IBB UAB

INSTITUT DE BIOTECNOLOGIA I DE BIOMEDICINA

ANNUAL REPORT

2023

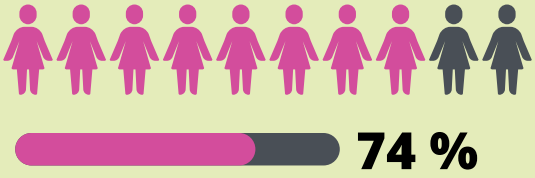
INDEX

FIGURES

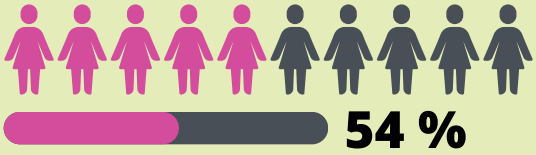
IBB UAB

Staff 217 people

23 ADMINISTRATIVE & TECHNICAL STAFF



194 RESEARCHERS



27% INTERNATIONAL

3 RESEARCH PROGRAMMES
17 RESEARCH GROUPS

Projects and publications

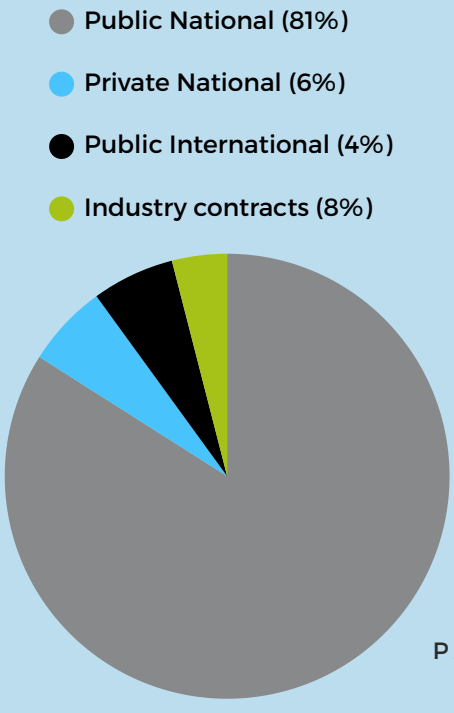
71 PUBLICATIONS

78% Q1 **25%** D1

25 COMPETITIVE PROJECTS ACTIVE

23 NATIONAL; **2** INTERNATIONAL

Funding 1,8M€



FIGURES

Academic merits

9	8	2	3
THESIS	MASTER	ICREA	ICREA ACADEMIA

3

PRIZES

Sònia Casillas:

- V Teaching Excellence Award, UAB

Salvador Ventura:

- Narcís Monturiol Medal 2022, Generalitat de Catalunya

Covadonga Vara:

- International PhD Mention & Extraordinary Doctorate Award, UAB

Tech transfer & outreach

6 PATENTS

7 INDUSTRY CONTRACTS

> 77 K€
IN SERVICES
AND INDUSTRY COLLABORATIONS

2652 SOCIAL MEDIA FOLLOWERS

24 EVENTS & VISITS

ABOUT IBB

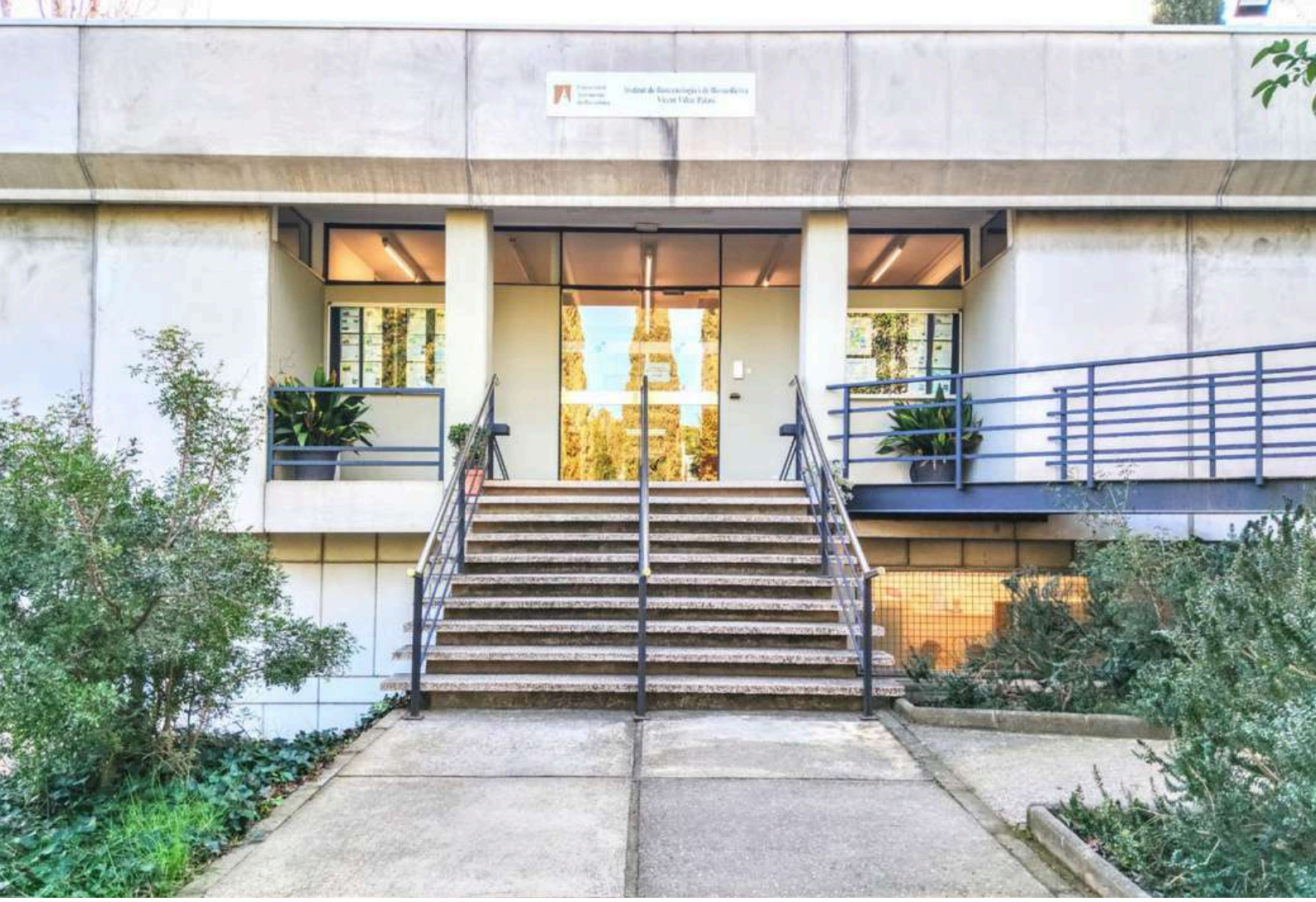
The Institut de Biotecnologia i de Biomedicina (IBB) was created in 1970 as a research institute of the Universitat Autònoma de Barcelona (UAB). Although the institute was originally devoted to promoting fundamental biological research, we have been focusing in the Biotechnology and Biomedicine fields for the last 20 years.

We conduct top-level multidisciplinary scientific research with the mission to improve the health and quality of life of the population through the production and dissemination of scientific knowledge.

Among the 194 researchers currently working at the IBB, there are lecturers and professors from the UAB, ICREA professors and senior researchers, postdoctoral fellows, and PhD and Master students.

Relevant institutional facts

- **NEREA ROHER HAS BEEN REAPPOINTED AS DIRECTOR OF THE IBB, WHILE JULIA LORENZO HAS ASSUMED THE ROLE OF EXECUTIVE ASSISTANT.**
- **THE NMR BIOMEDICAL APPLICATIONS GROUP, LED BY CARLES ARÚS, LEAVES THE IBB**
- **AN INSTITUTIONAL RECEPTION WAS HELD FOR A DELEGATION OF RESEARCHERS FROM TECNOLÓGICO DE MONTERREY (MEXICO) AND ADMINISTRATIVE STAFF FROM THE MEDICAL UNIVERSITY OF BIALYSTOK (POLAND) WITH THE AIM OF FOSTERING INTERNATIONAL COLLABORATIONS**
- **PARTICIPATION IN THE SABADELL TECHNOLOGY FORUM AND PROMOTION OF THE IBB IN THE #INVESTINSBD BROCHURE**
- **MEMBERS OF THE IBB VISITED THE ALBA SYNCHROTRON.**



RESEARCH SUPPORT STAFF

SCIENTIFIC DIRECTOR

Nerea Roher

RESEARCH TECHNICIANS

Almudena Merino
Francesca Mestres
Francisca Palma
Cristina Xufré

R&D&I PROMOTION

Montserrat Solé

MANAGER

Joan Josep Pancho

ADMINISTRATIVE SUPPORT

Lourdes Benítez
Elisabet Carrascosa
Núria Font
Natividad Infante
Rosa Puga
Lourdes Romero

RESEARCH PROGRAMES

Applied proteomics and protein engineering

Computational Biology

Theoretical Molecular Biology

Nanobiotechnology

Molecular Biology

Protein Engineering and Nanomedicine

Protein Folding and Conformational Diseases

Protein Structure

Genomics in evolution and disease

Genome Integrity and Instability

Comparative Molecular Physiology

Comparative and Functional Genomics

Bioinformatics of Genomics Diversity

Response mechanisms to stress and disease

Biosensing and Bioanalysis

Cellular Immunology

Bacterial Molecular Genetics

Evolutive Immunology

Yeast Molecular Biology

Bacterial Blood Pathogens

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

COMPUTATIONAL BIOLOGY

The main objective of our research group is the **development of new strategies to combat infections caused by multidrug-resistant bacteria**, in particular gram-negative bacteria. The increase in the emergence and spread of multidrug-resistant pathogens currently constitutes one of the main threats to public health. The shortage of effective antimicrobials for the treatment of infections by multidrug-resistant gram-negative bacteria is particularly alarming, since cases of resistance to practically all antibiotics are not uncommon. Therefore, the discovery of new therapeutic targets and mechanisms of antimicrobial action less prone to the induction of bacterial resistance has become an urgent need. In parallel, the development of effective vaccines can offer an alternative or complementary solution for at-risk population groups.

Our research team combines a series of computational and experimental techniques for the identification of antimicrobial targets with novel modes of action, as well as antigens for the development of vaccines that generate the desired type of immune response. Much of this research is carried out in collaboration with the Institute's Bacterial Molecular Genetics group.

COMPUTATIONAL BIOLOGY

Highlights

GROUP LEADER
XAVIER DAURA

Team members

Oscar Conchillo Solé: Research Support Technician

Scientific articles

A. C. Gómez, C. Horgan, D. Yero, M. Bravo, X. Daura, M. O'Driscoll, I. Gibert, T. P. O'Sullivan. **Synthesis and evaluation of aromatic BDSF bioisosteres on biofilm formation and colistin sensitivity in pathogenic bacteria**. Eur. J. Med. Chem. 2023, 261: 115819.

P. Coto-Segura, C. Segú-Vergés, A. Martorell*, D. Moreno-Ramírez, G. Jorba, V. Junet, F. Guerri, X. Daura, B. Oliva, C. Cara, O. Suárez-Magdalena, S. Abraham, J. M. Mas. **A quantitative systems pharmacology model for certolizumab pegol treatment in moderate-to-severe psoriasis**. Front. Immunol. 2023, 14: 1212981.

X. Coves, M. Bravo, P. Huedo, O. Conchillo-Solé, A. C. Gómez, A. Esteve-Codina, M. Dabad, M. Gut, X. Daura, D. Yero, I. Gibert. **A Stenotrophomonas maltophilia TetR-Like Transcriptional Regulator Involved in Fatty Acid Metabolism Is Controlled by Quorum Sensing Signals**. Appl. Environ. Microbiol. 2023, 89(6): e00635-23.

V. Junet, P. Matos-Filipe, J. M. García-Illarramendi, E. Ramírez, B. Oliva, J. Farrés, X. Daura, J. M. Mas, R. Morales. **A decision support system based on artificial intelligence and systems biology for the simulation of pancreatic cancer patient status**. CPT-Pharmacometrics & Systems Pharmacology 2023, 12(7): 916–928.

New patent

M. Chillón, J. Esandi, B. Almolda, A. Bosch, O Conchillo, X Daura, J Giraldo, P. V. Renault de Barros. **Klotho fusion protein and uses thereof**. Universitat Autònoma de Barcelona, Institució Catalana de Recerca i Estudis Avançats, Fundació Hospital Universitari Vall d'Hebrón - Institut de Recerca. Priority date: 15.06.2023. PCT/EP2024/066642.

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

THEORETICAL MOLECULAR BIOLOGY

The group, led by **Josep M. Lluch**, focuses on inflammatory processes and their molecular bases. Specifically, we are working on the design (and the design of their biocatalytic production in some cases) of two different kinds of drugs that can play an especially important role in the control and treatment of several life-threatening human diseases: Drugs related to lipoxygenases and cyclooxygenases for inflammatory-based diseases, and photoswitchable drugs, and their transfer to the production sector (Biotechnology and Pharmaceutical industry).

This research should lead to the discovery of a number of photoswitchable non-steroidal anti-inflammatory drugs (NSAIDs) without side effects. On the other hand, we try to develop a new generation of drugs (non-immunosuppressive SPMs) with great potency to stimulate the resolution of inflammation.

Nowadays the fear of cardiovascular events caused by NSAIDs has resulted in the cautious prescribing of COX-2–selective drugs in favor of older style medications that are more toxic to the gut and a failure to realize the full clinical potential of NSAIDs in the prevention of cancer. Then, we also focus on the development of new and safe COX-2 inhibitors that have a role in anti-tumor therapy.

THEORETICAL MOLECULAR BIOLOGY

Highlights

GROUP LEADER
JOSÉ M. LLUCH

Team members

Àngels González-Lafont: UAB Full Professor

PhD Thesis

Miquel Canyelles Niño, "Theoretical and experimental study of the reaction mechanism of several lipoxygenases and hydrolases: governing their product pattern by mutagenesis", directed by Àngels González-Lafont and José M. Llich. Defence date: 20/12/2023.

Scientific articles

R. Sortino; M. Cunquero; G. Castro-Olvera; R. Gelabert; M. Moreno; F. Riefolo; C. Matera; N. Fernàndez-Castillo; L. Agnetta; M. Decker, JM. Lluch, J. Hernando, P. Loza-Alvarez, P. Gorostiza. **Three-Photon Infrared Stimulation of Endogenous Neuroreceptors in Vivo**. Angewandte Chemie International Edition. 2023-12-18.

A. Zhuravlev; A.Cruz; V. Aksenov; A. Golovanov; JM. Lluch; H. Kuhn; À. González-Lafont; I. Ivanov. **Different Structures—Similar Effect: Do Substituted 5-(4-Methoxyphenyl)-1H-indoles and 5-(4-Methoxyphenyl)-1H-imidazoles Represent a Common Pharmacophore for Substrate Selective Inhibition of Linoleate Oxygenase Activity of ALOX15?**; Molecules. 2023-07-14.

K. R. Kakularam; M. Canyelles-Niño; X. Chen; JM. Lluch; À. González-Lafont; H. Kuhn. **Functional Characterization of Mouse and Human Arachidonic Acid Lipoxygenase 15B (ALOX15B) Orthologs and of Their Mutants Exhibiting Humanized and Murinized Reaction Specificities**. International Journal of Molecular Sciences. 2023-06-12.

A. Taborda; T. Frazão; MV. Rodrigues; X. Fernández-Luengo; F. Sancho; MFátima Lucas; C. Frazão; EP. Melo; M Rita Ventura; L. Masgrau, PT. Borges, LO. Martins. **Mechanistic insights into glycoside 3-oxidases involved in C-glycoside metabolism in soil microorganisms**. Nature Communications. 2023-11-14.

M. Canyelles-Niño; À. González-Lafont; JM. Lluch. **Hydroperoxidation of Docosahexaenoic Acid by Human ALOX12 and pigALOX15-mini-LO**X. International Journal of Molecular Sciences. 2023-03-23.

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

NANOBIOTECHNOLOGY

The Nanobiotechnology Unit, led by **Antonio Villaverde**, is committed to develop biomaterials, mostly based on recombinant proteins, for application in different therapeutic situations, as either drug carriers or therapeutic materials themselves. We are a member of the CIBER in the subject area of Bioengineering, Biomaterials and Nanomedicine. The team holds the Protein Production Platform which is offering services to both public and private sectors in protein production, technical advice and formation.

JL Corchero deals with the production, in mammalian cells as expression system, of recombinant human proteins for their use as therapeutics in the treatment of rare diseases (Fabry disease and Sanfilippo syndrome). and is involved in the development of new drug delivery systems. Neus Ferrer, in collaboration with IRTA, is developing protein-based nanomaterials as substitutes of antibiotics in animal medicine. Esther Vázquez develops tumor targeted protein nanoparticles as drug carriers, and smart nanoconjugates, for the treatment of colorectal cancer and triple negative breast cancer, in collaboration with Hospital Vall d'Hebron and Hospital de Sant Pau. Dr. A. Villaverde designs nanostructured protein-only antitumoral drugs for application in colorectal cancer, using intrinsically cytotoxic proteins and nanoarchitectonic peptide motives, in collaboration with E. Vázquez and Hospital de Sant Pau.

NANOBIOTECHNOLOGY

Highlights

GROUP LEADER
ANTONIO VILLAVERDE

PhD Thesis

Hèctor López Laguna, "SIMPLE BIOCHEMISTRY FOR COMPLEX PROTEIN MATERIALS", directed by E. Vázquez, A. Villaverde, U. Unzueta. Defence date: 31/03/2023.
Eric Voltà Durán, "EXPLORING AND EXPLOITING MULTI-DOMAIN RECOMBINANT PROTEINS AS TARGETED NANOMEDICAL TOOLS.", directed by E. Vázquez, A. Villaverde, U. Unzueta. Defence date: 12/09/2023.

Scientific articles

Español, P., Rovira, R., Caruana, P., Luna-Guibourg, R., Soler, C., Teixeira, N., Rodríguez, F., Gallardo, A. Edwards, M. Porta, O. Gámez, M., Sánchez, O. Llurba, E. Corchero, JL. Céspedes, M. V. (2023). **Dopamine receptors D1 and D2 show prognostic significance and potential therapeutic applications for endometrial cancer patients.** Gynecologic Oncology, 176, 25-35.

Jose Vicente Carratalá, Anna Arís, Elena Garcia-Fruitós, Neus Ferrer-Miralles. 2023. **Design strategies for positively charged endolysins: Insights into Artilysin development**. Biotechnology Advances 69, 108250.

López-Cano, A.; Ferrer-Miralles, N.; Sánchez, J.; Carratalá, J.V.; Rodriguez, X.R.; Ratera, I.; Guasch, J.; Pich, O.Q.; Bierge, P.; Garcia-de-la-Maria, C.; et al. **A Novel Generation of Tailored Antimicrobial Drugs Based on Recombinant Multidomain Proteins**. Pharmaceutics 2023, 15, 1068.

Hèctor López-Laguna, Ariana Rueda, Carlos Martínez-Torró, Lucía Sánchez-Alba, José Vicente Carratalá, Jan Atienza, Eloi Parladé, Julieta M. Sánchez, Naroa Serna, Eric Voltà-Durán, Neus Ferrer-Miralles, David Reverter, Ramon Mangues, Antonio Villaverde, Esther Vázquez, Ugutz Unzueta. 2023. **Biofabrication of Self-Assembling Covalent Protein Nanoparticles through Histidine-Templated Cysteine Coupling**. ACS Sustainable Chemistry & Engineering 11: ,4133−4144. Journal front cover.

Eric Voltà-Durán, Eloi Parladé, Naroa Serna, Antonio Villaverde, Esther Vazquez and Ugutz Unzueta. 2023. **Endosomal escape for cell-targeted proteins.** Going out after going in Biotechnology Advances 63, 108103.

Yáiza Núñez, Annabel Garcia-León, Aïda Falgàs, Naroa Serna, Laura Sánchez-García, Ana Garrido, Jorge Sierra, Alberto Gallardo, Lorena Alba-Castellón, Patricia Álamo, Ugutz Unzueta, Esther Vázquez, Antonio Villaverde, Ramon Mangues, Isolda Casanova. 2023. **T22-PE24-H6 nanotoxin selectively kills CXCR4-high expressing AML patient cells in vitro and potently blocks dissemination in vivo**. Pharmaceutics 15, 727.

NANOBIOTECHNOLOGY

Highlights

GROUP LEADER
ANTONIO VILLAVERDE

Scientific articles

José Luis Corchero, Marianna T P. Favaro, Merce Márquez-Martínez, Jara Lascorz, Carlos Martínez-Torró, Julieta M. Sánchez, Hèctor López-Laguna, Luís Carlos de Souza Ferreira, Esther Vázquez, Neus Ferrer-Miralles, Antonio Villaverde, Eloi Parladé. 2023. **Recombinant proteins for assembling as nano- and micro-scale materials for drug delivery: A host comparative overview**. Pharmaceutics, 15, 1197.

José Vicente Carratalá, Jan Atienza-Garriga, Hèctor López-Laguna, Esther Vázquez, Antonio Villaverde, Julieta M. Sánchez, Neus Ferrer-Miralles. 2023. **Enhanced recombinant protein capture, purity and yield from crude bacterial cell extracts by N-Lauroylsarcosine-assisted affinity chromatograph**y. Microbial Cell Factories, 22:81.

Carlos Martínez-Torró, Lorena Alba-Castellón, Luis Miguel Carrasco-Díaz, Naroa Serna, Laura Imedio, Alberto Gallardo, Isolda Casanova, Ugutz Unzueta, Esther Vázquez, Ramón Mangues, Antonio Villaverde. 2023. **Lymphocyte infiltration and antitumoral effect promoted by cytotoxic inflammatory proteins formulated as self-assembling, protein-only nanoparticles**. Biomedicine & Pharmacotherapy, 164: 114976.

Alamo, Patricia; Parladé, Eloi; Favaro , Marianna; Gallardo, Alberto; Mendoza, Rosa; Ferreira, Luis; Roher, Nerea; Mangues, Ramon; Villaverde, Antonio; Vázquez, Esther. 2023. **Probing the biosafety of implantable artificial secretory granules for the sustained release of bioactive proteins**. ACS Applied Materials & Interfaces. 15, 39167–39175.

Eloi Parladé, Julieta M. Sánchez, Hèctor López-Laguna, Ugutz Unzueta, Antonio Villaverde and Esther Vázquez. 2023. **Protein features instruct the secretion dynamics from metal-supported synthetic amyloids.** International Journal of Biological Macromolecules. 126164.

Ariana Rueda, Lorena Alba-Castellon, Eloi Parladé, Esther Vázquez, Antonio Villaverde, Ramon Mangues, Ugutz Unzueta. 2023. **Site-directed cysteine coupling of disulfide-containing non-antibody carrier proteins (THIOCAPs)**. Science China Materials. 66: 4109–4120.

Serna N, López-Laguna H, Aceituno P, Rojas-Peña M, Parladé E, Voltà-Durán E, Martínez-Torró C, Sánchez JM, Di Somma A, Carratalá JV, Livieri A, 1, Ferrer-Miralles N, Vázquez E, Unzueta U, Roher N, Villaverde A. 2023. **Efficient Delivery of Antimicrobial Peptides in an Innovative, Slow-Release Pharmacological Formulation**. Pharmaceutics. 15:2632.

NANOBIOTECHNOLOGY

Highlights

GROUP LEADER
ANTONIO VILLAVERDE

Scientific articles

Adrià López-Cano , Neus Ferrer-Miralles, Julieta Sánchez, Jose Vicente Carratalá, Xavier Rodriguez Rodriguez, Imma Ratera, Judith Guasch, Oscar Q. Pich, Paula Bierge, Cristina Garcia-de-la-Maria, Jose M. Miro, Elena Garcia-Fruitós and Anna Arís. 2023. **A Novel Generation of Tailored Antimicrobial Drugs Based on Recombinant Multidomain Proteins**. Pharmaceutics 15: 1068

Jose Vicente Carratalá, Anna Arís, Elena Garcia-Fruitós, Neus Ferrer-Miralles. 2023. **Design strategies for positively charged endolysins: Insights into Artilysin development**. Biotechnology Advances 69: 108250.

Highlighted project

New protein-based nanodrugs for the development of targeted tumor-agnostic therapy. MINISTERIO DE CIENCIA E INNOVACIÓN (CPP2021-008946). Nanoligent SL, UAB, Institut d'Investigació de l'Hospital de La Santa Creu i de San Pau. 2022 - 2024. 1.689.076,01 €. PI: E. Vázquez (coordinated by Nanoligent)

"This is a project to carry out preclinical trials of a nanoparticle with selective antitumor activity on stem cells with antimetastatic activity"

New patent

VÁZQUEZ GÓMEZ, Esther; VILLAVERDE CORRALES, Antonio; LÓPEZ LAGUNA, Hector; MARTÍNEZ TORRÓ, Carlos; NOFRARÍAS ESPADAMALA, Miquel; MAJO MASFERRER, Natalia; ARGILAGUET MARQUÈS, Jordi; BOSCH I CAMÓS, Laia; RODRÍGUEZ GONZÁLEZ, Fernando; BERTRAN DOLS, Kateri; ARAGÓN FERNÁNDEZ, Virgina. **Immunogenic composition with protein micro- and nanoparticles. Universitat Autònoma de Barcelona, IRTA-CRESA.** European Patent, PCT/EP2023/060476, Date of Receipt: 21/04/2023.

Other highlights

- The **spin-off Nanoligent**, dedicated to bringing the nanoparticles generated by the group to clinical use, remains **fully active**. It has raised €6 million in public and private funds, and is about to close a second round of investment.
- **Internship of Sara Chellou**, student of the Nanoscience and Nanotechnology Degree at the UAB. 10/07/2023 to 29/09/2023.
- **Internship of Kamila Bindek and Annia Wasiluk**, students of the University of Gdansk. Funded by the Exchange Program "Erasmus +". 02/10/2023 to 03/12/2023.

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

MOLECULAR BIOLOGY

Mycoplasmas are among the simplest biological systems and represent an attractive model of a minimal genome and a self-replicating minimal cell. However, their biology remains largely unknown. In addition, *M. genitalium* is an emerging sexually transmitted human urogenital pathogen with an increasing prevalence worldwide. with an alarming increase in resistance to antibiotic therapies.

We aim at developing by rational design a non-antibiotic drug for the therapy of *M. genitalium* infections. The candidate molecules are tested to determine their activity in mycoplasma cells using bioassays designed "ad hoc". A second relevant objective is the characterization of proteins involved in virulence and pathogenicity or in depth in some that we have begun to study. We are currently working on the determination of the 3D structure at atomic resolution by electron cryomicroscopy of the adhesion complex or Nap and on obtaining a panel of mutants to study the structure-function relationships of this complex, which also plays a central role in adhesion and cell motility. The study of structure-function relationships also extends to two additional cytoskeletal proteins, P32 and HMW1, and for these studies we are developing isogenic strains of M. genitalium carrying serial deletions in the repeated regions (MgPars) of the genome. Finally, the study of virulence factors is completed with a bioinformatic approach based on our experience in "moonlighting" proteins.

MOLECULAR BIOLOGY

Highlights

GROUP LEADER
JAUME PIÑOL

Team members

Jesús Jiménez Jordan: Master student
Marina Marcos Silva: Pre-doctoral researcher (FI grant)
Juan Cedano Rodríguez: Associate professor
Josep Antoni Pérez-Pons: Professor "agregat"
Enrique Querol Murillo: Emeritus professor
Angel Mozo Villarías: Honorary researcher

Master Thesis

Jesús Jiménez Jordan, "Development of a method to introduce unmarked point mutations in the genome of Mycoplasma genitalium and its application in the study of the transcriptional regulator MraZ", directed by Jaume Piñol. Defence date: 10/09/2023.

Scientific articles

Sprankel L, Vizarraga D, Martín J, Manger S, Meier-Credo J, Marcos M, et al. **Essential protein P116 extracts cholesterol and other indispensable lipids for Mycoplasmas**. Nat Struct Mol Biol. 2023;30: 321–329. doi:10.1038/s41594-023-00922-y

"This article was published in a high-impact journal and documents the discovery and properties of the first mycoplasma protein involved in the uptake of cholesterol and other essential lipids from human lipoproteins. This article opens a promising avenue for the development of innovative biotechnological and biomedical tools in the field of lipid diseases"

Huerta M, Franco-Serrano L, Amela I, Perez-Pons JA, Piñol J, Mozo-Villarías A, et al. **Role of Moonlighting Proteins in Disease: Analyzing the Contribution of Canonical and Moonlighting Functions in Disease Progression**. Cells. 2023;12. doi:10.3390/cells12020235

Cedano JA, Querol E, Mozo-Villarías A. **How hydrophobicity shapes the architecture of protein assemblies**. Eur Phys J E Soft Matter. 2023;46: 62. doi:10.1140/epje/s10189-023-00320-8

MOLECULAR BIOLOGY

Highlights

GROUP LEADER
JAUME PIÑOL

Highlighted project

PID2021-125632OB-C22. Virulence and pathogenicity of mycoplasmas from pneumoniae cluster. Design of antiadhesion drugs for antimicrobial therapy (2022-25). IP J. Piñol. Coordinated with Institut de Biologia Molecular de Barcelona (CSIC). Funding agency: Ministerio de Ciencia e Innovación, Spain.

New patent

Application MX2023007814A. González Luis González, Ribas Jaume Piñol, Murillo Enrique Querol, Arnau Marta Sitjà, Arguello Jesús María Osorio, Giralt Jordi Montané. **Composiciones inmunogenicas y vacunales contra la disenteria porcina**. Publication date 2023-07-07. Hipra Scientific SLU.

Highlighted conferences and outreach

- "Structural and functional studies of antibodies halting motility in Mycoplasmoides pneumoniae reveal the dynamic nature of the adhesion complex: contribution of transmembrane Engelman motifs". International knowledge exchange between collaborating laboratories. 23rd October, 2023. Toulouse, France.

- "24th Biennial Congress of the International Organization Mycoplasmology (IOM 2023)". July 16th to July 20th, 2023. OSAKA CITY CENTRAL PUBLIC HALL. Osaka, Japan.

- "33rd European Congress of Clinical Microbiology & Infectious Diseases". 15-18th April, 2023. Copenhagen, Denmark.

- Outreach conference at the Faculties of Sciences and Biosciences of the UAB within the cycle on the Nobel Prizes "The underrated research of RNA as a therapeutic molecule" (Nobel Prize in Physiology or Medicine 2023)

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

PROTEIN ENGINEERING AND NANOMEDICINE

The research developed by the group, led by **Julia Lorenzo**, focuses on protein engineering towards the generation of functional nanocarriers and bioinspired nanomaterials for applications in both nanomedicine and nanotechnology. They devote special attention to development of biocompatible nanomaterials and the study of their biological properties and interactions under clinically relevant conditions.

MAIN RESEARCH LINES:

- Design and validation of nanomaterials for brain disease treatment and diagnosis.
- Development of drug delivery systems based on engineered enzymes.
- Improvement of approaches for intranasal drug delivery.
- Elucidation of the cellular roles of metallocarboxypeptidases for biomedical or biotechnological uses.

PROTEIN ENGINEERING AND NANOMEDICINE

Highlights

GROUP LEADER
JULIA LORENZO

Team members

Sebastian Tanco: UAB Assistant Professor
Tamara Fernández: "Beatriu de Pinós" Postdoctoral Researcher
Paula Melón: Predoctoral Researcher
Pau Sarlé: Predoctoral Researcher
Paula Alfonso: Predoctoral Researcher
Marta Mulero: Predoctoral Researcher
Eddie Pradas: Predoctoral Researcher

PhD Thesis

Rafael Jiménez, "Targeting aldehyde dehydrogenases in combined therapy against glioblastoma", directed by jaume Farrés and Julia Lorenzo. Defence date: 30/06/2023.

Master Thesis

Núria Basanta, "Development of nanoconjugates based on star-shaped polymers for the intranasal treatment of Parkinson's disease", directed by Julia Lorenzo and Sebastian Tanco. Defence date: 14/07/2023.

Scientific articles

Gianni Ciofani, Marco Campisi, Clara Mattu, Roger D Kamm, Valeria Chiono, Alex Moothedathu Raynold, Joao Freitas, eugenio redolfi riva, Silvestro Micera, Carlotta Pucci, Fernando Novio, Julia Lorenzo, Daniel Ruiz-Molina, Giulia Sierri, Francesca Re, Hannah Wunderlich, Prachi Kumari, Kristen Kozielski, Mounia Chami, Attilio Marino and Lino Ferreira. **Roadmap on Nanomedicine for the Central Nervous System**. JPhys Materials. 2023. 6. 022501.DOI:10.1088/2515-7639/acab88. IF= 4.9 (Q2/MATERIALS SCIENCE, MULTIDISCIPLINARY).

Rodriguez-Calado S, Van Damme P, Avilés FX, Candiota AP, Tanco S, Lorenzo J*. **Proximity Mapping of CCP6 Reveals Its Association with Centrosome Organization and Cilium Assembly**. Int J Mol Sci. 2023 Jan 9;24(2):1273. doi: 10.3390/ijms24021273. IF= 4.9 (Q1/ Biochemistry & Molecular Biology).

Gonçalo A. Marcelo, David Montpeyó, Joana Galhano, Ramón Martínez-Máñez, Jose Luis Capelo-Martinez, Julia Lorenzo, Carlos Lodeiro*, Elisabete Oliveira*. **Development of New Targeted Nanotherapy Combined with Magneto-Fluorescent Nanoparticles against Colorectal Cancer**. Int J Mol Sci 2023 Apr 1;24(7):6612. doi: 10.3390/ijms24076612. IF= 4.9 (Q1/ BIOCHEMISTRY & MOLECULAR BIOLOGY).

PROTEIN ENGINEERING AND NANOMEDICINE

Highlights

GROUP LEADER
JULIA LORENZO

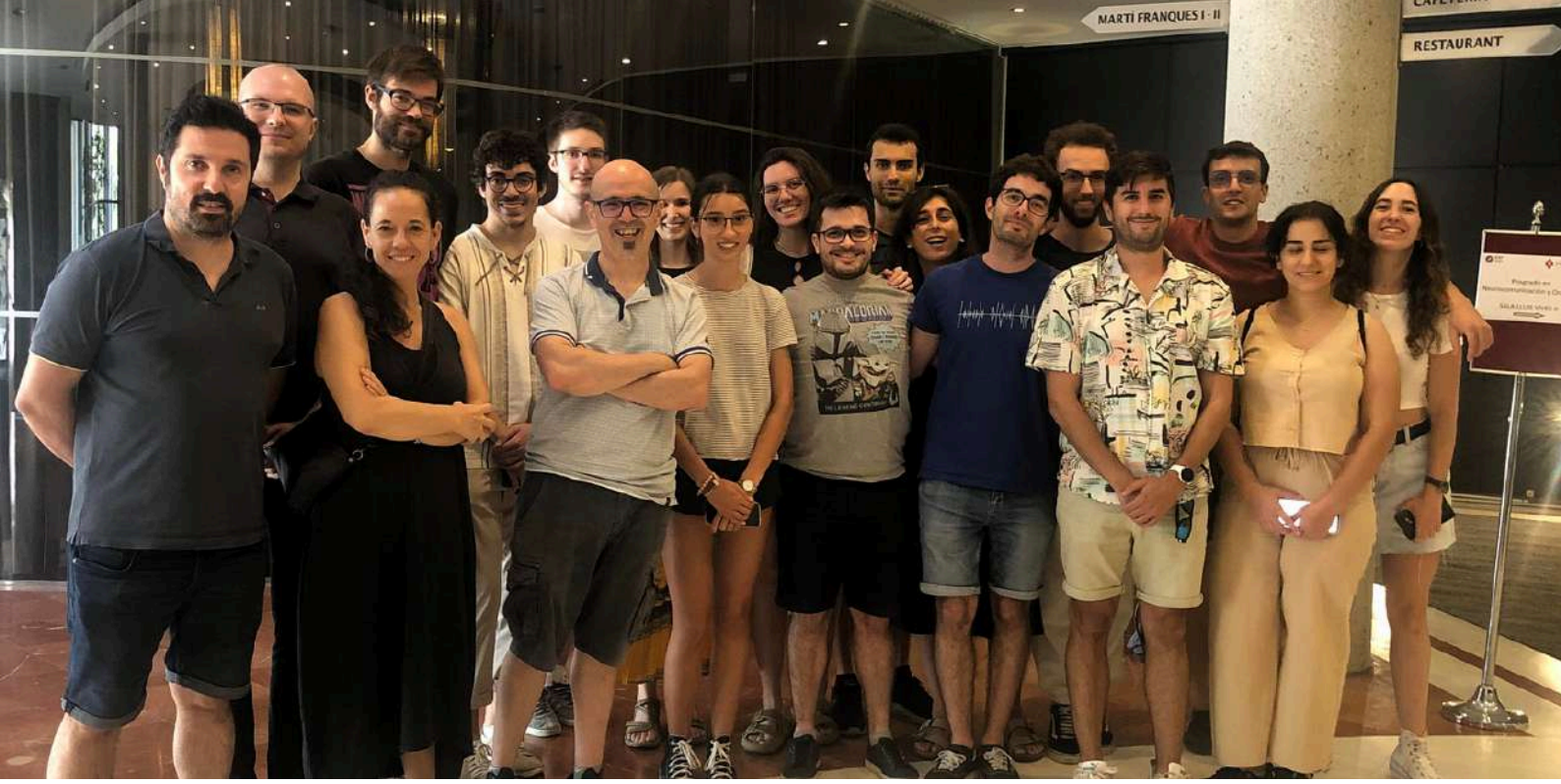
Scientific articles

Alfonso P. Lorenzo J., Candiota AP., Arús C., Ruíz-Molina D., Novio F. **Platinum-Based Nanoformulations for Glioblastoma Treatment: The Resurgence of Platinum Drugs?** Nanomaterials (Basel). 2023 May 12;13(10):1619. doi: 10.3390/nano13101619. IF= 4.4 (Q2/ MATERIALS SCIENCE, MULTIDISCIPLINARY)

Rojas L, Cabrera-Muñoz A, Espinosa LA, Montané S, Alvarez-Lajonchere L, Mojarena JD, Moya G, Lorenzo J, González LJ, Betzel C, Alonso-Del-Rivero Antigua M. **CogiTx1: A novel subtilisin A inhibitor isolated from the sea anemone Condylactis gigantea belonging to the defensin 4 protein family**. Biochimie. 2023 Apr 25;213:41-53. doi: 10.1016/j.biochi.2023.04.015. IF= 3.3 (Q2/ BIOCHEMISTRY & MOLECULAR BIOLOGY).

Patents

Martínez Marta, Lorenzo Julia, Vicent Maria Jesús, Novio Fernando, Montpeyó David, Pradas Eddi, Conejos Inma, Molina Daniel. **Glucocerebrosidase (GBA) polymer conjugate, preparation method and use for nanotechnological based Enzyme Replacement Therapy.** VHIR, UAB, CIPF e ICN2. Priority date: 29/11/2022. EP22383152. PCT 29/11/2023.



APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

PROTEIN FOLDING AND CONFORMATIONAL DISEASES

The group, led by **Salvador Ventura**, aims at studying the fundamental aspects of protein folding, misfolding, and aggregation, with a special focus on their molecular and structural determinants. In addition to defining the principles that govern these processes, their research aims to understand how their deregulation leads to the onset of human conformational diseases, such as neurodegenerative disorders. To this end, they use a multidisciplinary approach and integrate state-of-the-art techniques in computational biology, structural biology, molecular biology, biochemistry, and biophysics. By leveraging their knowledge, they develop innovative therapeutic molecules that target the pathogenic species of proteins involved in conformational disesaes. In particular, their effort focuses on developing disease modifying therapies to treat Parkinson's Disease, such as peptide-based therapies, immunotherapies and vaccines. Finally, their expertise also allows them to design and produce novel self-assembled materials for nanotechnology applications, including biosensors, biocatalysts, multivalent binders and vaccine platforms.

Ultimately, the group's goal is to contribute to the development of innovative technologies and molecules that improve human health.

PROTEIN FOLDING AND CONFORMATIONAL DISEASES

Highlights

GROUP LEADER
SALVADOR VENTURA

Team members

Irantzu Pallarès: Associate professor
Susanna Navarro: Postdoctoral Researcher
Javier Pardo: Postdoctoral Researcher
Michal Burdukiewicz: Postdoctoral Researcher
Valentín Iglesias: Postdoctoral Researcher
Jordi Pujols: Postdoctoral Researcher
Samuel Peña: Postdoctoral Researcher
Jaime Santos: Postdoctoral Researcher
Francisca Garcia de Carvalho: Postdoctoral Researcher
Molood Behbahanipour: Predoctoral Researcher
Marc Fornt: Predoctoral Researcher
Carlos Pintado: Predoctoral Researcher
Andrea Bartolomé: Predoctoral Researcher
Zoe Manglano: Predoctoral Researcher
Oriol Bárcenas: Master Student
Marta Falappi: Master Student
Marc Estivill: Undergrad student
Marc Montoursí: Undergrad student

PhD Thesis

Francisca Garcia de Carvalho, "Advancing in the treatment of transthyretin amyloidosis: Utilizing structure-driven approaches to develop kinetic stabilizers", directed by Salvador Ventura and Irantzu Pallarès. Defence date: 18/07/2023.

Jaime Santos, "Prevention of α-synuclein aggregation. Discovering disease-modifying molecules in Parkinson's disease", directed by Salvador Ventura and Irantzu Pallarès. Defence date: 11/04/2023.

Master Thesis

Oriol Bárcenas, "Structural determinants of α-synuclein binding to an inhibitory peptide studied by molecular dynamics simulations", directed by Salvador Ventura and Ramon Crehuet. Defence date: 05/07/2023.

Marta Falappi, "Advancing in the treatment of Parkinson's Disease:unraveling oligomer's conformational determinants", directed by Salvador Ventura. Defence date: 05/07/2023.

Scientific articles

Garcia-Pardo J, Ventura S. **Chemical targeting of amyloids**. Nat Chem Biol. 19(10):1176-1177. (2023). DOI: 10.1038/s41589-023-01394-3.

PROTEIN FOLDING AND CONFORMATIONAL DISEASES

Highlights

GROUP LEADER
SALVADOR VENTURA

Scientific articles

Kohler V, Arunagiri A, Ventura S. Kroschwald S, Ranganathan S. Editorial: **Molecular determinants of protein assemblies in health and disease**, Volume II. Front Mol Biosci. 10:1343082. (2023). DOI: 10.3389/fmolb.2023.1343082

Basu S, Martínez-Cristóbal P, Ventura S, Hnisz D, Salvatella X. **Rational optimization of a transcription factor activation domain inhibitor**. Nat Struct Mol Biol. 30(12):1958-1969. (2023). DOI: 10.1038/s41594-023-01159-5.

Pinheiro F, Varejão N, Sánchez-Morales A, Bezerra F, Navarro S, Velázquez-Campoy A, Busqué F, Almeida MR, Alibés R, Reverter D, Pallarès I, Ventura S. PITB: **A high affinity transthyretin aggregation inhibitor with optimal pharmacokinetic properties**. Eur J Med Chem. 5;261:115837. (2023). DOI: 10.1016/j.ejmech.2023.115837.

Behbahanipour M, Benoit R, Navarro S, Ventura S. **OligoBinders: Bioengineered Soluble Amyloid-like Nanoparticles to Bind and Neutralize SARS-CoV-2**. ACS Appl Mater Interfaces. 15(9):11444-11457. (2023). DOI: 10.1021/acsami.2c18305.

Garcia-Pardo J, Badaczewska-Dawid AE, Pintado-Grima C, Iglesias V, Kuriata A, Kmiecik S, Ventura S. **A3DyDB: exploring structural aggregation propensities in the yeast proteome**. Microb Cell Fact. 22(1):186. (2023). DOI: 10.1186/s12934-023-02182-3.

Navarro S, Díaz-Caballero M, Peccati F, Roldán-Martín L, Sodupe M, Ventura S. **Amyloid Fibrils Formed by Short Prion-Inspired Peptides Are Metalloenzymes.** ACS Nano. 17(17):16968-16979. (2023). DOI: 10.1021/acsnano.3c04164.

Ruiz-Solaní N et al. , Salguero-Linares J, Armengot L, Santos J, Pallarès I, van Midden KP, Phukkan UJ, Koyuncu S, Borràs-Bisa J, Li L, Popa C, Eisele F, Eisele-Bürger AM, Hill SM, Gutiérrez-Beltrán E, Nyström T, Valls M, Llamas E, Vilchez D, Klemenčič M, Ventura S, Coll NS. **Arabidopsis metacaspase MC1 localizes in stress granules, clears protein aggregates, and delays senescence**. Plant Cell. 35(9):3325-3344. (2023). DOI: 10.1093/plcell/koad172.

Ventura S. Kogan MJ, Diaz-Espinoza R. **Editorial: Peptide assemblies in nanotechnology**. Front Mol Biosci. 10:1281543. (2023). DOI: 10.3389/fmolb.2023.1281543.

Santos J, Ventura S. Pallarès I. **LL-37 and CsgC exemplify the crosstalk between anti-amyloid, antimicrobial, and anti-biofilm protein activities**. Neural Regen Res. 18(5):1027-1028. (2023). DOI: 10.4103/1673-5374.355757.

PROTEIN FOLDING AND CONFORMATIONAL DISEASES

Highlights

GROUP LEADER
SALVADOR VENTURA

Scientific articles

Pintado-Grima C, Bárcenas O, Iglesias V, Santos J, Manglano-Artuñedo Z, Pallarès I, Burdukiewicz M, Ventura S. **aSynPEP-DB: a database of biogenic peptides for inhibiting α-synuclein aggregation**. Database (Oxford). 2023:baad084. (2023). DOI: 10.1093/database/baad084.

Peña-Díaz S, García-Pardo J, Ventura S. **Development of Small Molecules Targeting α-Synuclein Aggregation: A Promising Strategy to Treat Parkinson's Disease**. Pharmaceutics. 15(3). (2023). DOI: 10.3390/pharmaceutics15030839.

Pintado-Grima C, Santos J, Iglesias V, Manglano-Artuñedo Z, Pallarès I, Ventura S. **Exploring cryptic amyloidogenic regions in prion-like proteins from plants**. Front Plant Sci 13:1060410. (2023). DOI: 10.3389/fpls.2022.1060410.

Garcia-Pardo J, Bartolomé-Nafría A, Chaves-Sanjuan A, Gil-Garcia M, Visentin C, Bolognesi M, Ricagno S, Ventura S. **Cryo-EM structure of hnRNPDL-2 fibrils, a functional amyloid associated with limb-girdle muscular dystrophy D3**. Nat Commun. 14(1):239. (2023). DOI: 10.1038/s41467-023-35854-0.

"In this work, we report the structure of the amyloid fibrils formed by hnRNPDL-2 isoform, which is implicated in limb-girdle muscular dystrophy type LGMD D3. Remarkably, this is the first amyloid structure solved by cryo-electron microscopy in Spain. Furthermore, we demonstrate that hnRNPDL-2 fibrils are stable, non-toxic, and capable of binding nucleic acids as a functional scaffold. In this work, we also inspect how alternative splicing can regulate the functional assembly of these supramolecular structures within the cell."

Highlighted project

COST action Non-Globular Proteins in the era of machine Learning (ML4NGP). EU, COST CA21160. 2022-2026. 800,000 EUR. Principal Investigator: Alexander Monzón. Principal Investigator UAB: Salvador Ventura.

"ML4NGP aims to create a leading research and innovation hub focused on applying the latest advances in machine learning to the study of non-globular proteins, both in health and disease. The consortium brings together several top European institutions in this field, forming a multidisciplinary team that combines state-of-the-art technologies to drive forward the study of non-globular proteins."

PROTEIN FOLDING AND CONFORMATIONAL DISEASES

Highlights

GROUP LEADER
SALVADOR VENTURA

New patents

Inhibitors of alpha-synuclein aggregation and uses thereof. Inventors: S. Ventura, I. Pallarès, J. Santos. S. Ventura, I. Pallarès, J. Santos U.S. Patent Application No. 18/005,998. Priority date and Country: 08-09-2023, U.S.

Atmc1 for clearing protein aggregates. Inventors: Coll NS, Armengot L. Ruiz-Solaní N, Salguero-Linares JM, Ventura S, Pallares I. Application number: EP23382624.7. Priority date and Country: 21-11-2023, EU.

Prizes

Salvador Ventura - **Narcís Monturiol Medal 2022**. Generalitat de Catalunya. For his contribution to scientific progress in Catalonia.

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

PROTEIN STRUCTURE

Our lab, **led by David Reverter**, uses protein crystallography with synchrotron radiation as a major procedure to decipher the molecular mechanisms that lay behind the atomic structure of proteins and protein complexes. In our lab we combine this powerful structural technique with a functional and biochemical characterization using either in vitro or in vivo methods. In the last decades structural and functional characterization of proteins and protein complexes have shed light into the most relevant molecular mechanisms in cell function.

Our research lines in the medium-long term period include the functional and structural characterization of protein complexes of the ubiquitin/SUMO pathway, such as the SUMO E3 ligase activity of the Nse2 subunit of the Smc5/6 complex, which is involved in the DNA micro-compaction and acts as a giant E3 ligase involved in DNA damage repair pathways.

Currently we are also working in the deconjugation mechanisms of SUMO and ubiquitin proteases. We have described the regulation mechanism behind the USP25 deubiquitinase, which moves from dimer (active) to tetramer (inactive) conformation, and behind USPL1, which is an unusual de-ubiquitinase that instead of ubiquitin cleaves off SUMO conjugates. Also, we have recently characterized human SENP7 and NopD from Rhizobia, interestingly the latter possessing a multiple deconjugation activity towards SUMO, ubiquitin and Nedd8.

PROTEIN STRUCTURE

Highlights

GROUP LEADER
DAVID REVERTER

Team members

Nathalia Varejão: Professor
Helena Borràs Gas: Predoctoral Researcher
Lucia Sánchez Alba: Predoctoral Researcher
Ge Huang: Predoctoral Researcher

Master Thesis

Sergio Duque, "Estudios estructurales y funcionales de la actividad SUMO en el complejo Smc5/6 humano", directed by David Reverter and Nathalia Varejão. Defence date: 14/07/2023.

Scientific articles

Varejão, N., Sánchez-Alba, L., Li, Y., Borràs-Gas, H., & Reverter, D. (2023). **Chemical tools for structural studies of ubiquitin and ubiquitin-like deconjugating proteases**. Current Research in Chemical Biology, Volume 3, 100046. doi:10.1016/j.crchbi.2023.100046.

Pinheiro, F., Varejão, N., Sánchez-Morales, Bezerra, A., Navarro, S., Velázquez-Campoy, A., Busqué, F., Almeida, M-R., Alibés, R., Reverter, D., Pallarès, I. & Ventura, S. (2023). **PITB: A high affinity transthyretin aggregation inhibitor with optimal pharmacokinetic properties.** Eur. J. Med. Chem. Dec 5:261:115837.doi: 10.1016/j.ejmech.2023.115837.

Lopez-Laguna, H.,...., Reverter, D., et al. (12/16) (2023). **Biofabrication of Self-Assembling Covalent Protein Nanoparticles through Histidine-Templated Cysteine Coupling**. ACS Sustainable Chem. Eng. 11, 10, 4133–4144 doi:10.1021/acssuschemeng.2c06635

Varejão, N. & Reverter, D. (2023). **Using Intrinsic Fluorescence to Measure Protein Stability Upon Thermal and Chemical Denaturation**. Methods Mol. Biol. 2581:229-241.doi:10.1007/978-1-0716-2784-6_16. LLIBRE

Other highlighted outputs

Oral communication at the EMBO Workshop. **"SUMOylation: From discovery to translation"** held in Povoa de Varzim (Portugal). September 2023.

GENOMICS IN EVOLUTION AND DISEASE PROGRAM

GENOMICS IN EVOLUTION AND DISEASE PROGRAM

GENOME INTEGRITY AND INSTABILITY

The research group is led by **Aurora Ruiz-Herrera** and **Ignasi Roig**, The research activity of the group has as a main objective to study of the mechanism(s) that are responsible for the origin and maintenance of mammalian genome integrity. We reach our main goal through a multidisciplinary approach, combining computational analysis and whole-genome comparisons with cutting-edge experimental technologies in both somatic and meiotic cells.

More specifically, the group is currently working in the following research lines:

- Investigate the conservation and functionality of the high-structural organization of mammalian genomes, both in the somatic and the germ line.
- Analysis of the signalling pathway that controls the progression of meiotic recombination in mammalian meiocytes.
- Identification of the role of the DNA damage response machinery in the DSB repair occurring during the meiotic prophase.
- Study how the DNA damage response mechanism controls the oocyte pool in mammals.
- Identification of non-annotated genes in the mammalian genome required to complete meiosis.
- Identification of the genetic basis of reproductive isolation and barriers of gene flow in mammalian natural populations.
- Development of a cell line repository of endangered mammalian species.
- Implementation of integrative bioinformatics and informatic tools for the analysis of the conservation and function of vertebrate genomes.
- Study the impact of COVID-19 on fertility.

GENOME INTEGRITY AND INSTABILITY

Highlights


GROUP LEADERS
AURORA RUIZ-HERRERA
IGNASI ROIG

Team members

Lucia Alvarez Gonzalez: Predoctoral Researcher
Laia Marin Gual: Predoctoral Researcher
Laura Gonzalez Rodelas: Predoctoral Researcher
Cristina Marín García: Predoctoral Researcher
Cristina Madrid Sandín: Predoctoral Researcher
Andros Maldonado Linares: Predoctoral Researcher
Nikoleta Nikou: Predoctoral Researcher
Maria López Panadés: Predoctoral Researcher

Master Thesis

Irene Alfonso Secanella, "Genomic approaches for studying of the Devil Facial Tumor Disease", directed by A. Ruiz-Herrera. Defence date: 06/07/2023.
Antonia Martí Nadal, "Role of SECISBP2 protein on female and male gametogenesis", directed by I. Roig. Defence date: 06/07/2023.

PhD Thesis

Andros Maldonado Linares, "Estudio de las funciones de TRIP13 en la profase meiòtica de mamíferos", directed by I. Roig. Defence date: 10/02/2023.

Scientific articles

S. Alonso-Alonso, A. Esteve-Codina, B. Martin-Mur, L. Álvarez-González, A. Ruiz-Herrera J. Santaló, E. Ibáñez. **Blastomeres of 8-cell mouse embryos differ in their ability to generate stem cells and produce lines with different transcriptional signatures.** Frontiers in Cell and Developmental Biology 11:1274660, 2023. DOI: 10.3389/fcell.2023.1274660

F. Javier Valero-Regalón, M. Solé, P. López Jiménez, R. de la Fuente, M. Martín-Ruiz, L. Marin-Gual, M. Valerio-de Arana, R. Gómez, M. Renfree, S. Berríos, A. Ruiz-Herrera, R. Fernández-Donoso and J. Page. **Divergent dynamics of chromosome synapsis and DNA damage signalling and distribution in marsupial meiosis**. Frontiers in Cell and Developmental Biology 11:1147610, 2023. DOI: 10.3389/fcell.2023.1147610

P.D. Waters, JAM Graves, S.L. Whiteley, A. Georges, A. Ruiz-Herrera. **The three dimensions of thermolabile sex determination**. Bioessays 45 (2), 2200123, 2023. DOI: 10.1002/bies.202200123

Huang Y, Roig I. **Genetic control of meiosis surveillance mechanisms in mammals**. Front Cell Dev Biol. 2023 Feb 23;11:1127440. DOI 10.3389/fcell.2023.1127440

GENOME INTEGRITY AND INSTABILITY

Highlights


GROUP LEADERS
AURORA RUIZ-HERRERA
IGNASI ROIG

New patent

Roig Navarro, I., Nikou ., N., & López Panadés, M. (2023). **AN ANTIOXIDANT COMPOUND FOR USE IN THE PREVENTION AND/OR TREATMENT OF THE DETRIMENTAL EFFECT CAUSED BY AGING OF THE OVARIAN RESERVE OF A FEMALE MAMMAL.** (Patent núm. WO2024105014A1).14 de nov. 2023.

Organization of scientific activities

- Session chair at the EMBO Workshop 'The evolution of animal genomes'. Sevilla, Spain. 18-21 Sept 2023.
- Session chair at the EMBO Meiosis meeting. Pamhagen (Austria). June 2023.
- Co-organizer of the XLIII Meeting of the Spanish Genetics of Society. Valencia. 21-23 June 2023.
- Organizer of 'Curso Nacional de Genética' (CNG2023). Madrid, March 2023

GENOMICS IN EVOLUTION AND DISEASE PROGRAM

COMPARATIVE MOLECULAR PHYSIOLOGY

The research group is led by **Joan Cerdà** and our primary interest is the investigation of the molecular basis of germ cell (male and female gametes) formation and function towards the development of biotechnological inventions for application in animal production and conservation biology. In our studies, we employ a broad repertoire of multidisciplinary approaches including phylogenomics and structure-function assays combined with cell and molecular biology methods, high-throughput genomics and transcriptomics, and proteomics.

The main lines of current research are:

- **Comparative evolutionary physiology of water channels (aquaporins)**. We study the structure, evolution and molecular function of aquaporins to elucidate their biological functions in male and female gametes, as well as their molecular and functional interactions with other membrane and regulatory proteins (e.g. ion channels and intracellular protein trafficking factors).

- **Molecular basis of sperm differentiation and maturation (spermiogenesis)**. Our objective is to uncover key endocrine, molecular and epigenetic regulatory mechanisms during spermiogenesis using nonmammalian model organisms.

- **Cryopreservation of highly yolked (megalecithal) oocytes and embryos**. Species producing megalecithal gametes and embryos (fish, amphibians, reptiles and birds) represent ~99% of the world's vulnerable or endangered vertebrates. However, their long-term conservation through cryopreservation has yet to be achieved. We are developing novel biotechnological innovations to facilitate freeze-tolerance in fish and amphibian oocytes and embryos to enhance their cryosurvival.

COMPARATIVE MOLECULAR PHYSIOLOGY

Highlights

GROUP LEADER
JOAN CERDÀ

Team members

François Chauvigné: CSIC Researcher
Roderick Nigel Finn: Research Professor (University of Bergen, Norway) adscribed to CSIC
Júlia Castro: Pre-doctoral researcher
Angel Rey: Pre-doctoral researcher
Noelia López: Pre-doctoral researcher

PhD Thesis

Júlia Castro Arnau, "Molecular mechanisms during the differentiation, maturation and function of marine fish spermatozoa", directed by Joan Cerdà. Defence date: 23/01/2023.

Scientific articles

Ferré A., Chauvigné F.,Vlasova A., Norberg B., Bargelloni L., Guigó R., Finn R.N., Cerdà J. (2023) **Functional evolution of clustered aquaporin genes reveals insights into the oceanic success of teleost eggs**. Molecular Biology and Evolution 40(4):msad071. DOI: 10.1093/molbev/msad071

"In this work, researchers from the IBB, in collaboration with researchers from the Norwegian Marine Research Institute, the Center for Genomic Regulation of Barcelona, and the University of Padua in Italy, provided new knowledge about how most marine teleosts developed hydration mechanisms for their eggs that allow embryos to float and disperse in the oceans. They discovered a group of duplicated water channel genes, called aquaporins, that only exist in teleosts, and are expressed in virtually all marine species that produce floating eggs. These genes allow water to flow through the membrane that surrounds the oocyte through a sophisticated system that controls the insertion of the proteins resulting from each gene in different areas of the membrane. In this way, both channels continue to perform the same function and avoid competing for the same membrane space, resulting in the acceleration of water flow into the maturing oocyte. This hydration mechanism is so effective that it provides the eggs with more than 90% water. These findings shed new light on the evolution of marine teleosts, whose ancestors ventured from freshwater to a saline environment."

Radio interview, pòdcast 'El Pou', Cugat Mèdia ("Com els peixos d'aigua dolça van conquerir els oceans"), on 12/04/2023

Ferré A., Chauvigné F., Gozdowska M., Kulczykowska E., Finn R.N., Cerdà J. (2023) **Neurohypophysial and paracrine vasopressinergic signaling regulates aquaporin trafficking to hydrate marine teleost oocytes.** Frontiers in Endocrinology 14:1222724. DOI: 10.3389/fendo.2023.1222724

COMPARATIVE MOLECULAR PHYSIOLOGY

Highlights

GROUP LEADER
JOAN CERDÀ

Scientific articles

Ferré A., Chauvigné F., Zapater C., Finn R.N., Cerdà J. (2023) **Aquaporin splice variation differentially modulates channel function during marine teleost egg hydration**. PLoS ONE 18(11): e0294814. DOI: 10.1371/journal.pone.0294814

Cerdà J., Chauvigné F., Finn R.N. (2023) **Evolution and function of peroxiporins in piscine spermatozoa. In: Peroxiporins: Redox Signal Mediators In and Between Cells** (I. Medraño-Fernández, P. Bienert, R. Sitia, eds). CRC Press/Taylor & Francis, pp 158-171.

Highlighted projects

Spanish Ministry of Science and Innovation. Ref.: PID2022-138066OB-I00. PI: J. Cerdà. Participants: R. N. Finn (CSIC-Univ. Bergen, Norway), I. Forné (LMU, Germany), O. Conchillo-Solé (IBB-UAB), C. Labbé and A. Laurent (LPGP-INRAE, France). Dates: 01/09/2023-31/08/2027.

"The paternal intergenerational effects related to epigenetic modifications, including the transfer of non-coding RNAs (cRNAs), are of increasing interest in life science research. However, the mechanisms of paternal epigenetic marks and ncRNAs inheritance at fertilization and during embryo and offspring viability are still a matter of study. Information on these mechanisms in piscine model species, such as the zebrafish, is expanding, while they remain completely unknown in most marine fish. In addition, most studies on fish have focused on the influence of the parental conditions on the epigenetic marks of ejaculated spermatozoa, rather than on the developmental regulation of transcriptional and epigenetic processes in the spermatozoa. The BIOSPERM project aims to investigate for the first time the reprogramming of the epigenome during the maturation of fish spermatozoa, and how endocrine signaling pathways and the delivery of vital factors via soma to germ cells exosomes can regulate this process and conform the final molecular cargo of the mature spermatozoon. Therefore, this research project is highly innovative and will have a high impact in the generation of entirely new knowledge in the field, with both scientific and technical implications."

Other highlighted outputs

- The group coordinates the Consolidated Research Group funded by the Generalitat de Catalunya "Fish Molecular Physiology, Epigenetics and Biotechnology" BIOAQUA (SGR2021 00068; https://webs.uab.cat/BIOAQUA/), including other groups from UAB and CSIC.

- Book: https://portalrecerca.csuc.cat/109625115?locale=en

GENOMICS IN EVOLUTION AND DISEASE PROGRAM

COMPARATIVE AND FUNCTIONAL GENOMICS

During the last years the genomic revolution has provide unique research opportunities unthought-of before. The group, led by **Mario Cáceres**, is focused on the application of the newest genomic techniques and the great wealth of available genomic data to the characterization of genetic changes across individuals and species, and how they translate in phenotypic and disease susceptibility differences.

To address these questions, they use humans as a model and take a multidisciplinary approach that combines experimental and bioinformatic analysis, generating results of interest to diverse fields. In particular, a great degree of structural variation, including hundreds of copy number variants (insertions, duplications and deletions) and inversions, has been discovered in multiple organisms. In addition, they now have the information of the variation in expression levels of thousands of genes in diverse tissues and individuals of many species. However, very little about the functional and evolutionary impact of these changes is known still.

Therefore, the goup's main line of research deals with the global analysis of polymorphic inversions in the human genome, which aims to investigate the biological significance of one of the less known types of variants in humans. This ranges from the development of new methods for inversion study and the first database of human polymorphic inversions, to the characterization of their population distribution, functional effects and selection signatures, as a way to ultimately determine their contribution to complex traits.

COMPARATIVE AND FUNCTIONAL GENOMICS

Highlights

GROUP LEADER
MARIO CÁCERES

Team members

Marta Puig: Lecturer professor
Konstantinos Karakostis: Maria Zambrano postdoctoral researcher
Elena Campoy: Pre-doctoral researcher
Ruth Gómez: Pre-doctoral researcher
Elías Yakymenko: Pre-doctoral researcher
Ricardo Moreira: Pre-doctoral researcher
Maria Diaz: Pre-doctoral researcher

Scientific articles

COVID-19 Host Genetics Initiative (including J. Lerga-Jaso and M. Cáceres). **A second update on mapping the human genetic architecture of COVID-19**. Nature 621: E7-E26 (2023).

GENOMICS IN EVOLUTION AND DISEASE PROGRAM

BIOINFORMATICS OF GENOMICS DIVERSITY

The Bioinformatics of Genomic Diversity research group, led by **Antonio Barbadilla**, analyzes and interprets genetic variation on a genomic scale in a growing number of species, including humans. The genomes of species contain stored their evolutionary histories that today, thanks to the genomic revolution, can be revealed. One of the most amazing examples of the power of natural selection is the distinctive footprint it leaves behind on patterns of genetic variation. Using theoretical population genetics models and statistical methods, they analyze and interpret genetic variation at the genomic scale while developing bioinformatics tools for cataloging and representing genetic diversity in a growing number of species.

Among other recent milestones, the group has (i) drawn the first high-resolution map of natural selection across a genome, (ii) mapped natural selection over the entire anatomy of an embryo, (iii) identified more of 800 new regions of the human genome as strong candidates to be targeted by natural selection. As a resource to facilitate research into genomic variability, they have made available to the scientific community the largest inventory of measures of genetic diversity throughout the human and Drosophila genome. Next, they ambition to create PopLife: a reference online population genomics browser across the tree of life.

Their research is regularly funded by the Spanish Science Research Agency. This research is an independent line of the Genomics, Bioinformatics and Biological Evolution group, recognized and funded by the Generalitat de Catalunya (2021 SGR 00526).

BIOINFORMATICS OF GENOMICS DIVERSITY

Highlights

GROUP LEADER
ANTONIO BARBADILLA

Master Thesis

Noah Jornet Calomarde. "Exploring altruism dynamics: A computational approach through Simulation and Artificial Neural Networks".
Cristina Amor Jiménez. "PopLife: A Population Genome Browser across the Tree of Life".

Highlighted projects

- 2023-2028: PopLife: the reference online population genomics browser across the tree of life. Antonio Barbadilla (IP), Sonia Casillas. RES - Spanish Supercomputing Network, DATE-2022-1-0015.
- 2022-2025: Genomics of adaptation populations. Researchers: Antonio Barbadilla (IP1), Jaime Martínez-Urtaza (IP2), Mauro Santos, Antonio Fontdevila, Pilar García-Guerreiro, Sònia Casillas, Raquel Egea, Andrés Santos, Jesús Murga, Aina Colomer, Ruth Gómez. MICINN PID2021-127107NB-I00
- Melanogaster Catch The Fly, "Time Flies! Observing our history and relationship with biodiversity", FECYT (FCT-23-19527)
- Integration of Nanopore Sequencing into Genomics Teaching: Improving Student Skills and Promoting Teaching Innovation (Faculty of Biosciences UAB)

Conferences and outreach activities

- PopLife: Un navegador de genómica de poblaciones para humanos, Drosophila, Vibrio y un creciente número de especies. Presentación oral. XXIII Seminario de Genética de Poblaciones y Evolución. Las Caldas, Asturias, 18-20 de enero.
- Evolucionisme versus Creacionisme. Debate. Antonio Barbadilla (Defensa evolucionisme) y Carlos Madrigal (Defensa creacionisme). Aula MIR d'extensió universitària. Montcada i Reixac. 8 de febrer de 2023.
- Svante Pääbo: En busca de genomas perdidos. Conferencia de clausura. XVIII Olimpiada española de Biología. Sala de actos de la Facultad de Biociencias. 26 de marzo 2023.
- PopLife: Genómica de poblaciones a través del árbol de la vida. X jornada científica del dpto, de Genética y Microbiología UAB. Sala de Graus de la Facultad de Biociencias. 14 de junio 2023.
- Evaluating allele frequency trajectory and selection coefficient estimates from genealogies with ancient DNA. Society Molecular Biology and Evolution (SMBE), Ferrara (Italy), July 2023.
- Bioinformática de la diversidad genética. Feria de la innovación UAB. Campus UAB, 17 de octubre.
- Svante Pääbo: En busca de genomas perdidos. Conferència Dia de la Ciència a les Escoles. INS de l'Arboç. 23 nov. 2023.

BIOINFORMATICS OF GENOMICS DIVERSITY

Highlights

GROUP LEADER
ANTONIO BARBADILLA

Conferences and outreach activities

- Svante Pääbo: En busca de genomas perdidos.Bcn Evolution Day. Museu de la Ciència CosmoCaixa, Barcelona. 25 nov. 2023.
- Svante Pääbo: En busca de genomas perdidos. Conferencia invitada curso bioinformática grado de genética de la UAB, Facultat de Biociències. 12 de diciembre.
- PopLife: A Population Genomics Browser across the Tree of Life. XI Jornades de Bioinformàtica i Genòmica. Museu de la Ciència, CosmoCaixa, Barcelona. 15-16 desembre 2023.
- Evaluating Allele Frequency Trajectory and Selection Coefficient Estimates from Genealogies including Ancient DNA data. XI Jornades de Bioinformàtica i Genòmica. Museu de la Ciència, CosmoCaixa, Barcelona. 15-16 desembre 2023.

Prizes

Sònia Casillas receives the UAB Teaching Excellence Award.

RESPONSE MECHANISMS TO STRESS AND DISEASE PROGRAM

RESPONSE MECHANISMS TO STRESS AND DISEASE PROGRAM

BIOSENSING AND BIOANALYSIS

The Biosensors and Bioanalysis Group, led by **María Isabel Pividori**, is particularly dedicated to designing rapid diagnostic test, biosensors and bioinstrumentation to contribute to the development of the next generation of in vitro diagnostic test (IVDs) for low-resource settings. These tests are meant to address societal challenges, including diseases that have a global impact on health. The group explores three key cross-cutting technological challenges in IVDs: (i) the isolation of targets from complex specimens by novel solid-phase preconcentration strategies and advanced materials including magnetic particles, magnetic molecularly-imprinted particles, magneto-actuated platforms, among others. (ii) the enhancement of the analytical signal by the integration of novel nanomaterials. (iii) The exploration of emerging diagnostic biomarkers, including the exosomes, for the early detection of global diseases.

The ultimate goal is to improve the analytical performance of IVDs, as the sensitivity, specificity and analytical simplification. Regarding the application fields, the group is mainly focused on affordable emerging technologies appropriate at community and primary-care level in healthcare and on food safety in low resource settings.

Mercè Martí is running two parallel lines of research: (1) Characterization of infiltrating T lymphocytes in samples of breast cancer (BREASTILs), in collaboration with the VHIO, and (2) Design of biosensors in the field of biomedicine (EXOSENS) with the collaboration of María Isabel Pividori.

BIOSENSING AND BIOANALYSIS

Highlights

GROUP LEADER
MARIA ISABEL PIVIDORI

Scientific articles

Magnetic Separation of Cell-Secreted Vesicles with Tailored Magnetic Particles and Downstream Applications. Bernuz, M., Pallarès-Rusiñol, A., Rossi, R., Fernández-Senac, C., Martí, M., Pividori, M.I. (2023). In: Vainio, S. (eds) Cell-Secreted Vesicles. 'Methods in Molecular Biology', vol 2668. Humana, New York, NY. https://doi.org/10.1007/978-1-0716-3203-1_18

Plasma extracellular vesicles reveal early molecular differences in amyloid positive patients with early-onset mild cognitive impairment. Amanda Cano, Pablo García, Mireia Bernuz, Raquel Puerta, Itziar de Rojas, Ester Esteban-De Antonio, Alba Pérez-Cordón, Laura Montreal, Raúl Núñez, Óscar Sotolongo-Grau, Silvia Alonso-Lana, Emilio Alarcón-Martín, Sergi Valero, Montserrat Alegret, Joan Martínez, Elvira Martín, Miren Ettcheto, Assumpta Vivas, Marta Gomez-Chiari, Miguel Ángel Tejero, Adelina Orellana, Lluís Tárraga, Marta Marquié, Mercè Martí, María Isabel Pividori, Mercè Boada, Agustín Ruiz, Journal of Nanobiotechnology 2023, 21 (1), 1-19. https://doi.org/10.1186/s12951-023-01793-7

Electrochemical genosensing of overexpressed GAPDH transcripts in breast cancer exosomes. A Pallarès Rusiñol, Lima de Moura, M Martí, MI Pividori. Electrochemical genosensing of overexpressed GAPDH transcripts in breast cancer exosomes. Analytical chemistry, 2023, 95, 2487–2495 https://doi.org/10.1021/acs.analchem.2c04773.

Advances in exosome analysis. A Pallares-Rusiñol, M Bernuz, S L Moura, C Fernández-Senac, R Rossi, M Martí and MI Pividori, in Advances in Clinical Chemistry 2023,112:69-117 https://doi.org/10.1016/bs.acc.2022.09.002

Extracellular vesicles, the emerging mirrors of brain physiopathology. Cano A, Ettcheto M, Bernuz M, Puerta R, Esteban de Antonio E, Sánchez-López E, Souto EB, Camins A, Martí M, Pividori MI, Boada M, Ruiz A. International Journal of Biological Sciences 19(3):721-743. doi:10.7150/ijbs.79063

Contracts, technological or transfer merits

- Advisory agreement in B-Triage. Proyecto de Desarrollo Tecnológico en Salud. DTS23/00105. IsGLOBAL. 1/07/2024-30/06/2025. 27.193,96 €.
- Advisory agreement in topics related with dementias. Fundació ACE Institut català de neurociències aplicades. 11/11/2020-10/11/2022.
- Contracts Bioeclosion SL. Maria Isabel Pividori Gurgo. (Department of Chemistry). 20/07/2020-19/07/2022. 17.000 €.

BIOSENSING AND BIOANALYSIS

Highlights

GROUP LEADER
MARIA ISABEL PIVIDORI

Highlighted projects

- AviaSens. Rapid Test for Viral Outbreaks in Poultry Farms. Ref: CPP2023-010442. Proyectos Colaboración Público-Privada 2023. €480.286,61 total. 03/10/2024 to 02/10/2027. Coordinator: BioEclosion SL. PI UAB: MI Pividori (106.554 €).
- SenS4IVD. Biosensing devices for in vitro diagnostics. MICINN. Ref: PID2022-136453OB-I00. 125.000,00 €. 1/09/23 to 31/08/26. PI: MI Pividori CoIp: M. Martí
- ExoSens-PoC. Enhancing tests for the early diagnosis of Alzheimer's disease. Ref: PDC2022-133363. Proyectos Pruebas de Concepto 2022. €138,000 01/12/2022 to 31/5/2025. PI UAB: MI Pividori.
- AmpliSens. Enhancing Rapid Tests for perinatal GBS. Ref: CPP2021-008459. Proyectos Colaboración Público-Privada 2021. €272,700 total. 03/10/2022 to 02/10/2025. Coordinator: BioEclosion SL Dr. PI UAB: MI Pividori (46,568 €).
- EChiLiBRiST. HORIZON-HLTH-2021-DISEASE-04-03. Ref: 101057114. €6,535,006.00 total. 01/09/2022 to 31/08/2027. Coordinator: Dr. Quique Bassat– Isglobal (ES). PI UAB: MI Pividori Gurgo (370 K€).
- ExoSens. The exosomes as diagnostic biomarkers in biosensors. MICINN. Ref: PID2019-106625RB-I00. 121.000,00 €. 01/06/2020 to 01/06/2023. PI:MI Pividori

More information at the Group's website: https://isabelpividori.net/

RESPONSE MECHANISMS TO STRESS AND DISEASE PROGRAM

CELLULAR IMMUNOLOGY

The group, led by **Dolores Jaraquemada**, is mainly foccused on the study of leukocyte cell-surface molecules, their signal transduction pathways, and their role in regulating immune responses in normal and pathological conditions.

Carme Roura-Mir investigates the mechanisms of tolerance breakdown in type 1 diabetes. The group is working on the study of events that cause metabolic alterations in β pancreatic cells as a cellular mechanism that can favor the presentation of autoantigens. The research line combines the group's experience in the analysis of the immunopeptidome presented by tissue-resident cells and professional APCs, with the analysis of T-cell responses in autoimmune diseases, along with new approaches to study the effect of stress on β-cells.

Iñaki Ruiz has focused on three projects of antigen processing and presentation:
1. The study of the interaction of the autoimmune regulator (AIRE) with E3-ubiquitin ligases.
2. The study of antigen processing by intermediate proteasomes and their contribution to the generation of the peptide repertoire of HLA class I molecules (HLA-I).
3. The analysis of the subpeptidomes generated in HLA-I molecules of the B7 supertype.

CELLULAR IMMUNOLOGY

Highlights

GROUP LEADER
DOLORES JARAQUEMADA

Team members

Carme Roura Mir: Adjunct professor
Manel García Ayala: Pre-doctoral researcher (PIF grant)
Xavier Viñas: Student
Saioa Auzmendi: Student
Iñaki Alvarez Pérez: Adjunct professor
Adrián Tirado Herranz: Pre-doctoral researcher (PIF grant)
Alba Pastor Moreno: Pre-doctoral researcher (FI-SDUR grant)
María Area Navarro: Pre-doctoral researcher (PIF grant)
Judith Perez Mormeneu: Internship studient

Collaborators

Eduarda Pizarro: Endocrinologist at Hospital Mataró
Vanessa Casas: Proteomics Specialist

PhD Thesis

Adrián Tirado Herranz, "ANÁLISIS PROTEÓMICO Y BIOQUÍMICO DEL REGULADOR AUTOINMUNE: NUEVAS FUNCIONALIDADES Y VÍAS DE DEGRADACIÓN DE AIRE", directed by Iñaki Alvarez. Defence date: 14/02/2023.

Scientific articles

Alvarez I, Tirado-Herranz A, Alvarez-Palomo B, Requena Osete J, Edel M. **Proteomic analysis of human iPSC derived neural stem cells and motor neurons identifies proteasome structural alterations**. (2023) Cells. 12:2800. https://doi.org/10.3390/cells12242800"

Tirado-Herranz A*, Guasp P*, Pastor-Moreno A, Area-Navarro M, Alvarez I. **Analysis of the different subpeptidomes presented by the HLA class I molecules of the B7 supertype.** (2023) Cellular Immunology. 387:104707. 10.1016/j.cellimm.2023.104707

RESPONSE MECHANISMS TO STRESS AND DISEASE PROGRAM

BACTERIAL MOLECULAR GENETICS

The group, led by **Isidre Gibert**, foccuses on the field of bacterial pathogenesis and antimicrobial resistance (PatoBAnt). Their research have been focused on the study of virulence and resistance determinants in different human pathogens. The group tries to unveil the genomic and molecular bases, from a genetic and functional point of view, of processes involved in pathogenesis, virulence and drug resistance.

Currently the roup has four research lines:

- Molecular and genomic bases of bacterial pathogenesis and antimicrobial agent resistance
- Quorum sensing signal-response systems in *Stenotrophomonas maltophilia*
- Study of the mechanisms of resistance to colistin in Gram-negative bacteria
- Validation of novel hit compounds as potential antibacterial drugs against Gram-negative pathogens

In collaboration with groups at IBB and other outside groups, they apply a multidisciplinary approach, ranging from classical microbiology and bacterial molecular genetics to genomics, proteomics, and bioinformatics that should end with a selection of validated targets and drugs to suppress bacterial virulence and/or resistance phenotypes.

BACTERIAL MOLECULAR GENETICS

Highlights

GROUP LEADER
ISIDRE GIBERT

Team members

Daniel Yero Corona
Andrómeda Celeste Gómez Camacho
Marc Bravo Bravo
Juan Camilo Ortiz Ortiz

Scientific articles

Gómez AC, Horgan C, Yero D, Bravo M, Daura X, O'Driscoll M, Gibert I, O'Sullivan TP. **Synthesis and evaluation of aromatic BDSF bioisosteres on biofilm formation and colistin sensitivity in pathogenic bacteria**. Eur J Med Chem. 2023 Dec 5;261:115819. doi: 10.1016/j.ejmech.2023.115819.

"This paper had a high rellevance and impact and an article was published in UABDivulga, the outreach magazine from UAB"

Coves X, Bravo M, Huedo P, Conchillo-Solé Ò, Gómez AC, Esteve-Codina A, Dabad M, Gut M, Daura X, Yero D, Gibert I. **A *Stenotrophomonas maltophilia* TetR-Like Transcriptional Regulator Involved in Fatty Acid Metabolism Is Controlled by Quorum Sensing Signals**. Appl Environ Microbiol. 2023 Jun 28;89(6):e0063523. doi: 10.1128/aem.00635-23.

Mamat U, Hein M, Grella D, Taylor CS, Scholzen T, Alio I, Streit WR, Huedo P, Coves X, Conchillo-Solé O, Gómez AC, Gibert I, Yero D, Schaible UE. **Improved mini-Tn7 Delivery Plasmids for Fluorescent Labeling of *Stenotrophomonas maltophilia*.** Appl Environ Microbiol. 2023 Jun 28;89(6):e0031723. doi: 10.1128/aem.00317-23.

Highllighted projects

Quorum Sensing regulatory networks in Stenotrophomonas maltophilia as targets for therapeutics alternatives to corrent antibiòtics: StenoQS. MICIN PID2019-111364RB-I00. 2019-2024.

"StenoQS is a project focusing on the discovery of new therapeutic strategies against infections caused by multi-drug resistant strains of the opportunistic pathogen S. maltophilia. It addresses primarily the investigation of the molecular bases of virulence in these bacteria and how it could be disarmed focusing on the quòrum sensing system. In addition, the project aims to identify compounds inhibiting the quòrum sensing network, therefore reducing the virulence of these bacteria and making the antibiotic treatment either unnecessary or more effective"

BACTERIAL MOLECULAR GENETICS

Highlights

GROUP LEADER
ISIDRE GIBERT

Highlighted outreach activities

The group and its laboratory are part of the IBB guided tour route for secondary/high school students.

In addition, we host students on stays from the ICE Argó program and organize an exhibition of informative posters as part of the summer course for high school students *What can we do to reduce antibiotic resistance?*

RESPONSE MECHANISMS TO STRESS AND DISEASE PROGRAM

EVOLUTIVE IMMUNOLOGY

The group, led by **Nerea Roher**, aims to understand host-pathogen interactions and how we can modulate the host immune system to have a good performance against pathogens. To do so, they use a combination of molecular, *in vitro* and *in vivo* methodologies.

The group develops their research using zebrafish as a model organism due to its high versatility and the availability of mutants. They do both basic and translational research on fish immunology in three main areas:

- Development of vaccines for animal health. Their approach is based on protein nanoparticles made with relevant viral antigens that will induce a good and sustained immunization through the intestinal mucosa
- Evolution of pathogen recognition in vertebrates. They are interested on Pathogen Recognition Receptors (PRRs) and specifically on Toll-like Receptors (TLRs) and in the role and biology of macrophages after pathogen exposure
- Development of diagnostic tools: biosensors for fish skin mucus. They take advantage of the high production of mucus by the fish skin to use mucus to monitorize fish health

RESPONSE MECHANISMS TO STRESS AND DISEASE PROGRAM

YEAST MOLECULAR BIOLOGY

The group, led by **Joaquín Ariño** and Antonio Casamayor, is interested in diverse topics concerning the biochemistry, the molecular biology and the genomics of the yeast *Saccharomyces cerevisiae*, specifically those that are related to cell signaling trough processes of phospho-dephosphorylation of proteins.

They have investigated the response to various stresses how these circumstances affect specific protein kinases and/or phosphatases (activity, localization, binding to other proteins, postranslational modifications…). They are also interested in the transcriptional response to saline and alkaline pH stress. As a follow-up of these studies, they are currently developing new platforms for the expression of proteins of biotechnological/industrial interest, in the yeasts S. cerevisiae and P. pastoris based on the use of natural or synthetic promoters regulated by alkaline pH.

YEAST MOLECULAR BIOLOGY

Highlights

GROUP LEADER
JOAQUÍN ARIÑO

Team members

Antonio Casamayor: Adjunct professor
Asier González: Assistant professor (since December 2023)
Marcel Albacar: Postdoctoral researcher
Abdel Zekhnini: Pre-doctoral researcher
Montserrat Robledo: Technician

Scientific articles

Bravo-Alonso, I.; Morin, M.; Arribas-Carreira, L.; Álvarez, M.; Pedrón-Giner, C.; Soletto, L.; Santolaria, C.; Ramón-Maiques, S.; Ugarte, M.; Rodríguez-Pombo, P.; Ariño, J.; Moreno-Pelayo, M.A.; Pérez, B. (2023) **Pathogenic variants of the coenzyme A biosynthesis-associated enzyme phosphopantothenoylcysteine decarboxylase (PPCDC) cause autosomal-recessive dilated cardiomyopathy.** Journal of Inherited Metabolic Disease. 46(2):261-272. doi: 10.1002/jimd.12584

Albacar, M; Zekhnini, A.; Pérez-Valle, J.; Martínez, J.L., Casamayor, A.; Ariño, J. (2023) **Transcriptomic profiling of the yeast Komagataella phaffii in response to environmental alkalinization**. Microbial Cell Factories. 22(1):63. doi: 10.1186/s12934-023-02074-6.

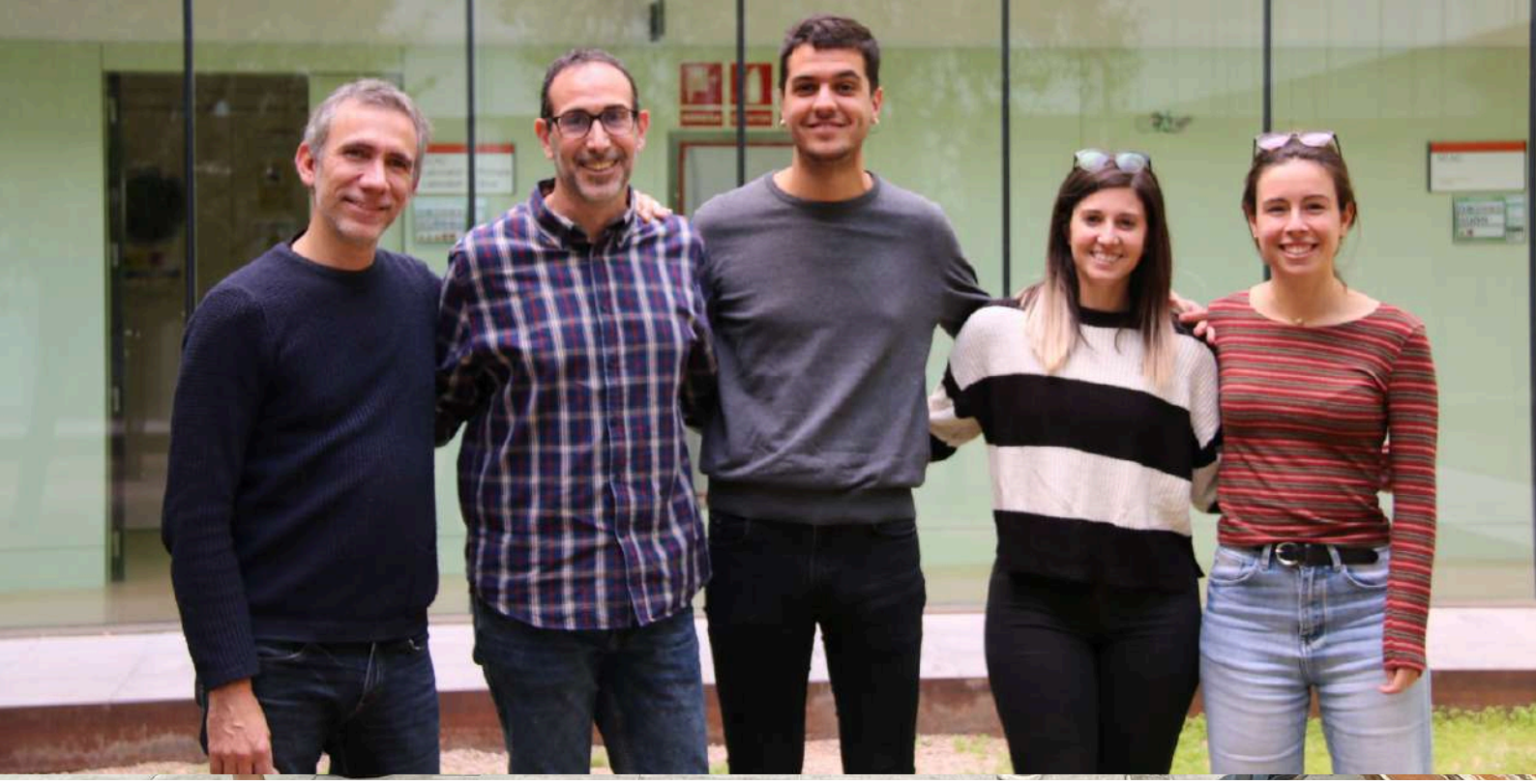
"This paper represents the first study of the transcriptional adaptation of the yeast Komagataella phaffii (P. Pastoris) to moderate alkalinization. We identified here several alkaline pH-responsive promoters able to potently produce GFP upon alkalinization. This study has been the basis for the current development of novel P. pastoris strains useful for production of industrial enzymes."

Zekhnini, A.; Albacar, M.; Casamayor, A.; Ariño, J. (2023) **The ENA1 Na+-ATPase Gene Is Regulated by the SPS Sensing Pathway and the Stp1/Stp2 Transcription Factors.** Int. J. Mol. Sci. 24, 5548. doi: 10.3390/ijms24065548.

Highlighted projects

Novel methanol free, ph inducible alternatives to produce industrially relevant recombinant proteins in the yeast pichia pastoris. PRODUCTE (Ref. 2023 PROD 00006). AGAUR, Generalitat de Catalunya.

"Results derived from our current grant PID2020-113319RB-I00 have allowed obtaining a "Producte" grant in which we are bringing to the bioreactor level the strains of P. pastoris developed in the laboratory. This work is being carried in collaboration with colleagues at the Dept. of Chemical, Biological and Environmental Engineering"



RESPONSE MECHANISMS TO STRESS AND DISEASE PROGRAM

BACTERIAL BLOOD PATHOGENS IBB/I3PT

The research group, co-led by **Òscar Quijada Pich** (IBB unit) and Oriol Gasch Blasi (I3PT unit), is part of the Community and Healthcare-Related Infections Study Group of the Parc Taulí Research and Innovation Institute (I3PT). The group studies bacterial infections, with special emphasis on blood infections and endocarditis, from an epidemiological, clinical and therapeutic perspective with the aim of improving the prognosis of infections.

Our current lines of research are:

- Study of the pathogenicity mechanisms of Gram-positive bacteria.
- Association studies of the bacterial genotype with clinical data of the infection (patient characteristics, evolution of the infection, etc.).
- Prevention of infections associated with medical devices.
- Study of the mechanisms of antibiotic resistance and design of strategies to prevent its transmission and dissemination.
- Development of new strategies for rapid diagnosis of infections.
- Improving the treatment of infections through combination therapies and new antimicrobial compounds.
- Epidemiological surveillance of antibiotic-resistant microorganisms in the wastewater drainage network.

BACTERIAL BLOOD PATHOGENS IBB/I3PT

Highlights

TEAM IBB LED BY
ÒSCAR QUIJADA

Team members

Paula Bierge Cabrera: Pre-doctoral researcher
Miquel Sánchez Osuna: Post-doctoral researcher
Inmaculada Gómez Sánchez: Laboratory technician

Scientific articles

López-Cano A, Ferrer-Miralles N, Sánchez J, Carratalá JV, Rodriguez XR, Ratera I, Guasch J, Pich OQ, Bierge P, Garcia-de-la-Maria C, Miro JM, Garcia- Fruitós E, Arís A; FUNCATH Investigators. **A novel generation of tailored antimicrobial drugs based on recombinant multidomain proteins.** Pharmaceutics. 2023 Mar 26;15(4):1068. doi: 10.3390/pharmaceutics15041068. PMID: 37111554.

"First article from the FUNCATH consortium, formed within the framework of the TV3 Marathon 2018 project, aimed at preventing bacterial infections associated with vascular catheters. The study describes the production and effectiveness of a new generation of antimicrobial molecules based on human defensins"

Giacobbe DR, Dettori S, Di Pilato V, Asperges E, Ball L, Berti E, Blennow O, Bruzzone B, Calvet L, Capra Marzani F, Casabella A, Choudaly S, Dartevel A, De Pascale G, Di Meco G, Fallon M, Galerneau LM, Gallego M, Giacomini M, González Sáez A, Hänsel L, Icardi G, Koehler P, Lagrou K, Lahmer T, Lewis White P, Magnasco L, Marchese A, Marelli C, Marín-Arriaza M, Martin-Loeches I, Mekontso-Dessap A, Mikulska M, Mularoni A, Nordlander A, Poissy J, Russelli G, Signori A, Tascini C, Vaconsin LM, Vargas J, Vena A, Wauters J, Pelosi P, Timsit JF, Bassetti M; JIR-ICU investigators (collaborators); Critically Ill Patients Study Group of the European Society of Clinical Microbiology and Infectious Diseases (ESGCIP), and the Fungal Infection Study Group of the European Society of Clinical Microbiology and Infectious Diseases (EFISG). ***Pneumocystis jirovecii* pneumonia in intensive care units: a multicenter study by ESGCIP and EFISG**. Crit Care. 2023 Aug 24;27(1):323. doi: 10.1186/s13054-023-04608-1. PMID: 37620828.

Grillo S, Pujol M, Miró JM, López-Contreras J, Euba G, Gasch O, Boix-Palop L, Garcia-País MJ, Pérez-Rodríguez MT, Gomez-Zorrilla S, Oriol I, López-Cortés LE, Pedro-Botet ML, San-Juan R, Aguado JM, Gioia F, Iftimie S, Morata L, Jover-Sáenz A, García-Pardo G, Loeches B, Izquierdo-Cárdenas Á, Goikoetxea AJ, Gomila-Grange A, Dietl B, Berbel D, Videla S, Hereu P, Padullés A, Pallarès N, Tebé C, Cuervo G, Carratalà J; SAFO study group. **Cloxacillin plus fosfomycin versus cloxacillin alone for methicillin-susceptible *Staphylococcus aureus* bacteremia: a randomized trial.** Nat Med. 2023 Oct;29(10):2518-2525. doi: 10.1038/s41591-023-02569-0. PMID: 37783969.

BACTERIAL BLOOD PATHOGENS IBB/I3PT

Highlights

TEAM IBB LED BY
ÒSCAR QUIJADA

Scientific articles

Pereira AP, Antunes P, Bierge P, Willems RJL, Corander J, Coque TM, Pich OQ, Peixe L, Freitas AR, Novais C; from the ESCMID Study Group on Food- and Water- borne Infections (EFWISG). **Unraveling Enterococcus susceptibility to quaternary ammonium compounds: genes, phenotypes, and the impact of environmental conditions.** Microbiol Spectr. 2023 Sep 22;11(5):e0232423. doi: 10.1128/spectrum.02324-23. PMID: 37737589.

Benavent E, Kortajarena X, Sobrino-Diaz B, Gasch O, Rodríguez-Pardo D, Escudero-Sanchez R, Bahamonde A, Rodriguez-Montserrat D, García-País MJ, Del Toro López MD, Sorli L, Nodar A, Vilchez HH, Muñez E, Iribarren JA, Ariza J, Murillo O; Group for the Study of Osteoarticular Infections – Spanish Society of Infectious Diseases and Clinical Microbiology (GEIO-SEIMC). **Vertebral osteomyelitis after spine instrumentation surgery: risk factors and management.** J Hosp Infect. 2023 Oct;140:102-109. doi: 10.1016/j.jhin.2023.07.008. PMID: 37482096.

Calzado S, Hernández-Meneses M, Llopis J, Boix-Palop L, Dietl B, Calbo E, Andrés M, García X, Agustí C, Dorca E, Tricas JM, Díez de Los Ríos J, Cuquet J, Cárdenas A, Roca JM, Ortiz M, Caresia AP, Guillamon L, Quintana E, Ambrosioni J, Gasch O, Miró JM; Central Catalonia 10 Endocarditis Teams (CC10ET). **The hidden side of infective endocarditis: Diagnostic and management of 500 consecutive cases in noncardiac surgery centers (2009-2018)**. Surgery. 2023 Sep;174(3):602-610. doi: 10.1016/j.surg.2023.04.061. PMID: 37321885.

Badia-Cebada L, Carmezim J, Pérez-Rodríguez MT, Bereciartua E, López LE, Montenegro MR, Pomar V, Andrés M, Petkova E, Sopena N, Lora-Tamayo J, Monsálvez V, Ramirez-Hidalgo MF, Gómez-Zorrilla S, Boix L, Meije Y, Jiménez E, Gasch O. R**andomized clinical trial of the need for antibiotic treatment for low-risk catheter-related bloodstream infection caused by coagulase-negative Staphylococci**. Antibiotics (Basel). 2023 May 1;12(5):839. doi: 10.3390/antibiotics12050839. PMID: 37237744.

Núñez-Pereira S, Benavent E, Ulldemolins M, Sobrino-Díaz B, Iribarren JA, Escudero-Sánchez R, Del Toro MD, Nodar A, Sorli L, Bahamonde A, Vilchez HH, Gasch O, Muñez E, Rodríguez-Montserrat D, García-País MJ, Haddad S, Sellarès-Nadal J, Murillo O, Rodríguez-Pardo D, On Behalf Of Geio-Seimc Group For The Study Of Osteoarticular Infections-Spanish Society Of Infectious Diseases And Clinical Microbiology. ***Cutibacterium spp.* infections after instrumented spine surgery have a good prognosis regardless of rifampin use: a cross-sectional study**. Antibiotics (Basel). 2023 Mar 4;12(3):518. doi: 10.3390/antibiotics12030518. PMID: 36978385.

BACTERIAL BLOOD PATHOGENS IBB/I3PT

Highlights

TEAM IBB LED BY
ÒSCAR QUIJADA

Highlighted projects

"The following projects are relevant for their impact on clinical practice, improving the prevention and diagnosis of complicated and difficult-to-treat infections"

Prevención de infecciones relacionadas con catéteres vasculares mediante la funcionalización de catéteres impregnados de hidrogeles activables térmicamente con antimicrobianos de amplio espectro. Fundació La Marató de TV3 (Ref. 201812-30). IP Oriol Gasch Blasi. 83,000 €. (June 2019 – May 2022)

Identificación de factores genéticos de Staphylococcus aureus asociados a un mayor riesgo de bacteriemia complicada mediante técnicas de secuenciación masiva. Instituto de Salud Carlos III (Ref. PI19/01911). IP Òscar Quijada Pich. 93,000 €. (January 2020 - December 2022)

Rapid chip-based detection of antibiotic resistances (ResisCHIP). ERC-2022-POC1 (2022) call (Ref. 101069316). PI. Albert Quintana. 150,000 €. 18 months (2022 - 2023).

FEATURED OUTREACH

PPMC participated as Organizing and Scientific Committee

Researchers from the PPMC group (Michał Burdukiewicz, Carlos Pintado-Grima, Irantzu Pallarès and Salvador Ventura), together with IRTA-CReSA, oganized the 11th Iberian Congress on Prions, which took place in Barcelona, 11-12 May 2023. Irantzu and Salvador were also part of the scientific committee. More info.

The IBB hosted a visit from 3 research managers from Poland

During the week of April 24 to 28, the IBB hosted the visit of Maria Szlachta, Sylwia Klepacka and Anna Bergiel, with the aim of exchanging research management methodologies at the university level, between the Medical University of Bialystok (Poland) and the UAB. This mobility was funded by a grant from the Erasmus+ program.

A Mexican delegation visited the IBB

On July 27 and 28, a Mexican delegation from the private university Tecnológico de Monterrey visited the IBB with the aim of exploring collaborations between both institutions. During their stay they visited our facilities and some UAB services and met with 4 research groups from the IBB.

Five IBB research groups exhibited their technological capabilities at the UAB Innovation Fair

This event aims to present the technology, innovative ideas or technological capabilities of UAB research groups, in order to facilitate their transfer to the business sector. On the other hand, it also aims to generate collaboration networks inside and outside the UAB Campus.

Research seminars

- 12 research seminars

Impact IBB visits

- 16 visits from different schools, +370 participants
- 3 international scientific visits

Social media followers

780	789	276	396
↑ 17,3%	↑ 33,1%	↑ 47,1%	↑ 0%

20 subscribers, 1 new video uploaded

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