is a natural progression of my scientific journey but represents a clear step into scientific independence under the Ramón y Cajal program.

Resumen del Currículum Vitae:

I am currently a Senior Scientist at the School of Bioengineering, IQS-URL (Barcelona), where I lead the gene-delivery team of the ERC-OBGate project and develop my independent line under the Beatriu de Pinós fellowship. Before moving to Spain, I completed my postdoctoral research on BBB-penetrating nanocarriers for CRISPR/siRNA therapy in glioblastoma stem cells. I obtained my PhD in Biosystems and Biomaterials Engineering from Seoul National University as a Korean Government Scholar, where my work on vitamin-B6-based cancer-targeting ligands earned the Excellent Academic Achievement Award from the National Institute for International Education. My earlier research training in India at the Institute of Genomics & Integrative Biology, Agilent Technologies and the Central Drug Research Institute strengthened my foundation in chemical synthesis, nanomaterials, and cancer biology. I hold an MS in Biotechnology (silver medal, 2nd rank) and a BSc in Chemistry (Honors).

My research focuses on developing functional nanocarriers (polymeric, lipid-based and nanochains) for targeted gene therapy, BBB crossing, and glioblastoma treatment. During my PhD, I designed hyperosmotic polydixylitol and vitamin-B6-targeted poly(esteramine) transporters that enhanced nucleic-acid delivery and enabled BBB transmigration. This work generated two U.S. and two Korean patents and led to the commercialization of Xylifectamine through the ELBio spin-off, where I contributed as R&D Head. In parallel, I established expertise in in vivo orthotopic GBM models and 3D microfluidic BBB/BTB systems, including nanochain-based siRNA delivery published in Biomaterials (2022). Later, I expanded my work to GSC-targeted therapies using CRISPR/Cas9 and siRNA to inhibit the Sonic hedgehog pathway, published in the Journal of Controlled Release (2023). At IQS, I now lead the development of conditionally active lipid nanoparticles for targeting BBB endothelial cells and expressing orthogonal receptors under the ERC project.

To date, I have authored 23 peer-reviewed publications (Biomaterials, Journal of Controlled Release, Chemical Communications, etc.), two book chapters, and eight international patents. I have presented my work at major meetings such as Gordon Research Conference, TERMIS, B4, Nano Today and Nature Chemical Biology, contributing invited talks, oral communications and posters. My collaborations span SNU Hospital, Ajou University Hospital, Konkuk University, the University of Coimbra and IIT-India, with active engagement with clinicians, industry partners and venture capital groups during technology translation.

I have secured research funding in South Korea and Europe, including the Beatriu de Pinós fellowship as PI. I have supervised two PhD and four MS students, contributed to PhD Day mentoring activities, conceived and wrote competitive grants and helped coordinate lab management and

experimental planning in both Korea and Spain. My outreach efforts include invited lectures, interviews, and public engagement at events such as CosmoCaixa□s Researcher□s Night. I also guest editor and review for journals including Pharmaceutics and RSC.

My career has been shaped by strong mobility, interdisciplinary training and translation into tangible biomedical tools. I now aim to establish an independent program in immunomodulatory nanotherapies for GSCs.

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TURNO GENERAL

Área Temática: **Biomedicina**
Nombre: RODRIGUEZ BERRIGUETE, GONZALO
Referencia: RYC2025-055923-I
Correo Electrónico: gonzalo.rb83@gmail.com

Título: Exploiting genetic vulnerabilities for precision radiosensitisation

Resumen de la Memoria:

My research focuses on developing targeted therapies to improve radiotherapy and understanding the processes underlying radiosensitivity. I completed my PhD in Biomedicine at the University of Alcalá (UAH, Spain, 2009–2013; PhD Excellence Award), where I showed that IL-1/TNFa signalling pathways are dysregulated in prostate cancer and can be exploited both therapeutically and as prognostic factors (e.g., Rodriguez-Berriguete et al., BMC Cancer 2010; Human Pathol 2012; Prostate 2012; Cytokine 2013; BMC Cancer 2015).

In my postdoctoral research at the University of Oxford (2014-Present), I have integrated high-throughput screening with a broad range of in vitro, in vivo and patient-based approaches to develop new drug–radiotherapy combinations and uncover determinants of tumour radiosensitivity. A major focus has been the development of first-in-class inhibitors of Pol-theta in collaboration with Artios Pharma. My work demonstrated that pharmacological Pol-theta inhibition provides tumour-selective radiosensitisation and elucidated its effects on DNA repair (Rodriguez-Berriguete et al., Clin Cancer Res 2023). I also identified SHLD2 loss—a frequent prostate cancer mutation—as a clinically actionable vulnerability for Pol-theta-targeted radiosensitisation (Rodriguez-Berriguete et al., bioRxiv 2025; under revision in Science Advances). The inhibitors I helped develop are now commercially available as research tools, and are undergoing clinical testing (NCT04991480, NCT05898399).

In parallel, I have advanced therapeutic strategies targeting tumour hypoxia—an important driver of resistance to radiotherapy, chemotherapy and immunotherapy. I contributed to clinical trials demonstrating that the electron transport chain inhibitor (ETCi) atovaquone safely reduces tumour hypoxia in patients (Skwarsky et al., Clin Cancer Res 2021; NCT02628080, NCT04648033) and showed, in preclinical models, that atovaquone synergises with immune checkpoint blockade—a therapeutic modality increasingly combined with radiotherapy—via CD8+ T cell activation (Rodriguez-Berriguete et al., Cell Death Dis 2024). I have also co-led a research project to develop next-generation ETCi.

My research has also focused on the development of high-throughput screening approaches for target and biomarker discovery, drug development and the identification of novel radiosensitivity determinants. For example, I developed and implemented a high-throughput screening platform that identified Nup54 as a novel radiosensitivity factor and demonstrated its role in homologous recombination repair (Rodriguez-Berriguete et al., Nucleic Acid Res., 2018).

Through the present call, I will identify vulnerabilities associated with common cancer mutations in radiotherapy-treated patients, along with the pharmacological strategies needed to exploit them and selectively enhance the antitumour effects of radiotherapy. Using CRISPR-based technology, advanced chemogenomic libraries and next-generation sequencing, supported by diverse in vitro and in vivo assays, this work will generate a pipeline of tumour-selective, biomarker-guided radiosensitisers poised for advancement toward clinical testing. The overall goal is to enable personalised radiotherapy–drug combinations to improve outcomes for patients with cancer.

Resumen del Currículum Vitae:

I did my PhD research on the prognostic and therapeutic implications of inflammatory signalling pathways in prostate cancer at the University of Alcala (Spain, 2009-2013, PhD Excellence Award). Then, I moved to the University of Oxford (UK, 2014-present), to work in Prof. Geoff Higgins' lab, where I have been developing novel targeted therapeutic approaches to improve radiotherapy. In addition, I carried out internships at the CIB-CSIC (Madrid, 2009-2010) and The MD Anderson Cancer Center (Houston, Texas, 2011).

I have authored 27 scientific articles (12 as 1st author, 3 as corresponding author), some of them in high visibility journals, like Nucleic Acids Res (Q1, IF 13.1) or Clin Cancer Res (Q1, IF 10.2). Another article as corresponding author has been accepted, and two more are under review (one as first author). I have also published two book chapters (1st-author) and presented my work at several international conferences. Furthermore, throughout my career, I have gained strong expertise on a broad range of molecular and cell biology techniques, including high throughput screens, and a broad range of in vitro and in vivo techniques.

I have participated in several national and international projects both as an appointed researcher (funded by CRUK RadNet award, 2020-2025; Advanced Clinician Scientist Fellowship, 2016-2020; Clinician Scientist Fellowship, 2012-2015), and as a team member (e.g., AECID 2009-2010; RadNet Seed Funding 2022-2024).
My capacity to attract funding independently is endorsed by the competitive personal fellowships I have been awarded and four research grants I secured as lead/co-lead investigator (Research Staff Training Fellowship, 2009-2013; Mobility Grant for Research Staff, 2011; Technical Support to Research Staff Fellowship 2008-2009; Supporting Research Staff Fellowship, 2008-2009; MRC/CiC 2025–2026; John Fell Fund 2025–2026; Xcellomics, 2023-2025; CRUK Development Fund, 2020-2022).

I have taken part in collaborations with industry: Before starting my PhD, I participated in the development of diagnostic tools for Diater Laboratorios S.A. (Technical Support to Research & Supporting Research Staff Fellowships, 2008-2009). Furthermore, during my postdoc, I have performed experiments and provided intellectual input in several projects aimed at testing novel drugs in combination with radiotherapy, in collaboration with several companies (e.g., Novintum, Bioscience Ltd, Artios Pharma, Sitryx, Exscientia).

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I have formally supervised thesis works and mentored students, including 3 PhD, 6 Master, and 6 undergraduate thesis projects. I have delivered 284 officially recognised lecturing hours (UAH, 2007-2013) and since April 2023 I am lecturer & tutor of the MSc in Radiobiology (Dept. Oncology, University of Oxford). Since 2024, I am Director of the MSc in Radiobiology at the University of Oxford, underscoring my leadership in academic research education. I received the department Excellence Award 2025.

As relevant outreach activities, I have been a member of the Public Engagement Committee (Dept. Oncology, University of Oxford, 2021-2025) and directly participated in the RCR CRORT (2017) and the 7 wonders of Oncology (2025) sessions. I have also participated as a referee for several scientific journals and reviewed grant proposals for the Wellcome Trust Institutional Strategic Support Fund (2019 & 2020).

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AYUDAS RAMÓN Y CAJAL – CONVOCATORIA 2025
TURNO GENERAL

Área Temática: **Biomedicina**
Nombre: LUCAS RUIZ, FERNANDO
Referencia: RYC2025-054249-I
Correo Electrónico: fer138lucas@gmail.com

Título: Diagnostic and prognostic tools based on AI and multi-omics in transplantation

Resumen de la Memoria:

My research trajectory has evolved from experimental neurobiology to translational bioinformatics, focused on inflammation and organ transplantation. This dual profile allows me to integrate clinical and multi-omics data with bench experiments to build diagnostic and prognostic tools, particularly in liver transplantation. A key milestone is my first- and corresponding-author GUT paper, where I led the full pipeline from hypothesis and experimental design to ML models showing that intrahepatic donor microbiota in preservation fluids predicts early post-transplant outcomes. This work builds on an earlier eBioMedicine study demonstrating how DAMPs released during cold ischaemia activate the NLRP3 inflammasome and influence early allograft function, supporting a patent. Additional work on extracellular-vesicle miRNA biomarkers and P2X7 signalling in NK cells further positions me at the interface between inflammation, immunology and transplantation, while my earlier visual neuroscience studies showed my capacity to lead complex experiments and establish methodological standards.

In parallel, I have consolidated an independent bioinformatics and AI profile. I am the main developer of cfDNA-donor-fraction, a pipeline to quantify donor-derived cell-free DNA in transplant recipients, and of Genus2Genes, a text-mining platform that links microbial taxa to genes using public databases. Both tools are protected as IP and released as open source, reflecting my commitment to technological innovation, open science and reproducible, FAIR research. My trajectory is supported by competitive fellowships (Margarita Salas, Sara Borrell). International mobility has been central: a two-year stay at INIMS (Hamburg) allowed me to deepen my expertise in omics and ML and to contribute to a study on complement factor H in multiple sclerosis, while an ERASMUS+ stay in Coimbra led to the transfer and consolidation of retinal organotypic culture techniques and to a corresponding-author publication. I maintain active collaborations with groups in Germany, Portugal, the UK, the USA and Spain and have contributed to more than 40 scientific communications.

Building on this background, my proposed research line aims to transform transplant medicine through AI-driven integration of clinical, imaging, immunological, lab and multi-omics data. I will develop models to optimise donor-recipient allocation, predict post-transplant risks and discover biomarkers and therapeutic targets, and translate these outputs into explainable clinical decision-support tools and dashboards, with attention to interpretability, fairness and privacy. Liver transplantation will serve as an initial model, capitalising on access to longitudinal cohorts and biobanked samples, with planned extension to kidney and other solid organs. An experimental programme using organoids, primary cultures, functional assays and in vivo models will test candidate biomarkers and pathways, validate mechanisms and refine predictions. By combining ML/DL, temporal and survival modelling, network analysis and laboratory validation, in close collaboration with clinical teams, this programme seeks to deliver actionable tools that improve transplant outcomes and help position our centre as an international reference in AI-assisted transplantation.

Resumen del Currículum Vitae:

I am a researcher with a dual background in experimental biology and clinical bioinformatics, focusing on the development of diagnostic and prognostic tools in liver transplantation and neuroinflammation. I obtained a BSc in Biochemistry (2013) and an MSc in Molecular Biology and Biotechnology (2014) at the University of Murcia, and a PhD in Visual Sciences (2019, Cum Laude, international mention), where I investigated retinal neurodegeneration and regeneration after optic nerve injury, characterising inflammatory mechanisms and testing neuroprotective and regenerative strategies.

During my PhD and a research stay at the Biomedical Research Institute of Coimbra, I implemented organotypic retinal culture models and led work that resulted in first- and corresponding-author papers on retinal neuroinflammation and contralateral effects after unilateral injury, marking my first steps towards scientific independence. I also supervised junior students, set up complex experimental protocols and presented my work at international meetings.

In 2021 I joined the Molecular Inflammation Group at the Biomedical Research Institute of Murcia (IMIB) as a postdoctoral researcher under the mentorship of Dr. Pablo Pelegrín and Dr. Alberto Baroja-Mazo. I shifted my focus to inflammation and transplant biology, studying damage-associated molecular patterns (DAMPs) and NLRP3 inflammasome activation in liver transplant preservation fluids and their impact on early allograft function, work that led to first-author publications in translational journals. Between 2022 and 2024, as a Margarita Salas postdoctoral fellow at the Institute of Neuroimmunology and Multiple Sclerosis (INIMS, Hamburg), I expanded my expertise in immunology and transcriptomics, investigating retinal inflammation in models of multiple sclerosis and consolidating an international network of collaborators.

Currently, as a Sara Borrell postdoctoral fellow at IMIB, I lead the bioinformatic and multi-omics arm of a translational programme on hepatic microbiota in liver transplantation. I am first and corresponding author of a Gut paper describing an intrahepatic donor microbiota signature in organ preservation solution that predicts short-term transplant outcomes, exemplifying my ability to integrate clinical, metataxonomic and molecular data with machine learning to build predictive models. In parallel, I contribute to projects on extracellular vesicles, epitranscriptomics and liquid biopsy in liver disease, and co-lead the design of computational pipelines for cell-free DNA analysis and microbiota-gene mining, which have been protected as intellectual property.

To strengthen my computational profile, in 2024 I completed an MSc in Bioinformatics (Thesis Award), where I developed a diagnostic tool based on multi-omics integration, consolidating my skills in data science, machine learning and reproducible workflows. I have participated in 9 competitive research projects, co-authored 24 peer-reviewed publications (several as first or corresponding author, H-index 14), and contributed more than 40 communications to meetings. My career is defined by a commitment to interdisciplinary collaboration, rigorous quantitative analysis and the translation of multi-omics data into practical tools for precision diagnostics and prognosis in clinical settings.

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AYUDAS RAMÓN Y CAJAL – CONVOCATORIA 2025
TURNO GENERAL

Área Temática: **Ciencias físicas**
Nombre: DE VICENTE-RETORTILLO RUBALCABA, ÁLVARO
Referencia: RYC2025-056850-I
Correo Electrónico: adevicente89@gmail.com

Título: Martian atmospheric dynamics and radiation in relation to the dust cycle in preparation for future exploration

Resumen de la Memoria:

The research line of the candidate lies on the Martian atmospheric dynamics and radiation in relation to the dust cycle, with focus on enhancing the scientific return of current missions and preparing the future human exploration of Mars. A comprehensive characterization of Martian atmospheric physical processes, radiative fluxes, atmospheric aerosols, and the complex interactions among them, is critical to better understand the dust cycle and the climate, as well as to minimize risks of future missions.

During his PhD, he developed a Mars radiative transfer model from scratch and designed novel methodologies to enhance the scientific return of Mars missions. Then, he had an appointment as Postdoctoral Research Fellow at U. of Michigan (USA), attracting funding from NASA (208,000 euros) to lead a project for the correction of Mars Science Laboratory (MSL) REMS UV measurements, first of their kind on Mars. With this project he became the Lead of the REMS UV Sensor; as such, he leads the majority of the studies and collaborations involving the sensor, regularly publishing in the NASA PDS open repository the corrected data, and coordinating specific campaigns involving other MSL instruments.

He joined Centro de Astrobiología as a researcher of the María de Maeztu excellence program. He specialized in novel methods to characterize dust lifting and deposition, becoming the worldwide reference in the effect of dust accumulation on surface mission assets; as an example, he is consultant of the future Mars Sample Return. As European Scientific Lead of the Mars 2020 MEDA TIRS instrument, he has led groundbreaking studies on dust lifting processes, the main open question in planetary surface-atmosphere interactions (NASEM). He is involved in the design and development of new instruments (WAISR, MAHRS, MetSIS). He officially fully supervised a doctoral thesis on dust storms from satellite measurements, opening a new research line at CAB for new insights into the dust cycle.
He has developed original research ideas, contributing to the generation of knowledge in multiple disciplines (see the scientific report): Radiative Transfer, Atmospheric Aerosols and Chemistry, Mars Exploration, Climate and Atmospheric Physics, and Astrobiology and Habitability

He aims to use his experience in mentoring, proposal preparation, and funding attraction, as well as in leading and developing new research lines. Moreover, he plans to develop a research group and propose new research lines in future R+D projects while consolidating ongoing international collaborations.

The proposed future research lines (see the scientific report), involve Atmospheric Dynamics, Impact of the Dust Cycle on Mars Exploration, Instrumentation Development and Calibration, and Science Return Enhancement. They are oriented towards addressing investigations of the highest scientific priority, as they are highlighted in NASEM and MEPAG (ESA and NASA roadmaps). Also, they are aligned with the Strategic Plan of Centro de Astrobiología (CAB).

If awarded, this research line will put the Spanish R&D system at the forefront of the question of dust lifting processes outside the Earth and the impact of dust accumulation on Mars Exploration (solar power is the practical solution for future reduced-cost missions), with high-impact investigations developed and coordinated in national institutions.

Resumen del Currículum Vitae:

He began his research career at U. Complutense de Madrid (4 years) with funding from an FPI grant awarded by MINECO (and 3 mobility grants for 3 three-month stays at the U. of Michigan (USA)). Then, he had a two-year appointment as a Postdoctoral Research Fellow at the University of Michigan (USA), attracting funding from NASA. He joined Centro de Astrobiología (CAB) as a Postdoctoral Researcher of the María de Maeztu Excellence Program, funded by AEI/MCIN.

He has participated in 61 scientific articles, 59 in international peer-reviewed JCR journals, including Science and Nature, and being first author in high-impact journals such as Space Science Reviews, Geophysical Research Letters or JGR: Planets. He has an h-index of 23 and these publications have received more than 2,300 citations, 742 of them in 2024/25 (Web of Science metrics).

The prioritization of high-impact studies and key collaborations has allowed him to become an international reference in radiative transfer, solar radiation instrumentation, and in the impact of the dust cycle on Mars climate and exploration. These topics are key in Mars Exploration, both from scientific and engineering contexts. In Science, he has established and led synergetic collaborations in several disciplines (see research lines). In Engineering, he is the consultant of the future Mars Sample Return mission to inform the solar panel design of the helicopter and generate power scenarios. He participates in the design and development of new instrumentation (MAHRS, WAISR, MetNet).

His strong involvement in four Mars missions, highlighting two active NASA missions: Mars 2020 (European Scientific Lead of MEDA□s TIRS instrument), and Mars Science Laboratory (Lead of REMS UV Sensor and REMS Payload Uplink/Downlink Lead), has led him to establish and consolidate international collaborations with well-known experts from +20 institutions, leading, coordinating and contributing to numerous studies.

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In 2024/25, he has participated in 18 articles outside (8) and inside (10) the frame of the mission teams. Beyond the missions, he has defined and led collaborations with experts in other fields, highlighting biosignatures and organics (INAF, Italy; Georgetown U, USA), numerical modelling (LMD, France), and colorimetry (U Granada, Spain).

He has participated in +100 contributions to international conferences, 25 as first author (10 oral). He chaired a session at the 7th MAMO Workshop, the most prestigious international congress in his field. He has been invited to give talks in R+D centers and is part of the Seminar Commission at CAB.

He is officially director/supervisor of two doctoral theses: C. Martín-Rubio (12/05/25, UCM, cum laude, fully supervised, being second author of the articles of her thesis) and T. Moya Blanco (UAH, since 01/25). He is tutor of external practices (UCM, Physics). He is frequent reviewer of JGR-Planets, GRL or Icarus. He transmits knowledge to the society, participating in media and outreach activities (talks to unspecialized audiences).

He has been strongly involved in 6 research projects, participating in the proposal definition and leading research lines in all of them. He has attracted funding from NASA (208,000 euros), designing and executing a project in USA for correcting REMS UV data. He obtained 76/100 points in the R3 Certificate 2024 call.

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TURNO GENERAL

Área Temática: **Ciencias físicas**
Nombre: GUSEVA , ANNA
Referencia: RYC2025-056580-I
Correo Electrónico: anna.guseva@upc.edu

Título: Data-driven modelling of stellar shear flows

Resumen de la Memoria:

Shear flows play a crucial role in stellar physics, triggering instabilities, driving turbulence and mixing across a wealth of flow scales. They organize themselves in large-scale coherent structures, whose transient dynamics and intermittency play a key role in generating heat, momentum and chemicals transfer, and magnetic fields in these flows. These processes determine the emergent properties of stars that can be observed yet lack explanation: rotation rates, stellar magnetic topology, activity and chemical composition. It is yet unclear how the nonlinear interaction of coherent structures in shear flows determines these emergent properties; one of the main challenges in stellar physics is thus to provide mathematical models that allow to understand and predict such interactions. Since 2014, I developed four research directions in modelling of these flows, including (i) comprehensive numerical and mathematical modelling of turbulent transport at transpiring boundaries; (ii) prediction of accretion rates in resistive accretion discs threaded by magnetic fields; (iii) elucidating mechanism of generation and collapse of dipolar fields in low-mass and pre-main-sequence stars; (iv) novel, data-driven modelling of complex nonlinear scale interactions in magnetohydrodynamic turbulence.

Due to complexity of the underlying flow equations, numerical simulations result in terabytes of data representing the flow at many scales, and are not feasible in astrophysically relevant parameter regimes. This project proposes a novel data-driven approach of model reduction to extract the dynamically relevant information from these data and to relate by extrapolation the dynamics of DNS flow structures to astrophysical observations of stars. Through studying three stellar flow configurations: shear at convective-radiative interfaces, convective- and instability-driven magnetic fields, and free shear flows in stellar atmospheric structures, it will provide low-order data-driven models for large-scale structures of these flows, and reduced prescriptions for stellar transport and magnetic activity. More generally, comprehensive understanding of shear flow physics will lead to far-reaching outcomes of this research proposal: precise definition of stellar ages, ages and masses of exoplanets, and stellar magnetic winds.

Resumen del Currículum Vitae:

Anna Guseva holds a PhD in Fluid Mechanics (University of Bremen, 2018). Since September 2025, she is an Assistant Professor at the Fluid Mechanics Department of the Polytechnic University of Catalonia (UPC). Her main research interests include turbulence and instabilities in astrophysical flows, with a unique combination of numerical, mathematical and data-driven approaches to modeling of these complex multiscale phenomena. She is an author of 19 peer-reviewed articles in high-impact journals including Physical Review Letters, Astronomy and Astrophysics, the Astrophysical Journal, and Journal of Fluid Mechanics, with 9 of them as a first author. From 2020 to 2022, she was awarded Marie Curie Research Fellowship at the University of Leeds (UK), where she introduced novel data-driven approach to reduced-order modelling of astrophysical dynamos. From 2022 to 2025, she was awarded Research Fellowship of the Paris Observatory – Paris Sciences et Lettres (PSL) University, and brought this approach to analysis of pre-main-sequence stars within the collaborative project PROMETHEE on star formation. She is an expert in astrophysical DNS and HPC, and developed her own HPC research software in MPI Fortran 90 to model magneto- and hydrodynamic instabilities in Taylor-Couette and channel flow codes. She supervised several students and PhD research projects, and has a large collaborative network in astrophysics and fluid dynamics throughout Spain, France, Germany and UK.

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TURNO GENERAL

Área Temática: **Ciencias físicas**
Nombre: FUMAGALLI , JACOPO
Referencia: RYC2025-055000-I
Correo Electrónico: jfumagalli@fqa.ub.edu
Título: Cosmic inflation at small scales: from theoretical modeling to gravitational-wave observatories

Resumen de la Memoria:

Trajectory

Throughout my career, I have contributed to the development of both formal and phenomenological aspects of the physics of the very early universe, with a particular emphasis on inflation, its interplay with particle physics, and the prospects of probing fundamental physics through gravitational waves (GWs).

I am currently an independent postdoctoral associate at the Institute of Cosmos Sciences (ICC) in Barcelona where I provide the department with a unique role, positioning myself at the intersection of theoretical cosmology, the formal aspects of quantum field theory, and GW data analysis.

At each stage of my academic path, I have led independent, innovative research and taken initiative in projects.
During my PhD at Nikhef (Amsterdam), I conceived and completed a single-author project that has earned recognition within the academic community. During my first postdoc at IAP (Paris), I initiated an independent line of research on inflation at small scales, now the core theme of this proposal. This work yielded notable results on PBHs and primordial GWs, now among my most recognized contributions to the field, and led to my involvement in the LISA Consortium, where I began working autonomously during my time at IFT (Madrid). At ICC (Barcelona), I resolved key issues in a widely debated topic, leading to two single-author papers (one already inspiring a PhD thesis). In parallel, I collaborate, mainly with local researchers, on the statistics of PBHs and continue my theoretical and observational work on the SGWB, including foreground separation, with external collaborators and within the LISA Cosmology working group (CosWG).
Beyond my research contributions, I was elected Chair of the LISA CosWG.

Research lines

My research investigates the theoretical challenges and phenomenological imprints of cosmic inflation at small scales, with the goal of connecting them to the emerging potential of gravitational-wave observatories, in particular LISA, thereby opening new avenues to probe early-universe physics beyond current observational limits.

While cosmic inflation, the leading paradigm for understanding the physics of the early Universe, successfully explains the large-scale structure of the cosmos, its small-scale dynamics (below 1 Mpc) remain largely unconstrained. These phases may leave characteristic and potentially detectable signatures in the stochastic gravitational-wave background (SGWB). If properly interpreted, such a discovery would likely have an impact on our understanding of the universe comparable to that of the CMB. As cosmologists, it is thus our duty to be equipped with both solid theoretical predictions and a clear framework for interpreting potential findings. At present, without refined theoretical understanding and analysis tools, the community is not equipped to extract or interpret a possible detection of a primordial signal.

My research seeks to bridge this gap by: (1) Developing the theory of loop corrections in inflation at small scales and their observational signatures; (2) Characterizing SGWB spectral shapes linked to small-scale inflationary features; (3) Designing methods to disentangle primordial signals from astrophysical and instrumental backgrounds; and (4) Establishing first-principles predictions for PBH abundance in frameworks that could give rise to detectable stochastic GW signals.

Resumen del Currículum Vitae:

I am a theoretical physicist particularly interested in studying different aspects related to early universe cosmology, inflation, primordial black holes and stochastic background of gravitational waves. I am a member of the Einstein Telescope collaboration and of the LISA (Laser interferometer space antenna) consortium, where I am currently co-chair of the LISA Cosmology Working Group.

I completed my BSc and MSc at the University of Pavia (Italy), graduating as the highest-ranked student in my department. During my undergraduate studies, I was also enrolled at the Institute for Advanced Studies of Pavia (IUSS) and I conducted my master□s thesis research at the University of Geneva after winning a competitive scholarship. I earned my PhD in 2018 from the University of Amsterdam., with a thesis at the intersection of particle physics and cosmology, which was awarded the Jan Kluyver Prize, the annual PhD thesis prize from the national institute of subatomic physics (Nikhef) in which I demonstrated that the predictions for the Cosmic Microwave Background parameters in the well-established Higgs inflation model are robust and independent of unknown high-energy physics.

I have held postdoctoral fellowships at the Institut d□Astrophysique de Paris (IAP)/Sorbonne U. (2018□2021), at the Instituto de Física Teórica (IFT) in Madrid (2021□2022), and I am currently an independent postdoctoral associate at the Institute of Cosmos Sciences (ICCUB) in Barcelona.

Among my key achievements are several noteworthy contributions. In 2020, I proposed a novel mechanism for seeding primordial black holes (PBHs) in multifield inflation, which has since gained traction across the community for its theoretical and observational implications. That same year, I initiated a comprehensive study on a new method to probe primordial features, namely oscillations in the primordial power spectrum linked to fundamental physics, using gravitational waves (GWs), thereby opening the assessment of their detectability with upcoming GW observatories such

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as LISA. After that, I served as one of the three lead authors in a LISA collaborative project focused on template-based analysis of the SGWB of inflationary origin. More recently, in 2023-2024, I independently proved that one-loop corrections to long-wavelength modes are unaffected by short and enhanced modes in non-slow-roll inflationary dynamics. This finding demonstrates that theoretical scenarios relevant to PBHs and GWs do not threaten CMB physics and lays the groundwork for further investigations in the field.

I have supervised two MSc students both for an entire year and I am currently supervising a PhD and a MSc student at UB.
Since 2015, I gave 60 presentations, 35 of which as invited speaker at international conferences, theory seminars and schools. I have organized international workshops (5), seminar series (3) and a PhD school related to my area of expertise.
I have 25 citable papers. Citation count according to Inspire; Total: 2088, h-index: 21, single-author: 4.

I have been the Postdoc representative at ICCUB (2023-present) and at IAP (2021), and I am currently representative in the LISA council. I have been a member of the Watch against discrimination committee at IAP (2021).
During my PhD I served as teaching assistant (4 courses), during my undergraduates I was selected as a tutor (2 courses).

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TURNO GENERAL

Área Temática: **Ciencias y tecnologías medioambientales**
Nombre: SALMÓN SARO, PABLO
Referencia: RYC2025-054980-I
Correo Electrónico: pablo.salmon.saro@gmail.com

Título: Physiological and evolutionary mechanisms of wildlife responses to anthropogenic change

Resumen de la Memoria:

My scientific career focuses on understanding how organisms respond to human-driven environmental change using an integrative approach that combines ecophysiology, evolutionary biology and biomedicine. I have developed an internationally recognised research line on the use of cellular biomarkers, such as telomeres, oxidative stress and mitochondrial function, to uncover mechanisms linking environmental conditions with health, life-history strategies and performance in wild vertebrates. My work has provided key evidence on how urbanisation, pollution and other stressors reshape fundamental physiological processes and generate evolutionary change at scale. I have also shown how variation in growth, cellular senescence, metabolism and migratory strategy influences individual survival and performance. My research combines field and experimentation with molecular techniques and comparative, meta-analytic and genomic approaches. This has enabled me to characterise physiological responses to urbanisation (e.g. early telomere shortening, antioxidant compensation, changes in coloration), document genomic signatures of urban adaptation in birds across Europe, and advance the study of physiological ageing, including tissue-specific and longitudinal mitochondrial patterns in avian models. Further, I have examined how migration and its energetic demands shape cellular traits, identifying protective mechanisms in migratory birds. Throughout my international career, I have worked at institutions in Sweden, UK and Germany, undertaken competitive research stays abroad, and built collaborations with publications, coordinated sampling and training networks. I currently hold a permanent position at the Institute of Avian Research (Germany), where I have expanded my scientific independence, coordinated multinational projects and strengthened my role as research leader, editor and supervisor. I have secured competitive funding as PI since early stages and contributed to obtaining resources for major research infrastructure. The Ramón y Cajal programme will consolidate two emerging research lines: (1) Microbiome, metabolism and migration. I will investigate how seasonal flexibility of the gut microbiome and its interactions with mitochondrial function influence energy balance, fat accumulation, migratory behaviour and resilience to stressors, integrating metagenomics, bioenergetics and experimental manipulations. I will also evaluate how pesticides and other anthropogenic factors disrupt these functional links. (2) River pollution, prey quality and physiology. I will analyse how contaminants in river systems, including heavy metals and microplastics, transfer through food webs and affect physiology, health and life-history of riparian birds. I will integrate dietary metabarcoding, physiological biomarkers and spatial analyses to understand the impacts of mining, agricultural and urban activities. Through these research lines, my goal is to establish a robust programme connecting physiological and evolutionary processes with current environmental challenges, contributing to conservation and a One Health perspective.

Resumen del Currículum Vitae:

I am an animal ecologist fascinated by the evolution of life-history strategies, physiology, and their intersection, and how this helps explain species persistence under anthropogenic change. From this cross-disciplinary perspective, I use physiological and molecular approaches, adapted from biomedical research, to investigate life-history variation and the impacts of environmental change (e.g. urbanisation, pollution) on wildlife health and fitness. Since my PhD at Lund Univ. (2017), I have led first-author publications in Nature Communications, Proc. R. Soc. B., Mol. Ecol. and Aging Cell, advancing understanding of links between physiology, ecology and challenges in human-modified environments. My research broadened during two postdoctoral positions at the Univ. of Glasgow (2017-2022), the second funded by a Basque Government fellowship, and a 4-month secondment at the Univ. of Debrecen. During this time, I developed an interdisciplinary and international profile bridging physiology and evolutionary ecology through experimental, field, meta-analytical and molecular approaches. My work on urban-driven evolution, environmental effects on cellular senescence and ecological relevance of mitochondrial physiology has gained international media interest and includes publications within the top 1% Altmetric scores. Since 2022, I have been a tenured Senior Scientist at the Institute of Avian Research (Germany), where I lead independent projects, supervise MSc, BSc and PhD students, and manage research infrastructure. So far, I have published 30 JCR-indexed studies (15 as first or senior author), 1 book chapter, a popular science monograph, and species accounts for Euskadi Breeding Atlas. I have presented at 19 international and national conferences (2 invited symposia and 13 talks) and co-organised 3 international and 1 national symposia. My research has been featured by more than 20 media outlets, including BBC, Science News and Smithsonian Magazine. I do active outreach at schools, festivals, blogs (The Conversation Spain) and radio interviews. I co-edit a Special Issue on avian migration physiology (J. of Avian Biology) and have integrated mitochondrial metabolism in ecological contexts in papers in Aging Cell and GeroScience. I have supervised 1 PhD student (senior author in 2 chapters), 5 MSc students, 2 BSc students, an Erasmus+ project, and mentored technical staff. Several students now pursue PhDs or conservation careers. I have contributed >400 hours of teaching at 4 universities, covering ecology, physiology, molecular biology and respirometry at undergraduate and postgraduate levels. I serve as Associate Editor for J. of Animal Ecology and J. of Avian Biology, and review ~10 manuscripts annually for journals such as Ecol. Let. and Proc. R. Soc. B. I have reviewed grants for 4 international funding agencies and served on 3 PhD panels. These roles reflect my scientific leadership and commitment to the research community. I have secured competitive funding as PI for 13 projects (~160 k□, including ~63 K□ directly for research), ~3.2 K□ in travel awards, and contributed to two infrastructure grants (~229K□). This funding has supported molecular and physiological research in 4 countries and supported a collaborative network of 60 co-authors in 11 countries. My international experience spans ~12 years in Sweden, the UK, Germany and Hungary.

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TURNO GENERAL

Área Temática: **Estudios del pasado: historia y arqueología**
Nombre: OLESEN , BRIAN KJÆR
Referencia: RYC2025-055522-I
Correo Electrónico: Brian.Olesen@EUI.eu
Título: Atlantic Empires and Commercial Monarchies: Spain and Denmark in the Global Eighteenth Century

Resumen de la Memoria:

Trained as an historian, my research interests lie in the fields of (1) Enlightenment studies, (2) the history of modern European political thought, 1500-1850, and (3) global history. My contribution to Enlightenment studies has been to reconstruct the intellectual history of the Scandinavian Enlightenment, a particular branch of the Enlightenment, which blossomed in eighteenth-century Scandinavia, and which was distinct from, yet intertwined with contemporary European Enlightenments. In my PhD dissertation, Monarchism, Religion, and Moral Philosophy: Ludvig Holberg and the Early Northern Enlightenment, which I have published open access, I offer a comprehensive account of the political, moral, and religious thought of the Danish-Norwegian writer Ludvig Holberg (1684-1754). Primarily celebrated for his literary and dramatic production, I demonstrate that Holberg was a versatile and prolific writer, deeply engaged in contemporary religious and political debates. Elucidating a largely unknown and unexplored branch of the Enlightenment, my research on Holberg has led me to further explore not only the relationship between the Enlightenment and the European Republic of Letters, but also to recover deeper historical ties between Enlightenment and religion. My contribution to the field of modern European political thought has focused on the rise of Danish absolutism and the relation between individual liberty and the state. My research on freedom and the state has pioneered a perspective that goes beyond the classical republicanism-monarchism divide. Highlighting the republican sources of monarchical freedom and the monarchical element of patrician republicanism, I have contributed to the generation of knowledge, ideas and results that have opened up new avenues for the study of the history of political thought. Finally, my contribution to the field of global history has focused on how Danish imperial strategies in the Global North, that is the North Atlantic and Artic regions were shaped in response to the eighteenth-century crisis of the European states system. A key focus area of my current MSCA-project, this line of research has illuminating a hitherto neglected imperial space in European and global history. Committed to the principles of open science, several of my publications have been publicised in open access journals or open access platforms. Engaging a wider public, I am presently setting up an art exhibition around engravings printed in Carsten Niebuhr□s account of his travel in the Orient. Arranged as an intersectoral partnership with the Göttinger Verlag der Kunst, the exhibition opens in April 2026. A key figure in my current MSCA project, Niebuhr□s oriental travel offers another innovative perspective on the global.

Resumen del Currículum Vitae:

My previous research has been funded by major, highly prestigious and competitive research grants from (i) the Danish Ministry of Science, Technology and Innovation (□ 120,000), (ii) the Danish Council for Independent Research □ Humanities (□ 261,248), and (iii) the European Commission, Horizon Europe (□ 189,687.36). I have pursued an international career with high degree of mobility at leading universities and research centres in Denmark, Italy, Germany, and Spain. I have established an international network that far exceeds the places in which I have worked. Throughout my career, I have been active in international projects and networks such as the highly innovative, intersectional □Federal Unions□-project. I have, moreover, taken a leading role in organising scholarly events around my core academic interests. I have previously been responsible for the organisation of 9 international congresses in three different countries, 3 scientific panels, and 3 working groups. I have attended academic congresses and presented my research in 8 different countries, giving a total of 37 papers □ most of them in English. Currently co-directing and coordinating a pioneering research network on European Abolitionism with participants from all major European countries, I have made a significant contribution to the internationalisation of research and taken leadership regarding the terms of future historical scholarship. Lastly, I have acted as a peer reviewer for Brill and for the top-ranking journal History of European Ideas. I have completed a formal course on Teaching Training at the EUI, and I have experience with academic teaching and evaluation from Denmark, Germany and Spain. In the context of my Copenhagen working group, I have mentored a group of MA and PhD students and helped to launch the academic career of one of the participants, a former MA student of mine on whose behalf I wrote a letter of recommendation. Drawing on my previous international experience and my academic leadership, while expanding the perspectives of my previous research, I am now undertaking a large-scale research project that examines enlightened reform in in the context of Danish and Spanish Atlantic empires.

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TURNO GENERAL

Área Temática: **Producción industrial, ingeniería civil e ingenierías para la sociedad**
Nombre: PEÑUELA FERNANDEZ, ANDRES
Referencia: RYC2025-054998-I
Correo Electrónico: penyuela@gmail.com

Título: Next-Generation Hydroinformatics: Transparent and Robust Tools for the Proactive Management of Water and Sediment Systems

Resumen de la Memoria:

My career is defined by ~10 years of international experience at world-leading institutions in Belgium and the UK and collaborations with the water industry in UK and Korea. My research integrates Hydroinformatics, Connectivity, and Operational Hydrology to develop robust modelling tools for the sustainable management of water and soil resources and to bridge the critical gap between academic research and engineering practice. My contributions are structured into four axes:

1. Upscaling Hydro-Sedimentary Connectivity: During my PhD, I derived new physically-based equations to quantify hydrological connectivity. These expressions provide a robust method for parameterizing subgrid-scale flow routing, essential for designing effective runoff and erosion control measures.

2. Long-term Sediment Modelling: At Liverpool, I developed MMF-TWI, a parsimonious model designed to simulate multi-decadal sediment fluxes and represent hydro-sedimentary connectivity. I validated this approach using radiometric dating of lake sedimentation records, demonstrating the utility of these proxies for reconstructing sediment yield history.

3. Operational Hydrology: At Bristol, I developed the iRONS toolbox (Python) for reservoir optimization and to bridge the gap between meteorological science and engineering. In collaboration with Wessex Water (UK) and K-water (South Korea), I applied iRONS to demonstrate that probabilistic seasonal forecasts can significantly enhance drought management and supply reliability□work recognized with the 2024 Best Research-Oriented Paper Award by the American Society of Civil Engineers (ASCE).

4. Hydroinformatics & Open Science: I champion a "glass-box" approach, developing interactive Decision Support Systems (DSS) via Jupyter Notebooks (iRONS and iMPACT-erosion) to facilitate knowledge and technology transfer to non-specialists.

I have transitioned from a contributor to a Principal Investigator (PI). I recently lead the MSCA project "Robust and accessible modelling for an effective management of agricultural soil erosion" and currently I am PI of a national project on seasonal forecasting integration and Co-PI on an AI-based soil moisture project. My leadership extends to supervision (1 postdoc, 7 MSc/Undergraduate theses), both national and international teaching (accredited Profesor Contratado Doctor), and organizing international scientific events (e.g., IAHR Symposium, EGU courses).

My proposed research addresses a "Grand Challenge": the disconnect between the Agronomic Domain (source of soil loss) and the Hydraulic Engineering Domain (sink/reservoir impacts).
Reservoir sedimentation is a critical threat to global water security. Current solutions like dredging are reactive and costly. I propose an Integrated Hydroinformatics Framework to promote and facilitate a proactive sediment management through three transformative goals:

O1. Accessible DSS
O2. Robust Reliability: rigorous model evaluation by coupling GSA with FRN
O3. Proactive Management: Hydrological Connectivity + Seasonal Weather Forecasts

This research defines a proactive early warning system for reservoir clogging. It empowers infrastructure managers to transition from reactive maintenance to preventive catchment management, ultimately extending the lifespan of critical water infrastructure and ensuring the resilience of water supply systems in Europe.

Resumen del Currículum Vitae:

I hold a PhD from Univ. catholique de Louvain (Belgium), funded by the prestigious F.R.S.-FNRS scholarship (equiv. FPU). I held postdoctoral positions at Univ. of Liverpool (2016) and Univ. of Bristol (2018; ranked 9th globally in Water Resources) before joining the Univ. of Córdoba as a Marie Sklodowska-Curie (MSCA) Fellow.

My goal is to bridge the gap between academia and engineering practice through robust, transparent tools. My contributions center on three axes:
□ Upscaling Connectivity: During my PhD, I derived new equations to quantify hydrological connectivity, solving the critical challenge of simulating subgrid runoff generation in catchment-scale models.
□ Sediment Modelling: At Liverpool, I developed MMF-TWI, a parsimonious model for multi-decadal sediment fluxes validated against lake sedimentary records (radiometric dating). At Cordoba, I created the iMPACT-erosion toolbox to transfer complex hydro-sedimentary knowledge to non-specialists.
□ Operational Hydrology: Developed the iRONS toolbox (Python) at Bristol. Collaborating with Univ. of Sheffield, I used iRONS to evaluate how seasonal forecast skill translates into operational value, earning the 2024 ASCE Best Research-Oriented Paper Award.
I established myself as an independent leader by executing the MSCA project (□226k) and currently serving as PI and co-PI on two projects (□79k total). I maintain a solid network with collaborators in the UK (Bristol, Sheffield, Liverpool, Reading), USA (Kansas, Northern Arizona), Netherlands (Wageningen), and NZ (Manaaki Whenua).

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My research translates scientific innovation into societal benefit.

- Technological Transfer: Successfully transferred research to the private sector. Developed iRONS with Wessex Water (UK) to optimize reservoir operations. Subsequently, K-water funded a project employing iRONS to optimize drought management in South Korea using seasonal forecasts.
- Open-Source Innovation: Championing a "glass-box" approach, I developed iMPACT-erosion and iRONS as open-source Decision Support Systems (DSS). These interactive tools democratize access to modelling, enabling transparent, auditable decisions for land managers and utilities.
- Dissemination: Active communication evidenced by my EGU Best Blog Post of 2020 award (explaining reproducibility via a pizza analogy) and invitations to deliver seminars at ECMWF (2019) and CSDMS (2025).

I am committed to training the next generation of engineers and researchers.

- Mentoring: Supervised a hired postdoc ("Soil Footprint" project), co-supervised 4 final degree projects (Bristol) and 4 Master's theses (Louvain and Córdoba). Currently supervising PhD students.
- Teaching: Accredited Profesor Contratado Doctor (ANECA). Substantial experience (~23 ECTS) in English (Bristol) and Spanish (Córdoba). Designed specialized short courses on Python and Sensitivity Analysis.
- Service & Evaluation: Organized the 2nd Int. Symposium on Water System Operations; EGU course co-convener. Regular reviewer for J. Hydrol., HESS, and WRR.

I advocate for Open Science and FAIR data. All outputs are public on GitHub/Zenodo and project websites (ironstoolbox.github.io, impact-erosion.github.io) to maximize reproducibility.

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TURNO GENERAL

Área Temática:	**Tecnologías de la información y de las comunicaciones**
Nombre:	SARKAR , MITRADEEP
Referencia:	RYC2025-054946-I
Correo Electrónico:	mitradeep.sarkar@icfo.eu
Título:	Espectroscopía y Nanofotónica en el Infrarrojo para Sensores Avanzados y Materiales Funcionales

Resumen de la Memoria:

My scientific trajectory is defined by continuous international mobility, strong participation in European consortia, and the development of an increasingly independent research line in thermal photonics and nanophotonics. After completing my education in India, I was awarded the Erasmus Mundus scholarship for a joint master's degree between Institut d'Optique (France) and TU Delft (Netherlands). My master's thesis at Philips Research produced a peer-reviewed publication and an international patent as co-inventor, providing early training in both academic and industrial environments.

I pursued my PhD at Université Paris-Saclay under the IDEX fellowship, complemented by a formal research stay at the University of Sherbrooke (Canada), which generated joint publications and long-term collaborations. During my postdoctoral stages in France, I contributed to the H2020 MAGENTA project and later coordinated an individual Paris Region fellowship on multimodal biomedical imaging. As the sole postdoctoral researcher driving the project, I coordinated three laboratories, defined the experimental milestones, delivered all reports and results including two peer-reviewed papers and strengthened multidisciplinary collaboration across the partner institutions.

Since joining ICFO (Spain), supported by national and ERC funding, I have consolidated an international scientific profile through collaborations with TU Delft, Vanderbilt University, and groups in Canada, Brazil, Japan, Israel, Latvia, and Iran. These collaborations have produced joint publications, coordinated experiments, and shared access to specialized instrumentation. At ICFO, I serve as the senior experimental scientist in the Thermal Photonics group, scientific responsible for the VERTEX 80v FTIR system, and superuser of the spectroscopic ellipsometry platforms. I lead the design and implementation of new characterization protocols, contributing directly to high-impact publications and patent applications in coordination with ICFO's Knowledge and Technology Transfer unit. I also serve as Expert and Project Leader at the EU-funded PhotonHub PHACTORY, where I independently design experimental workflows for SMEs and academic teams.

My leadership is further supported by my role in coordinating experimental activities for the H2020 MAGENTA consortium, the co-supervision of five PhD students and seven master's students, and teaching responsibilities at Institut d'Optique. I serve as Guest Editor for the 2025 IJMS Special Issue on Nanophotonics, Reviewing Editor for Springer Nature, and reviewer for major optics and materials journals. I have participated in scientific organizing committees and was elected to the Laboratory Board of the Charles Fabry Laboratory (CNRS).

The research line to be developed during the Ramón y Cajal contract focuses on compact, energy-efficient, CMOS-compatible mid-IR thermal emitters engineered for vibrational spectroscopy, thin-film metrology, and chiral molecular detection. By combining interferometric engineering, phonon-polariton materials, and scalable birefringent structures, this work enables precise spectral and polarization control not accessible with conventional emitters. The line responds to emerging needs in chemical sensing, optical diagnostics, and vibrational CD, and aligns with national and European priorities in photonics, sensing, and semiconduct

Resumen del Currículum Vitae:

Scientific contributions: I specialize in nanophotonic devices for sensing and energy applications, with more than 10 years of experience in theoretical and experimental photonics. My PhD demonstrated the use of hybrid plasmon polaritons for trace-molecule detection. Since then, I have worked on nanoscale light matter interactions, polariton resonances, thermal properties of colloids, and preclinical biomedical imaging. At CNRS Sorbonne University I explored magnetic nanofluids for waste-heat harvesting, and at University of Paris I helped develop multimodal imaging of blood perfusion and oxygenation in live rodents. My current research at ICFO focuses on mid long-IR nanophotonics and emerging low-dimensional materials, where I conduct several experimental activities and supervise FTIR instrumentation and nano-fabrication/optical characterization workflows.
Mobility and internationalization: My research is highly interdisciplinary and has involved collaborations with physicists, chemists, biologists, clinicians, and engineers. I have participated in projects funded by ANR, ERC, the Paris Region, and industrial partners such as Philips Research. I received the Young Researcher Award from COST Nanouptake and currently coordinate experimental projects at ICFO with partners in Spain and abroad. I have carried out research in France, Spain, the Netherlands and Canada, collaborated with several companies (Philips, FIAT, Horiba, Mapsi Photonics), and worked as an external consultant at Doliage Laboratories. I have also contributed to teaching activities at the Institut d'Optique (France) in both French and English.
Independence and leadership: I have co-authored 25 peer-reviewed papers (10 1st author, 10 2nd author), a book chapter, over 30 conference contributions, and one international patent. I have contributed to the supervision of 5 PhD candidates and 7 master's students, contributing to their scientific development and integration into research teams. I serve as an expert and project leader at PhotonHub Phactory (EU), was invited to the IR-EMPOWER workshop (2024), and participate in organizing activities such as the ICFO Experimental Lecture Series and the ICMF 2019 conference. I was elected to the Laboratory Board of the Charles Fabry Laboratory (CNRS, 2017) and act as a reviewer and guest editor for major journals (Nature, Optica, ACS, RSC, Elsevier, MDPI).