INSTITUT DE BIOTECNOLOGIA I DE BIOMEDICINA

ANNUAL REPORT

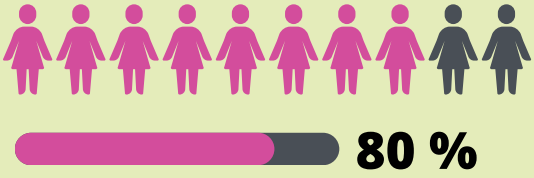
2022

INDEX

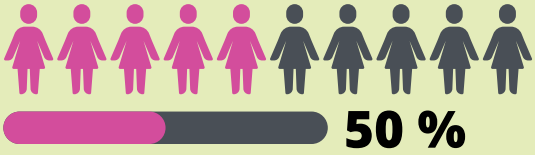
FIGURES

Staff 231 people

18 ADMINISTRATIVE & TECHNICAL STAFF



213 RESEARCHERS



18% INTERNATIONAL

3 RESEARCH PROGRAMMES
17 RESEARCH GROUPS

Projects and publications

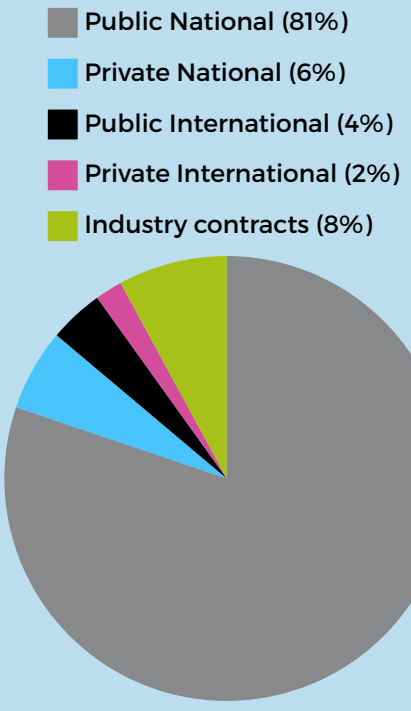
111 PUBLICATIONS

72% Q1 **23%** D1

36 COMPETITIVE PROJECTS ACTIVE

33 NATIONAL; **3** INTERNATIONAL

Funding 2,58M€



FIGURES

Academic merits

18 THESIS

15 MASTER

2 ICREA

3 ICREA ACADEMIA

3 PRIZES

David Reverter:

- Icrea Academia 2022

Salvador Ventura:

- Transferència 2022, Consell Social UAB.
- Narcís Monturiol Medal 2022. Generalitat de Catalunya.

Tech transfer & outreach

4 PATENTS

13 INDUSTRY CONTRACTS

> 196 K€
IN SERVICES
AND INDUSTRY COLLABORATIONS

2126 SOCIAL MEDIA FOLLOWERS

28 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 213 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

- **DR. JAUME PIÑOL; THE NEW SCIENTIFIC LEADER OF THE MOLECULAR BIOLOGY RESEARCH GROUP** (NOVEMBER 2022)
- **DR.ISIDRE GIBERT,** SCIENTIFIC LEADER OF THE BACTERIAL MOLECULAR GENETICS GROUP, **APPOINTED DEAN OF THE BIOSCIENCE FACULTY**
- **I3PT-IBB CANCER RESEARCH CONFERENCE ON 22ND JUNE 2022:** TO BOOST THE RESEARCH COLLABORATION OPPORTUNITIES BETWEEN IBB AND I3PT (THE RESEARCH INSTITUTION FROM PARC TAULÍ HOSPITAL) INSTITUTIONS
- **GERARD TORRENT: SECOND TRAINEE** IN COMMUNICATION FROM THE FACULTY OF COMMUNICATION (UAB) JOINS IBB FROM OCTOBER 2022 TO JANUARY 2023.
- WE DECIDE TO PROMOTE INSTAGRAM AND LEAVE BEHIND FACEBOOK

RESEARCH SUPPORT STAFF

SCIENTIFIC DIRECTOR

Nerea Roher

MANAGER

Joan Josep Pancho

RESEARCH TECHNICIANS

Almudena Merino
Francesca Mestres
Àngels Torres
Francisca Palma
Carla Cabrera (internship)

ADMINISTRATIVE SUPPORT

Natividad Infante
Lourdes Benítez
Silvia Gómez
Rosa Calzada
Laura Bueno
Elisabet Carrascosa

R&D&I PROMOTION

Montserrat Solé

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

Biomedical Applications of Nuclear Magnetic Resonance

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

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

COMPUTATIONAL BIOLOGY

The group, led by **Xavier Daura**, aims at developing new strategies to combat infections by multidrug-resistant (MDR) bacteria, in particular of the Gram-negative (GN) group.

The increasing emergence and spread of MDR pathogens constitutes at present one of the major threats to public health. The shortage of effective antimicrobials for the treatment of MDR GN infections is particularly critical as cases of pan-resistance are not uncommon. The discovery of new drug targets and modes of action (MoA), less prone to the development of resistance, has therefore become a pressing need. In parallel, the development of effective vaccines may offer a solution for high-risk population groups.

The team works in collaboration with the group of Bacterial Molecular Genetics of IBB combining a range of computational and experimental techniques for the identification of antimicrobial-target candidates with new MoA and vaccine candidates eliciting prescribed resposes.

COMPUTATIONAL BIOLOGY

Highlights

GROUP LEADER
XAVIER DAURA

Master Thesis

Marc Moro Buendia, "Development of Convolutional Neural Networks for the prediction of cytokine release profiles based on epitope sequence", directed by Xavier Daura. Defence date: 13/09/2022.

PhD Thesis

Valentin P. Junet, "Machine Learning techniques in bioinformatics: From data integration to the development of application-oriented
tools", directed by Xavier Daura and José Manuel Mas Defence date: 01/02/2022.

Scientific articles

X. Daura, O. Conchillo-Solé. On Quality **Thresholds for the Clustering of Molecular Structures**. J. Chem. Inf. Model. 2022, 62, 5738–5745 (doi: 10.1021/acs.jcim.2c01079).

A. C. Gómez, T. Lyons, U. Mamat, D. Yero, M. Bravo, X. Daura, O. Elshafee, S. Brunke, C. G. M. Gahan, M. O'Driscoll, I. Gibert, T. P. O'Sullivan. **Synthesis and evaluation of novel furanones as biofilm inhibitors in opportunistic human pathogens.** Eur. J. Med. Chem. 2022, 242, 114678 (doi: 10.1016/j.ejmech.2022.114678)

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, they 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, they 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, they 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
JOSEP MARIA LLUCH

PhD Thesis

Sonia Romero Téllez, "Estudios moleculares in silico de reacciones de transglicosidación catalizadas por enzimas", directed by Àngels González-Lafont and Laura Masgrau. Defence date: 02/02/2022.

Alejandro Cruz Saez, "Simulaciones biomoleculares de algunas enzimas relevantes en procesos inflamatorios: 15-LOX, 5-LOX y COX-2. Aplicación al estudio de mecanismos y al diseño de inhibidores", Àngels González-Lafont
and José M. Lluch. Defence date: 15/07/2022.

Scientific articles

A. Cebrián-Prats, A. Pinto, À. González-Lafont, P.A. Fernandes and JM. Lluch. **The role of acetylated cyclooxygenase-2 in the biosynthesis of resolvin precursors derived from eicosapentaenoic acid**. Org. Biomol. Chem., 2022, 20, 1260.

A. Golovanov, A. Zhuravlev, A. Cruz, V. Aksenov, R. Shafiullina, K.R. Kakularam, JM. Lluch, H. Kuhn, À. González-Lafont and I. Ivanov. **N-Substituted 5-(1H-Indol-2-yl)-2-methoxyanilines Are Allosteric Inhibitors of the Linoleate Oxygenase Activity of Selected Mammalian ALOX15 Orthologs: Mechanism of Action**. J. Med. Chem. 2022, 65, 1979–1995

M. Canyelles-Niño, À. González-Lafont and JM. Lluch. **Theoretical Characterization of the Step-by-Step Mechanism of Conversion of Leukotriene A4 to Leukotriene B4 Catalysed by the Enzyme Leukotriene A4 Hydrolase**. Int. J. Mol. Sci. 2022, 23, 3140

M. Garcia-Viloca, JR. Bayascas, JM. Lluch, and À. Gonzalez-Lafont. **Molecular Insights into the Regulation of 3-Phosphoinositide-Dependent Protein Kinase 1: Modeling the Interaction between the Kinase and the Pleckstrin Homology Domains**. ACS Omega 2022, 7, 25186–25199.

M. Moreno, JM. Lluch and R. Gelabert. **On the Computational Design of Azobenzene-Based Multi-State Photoswitches.** Int. J. Mol. Sci. 2022, 23, 8690.

S. Luang, X. Fernández-Luengo, A. Victor A. Streltsov, JG. Schwerdt, S. Alonso-Gil, JR. Ketudat Cairns, S. Pradeau, S. Fort, JD. Maréchal, L. Masgrau, C. Rovira & M. Hrmova. **The evolutionary advantage of an aromatic clamp in plant family 3 glycoside exo-hydrolases**. Nat Comm 2022, 13:5577

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

NANOBIOTECHNOLOGY

he 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. The team is 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

Master Thesis

Jessica Soto Giraldo, "Caracterización de mutantes de la enzima humana alfa-galactosidasa A", directed by José Luis Corchero. Defence date: July 2022.

Genís Pérez Collell, "Producció, encapsidació en liposomes i caracterització de proteïnes de fusió amb pèptids de defensa de l'hoste com a possible tractament anti BRD", directed by Neurs Ferrer Miralles. Defence date: 08/09/2022.

Scientific articles

Potent Anticancer Activity of CXCR4-Targeted Nanostructured Toxins in Aggressive Endometrial Cancer Models. Medina-Gutiérrez E, García-León A, Gallardo A, Álamo P, Alba-Castellón L, Unzueta U, Villaverde A, Vázquez E, Casanova I, Mangues R. Cancers (Basel) (IF: 6.13; Q1). 2022 Dec 23;15(1):85. doi: 10.3390/cancers15010085. PMID: 36612081

Protein scaffolds in human clinics. Cano-Garrido O, Serna N, Unzueta U, Parladé E, Mangues R, Villaverde A, Vázquez E. Biotechnol Adv (IF: 14.23; Q1). 2022 Dec;61:108032. doi:10.1016/j.biotechadv.2022.108032. Epub 2022 Sep 9. PMID: 36089254

GSDMD-dependent pyroptotic induction by a multivalent CXCR4-targeted nanotoxin blocks colorectal cancer metastases. Sala R, Rioja-Blanco E, Serna N, Sánchez-García L, Álamo P, Alba-Castellón L, Casanova I, López-Pousa A, Unzueta U, Céspedes MV, Vázquez E, Villaverde A, Mangues R. Drug Deliv (IF: 6.42; Q1). 2022 Dec;29(1):1384-1397. doi: 10.1080/10717544.2022.2069302. PMID: 35532120

The Diphtheria Toxin Translocation Domain Impairs Receptor Selectivity in Cancer Cell-Targeted Protein Nanoparticles. Voltà-Durán E, Sánchez JM, Parladé E, Serna N, Vazquez E, Unzueta U, Villaverde A. Pharmaceutics (IF: 4.42; Q1). 2022 Nov 29;14(12):2644. doi: 10.3390/pharmaceutics14122644. PMID: 36559138

Recombinant vaccines in 2022: a perspective from the cell factory. de Pinho Favaro MT, Atienza-Garriga J, Martínez-Torró C, Parladé E, Vázquez E, Corchero JL, Ferrer-Miralles N, Villaverde A. Microb Cell Fact (IF: 4.19; Q1). 2022 Oct 5;21(1):203. doi: 10.1186/s12934-022-01929-8. PMID: 36199085

Novel Endometrial Cancer Models Using Sensitive Metastasis Tracing for CXCR4-Targeted Therapy in Advanced Disease. Medina-Gutiérrez E, Céspedes MV, Gallardo A, Rioja-Blanco E, Pavón MÀ, Asensio-Puig L, Farré L, Alba-Castellón L, Unzueta U, Villaverde A, Vázquez E, Casanova I, Mangues R. Biomedicines (IF: 4.72; Q1). 2022 Jul 12;10(7):1680. doi: 10.3390/biomedicines10071680. PMID: 35884987

NANOBIOTECHNOLOGY

Highlights

GROUP LEADER
ANTONIO VILLAVERDE

Scientific articles

A diphtheria toxin-based nanoparticle achieves specific cytotoxic effect on CXCR4+ lymphoma cells without toxicity in immunocompromised and immunocompetent mice. Falgàs A, Garcia-León A, Núñez Y, Serna N, Sánchez-Garcia L, Unzueta U, Voltà-Durán E, Aragó M, Álamo P, Alba-Castellón L, Sierra J, Gallardo A, Villaverde A, Vázquez E, Mangues R, Casanova I. Biomed Pharmacother (IF: 6.53; Q1). 2022 Jun;150:112940. doi: 10.1016/j.biopha.2022.112940. Epub 2022 Apr 11. PMID: 35421785

Self-assembling protein nanocarrier for selective delivery of cytotoxic polypeptides to CXCR4+ head and neck squamous cell carcinoma tumors. Rioja-Blanco E, Arroyo-Solera I, Álamo P, Casanova I, Gallardo A, Unzueta U, Serna N, Sánchez-García L, Quer M, Villaverde A, Vázquez E, Mangues R, Alba-Castellón L, León X. Acta Pharm Sin B (IF: 11.41; Q1). 2022 May;12(5):2578-2591. doi: 10.1016/j.apsb.2021.09.030. Epub 2021 Oct 14. PMID: 35646535

An In Silico Methodology That Facilitates Decision Making in the Engineering of Nanoscale Protein Materials. Parladé E, Voltà-Durán E, Cano-Garrido O, Sánchez JM, Unzueta U, López-Laguna H, Serna N, Cano M, Rodríguez-Mariscal M, Vazquez E, Villaverde A. Int J Mol Sci (IF: 4.56; Q1). 2022 Apr 29;23(9):4958. doi: 10.3390/ijms23094958. PMID: 35563346

A Novel CXCR4-Targeted Diphtheria Toxin Nanoparticle Inhibits Invasion and Metastatic Dissemination in a Head and Neck Squamous Cell Carcinoma Mouse Model. Rioja-Blanco E, Gallardo A, Arroyo-Solera I, Álamo P, Casanova I, Unzueta U, Serna N, Sánchez-García L, Quer M, Villaverde A, Vázquez E, León X, Alba-Castellón L, Mangues R. Pharmaceutics (IF: 4.42; Q1). 2022 Apr 18;14(4):887. doi: 10.3390/pharmaceutics14040887. PMID: 35456719

The Poly-Histidine Tag H6 Mediates Structural and Functional Properties of Disintegrating, Protein-Releasing Inclusion Bodies. Sánchez JM, Carratalá JV, Serna N, Unzueta U, Nolan V, Sánchez-Chardi A, Voltà-Durán E, López-Laguna H, Ferrer-Miralles N, Villaverde A, Vazquez E. Pharmaceutics (IF: 4.42; Q1). 2022 Mar 10;14(3):602. doi: 10.3390/pharmaceutics14030602. PMID: 35335976

CXCR4-targeted nanotoxins induce GSDME-dependent pyroptosis in head and neck squamous cell carcinoma. Rioja-Blanco E, Arroyo-Solera I, Álamo P, Casanova I, Gallardo A, Unzueta U, Serna N, Sánchez-García L, Quer M, Villaverde A, Vázquez E, León X, Alba-Castellón L, Mangues R. J Exp Clin Cancer Res (IF: 7.04; Q1). 2022 Feb 4;41(1):49. doi: 10.1186/s13046-022-02267-8. PMID: 35120582

NANOBIOTECHNOLOGY

Highlights

GROUP LEADER
ANTONIO VILLAVERDE

Scientific articles

Engineering non-antibody human proteins as efficient scaffolds for selective, receptor-targeted drug delivery. Serna N, Pallarès V, Unzueta U, Garcia-Leon A, Voltà-Durán E, Sánchez-Chardi A, Parladé E, Rueda A, Casanova I, Falgàs A, Alba-Castellón L, Sierra J, Villaverde A, Vázquez E, Mangues R. J Control Release (IF: 9.78; Q1). 2022 Mar;343:277-287. doi: 10.1016/j.jconrel.2022.01.017. Epub 2022 Jan 17. PMID: 35051493

"In this article we have generated several protein nanoconjugates with antitumoral activity based on targeted, multivalent protein nanoparticles, that use non-antibody human scaffolds. We show the high efficiency and specificity when delivering an antitumoral drug in an acute myeloid leukemia model"

Time-Prolonged Release of Tumor-Targeted Protein-MMAE Nanoconjugates from Implantable Hybrid Materials. Serna N, Falgàs A, García-León A, Unzueta U, Núñez Y, Sánchez-Chardi A, Martínez-Torró C, Mangues R, Vazquez E, Casanova I, Villaverde A. Pharmaceutics (IF: 4.42; Q1). 2022 Jan 14;14(1):192. doi: 10.3390/pharmaceutics14010192. PMID: 35057088

A multivalent Ara-C-prodrug nanoconjugate achieves selective ablation of leukemic cells in an acute myeloid leukemia mouse model. Pallarès V, Unzueta U, Falgàs A, Aviñó A, Núñez Y, García-León A, Sánchez-García L, Serna N, Gallardo A, Alba-Castellón L, Álamo P, Sierra J, Cedó L, Eritja R, Villaverde A, Vázquez E, Casanova I, Mangues R. Biomaterials (IF: 12.48; Q1). 2022 Jan;280:121258. doi: 10.1016/j.biomaterials.2021.121258. Epub 2021 Nov 24. PMID: 34847435

Insights on the emerging biotechnology of histidine-rich peptides. López-Laguna H, Voltà-Durán E, Parladé E, Villaverde A, Vázquez E, Unzueta U. Biotechnol Adv (IF: 14.23; Q1). 2022 Jan-Feb;54:107817. doi: 10.1016/j.biotechadv.2021.107817. Epub 2021 Aug 19. PMID: 34418503

***Escherichia coli* as a New Platform for the Fast Production of Vault-like Nanoparticles: An Optimized Protocol.** Fernández R, Carreño A, Mendoza R, Benito A, Ferrer-Miralles N, Céspedes MV, Corchero JL. Int J Mol Sci (IF: 4.56; Q1). 2022 Dec 8;23(24):15543. doi: 10.3390/ijms232415543. PMID: 36555185

Nano-Based Approved Pharmaceuticals for Cancer Treatment: Present and Future Challenges. Rodríguez F, Caruana P, De la Fuente N, Español P, Gámez M, Balart J, Llurba E, Rovira R, Ruiz R, Martín-Lorente C, Corchero JL, Céspedes MV. Biomolecules (IF: 4.08; Q1). 2022 Jun 4;12(6):784. doi: 10.3390/biom12060784. PMID: 35740909

NANOBIOTECHNOLOGY

Highlights

GROUP LEADER
ANTONIO VILLAVERDE

Scientific articles

All-in-one biofabrication and loading of recombinant vaults in human cells. Martín F, Carreño A, Mendoza R, Caruana P, Rodriguez F, Bravo M, Benito A, Ferrer-Miralles N, Céspedes MV, Corchero JL. Biofabrication (IF: 9.95; Q1). 2022 Mar 9;14(2). doi: 10.1088/1758-5090/ac584d. PMID: 35203066

"Among natural protein nanoparticles explored as drug delivery systems (DDSs), eukaryotic vaults show a promising future due to their structural features, in vitro stability and non-immunogenicity. In this work, we proposed new procedures (based on the co-expression of vaults and cargo in human cells, and further affinity purification) for the fast and easy expression, loading and purification of recombinant vaults. These new protocols represent a promising alternative to replace tedious and time-consuming current strategies to produce and purify recombinant vaults"

Eukaryotic Aggresomes: Protocols and Tips for Their Production, Purification , and Handling. Mendoza R, Ferrer-Miralles N, Corchero JL. Methods Mol Biol (IF: 1.372; Q3). 2022;2406:417-435. doi: 10.1007/978-1-0716-1859-2_25. PMID: 35089572

Recombinant Protein Production and Purification of Insoluble Proteins. Ferrer-Miralles N, Saccardo P, Corchero JL, Garcia-Fruitós E. Methods Mol Biol (IF: 1.372; Q3). 2022;2406:1-31. doi: 10.1007/978-1-0716-1859-2_1. PMID: 35089548

Projects

- **Grup Recerca Qualitat: Biofármacos innovadores.** Generalitat de Catalunya. Ref.: 2021-SGR-00092 (2022-2024)
- **Improved colorectal cancer therapy using CXCR4-targeted functional protein nanoparticles with enhanced cytosolic release. NANOSCAPE.** CIBER-BBN. 2019-25.
- **COST-Action Nano2Clinics (Cancer Nanomedicine - From bench to bedside)** (CA17140). 2019-2022.
- **Humanized nanomedicines selectively killing CXCR4+ cancer cells for Acute Myeloid Leukemia therapy.** Fundació La Marató de TV3 201941-31 (30, 31, 32). 014/07/2020-13/07/2023.
- **Functionalization of DNA origami with the T22-GFP-H6 protein for the enhancement of antimetastatic properties (Nanotrojans)**. CIBER-BBN. 2020-25.
- **Novel nanostructured drugs for time-sustained and multivalent antimicrobial treatments (NAUTILIS)**. Proof-of-Concept. Generalitat de Catalunya-UAB. 01/10/2020-31/07/2021.
- **Targeted Reinforcement of the innate immune response Against Colorrectal Cancer (TRACC)**. CIBER-BBN. 2021-25.

NANOBIOTECHNOLOGY

Highlights

GROUP LEADER
ANTONIO VILLAVERDE

Projects

- **Site-directed conjugation of multivalent protein nanomaterial for precision medicines of cancer (NANOLINK)**. CIBER-BBN. 2021-25.
- **Increase of the stability, activity and crossing of biological barriers of recombinant proteins through their vehiculization by EXtracellular vesicles and their PotentiaL biOmedical and industRial usE (EXPLORE-2)**. CIBER-BBN. 2021-25.
- **Enzyme MutANts as tools in the quest for improved TheRapies for FAbry disease (MANTRA).** CIBER-BBN. 2021-25.
- **Protein delivery system based on non-covalent PEGylation with telodendrimers (TELOprot)**. CIBER-BBN. 2021-25.
- **A biomimetic nanovaccine against African Swine Fever virus (NANOSWINE)**. Proof-of-Concept. Generalitat de Catalunya-UAB. 01/04/2021-31/12/2021.
- **A long-lasting anti-Covid-19 subcutaneous vaccine through a novel, industrially competitive and biologically safe nanomimetic concept (INVITA)**. PANDÈMIES 2020. 2020PANDE00003. AGAUR. Generalitat de Catalunya. 13/05/2021-12/11/2022.
- **Advanced Extracellular Vesicles for Enzyme Replacement Therapy (ADVERT)**. VALORIZATION PROGRAM CIBER-BBN. 01/01/2021-31/12/2022.
- **MICRO-DEPOSITOS PROTEICOS BIOMIMETICOS COMO UNA PLATAFORMA DE ADMINISTRACION SOSTENIDA DE FARMACOS EN Y A TRAVES DE LA PIEL (PERDURA)**. PID2020-116174RB-I00. 1/09/2021-31/08/2023.
- **Membrane biophysics in lysosomal storage disorders for improved therapies (MEMPHYS)**. CIBER-BBN. 2022-2025.
- **Design of tumor-targeted nanostructured venoms for the treatment of CXCR4+ human neoplàsies.** VENOM4CANCER
- **Design and implementation of a novel protein-based nanobiotechnological platform for the remote delivery of tumor-targeted antitumoral drugs. NANOREMOTE.** CIBER-BBN. 2022-2025.
- **Targeting triple negative breast cancer stem cells with nanomedicines. PENTRI- 2.** CIBER-BBN. 2022-2025.
- **Increase of the stability, activity and crossing of biological barriers of recombinant proteins through their vehiculization by exosomes and their potential biomedical and industrial use.** EXPLORE. CIBER-BBN. 2022-2025.
- **3D scaffolds and dynamic molecular bio-interfaces for controlled environments towards vascular morphogenesis.** DynaMo4Vasc. CIBER-BBN. 2022-2025.
- **Targeted nanoparticle combination for the selective killing of metastasis stem cells and metastasis associated fibroblasts in colorectal càncer.** 4NANOMETS. CIBER-BBN. 2022-2025.
- **Functionalization of DNA origami with the T22-GFP-H6 protein for the enhancement of antimetastatic properties. Nanotrojans.** CIBER-BBN. 2022-2025.

NANOBIOTECHNOLOGY

Highlights

GROUP LEADER
ANTONIO VILLAVERDE

Projects

- **Paving the way for efficient preclinical GL261 GB therapy through CXCR4 targeting to enhance antiproliferative treatment.** CXCR4inGB. CIBER-BBN. 2022-2025.
- **GRANULOS DE SECRECION ARTIFICIALES PARA LA ENTREGA REMOTA DE FÁRMACOS ANTITUMORALES. SECRETOR.** PID2019-105416RB-I00. 01/06/2020-01/06/2023.
- **Nanoengineering host defense-based drugs into efficient drug delivery systems for intranasal administration.** PID2019-107298RB-C22. 01/06/2020-01/06/2023.
- **Convenio de colaboración de personal externo entre la Universidad Autónoma de Barcelona y la sociedad Nanoligent S.L.** 2019- Actualidad.
- **Estrategias innovadoras para terapia contra células madre tumorales: activando receptores de dopamina con nanopartículas proteicas.** Instituto de Salud "Carlos III", AES 2020. PI20/00770. 2021-2023.
- **Time-sustained therapy of metastatic cancer from secretable nanoparticles.** MINISTERIO DE CIENCIA E INNOVACIÓN (PDC2022-133858-I00). 2022-2024
- **New protein-based nanodrugs for the development of targeted tumor-agnostic therapy**. MINISTERIO DE CIENCIA E INNOVACIÓN (CPP2021-008946).2022 -2024

"This project has received a total amount of 1.689.076,01 €, in collaboration with Nanoligent and Hospital de Sant Pau, to perform the preclinical experiments necessary to track one of our patented products on clinical trials"

- **In ovo vaccination of chickens against infectious bursal disease virus using ImmunoStimulatory Protein-Only Microparticles (ISPOM)** AGAUR (PRODUCTE) (2021 PROD 00196) 2022-2024

New Patents

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. P6126EP00, EP22382383 1/08/2022**

E. Vázquez, A. Villaverde, E. Voltà, R. Mangues, L. Alba-Castellón, U. Unzueta**. NANOCONJUGATES CONTAINING PDGFR-beta LIGANDS AND USES THEREOF. Universitat Autònoma de Barcelona, Fundació Privada Institut de Recerca de l'Hospital de la Santa Creu I Sant Pau y Centro de Investigación Biomédica en Red CIBER. 300467211. 15 November 2022**

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

MOLECULAR BIOLOGY

The Molecular Biology Group, led by **Enrique Querol** (January - October) and **Jaume Piñol** (November - December), uses *Mycoplasma genitalium* as a model of minimal cell and genome to study molecular mechanisms of pathogenicity and virulence. Also, they do reverse vaccinology and bioinformatics analysis of protein structure and function. Moonlighting proteins.

A research group led by **Òscar Quijada**, scientist from the Group A8G1 at the I3PT institute, is a visiting scientist hosted at the MB Group. The group studies community and healthcare-related infections from an epidemiological, clinical and therapeutic perspective. Among others, the group directs the study of blood infections, sexually transmitted infections, and zoonosis. The main objectives of their research are:

- Study the mechanisms of bacterial pathogenicity, with special emphasis on Gram-positive bacteria
- Establish associations between the bacterial genotype and the clinical characteristics of the infection
- Prevent infections associated with medical devices (catheters, pacemakers)
- Determine the mechanisms of antibiotic resistance and the causes of its spread
- Develop new strategies for rapid diagnosis of infections

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

PhD Thesis

Sergi Rodríguez Calado, "Insights into the functional role of Cytosolic Carboxypeptidases 1 and 6: from interactomics to cell biology", directed by Julia Lorenzo. Defence date: 10/02/2022.

Gonçalo Marcelo, "Biodegradable Magneto-Luminescent Mesoporous Nanoparticles as New Nanobiomedical Tools in Cancer Treatment", directed by Elisabete de Oliveira, Carlos Lodeiro and Julia Lorenzo. Defence date: 21/12/2022.

Scientific articles

1.Mao, X.; Wu, S.; Calero-Pérez, P.; Candiota, A.P.; Alfonso, P.; Bruna, J.; Yuste, V.J.; Lorenzo, J.; Novio, F.; Ruiz-Molina, D. **Synthesis and Validation of a Bioinspired Catechol-Functionalized Pt(IV) Prodrug for Preclinical Intranasal Glioblastoma Treatment.** Cancers. 2022. 14, 410. DOI: 10.3390/cancers14020410.

Mao, X.; Calero-Pérez, P.; Montpeyó, D.; Bruna, J.; Yuste, V.J.; Candiota, A.P.; Lorenzo, J*; Novio, F.; Ruiz-Molina, D. **Intranasal Administration of Catechol-Based Pt(IV) Coordination Polymer Nanoparticles for Glioblastoma Therapy.** Nanomaterials. 2022, 12, 1221. DOI: 10.3390/nano12071221.

Morales, K; Rodriguez-Calado, S; Hernando, J; Lorenzo, J ; Rodriguez-Dieguez, A; Jaime, C; Nolis, P; Capdevila, M; Palacios, O; Figueredo, M; Bayón, P. **Synthesis and In Vitro Studies of Photoactivatable Semisquaraine-type Pt(II) Complexes.** Inorg. Chem. 2022 May 23;61(20):7729-7745. doi: 10.1021/acs.inorgchem.1c03957.

Garcia-Pardo, J.; Montané, S.; Avilés, F.X.; Tanco, S.; Lorenzo, J*. **Enhanced Production of ECM Proteins for Pharmaceutical Applications Using Mammalian Cells and Sodium Heparin Supplementation.** Pharmaceutics 2022, 14, 2138. DOI:10.3390/pharmaceutics14102138.

Ruiz-Molina, D.; Mao, X.; Alfonso-Triguero, P.; Lorenzo, J.; Bruna, J.; Yuste, V.J.; Candiota, A.P.; Novio, F. **Advances in Preclinical/Clinical Glioblastoma Treatment: Can Nanoparticles Be of Help?** Cancers 2022, 14, 4960. DOI: 10.3390/cancers14194960.

Peña, Q., Simaan, A. J., Capdevila, M., Bayón, P., Palacios, O., Lorenzo, J*., & Iranzo, O. (2022). **Cell-penetrating peptide-conjugated copper complexes for redox-mediated anticancer therapy.** Frontiers in Pharmacology. 2022 Nov 15;13:1060827. doi: 10.3389/fphar.2022.1060827. eCollection 2022.

PROTEIN ENGINEERING AND NANOMEDICINE

Highlights

GROUP LEADER
JULIA LORENZO

Highlighted project

CaixaResearch Health Research 2022 grant:
“New nanotechnological therapy for Parkinson's disease: nose to brain”, with the Vall d'Hebron Research Institute (VHIR) and the Príncipe Felipe Research Center (CIPF) to develop polymeric nanoconjugates with enzymes GBA for treatment of Parkinson's disease, via intranasal route.

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

PROTEIN FOLDING AND CONFORMATIONAL DISEASES

The group, led by **Salvador Ventura**, takes a multidisciplinary approach to 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 aim they integrate state-of-the-art techniques in computational biology, structural biology, molecular biology, biochemistry, and biophysics. By leveraging their knowledge of the underlying mechanisms of protein misfolding and aggregation, they strive to develop innovative therapeutics to target these pathologies. The group's expertise in this area 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

PhD Thesis

Samuel Sánchez Peña, "Discovering disease-modifying molecules in Parkinson's disease", directed by Salvador Ventura. Defence date: 24/11/2022.

Marcos Gil García, "Designing improved therapeutic proteins and novel protein nanomaterials", directed by Salvador Ventura. Defence date: 28/03/2022.

Scientific articles

Pena-Dlaz S, Ventura S. **One ring is sufficient to inhibit α-synuclein aggregation**. Neural Regen Res. 2022; 17(3):508-511. doi: 10.4103/1673-5374.320973.

Quaglia F, Mészáros B, Salladini E, ... Ventura S, Dosztányi Z, Tompa P, Tosatto SCE, Piovesan D. **DisProt in 2022: improved quality and accessibility of protein intrinsic disorder annotation**. Nucleic Acids Res. 2022; 50(D1):D480-D487. doi: 10.1093/nar/gkab1082.

Pujols J, Iglesias V, Santos J, Kuriata A, Kmiecik S, Ventura S. A3D 2.0 **Update for the Prediction and Optimization of Protein Solubility.** Methods Mol Biol. 2022; 2406:65-84. doi: 10.1007/978-1-0716-1859-2_3.

Kuriata A, Badaczewska-Dawid AE, Pujols J, Ventura S, Kmiecik S. Protocols for Rational **Design of Protein Solubility and Aggregation Properties Using Aggrescan3D Standalone**. Methods Mol Biol. 2022; 2340:17-40. doi: 10.1007/978-1-0716-1546-1_2.

Gitto R, Vittorio S, Bucolo F, Peña-Díaz S, Siracusa R, Cuzzocrea S, Ventura S, Di Paola R, De Luca L. **Discovery of Neuroprotective Agents Based on a 5-(4-Pyridinyl)-1,2,4-triazole Scaffold**. ACS Chem Neurosci. 2022; 13(5):581-586. doi: 10.1021/acschemneuro.1c00849. E

Santos J, Pallarès I, Ventura S. **Is a cure for Parkinson's disease hiding inside us?** Trends Biochem Sci. 2022; 47(8):641-644. doi: 10.1016/j.tibs.2022.02.001.

"We propose a new way of researching Parkinson's disease, based on the identification of human endogenous peptides that selectively block the toxic aggregates that cause it and that could lead to the development of innovative treatments against neurodegenerative decline"

Navarro S, Ventura S. **Computational methods to predict protein aggregation**. Curr Opin Struct Biol. 2022; 73:102343. doi: 10.1016/j.sbi.2022.102343.

PROTEIN FOLDING AND CONFORMATIONAL DISEASES

Highlights

GROUP LEADER
SALVADOR VENTURA

Scientific articles

Peña-Díaz S, Pujols J, Vasili E, Pinheiro F, Santos J, Manglano-Artuñedo Z, Outeiro TF, Ventura S. **The small aromatic compound SynuClean-D inhibits the aggregation and seeded polymerization of multiple α-synuclein strains**. J Biol Chem. 2022; 298(5):101902. doi: 10.1016/j.jbc.2022.101902.

Badaczewska-Dawid AE, Garcia-Pardo J, Kuriata A, Pujols J, Ventura S, Kmiecik S. **A3D database: structure-based predictions of protein aggregation for the human proteome**. Bioinformatics. 2022; 38(11):3121-3123. doi: 10.1093/bioinformatics/btac215.

Iglesias V, Pintado-Grima C, Santos J, Fornt M, Ventura S. **Prediction of the Effect of pH on the Aggregation and Conditional Folding of Intrinsically Disordered Proteins with SolupHred and DispHred**. Methods Mol Biol. 2022;2449:197-211. doi: 10.1007/978-1-0716-2095-3_8.

Pintado-Grima C, Bárcenas O, Ventura S. **In-Silico Analysis of pH-Dependent Liquid-Liquid Phase Separation in Intrinsically Disordered Proteins**. Biomolecules. 2022; 12(7):974. doi: 10.3390/biom12070974.

Pintado-Grima C, Bárcenas O, Manglano-Artuñedo Z, Vilaça R, Macedo-Ribeiro S, Pallarès I, Santos J, Ventura S. **CARs-DB: A Database of Cryptic Amyloidogenic Regions in Intrinsically Disordered Proteins.** Front Mol Biosci. 2022; 9:882160. doi: 10.3389/fmolb.2022.882160.

Pinheiro F, Pallarès I, Peccati F, Sánchez-Morales A, Varejão N, Bezerra F, Ortega-Alarcon D, Gonzalez D, Osorio M, Navarro S, Velázquez-Campoy A, Almeida MR, Reverter D, Busqué F, Alibés R, Sodupe M, Ventura S. **Development of a Highly Potent Transthyretin Amyloidogenesis Inhibitor: Design, Synthesis, and Evaluation**. J Med Chem. 2022; 65(21):14673-14691. doi: 10.1021/acs.jmedchem.2c01195.

Bárcenas O, Pintado-Grima C, Sidorczuk K, Teufel F, Nielsen H, Ventura S, Burdukiewicz M. **The dynamic landscape of peptide activity prediction**. Comput Struct Biotechnol J. 2022; 20:6526-6533. doi: 10.1016/j.csbj.2022.11.043.

De Luca L, Vittorio S, Peña-Díaz S, Pitasi G, Fornt-Suñé M, Bucolo F, Ventura S, Gitto R. **Ligand-Based Discovery of a Small Molecule as Inhibitor of α-Synuclein Amyloid Formation**. Int J Mol Sci. 2022; 23(23):14844. doi: 10.3390/ijms232314844.

PROTEIN FOLDING AND CONFORMATIONAL DISEASES

Highlights

GROUP LEADER
SALVADOR VENTURA

Scientific articles

Kroschwald S, Arunagiri A, Ventura S, Ranganathan S, Kohler V. Editorial: **Molecular determinants of protein assemblies in health and disease.** Front Mol Biosci. 2022; 9:1107686. doi: 10.3389/fmolb.2022.1107686.

Esperante SA, Alvarez-Paggi D, Salgueiro M, Desimone MF, de Oliveira GAP, Arán M, García-Pardo J, Aptekmann AA, Ventura S, Alonso LG, de Prat-Gay G. **A finely tuned interplay between calcium binding, ionic strength and pH modulates conformational and oligomerization equilibria in the Respiratory Syncytial Virus Matrix (M) protein**. Arch Biochem Biophys. 2022; 731:109424. doi: 10.1016/j.abb.2022.109424.

Highlighted project

Excellence Hub on Phase Transitions in Aging and Age-Related Disorders. 952334.
Finance provider: EU, H2020-WIDESPREAD-2018-2020
Duration, From-To: 2021-23
Amount: 899.741 EUR; Amount UAB: 117.500 EUR
Principal Investigator: S.Macedo; UAB Principal Investigator: S. Ventura
Partners: Instituto de Biologia Molecular e Celular. Portugal; UAB. Spain; University of Padova (UNIPD,). Italy; Vlaams Instituut voor Biotechnologie (VIB, BE)

"PhasAGE aims to establish a research and innovation hub in the emerging field of biomolecular phase transitions in aging and age-related disorders, placing the participant insititutions at the forefront of this field. A cross-disciplinary team with top-edge leading partners is committed to advance the roadmap of R&I in phase transitions"

Prizes

- Prize Transferència 2022. Consell Social de la UAB.
- Narcís Monturiol Medal 2022. Generalitat de Catalunya.

Conference organization

Scientific Committee of the **10th Iberian Congress on Prions**. Vila Real, Spain. May 19-20. 2022.
Organizing Committee of the **1st Barcelona Protein Aggregation Training School**. PhasAge. Barcelona, Spain. September 12-16. 2022.

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

PROTEIN STRUCTURE

Our group, 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 the lab they combine this powerful structural technique with a functional and biochemical characterization using either in vitro or in vivo methods. In the last decades protein-function characterization of proteins and protein complexes have shed light into the most relevant discoveries in biochemistry and molecular biology.

The group foccuses on:

- The structural and functional studies on post-translational modification of proteins by SUMO conjugation
- The structural and functional characterization of the Human USP25 (and USP28) deubiquitinase enzyme
- The structural and functional characterization of the SM56 complexes, a multimeric SUMO E3 ligase enzyme
- The structural mechanism for the temperature-dependent activation of the hyperthermophilic Pf2001 esterase

SUMO and ubiquitin are small protein modifiers that can be attached via an iso-peptidic bond to lysine residues of target proteins. This type of post-translational modification is very common and regulate almost all processes of cell life, including cell division, DNA repair or gene expression. Esterases and lipases are very important biocatalysts for industrial purposes, since they catalyze reactions of synthesis or hydrolysis of lipidic ester bonds.

PROTEIN STRUCTURE

Highlights

GROUP LEADER
DAVID REVERTER

PhD Thesis

Jara Lascorz, "Structural and functional studies of Nse2, the SUMO E3 ligase of the Smc5/6 complex", directed by Nathalia Varejão and David Reverter. Defence date: March 2022. CUM LAUDE (1st THESIS Eli-Lilly AWARD SEBBM).

Ying Li, "Structural basis studies of Ubiquitin/SUMO-related protease activity", directed by David Reverter. Defence date: September 2022. CUM LAUDE.

Scientific articles

Pinheiro, F., Reverter, D., et al., (12/16) (2022). **Development of a Highly Potent Transthyretin Amyloidogenesis Inhibitor: Design, Synthesis, and Evaluation**. J. Med. Chem. https://doi.org/10.1021/acs.jmedchem.2c01195

Li, Y., De Bolòs, A., Amador, V. & Reverter, D*. (2022) **Structural basis for the SUMO2 isoform specificity of SENP7**. J. Mol. Biol. https://doi.org/10.1016/ j.jmb.2022.167875

Li, Y., Varejão, N. & Reverter, D.* (2022) **Structural basis for the SUMO protease activity of the atypical ubiquitin-specific protease USPL1**. Nature Communications 13, 1819 (2022). https://doi.org/10.1038/s41467-022-29485-0.

Highlighted project

"Plan Nacional" from "Ministerio de Ciencia e Innovación". (PID2021-124602OB-I00).
Title: **Structural and functional insights into the ubiquitin/sumo conjugation and deconjugation pathway.**
Grant: 229900 EUR.
Execution dates: 01/09/2022 - 31/08/2025

APPLIED PROTEOMICS AND PROTEIN ENGINEERING PROGRAM

BIOMEDICAL APPLICATIONS OF NUCLEAR MAGNETIC RESONANCE

The aim of our group, led by **Carles Arús**, is to improve the diagnostic and prognostic evaluation of patients bearing abnormal brain masses. They use magnetic resonance spectroscopy (MRS), which can be performed concominantly to a conventional magnetic resonance imaging (MRI) study.

The information provided by MRS allows them to characterise the metabolic profile of these abnormal brain masses without the need to perform a biopsy.

The group is distributed between the Department of Biochemistry and Molecular Biology of the Bioscience Faculty, where they perform the preclinical studies in animal models, and the IBB. What the IBB subgroup does is to analyse all clinical patient data from our collaborating hospitals. They also work in the improvement of current processing and analysis tools for analysing MRS data.

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**, Their research activity has as a main objective to study of the mechanism(s) that are responsible for the origin and maintenance of mammalian genome integrity. They reach their 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

Master Thesis

Keren E. Yam Duarte, "Functional and epigenetic implications of Robertsonian fusions in mouse spermatogenesis", directed by A. Ruiz-Herrera. Defence date: 10/09/2022.

Albert Gubern Burset, "Dissecting the genomic architecture of transmissible cancers: the case of the tasmanian devil facial tumor disease", directed by A. Ruiz-Herrera. Defence date: 05/09/2022.

Nina Bucevic, "Characterization of a novel meiosis-specific Bend2 gene", directed by I. Roig. Defence date: 08/07/2022

Júlia Fabà Costa, "Functional analysis of a novel meiosis-specific Usp44 gene", directed by I. Roig. Defence date: 09/09/2022.

Scientific articles

L. Álvarez-González, C. Arias-Sardá, L. Marin-Gual, C. Vara, F. Garcia, T.J. Robinson, J. Deakin, P.D. Waters, M. Farré, A. Ruiz-Herrera*. **Principles of 3D chromosome folding and evolutionary genome reshuffling in mammals.** Cell Reports 41, 111839, 2022. Journal Cover

L. Marin-Gual#, L.González-Rodelas#, M.G. Ramis, L. Kratochvil, J.M. Graves, A. Georges, P. D Waters, A. Ruiz-Herrera*. **Meiotic chromosome dynamics in Reptiles**. Frontiers in Cell and Developmental Biology 10:1009776, 2022.

L. Álvarez-González#, F. Burden#, D. Doddamani#, R. Malinverni, Emma Leach, C. Marín-García, L. Marin-Gual, A. Gubern, C. Vara, A. Paytuví-Gallart, Marcus Buschbeck, P. Ellis*, M. Farré*, A. Ruiz-Herrera*. **3D chromatin remodeling in the germ line modulates genome evolutionary plasticity**. Nature Communications 13 (2608), 2022

A. Ruiz-Herrera* and P. D. Waters*. **Fragile, unfaithful and persistent Ys: drivers of recombination rates.** Heredity, 129, 22–30, 2022.

L. Marin-Gual, L. Rodríguez-Rodelas, G. Pujol, C. Vara, M. Martín-Ruiz, S. Berríos, R. Fernández-Donoso, A. Pask, M. Renfree, J. Page, P. D Waters, A. Ruiz-Herrera*. **Strategies for meiotic sex chromosome dynamics and telomeric elongation in Marsupials.** PLOS Genet 18(2): e1010040, 2022

GENOME INTEGRITY AND INSTABILITY

Highlights


GROUP LEADERS
AURORA RUIZ-HERRERA
IGNASI ROIG

Scientific articles

C. Vara, A. Ruiz-Herrera*. **Unpacking chromatin remodelling in germ cells**. Trends in Genetics, 38(5), pp. 422–425, 2022

Sanchez-Donoso I, Ravagni S, Rodríguez-Teijeiro JD, Christmas MJ, Huang Y, Maldonado-Linares A, Puigcerver M, Jiménez-Blasco I, Andrade P, Gonçalves D, Friis G, Roig I, Webster MT, Leonard JA, Vilà C. **Massive genome inversion drives coexistence of divergent morphs in common quails.** Curr Biol 2022;32(2):462-469.e6.

Marcet-Ortega M, Maldonado-Linares A, López-Panadés M, Roig I. **p53 Controls Meiotic Prophase Progression and Crossover Formation.** Int J Mol Sci. 2022 Aug 29;23(17):9818.

New patent

Inventors: Ignasi Roig, Maria López Panadés, Nikoleta Nikou
Titule: **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.**
Application number: EP22383101
Country: Spain
Priority date: 15-11-2022
Owner: Universitat Autònoma de Barcelona

GENOMICS IN EVOLUTION AND DISEASE PROGRAM

COMPARATIVE MOLECULAR PHYSIOLOGY

The research group, led by **Joan Cerdà**, is primarly interested in the molecular basis of germ cell (male and female gametes) formation and function towards the development of biotechnological inventions for animal production and conservation biology.

The current research lines of the group include:

- Comparative studies on the evolution, structure and function of aquaporin water channels
- Molecular physiology of aquaporins and ion channels in male and female gametes;
- Endocrine, genetic and epinegetic mechanisms during spermatozoa differentiation and maturation
- Development of new aquaporin-based biotechnological methods for the (cryo)preservation of gametes and embryos.

COMPARATIVE MOLECULAR PHYSIOLOGY

Highlights

GROUP LEADER
JOAN CERDÀ

Scientific articles

Chauvigné F., Lleberia J., Vilafranca C., Rosado D., Martins M., Silva F., González-López W., Ramos-Júdez S., Duncan N., Giménez I., Blanquet I., Cerdà J. (2022) **Gonadotropin induction of spermiation in Senegalese sole: effect of temperature and stripping time**. Aquaculture 550:737844.

Castro-Arnau J., Chauvigné F., Gómez-Garrido J., Esteve-Codina A., Dabad M., Alioto T., Finn R.N., Cerdà J. (2022) **Developmental RNA-seq transcriptomics of haploid germ cells and spermatozoa reveals novel pathways associated with teleost spermiogenesis**. Scientific Reports 12:14162.

Castro-Arnau J., Chauvigné F., Cerdà J. (2022) **Role of ion channels in the maintenance of sperm motility and swimming behaviour in a marine teleost**. International Journal of Molecular Sciences 23:12113.

New Patents

The group has recently filled an European Patent application entitled: **Membrane channel trafficking motifs for intracellular transport**. Ref. EP22382513.4 filed on 27/05/2022 (priority date). This patent describes a novel biotechnological method for targeting membrane channels to intracellular vesicles.

Highlighted project

Vesicle-targeted protein engineering: A novel biotechnological approach for the cryopreservation of fish oocytes and embryos (CRYOYOLK). Spanish Ministry of Economy and Competitiveness. Ref.: PID2019-103868RB-I00.

"The project is directed to engineer molecular pathways that can facilitate the long-term cryopreservation of highly yolked (megalecithal) oocytes and embryos. To date such cryopreservation has not been possible, due to intracellular ice formation in the yolk stored in yolk platelets (YPs). The ground-breaking advance of this project will be to utilize a newly discovered YP-targeted protein trafficking domain to engineer channels that specifically improve the permeability of the YP membrane to water and cryoprotective solutes. This pioneering biotechnology will be combined with the expression of plasma membrane targeted water and solute channels, as well as of biostabilization-enhancing molecules from anhydrobiotic organisms. Both technologies will be then used to engineer transient desiccation- and freeze-tolerance in megalecithal oocytes and embryos allowing the development of novel cryobiological methods for their preservation. This ground-breaking research may have an important impact on aquaculture and biomedical research, as well as in conservation biology, since ~99% of the world's vulnerable or endangered vertebrates produce megalecithal gametes and embryos."

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

Master Thesis

Maria Diaz Ros, "Long-term inversion recurrence and segmental duplication conservation during mammalian evolution", directed by Mario Cáceres. Defence date: 06/07/2022.

Judit Camps Bruch, "Evolutionary analysis of inversions in ancient human genomes", directed by Mario Cáceres. Defence date: 08/09/2022.

Scientific articles

F. Degenhardt, D. Ellinghaus, S. Juzenas, J. Lerga-Jaso, M. Wendorff, D. Maya-Miles,... (+ 323 authors)... T. L. Lenz, R. Asselta, R. de Cid, L. Valenti, T. H. Karlsen, M. Cáceres,A. Franke. **Detailed stratified GWAS analysis for severe COVID-19 in four European populations**. Human Molecular Genetics, 31: 3945-3966 Link (2022).

E. Campoy, M. Puig, I. Yakymenko, J. Lerga-Jaso, M. Cáceres. **Genomic architecture and functional effects of human inversion supergenes.** Philosophical Transactions of the Royal Society B 377: 20210209 Link (2022).

Scientific articles

J. Valls-Margarit, I. Galván-Femenía, D. Matias-Sánchez, N. Blay, M. Puiggròs, A. Carreras, C. Salvoro, B. Cortés, R. Amela, X. Farre, J. Lerga-Jaso, M. Puig, J. F. Sánchez-Herrero, V. Moreno, M. Perucho, L. Sumoy, Ll. Armengol, O. Delaneau, M. Cáceres, R. de Cid, D. Torrents. **GCAT|Panel, a comprehensive structural variant haplotype map of the Iberian population from high-coverage whole-genome sequencing**. Nucleic Acids Research 50: 2464-2479 Link (2022).

M. Padariya, M.-L. Jooste, T. Hupp, R. Fåhraeus, B. Vojtesek, F. Vollrath, U. Kalathiya, K. Karakostis. **The Elephant Evolved p53 Isoforms that Escape MDM2-Mediated Repression and Cancer**. Molecular Biology and Evolution 39(7):msac149 Link (2022).

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

PhD Thesis

Jesús Murga Moreno, "Cataloguing the shape and strength of positive selection on 1000 Genomes Project data", directed by Antonio Barbadilla and Sònia Casillas. Defence date: 07/04/2022.

Scientific articles

Aina Colomer-Vilaplana, Jesús Murga-Moreno, Aleix Canalda-Baltrons, Clara Inserte, Daniel Soto, Marta Coronado-Zamora, Antonio Barbadilla, Sònia Casillas 2022. **PopHumanVar: an interactive application for the functional characterization and prioritization of adaptive genomic variants in humans**, Nucleic Acids Research, Volume 50, Issue D1, 7 January 2022, Pages D1069–D1076, https://doi.org/10.1093/nar/gkab925 IF: 19.160

"An interactive online application that is designed to facilitate the exploration and thorough analysis of candidate genomic regions associated to natural selection by integrating both functional and population genomics data currently available"

Jesús Murga-Moreno, Marta Coronado-Zamora, Sònia Casillas, Antonio Barbadilla. 2022. **The Imputed McDonald and Kreitman test (impMKT): a straightforward correction that significantly increases the evidence of positive selection of gene-by-gene MKT analyses,** G3 Genes|Genomes|Genetics, 2022;, jkac206, https://doi.org/10.1093/g3journal/jkac206 IF: 3.154

Highlighted project

The PopLife project, the development and implementation of a reference online population genomics browser across the tree of life.

Highlighted outreach activities

Casillas, S.; organization of the summer course Argó "**Adapta't: la nostra història evolutiva llegida en el genoma**", 2022 (25 students).

Casillas, S.; UAB organization commission of the **Olimpíades de Biologia de Catalunya.**
Barbadilla, A.; **¿Qué nos permite saber el estudio del ADN?** Programa Universo Sostenible, La Aventura del Saber TV2 - (27 April 2022)

Organization of the **Code the Fly Workshop**, citizen science, targeted to bachelor Bioscience UAB students, academic course 2022-23.

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 Dra. María Isabel Pividori.

BIOSENSING AND BIOANALYSIS

Highlights

GROUP LEADER
MARIA ISABEL PIVIDORI

PhD Thesis

Arnau Pallarès Rusiñol, "Novel methods for the detection of exosomas as biomarkers for noncommunicable diseases", directed by Mercè Martí and Maria Isabel Pividori. Defence date: 04/11/2022. FPU grant.

Master Thesis

Marina Tuxans Serrano, "Nano-flow cytometry methods for exosomas molecular characterization", directed by Mercè Martí and Maria Isabel Pividori. Defence date: 2022.

Berta Solà Fustagueras, "Design and Optimization of a Magnetoassay for the Detection and Quantification of microRNAs", directed by Mercè Martí and Maria Isabel Pividori. Defence date: 2022.

Scientific articles

M Bernuz, A Pallares-Rusiñol, R Rossi, C Fernández-Senac, M Martí and MI Pividori, **Magnetic separation of cell secreted vesicles with tailored magnetic particles and downstream applications**. In Cell Secreted Vesicles: Methods and Protocols, 'Methods in Molecular Biology' by Humana Press, in press.

R. Blasques, A. Mendes A. Costa, T. Canevari, L.Arenas; (…) MI Pividori, Paulo Villis, **Electrochemical glyphosate sensor based on hybrid material SiO2/Sm2O3/carbon modified with Meldola Blue**. Electroanalysis 2022, 34, 1– 13. https://doi.org/10.1002/elan.202200373

Tang X, Zhang Q, Pividori MI, Zhang Z, Marty J-L, Catanante G. A. **Sensitive Aptasensor Using Biotin-Streptavidin System for Patulin Detection in Apple Juice**. Biosensors. 2022; 12(2):59. https://doi.org/10.3390/bios12020059

Silio Lima de Moura, Arnau Pallarès Rusiñol, Luciano Sappia, Mercè Martí and MI Pividori. **The activity of alkaline phosphatase in breast cancer exosomes simplifies the biosensing design.** Biosensors and Bioelectronics 198, 113826. https://doi.org/10.1016/j.bios.2021.113826

BIOSENSING AND BIOANALYSIS

Highlights

GROUP LEADER
MARIA ISABEL PIVIDORI

Highlighted projects

- **ExoSens-PoC. Enhancing tests for the early diagnosis of Alzheimer's disease**.

Proyectos Pruebas de Concepto 2022 (Ref: PDC2022-133363)
Budget: 138,000 €
PI UAB: MI Pividori

- **AmpliSens. Enhancing Rapid Tests for perinatal GBS**.

Proyectos Colaboración Público-Privada 2021 (Ref: CPP2021-008459)
Budget: 272,700 € total - 46,568 € UAB
Dates: 03/10/2022 to 02/10/2026.
Coordinator: BioEclosion SL Dr. PI UAB: MI Pividori

- **EChiLiBRiST. Enhancing Children's Lives with Biomarkers for Risk Stratification and Triage.**

HORIZON-HLTH-2021-DISEASE-04-03 (Ref: 101057114)
Budget: 6,535,006.00 € total - 370.000€ UAB.
Dates: 01/09/2022 to 31/08/2027.
Coordinator: Dr. Quique Bassat– Isglobal (ES). PI UAB: MI Pividori Gurgo

- **ExoSens. The exosomes as diagnostic biomarkers in biosensors.**

MICINN (Ref: PID2019-106625RB-I00).
Budget: 121.000,00 €.
Dates: 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

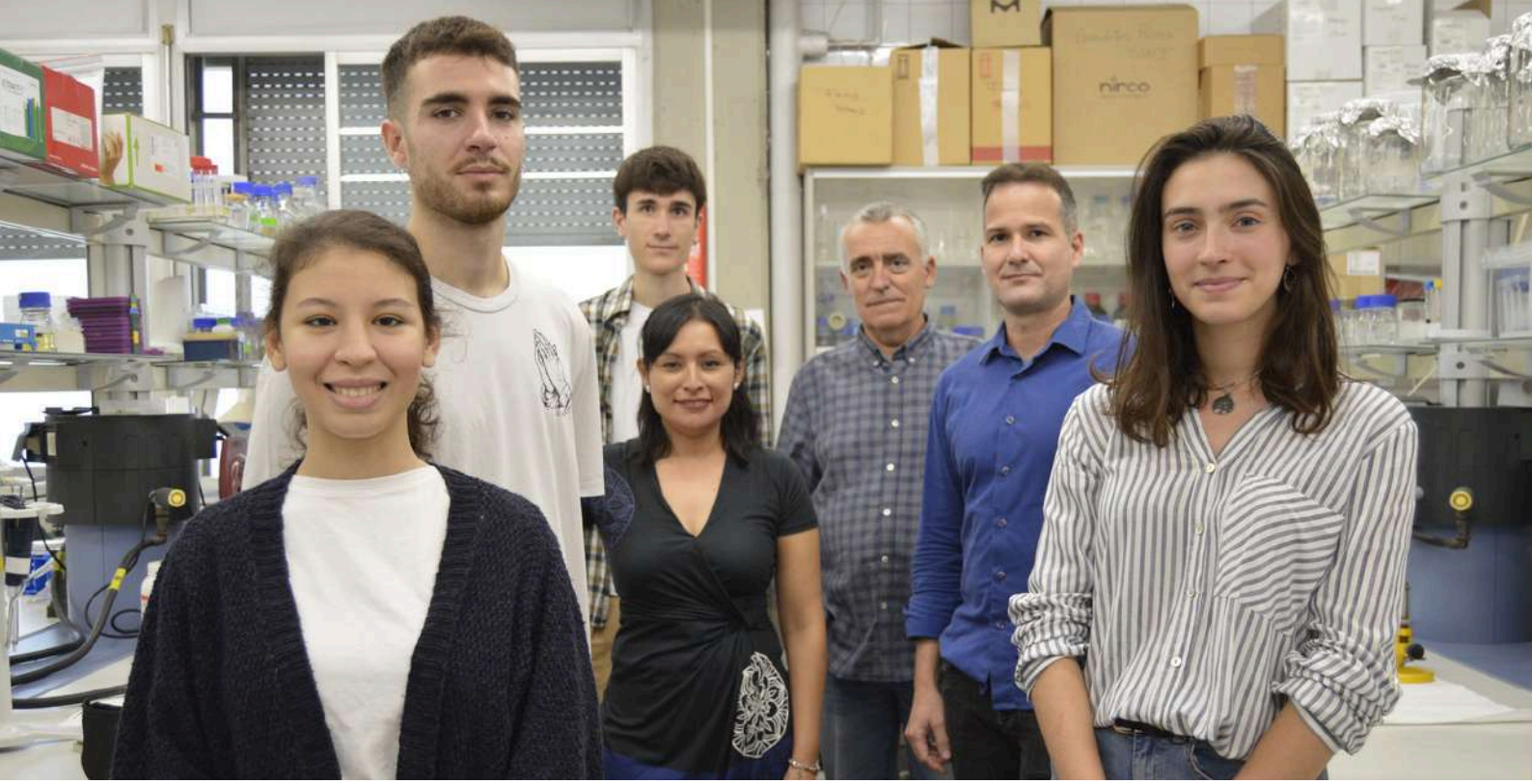
CELLULAR IMMUNOLOGY

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.

Dolores Jaraquemada aims at the identification of the protein autoantigens in Type 1 Diabetes.

Carme Roura-Mir is working on the lipid autoantigens in human type I Diabetes.

Iñaki Ruiz aims at the (1) study of the specificity and contribution on the HLA peptide repertoires of different proteasomes and its role in tolerance and disease, (2) analysis of the role of the autoimmune regulator (AIRE) in antigen expression, processing and presentation, and (3) study of standard and post-translational modificated HLA ligands in tolerance and disease.



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

PhD Thesis

Xavier Coves Lozano, "Factors de Resistència i Virulència Relacionats amb el Quorum Sensing i la Regulació del Metabolisme i Homeòstasi Lipídica en *Stenotrophomonas maltophilia*", directed by isidre Gibert and Daniel Yero. Defence date: 05/04/2022.

Scientific articles

Gómez AC, Lyons T, Mamat U, Yero D, Bravo M, Daura X, Elshafee O, Brunke S, Gahan CGM, O'Driscoll M, Gibert I, O'Sullivan TP. 2022. **Synthesis and evaluation of novel furanones as biofilm inhibitors in opportunistic human pathogens.** Eur J Med Chem. 242:114678. DOI: 10.1016/j.ejmech.2022.114678.

"In this work, in collaboration with other European laboratories, we have evaluated several compounds that have been shown to inhibit biofilm formation in important opportunistic human pathogens. This paper had a high rellevance and impact and an article was published in UABDivulga, the outreach magazine from UAB"

Yero D, Jia B, Gao F. 2022. **Editorial: Insights in Evolutionary and Genomic Microbiology: 2021**. Front Microbiol. 18;13:915593. DOI: 10.3389/fmicb.2022.915593. eBook 2022. ISBN: 978-2-88976-340-5.

Gomes-Fernandes M, Gomez AC, Bravo M, Huedo P, Coves X, Prat-Aymerich C, Gibert I, Lacoma A, Yero D. 2022. **Strain-specific interspecies interactions between co-isolated pairs of *Staphylococcus aureus* and *Pseudomonas aeruginosa* from patients with tracheobronchitis or bronchial colonization**. Sci Rep. 12(1):3374. DOI: 10.1038/s41598-022-07018-5.

Highlighted projects

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

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**, is interested in several 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. For this purpose, they investigate issues such as ion homeostasis, the response to various stresses or the cell cycle regulation and how these circumstances affect specific protein kinases and/or phosphatases (activity, localization, binding to other proteins, postraductional modifications,...).

They have worked on two parallel lines. The first, which is coming to an end, is the characterization of the regulation of the Ppz1 phosphatase and the molecular bases of its toxicity when the protein is overexpressed. The second, recently initiated, pursues the development of new platforms for the expression of proteins, of biotechnological/industrial interest, in the yeasts *S. cerevisiae* and *P. pastoris* based on the use of promoters adjustable by alkaline pH.

YEAST MOLECULAR BIOLOGY

Highlights

GROUP LEADER
JOAQUÍN ARIÑO

PhD Thesis

Marcel Albacar Carot, "The *S. cerevisiae* protein phosphatase Ppz1: unraveling the molecular basis of its toxicity and its connection with intracellular localization", directed by J. Ariño and A. Casamayor. Defence date: 18/02/2022.

Carlos Santolaria Bello, "Regulación de la proteína fosfatasa Ppz1 por su subunidad Hal3: Un análisis por mutagénesis", directed by J. Ariño and A. Casamayor. Defence date: 14/10/2022.

Master Thesis

Antonia Bauzà, "Identificació i caracterització d'elements reguladors transcripcionals en cis que responen a pH alcalí en S. cerevisiae", directed by A. Casamayor. Defence date: 28/06/2022.

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 MÁ, Pérez B. **Pathogenic variants of the coenzyme A biosynthesis-associated enzyme phosphopantothenoylcysteine decarboxylase cause autosomal-recessive dilated cardiomyopathy**. J Inherit Metab Dis. 2022 Dec 23. doi: 10.1002/jimd.12584. Epub ahead of print. PMID: 36564894.

"Multicenter investigation in which the first case of mutation of PPCDC, a key enzyme in the synthesis of Coenzyme A in humans, is described. The UAB group contributed with its experience in using yeast as a model organism, recreating the mutations found in the human gene"

Casamayor A, Ariño J. **Fungal Hal3 (and Its Close Relative Cab3) as Moonlighting Proteins.** J Fungi (Basel). 2022 Oct 11;8(10):1066. doi: 10.3390/jof8101066. PMID: 36294631; PMCID: PMC9604783.

"It is a review that summarizes, to a good extent, one of the research projects carried out in the laboratory in recent years, which include results from multiple publications from the laboratory where two functions of the yeast protein Hal3 are defined, not related to each other: as a protein inhibitor of the activity of the yeast Ppz1 protein phosphatase and as a participant in the metabolic pathway of coenzyme A synthesis"

Highlighted Outreach

Inaugural speech at the XV Congreso Nacional de Micología (Valencia, 7-09-22)

YEAST MOLECULAR BIOLOGY

Highlights

GROUP LEADER
JOAQUÍN ARIÑO

Scientific articles

Santolaria C, Velázquez D, Albacar M, Casamayor A, Ariño J. **Functional mapping of the N-terminal region of the yeast moonlighting protein Sis2/Hal3 reveals crucial residues for Ppz1 regulation.** FEBS J. 2022 Dec;289(23):7500-7518. doi: 10.1111/febs.16572. Epub 2022 Jul 18. PMID:
35811492.

Sharma SC, Arino J, Pascual-Ahuir A, Mulet JM, Mazzoni C. Editorial: **Microbial Stress Responses: Antioxidants, the Plasma Membrane, and Beyond**. Front Microbiol. 2022 Jun 2;13:891964. doi: 10.3389/fmicb.2022.891964. PMID: 35722293; PMCID: PMC9201919.

Casamayor A, Ariño J. **When Phosphatases Go Mad: The Molecular Basis for Toxicity of Yeast Ppz1.** Int J Mol Sci. 2022 Apr 13;23(8):4304. doi: 10.3390/ijms23084304. PMID: 35457140; PMCID: PMC9029398.

Albacar M, Velázquez D, Casamayor A, Ariño J. **The toxic effects of yeast Ppz1 phosphatase are counteracted by subcellular relocalization mediated by its regulatory subunit Hal3.** FEBS Lett. 2022 Jun;596(12):1556-1566. doi: 10.1002/1873-3468.14330. Epub 2022 Mar 23. PMID: 35278214.

Casamayor A, Velázquez D, Santolaria C, Albacar M, Rasmussen MI, Højrup P, Ariño J. **Comparative Analysis of Type 1 and Type Z Protein Phosphatases Reveals D615 as a Key Residue for Ppz1 Regulation.** Int J Mol Sci. 2022 Jan 25;23(3):1327. doi: 10.3390/ijms23031327. PMID: 35163251; PMCID: PMC8836105.

"We define a new function for the Hal3 protein: it not only inhibits the activity of the protein phosphatase Ppz1, but when it is in excess, it removes it from the cell periphery, anchoring it in the vacuolar membrane, to attenuate the toxicity of the excess phosphatase"

Highlighted project

In 2022, a project developed in the context of "Grups Operatius" of the DARP (Generalitat de Catalunya) on the development of leghemoglobin expression systems for food use ended.

"The PID2020-113319RB-I00 project is currently being developed, whose objective is to identify and develop new promoters for the expression of proteins in S. cerevisiae and P. pastoris. A relevant collaborator is the Department of Biotechnology and Biomedicine from the Technical University of Denmark."

FEATURED OUTREACH

1st Barcelona Protein Aggregation Training School

International Training School organised by the PPMC Group, under the PhasAGE European project umbrella

Conference I3PT-IBB

Organised by the IBB Promotion Area together with the I3PT

Interview #8M to 3 scientific generations

Aquaculture conference SCB

Organised by the Evolutive Immunology Group

Research seminars

- 14 research seminars

Impact IBB visits

- 5 visits from different schools, +106 participants
- 1 international scientific visit

Social media followers

665	789	276	396
↑35%	↑64%	↑200%	↑2,6%

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