Scientific Report

2020 - 2022

Institute for Advanced Chemistry of Catalonia

IQAC

CSIC
Consejo Superior de Investigaciones Científicas

WHO WE ARE

We are a public research center belonging to the Spanish National Research Council (CSIC), dedicated to the application of chemical approaches to identify and solve societal challenges, mainly those related to human health, sustainability of chemical processes and products, and the needs for novel materials for different applications.

Created in 2007, IQAC headquarters are located close to the campus of the University of Barcelona. It brings together **20 research groups** organized around two main departments: **Biological Chemistry** and **Surfactants and Nanobiotechnology**.

Where Chemistry Helps!

*"Our mission is to perform research of excellence in chemical sciences with the broad goal of improving the quality of life. In a scenario where the general public worldwide has a poor opinion of chemistry, at IQAC, **we are committed to persuading the citizens that chemistry provides enormous benefits to all of us**."*

Jesús Joglar, IQAC Director.

OUR ASPIRATIONS

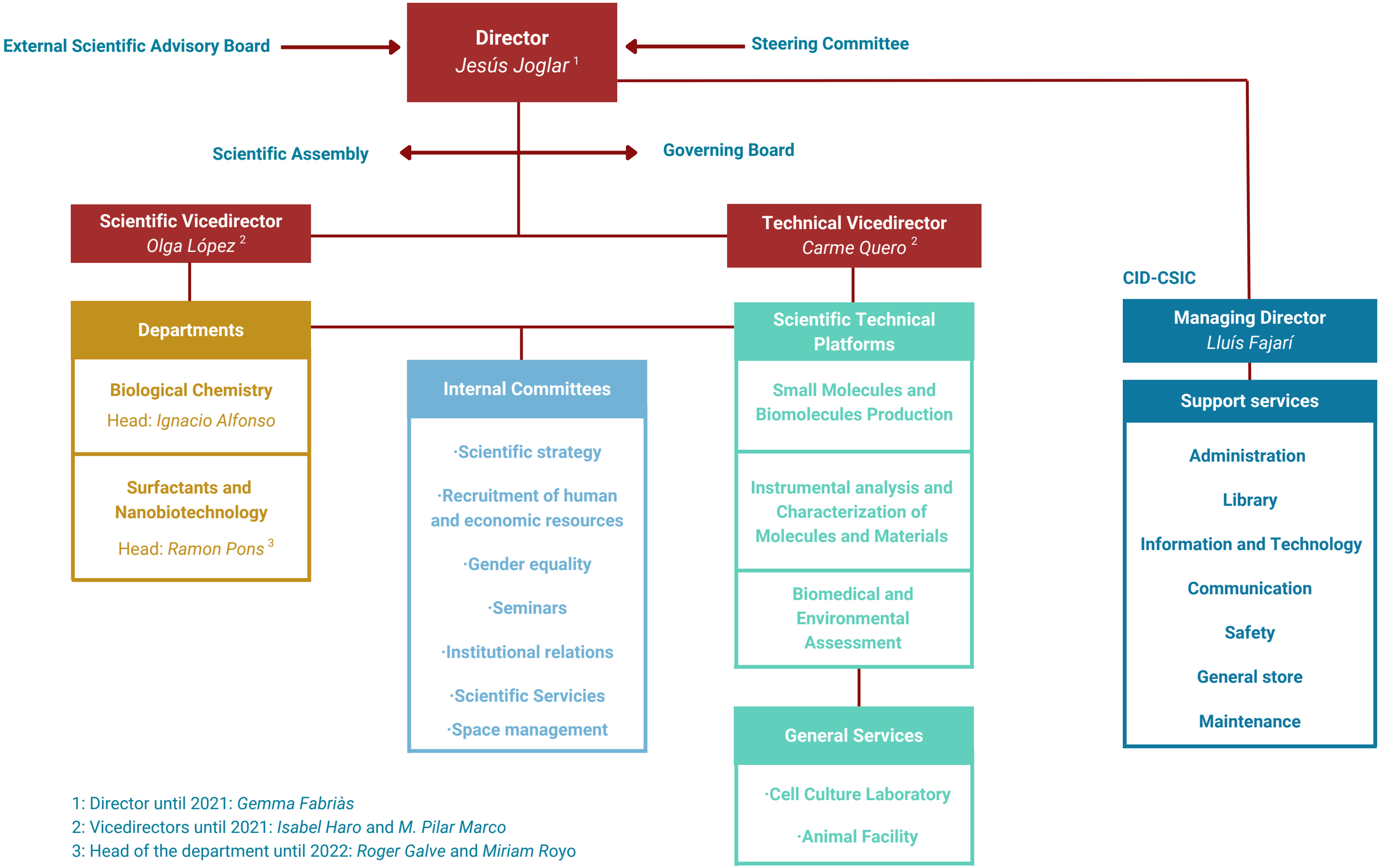
Carry out innovative **BASIC RESEARCH** on chemical science

SOLVE specific problems of our society

TRANSFER IQAC knowledge and technology results to the industrial sector

DISSEMINATE and **OUTREACH** our science and its impact to the society

ORGANISATION



1: Director until 2021: *Gemma Fabriàs*
2: Vicedirectors until 2021: *Isabel Haro* and *M. Pilar Marco*
3: Head of the department until 2022: *Roger Galve* and *Miriam* Royo

RESEARCH LINES

RL1

DEVELOPMENT OF METHODS AND STRATEGIES FOR THE SYNTHESIS OF MOLECULES OF HIGH ADDED VALUE

RL2

DISCOVERY OF CHEMICAL AND MOLECULAR ENTITIES OF THERAPEUTIC, BIOLOGICAL AND BIOMEDICAL INTEREST

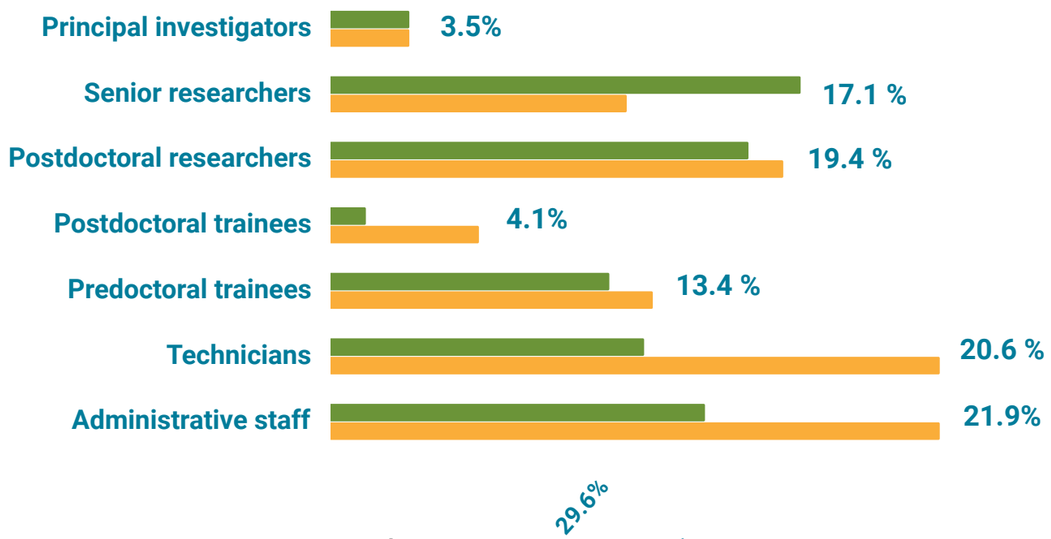
RL4

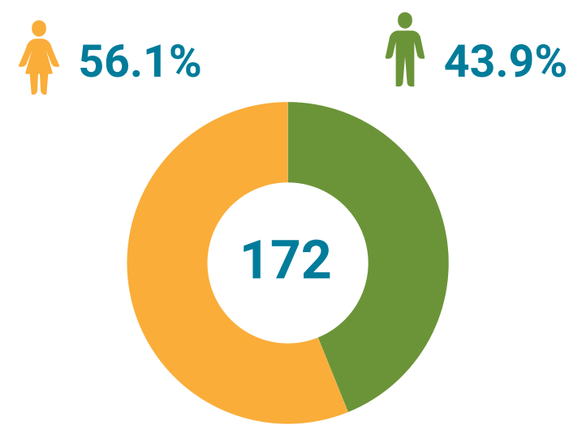
NANOBIOTECHNOLOGY FOR THE PREVENTION, DIAGNOSTIC AND TREATMENT OF DISEASES

RL3

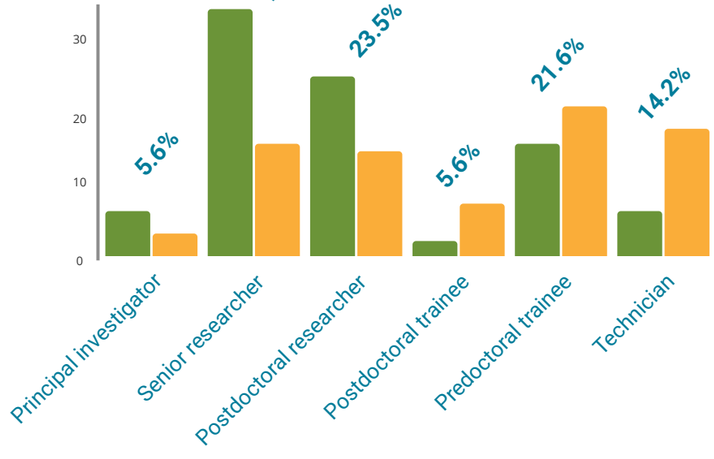
SURFACTANTS: SYNTHESIS, BIOPHYSICAL STUDIES AND APPLICATIONS

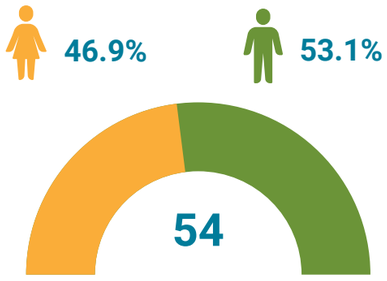
OUR COMMUNITY (during the period 2020-2022)



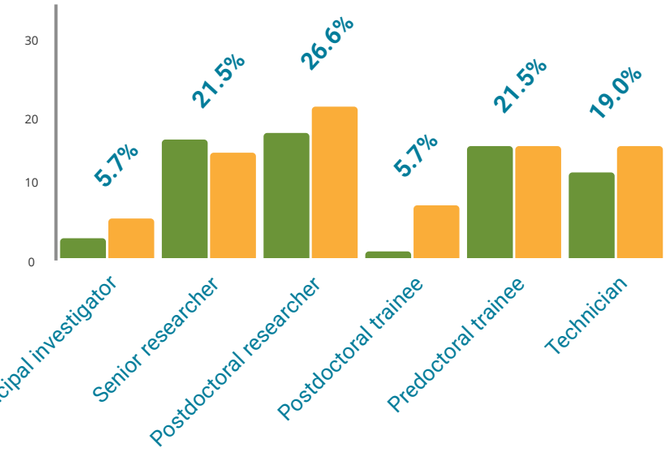


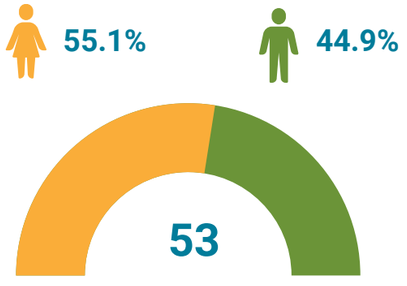
Biological Chemistry





Surfactants and Nanobiotechnology





IQAC IN NUMBERS

PROJECTS

64

National and International ongoing research projects

International

11

National

53

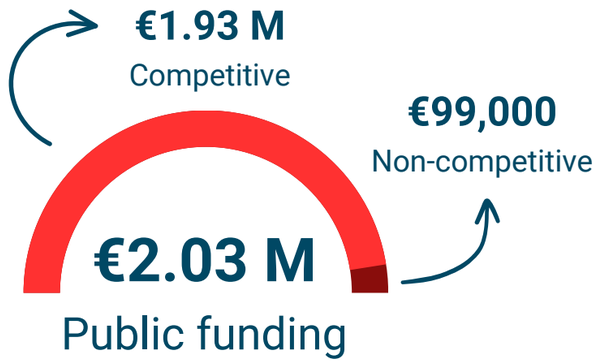
National
€3.12 M

International
€1.3 M

FUNDING

€2.28 M

Average funding



€245,000
Private funding

TRAINING

32

PhD Theses defended

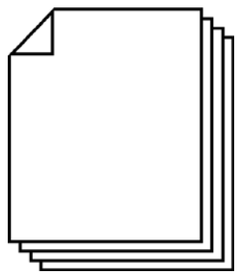
43

Final Master Theses

70

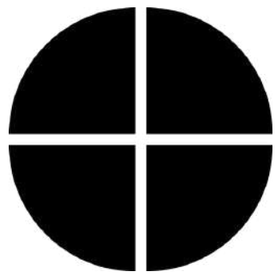
Final Degree Projects

PUBLICATIONS



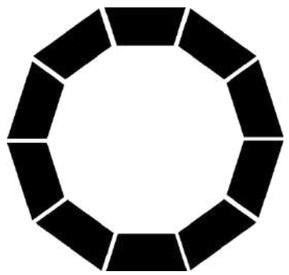
TOTAL PUBLICATIONS
2020-2022

420



FIRST QUARTILE
PUBLICATIONS (Q1)

318



FIRST DECILE
PUBLICATIONS (D1)

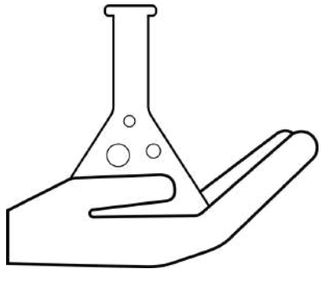
178

OPEN ACCESS

385

AVERAGE CITES

11.4



TOTAL PRODUCTION

627

Data from GesBIB 2020-2022

PUBLICATIONS

Journals in which we published the most

Data from GesBIB 2020-2022

KNOWLEDGE TRANSFER

Patent portfolio

51

New patents 2020-2022

8

- 8 **Priority**
- 4 **PCT**
- 3 **National phases**

License agreements

22

New license agreements 2020-2022

9

Spin-offs

1

Priority Patent Application (2020-2022)

- In vitro method for detection of infections caused by Pseudomonas Aeruginosa (**EP20382256**)
- Azido compounds and method for monitoring of acid ceramidase activity in intact cells using thereof (**EP20382533**)
- Lipid hydrogel, preparation and use procedure (**P202031135**)
- Polypurine reverse Hoogsteen hairpins and parallel clamps and their use as biosensors (**EP21382818**)
- Spermine derivatives as heparin antidotes (**EP21382962**)
- Attractive composition of flies (**P202230440**)
- DNA aptamer conjugates recognizing and degrading coronavirus proteins (**EP22382617**)
- A novel acylated derivated of phloretin and its use as antioxidant (**EP22382582**)

BIOLOGICAL CHEMISTRY DEPARTMENT

Research Unit on Bioactive Molecules

Their interests are focused on the chemistry and biology of lipids, particularly in the development of chemical probes for cell biology studies related to sphingolipid metabolism, including pharmacological chaperones as new promising alternatives for some sphingolipidoses. They also deal with various aspects related to new insect pheromones, from structural characterization, synthesis, and the establishment of the attractant activity in the laboratory by electrophysiology techniques to behavioral bioassays in the field.

Group Leaders: *Josefina Casa* and *Gemma Fabriàs*

Unit of Synthesis & Biomedical Applications of Peptides

Their scientific interests focus on the chemistry of peptides from three different points of view: design, synthesis, and study of the possible therapeutic value of peptide molecules. The general objectives of their research are summarized in the use of synthetic peptides in the field of Biomedicine, both in the improvement of current diagnostic systems and in the design of new therapeutic targets.

Group Leader: *Isabel Haro*

Medicinal Chemistry & Synthesis

The Medicinal Chemistry group is dedicated to the discovery of small molecules with activity in biologically relevant processes, including medicinal chemistry and chemical biology. The research projects are on the borderline between chemistry and biology to find molecules useful to study basic processes and mechanisms and to develop new therapeutics for diseases. The main research topics of the group include photopharmacology, immunotherapy, and chemical methods for native protein labeling.

Group Leader: *Amadeu Llebaria*

Chemical Biology

Their main goal is the use of chemical tools to study and characterize diseases and improve their knowledge of important biological phenomena, principally autophagy, lipid-protein interactions, signaling pathways such as Sonic Hedgehog and K-ras, and the regulation of the transcription by the design of artificial transcription factors. As a result, their scientific interests span organic chemistry, biochemistry, biophysics, and medicinal chemistry.

Group Leader: *Gemma Triola*

Nutraceuticals and Free Radicals

The nutraceuticals are natural products obtained either from agricultural and fishery by-products or by environmentally friendly biosynthetic procedures. The group is mainly focused on the prevention of the modern epidemics of obesity and diabetes, paying particular attention to oxidative stress, which is a major damaging process mediated by free radicals and occurring in diabetes as well as in other disorders such as cardiovascular disease, cancer, and Alzheimer's disease.

Group Leader: *Josep Lluís Torres*

Theoretical and Computational Chemistry

The computational and theoretical chemistry group (CTCG) investigates the behavior and properties of molecules to understand their reactivity, their dynamics, and their function. They use both Quantum Chemical and Molecular Modelling methods.

Group Leaders: *Josep María Anglada* and *Ramon Crehuet*

Supramolecular Chemistry

Supramolecular chemistry is the “chemistry beyond the molecule” and deals with the interactions between chemical species in an ordered and hierarchical way, leading to the formation of well-defined supramolecules. They mainly work in the fields of molecular recognition, programmed folding, and self-assembling processes, using a large variety of experimental and theoretical approaches. Their scientific activity is inspired by the structural and interactional complexity of living organisms.

Group Leader: *Ignacio Alfonso*

Biotransformations and Bioactive Molecules

The research of the group is focused on the development and optimization of new and existing biocatalysts for carbon-carbon bond formation (carboligases). Carboligases have the potential to efficiently access complex molecular scaffolds from simple starting materials, with unparalleled stereoselectivity and without a need for tedious and time-consuming iterative steps for protection and deprotection of sensitive or reactive functional groups.

Group Leader: *Pere Clapés*

Synthetic Methodology and New Building Blocks

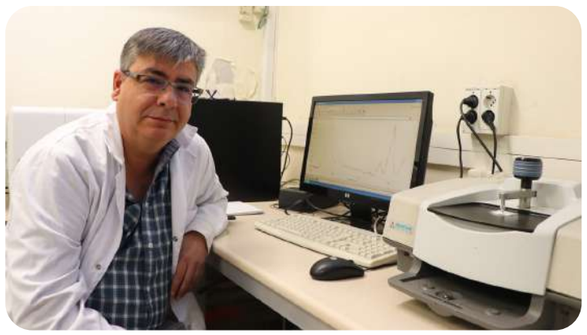
This research group combines the design of reactive organic intermediates, particularly those based on halogens, boron, and silicon, with catalysis to develop new types of C-C and C-X bond-forming reactions. In particular, they are interested in exploiting the carbon-iodine unit in iodoarenes to direct new types of C-H functionalization reactions, in which new reactivity is achieved via high-valent iodine(III) intermediates.

Group Leader: *Alexandr Shafir*

Unit of Glycoconjugate Chemistry

The Unit aims to study biochemical or medicinal chemistry issues by using chemical methodologies. The most frequently used tools are peptide and carbohydrate chemistry, halogenation reactions, aqueous organometallic catalysis, and proteomic techniques. Traditional fields of interest are enzyme catalysis, pain and immunity related mechanisms, transthyretin amyloidosis inhibitors, and more recently, Alzheimer’s disease (AD) interfering compounds.

Group Leader: *Gemma Arsequell*



Plasma Chemistry

The research in the Plasma Chemistry Group is focused on the technological applications of non-thermal plasmas (low and atmospheric pressure). The activity and interest of the group deals with different plasma processes: surface functionalization, plasma treatment in liquids, and plasma treatment of biomaterials.

Group Leader: *Ricardo Molina*

SURFACTANTS AND NANOBIOTECHNOLOGY DEPARTMENT

Nucleid Acids Chemistry

Their studies are aimed at gaining a better understanding of novel nucleic acids (DNA and RNA) by chemical modification to evaluate their efficacy in antisense and RNA interference therapies. The projects undertaken by the group deal with the structural properties of nucleic acids. The group has undertaken the synthesis of new transfecting agents based on cationic lipids for the improvement of nucleic acids delivery. They develop nucleic acid molecules designed for the assembly of nanomaterials and biosensor systems for detecting biologically relevant DNA and RNA molecules.

Group Leader: *Ramon Eritja*

Biophysics of Lipids and Interfaces

The group addresses scientific objectives that consider biophysical, biochemical, physicochemical, and technological aspects related to biological membranes and complex tissues. The group's research is based on the study and biomedical application of nanostructured systems formed mainly by lipids and other amphiphilic molecules, such as liposomes, micelles, bicelles, bicosomes, gels, and other supramolecular structures. Additionally, the research carried out by the group is related to the knowledge, behavior, and treatment of tissues such as skin, mucous membranes, and hair.

Group Leader: *Olga López*

Multivalent Systems for Nanomedicine

Chemical Multivalent Systems are molecules containing multiple functional groups disposed on spatial distributions that are directly associated with their skeleton/scaffold architecture. These functional groups can be modified, in a controlled manner, with diverse biomolecules, drugs, or ligands. Due to this versatility, multivalent systems become chemical tools with great potential in areas such as chemical biology and nanomedicine, such as drug delivery, diagnosis and biomaterials.

Group Leader: *Miriam Royo*

Surface Chemistry

The main objective is to study the formation and characterization of new (nano) structured systems and evaluate their possible applications in new technological processes. The field of study includes systems with the presence of interfaces, whether liquid dispersions (emulsions, microgels, etc.), soft materials (hydrogels), or solid porous materials (solid foams). Structured liquid systems obtained by molecular self-aggregation, as well as by molecular segregation processes, are studied mainly in the nanometric size range.

Group Leader: *Jordi Esquena*

Nanobiotechnology for Diagnostics

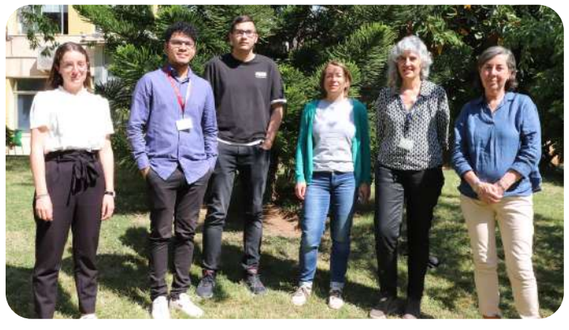
The Nanobiotechnology for Diagnostics group (Nb4D) has focused on the development of novel molecular diagnostic tools to provide alternatives to the actual limitations existing in several fields, particularly in the clinical and food safety areas. To do so they investigate the preparation of novel nanomaterials and micro (nano) devices as signal transducers of biomolecular recognition events and the production of specific bioreceptors with tailored features.

Group Leader: *M. Pilar Marco*

Physical Chemistry of Surfactant Systems

The general subject of research is the physical chemistry of surfactants and surfactant based systems. Particular focus is given to dynamic transformations (emulsification and solubilisation) and new biocompatible surfactant behavior. The main techniques are SAXS-WAXS, Light Scattering, tensiometry, conductivity, and selective electrode. These can be applied to the characterization of the structure of systems in the sub nanometer to the millimetre range.

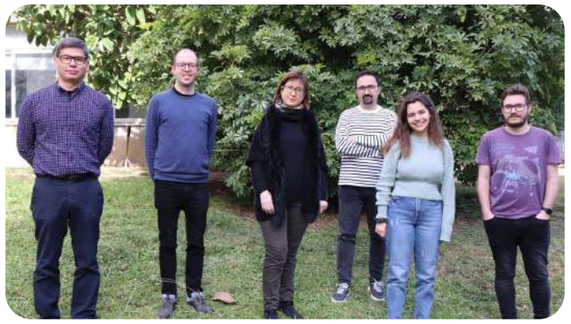
Group Leader: *Ramon Pons*



Cosmetic and Textile Innovations

The main scientific activity of this group focuses on the study of cosmetic and textile applications of vehicles able to encapsulate active principles. These lipid structures, such as liposomes, microspheres, etc., modulate the penetration of the actives in the different substrates. The effectiveness of the topical application on skin or hair to improve hydration and skin barrier function, lipid peroxidation, etc. is evaluated. Percutaneous absorption profiles of these formulations after being applied directly to the skin or through biofunctional textiles are also being studied.

Group Leader: *M. Luisa Coderch*



Colloidal and Interfacial Chemistry

The group is focused on molecular self-assembly in soft matter as a vehicle for the bottom-up fabrication of nanomaterials with minimum use of energy. Through state-of-the-art techniques, the group intends to understand the fundamental mechanisms of aggregation, colloidal forces, and interfacial interactions and their impact on material domain size, structure, stability, and other properties. The group aims to use molecular information and physicochemical parameters to predict, control, and program hierarchical self-organization at multiple scales and with increasing complexity, for materials with new or improved properties and applications.

Group Leader: *Carlos Rodíguez*

Biocompatible Surfactants and Ionic Liquids

This group conducts comprehensive research on novel surfactants and ionic liquids derived from natural renewable sources like amino acids and natural oils. The goal is to develop biocompatible compounds with low toxicity and high biodegradability. Surfactants and ionic liquids with these properties would fulfill the requirements of industries in the food, cosmetics, and pharmaceutical field.

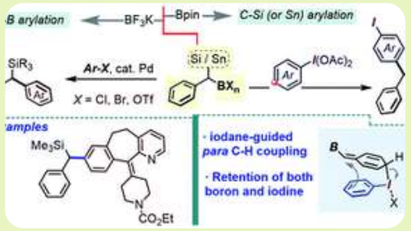
Group Leaders: *M. Teresa García, Aurora Pinazo and Lourdes Pérez*

SCIENTIFIC HIGHLIGHTS

RL1

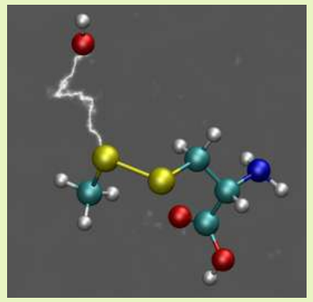
DEVELOPMENT OF METHODS AND STRATEGIES FOR THE SYNTHESIS OF MOLECULES OF HIGH ADDED VALUE

Researchers at IQAC aim to develop new catalysts, synthetic protocols and biocatalytic reactions for the preparation of complex and valuable products.



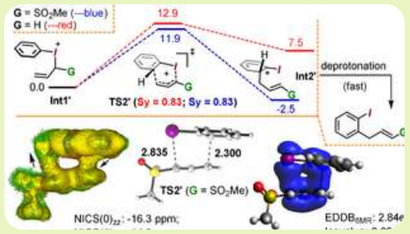
Exploring benzylic gem-C(sp3)–boron–silicon and boron–tin centers as synthetic platform

Chen, W. W.; Fernández, N. P.; Baranda, M. D.; Cunillera, A.; Rodríguez, L. G.; Shafir, A.; Cuenca, A. B., *Chem. Sci.*, **2021**, *12*, 10514-10521.



Two-step reaction mechanism reveals new antioxidant capability of cysteine disulfides against hydroxyl radical attack

Adhikari, S.; Crehuet, R.; Anglada, J. M.; Francisco, J. S.; Xia, Y., *Proc. Natl. Acad. Sci.*, **2020**, *117*, 18216-18223.

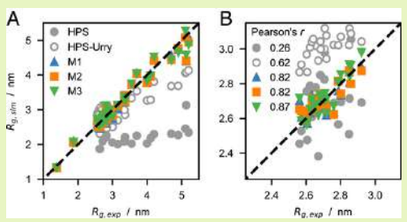


Iodane-Guided ortho C–H Allylation

Chen, W. W.; Cunillera, A.; Chen, D.; Lethu, S.; López de Moragas, A.; Zhu, J.; Solà, M.; Cuenca, A. B.; Shafir, A., *Angew. Chem. Int. Ed.*, **2020**, *59*, 20201-20207.

Biocatalytic Construction of Quaternary Centers by Aldol Addition of 3,3-Disubstituted 2-Oxoacid Derivatives to Aldehydes

Marín-Valls, R.; Hernández, K.; Bolte, M.; Parella, T.; Joglar, J.; Bujons, J.; Clapés, P., J. *Am. Chem. Soc*., **2020**, *142*, 19754-19762.

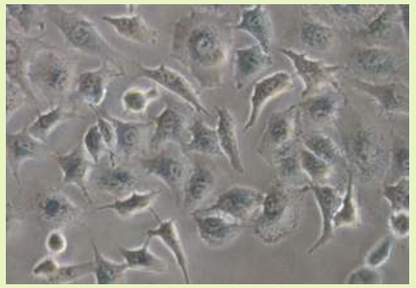


Accurate model of liquid–liquid phase behavior of intrinsically disordered proteins from optimization of single-chain properties

Tesei, G.; Schulze, T. K.; Crehuet, R.; Lindorff-Larsen, K., *Proc. Natl. Acad. Sci.*, **2021**, *118*, e2111696118.

Synthesis of γ-Hydroxy-α-amino Acid Derivatives by Enzymatic Tandem Aldol Addition–Transamination Reactions

Moreno, C. J.; Hernández, K.; Charnok, S. J.; Gittings, S.; Bolte, M.; Joglar, J.; Bujons, J.; Parella, T.; Clapés, P., *ACS Catal*., **2021**, *11*, 4660-4669.



Live-Cell-Templated Dynamic Combinatorial Chemistry

Carbajo, D.; Pérez, Y.; Bujons, J.; Alfonso, I., *Angew. Chem. Int. Ed.*, **2020**, *59*, 17202-17206.

Physicochemical surface analysis and germination at different irrigation conditions of DBD plasma-treated wheat seeds

Molina, R.; Lalueza, A.; López-Santos, C.; Ghobeira, R.; Cools, P.; Morent, R.; de Geyter, N.; González-Elipe, A. R., *Plasma. Process. Polym.*, **2021**, *18*, e2000086.

Modulation of Src Kinase Activity by Selective Substrate Recognition with Pseudopeptidic Cages

Tapia, L.; Solozabal, N.; Solà, J.; Pérez, Y.; Miller, W. T.; Alfonso, I., *Chem. Eur. J.*, **2021**, *27*, 9542-9549.

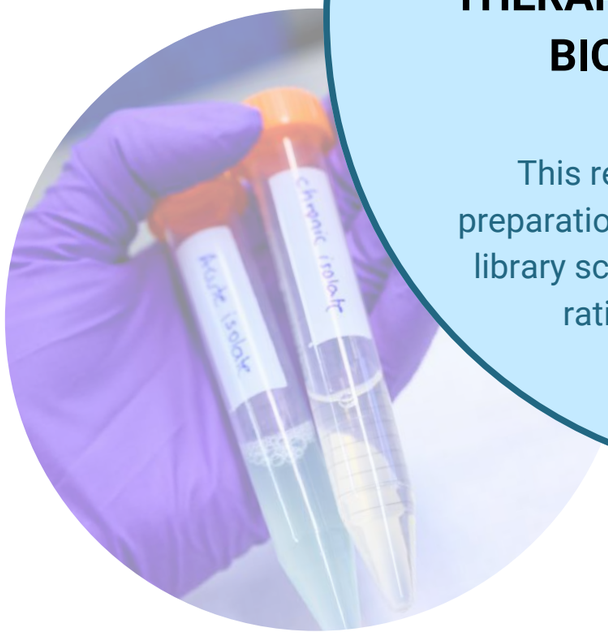
Laser-induced scanning transfer deposition of silver electrodes on glass surfaces: A green and scalable technology

Molina, R.; Ertuğrul, M.; Larrea, Á.; Navarro, R.; Rico, V.; Yubero, F.; González-Elipe, A. R.; de la Fuente, G. F.; Angurel, L. A., *Appl. Surf. Sci.*, **2021**, *556*, 149673.

RL2

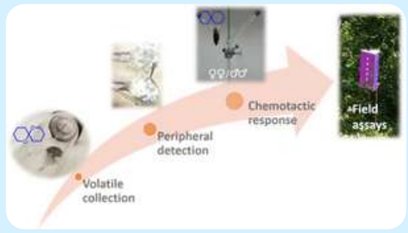
DISCOVERY OF CHEMICAL AND MOLECULAR ENTITIES OF THERAPEUTIC, BIOLOGICAL AND BIOMEDICAL INTEREST

This research line is focussed in the preparation of bioactive molecules either by library screening (in vitro or in silico) or by rational design and synthesis.



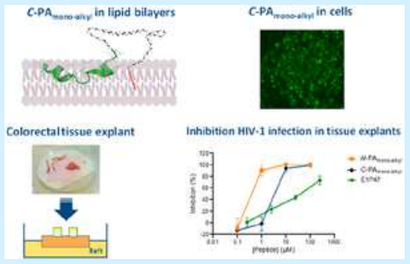
Anti-carbamylated proteins antibody repertoire in rheumatoid arthritis: evidence of a new autoantibody linked to interstitial lung disease

Castellanos-Moreira, R.; Rodríguez-García, S. C.; Gomara, M. J.; Ruiz-Esquide, V.; Cuervo, A.; Casafont-Solé, I.; Ramírez, J.; Holgado, S.; Gómez-Puerta, J. A.; Cañete, J. D.; Haro, I.; Sanmarti, R., *Ann. Rheum. Dis.*, **2020**, *79*, 587-594.



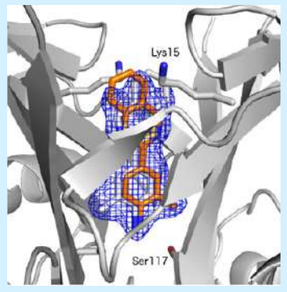
Olean (1,7-dioxaspiro[5.5]undecane): A Novel Intraspecific Chemical Cue in Coraebus undatus (F.) (Coleoptera: Buprestidae)

López, S.; Álvarez-Calero, J. M.; Riba-Flinch, J. M.; Coca-Abia, M. M.; Torrell, A.; Quero, C., *Insects*, **2021**, *12*, 1085.



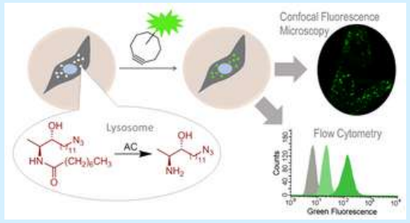
Peptide Amphiphilic-Based Supramolecular Structures with Anti-HIV-1 Activity

Gómara, M. J.; Pons, R.; Herrera, C.; Ziprin, P.; Haro, I., *Bioconjug. Chem.*, **2021**, 32, 1999-2013.



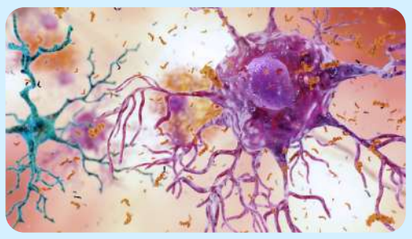
Targeting transthyretin in Alzheimer's disease: Drug discovery of small-molecule chaperones as disease-modifying drug candidates for Alzheimer's disease

Cotrina, E. Y.; Santos, L. M.; Rivas, J.; Blasi, D.; Leite, J. P.; Liz, M. A.; Busquets, M. A.; Planas, A.; Prohens, R.; Gimeno, A.; Jiménez-Barbero, J.; Gales, L.; Llop, J.; Quintana, J.; Cardoso, I.; Arsequell, G., *Eur. J. Med. Chem.*, **2021**, *226*, 113847.



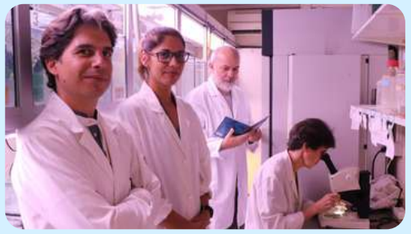
Click and count: specific detection of acid ceramidase activity in live cells

Casasampere M., Izquierdo E., Casas J., Abad JL., Liu X., Xu R., Mao C., Chang YT., Delgado A., Fabrias G., *Chem. Sci.,* **2020**, 11(48), 13044-13051.



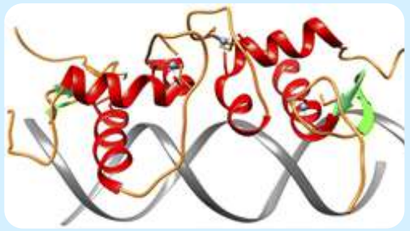
An Assay for Screening Potential Drug Candidates for Alzheimer's Disease That Act as Chaperones of the Transthyretin and Amyloid-β Peptides Interaction

Cotrina EY, Gimeno A, Llop J, Jiménez-Barbero J, Quintana J, Prohens R, Cardoso I, Arsequell G. *Chemistry*, **2020** Dec 23;26(72):17462-17469.



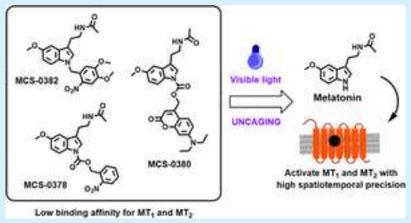
A Photoswitchable Ligand Targeting the β1-Adrenoceptor Enables Light-Control of the Cardiac Rhythm

Duran-Corbera, A.; Faria, M.; Ma, Y.; Prats, E.; Dias, A.; Catena, J.; Martinez, K. L.; Raldua, D.; Llebaria, A.; Rovira, X., *Angew. Chem. Int. Ed.*, **2022**, *61*, e202203449.



A versatile o-aminoanilide linker for native chemical ligation

Sánchez-Campillo, I.; Miguel-Gracia, J.; Karamanis, P.; Blanco-Canosa, J. *B., Chem. Sci.*, **2022**, *13*, 10904-10913.

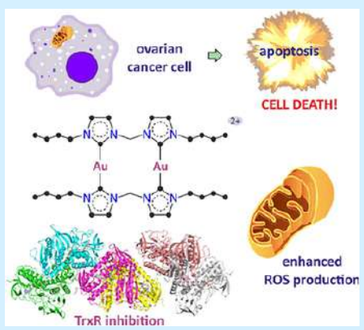


Design and Validation of the First Family of Photo-Activatable Ligands for Melatonin Receptors

Somalo-Barranco, G.; Serra, C.; Lyons, D.; Piggins, H. D.; Jockers, R.; Llebaria, A.; *J Med Chem.* **2022**, *65*, 11229-11240.

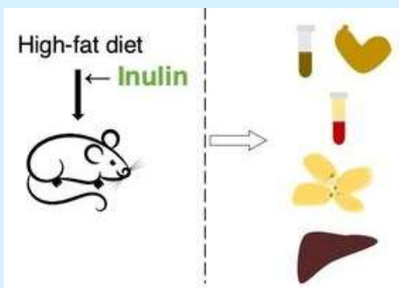
Fiber-like action of D-fagomine on the gut microbiota and bodyweight of healthy rats

Ramos-Romero, S.; Ponomarenko, J.; Amézqueta, S.; Hereu, M.; Miralles-Pérez, B.; Romeu, M.; Méndez, L.; Medina, I.; Torres, Lluis J., *Nutrients*, **2022**, *14*, 4656.



Dinuclear silver and gold bisNHC complexes as drug candidates for cancer therapy

Quintana, M.; Rodriguez-Rius, A.; Vellé, A.; Vives, S.; Sanz Miguel, P. J.; Triola, G.; *Bioorg. Med. Chem.* **2022**, *67*, 116814.



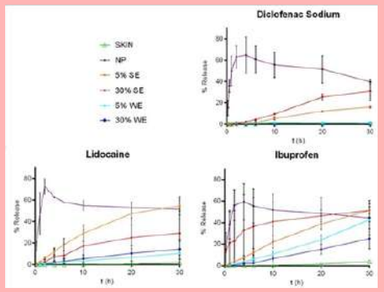
Influence of dietary inulin on fecal microbiota, cardiometabolic risk factors, eicosanoids, and oxidative stress in rats fed a high-fat diet

Miralles-Perez, B.; Rosa Nogues, M.; Sanchez-Martos, V.; Fortuno-Mar, A.; Ramos-Romero, S.; Torres, J. L.; Ponomarenko, J.; Amezqueta, S.; Zhang, X.; Romeu, M., *Foods*, **2022**, *11, 4072.*

RL3

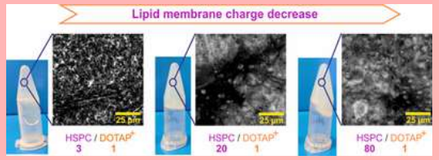
SURFACTANTS: SYNTHESIS, BIOPHYSICAL STUDIES AND APPLICATIONS

The aim of this area is to gain knowledge in the biophysical properties and biocompatibility of different surfactants and related systems to address some of the society problems in chemical processes and human health.



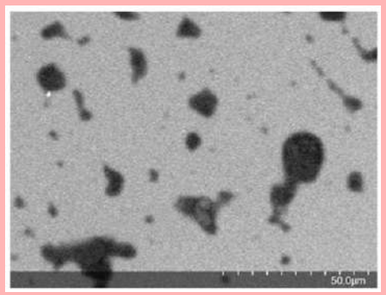
Permeation kinetics of active drugs through lanolin-based artificial membranes

Alonso, C.; Collini, I.; Carrer, V.; Barba, C.; Marti, M.; Coderch, L., *Colloids Surf. B.*, **2020**, *192, 111024*.



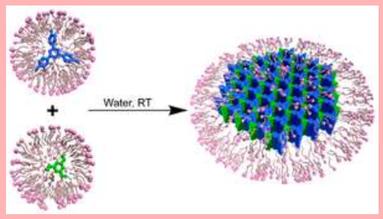
Gels formed from the interaction of lipid vesicles: Influence of charge in their structural and rheological properties

Tallo, K.; Vilchez, S.; Pons, R.; Lopez, O., *J. Mol. Liq.*, **2021**, *322, 114957*.



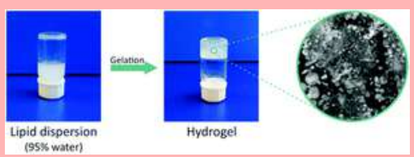
Formation and Characterization of Oregano Essential Oil Nanocapsules Applied onto Polyester Textile

Salinas, C.; Lis, M. J.; Coderch, L.; Marti, M., *Polym.*, **2022**, *14*, 5188.



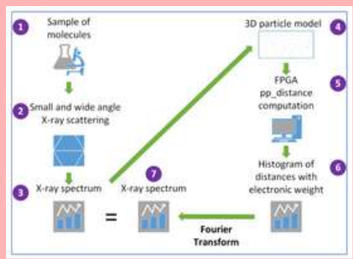
Biomimetic Synthesis of Sub-20 nm Covalent Organic Frameworks in Water

Franco, C.; Rodríguez-San-Miguel, D.; Sorrenti, A.; Sevim, S.; Pons, R.; Platero-Prats, A. E.; Pavlovic, M.; Szilágyi, I.; Ruiz Gonzalez, M. L.; González-Calbet, J. M.; Bochicchio, D.; Pesce, L.; Pavan, G. M.; Imaz, I.; Cano-Sarabia, M.; Maspoch, D.; Pané, S.; de Mello, A. J.; Zamora, F.; Puigmartí-Luis, J., *J. Am. Chem. Soc.*, **2020**, *142*, 3540-3547.



Preparation and characterization of a supramolecular hydrogel made of phospholipids and oleic acid with a high water content

Talló, K.; Bosch, M.; Pons, R.; Cocera, M.; López, O., *J. Mater. Chem. B.*, **2020**, *8*, 161-167.

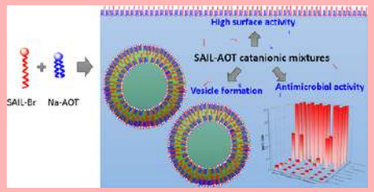


High Performance Computing PP-Distance Algorithms to Generate X-ray Spectra from 3D Models

Gonzalez, C.; Balocco, S.; Bosch, J.; Miguel de Haro, J.; Paolini, M.; Filgueras, A.; Alvarez, C.; Pons, R., *Int. J. Mol. Sci.*, **2022**, *23*.

Cationic Surfactants Based on Arginine-Phenylalanine and Arginine-Tryptophan: Synthesis, Aggregation Behavior, Antimicrobial Activity, and Biodegradation

Perez, L.; Teresa Garcia, M.; Pinazo, A.; Perez-Matas, E.; Hafidi, Z.; Bautista, E., *Pharmaceutics*, **2022**, *14*.



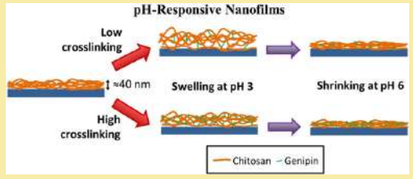
Surface activity, self-aggregation and antimicrobial activity of catanionic mixtures of surface active imidazolium- or pyridinium-based ionic liquids and sodium bis(2-ethylhexyl) sulfosuccionate

Teresa Garcia, M.; Ribosa, I.; Jose Gonzalez, J.; Comelles, F., *J. Mol. Liq.*, **2020**, *303*, 112637.

RL4

NANOBIOTECHNOLOGY FOR THE PREVENTION, DIAGNOSTIC AND TREATMENT OF DISEASES

Using the knowledge and technology at IQAC our scientists develop new tools for identification of relevant biomarkers for disease detection and develop new delivery platforms to improve therapeutic treatments.



pH-responsive chitosan nanofilms crosslinked with genipin

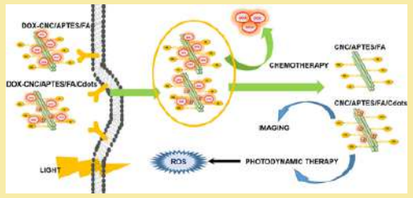
Miras, J.; Liu, C.; Blomberg, E.; Thormann, E.; Vilchez, S.; Esquena, J., *Colloids Surf. A*, **2021**, *616*, 126229.

The gene silencing of IRF5 and BLYSS effectively modulates the outcome of experimental lupus nephritis

Guiteras, J.; Ripoll, E.; Bolanos, N.; Ramon, L. D.; Fontova, P.; Lloberas, N.; Cruzado, J. M.; Aran, J. M.; Avino, A.; Eritja, R.; Goma, M.; Taco, R.; Grinyo, J. M.; Torras, *J., Mol. Ther. Nucleic Acids.*, **2021**, *24*, 807-821.

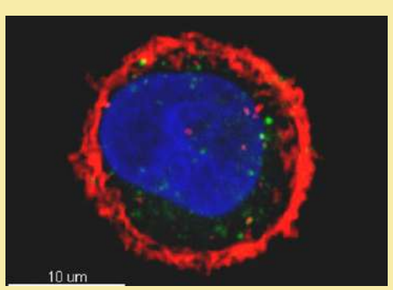
Formation and stabilization of multiple water-in-water-in-water (W/W/W) emulsions

Beldengrun, Y.; Dallaris, V.; Jaen, C.; Protat, R.; Miras, J.; Calvo, M.; Garcia-Celma, M. J.; Esquena, J., *Food Hydrocoll.*, **2020**, *102*, 105588.



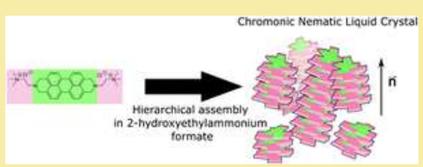
A nanocellulose-based platform towards targeted chemo-photodynamic/photothermal cancer therapy

Do, T. T. A.; Grijalvo, S.; Imae, T.; Garcia-Celma, M. J.; Rodríguez-Abreu, C., *Carbohydr. Polym.*, **2021**, *270*, 118366.



A multivalent Ara-C-prodrug nanoconjugate achieves selective ablation of leukemic cells in an acute myeloid leukemia mouse model

Pallares, V.; Unzueta, U.; Falgas, A.; Avino, A.; Nunez, Y.; Garcia-Leon, A.; Sanchez-Garcia, L.; Serna, N.; Gallardo, A.; Alba-Castellon, L.; Alamo, P.; Sierra, J.; Cedo, L.; Eritja, R.; Villaverde, A.; Vazquez, E.; Casanova, I.; Mangues, R., *Biomater.*, **2022**, *280*, 121258.

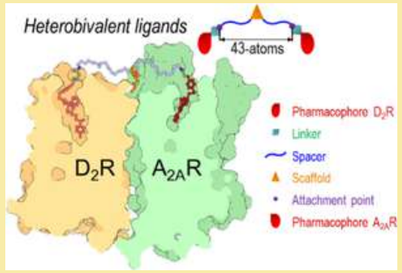


Chromonic nematic liquid crystals in a room-temperature ionic liquid

Magana, J. R.; Pérez-Calm, A.; Rodriguez-Abreu, C., *Chem. Commun.*, **2022**, *58*, 1724-1727.

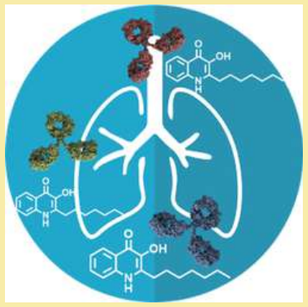
An Immunochemical Approach to Detect the Quorum Sensing-Regulated Virulence Factor 2-Heptyl-4-Quinoline N-Oxide (HQNO) Produced by Pseudomonas aeruginosa Clinical Isolates

Montagut, E. J.; Raya, J.; Martin-Gomez, M. T.; Vilaplana, L.; Rodriguez-Urretavizcaya, B.; Marco, M. P., *Microbiol. Spectr.*, **2022**, *10*.



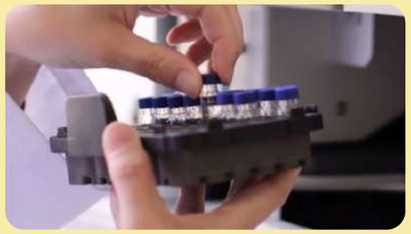
Heterobivalent Ligand for the Adenosine A2A–Dopamine D2 Receptor Heteromer.

Pulido, D.; Casado-Anguera, V.; Gomez-Autet, M.; Llopart, N.; Moreno, E.; Casajuana-Martin, N.; Ferre, S.; Pardo, L.; Casado, V.; Royo, M., *J. Med. Chem.*, **2022**, *65*, 616-632.



An Immunochemical Approach to Quantify and Assess the Potential Value of the Pseudomonas Quinolone Signal as a Biomarker of Infection

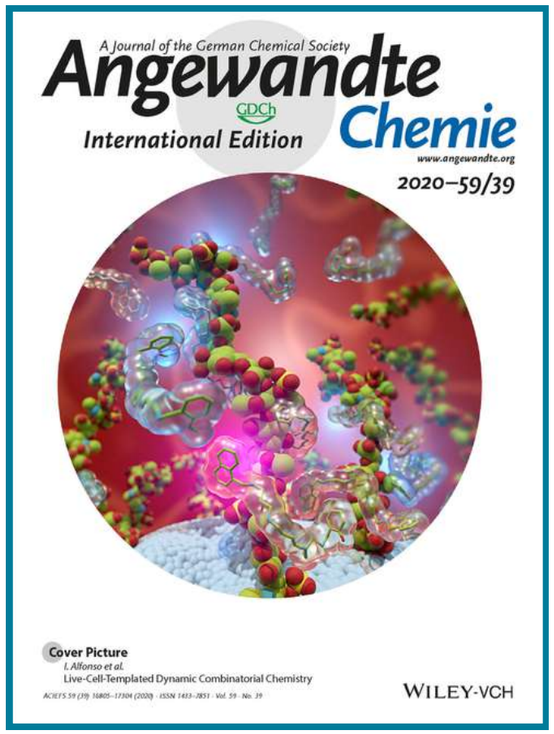
Montagut, E. J.; Martin-Gomez, M. T.; Marco, M. P., *Anal. Chem.*, **2021**, *93*, 4859-4866.

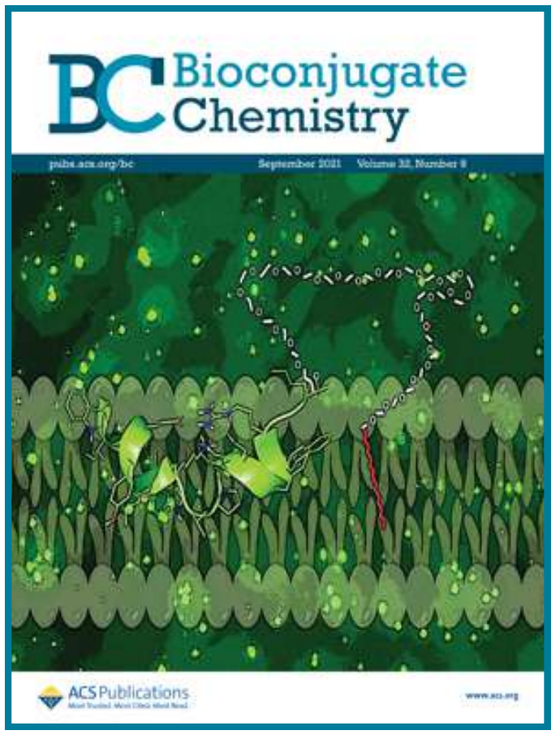


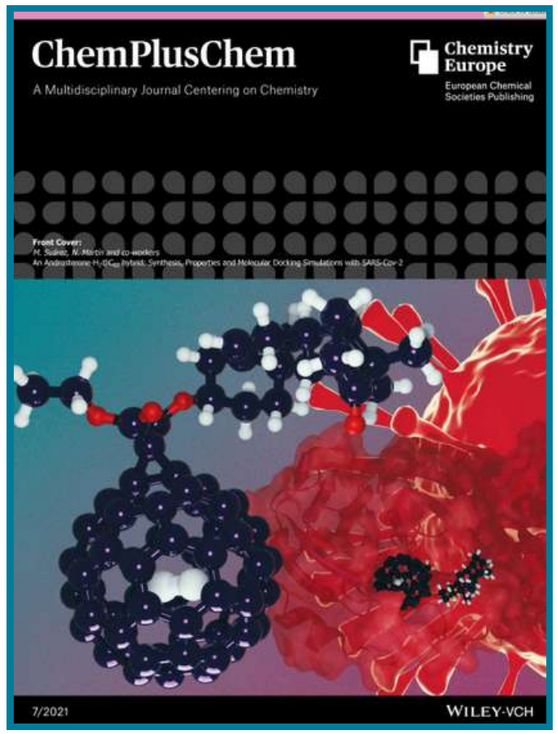
Synthesis of Stable Cholesteryl–Polyethylene Glycol–Peptide Conjugates with Non-Disperse Polyethylene Glycol Lengths

Cristóbal-Lecina, E.; Pulido, D.; Martin-Malpartida, P.; Macias, M. J.; Albericio, F.; Royo, M., *ACS Omega*, **2020**, *5*, 5508-5519.

IQAC research papers selected as front covers of scientific journals







INTERDISCIPLINARY THEMATIC PLATFORMS (PTIs)

PTI SALUD GLOBAL

INTERDISCIPLINARY THEMATIC PLATFORMS (PTIs) are an instrument of research and innovation created by CSIC to **address multidisciplinary challenges of great scientific, economic and social impact**.

IQAC participates on the **PTI Global Health** which covers all aspects of pandemic infections: **prevention, social impact and communication**.

Moreover, within this PTI, the **CSIC Chemical Library (Quimioteca)** was created. This important tool is established to **promote the intern collaboration among different CSIC research groups**, as well as the possibility of collaboration with **industrial partners in projects like novel drugs discovery**.

Quimioteca del CSIC

These are the IQAC groups that participate in the Global Health PTI areas:

DIAGNOSIS

- **Nanobiotechnology for Diagnostics**
- **Multivalent Systems for Nanomedicine**
- **Nucleid Acid Chemistry**

ANTIVIRAL

- **Multivalent Systems for Nanomedicine**
- **Medicinal Chemistry and Synthesis**
- **Research Unit on Bioactive Molecules**

CONEXIONES CSIC (CSIC-HUBs)

Thematic CSIC HUBs (Conexiones CSIC) are scientific-technical collaboration networks that seek to establish synergic links between researchers from different institutes around priority topics.

IQAC is part of the **Nanomedicine**, **Cancer** and **Life** HUBs.

Conexión Nanomedicina CSIC

24 CSIC centers
60 Research groups participating

- Chemical Biology
- Nucleic Acid Chemistry
- Colloidal and Interfacial Chemistry
- Unit of Synthesis and Biomedical Applications of Peptides
- Nanobiotechnology for Diagnostics

Cancer

20 CSIC centers
94 Research groups participating

- Research Unit on Bioactive Molecules
- Chemical Biology

LIFEHUB

49 CSIC centers
191 Research groups participating

- Theoretical and Computational Chemistry

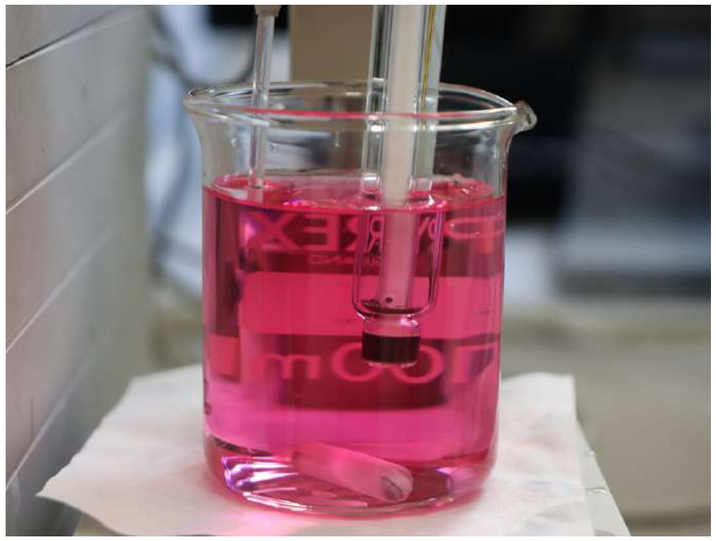
SCIENTIFIC TECHNOLOGICAL PLATFORMS

SMALL MOLECULES AND BIOMOLECULES PRODUCTION

Dedicated to the production of small molecules, peptides and antibodies.

- Synthesis of High Added Value Molecules
- Custom Antibody Service
- Peptides Synthesis

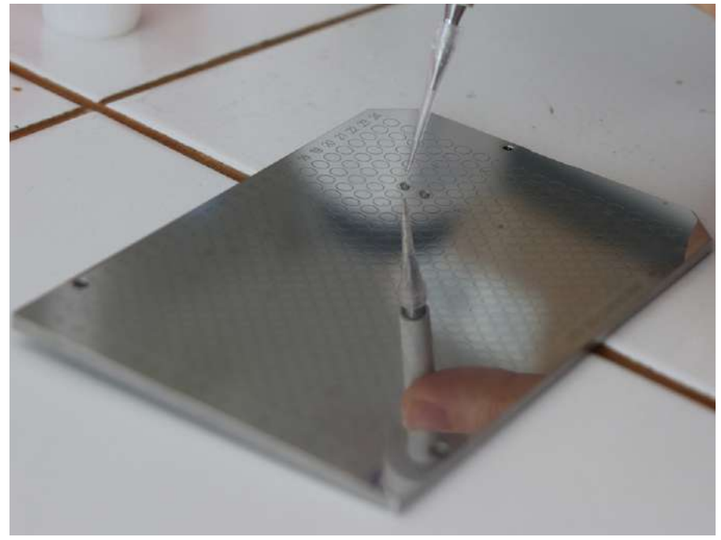
INSTRUMENTAL ANALYSIS AND CHARACTERIZATION OF MOLECULES AND MATERIALS



Devoted to the full characterization and quality control of molecules and materials.

- Spectroscopy (NMR, EPR, SAXS-WAXS, UV-Vis, FT-IR)
- Mass Spectrometry
- Thermal Analysis and Calorimetry
- Microanalysis
- Characterization of Colloidal Dispersions

BIOMEDICAL AND ENVIRONMENTAL ASSESSMENT

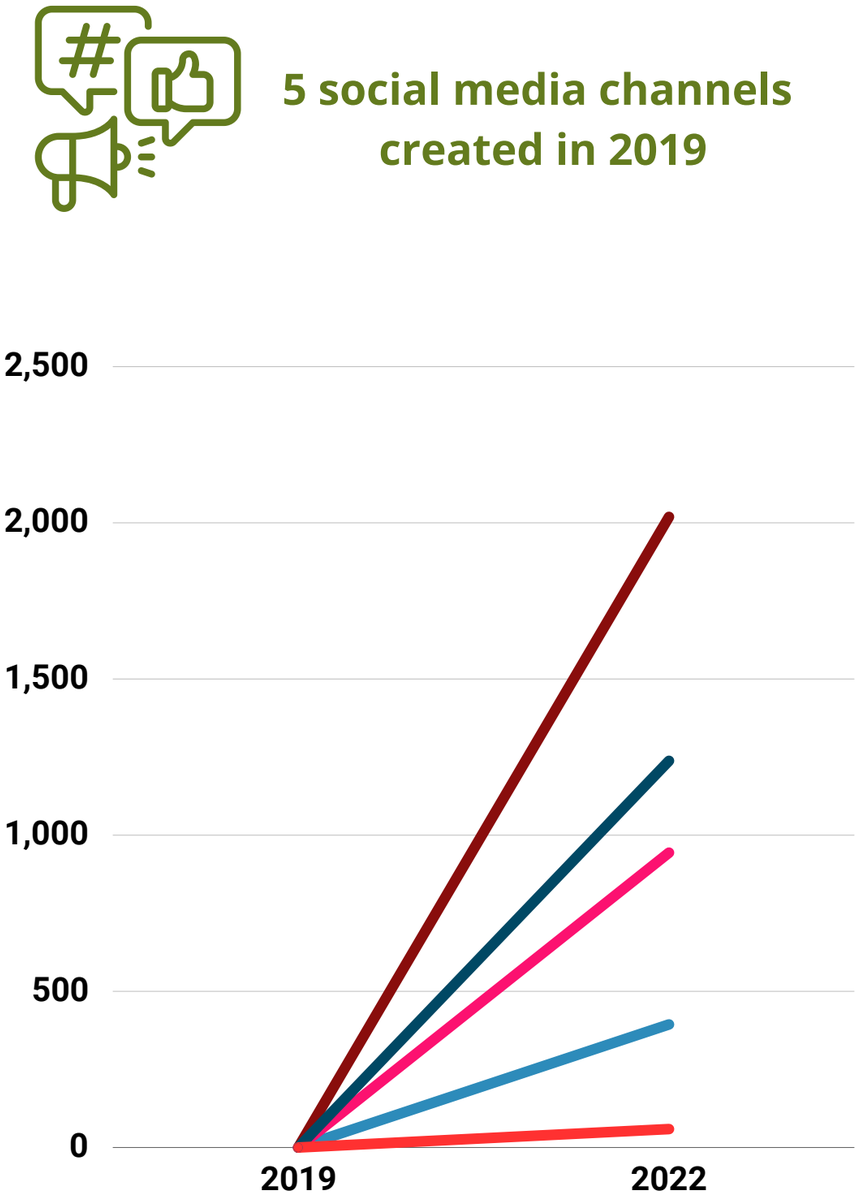


This platform offers the evaluation of molecules and materials on different biological and environmental systems.

- Dermocosmetic Assessment
- OMICS and MS-Imaging
- Biodegradability and Ecotoxicity
- Cell Culture (CID-CSIC)
- Animal Facility (CID-CSIC)

COMMUNICATION AND OUTREACH

5 social media channels created in 2019



Outreach activities

- Conferences: 20
- Workshops: 19
- Exhibitions: 3
- Outreach fairs: 1
- Others events: 1
- Courses: 1

3,083 Target audience reached

IQAC in the media

- Press releases: 17
- Media appearances: 61
- Blogs and dissemination articles: 51

Media appearance highlights

Researchers from IQAC-CSIC seek to reinforce nasal and oral mucosa to make them impermeable to SARS-COV-2

CSIC researchers developed photocontrolable drugs that enable the control of the heart rate by light

COMMUNICATION AND OUTREACH

Highlights

CSIC4Girls

Girls belong in Science
FECYT Project

BBQ-CSIC

I Interdisciplinary workshop on Biology, Biomedicine and Chemistry

Citizen help

Leptoglossus occidentalis

IQAC YRD

I and II Editions of the Young Researchers' Day

IQAC COMMITTEES

The institute's internal committees are made up of volunteer staff from different areas and provide support to management on various issues.

Scientific strategy

- Preparation of the IQAC and the Maria de Maeztu Strategic Plans.

Seminars

- Organization of internal seminars of IQAC researchers and invited speakers.
- Organization of the Annual Symposium and the Young Researchers' Day.

Gender Equality

- Proposals of gender equality initiatives.
- Participation in the gender equality plan of the CID-CSIC.

Space management

- Evaluation of the availability and suitability of institute spaces.
- Analysis and optimization of space occupation by research groups and facilities.

Recruitment of Human and Economic Resources

- Proposals of initiatives for scientific talent attraction.
- Identification of researchers interested in working at IQAC.

Institutional Relations

- Evaluation, proposals, and promotion of relations with Universities, research centers, technological platforms, and companies.
- Participation in the preparation of agreements with other institutions.

Scientific Services

- Organization of the scientific and technical facilities.
- Biannual evaluation of the IQAC facilities.
- Prioritization of instrument requests.

Scientific report conducted by: Ana Sotres and Alejandro Rodríguez.
With the support of: Fernando del Blanco Rodríguez, María José Bleda, Carlos Rodríguez, Carlos Santalices, and Jordi Solà.
Layout: Ana Sotres and Alejandro Rodríguez.
Pictures: Jesús Joglar, Alejandro Rodríguez, and César Hernández.

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