Institut de Nanociència
i Nanotecnologia
UNIVERSITAT DE BARCELONA

activity report 2020

UNIVERSITAT DE BARCELONA

Institut de Nanociència
i Nanotecnologia

activity report 2020

UNIVERSITAT DE BARCELONA

foreword

Dr. Guillem Aromí Bedmar

IN²UB Director

The Scientific Activity Report of the IN²UB of the year 2020 is with no doubts a very especial one for the history of the Institute. It summarizes the engagement of the organization during the year of the irruption of COVID19 and its most acute effects. I use this opportunity to extend the sympathy of the IN2UB to these who have suffered this disaster in any form. These events have marked also life at the Institute and its activities. Despite the difficulties imposed by the sudden outbreak, the current report demonstrates that we have been able to overcome it notably and to take, when possible, the new opportunities that the situation has furnished.

Thus, the scientific production of our scientists has remained intense and of high impact during this year. The scientific stature is also gauged by the capacity to attract competitive funds. For example, the year 2020, scientists from our Institute have excelled in the establishment of several prestigious H2020 FET-OPEN consortia. The IN²UB flagship program of collaborative fellowships (ART) has been deployed as planned, while we were pioneers in adapting to the new situation by introducing immediately the format of on-line remote presentations to maintain our regular International Research Seminars (IRS) cycle in schedule. The timing of the events made it unavoidable to cancel our Annual Workshop, which was designed to host our newly established International Advisory Board. The IN2UB reacted to this cancellation by creating a new roadmap to obtain the Evaluation Report on the IN2UB performance from this Board on 2020, as planned. This important document, crucial for the future endeavours of the organization, was obtained at the end of the year.

The engagement of the IN²UB with the Doctorate of Nanoscience and the Masters of Nanoscience and Nanotechnology, both coordinated by members of the Institute, remains high. The Institute manages the concession of some of the PhD Fellowships furnished by the Universitat de Barcelona while it has used some of its funds to secure the offer of four Masters Fellowships to be hosted by researchers of the unit. This fructifies in many things, among which, the training and graduation of scientists on the areas of nanoscience emerging from our laboratories.

In terms of outreach and technology transfer, another important commitment of our Institute, several researchers of the unit have been at the spotlight of highlighted news by the University of Barcelona and other press releases, as summarized in this memoir. In this context, despite the limitations of the COVID pandemics, the year 2020 has witnessed an explosion of outreach activities thanks to the success of the new permanent commission of outreach of the IN2UB created the previous year and to the engagement of its members. In these pages, you will have the chance to walk through the many activities conducted, most following the requirements imposed by the pandemic situation.

I hope you enjoy this journey through the year 2020 at the IN²UB. I believe that we can use the hard lessons learned and the unexpected new opportunities created during this period to grow as a scientific organization and as a human group.

activity report 2020

table of contents

1. about IN²UB

1.1. Presentation

The Institute of Nanoscience and Nanotechnology of the University of Barcelona (IN2UB) was created in 2006. Its main goal is to coordinate and enhance multidisciplinary research among research groups from the Faculties of Chemistry, Physics, Pharmacy and Food Sciences, Biology, Earth Sciences and Medicine and Health Sciences that work on the different phenomena occurring at the nanoscale. This collaborative spirit aims at integrating both, internally and internationally, interdisciplinary activities which integrate equally, basic and applied research.

The IN²UB wants to contribute to the progress of science, while spurring, at the same time, industrial excellence. In this sense, several spin-off companies are now led by IN2UB researchers. Finally, all members of the IN²UB are strongly involved in teaching endeavours, the most important programs being the Master of Nanoscience and Nanotechnology and the Doctoral Program of Nanoscience. Research and education serve us to convey our strong commitment with society.

IN²UB gathers around 200 researchers (including permanent, postdoctoral researchers and Predoctoral Researchers). They are organized in 52 research groups distributed among seven major research areas.

Research Areas:

1. Modeling, Simulation and Nanoscopic Methods (NanoMet)
2. Nanobioscience, Nanobiomechanics and BioNanotechnology (NanoBio)
3. Nanopharmaceutics and Nanomedicine (NanoPharmaMed)
4. Nanomagnetism and Spintronics (NanoMagnetics)
5. Nanoelectronics, Nano-optics and Nanophotonics (NanoPhotoElectro)
6. Nanostructured materials (NanosMat)
7. Nanoenergy: Production and Storage (NanoEnergy)

1.2. Organization

The institute is led by the Steering Committee, the Secretary and the Director. Each of the seven research areas has a coordinator. In addition, the Institute receive the advises from internal and external scientific boards.

The institute currently has **51 research groups** with **214 researchers**:

**GL: Group Leader, leading an independent research group at the unit*

***SR: Senior researcher, Investigator leading one or several projects in a research group, but not being GL*

Director: **Dr. Guillem Aromí Bedmar**
Secretary: **Dr. Albert Romano Rodríguez**

STEERING COMMITTEE

- Dr. Xavier Batlle Gelabert
- Dr. Enric Bertran Serra
- Dr. Gustavo Egea Guri
- Dr. Sònia Estradé Albiol
- Dr. Giancarlo Franzese
- Dr. M. José García Celma
- Dr. Blas Garrido Fernandez
- Dr. Frank Güell Vilà
- Dr. Narcís Homs Martí
- Dr. Sergi Hernández Márquez
- Dr. Jordi Ignés Mullol
- Dr. Francesca Peiró Martínez

RESEARCH AREAS COORDINATORS

1. NanoMet: Dr. Francesca Peiró Martínez
2. NanoBio: Dr. Gustavo Egea Guri
3. NanoPharmaMed: Dr. M José García Celma
4. NanoMagnetics: Dr. Xavier Batlle Gelabert
5. NanoPhotoElectro: Dr. Blas Garrido Fernández
6. NanosMat: Dr. Enric Bertran Serra
7. NanoEnergy: Dr. Narcís Homs Martí

INTERNAL SCIENTIFIC BOARD

- Dr. Maria Pilar Vinardell Martinez Hidalgo (President)
- Dr. Ramon Farré Ventura
- Dr. Amílcar Labarta Rodríguez
- Dr. Francesc Sagués Mestre

INTERNATIONAL SCIENTIFIC ADVISORY BOARD

- Dr. Ivan Schuller | UC San Diego (President)
- Dr. Kenneth Dawson | UC Dublin
- Dr. Katja Schenke-Layland | Eberhard Karls University Tübingen
- Dr. Maria Jesús Vicent | Centro de Investigación Príncipe Felipe

OUTREACH COMMISSION

Dr. Sònia Estradé Albiol (Coordinator January - September) - Dr. Jordi Díaz Marcos (from October 2020); Dr. Xavier Batlle Gelabert; Dr. Giancarlo Franzese; Dr. M. Aranzazu Fraile Rodríguez; Dr. Blas Garrido Fernández; Dr. Oscar Iglesias Clotas; Dra. Francesca Peiró Martínez; Dr. Laura Rodríguez Raurell; Dr. M. Antònia Busquets Viñas; Dr. Giancarlo Franzese; Dr. Jordi Díaz Marcos; Dra. Sonia Trigueros; Mariona Escoda Torroella, Elena Lopez Aymerich
Contact: in2ub-divulga@ub.edu

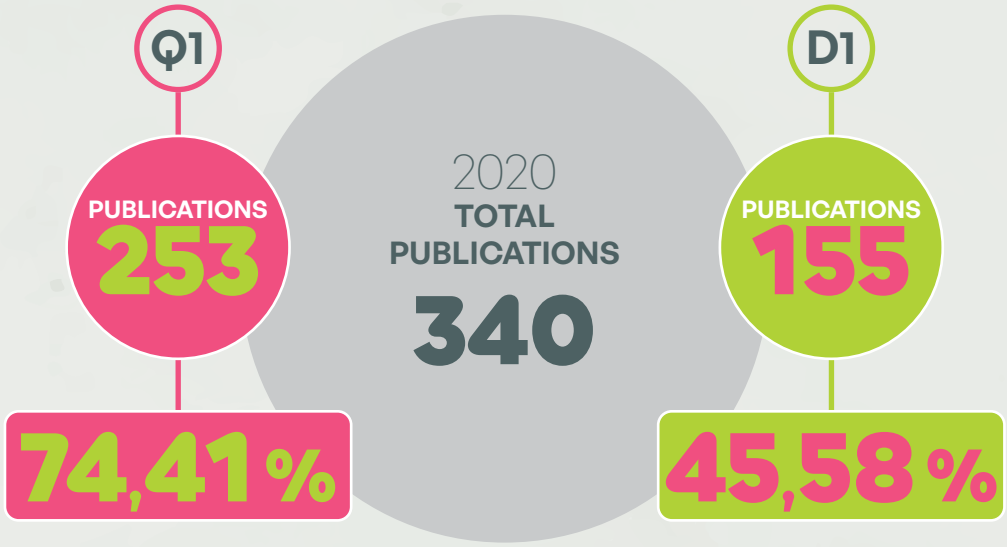
RESEARCH MANAGEMENT

Dr. Ifigènia Saborit Villarroya

1.3. Research Outputs, Funding Sources and Transfer Indicators

1.3.1. Scientific Production

IN²UB is a multidisciplinary research unit, mainly harvesting research in the field of **Physics, Chemistry, Material Science, Pharmacology and Biology**. Specifically, the following major subject areas represent IN²UB scientific production: **Chemistry, Physics and Astronomy and Material Science, Biochemistry, Genetics and Molecular Biology, Engineering, Medicine and Chemical Engineering and Pharmacology, Toxicology and Pharmaceutics**. The rest of IN²UB publications, are integrated in other related subject areas such as **Medicine, Mathematics, Energy Environmental Science or Earth and Planetary Sciences**. The analysis of these areas during 2020 period, represented 340 papers published in indexed journals in Scopus, with 74.41 % of this production at first quartile.



Data from Indexed Scopus Sources (February 2021)

1.3.2. High Index Publications

- **On the Promotion of Catalytic Reactions by Surface Acoustic Waves**
  von Boehn B., Foerster M., von Boehn M., Prat J., Macià F., Casals B., Khaliq M.W., Hernández-Mínguez A., Aballe L., Imbihl R. Angewandte Chemie - International Edition, 2020, 59(45).

- **On the Binding of Congo Red to Amyloid Fibrils**
  Espargaró A., Llabrés S., Saupe S.J., Curutchet C., Luque F.J., Sabaté R.
  Angewandte Chemie - International Edition, 2020, 59(21).

- **Nanochaperone-Based Strategies to Control Protein Aggregation Linked to Conformational Diseases**
  Caballero A.B., Gamez P. Angewandte Chemie - International Edition, 2020, 60.

- **Tandem Mn–I Exchange and Homocoupling Processes Mediated by a Synergistically Operative Lithium Manganate**
  Uzelac M., Mastropierro P., de Tullio M., Borilovic I., Tarrés M., Kennedy A.R., Aromí G., Hevia E.
  Angewandte Chemie - International Edition, 2020, 59.

- **Ultrafast relaxation of photoexcited superfluid He nanodroplets**
  Mudrich M., LaForge A.C., Ciavardini A., O'Keeffe P., Callegari C., Coreno M., Demidovich A., Devetta M., Fraia M.D., Drabbels M., Finetti P., Gessner O., Grazioli C., Hernando A., Neumark D.M., Ovcharenko Y., Piseri P., Plekan O., Prince K.C., Richter R., Ziemkiewicz M.P., Möller T., Eloranta J., Pi M., Barranco M., Stienkemeier F. Nature Communications, 2020, 11(1), 112.

- **Spatial defects nanoengineering for bipolar conductivity in MoS2**
  Zheng X., Calò A., Cao T., Liu X., Huang Z., Das P.M., Drndic M., Albisetti E., Lavini F., Li T.-D., Narang V., King W.P., Harrold J.W., Vittadello M., Aruta C., Shahrjerdi D., Riedo E.
  Nature Communications, 2020, 11(1), 3463.

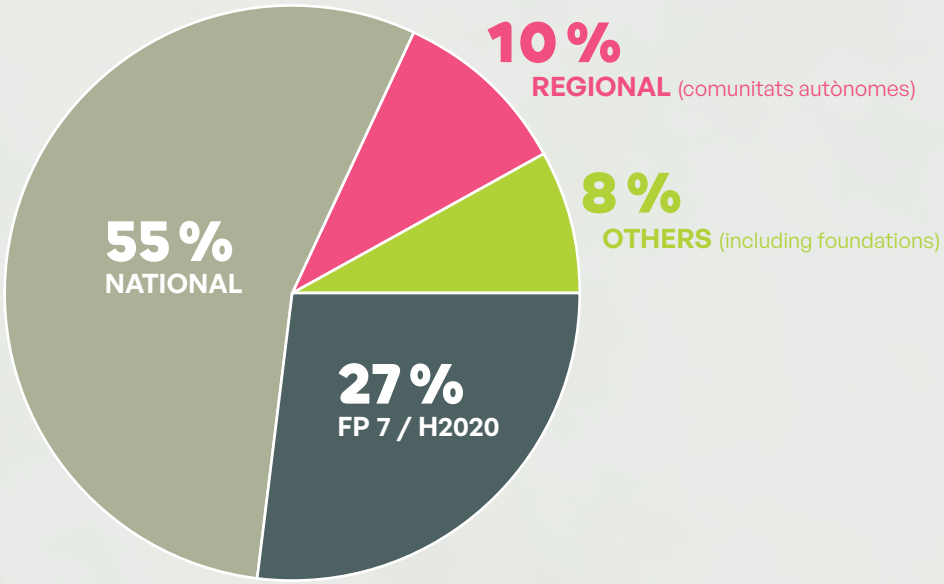
- **Natural optical activity as the origin of the large chiroptical properties in π-conjugated polymer thin films**
  Wade J., Hilfiker J.N., Brandt J.R., Liirò-Peluso L., Wan L., Shi X., Salerno F., Ryan S.T.J., Schöche S., Arteaga O., Jávorfi T., Siligardi G., Wang C., Amabilino D.B., Beton P.H., Campbell A.J., Fuchter M.J.
  Nature Communications, 2020, 11(1), 6137.

- **Engineering grain boundaries at the 2D limit for the hydrogen evolution reaction**
  He Y., Tang P., Hu Z., He Q., Zhu C., Wang L., Zeng Q., Golani P., Gao G., Fu W., Huang Z., Gao C., Xia J., Wang X., Wang X., Zhu C., Ramasse Q.M., Zhang A., An B., Zhang Y., Martí-Sánchez S., Morante J.R., Wang L., Tay B.K., Yakobson B.I., Trampert A., Zhang H., Wu M., Wang Q.J., Arbiol J., Liu Z.
  Nature Communications, 2020, 11(1), 57.

- **Variable optical elements for fast focus control**
  Kang S.Y., Duocastella M., Arnold C.B. Nature Photonics, 2020, 14(9).

1.3.3. Funding Sources

The graphic and pie below, show the amount allocated for 2020 from competitive calls from public organizations achieved by our researchers, provided by GREC UB.



1.3.4. Highlighted Projects

During 2020 the researchers from IN²UB have been awarded with 4M € to be distributed in the forthcoming years. Form all these projects, here we highlight the most relevant ones:

- **H2020 FET-Open, Fully Oxide-based Zero-Emission and Portable Energy Supply** (acronym, FOXES; 951774). UB-IP: *J. Daniel Prades*. Budget: 3.9M€ (796K€ for UB) (2020-2024)

- **H2020 FET-Open, Scalable Structured Micro Illumination Light Engines** (acronym, SMILE). Coordinators: *Ángel Dieguez* and *J. Daniel Prades*. Budget: 1.9M€ (774K€ for UB) (2020-2022)

- **H2020 FET-Open, FAult Tolerant MOLecular Spin processor** (acronym, FATMOLS). UB-PI: *Guillem Aromí*. Budget: 3.2M€ (227K€ for UB) (2020-2023)

- **ERC Proof of Concept, A user-friendly approach to widespread gas monitoring** (acronym, Stick-n-Sense). IP: *J. Daniel Prades*. Budget: 150.000 EUR (2021-2022)

- **H2020 FET-OPEN, Continuous two-dimensional Stretch monitoring of fresh tissue Biopsies** (acronym, StretchBio). Coordinator of the project: *Albert Romano*. Budget: 3.8M€ (1.4M€ for UB) (2021-2025)

- **H2020 FET-OPEN, Technology for real-time visualizing and modelling of fundamental process in living organoids towards new insights into organ-specific health, disease, and recovery** (acronym, OrganVision). UB-IP: *Martí Duocastella*. Budget: 3.7M€ (533K€ for UB) (2021-2025)

1.3.5. Transfer Indicators

A relevant indicator is the number of spin-off companies emerged from IN2UB. The Institute has 6 spin-offs currently active, which are described below:

- **Impetux Optics, S.L.**, created in 2012 lead by *Dr. Mario Montes Usategui*. Impetux Optics focuses its activity on Design, Manufacturing and Marketing of optical force measurement systems for Optical Tweezers. The company makes available a patented technology that overcomes existing limitations, providing clear advantages when measuring optical forces. The systems developed, allow force measurements in experiments where trap stiffness calibration is difficult or impossible.

- **Advanced Nanotechnologies, S.L.**, created in 2012 by *Dr. Enric Bertran Serra*, *Dr. Esther Pascual Miralles* and *Dr. José Luís Andújar Bella*. Advanced Nanotechnologies S.L. is devoted to materials and surface applications addressed to general consumers and to the business market. It supports R&D projects by developing specific processes and equipment for each application. The company offers innovative solutions based on nanotechnology adapted to specific developments of the costumers, related to the manufacturing of nanostructured materials. It offers also consultancy services.

- **Smalle Technologies, S.L.** (by *Dr. Christophe Serre* and *Dr. Alejandro Pérez Rodríguez*), created in 2012. Smalle Technologies is a company that develops new methods for maximizing the benefits from renewable and sustainable energy sources in order to address energy supply shortages of off-grid devices. Smalle Technologies develops generators that transform the energy contained in the waves into electricity to supply power to off-shore devices.

- **EndoASIC, S.L. (2013)** (*Dr. Angel Dieguez Barrientos*, *Dr. Oscar Alonso Casanovas* and *Dr. Ana Vilà Arbonés*, members of the entrepreneurial group). This company develops, using micro and nanotechnologies, autonomous minimally invasive systems for the substitution of gastrointestinal endoscopic systems.

- **Enlighting Technologies**, created in 2016 by *Dr. Blas Garrido Fernández* and *Dr. Sergi Hernández Márquez*. It aims at achieving a more comfortable and adaptable light to each need and situation. They have developed the FLEXILIGHT-UB technology, which is able to reproduce any spectrum of light accurately and imitate any kind of light.

- **ColorSensing, S.L.**, created in 2018 by *Dr. Juan Daniel Prades García*, devoted to smart packaging for food processing efficiency, quality, and safety.

During this period, IN²UB has applied for 4 patents (priority patents).

1.3.6. Scientific Highlighted News

- *Dr. Martí Duocastella Solà* (Faculty of Physics) has been awarded with a European Research Council Consolidator Grant, for his project **Ultrasonic Endoscopes for DEEP Light Focusing (DEEP)**.

- *Dr. Albert Romano Rodríguez.* **Continuous two-dimensional Stretch monitoring of fresh tissue Biopsies (StretchBio)** FET. Future and Emerging Technologies (2020)

- **FOXES project - Horizon 2020 FET Proactive Programme** - (with the participation of *Dr. Juan Daniel Prades García* from Department Electronics and Biomedical Engineering, Faculty Physics) to develop a zero-emission energy supply system has been launched, with the aim to create a zero-emission energy supply system for powering wireless devices for the Internet of Things.

- The project **Microscopi de matriu programable amb filtratge virtual** by *Dr. Mario Montes Usategui* from BiOPT: Optical Trapping Lab - Grup de Biofotònica (Department of Applied Physics, Faculty of Physics) has been awarded by AGAUR "Ajuts Producte destinats a l'obtenció de prototips i a la valorització i transferència"

- **From bench to bedside: Analysing the blood**, RheoDx initiates preclinical assays of the new device. The company Rheo Diagnostic (RheoDx) has a double scientific background. From one hand, the scientific research led by *Dr. Aurora Hernández-Machado*, (Faculty of Physics - Department Condensed Matter and IN²UB) and inventor of technology and, in parallel, the models developed by the Center for Mathematical Research (CRM).

- The European Innovation Council funds 2 FET-Proactive Boosting emerging technologies from IN²UB researchers to develop avant-garde technologies:

  - *Dr. Juan Daniel Prades García* (Department of Electronic and Biomedical Engineering), project coordinator of SMILE project, based on ChipScope project, to develop series of micro-LED to activate and manipulate chemical and biological reactions.

  - *Dr. Jordi Ignés-Mullol* (Department of Materials Science and Physical Chemistry), UB node IP of ANGIE, to develop magnetically steerable wireless nanodevices for the targeted delivery of therapeutic agents in vascular regions of the body.

- *Dr. Juan Daniel Prades García* (Department of Electronics and Biomedical Engineering) has been distinguished in the European Research Council Proof of Concept call. He has been awarded for his work on the project **Stick&Sense**, a new gas monitoring technology accessible to everyone.

- **Magnetoacoustic waves: towards a new paradigm of on-chip communication**. In a collaborative study, researchers have observed directly and for the first time magnetoacoustic waves (sound-driven spin waves), which are considered as potential information carriers for novel computation schemes. *Dr. Ferran Macià Bros* (UBXLAB at Faculty of Physics) is leader of the project at the Institute for Nanoscience and Nanotechnology of the University of Barcelona (IN²UB).

- A IN²UB study featured in the cover of ChemPhysChem. A work from Statistical Physics of Complex Matter, group lead by *Dr. Giancarlo Franzese* (Faculty of Physics) identified the general features of a protein aggregation (a key process in neurodegenerative processes such as Alzheimer's and Parkinson's and even cataracts) when its concentration varies. The study has been featured in the cover of the journal ChemPhysChem in their March issue. A collaborative work with the group has identified the general characteristics of a protein aggregation when its concentration varies.

- Researchers from Nanostructured Systems for Controlled Drug Delivery Group (team led by *Dr. María Luisa García López* at the Faculty of Pharmacy and Food Sciences) receive Jorge Heller Journal of Controlled Release Outstanding Paper Award 2019. This award has been given to the international collaborative article published in Journal of Controlled Release about the applications of nanotechnology in the treatment of neurodegenerative processes such as Alzheimer's disease.

- **ColorSensing,** a spin-off which resulted from a research project led by *Dr. Juan Daniel Prades García*, has received the Entrepreneurship Award (VII Edition) granted by the Fundació Caixa d'Enginyers.

2.

research at IN²UB

2.1. Research Lines

1. Modeling, Simulation and Nanoscopic Methods (NanoMet)

Coordination: Dr. Francesca Peiró Martínez

This research area develops instrumentation and methodology (employing experimental and theoretical tools) to characterize nanostructures and nanosystems of any nature,

A. NanobioInteractions: Interactions between biological and nanoscopic systems.
B. Confinement-related phenomena: reactivity, magnetism, optoelectronics and quantum photonics.
C. Transport and conduction.
D. Surface effects.
E. Electronic structure and excitations.
F. Bose-Einstein condensates and quantum confined gases.
G. Advanced Electronic Microscopy (EFM, TEM, STM, EELS, EDS).
H. Instrumentation and Methodology Development in Electron Microscopy.

2. Nanobioscience, Nanobiomechanics and BioNanotechnology (NanoBio)

Coordination: Dr. Gustavo Egea

This research area studies the organizational patterns observable in the molecular structures that control and rule the biological systems both at the cellular and at the molecular scales. Its most relevant application is that of developing techniques and devices aimed at prevention and diagnose in nanomedicine.

A. Functionalisation of surfaces.
B. Cellular and molecular biomechanics
C. Biomimetic structures and systems
D. Nanofluidics and nanorobotics. Nanomotors.
E. Diagnosis in nanomedicine: marking and molecular observation
F. Nanobiosensors; DNA and Protein Chips; lab on chip.

3. Nanopharmaceutics and Nanomedicine (NanoPharmaMed)

Coordination: Dr. M. José García Celma

This area aims at developing nanostructured systems for controlled drug release and to the improvement of drug therapeutic efficiency when administered on targets to treat diseases.

A. Nanostructured Systems for controlled drug release. Nanocapsules.
B. Nanostructured systems interaction with biological structures.
C. Bioavailability, toxicity and therapeutic efficiency of nanostructured systems.
D. Non-viral vectors. Gene therapy. Pharmacogenomics and nutrigenomics.
E. Molecular internalization, molecular marking and detoxification.

4. Nanomagnetism and Spintronics (NanoMagnetics)

Coordination: Dr. Xavier Batlle Gelabert

The area aims at developing new systems for storage and processing of information at the nanoscopic scale for information processing. It is also devoted to the study of new phenomena appearing at the nanometric size for the implementation of innovative devices of application in healthcare, sustainable energy, environment, healthy food and security.

It is also involved with the preparation and study of multifunctional molecular nanomagnets for spintronics and quantum computing.

A. Magnetic nanoparticles and single molecule magnets.
B. Dynamic processes in nanomagnetism and interaction with microwaves.
C. Magnetic electronics.
D. Spin-based molecular quantum bits and quantum gates for quantum computing.

5. Nanoelectronics, Nano-optics and Nanophotonics (NanoPhotoElectro)

Coordination: Dr. Blas Garrido Fernández

Study and exploitation at the nanoscale of the interaction of electric, magnetic and optical properties for the design of functional nanosystems.

A. NEMS (Nanoelectromechanical Systems).
B. Nanodevices, nanosensors and electronic nanosystems, optoelectronics and photonics. Photonic crystals.

6. Nanostructured materials (NanosMat)

Coordination: Dr. Enric Bertran Serra

This research area aims at developing new nanostructured materials or improving the properties of existing materials. This line also includes knowledge-frontier research in characterization techniques and manipulation tools at the nanoscale (as electron and probe microscopies, surface analysis, or spectroscopic and magnetic characterization).

A. Synthesis, nanomanufacturing and nanomanipulation.
B. Thin layers, nanostructured multilayers and coatings.
C. Nanoparticles, gels, nanofibers, nanorods, nanothreads and nanotubes.
D. Nanostructured metallic oxides.
E. Mesoporous Materials and Nanopatterns.

7. Nanoenergy: Production and Storage (NanoEnergy)

Coordination: Dr. Narcis Homs Martí

The aim of this research line is the application of nanomaterials to energy production and storage to overcome efficiency and lifetime limits.

A. Catalytic nanostructures for energy production. Fuel cells.
B. Nanomaterials for solar cells and photocatalytic processes.
C. Nanostructured systems for energy storage.

2.2. Groups at Research Lines

In the following section, you will find all research groups distributed along the 7 research lines according to the research developed. However, due to the transversally of the research performed, some groups can be found in more than one main line.

2.2.1. Bioelectrical Characterization at Nanoscale (NanoBio)

Department Electronics and Biomedical Engineering, Faculty Physics

Team

Gabriel Gomila Lluch (Full Professor)
Annalisa Caló (Tenure-Track Lecturer)

Research

The main goal of the group is to develop new experimental setups based on atomic force microscopy and new theoretical frameworks enabling the quantification of the electrical properties of biological systems at the nanoscale (including biomembranes, single viruses, single bacteria cells and eukaryotic cells). The main aim is to contribute to develop new label-free biological nanoscale characterization methods and new electronic biosensors. Furthermore, the group objective is to develop the multiparametric atomic force microscopy for the simultaneous, label-free biophysical characterization (mechanical and electrical) of clinical samples at meso and nanoscales.

SELECTED PAPERS

- **Bioelectronic Recordings of Cardiomyocytes with Accumulation Mode Electrolyte Gated Organic Field Effect Transistors.** *Kyndiah A., Leonardi F., Tarantino C., Cramer T., Millan-Solsona R., Garreta E., Montserrat N., Mas-Torrent M., Gomila G.* **Biosensors and Bioelectronics** 150, 111844 (2020).
- **Mapping the capacitance of self-assembled monolayers at metal/electrolyte interfaces at the nanoscale by In-liquid scanning dielectric microscopy.** *R. Millan-Solsona, M. Checa, L. Fumagalli, G. Gomila* **Nanoscale** 12, 20658 (2020).
- **Spatial mapping of the collagen distribution in human and mouse tissues by force volume atomic force microscopy.** *Calò, A., Romin, Y., Srouji, R., Zambirinis, C. P., Fan, N., Santella, A., Feng, E., Fujisawa, S., Turkekul, M., Huang, S., Simpson, A. L., D'Angelica, M., Jarnagin, W. J., Manova-Todorova, K.* **Sci. Rep.** 10, 15664 (2020).
- **Spatial defects nanoengineering for bipolar conductivity in MoS2.** *Zheng, X. Calò, A., Cao, T., Liu, X., Huang, Z., Masih Das, P., Drndic, M., Albisetti, E., Lavini, F., Narang, V., King, W. P., Harrold, J. W., Vittadello, M., Aruta, C., Shahrjerdi, D., Riedo, E.* **Nat. Commun.** 11, 3463 (2020).

Selected Projects

- Ajut a la Recerca Transversal 2020 (IN²UB): **Routine characterization of clinical samples with a multiparametric SPM design.** IP: *Annalisa Calò*
- **Métodos de datos masivos aplicados a la microscopia de sonda de barrido para estudios electricos funcionales en ciencias de la vida.** Convocatoria 2019 Proyectos de I+D+i. MINECO. IP: *Gabriel Gomila*

International Collaborations

- The Manchester University, Manchester, UK *(Dr. Laura Fumagalli)*
- Italian Institute of Technology, Milan, Italy *(Dr. Adrica Kyndiah)*
- New York University (NYU), New York, USA *(Professor Elisa Riedo)*
- Memorial Sloan Kettering Cancer Center, New York, USA *(Dr. Katia Manova Todorova)*

2.2.2. Bio-Inorganic Chemistry (BIC) Research Group (NanoPharmaMed)

Department Inorganic and Organic Chemistry, Faculty Chemistry

Website: NanoBIC

Team

Patrick Gamez Enamorado (ICREA Researcher)
Amparo Caubet Marín (Associate Professor)
Ana Belén Caballero (Associate Professor)

SELECTED PAPERS

- **Nanochaperone-Based Strategies to Control Protein Aggregation Linked to Conformational Diseases.** *Caballero, A.B., Gamez, P.* Angewandte Chemie. 2020, 132, 2-14
- **Thiosemicarbazone Derivatives as Inhibitors of Amyloid-β Aggregation: Effect of Metal Coordination.** *Matesanz A.I., Caballero A.B., Lorenzo C., Espargaró A., Sabaté R., Quiroga A.G., Gamez P.* Inorganic Chemistry. 2020, 59(10)
- **Peptidic Scaffolds to Reduce the Interaction of Cu(II) Ions with β-Amyloid Protein.** *Caballero A.B., Iranzo O., Hautier A., Sabaté R., Gamez P.* Inorganic Chemistry. 2020, 59(1)

Research

The research carried out in BIC lies in the areas of cancer and Alzheimer's disease (AD). The BIC group is currently using Fe3O4 and Au nanoparticles as nanocarriers and drug-releasing Systems to treat these diseases.

Photoactivatable compounds are receiving increasing attention in anticancer drug design. The BIC group has developed a new approach to generate photoswitchable metal complexes whose biological activity can be changed through the photomodification of the ligand. Amyloid-β is a peptide involved in AD that leads both to oxidative stress and to the formation of senile plaques. The BIC team is designing and producing tri- and tetrapeptides that show (i) anti-aggregation properties (thus impeding the formation of amyloid-β fibrils) and (ii) strong copper-binding properties, hence blocking its redox behaviour and therefore the generation of harmful oxidative species.

Selected Projects

- **Nanocarriers for drug delivery through thermal release.** CTQ2017-88446-R. Ministerio de Economía y Competitividad of Spain. IP1: *Gamez, Patrick* 2018 –2020.
- Ajut a la Recerca Transversal 2020 (IN²UB): **Multitarget approach to develop antiprion drugs for transmissible spongiform encephalopathies (TSEs).** IP: *Alba Espargaró.*

2.2.3. Biomolecule and small-systems physics (NanoBio)

Department Condensed Matter Physics, Faculty Physics

Website: Small Biosystems Lab

Team

Fèlix Ritort Farran (Full Professor)

Maria Mañosas (Postdoctoral Researcher Ramon y Cajal)

SELECTED PAPERS

- **Direct detection of molecular intermediates from first-passage times.** *Thorneywork A.L., Gladrow J., Qing Y., Rico-Pasto M., Ritort F., Bayley H., Kolomeisky A.B., Keyser U.F.* **Science Advances.** 2020, 6(18)
- **Detection of single DNA mismatches by force spectroscopy in short DNA hairpins.** *Landuzzi F., Viader-Godoy X., Cleri F., Pastor I., Ritort F.* **Journal of Chemical Physics.** 2020, 152(7)

Research

The main goal of the Small Biosystems Lab is to combine advanced experimental techniques and theoretical knowledge to address questions related to energy processes in the nano-scale. The main research lines are single-molecule biophysics and non-equilibrium physics to study intermolecular interactions (such as peptides and proteins binding to DNA) and intramolecular interactions (DNA hybridization, DNA, RNA and protein folding).

Selected Projects

- **Experimental measurement of entropy and information in single molecules and cells.** PID2019-111148GB-I00. Ministerio de Ciencia, Innovación y Universidades. IP: *Felix Ritort* and *Maria Mañosas* (2020-2023)
- **ICREA Academia.** 2008, 2013, 2018. IP: *Félix Ritort*. Generalitat de Catalunya (2009-2023)

Singular scientific equipment

- Optical tweezers instruments (3 at room temperature, 1 with temperature controller), 1 magnetic tweezers, 1 instrumental setup for single molecule translocation also combined with optical tweezers.

International collaborations

- Università degli Studi di Padova (Italy); *B. Ibarra* (IMDEA,Madrid); *U. Keyser* (U. Cambridge); *U. Seifert* (U. Stuttgart), *P. Pietzonka* (U. Cambridge), *M. Baiesi* and *I. Di Terlizzi* (U. Padova); *A. Alemany* (Hubrecht Inst.,Utrecht), *J. Johansson* and *H. Linke* (U. Lund), *J. M. Parrondo* (U. Autonoma Madrid) and *M. Ribezzi* (ESPCI, Paris), on information-energy conversion;
- *A. Zaltron*, *G. Mistura*, *F. Seno* (U. Padova), *J. Sancho* (U. Zaragoza) and *S. Frutos* (Parc científic, Barcelona) on protein folding;
- *C. V. Bizarro* (U. Porto Alegre) on RNA unzipping. *G. Wuite* (U. Vrije, Amsterdam) on red blood cell dynamics;
- *V. Croquette* (ENS, Paris) on helicase dynamics;
- *F. Cleri* (U. Lille, France) on simulations of hairpin folding kinetics;
- *A. Crisanti* (U. La Sapienza, Roma) and *M. Picco* (U. Paris VI, Paris) on fluctuation theorems in glassy systems;
- *F. Westerlund* (U. Chalmers, Gotheborg) on force spectroscopy of nucleic acids.

2.2.4. Biophysics and Bioengineering Unit (NanoBio)

Department Biomedicine, Faculty Medicine

Website: Biophysics and Bioengineering Unit

Team

Ramon Farré Ventura (Full Professor)

Pere Roca Cusachs (Associate Professor)

Daniel Navajas Navarro (Emeritus Professor)

Miguel Rodriguez Lazaro (Technician)

SELECTED PAPERS

- **Low-cost, easy-to-build noninvasive pressure support ventilator for under-resourced regions: Open source hardware description, performance and feasibility testing.**
  Garmendia O., Rodríguez-Lazaro M.A., Otero J., Phan P., Stoyanova A., Dinh-Xuan A.T., Gozal D., Navajas D., Montserrat J.M., Farré R.
  European Respiratory Journal. 2020, 55(6)

- **The conventional isoproterenol-induced heart failure model does not consistently mimic the diaphragmatic dysfunction observed in patients.**
  Cabrera-Aguilera I., Falcones B., Calvo-Fernández A., Benito B., Barreiro E., Gea J., Farré R., Almendros I., Farré N. PLoS ONE. 2020, 15(7)

Research

The Unit of Biophysics and Bioengineering is largely specialized in applying the principles and methodologies of physics and engineering to the study of a variety of biological systems in normal and diseased conditions. The scope of this multidisciplinary research includes both basic and translational approaches, and is conducted in close collaboration with clinical research groups. The goal is to improve the diagnostic and treatment of human diseases. Most of the work applies to different length scales, including the molecular, cellular and tissue/organ level. The main areas of research include mechanobiology, respiratory and cardiovascular biophysics, and biomedical image processing.

Selected projects

- **Efectos de la hipoxia/hipercapnia en la interacción biomecánica célula-matriz pulmonar en la progresión de las enfermedades respiratorias.** SAF2017-85574-R. Ministerio de Economia y Competitividad. IP: *Ramon Farré* (2018-2020)

2.2.5. BiOPT: Optical Trapping Lab - Grup de Biofotònica (NanoBio)

Department Applied Physics, Faculty Physics
Website: BiOPT: Optical Trapping Lab - Grup de Biofotònica

SELECTED PAPERS

- **Acousto-holographic optical tweezers.** *Bola R., Treptow D., Marzoa A., Montes-Usategui M., Martín-Badosa E.* **Optics Letters.** 2020, 45(10)

Team

Estela Martín Badosa (Associate Professor)
Mario Montes Usategui (Assciate Professor)
Raul Bola Sampol (Predoctoral Researcher)
Dorian Treptow (Predoctoral Researcher)
Antonio Marzoa (Predoctoral Researcher)
Ferran Marsà Samper (External Collaborator)

Research

The group, which has an increasingly interdisciplinary composition, develops photonic tools to address problems of biological interest. Specifically, the group explore the capabilities of optical tweezers technology for the study of living matter at the molecular and cellular scales.

The systems developed in the group combine fluorescence microscopy, holographic optical manipulation, force measurement and high speed imaging, allowing to reach inside cells and help study their inner processes.

Selected projects

- **Microscopio Digital Super-Rápido y Super-Flexible.** PID2019-109225RB-I00. Ministerio de Ciencia, Innovación y Universidades. IP: *Estela Martín* (2020-2023)
- **PASCAL: Microscopi de matriu programable amb filtrat virtual.** 2019PROD00129. Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR). IP: *Mario Montes* (2020-2022)

Singular scientific equipment

The group has two complete optical tweezers setups mounted on vibration-isolated optical tables, and equipped with high power lasers (@1064 nm) and research microscopes (Nikon TE-2000E) for brightfield, phase-contrast, DIC and epifluoresence imaging. For the dynamic manipulation of samples the group has liquid crystal spatial light modulators (Hamamatsu X10468-03) for the creation of holographic trap patterns or, alternatively, acousto-optic deflectors (AA Optoelectronic DTSXY-400-1064) for time-sharing traps. It can be directly measure the forces exerted by the traps from changes in the light momentum (Impetux Optics LUNAM T40-i). Other equipment includes conventional CCD and fast and sensitive EMCCD cameras (Qimaging QICAM, Andor Ixon-860 EMCCD), precision optomechanical components, position-sensitive detectors (PSDs) and a piezo-electric positioning platform (Piezosystem Jena TRITOR 102 SG). The group also have a fully-equipped cell culture laboratory.

2.2.6. Cancer therapy group (NanoBio)

Department Biochemistry and Physiology, Faculty Pharmacy and Food Sciences
Website: Cancer therapy group

Team

Carlos Ciudad Gómez (Full Professor)
Verònica Noé Mata (Full Professor)
Eva Aubets Gil (Predoctoral Researcher)

Research

The research of the group is focused on the development of new applications for our technology of Polypurine reverse Hoogsteen hairpins (PPRHs) for gene silencing and gene editing.

PPRH hairpins are non-modified DNA molecules formed by two antiparallel polypurine strands linked by a pentathymidine loop that allows the formation of intramolecular reverse-Hoogsteen bonds between both strands. These PPRHs bind to polypyrimidine stretches in the DNA via Watson-Crick bonds, while maintaining the hairpin structure. Upon binding their polypyrimidine target in a dsDNA, PPRHs provoke strand displacement of the polypurine tract of the duplex, producing inhibition of transcription or altering splicing, thus causing specific gene silencing.

In addition to demonstrate the silencing effectiveness of PPRHs *in vitro*, two *in vivo* efficacy assays were conducted using two different routes of administration, either intratumorally or intravenously, in a subcutaneous xenograft tumor model of prostate cancer cells.

The group have studied the ability of PPRHs to silence a variety of relevant cancer-related genes in several human cell lines. All PPRHs were effective in decreasing cell survival and mRNA levels and increasing apoptosis in cancer cells. In the context of tumor immunology, we designed PPRHs to silence both CD47/SIRPα and PD1/PDL-1 pathways with the aim to eliminate tumor cells by macrophages in co-culture experiments.

Stability experiments revealed that the half-life of PPRHs is much longer than that of siRNAs. Regarding the innate immune response, different determinations indicated that PPRHs, unlike siRNAs, do not activate the innate inflammatory response. More recently, we have performed a pharmacogenomics study that indicated that unspecific PPRHs did not originate differentially expressed genes, thus demonstrating the lack of off-target effects.

Correction of point mutations that lead to aberrant transcripts, often with pathological consequences, has been the focus of considerable research. The group explored the possibility of repairing a point mutation in mammalian cells using PPRHs as tools. These Repair-PPRHs contain a hairpin core bearing an extension sequence at one end, homologous to the DNA strand to be repaired but containing the wild type nucleotide instead of the mutation. We demonstrated *in vitro* that PPRHs bind specifically to their polypyrimidine target sequence, opening the two strands of the dsDNA, and allowing the binding of a given repair oligonucleotide to the displaced strand of the DNA. Then, different Repair-PPRHs were designed to correct insertions, deletions, substitutions present in a collection of mutants at the endogenous *locus* of the *aprt* gene. Surviving

SELECTED PAPERS

- **Nucleic acids therapeutics using PolyPurine Reverse Hoogsteen hairpins.** *Noé V, Aubets E, Félix AJ, Ciudad CJ.* **Biochem Pharmacol.** 2020 Dec 16:114371.
- **Detection of a G-Quadruplex as a Regulatory Element in Thymidylate synthasefor Gene Silencing Using Polypurine Reverse Hoogsteen Hairpins.** *Aubets E, J Félix A, Garavís M, Reyes L, Aviñó A, Eritja R, Ciudad CJ, Noé* V. **Int J Mol Sci.** 2020 Jul 16;21(14):5028.
- **Targeting replication stress response using polypurine reverse hoogsteen hairpins directed against WEE1 and CHK1 genes in human cancer cells.** *Aubets E., Noé V., Ciudad C.J.* **Biochemical Pharmacology.** 2020, 175
- **Correction of the aprt Gene Using Repair-Polypurine Reverse Hoogsteen Hairpins in Mammalian Cells.** *Félix A.J., Ciudad C.J., Noé V.* **Molecular Therapy - Nucleic Acids.** 2020, 19

colonies were analyzed by DNA sequencing, and by mRNA and enzymatic measurements, confirming that all the *aprt* mutants had been corrected.

Selected projects

- **Terapia génica mediada por PPRHS: vehiculizacion, silenciamiento, reparacion y aproximaciones *in vivo*.** RTI2018-093901-B-I00. Ministerio de Ciencia, Innovación y Universidades. IP: *Verónica Noé Mata* and *Carlos Ciudad Gomez* (2019-2021)

International collaborations

- *Dr. Alejandra Bruna* from the Cancer Research UK Cambridge Institute, University of Cambridge, UK, who has developed a breast cancer PDTX biobank, to perform *in vivo* approaches in order to evaluate the effectiveness of PPRHs.
- *Dr. Lawrence Chasin*, Department of Biological Sciences, Columbia University, NY, on the repair of *dhfr* and aprt mutant cell lines.

2.2.7. Catalysis and Advanced Inorganic Materials (NanoEnergy)

Department Inorganic and Organic Chemistry, Faculty Chemistry
Website: MATCAT

Team

Narcis Homs Martí (Full Professor)
Pilar Ramírez de la Piscina (Full Professor)
Paulina Raquel Martinez Alanis (Adjunct Lecturer-Postdoc)
Arturo Pajares Rojas (Predoctoral Researcher)
Yan Wang (Predoctoral Researcher)
Joan Roca Busacker (Master Student)

Research

The research activities of the group focus on the preparation of tailored, nanostructured catalytic materials for energy conversion and chemical storage. The main goal of the research is to reach a high level of preparative abilities of nanostructured materials and the understanding of their characteristics. Then, this strategy is applied to two main domains: i) H_2 production from bioresources (mainly bioalcohols) using catalytic reforming and photocatalytic processes and, ii) the chemical recycling of CO_2 trough catalytic conversion and photoreduction to chemicals and liquid fuels.

SELECTED PAPERS

- **Monitoring the insertion of Pt into $Cu_{2-x}Se$ nanocrystals: a combined structural and chemical approach for the analysis of new ternary phases.** Casu A., Dalmases M., Lin M., Wang Y., Homs N., Ramírez de la Piscina P., Llorca J., Figuerola A., Falqui A. **Nanoscale** 2020, 12, 16627–16638
- **Critical effect of carbon vacancies on the reverse water gas shift reaction over vanadium carbide catalysts.** Pajares A., Prats H., Romero A., Viñes F., Ramírez de la Piscina P., Sayós R., Homs N., Illas F. **Applied Catalysis B: Environmental** 2020, 267, 118719
- **Photocatalytic H_2 production from ethanol aqueous solution using TiO_2 with tungsten carbide nanoparticles as co-catalyst.** Pajares A., Wang Y., Kronenberg M.J., Ramírez de la Piscina P., Homs N. **International Journal of Hydrogen Energy** 2020, 45(40), 20558-20567
- **Preparation and characterization of bulk Mo_xC catalysts and their use in the reverse water-gas shift reaction.** *Liu X., Pajares A., Calinao Matienzo D.D., Ramírez de la Piscina P., Homs N.* **Catalysis Today** 2020, 356, 384-389
- **Behaviour of Pt/TiO_2 catalysts with different morphological and structural characteristics in the photocatalytic conversion of ethanol aqueous solutions.** *Sola A.C., Ramírez de la Piscina P., Homs N.* **Catalysis Today** 2020, 341, 13-20

Selected projects

- **Diseño de catalizadores basados en carburos de metales de transición eficientes en procesos de producción de H_2 y para la activación selectiva de CO_2.** MAT2017-87500-P, IP: *Homs Martí, Narcís*. Ministerio de Economia y Competitividad, 2018-2020
- **L-Hydrogen.** EMC/1124/2018, IP: *EVARM Innovación SL*, Acció Nuclis, Generalitat de Catalunya, 2019-2021

Singular scientific equipment

- Microwave and ultrasonic facilities for synthesis and reaction
- TG-DSC-microcalorimetry coupled to MS
- TPR/TPO/TPD analysis coupled to MS
- In-situ DRIFTS coupled to MS facility
- Thermal and photocatalytic reactors with on-line GC-MS analysis

International collaborations

- *Dr. Marcelo Maciel Pereira*, UFRJ, Brazil
- *Dr. Elisabete Assaf*, IQSC, USP, Brazil
- *Dr. Jamil Toyir*, Fez, Morocco
- *Dr. Weijie Cai*, Dalian, China
- *Dr. Lorenzo Mino*, UNITO, Turin, Italy

2.2.8. Cellular Responses to Xenobiotics (NanoPharmaMed)

Dept Biochemistry and Physiology,
Faculty Pharmacy and Food Sciences

Team

Maria Pilar Vinardell Martínez-Hidalgo (Full Professor)
Montserrrat Mitjans Arnal (Associate Professor)
M del Carmen Moran Bádenas (Associate Professor)
Wawan Kurniawan (Predoctoral Researcher)
Michele Ferrari (External Collaborator-CNR-ICMATE Italy)

Research

The group focus its research in the development of in vitro methods to evaluate the potential cytotoxicity of nanoparticles and nanovesicles for drug delivery. The increase use of nanomaterials supposes a potential risk to the human health and it is necessary to ensure the safety of these materials before marketing.

Another area of interest is the study of nanoparticle interactions with erythrocytes and plasma proteins and the coagulation process. The potential photoprotective effect of nanovesicles are also studied.

Ongoing research is aslo focused on building up stimulus triggered devices for the effective delivery of gene/drugs.

SELECTED PAPERS

- **MKC-Quatsomes: a stable nanovesicle platform for bio-imaging and drug-delivery applications.** *Vargas-Nadal G., Muñoz-Ubeda M., Alamo P., Arnal M.M., Céspedes V., Köber M., Gonzalez E., Ferrer-Tasies L., Vinardell M.P., Mangues R., Veciana J., Ventosa N.* Nanomedicine: Nanotechnology, Biology, and Medicine. 2020, 24
- **pH-Sensitive chitosan-tripolyphosphate nanoparticles increase doxorubicin-induced growth inhibition of cervical HeLa tumor cells by apoptosis and cell cycle modulation.** *Nogueira-Librelotto D.R., Scheeren L.E., Macedo L.B., Vinardell M.P., Rolim C.M.B.* Colloids and Surfaces B: Biointerfaces. 2020, 193
- **Transferrin-conjugated doxorubicin-loaded PLGA nanoparticles with pH-responsive behavior: a synergistic approach for cancer therapy.** *Scheeren L.E., Nogueira-Librelotto D.R., Macedo L.B., de Vargas J.M., Mitjans M., Vinardell M.P., Rolim C.M.B.* Journal of Nanoparticle Research. 2020, 22(3)

International collaborations

- *Michele Ferrari*, Instituto di Chimica della Materia Condensata e di Tecnologie per l'Energia (ICMATE-CNR) Genova, Italy
  Codi GREC 18407- Framework Cooperation Agreement (2018/2021)
  Faculty of Pharmacy and Food Science (UB)- Institute for Chemistry of Condensed Matter and Technologies for Energy (ICMATE-CNR)
- *Clarice M B Rolim*, Department of Industrial Pharmacy, Universida de Federal de Santa Maria, Av. Roraima 1000, 97105-900 Santa Maria, RS, Brazil.
- *Emanuela Corsini*, Dipartimento di scienze farmacologiche e biomolecolari. Università degli Studi di Milano, Milan, Italy

2.2.9. Colloids (NanoPharmaMed)

Department Pharmacy and Pharmaceutical Technology and Physical-Chemical, Faculty Pharmacy and Food Sciences

Team

Joan Estelrich Latràs (Full Professor)
M. Antonia Busquets Viñas (Associate Professor)

Research

Since laser-induced photothermal ablation has shown satisfactory results for the removal of tumors, the group Colloidal Group is working on the development of new generation of nanoparticles (NP) aimed for photothermal therapy (PTT). These NP are light-absorbing materials, namely photothermal agents (PA) that can convert absorbed light into heat. The researchers have designed and developed PA that generate heat after irradiation at the second biological window which offers improved light penetration, lower background signal, and higher maximum permission exposure compared to the traditional first window. The developed nanoparticles will also be designed to be directed by an external magnetic field or to be used as image probe, therefore as theranostic agents.

SELECTED PAPERS

- **Superparamagnetic Nanoparticles with Efficient Near-Infrared Photothermal Effect at the Second Biological Window.** *Busquets, M.A., Fernández, J.M., Serra, P., Estelrich, J.* Molecules 2020, 25(22). ***With Ajut a la Recerca Transversal (ART) Institute of Nanoscience and Nanotechnology Call 2019 financial support.***
- **Prussian blue nanoparticles: synthesis, surface modification, and biomedical applications.** *Busquets M.A., Estelrich J.* Drug Discovery Today. 2020, 25(8)
- **Flash tooth whitening: A friendly formulation based on a nanoencapsulated reductant.** *Babot-Marquillas C., Sánchez-Martín M.-J., Rodríguez-Martínez J., Estelrich J., Busquets M.-A., Valiente M.* Colloids and Surfaces B: Biointerfaces. 2020, 195

2.2.10. Conformational Diseases Group (NanoPharmaMed)

Department Pharmacy and Pharmaceutical Technology and Physical-Chemical, Faculty Pharmacy and Food Sciences

Team

Raimon Sabaté Lagunas (Associate Professor)
Alba Espargaró Colomé (Tenure-Track Lecturer)

Research

Conformational Diseases Group is interested in studying bacterial inclusion bodies as a model to treat amyloid aggregation based human disorders, such as Alzheimer or Parkinson's diseases.

SELECTED PAPERS

- **On the Binding of Congo Red to Amyloid Fibrils.** *Espargaró A., Llabrés S., Saupe S.J., Curutchet C., Luque F.J., Sabaté R.* Angewandte Chemie - International Edition. 2020, 59(21)
- **1-Benzylpyrrolidine-3-amine-based BuChE inhibitors with anti-aggregating, antioxidant and metal-chelating properties as multifunctional agents against Alzheimer's disease.** *Wichur T., Więckowska A., Więckowski K., Godyń J., Jończyk J., Valdivieso ÁD.R., Panek D., Pasieka A., Sabaté R., Knez D., Gobec S., Malawska B.* European journal of medicinal chemistry. 2020, 187

Selected projects

- **Nanocarriers for drug delivery through thermal release.** CTQ2017-88446-R. IP2: *Sabaté, Raimon*. Ministerio de Economía y Competitividad of Spain. 2018 –2020.

2.2.11. Design and Improvement of Processes and Materials (NanoEnergy)

Department Materials Science and Physical Chemistry, Faculty Chemistry

Website: DIOPMA

Team

Mercè Segarra Rubí (Full Professor)
Elena Xuriguera Martín (Associate Professor)
Joan Formosa Mitjans (Associate Professor)
Jaume Calvo de la Rosa (Predoctoral Researcher)
Jordi Díaz Marcos (Adjunct Lecture)
José Antonio Pandilla Sánchez (Adjunct Lecture)

SELECTED PAPERS

- **Approach for the analysis of TES technologies aiming towards a circular economy: Case study of building-like cubicles.** *Boer D., Segarra M., Fernández A.I., Vallès M., Mateu C., Cabeza L.F.* Renewable Energy. 2020, 150
- **Where is Thermal Energy Storage (TES) research going? – A bibliometric analysis.** *Calderón A., Barreneche C., Hernández-Valle K., Galindo E., Segarra M., Fernández A.I.* Solar Energy. 2020, 200
- **Analysis of embodied energy and product lifespan: the potential embodied power sustainability indicator.** *Ordoñez Duran J.F., Chimenos J.M., Segarra M., de Antonio Boada P.A., Ferreira J.C.E.* Clean Technologies and Environmental Policy. 2020, 22(5)

Research

DIOPMA's research activity in the field of nanotechnology is devoted to the synthesis of nanostructured materials and nanoparticles, as well as it nanomechanical characterization, by different methos for the manufacture of components of solid oxide fuel cells (SOFC) and superconductors.

Selected Projects

- **Metodologia para el análisis de tecnologías de almacenamiento de energía térmica hacia una economía circular.** RTI2018-093849-B-C32. Ministerio de Ciencia, Innovación y Universidades. PI2: *Mercè Segarra* (2019-2021)

Singular scientific equipment

- Nanoindentaitor Nano Indenter XP (MTS) with CSM (Continuous Stiffness Measurement)

International collaborations

- CIEFMA - Centro de Integridad Estructural y Fiabilidad de los Materiales (UPC)
- GLT – Georgea Tech Lorraine, Metz (France)
- FEMAN - Grupo de Física e Ingeniería de Materiales Amorfos y Nanoestructuras (UB)

2.2.12. Drug Design and Response-evaluation within Pharmaceutical Nanostructured and self-ordered Systems Group (NanoPharmaMed)

Department Pharmacy and Pharmaceutical Technology and Physical-Chemical, Faculty Pharmacy and Food Sciences

Team

Elvira Escribano Ferrer (Full Professor)
Francesc Xavier García Sala (Adjunct Lecturer)

Research

The main research lines lead by the group is the study of transdermal delivery nanostructured systems are being developed in order to improve the permeation through the skin of anti-inflammatory drugs or other. Other lines of research are pharmacokinetic studies of active ingredients from different delivery systems, and intestinal absorption studies using in situ techniques in rats. Recently, the group also focuses its attention on the study of natural products with health-promoting properties.

SELECTED PAPERS

- **Mangiferin glycethosomes as a new potential adjuvant for the treatment of psoriasis.** *Pleguezuelos-Villa M., Diez-Sales O., Manca M.L., Manconi M., Sauri A.R., Escribano-Ferrer E., Nácher A. International* Journal of Pharmaceutics. 2020, 573
- **Conservation of Native Wild Ivory-White Olives From the MEDES Islands Natural Reserve to Maintain Virgin Olive Oil Diversity.** *López-Yerena, A.; Ninot, A.; Lozano-Castellón, J.; Escribano-Ferrer, E.; Romero-Aroca, A.J.; Belaj, A.; Vallverdú-Queralt, A.; Lamuela-Raventós, R.M.* Antioxidants. 2020
- **Insights into the binding of dietary phenolic compounds to human serum albumin and food-drug interactions.** *López-Yerena, A., Perez, M., Vallverdú-Queralt, A., Escribano-Ferrer, E.* Pharmaceutics. 2020, 12(11)

2.2.13. Engineering of colloidal systems (NanosMat)

Department Chemical Engineering and Analytical Chemistry, Faculty Chemsitry)

Team

José Maria Gutiérrez González (Associate Professor)
Alicia Maestro Garriga (Associate Professor)

Research

The research developed by the group aims, from one hand, at the preparation of nanoemulsions and nanoparticles and from the other, to prepare mesoporous materials for food technology application.

SELECTED PAPERS

- **Encapsulation of ginger oil in alginate-based shell materials.** *Atencio S., Maestro A., Santamaría E., Gutiérrez J.M., González C.* Food Bioscience. 2020, 37
- **Rheology of water-in-water emulsions: Caseinate-pectin and caseinate-alginate systems.** *Maestro A., Gutiérrez J.M., Santamaría E., González C.* Carbohydrate Polymers. 2020, 249

2.2.14. Genomics, Proteomics and Plant Metabolomics (NanoBio)

Department Biology, Healthcare and the Environment and Department Biochemistry and Physiology, Faculty Pharmacy and Food Sciences

Team

Antonio Fernàndez Tiburcio (Full Professor)
Jaume Bastida Armengol (Full Professor)
Francesc Viladomat Meya (Full Professor)
Montserrat Arró Plans (Associate Professor)
Laura Torras Claveria (Associate Professor)

SELECTED PAPERS

- **Amaryllidaceae alkaloids with anti-Trypanosoma cruzi activity.** *Martinez-Peinado N., Cortes-Serra N., Torras-Claveria L., Pinazo M.-J., Gascon J., Bastida J., Alonso-Padilla J.* **Parasites and Vectors.** 2020, 13(1)

Research

The group aims at investigating the potential application of natural products derived from plants as sources of drugs to treat diseases such as Alzheimer.

2.2.15. Group of Magnetism and Functional Molecules (NanoMagnetics, NanosMat)

Department Inorganic and Organic Chemistry, Faculty Chemistry

Website: GMMF

Team

Guillem Aromí Bedmar (Full Professor)
Eva Carolina Sañudo (Associate Professor)
David Aguilà Avilés (Postdoctoral Researcher)
Leoni A. Barrios Moreno (Postdoctoral Researcher)
Verónica Velasco Amigó (Adjunct Lecturer)
Rosa Diego Creixenti (Predoctoral Researcher)
Guillem Gabarró (Predoctoral Researcher)
Manto Maniaki (Predoctoral Researcher)

SELECTED PAPERS

- **Dinuclear Copper(II) Complexes Exhibiting Reversible Photochromism.** *Salinas-Uber J., Barrios L.A., Estrader M., Roubeau O., Aromí G.* European Journal of Inorganic Chemistry. 2020, 2020(6)
- **A bis-vanadyl coordination complex as a 2-qubit quantum gate.** *Borilovic I., Alonso P.J., Roubeau O., Aromí G.* Chemical Communications. 2020, 56(21)
- **Two [Ln4] molecular rings folded as compact tetrahedra.** *Salinas-Uber J., Barrios L.A., Roubeau O., Aromí G.* Dalton Transactions. 2020, 49(21)
- **Selective signalling of alcohols by a molecular lattice and mechanism of single-crystal-to-single-crystal transformations.** *Costa J.S., Rodríguez-Jiménez S., Craig G.A., Barth B., Beavers C.M., Teat S.J., Gagnon K.J., Barrios L.A., Roubeau O., Aromí G.* Inorganic Chemistry Frontiers. 2020, 7(17)
- **Dopamine Sensing Based on Ultrathin Fluorescent Metal-Organic Nanosheets.** *Moghzi F., Soleimannejad J., Sañudo E.C., Janczak J.* ACS Applied Materials and Interfaces. 2020. 12(40)

Research

The Group of Magnetism and Functional Molecules (GMMF) is a coordination chemistry group with the aim to understand and gain knowledge in the use of nanomagnets to current areas of interest, like nanotechnology, quantum computing and functional materials. At GMMF they pursue the design and preparation of molecular materials with multifunctional properties, mainly focusing on the combination of magnetic properties (single molecule magnets -SMMs-, spin crossover -SCO- molecules or molecular quantum bits and quantum gates) with optical properties.

Selected projects

- **Scaling up quantum computation with molecular spins.** EU H2020 ERA-NET Consortium (QuantERA); Acronym, SUMO. Coordinator: *Fernando Luis*
- **PI Working Package 1.** (PCI2018-093106): *Aromí Bedmar, Guillem* (2018-2020)
- **Diseño y Nanoestructuración de Moléculas Multifuncionales para el Avance de la Espintrónica.** PGC2018-098630-B-I00. Ministerio de Ciencia, Innovación y Universidades. PI1: *Guillem Aromí* /PI2: *E. Carolina Sañudo* (2019-2022)
- **Convocatòria del Programa ICREA Acadèmia - Fundació Institució Catalana de Recerca i Estudis Avançats (ICREA).** IP: *Aromí Bedmar, Guillem* (2019-2023)

Singular scientific equipment

- Bruker apexii qazar single crystal x-ray diffractometer
- Fully equipped laboratories, with hoods and all the necessary material for the synthesis, in an inert atmosphere or in the air, of organic and inorganic compounds.
- Four gloves box of inert atmosphere from Innovative Technology equipped with freezer, O2 detector, water detector, two vacuum chambers and a cooling blanket with liquid N2.

- Xenon light source: 300W Max303 (Asahi Spectra)
- Microwave oven for organic and inorganic chemistry synthesis
- Oven for heat treatments in chemical synthesis.

International collaborations

- *Liu, Chun Sen* (Zhenzhou Light Industry University, P.R. China): synthesis of MOFs
- *Jan Dreiser* (Paul Scherrer Institute, SLS, Switzerland): XAS and XMCD
- QUANTERA Consortium:
  - Consejo Superior de Investigaciones Científicas (CSIC); *F. Luis*
  - University of Manchester (UMAN); *R. Winpenny*
  - Consorzio Interuniversitario Nazionale per la Scienza e Tecnologia dei Materiali (INSTM); *S. Carretta*
  - Universität Stuttgart/ Institut für Funktionelle Materie und Quantentechnologien (FMQ) ; *S. Loth*
  - TU Wien/Atom Institut (TUWIEN) ; *J. Majer*

2.2.16. Group of Magnetic Nanomaterials (NanoMet, NanoMagnetics, NanoPharmaMed, NanoPhotoElectro)

Department Condensed Matter Physics,
Faculty Physics
Website: Group of Magnetic Nanomaterials

SELECTED PAPERS

- **Unveiling the origin of multidomain structures in compositionally modulated cylindrical magnetic nanowires.** *Bran, C., Fernandez-Roldan, J.A., Del Real, R.P., Asenjo, A., Chen, Y.S., Zhang.J, Zhang, X., Fraile-Rodríguez, A., Foerster, M., Aballe, L., Chubykalo-Fesenko, O., Vazquez, M.* **ACS Nano.** 2020, 14(10)
- **Tailoring dual reversal modes by helicity control in ferromagnetic nanotubes.** *H. D. Salinas, J. Restrepo* and *Òscar Iglesias.* **Phys. Rev. B** 2020, 101, 054419

Team

Amílcar Labarta Rodríguez (Full Professor)
Xavier Batlle Gelabert (Full Professor)
Òscar Iglesias Clotas (Associate Professor)
Montserrat García del Muro Solans (Associate Professor)
Arantxa Fraile Rodríguez (Associate Professor)
Eric Langenberg Perez (Tenure-Track Lecturer)
Mariona Escoda Torroella (Predoctoral Researcher)
Javier Rodríguez Álvarez (Predoctoral Researcher)
Ana Conde Rubio (External Collaborator)
Moya Alvarez (External Collaborator)

Research

Our first line of research deals with the study of the correlation between the nanostructure and the physical properties (magnetic, electronic…) of a variety of magnetic-based nanosystems such as thin films and heterostructures, nanoparticles and nanocomposites, and study their dependence on finite-size, surface, proximity and interphase effects, or inter-particle interactions. We also work in the application of bifunctional nanoparticles as enhanced contrast agents for magnetic resonance imaging or computed tomography.

Our second line of research focuses on novel arrays of plasmonic nanoelements with a strong interplay between localized and collective plasmon modes, giving rise to both enhanced plasmonic properties and enhanced functionalities in hybrid plasmonic nanostructures. We also work in their application as perfect absorbers, highly sensitive platforms for SERS and other enhanced spectroscopies, and active chiral systems for ultrasensitive and selective molecular detection.

Selected Projects

- **Propiedades plasmónicas y magnéticas mejoradas en redes de nanoestructuras y nanopartículas multifuncionales.** Ref: PGC2018-097789-B-I00. PI: *A. Fraile Rodríguez* and *Xavier Batlle*. Ministerio de Ciencia, Innovación y Universidades (2019-2021)
- **Red Española de Espintrónica.** Ref: MAT2017-90771-REDT. Coordinator: *Fernando Bartolomé* (INMA). PI (UB): *Arantxa Fraile Rodríguez*. Ministerio de Economia y Competitividad (2018-2020)

Singular scientific equipment

- Fully-equipped lab specialized in the preparation of nanoparticles and thin films by both chemical and physical routes. We have a Glovebox and a Schenk line to work under controlled inert atmosphere. In addition, we use suitable set-ups and temperature controllers to have a full control of the particle reaction profile. The lab follows the current legislation in terms of storage of reactants, solvents, separation and management of residues.
- Physical properties lab: resistance, magnetoresistance and conductance, as functions of temperature and magnetic field (4.2 K, 5 T).
- Others: rf magnetron sputtering equipped with 3 guns for thin film deposition and arc furnace for bulk alloy synthesis; differential scanning calorimeter to study magneto-structural phase transition, for bulk materials as a function of temperature and magnetic field (4.2 K, 5 T).
- Atomic Force Microscope (AFM) equipped with a variety of operating modes: Magnetic Force Microscopy (MFM), torsion MFM, Piezo Force Microscopy, Electric Field Microscopy, conductive-AFM.
- Regular access to optical spectrometers (NanoOpto group, ICMAB-CSIC, Bellaterra).
- Regular access to Clean Room for Micro and Nanofabrication (IMB-CNM-CSIC, Bellaterra)
- Regular users of synchrotron radiation facilities: ALBA (Spain), BESSY (Germany), SLS-PSI (Switzerland) and ALS-LBNL (USA).
- Occasional access to neutron facilities: ILL (France).
- Occasional access to advanced microscopy facilities: Titan microscopes at LMA (Zaragoza); EELS-STEM at Oak-Ridge National Lab (ORNL, USA).

International collaborations

- *Prof. I. K. Schuller,* Physics Department, University of California San Diego (USA).
- *Dr. Andreas Scholl,* Advanced Light Source, LBNL (USA).
- *Dr. J. G. Ramírez,* Universidad de Los Andes (Colombia).
- *Dr. F. Kronast,* Helmholtz-Zentrum Berlin (Germany).
- *Dr. Cinthia Piamonteze,* Swiss Light Source, Paul Scherrer Institut (Switzerland).
- *Dr. Armin Kleibert* and *Prof. Frithjof Nolting,* Paul Scherrer Institut (Switzerland).
- *Dr. Claudio Sangregorio* and *César de Julián,* CNR Firenze-Parma (Italy).
- *Drs. Nuno J. O. Silva and V. Amaral, Univ.* Porto and CICECO (Portugal).
- *Profs. Hari Srikanth and Manh-Huong Phan,* Univ. South Florida (USA).
- *Dr. Johans Restrepo,* Univ. Antioquia (Colombia).
- *Prof. Saurav Giri,* Indian Association for the Cultivation of Science (India).
- *Prof. Hamid Kachkachi,* Université de Perpignan, Perpignan (France).
- *Dr. Dimitris Kechrakos,* ASPETE (Greece).
- *Dr. Juan Idrobo Tapia,* ORNL (USA).

2.2.17. Homogeneous Catalysis (NanosMat)

Department Inorganic and Organic Chemistry, Faculty Chemistry

Team

Arnald Grabulosa Rodriguez (Associate Professor)
Anton Vidal Ferran (ICREA Researcher)
Dana Josa Hidalgo (Predoctoral Researcher)

Research

The research is on catalysis, which is an area of chemistry that enables conversion of simple compounds into complex molecules of enormous practical utility. This area has transformed —and will continue to transform—products and processes in diverse sectors (e.g. life sciences and fine chemicals) with significant financial and societal impact. The potential for research and innovation is limited only by imagination, with ample scope for formulating, characterizing and developing transformational practical applications.

The current research efforts of the group are focused to develop efficient, reliable and selective catalytic systems, both molecular and nanostructured, for synthetic transformations of interest and studying their use to obtain relevant products for the life science and fine chemical sectors. We strive to achieve this challenging objective by: (i) the modular design of catalysts, mostly from phosphorus-based transition-metal complexes, (ii) the use of versatile synthetic procedures (inorganic or organic transformations, or supramolecular processes), (iii) concepts from supramolecular chemistry and physical inorganic and organic chemistry combined with traditional approaches from stereoselective catalysis, (iv) use of sustainable and benign reaction conditions (i.e., catalyst recycling and reuse, use of benign reagents and solvents, etc.), and (v) the computational study of the catalytic cycles (through collaborations).

In addition, the ample experience in (mainly enantiopure) ligand synthesis and in coordination and organometallic chemistry is ideal to establish collaborations with other groups working in organophosphorus chemistry, carbenes, enantioselective synthesis or in the application of transition metal complexes to other areas apart from catalysis.

SELECTED PAPERS

- **Selective functionalisation of aromatic alcohols with supramolecularly regulated gold(i) catalysts.** *Carreras Vinent, L.; Franconetti, A.; Grabulosa, A.; Frontera, A.; Vidal-Ferran, A.,* **Org. Chem. Front.** 2020, 7, 1626
- **Palladium Complexes of Methylene-Bridged P-Stereogenic, Unsymmetrical Diphosphines** *Córdoba, J. C.; Vidal-Ferran, A.; Font-Bardia, M.; Grabulosa, A.,* **Organometallics** 2020, 39, 2511
- **Supramolecularly regulated copper-bisoxazoline catalysts for the efficient insertion of carbenoid species into hydroxyl bonds.** *Iniesta, E.,* **Chem. Commun.** 2020, 56, 6364
- **Expanding the Range of Pyrenylphosphines and Their Derived Ru(II)-Arene Complexes**. *Torrente, S.; Aguilà, D.; Soto-Cerrato, V.; Pérez-Tomás, R.; Gamez, P.; Grabulosa, A.,* **Organometallics** 2020, 39, 2959
- **Enhanced Performance of Zirconium-Doped Ceria Catalysts for the Methoxycarbonylation of Anilines.** *Núñez-Rico, J.; Rellán-Piñeiro, M.; Puértolas, B.; Vidal-Ferran, A.; López, N.; Pérez-Ramírez, J.; Wershofen, S.,* **Chem. Eur. J.** 2020, 11, 16129

Selected Projects

- **Conceptually new catalytic systems for the methoxycarbonylation and N-Carbamoylation of anilines.** Covestro AG, IP: *Vidal Ferran, Anton.* 2016-2021

Singular scientific equipment

- Nitrogen Glovebox M-Braun
- Pressure facilities to work with CO, H2 and other gases up to 150 bar
- State-of-the-art facilities for working under oxygen- and water-free conditions.

International collaborations

- Collaboration with the research group of Profs. Bouteiller and Raynal, "Université Pierre et Marie Curie" (Paris, France) on the Development of Transition-Metal-Based (Stereo)Selective Supramolecular Catalysts.
- Collaboration with the research group of Prof. Müller, Institute of Chemistry and Biochemistry of the "Freie Universität Berlin" (Germany) on the Development of New Phosphorus Derivatives for Enantioselective Catalysis.

2.2.18. Instrumentation Systems and Communications (SIC) (NanoPhotoElectro, NanoEnergy)

Department Electronics and Biomedical Engineering, Faculty Physics

Team

Anna Vilà Arbonés (Associate Professor)
Angel Dieguez Barrientos (Associate Professor)
Mauricio Moreno Sereno (Associate Professor)
Christophe Serre (Associate Professor)

Research

Since 1999 part of the team works designing microelectronic chips for a large variety of applications. As part of this research, the group is one of the pioneer groups designing CMOS single photons detectors (SPADs) with applications in radiation and point-of-care biomedical devices. Related to this activity, we developed new small customized cameras and new types of ubiquitous chip-sized and lens-less microscopes.

In the frame of Nanostructured Materials, the group work since 2006 in printed electronics, developing their own inks to print conductors, semiconductors and isolants, mainly in the form of metal-oxides and polymers. The nanostructured films and devices obtained from this ecofriendly processes are nowadays focused on biocompatible optoelectronics and sensing applications. Another main research line of the group refers to harvesting and scavenging energy for low-power applications and self-powered devices.

SELECTED PAPERS

- **An internet of things-based intensity and time-resolved fluorescence reader for point-of-care testing.** *Alonso O., Franch N., Canals J., Arias-Alpízar K., de la Serna E., Baldrich E., Diéguez A.* **Biosensors and Bioelectronics.** 2020, 154
- **Nano-Illumination Microscopy: a technique based on scanning with an array of individually addressable nanoLEDs.** *Franch, N.; Canals, J.; Moro, V.; Vilà, A.; Romano-Rodríguez, A.; Prades, J.D.; Guelink, J.; Bezshlyakh, D.; Waag, A.; Kluczyk, K.; Auf der Maur, M.; Di Carlo, A.; Dieguez, A.* **Optics Express.** 2020, 28
- **Directly addressable GaN-based nano-LED arrays: fabrication and electro-optical characterization.** *Bezshlyakh, D.D.; Spende, H.; Weimann, T.; Hinze, P.; Bornemann, S.; Gülink, J.; Canals, J.; Prades, J.D.; Dieguez, A.; Waag, A.,* **Microsystems & Nanoengineering.** 2020, 6

Selected projects

- **Cámara CMOS basada en SPADs con histogramas analógicos integrados para medidas de resolución temporal en técnicas de microscopía emergentes de superresolución.** PID2019-105714RB-I00. Ministerio de Ciencia, Innovación y Universidades. IP: *Angel Dieguez*. (2020-2023).
- **Scalable Structured Micro Illumination Light Engines (SMILE).** IP1: *Juan Daniel Prades*/IP2: *Angel Dieguez*. FET OPEN 952135. (2020-2022)
- **Disseny d'acceleradors basats en la tecnologia RISC-V per a la propera generació de computadors (DRAC).** IP: Angel Dieguez. Departament d'Empresa i Coneixement. Generalitat de Catalunya. RIS3CAT. (2019-2022)

- **Overcoming the Limits of Diffraction with Superresolution Lighting on a Chip (ChipScope).** IP: *Angel Dieguez.* FET OPEN 737089. (2017-2020)

Singular scientific equipment

- Materials inkjet printer DIMATIX 2831
- Cadence, Synopsys, Mentor Graphics microelectronic design tools

International collaborations

The group collaborates with the Universitat de Girona (UdG), the Instituto de Microelectrónica de Barcelona-Centro Nacional de Microelectrónica (IMB-CNM), the LAAS-CNRS from Toulouse (France) and the College of Engineering, Mathematics and Physical Sciences from Exeter (UK), the University of Braunschweig (TUBS), the University Roma Tor-Vergata (UNITOV), Silicon Labs Austria (SAL), the Fraunhofer Institute. Barcelona Supercomputing center (BSC). Polytechnical University of Catalonia (UPC).

2.2.19. Laboratory of connective tissue signaling and genetic diseases (CTS-GD) (NanoBio)

Department Biomedicine, Faculty Medicine

Website: Laboratory of connective tissue signaling and genetic diseases (CTS-GD)

Team

Gustavo Egea Guri (Full Professor)

SELECTED PAPERS

- **Reactive oxygen species and oxidative stress in the pathogenesis and progression of genetic diseases of the connective tissue.** *Egea, G., Jiménez-altayó, F., Campuzano, V.* **Antioxidants.** 2020, 9(10)
- **Cyclophilin A/EMMPRIN Axis Is Involved in Pro-Fibrotic Processes Associated with Thoracic Aortic Aneurysm of Marfan Syndrome Patients.** *Perrucci, G.L., Rurali, E., Corlianò, M., Balzo, M., Piccoli, M., Moschetta, D., Pini, A., Gaetano, R., Antona, C.e, Egea, G., Fischer, G., Malešević, M., Alamanni, F., Cogliati, E., Paolin, A., Pompilio, G., I, Nigro, P.* **Cells.** 2020, 9(1)

Research

The research group is interested on genetic diseases of connective tissue, especially on Marfan syndrome, which is a rare genetic disease of the connective tissue (1:5,000 people) that affects the cardiovascular (the ascending aorta and the heart), respiratory (alveoli), skeletal (muscle, long bones and ribs), and ocular (crystalline) systems. This syndrome is caused by mutations in the gene that codifies for fibrillin-1 (FBN1), which is an essential component of elastic fibers. The main critical clinical problem is the formation of aortic aneurysm (abnormal dilatation) that usually leads to the dissection and rupture of the vessel. It is crucial a correct diagnosis of the disease and do it on time, and to follow-up the appearance and progression of aneurysm to subject the aorta to reparatory surgery at due time. Nowadays, there are pharmacological therapies that help to slow-down the formation of the aneurysm, but unfortunately, they do not prevent it. The research group assay alternative therapies using a murine model of the disease, as well as we investigate several physiopathological processes that seems to be involved in the progress of the disease: membrane trafficking of TGF-beta receptors, and TGF-beta signaling and mechano-transduction. At the same time, the group is highly interested to know what is the impact of smoking, the physical exercise and sleep apneas in the formation/progression of the aortic aneurysm.

Selected projects

- **Impacto fisiopatológico de un péptido anti-TGF-beta, del ejercicio físico y del humo de los cigarrillos en la formación del aneurisma aórtico en el síndrome de Marfan.** SAF2017-83039-R. IP: *Egea Guri, Gustavo*. Ministerio de Economia y Competitividad. 2018-2020

2.2.20. Laboratory of Electron Nanoscopies (LENS)- Micro and Nanotechnology and nanoscopies for Electronic and Electrophotonic devices (MIND) (NanoMet)

Department Electronics and Biomedical Engineering, Faculty Physics

Website: http://lens.el.ub.edu

https://www.ub.edu/portal/web/dp-electronica

Team

Francisca Peiró Martínez (Full Professor)
Sònia Estradé Albiol (Associate Professor)
Lluís Yedra Cardona (Postdoctoral Researcher-Juan de la Cierva)
Daniel del Pozo Bueno (Predoctoral Researcher)
Catalina Coll (Predoctoral Researcher)
Javier Blanco Portals (Predoctoral Researcher)
Gemma Martin Malpartida (Collaborator)
Josep Manel Rebled Corselles (Collaborator)
Luís López Conesa (Collaborator)
Pau Torruella Besa (External Collaborator)

SELECTED PAPERS

- **Fast-ADT: A fast and automated electron diffraction tomography setup for structure determination and refinament.** *Plana-Ruiz S., Krysiak Y., Portillo J., Alig E., Estradé S., Peiró F., Kolb U.* **Ultramicroscopy 211**, 112951 (2020)
- **Structural and Magnetic Implications of Transition Metal Migration within Octahedral Core-Shell Nanocrystals.** *Rivas-Murias B., Testa-Anta M., Torruella P., Estradé S., Peiró F., Rodríguez-González B., Comesaña-Hermo M., Salgueiriño V.* **Chemistry of Materials 32**, 10435 (2020)
- **Reliable Characterization of Organic & Pharmaceutical Compounds with High Resolution Monochromated EEL Spectroscopy.** *Partha Pratim Das; Giulio Guzzinati; Catalina Coll; Alejandro Gómez Pérez; Stavros Nicolopoulos; Sonia Estradé; Francesca Peiró; Johan Verbeeck; Aikaterini A. Zompra; Athanassios S. Galanis.* **Polymers 12**, 1434 (2020)
- **Grain size control of crystalline III-V semiconductors at ambient conditions using electrochemically mediated growth** *Valenti, M.; Bleiji, Y.; Blanco Portals, J.; Muscarella, L.A.; Aarts, M.; Peiro,F.; Estrade, S.; Alarcón-Lladó, E.* **J. Mater. Chem. A, 8**, 2752 (2020)

Research

The main objective of LENS is the development of instrumental methods as well as data treatment for advanced scientific problems in nanomaterials using Transmission Electron Microscopy and related techniques. LENS pursues challenging objectives in cutting-edge methodologies as the combination of electron tomography (ET), precession (EP) and electron energy loss spectroscopy (EELS), with machine learning and DFT simulation tools for data analysis.

During the last year, LENS has contributed, from the instrumental point of view, to the development of automated modes for electron diffraction tomography and also to the obtention of state-of-art materials, as mixed ionic-electronics conductors for solid oxide fuels cells and nanoparticles for magnetic applications with the combination of the most advanced HR-(S)TEM imaging and energy loss and X-ray spectroscopic techniques with unsupervised machine learning clustering algorithms.

Selected projects

- **In4CIS: New in-line optical methodologies for advanced assessment of high efficiency CIGS industrial processes.** SOLAR-ERA.NET Cofund Program (H2020 Cost program). Coordinator: *Marcel Placidi.* IP UB: *Sònia Estradé.* Código: SOLAR-ERA.NET Cofund 2nd Call –Project Number 48. Partners: IREC (Institut de Recerca en Energia de Catalunya), Universitat de Barcelona, Lenz Instruments SL, ZSW (Center for Solar Energy and Hydrogen Research Baden-Württemberg, Germany), Manz AG (Germany). 2019-2022

- **TOTEM: Hacia nuevos métodos en microscopia electrónica de barrido y transmisión (TOME).** PID2019-106165GB-C21. MICIIN - Ministerio de Ciencia e Innovación. IPs: *Francisca Peiró Martínez* and *Sònia Estradé*. 2020-2023

Singular scientific equipment

- LENS is a main research actor in the Barcelona node (UMEAP-CCiTUB) of the Scientific and Technological Singular Distributed Infrastructure ELECMI (https://elecmi.es/). In 2020 the node UMEAP-CCITUB was granted by the ERDF funds of the European Union allocated to the *Operational Program Catalonia 2014-2020 for cooperative projects of creation, building, acquisition and improvement of equipment and shared scientific and technological platforms* (final resolution published on July 29th 2020) thanks to the project **Advanced Electron Microscopy for Research, Innovation and Knowledge Transfer (MERIT)** presented by a consortium leaded by the University of Barcelona. The tendering process will finish during the year 2021, and the equipment is expected to be installed and operative by the end of 2022.

International collaborations

- Electron Microscopy Center (EMZ-DA) at TU Darmstadt), Prof. Ute Kolb, optimization of 3D reconstruction of reciprocal space through electron beam precession assisted electron tomography.
- Center for Nanophotonics, AMOLF, The Netherlands, Prof. Esther Alarcón-Lladó, Grain size control of crystalline III–V semiconductors.
- NanoMegas SPRL, Brussels, Belgium, Partha Pratim Das and Stavros Nicolopoulos, EEl spectroscopy of pharmaceutical products.
- LPS, Laboratoire de Physique des Solides, Prof. Mike Walls, EELS of CFO spinel oxides.

2.2.21. Laboratory of Nanostructured and Nanocomposite Materials (LM2N) (NanoMagnetics/NanosMat)

Department Inorganic and Organic Chemistry, Faculty Chemistry

Team

Albert Figuerola Silvestre (Associate Professor)
Marta Estrader Bofarull (Ramón y Cajal Researcher)
Mengxi Lin (Predoctoral Researcher)

Research

The Laboratory of Nanostructured and Nanocomposite Materials (LM2N) focuses on the synthesis and development of new solid state nanostructured materials by means of chemical bottom-up approaches in solution. The research at the group can be divided into two main lines related to the synthesis of A) semiconductor nanocrystals with optical, electronic and/or thermal properties of interest and B) magnetic nanocrystals with enhanced anisotropy or magneto-optical activity.

SELECTED PAPERS

- **Preparation and antitumoral activity of Au-based inorganic-organometallic nanocomposites.** *Dalmases M., Pinto A., Lippmann P., Ott I., Rodríguez L., Figuerola A.* **Frontiers in Chemistry.** 2020, 7
- **Monitoring the insertion of Pt into Cu2- xSe nanocrystals: A combined structural and chemical approach for the analysis of new ternary phases.** *Casu A., Dalmases M., Lin M., Wang Y., Homs N., Ramírez De La Piscina P., Llorca J., Figuerola A., Falqui A.* **Nanoscale.** 2020, 12(31)
- **Dinuclear Copper (II) Complexes Exhibiting Reversible Photochromism.** *Salinas-Uber, J., Barrios, LA., Estrader, M., Roubeau, O., Aromí, G.* European **Journal of Inorganic Chemistry.** 2020, 6, 561

Selected Projects

- **Hacia nuevos nanomateriales para tecnologías emergentes.** PID2019-106165GB-C22. Ministerio de Ciencia, Innovación y Universidades. IP1: *Albert Figuerola* IP2: *Marta Estrader*. 2020-2023

Singular scientific equipment

The lab is fully equipped for the synthesis of colloidal nanoparticles, including glassware, Schlenk lines for reactions requiring inert atmosphere, centrifuges and hoods. The group has also access to a glove box (Innovative Technology PL-HE-4GB-2800) and to most of the standard materials characterization techniques through the Department and the Centres Científics i Tecnològics from the UB (CCiTUB).

International collaborations

- *Dr. Andrea Falqui* (King Abdullah University of Science and Technology)
- *Dr. Maksym V. Kovalenko* (ETH Zürich)
- *Dr. Maria Ibáñez* (Institute of Science and Technology Austria)
- *Dr. Damien Alloyeau* (Université Paris Diderot)
- *Dr. Teresa Pellegrino* (Italian Institute of Technology)
- *Dr. Víctor A. de la Peña O'Shea* (IMDEA Energía)
- *Dr. Francesca Peiró* (UB)
- *Dr. Manuel Pernia Leal* (Centro Andaluz de Nanomedicina y Biotecnologia BIONAND)
- *Dr. Emilio Palomares* (Institut Català d'Investigació Química)
- *Dr. Josep Nogués* (Catalan Institute of Nanoscience and Nanotechnology, ICN2)
- *Dr. Bruno Chaudret* (Laboratoire de Physique et Chimie des Nano-objects)
- *Dr. Katerina Soulantika* (Laboratoire de Physique et Chimie des Nano-objects)
- *Dr. Stefan Schrittwieser* (Austrian Institute of Technology)
- *Dr. Salvador Pané* (ETH Zürich)
- *Dr. Eva Pellicer* (Universitat Autònoma de Barcelona)
- *Dr. Jordi Sort* (Universitat Autònoma de Barcelona)

2.2.22. LASER- Micro and Nanotechnology and nanoscopies for Electronic and Electrophotonic devices (NanoPhotoElectro)

(Department Applied Physics, Faculty Physics)
Website: Dynamic Optical Systems Lab
Website: www.ub.edu/dlight
Website: LASER-MIND

Team

Pere Serra Coromina (Full Professor)
Juan Marcos Fernández Pradas (Associate Professor)
Martí Duocastella Solà (Tenure-Track Lecturer-Serra Húnter – ERC Consolidator Grant)
Ernest Martí Jerez (PhD Student)
Narcís Vilar Solé (PhD Student)

SELECTED PAPERS

- **Variable optical elements for fast focus control.** *Kang S.Y., Duocastella M., Arnold C.B.* Nature Photonics. 2020, 14(9)
- **Volumetric Lissajous confocal microscopy with tunable spatiotemporal resolution.** *Deguchi T., Bianchini P., Palazzolo G., Oneto M., Diaspro A., Duocastella M.* Biomedical Optics Express. 2020, 11, 6293
- **Laser-induced forward transfer: a digital approach for printing devices on regular paper.** *Sopeña P., Sieiro J., Fernández-Pradas J.M., López-Villegas J.M., Serra P.* Advanced Materials Technologies. 2020, 5, 2000080
- **Laser-induced forward transfer of conductive screen-printing inks.** *Sopeña P., Fernández-Pradas J.M., Serra P.* Applied Surface Science. 2020, 507
- **Superparamagnetic nanoparticles with efficient near-infrared photothermal effect at the second biological window.** Busquets, M.A., Fernández, J.M., Serra, P., Estelrich, J. Molecules 2020, 25(22)

With Ajut a la Recerca Transversal (ART) Institute of Nanoscience and Nanotechnology Call 2019 financial support.

Research

The research activity of the group is actually focused on three research lines. The first one is developing novel optical methods for three-dimensional light engineering, with applications in materials science, sensing, and biology. Key examples of our work in this area include the development of laser catapulting for additive micro-optics manufacturing, acousto-optofluidic systems for focusing and shaping the light at sub-microsecond time scales, and fast inertia free optical microscopes for unprecedented volumetric imaging speed and particle tracking.

The second main research line is the laser printing of inks with special interest in electronic applications. We have proved the feasibility of laser-induced forward transfer (LIFT) for printing sensors and RF devices with screen-printing inks.

The last research line is devoted to photothermal therapies. Its main objective is to develop new strategies for treating tumours and infections by combining laser light and smart nanomaterials.

Selected projects

- **Impresión con láser para aplicaciones de electrónica basada en papel.** TEC2017-83301-P. Ministerio de Economía, Industria y Competitividad. IP: *Pere Serra Coromina*. 2018-2020
- **Technology for real-time visualizing and modelling of fundamental process in living organoids towards new insights into organ-specific health, disease, and recovery (OrganVision).** FET OPEN, 964800. IP: *Martí Duocastella* (2021-2025)
- **Ultrasonic Endoscopes for DEEP Light Focusing (DEEP).** ERC Consolidator Grant (ERC-2020-COG), 101002460. IP: *Martí Duocastella*

International collaborations

- Naval Research Laboratory
  Group leader: *A. Piqué*. Washington DC (USA)
- Univeristé Aix-Marseille/CNRS
  Group leader: *P. Delaporte*. Marsella (França)
- Princeton University
  Group leader: *C.B. Arnold*. Princeton (USA)
- Istituto Italiano di Tecnologia
  Group leader: *Alberto Diaspro*. Genoa (Italy)

2.2.23. Magnetic Interactions and Molecular Magnetism (NanoMagnetics)

(Department Inorganic and Organic Chemistry, Faculty Chemistry)

Team

Ramón Vicente Castillo (Full Professor)
Albert Escuer Fité (Full Professor)
Mohamed Salah El Fallah (Full Professor)
Montserrat Corbella Cordomí (Associate Professor)

SELECTED PAPERS

- **Na2Mn III 6 LnIII clusters with a non-equivalent core: Chiral: vs. meso isomerism.** *Mayans J., Font-Bardia M., Escuer A.* Dalton Transactions. 2020, 49(14)
- **Rare nuclearities in Ni(II) cluster chemistry: An unprecedented (Ni12) nanosized cage from the use of N-naphthalidene-2-amino-5-chlorobenzoic acid.** *Perlepe P.S., Pantelis K.N., Cunha-Silva L., Bekiari V., Escuer A., Stamatatos T.C.* Inorganics. 2020, 8(5)

Research

The Magnetic Interactions and Molecular Magnetism research group is dedicated to the Chemistry of Coordination of polynuclear compounds, making their synthesis, structural characterization and magnetic studies.

The objectives of the research are: 1) to find magnetic-structural relationships based on the magnetic and structural data of the new complexes; 2) to reach the formation of new molecular magnets (SIM or SMM); 3) to study the effect of the enantiopure systems in supramolecular chirality; 4) study mixed valence manganese species that behave as models of bioinorganic processes.

Selected projects

- **Clústeres quirales de cationes d/f: nuevos materiales multipropiedad magnéticos y/o luminiscentes y/o ferroelectricos. Aplicaciones de clusters de Manganeso como antoxidantes.** PGC2018-094031-B-I00. IP: *Albert Escuer Fite*. Ministerio de Ciencia, Innovación y Universidades. 2019-2022

2.2.24. Magnetic Soft Matter Group (NanoBio)

Department Condensed Matter Physics, Faculty Physics
Website: Magnetic Soft Matter Group

Team

Pietro Tierno (Associate Professor - ERC Consolidator Grant)
Antonio Ortiz-Ambriz (Associate Professor)
Eric Cereceda López (Predoctoral Researcher)

SELECTED PAPERS

- **Collective Directional Locking of Colloidal Monolayers on a Periodic Substrate.** *Stoop R.L., Straube A.V., Johansen T.H., Tierno P.* **Physical Review Letters.** 2020, 124(5), 058002
- **Emergent collective colloidal currents generated via exchange dynamics in a broken dimer state.** *Massana-Cid H., Ortiz-Ambriz A., Vilfan A., Tierno P.* **Science Advances.** 2020, 6(10), eaaz2257

Research

The research group is interested in Soft matter systems like colloids, polymers or liquid crystals, with special emphasis on out equilibrium conditions, when external field or forces act over the systems. In particular, at the present we are working on the following topics:

- Artificial colloidal ice.
- Propulsion in viscous fluids.
- Ratchet transport.
- Realization of shape-anisotropic field responsive particles.
- Colloids in periodic potentials.

Selected projects

- **ENgineering FrustratiOn in aRtificial Colloidal icEs: degeneracy, exotic lattices and 3D states (ENFORCE).** ERC Consolidator Grant. IP: *Pietro Tierno*. (2020-2024)

2.2.25. Magnetism (NanoMagnetics)

Department Condensed Matter Physics,
Faculty Physics
Website: Magnetism

Team

Javier Tejada Palacios (Emeritus Professor)
Antoni García Santiago (Associate Professor)
Joan Manel Hernández Ferràs (Associate Professor)
Ferran Macià Bros (Associate Professor)

Research

The group studies magnetism and spin-dependence electron transport (spintronics) in mesoscopic systems and dynamical systems in a general sense. During the last 4 years the group has focused in the study of the interaction between surface acoustic waves and magnetic excitations at the nanoscale. We also study the creation of spin currents from magnetic excitations in different materials (spin-pumping and spin Seebeck effects).

SELECTED PAPERS

- **Large Nonreciprocal Propagation of Surface Acoustic Waves in Epitaxial Ferromagnetic/Semiconductor Hybrid Structures.** *Hernández-Mínguez A., Macià F., Hernàndez J.M., Herfort J., Santos P.V.* Physical Review Applied. 2020, 13(4), 044018
- **Generation and Imaging of Magnetoacoustic Waves over Millimeter Distances.** *Casals B., Statuto N., Foerster M., Hernández-Mínguez A., Cichelero R., Manshausen P., Mandziak A., Aballe L., Hernàndez J.M., Macià F.* Physical Review Letters. 2020, 124(13), 137202
- **Effect of the Zhang-Li torque on spin-torque nano-oscillators.** *J Albert, F Macià, JM Hernàndez.* Physical Review B 102 (18), 184421 (2020)
- **On the promotion of catalytic reactions by surface acoustic waves.** *B von Boehn, M Foerster, M von Boehn, J Prat, F Macià, B Casals, MW Khaliq, AHernández-Mínguez, L Aballe, R Imbihl.* Angewandte Chemie International Edition 59 (45), 20224-20229 (2020)
- **Magnetic droplet solitons** *F Macià, AD Kent.* Journal of Applied Physics 128 (10), 100901 (2020)

Selected Projects

- **Phonon-Magnon Pumping in Oxide Nano-structures - Creating condensates for Boson based computin.** Prokject owner – Norwegian University of Technology and Science. Partners: UB, Stockholm University, JAIST. Funding agency: Research Council of Norway (RCN). 2021-2025
- **Matheroes: The Box.** Finacial Support: Project co-funded by ICMAB-CSIC and FECYT - Fundación Española para la Ciencia y la Tecnología. IP: *Anna May Masnou.* 2020-2021

Singular scientific equipment

- E4448A PSA Series Spectrum Analyzer, 3 Hz - 50 GHz
- 8565E Portable Spectrum Analyzer, 9 kHz to 50 GHz
- 8510C Vector Network Analyzer
- E8361A PNA Network Analyzer, 10 MHz to 67 GHz
- PNA Millimeter-Wave Network Analyzer, 10 MHz to 110 GHz

International collaborations

- *Andrew D. Kent* (New York University)
- *Prof. Erik Wahlstrom* (NTNU)
- *Dra. Carla Cirillo* (SPIN-CNR)
- *Prof. Josep Fontcuberta* (ICMAB)
- *Dr. Alberto Hernández-Mínguez* (PDI Berlin)
- *Dr. M. Foerster* (ALBA-CELLS)

2.2.26. Materials for Energy, Photonics and Catalysis (NanosMat)

Department Applied Physics, Faculty Physics

Website: ENPHOCAMAT

Team

Enric Bertran Serra (Full Professor)
Adolf Canillas Biosca (Full Professor)
Esther Pascual Miralles (Full Professor)
José Luis Andújar Bella (Associate Professor)
Franc Güell Vilà (Associate Professor)
Oriol Arteaga Barriel (Postdoctoral Researcher Ramon y Cajal)
Roger Amade Rovira (Tenure-Track Lecturer)
Jordi Gomis Bresco (Tenure-Track Lecturer)
Islam Alshaikh (Predoctoral Researcher)
Joan Martí González (Predoctoral Researcher)

SELECTED PAPERS

- **Homogeneous Fe2O3 coatings on carbon nanotube structures for supercapacitors.** *Yu P., Coll M., Amade R., Alshaikh I., Pantoja-Suárez F., Pascual E., Andújar J.L., Serra E.B.* Dalton Transactions. 2020, 49(13)
- **Photoluminescence from carbon structures grown by inductively coupled plasma chemical vapor deposition.** *Musheghyan-Avetisyan A., Güell F., Martínez-Alanis P.R., Amade R., Martí-González J., Bertran-Serra E.* Journal of Vacuum Science and Technology A: Vacuum, Surfaces and Films. 2020, 38(2), 023405
- **Super-Capacitive Performance of Manganese Dioxide/Graphene Nano-Walls Electrodes Deposited on Stainless Steel Current Collectors.** *R. Amade, A. Muyshegyan-Avetisyan, J. Marti-Gonzalez, .A Perez del Pino, E. Gyorgy, E. Pascual, JL. Andujar, E. Bertran-Serra.* Materials, 12(2020)483

Research

The group 'Materials for Energy Photonics and Catalysis' (ENPHOCAMAT) focuses its activity on the search of advanced materials through the production, treatment, structural and compositional characterization, physical-chemical functionality, photonic characterization of materials in general and of nanometric structures. All these activities are aimed at catalysis, photonics and energy applications.

Lines and activities of the Group ENPHOCAMAT:

- New nanostructured materials
- Nanostructured carbon supercapacitors
- Optical characterization: polarimetry and generalized ellipsometry
- Photonic Materials
- Preparation and characterization of new materials with catalytic properties
- Studies of the relationship between the catalytic behavior and the characteristics of materials;
- The application of new materials as catalysts in:
  - Chemical recycling of CO_2
  - Transformation of biomass-derived resources into chemicals and energy carriers.

Selected projects

- **ADHES, Synthesis of CNS (VACNTs and GNWs) in flexible metal tapes and study of their electrochemical properties after functionalization with metal oxide composites.** ENE2017-89210-C2-2-R. *Enric Bertran Serra* (IP), *Esther Pascual Miralles* (Co-IP). Ministerio de Economia y Competitividad . 2018 -2020
- **TCCV2,Textile Competence Center Vorarlberg 2.** FFG 882502, *Enric Bertran Serra* (IP), programa. COMET projects finançat per la Austrian Funding Agency, 2021-2024

Singular scientific equipment

- Catalysis laboratory
- Spectral and Generalized Ellipsometer (UV-VIS)
- Mueller Matrix Polarimeter
- PECVD-PVD CNTs reactor
- ICP-CVD Graphene reactor
- Thermal evaporator
- Sputtering Magnetron (3")
- Langmuir-Blodgett
- Ion beam gun (etching and surface treatment)
- Nanotribometer
- Goniometer (contact angle)
- Electrical Transport measurements
- Electrochemical characterization (voltammetry & amperometry)
- Impedance Spectroscopy

International collaborations

- Group of *Prof. Pagona Papakonstantinou* del NIBEC, University of Ulster, Belfast, Northern, Ireland (UK).
- Group of *Prof. David Mariotti* del NIBEC, University of Ulster, Belfast, Northern Ireland (UK).
- Group of *Prof. MPY Desmulliez* and *Dr. José Marques-Hueso* of Institute of Sensors, Signals & Systems, School of Engineering & Physical Sciences, Institute of Mechanical, Process & Energy Engineering, Energy Academy, Heriot-Watt University.
- Departamento de Materiales, Facultad de Ingeniería Mecánica, Escuela Politécnica Nacional, Quito (Ecuador).
- Group of *Dr. Adrian Boyd* and *Dr. Shahzad Hussain* of the NIBEC, Jordanstown, Ulster University, Norther Ireland, UK.
- Group of *Prof. Thomas Bechtold* and *Dr. Noemi Aguiló Aguayo* of Research Institute of Textile Chemistry and Textile Physics, University of Innsbruck, Austria.
- Group of *Prof. A. Dimoulas and Dr. S. Chaitoglou* of Laboratory of Epitaxy and Surface Science, Institute of Nanoscience and Nanotechnology, NCSR Demokritos , Greece.
- Group of *Prof. Tung Pham* of Research Institute of Textile Chemistry and Textile Physics of the University of Innsbruck, Austria.

2.2.27. Materials: Phase transitions (NanoMet)

Department Condensed Matter Physics, Faculty Physics

Team

Antoni Planes Vila (Full Professor)
Lluís Mañosa Carrera (Full Professor)
Teresa Castán Vidal (Full Professor)
Michela Romanini (Postdoctoral Researcher Juan de la Cierva)
Marcel Porta Tena (Adjunct Lecturer)

Research

Research activity of the group has the following three main objectives. The first two are experimental and aim at

- The development and characterization of new materials with giant caloric response, which is a class of materials potentially interesting for environmentally friendly solid state refrigeration and energy harvesting applications.
- The study of externally driven materials that respond intermittently through a sequence of avalanches. The group is essentially interested in the study of the dependence of the distributions of energy and duration of acoustic emission avalanches in materials with tailored microstructures with the aim of gaining understanding on the influence of heterogeneities on their dynamics.

The third objective is devoted to

- Phase field modelling and numerical simulation of microstructural pattern formation in materials with multiple degrees of freedom that undergo structural transitions. This is applied to the study of the caloric and multicaloric response of these systems and the occurrence intermittent dynamic processes and its influence on hysteresis effects in this class of materials.

SELECTED PAPERS

- **Solid-state cooling by stress: A perspective.** *Mañosa L., Planes A.* Applied Physics Letters. 2020, 116(5), 050501
- **Reversible and irreversible colossal barocaloric effects in plastic crystals.** *Aznar A., Lloveras P., Barrio M., Negrier P., Planes A., Mañosa L., Mathur N.D., Moya X., Tamarit J.-L.* Journal of Materials Chemistry A. 2020, 8(2), 639
- **Multicaloric effects in metamagnetic Heusler Ni-Mn-In under uniaxial stress and magnetic field.** *Gràcia-Condal A., Gottschall T., Pfeuffer L., Gutfleisch O., Planes A., Mañosa L.* Applied Physics Reviews. 2020, 7(4), 041406
- **Reversible barocaloric effects over a large temperature span in fullerite C60** *Li, J., Dunstand, D., Lou, X., Planes. A., Mañosa, L., Barrio, M., Tamarit, J.L., Lloveras, P. J.* Mater. Chem. A. (2020) 8, 20354
- **Tracking the dynamics of power sources and sinks during the martensitic transformation of a Cu-Al-Ni single crystal.** *Ianniciello L., Romanini, M., Mañosa, L., Planes, A., Engelbrecht, K., Vives, E.* Applied Physics Letters (2020), 116, 183901

Selected projects

- **Materiales con respuesta activa para refrigeración limpia y eficiente.** MAT2016-75823-R. Co-IP: *Antoni Planes Vila*. Ministerio de Economia y Competitividad. 2016-2020
- **Ajut a la Recerca Transversal 2019 (IN²UB): Multicaloric Effects in Ferroelectric Plastic Crystals.** IP: *Michela Romanini*

Singular scientific equipment

- DSC calorimeter with applied magnetic field and stress
- Acoustic emission detection systems in the frequency range of MHz.
- High resolution infra-red camera.

International collaborations

- *Prof. E.K.H. Salje*, Department of Earth Sciences, University of Cambridge, U.K.
- *Prof. Mehmet Acet*, Physics Department, Universität Duisburg-Essen, Germany
- *Profs. N. D. Mathur* and *X. Moya*, Department of Materials Science, University of Cambridge, U.K.
- *Dr. Avadh Saxena*, Theoretical Division, Los Alamos National Lab., U.S.A.
- *Dr. Oliver Gutfleisch*, Technische Universität Darmstad, Germany

2.2.28. Mechanisms of Reactions in Inorganic Chemistry (NanosMat)

Department Inorganic and Organic Chemistry, Faculty Chemistry

Website: Mechanisms of Reactions in Inorganic Chemistry

Team

Manuel Martínez López (Full Professor)

Montserrat Sofia Ferrer García (Associate Professor)

Research

There is a general interest in the possibility of tuning the reaction mechanisms via careful systematic modifications. Therefore, the group's general research project is based on increasing the kinetico-mechanistic information available on already described reactions, as well as on some new processes specifically designed for this purpose. It is important to highlight that the "Mecanismes de Reacció en Química Inorgànica" research group of the Universitat de Barcelona is one of the few internationally active groups in kinetico-mechanistic studies, which provides a significant added value to its activity.

SELECTED PAPERS

- **A detailed kinetico-mechanistic investigation on the palladium C-H bond activation in azobenzenes and their monopalladated Derivatives.** *A. Bjelopetrović, D. Barišić, Z. Duvnjak, I. Džajić, M.J. Kulcsár, I. Halasz, M. Martínez, A. Budimir, D. Babić, M. Ćurić.* **Inorg. Chem.** 2020; 59; 17123-17133
- **Benchmarking of DFT methods using experimental free energies and volumes of activation for the cycloaddition of alkynes to cuboidal Mo3S4 clusters.** *E. Pedrajas, J.A. Pino-Chamorro, M. Ferrer, M.J. Fernández-Trujillo, R. Llusar, M. Martínez, M.G. Basallote, A.G. Algarra.* **Int. J. Quantum Chem.** 2020; 120; e26353
- **Self-assembled highly positively charged Allyl-Pd crowns: cavity-pocket driven interactions of fluoroanions.** *M. Ferrer, A. Gallen, A. Gutierrez, M. Martinez, E. Ruiz, Y, Lorenz, M. Engeser.* **Chem., Eur. J.** 2020; 26; 7847-7869
- **Self-assembly and properties of a discrete water-soluble PrussianBlueAnalog FeII/CoIII cube; confinement of a water molecule in aqueous solution.** *M. A. Gonzalvez, A. Gallen, M. Ferrer, M. Martinez.* **Inorg. Chem.** 2020; 59; 1582-1587

Selected Projects

- **Estudios cinetico-mecanísticos de la reactividad de compuestos de coordinacion en disolucion: la importancia de las variables inocentes en los parámetros de activación.** PID2019-107006GB-C21. IP: *Manuel Martínez* (UB)
- **Materiales supramoleculares funcionales.** RED2018-102331-T. Universidad de las Islas Baleares
- **Red de iones metálicos en sistemas biológicos.** CTQ2017-90802-REDT. Universidad de Vigo

Singular scientific equipment

- Stopped-flow UV-Vis system, with premixing unit
- Stopped-flow UV-Vis system for measures up to 2000 atmospheres of hydrostatic pressure
- High hydrostatic pressure (up to 2000 atmospheres) system for measures of conventional and time-resolved UV-Vis
- UV-Vis probe for conventional and time-resolved UV-Vis measures at low temperature

International collaborations

- *Paul Bernhardt* (University of Queensland, Australia)
- *Ana Budimir* (University of Zagreb,Croatia)
- *Rudi van Eldik* (Univesität Erlangen, Gremany)
- *Marianne Engeser* (Univesität Bonn, Germany)
- *Montserrat Gómez Simón* (Université Paul Sabatier de Toulouse, France)
- *Marcel Maeder* (University of Newcastle, Australia)
- *Grazyna Stochel* (Jagiellonian University, Krakow, Poland)

2.2.29. Microbian Enzymes for Industrial Applications Group (NanoBio)

Department Genetics, Microbiology and Statistics, Faculty Biology

Website: Microbian Enzymes for Industrial Applications Group

Team

Francisco I. Javier Pastor Blasco (Full Professor)
Pilar Díaz Lucea (Full Professor)
Josefina Martínez Martínez (Associate Professor)
Susana Valenzuela Mayorga (Adjunct Lecturer)
Carolina Buruaga (Predoctoral Researcher)
Lourdes Verónica Cabañas (Predoctoral Researcher)

SELECTED PAPERS

- **Bacterial cellulose-chitosan paper with antimicrobial and antioxidant activities.** *Cabañas-Romero L.V., Valls C., Valenzuela S.V., Roncero M.B., Pastor F.I.J., Diaz P., Martínez J.* Biomacromolecules. 2020, 21(4)
- **Development of an antimicrobial bioactive paper made from bacterial cellulose.** *Buruaga-Ramiro C., Valenzuela S.V., Valls C., Roncero M.B., Pastor F.I.J., Díaz P., Martinez J.* International Journal of Biological Macromolecules. 2020, 158
- **Bacterial cellulose matrices to develop enzymatically active paper.** *Buruaga-Ramiro C., Valenzuela S.V., Valls C., Roncero M.B., Pastor F.I.J., Díaz P., Martínez J.* Cellulose. 2020, 27(6)
- **Structural analysis of the reducing-end xylose-releasing exo oligoxylanase Rex8A from Paenibacillus barcinonensis BP 23 deciphers its molecular specificity.** *Jimenez-Ortega E, Valenzuela S.V., Ramirez-Escudero M., Pastor F.I.J., Sanz-Aparicio J.* The FEBS Journal. 2020, 287

Research

The group of Microbial Enzymes for Industrial and Environmental Applications works on the biotransformation of natural polymers, including the development of enzymes that catalyze their modification, hydrolysis, and/or synthesis. In addition, they are exploring the potential of bacterial nanocellulose and other nanocellulosic materials, as sources of new biomaterials, suitable for high added value applications.

Selected projects

- **Diseño de herramientas biotecnológicas para el desarrollo de componentes de microdispositivos biodegradables.** CTQ2017-84966-C2-2-R. Ministerio de Economia y Competitividad. IP: *Pastor Blasco, Francisco I. Javier.* 2018-2021

Singular scientific equipment

- Nanofibrillated cellulose preparation: Panda Plus 2000, for high-pressure homogenization
- Protein purification: ÄKTA protein purification system, for chromatographic separation of proteins
- Screening for activity: ASYS UVM340 Microplate reader / Agilent, Varian Cary Eclipse Fluorescence Spectrophotometer, for microplate

International collaborations

- *Peter Biely's Lab:* Institute of Chemistry, Slovak Academy of Sciences, Bratislava, Slovakia.
- *Sonia Rodriguez Giordano's Lab:* Bioscience Department, Universidad de la República. Montevideo, Uruguay.
- *Diana Ciolacu:* "Petru Poni" Institute of Macromolecular Chemistry, Department of Physical Chemistry of Polymers. Iasi, Romania.
- *Mirjam Kabel:* Department of Agrotechnology and Food Sciences, Wageningen University & Research. Wageningen, Netherlands
- *Nawel Boucherba:* Head of Team Microbial enzymes, president of the scientific council of the FNSL. University A/Mira of Bejaia

2.2.30. Micro and Nanotechnology and nanoscopies for Electronic and Electrophotonic Devices (NanoPhotoElectro)

Department Electronics and Biomedical Engineering, Faculty Physics

Website: MIND

Team

Albert Cornet Calveras (Full Professor)
Blas Garrido Fernández (Full Professor)
Albert Cirera Hernández (Full Professor)
Juan Daniel Prades Garcia (Full Professor)
Albert Romano Rodríguez (Full Professor)
Paolo Pellegrino (Associate Professor)
Daniel Navarro Urrios (Associate Professor)
Sergio Hernández Márquez (Associate Professor)
Cristian Fàbrega Gallego (Tenure-Track Lecturer)
Francisco de P. Hernandez Ramirez (Adjunct Lecturer)
Olga Casals Guillén (Postdoctoral Researcher)
Adrià Huguet Ferran (Predoctoral Researcher)
Alexander Cabal Tato (Predoctoral Researcher)
Juan Luis Frieiro Castro (Predoctoral Researcher)
Elena López Aymerich (Predoctoral Researcher)

SELECTED PAPERS

- **The structural, electronic, and optical properties of GE/SI quantum wells: Lasing at a wavelength of 1550 NM.** *Li H., Wang J., Bai J., Zhang S., Zhang S., Sun Y., Dou Q., Ding M., Wang Y., Qu D., Du J., Tang C., Li E., Prades J.D.* Nanomaterials. 2020, 10(5)
- **Toward RGB LEDs based on rare earth-doped ZnO.** *Frieiro J.L., Guillaume C., López-Vidrier J., Blázquez O., González-Torres S., Labbé C., Hernández S., Portier X., Garrido B.* Nanotechnology. 2020, 31(46).
- **Directly addressable GaN-based nano-LED arrays: fabrication and electro-optical characterization.** *Bezshlyakh D.D., Spende H., Weimann T., Hinze P., Bornemann S., Gülink J., Canals J., Prades J.D., Dieguez A., Waag A.* Microsystems and Nanoengineering. 2020, 6(1)
- **Laser nanostructuring of thin films of PEDOT:PSS on ITO: Morphology, molecular structure and electrical properties.** *Gutiérrez-Fernández, E., Gabaldón-Saucedo, I.A., Rodríguez-Rodríguez, Á., Solano, E., García-Gutiérrez, M.C., Nogales, A., Cirera, A., Ezquerra, T.A., Rebollar, E.* Applied Surface Science. 2020, 509

Research

The activities developed by the group can be named Development of Advanced Micro and Nanosystems. They cover from basic science (physics, chemistry, materials and nanoscience) to applied and technological topics (applied physics, engineering, micro and nanofabrication), always focusing on addressing specific societal problems. The three main topics are described briefly in the following:

1. Fabrication of advanced nanomaterials, their integration into nanodevices and the development of nanosystems for gas sensing applications.
2. Development of a nanosystem for the assessment of mechanical stresses in living tissues, started in an Explora project (TEC2014-62144-EXP). The continuation of this work has been suppored by a FET-Open project called StertchBio.
3. Development of ultra low power gas sensors, targeting improvements 3 orders of magnitude better than the state-of-the-art (i.e. a reduction from ~10mW down to ~10 W).

Selected projects

- **DRop-on demand flexible optoelectronics & photovoltaics by means of lead-free halide perovskITes (DROP-IT).** (H2020-FETOPEN-2018-2019-2020-01). IP: *Garrido Fernández, Blas.* (2019-2022)
- **Continuous two-dimensional stretch monitoring of fresh tissue biopsies (StretchBio).** H2020 FET-OPEN. IP: *Albert Romano* (2021-2025)

- **A user-friendly approach to widespread gas monitoring (Stick-n-Sense).** (ERC-2020-PoC).
  IP: *Prades García, Juan Daniel*. (2021-2022)

International collaborations

- Research Center: Technical University of Denmark (DTU)
  Group leader: *Winnie E. Svendsen*
  City: Lyngby (Denmark)
- Research Center: Goethe University of Frankfurt
  Group leader: *Sven Barth*
  City: Frankfurt (Germany)
- Research Center: Albrechts-Ludwig Universität Freiburg
  Group leader: *Jürgen Wöllenstein*
  City: Freiburg im Breisgau (Germany)
- Research Center: TU Braunschweig
  Group leader: *Andreas Waag*
  City: Braunschweig (Germany)

2.2.31. Mineral Resources Research Group (NanoBio)

Department Mineralogy, Petrology and Applied Geology, Faculty Earth Sciences

Team

Josep Roqué Rosell (Associate Professor)
Joaquín Antonio Proenza (Associate Professor)
Joan Carles Melgarejo Draper (Associate Professor)
Maria Abigaíl Jiménez Franco (Postdoctoral Researcher)

Research

The group is developing research in mineralogy at nanoscale by using cutting edge research techniques such as Transmission Electron Microscopy (TEM) and Synchrotron Radiation Sources (SRS) to explore and understand the geological and biological interactions taking place in minerals. The task that they develop consists of the study at nanoscale of the metals partitioning in geological systems, the study of natural nanoparticles aggregation, the study of nanoporosity in rocks and soils, the ab-initio structure determination of nanominerals and the study of their stability. This research has a direct impact on the integral study of mineral resources (from exploration to the metallogenetic studies), on the possible applications of their minerals, on the environmental impact and the sustainability of these resources.

SELECTED PAPERS

- **Mineralogy of the HSE in the subcontinental lithospheric mantle — An interpretive review.** *González-Jiménez J.M., Tassara S., Schettino E., Roqué-Rosell J., Farré-de-Pablo J., Saunders J.E., Deditius A.P., Colás V., Rovira-Medina J.J., Dávalos M.G., Schilling M., Jimenez-Franco A., Marchesi C., Nieto F., Proenza J.A., Gervilla F.* **Lithos.** 2020, 372-373
- **Nanoscale constraints on the in situ transformation of Ru–Os–Ir sulfides to alloys at low temperature.** *Jiménez–Franco A., González–Jiménez J.M., Roqué J., Proenza J.A., Gervilla F., Nieto F.* **Ore Geology Reviews.** 2020, 124
- **Diamond forms during low pressure serpentinisation of oceanic lithosphere.** *Pujol-Solà N, Garcia-Casco A, Proenza JA, González-Jiménez JM, del Campo A, Colás V, et al.* **Geochemical Perspect Lett.** 2020 19–24
- **Synchrotron XAS study of Mn and Fe in Chinese blue-and-white Ming porcelains from the second half of the 15th century.** *Roqué-Rosell J, Pinto A, Marini C, Prieto Burgos J, Groenen J, Campeny M, et al.* **Ceram Int.** 2020; 2715-2724

Selected projects

- **Recursos minerales en la litosfera de arcos volcánicos intra-oceánicos: una perspectiva a partir de sistemas minerales.** (MISYAP) Ministerio de Ciencia, Innovación y Universidades PID2019-105625RB-C21

International collaborations

- Lawrence Berkeley National Laboratory, 1 Cyclotron Road Mailstop, Berkeley, CA 94720
- NanoMEGAS SPRL, Rue Émile Claus 49 bte 9, 1050 Brussels (Belgium)

2.2.32. Nanobioengineering and Biomaterials Unit (NanoBio)

Department Electronics and Biomedical Engineering, Faculty Physics

Team

Josep Samitier Martí (Full Professor)
Oscar Castaño Linares (Associate Professor)
Romén Rodríguez Trujillo (Tenure-Track Lecturer)
Mònica Mir Llorente (Adjunct Lecturer)

Research

The group is devoted to the application of nanotechnology and biomaterials for the development of new systems, protocols and biomedical devices with the aim of creating new diagnostic platforms, models and biological microenvironments, and regenerative therapies. The main research activities of the group include the biochemical engineering, soft lithography en microfabrication techniques, functionalization of biomaterials integrated with microfluidic systems and the three-dimensional scaffolding of biodegradable and bioactive biomaterials.

Bioengineering microdevices are used to study cellular responses to biomolecular compounds applied to Organ-on-Chip devices, or for the development of new laboratory-based biosensors on a chip. The objective is to manufacture microsystems that contain living cells that recapitulate the functions at the level of tissues and organs *in vitro* and new portable diagnostic devices that can be used as point of care systems.

SELECTED PAPERS

- **Micro-needle implantable electrochemical oxygen sensor: *ex-vivo* and *in-vivo* studies.** *Rivas L., Dulay S., Miserere S., Pla L., Marin S.B., Parra J., Eixarch E., Gratacós E., Illa M., Mir M., Samitier J.* Biosensors and Bioelectronics, 2020. 153, 112028
- **Sensor-integrated microfluidic approaches for liquid biopsies applications in early detection of cancer.** *Sierra J., Marrugo-Ramírez J., Rodriguez-Trujillo R., Mir M., Samitier J.* Sensors. 2020, 20(5)
- **Engineering cell-derived matrices: from 3D models to advanced personalized therapies.** *Rubi-Sans G., Castaño O., Cano I., Mateos-Timoneda M.A., Perez-Amodio S., Engel E.* Advanced Functional Materials. 2020, 30(44)
- **Layer-by-layer modification effects on a nanopore's inner surface of polycarbonate track-etched membranes.** *Paoli R., Bulwan M., Castaño O., Engel E., Rodriguez-Cabello J.C., Homs-Corbera A., Samitier J.* RSC Advances. 2020, 10(59)

Selected Projects

- **Plataformas microfisiológicas *in vitro* para la mimetización de las barreras del sitema nervioso central: aplicaciones en cerebro y médula espinal.** RTI2018-097038-B-C22. Ministerio de Ciencia, Innovación y Universidades. PI1: *Oscar Castaño/* PI2: *Romen Rodriguez*. 2019-2021

Singular scientific equipment

- Nanofabrication and nanomanipulation
  - 3D Printing system for microfluidic devices
  - Soft lithography en microfabrication techniques
  - Graphtech
  - Electrospinning device
  - Spin-coater
- Characterization
  - Potentiostates
  - Optical Waveguide Lightmode Spectroscope (OWLS)
  - Atomic Force Microscope (AFM)
  - Optical Microscopes (white light/epifluorescence)
  - Combustion furnace
  - High temperature furnace
  - Ball mill
  - Inert atmosphere facilities
  - Sol-gel facilities

- Electrical Impedance spectroscopy (EIS)
- Multi-frequency Lock-in Amplifier
- Sub-femtoamp Remote SourceMeter Instrument
- Surface characterization equipment (contact angle, Z potential)
- Differential Scanning Calorimetry (DSC)
- Soft tissue mechanical testing machine
- Peptide synthesizer
- Vibrational viscosimeter

- Molecular/cell biology
  - Cell culture facilities
  - Molecular Biology equipment: protein and DNA electrophoresis
  - Thermocycler (PCR)
  - Biological safety cabinet (class II)
  - Microwell plate readers
  - Protein and DNA electrophoresis systems
  - Microincubator Okolab
  - Nanodrop spectrophotometer
  - CO_2 incubator for cells
  - Cell culture cabin
- Microfluidics
  - High precision syringe pumps
  - Peristaltic pumps

International collaborations

Dr. Adrian Carretero, Institut d'Electronique et des Systèmes, Montpellier, France
Dr. Graham Johnson, Uniscan Instruments Ltd, Buxton, UK
Dr. Izabella Rajzer, Institute of Textile Engineering and Polymer Materials, University of Bielsko-Biala, Poland
Dr. Nicole Jaffrezic, Université Claude Bernard Lyon 1, France
Prof. Albert Folch, Dpt. of Bioengineering, University of Washington, USA
Prof. Albert van den Berg, University of Twente, The Netherlands
Prof. Andre Bernard, Institut für Mikro- und Nanotechnologie (MNT-NTB), Buchs, Switzerland
Prof. E. Faszewski, Wheelock College, Boston, USA
Prof. G. Fuhr, FhG Biomedicine, St. Ingbert, Germany
Prof. H. Börner Max, Planck Institute of Colloids and Interfaces, Golm, Germany
Prof. Jean-Louis Marty, U. de Perpignan Via Domitia, France
Prof. Juan C. Izpisúa, Salk Institute for Biological Studies, La Jolla, California
Prof. Kevin Healy, Biomaterials & Tissue Engineering Laboratory, University of California at Berkeley, USA
Prof. Matthew Dalby, University of Glasgow, UK
Prof. Paolo Dario, Scuola Superiore Sant'Anna (SSSA), Pontedera, Italy
Prof. Roger D. Kamm, Biological Engineering, Massachusetts Institute of Technology (MIT), Cambridge, USA

2.2.33. NanoBioPharma (NanoPharmaMed)

Department Pharmacy and Pharmaceutical Technology and Physical-Chemical, Faculty Pharmacy and Food Sciences

Team

Ana Calpena Campmany (Associate Professor)
Mireia Oliva (Associate Professor)
Lyda Halbaut Bellowa (Associate Professor)
Helen Lissette Alvarado Bonilla (Adjunct Lecturer)
Joaquim Suñer Carbó (Adjunt Lecturer)
Mireia Mallandrich Miret (Postdoctoral Researcher)
Paulo Cesar Sarango Granda (Predoctoral Researcher)
Marcelle Silva de Abreu (External Collaborator)
Guadalupe Del Carmen Abrego Escobar (External Collaborator)
Beatriz Clares Maveros (External Collaborator)
Lupe Carolina Espinoza Tituana (External Collaborator)

SELECTED PAPERS

- **Topical pioglitazone nanoformulation for the treatment of atopic dermatitis: Design, characterization and efficacy in hairless mouse model.** *Espinoza L.C., Vera-García R., Silva-Abreu M., Domènech Ò., Badia J., Rodríguez-Lagunas M.J., Clares B., Calpena A.C.* Pharmaceutics, 2020. 12(3), 255
- **Design and evaluation of a multifunctional thermosensitive poloxamer-chitosan-hyaluronic acid gel for the treatment of skin burns.** *Soriano-Ruiz J.L., Calpena-Campmany A.C., Silva-Abreu M., Halbout-Bellowa L., Bozal-de Febrer N., Rodríguez-Lagunas M.J., Clares-Naveros B.* International Journal of Biological Macromolecules. 2020, 142

Research

The NanoBioPharma Group is interested on the study and development of control released nanostructured components for transdermal application for the treatment of inflammatory processes.

2.2.34. Nanoenergy and Electronic Materials (M2E) Group (NanoEnergy)

Department Electronics and Biomedical Engineering, Faculty Physics

Team

Joan Ramon Morante Lleonart (Full Professor)

Research

Study of the energy conversion processes at the nano scale using these processes for energy storage and the production of solar, synthetic fuels and added value chemicals for the replacement of fossil sources. Moreover, activities involved the deployment of sustainable mobility based on batteries and/or on hydrogen as well as in smart energy networks for sustainable cities and societies.

Research efforts have been addressed to a bottom-up approach pursuing transformative materials, chemistries, and architectures that can be mixed and matched to produce catalyst, electrodes, reactors and batteries with a variety of targeted performance metrics spanning energy density, power, capacity, cost, lifetime, and safety.

Related topics in chemical storage: green hydrogen, biomethane, solar hydrogen, CO_2 capture and reduction to CO, formic acid, syngas, methanol,... e-fuels; plastic circular economy...

Related topics in batteries: high energy density batteries.

Selected projects

- HYBRIS horizon 2020
- COBRA horizon 2020
- Heat to Fuel horizon 2020

Singular scientific equipment

- Energy storage laboratory facilities

International collaborations

- Europe, Asia, America, Australia

SELECTED PAPERS

- **Photoelectrochemical water splitting: a road from stable metal oxides to protected thin film solar cells.** *Ros C., Andreu T., Morante J.R.* Journal of Materials Chemistry A, 2020, 8(21)
- **Atomically dispersed Fe in a C2N based catalyst as a sulfur host for efficient lithium–sulfur batteries.** *Liang Z., Yang D., Tang P., Zhang C., Jacas Biendicho J., Zhang Y., Llorca J., Wang X., Li J., Heggen M., David J., Dunin-Borkowski R.E., Zhou Y., Morante J.R., Cabot A., Arbiol J.* Advanced Energy Materials. 2020
- **ZnSe/N-doped carbon nanoreactor with multiple adsorption sites for stable lithium-sulfur batteries.** *Yang D., Zhang C., Biendicho J.J., Han X., Liang Z., Du R., Li M., Li J., Arbiol J., Llorca J., Zhou Y., Morante J.R., Cabot A.* ACS Nano. 2020, 14 (11)
- **Photoelectrochemical water splitting: a road from stable metal oxides to protected thin film solar cells.** *Ros C., Andreu T., Morante J.R.* Journal of Materials Chemistry A. 2020, 8(21)
- **Outstanding Reviewers for Energy & Environmental Science in 2019.** Energy & Environmental Science, 2020, 13(5), 1299-1299
- **Engineering grain boundaries at the 2D limit for the hydrogen evolution reaction.** Nature Communications, 2020, 11(1)
- **Book:** https://www.fundacionnaturgy.org/publicacion/hidrogeno-vector-energetico-de-una-economia-descarbonizada/

2.2.35. Nanomalaria Group (NanoBio)

Department Biochemistry and Molecular Biology, Faculty Biology

Team

Santiago Imperial Ródenas (Associate Professor)
Xavier Fernández Busquets (External collaborator-IBEC-CRESIB)
Carlota Roca Martínez (Predoctoral Researcher)

Research

The driving force of the Nanomalaria group is their personal commitment to applying nanomedicine to infectious diseases of poverty through several research lines: (i) Exploration of different types of encapsulating structure (liposomes, synthetic and natural polymers), targeting molecule (protein, polysaccharide, nucleic acid aptamers), and antimalarial compound (e.g. new structures derived from marine organisms and antimicrobial peptides) for the assembly of nanovectors capable of delivering their drug cargo with complete specificity to diseased cells. (ii) Study of metabolic pathways present in Plasmodium but absent in humans, with the aim of identifying specific enzymes as therapeutic targets. (iii) Use of glycosaminoglycans for innovative antimalarial strategies. (iv) Design of new methods for the targeted drug delivery to Plasmodium stages in the mosquito vector. (v) Investigation of novel drugs against insect-borne diseases working through radically new mechanisms. (vi) Extension of our activities to new pathologies (leishmaniasis).

SELECTED PAPERS

- **Lepidine b & e as new target inhibitors from Lepidium sativum seeds against four enzymes of the pathogen Candida albicans: *In vitro* and *in Silico* studies.** *Gacemi S., Benarous K., Imperial S., Yousfi M.* Endocrine, Metabolic and Immune Disorders - Drug Targets. 2020, 20(1)
- **Repurposing heparin as antimalarial: evaluation of multiple modifications toward *in vivo* application.** *Lantero, E. Aláez-Versón, C.R., Romero, P., Sierra, T., and Fernàndez-Busquets, X.* Pharmaceutics. 2020, 12, E825
- **Heparin administered to Anopheles in membrane feeding assays blocks Plasmodium development in the mosquito.** *Lantero, E., Fernandes, J., Aláez-Versón, C.R., Gomes, J., Silveira, H., Nogueira, F., and Fernàndez-Busquets, X.* Biomolecules. 2020, 10, E1136
- **Extracellular vesicles derived from Plasmodium-infected and non-infected red blood cells as targeted drug delivery vehicles.** *Borgheti-Cardoso, L.N., Kooijmans, S.A.A., Gutiérrez Chamorro, L., Biosca, A., Lantero, E., Ramírez, M., Avalos-Padilla, Y., Crespo, I., Fernández, I., Fernandez-Becerra, C., del Portillo, H.A., and Fernàndez-Busquets, X.* Int. J. Pharm. 2020, 587, 119627

Selected projects

- **Discovery of new antiparasitic agents. UNIUN - Unión Iberoamericana de Universidades.** PI1: *Santiago Imperial* / PI2: *Xavier Fernandez-Busquets*. 2019-2021
- **Investigation of protein aggregation as a new antimalarial target.** RTI2018-094579-B-I00. Ministerio de Ciencia, Innovación y Universidades. 2019-2021
- **Coated liposome nanocomplexes as drug delivery systems for treatment of leishmaniasis** 201811-30 Fundació La Marató de TV3 call for Research Projects on Infectious Diseases. 2019-2022

2.2.36. Nanostructure of Biomembranes Group (NanoBio)

Department Pharmacy and Pharmaceutical Technology and Physical-Chemical, Faculty Pharmacy and Food Sciences

Team

Jordi Borrell Hernández (Full Professor)
Maria Teresa Montero Barrientos (Associate Professor)
Òscar Domènech Cabrera (Associate Professor)
Martha Leticia Vázquez González (Adjunct Lecturer)
Adrià Botet Carreras (Predoctoral Researcher)

SELECTED PAPERS

- **Characterization of monolayers and liposomes that mimic lipid composition of HeLa cells.** *Botet-Carreras A., Montero M.T., Sot J., Domènech Ò., Borrell J.H.* Colloids and Surfaces B: Biointerfaces. 2020, 196
- **Cholesterol effect on the specific capacitance of submicrometric DOPC bilayer patches measured by in-liquid scanning dielectric microscopy.** *Muzio M.D., Millan-Solsona R., Borrell J.H., Fumagalli L., Gomila G.* Langmuir. 2020, 36(43)

Research

The Nanostructures of Biomembranes Group has traditionally worked with spectroscopic techniques, particularly spectrofluorimetry, NMR, DSC, Langmuir monolayers and Langmuir Blodgett films and more recently, with the Atomic Force Microscope (AFM).

What characterizes the group is the fact that we combine the application of these techniques with molecular biology methods for which we are self-sufficient. Specifically, we obtain the proteins under investigation, lactose permease, NorA or KcsA, from Escherichia coli cultures. These proteins are models of efflux pump proteins related with the drug resistance in bacteria. We can extract the proteins from the cell membrane and after purification, we finally reconstitute them into membrane models of desired compositions. Spectrofluorometric studies of surface potential or FRET tell us about the interactions between proteins and the lipids that surround it. The characterization of the membrane models with the AFM allows the visualization and interaction (Force Spectroscopy) with an individual molecule of protein giving us the idea of the necessary force to take it out of the membrane. This information is important to understand how proteins are inserted in cell membranes and how they perform their function. Altering the membrane lipid composition modifies these force profiles suggesting a possible approach to inhibit the functionality of the protein when inserted in the membrane.

Selected projects

- **Breaking the Borders of Antimicrobial Resistance. Searching New Antimicrobial Compounds against Multi-Drug Resistant Bacteria: A Study of Policationic AMPS and Lipid Nanoparticles.** Fundació La Marató (TV3) (FMTV) 2018-2021. IP. *Miquel Viñas Ciordia*

Singular scientific equipment

- Multimode IV Atomic Force Microscope from Bruker controlled by Nanoscope V electronics equipped with a 15 µm scanner.
- Two KSV Nima Langmuir troughs equipped with surface pressure balance, surface potential and Brewster Angle Microscope (BAM).
- SLM Aminco 8100 Spectrofluorometer equipped with Xenon Lamp and thermostatted cuvette holder.

International collaborations

- *Ronald H. Kaback*. Department of Physiology. University of California, Los Angeles, USA. Physicochemical studies of Lactose permease (Lac Y) protein in model membranes
- *Pierre Emmanuel Milhiet*. Structural Biochemistry Centre CNRS UMR 5048 - UM - INSERM U 1054, Montpellier, France. Physicochemical studies of Macromolecules - model membrane interactions by AFM.
- *Marie-Paule Mingeot Leclercq*. Department of Cellular and Molecular Pharmacology, Catholic University of Louvain, Brussels, Belgium. Macromolecules - model membrane interactions
- *Manuel Prieto*. Molecular Physical Chemistry Centre, Technical University of Lisbon, Portugal. FRET fluorescence studies between membrane proteins and lipids in the annular region.

2.2.37. Nanostructured systems for controlled drug delivery (NanoPharmaMed)

Department Pharmacy and Pharmaceutical Technology and Physical-Chemical, Faculty Pharmacy and Food Sciences

SELECTED PAPERS

- **Recent advances on antitumor agents-loaded polymeric and lipid-based nanocarriers for the treatment of brain cancer.** *Cano A., Espina M., García M.L.* **Current Pharmaceutical Design,** 2020, 26(12)
- **Ocular penetration of fluorometholone-loaded PEG-PLGA nanoparticles functionalized with cell-penetrating peptides.** *Gonzalez-Pizarro R., Parrotta G., Vera R., Sánchez-López E., Galindo R., Kjeldsen F., Badia J., Baldoma L., Espina M., García M.L.* **Nanomedicine,** 2020, 14(23)

Team

M. Luisa García López (Full Professor)
Espina García Marta (Associate Professor)
Elena Sanchez Lopez (Tenure-Track Lecturer)
Fidencia Gamisans Linares (Adjunct Lecturer)
Gerard Esteruelas (Predoctoral Researcher)
Eleni Aeridou (Master Student)
Rubén Pareja (Master Student)
Amanda Cano Fernández (External Collaborator - Fundació ACE)

Research

The research group develops and assesses nanostructured systems of controlled released in order to treat neurodegenerative diseases or ocular inflammation.

Singular scientific equipment

- Particle size analyzers (Nanozeta sizer y difracción lasser)
- Homogenizers (ultrasound and high pression piston-gap)
- Thermal Analysis Systems (DSC, TG, thermomicroscopy)
- Otical Analyzer (Turbiscan Lab)
- Liofilizers (Lyo Quest y Lyo Beta), SPRAY DRIED, ROTAVAPORES
- Corneal camera, Franz cells
- HPLC

International collaborations

- Group of Pharmaceutical Technology, Faculty of Pharmacy, University of Coimbra, Coimbra, Portugal

2.2.38. Nanosystems Statistical Physics (NanoMet)

Department Condensed Matter Physics, Faculty Physics

Website: Nanosystems Statistical Physics

Team

Miguel Rubí Capaceti (Full Professor)

Andrés Arango Restrepo (Predoctoral Researcher)

SELECTED PAPERS

- **Saturation of radiative heat transfer due to many-body thermalization.** *Latella I., Messina R., Biehs S.-A., Rubi J.M., Ben-Abdallah P.* **Scientific Reports**, 2020, 10(1)8938

Research

The research in the group is focused Non-equilibrium statistical physics, Non-equilibrium nanoscale phenomena, Mesoscopic non-equilibrium thermodynamics, Transport in confined Systems, Biophysics, Magnetization dynamics.

Selected projects

- **Física Estadística.** SGR. 2017SGR884. IP: *Rubi Capaceti, Jose Miguel*. Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR). 2017-2020
- **Statistical physics of small-scale systems: structure, functionallty and cooperativity.** PGC2018-098373-B-I00. IP: *Rubi Capaceti, Jose Miguel*. Ministerio de Ciencia, Innovación y Universidades. 2019-2021

2.2.39. Organic Materials Unit (NanosMat)

Department Inorganic and Organic Chemistry, Faculty Chemisty

Team

Maria Dolors Velasco Castrillo (Full Professor)
Jaume García Amorós (Associate Professor)
Roger Bujaldón Carbó (Predoctoral Researcher)

SELECTED PAPERS

- **Structural features guiding the design of liquid-crystalline elastomeric fluorescent force sensors.** *Garcia-Amorós J., Velasco D.* Applied System Innovation. 2020, 3(7)

Research

One of the major challenges of the research in the Organic Materials group will be the programming of different properties (optical, electronic, luminescent or magnetic) into liquid single crystal elastomers (LSCE), i.e. weakly cross-linked polymer networks that combine the elasticity of conventional rubbers with the long-range molecular order of liquid crystals, which reaches the macroscopic level.

The research group has garnered a solid background in organic synthesis, macromolecular chemistry and materials chemistry and physics over the years. The Organic Materials group investigates in the design and comprehension of the different factors that influence the semiconductor behaviour of organic materials and in the Interface engineering and solid-state organization for organic thin-film transistors. They are also engaged in the development of molecular and macromolecular liquid-crystalline systems for different applications.

Selected projects

- **Materials funcionales con actividad programable frente a campos externos.** PGC2018-095477-B-I00. IP: *M. Dolores Velasco Castrillo*. Ministerio de Ciencia, Innovación y Universidades. 2019-2021

Singular scientific equipment

- Polarised Optical Microscopy
- Photoisomerization set-up
- Heating centrifuge

International collaborations

- *Dr. O. Poizat* (Laboratoire de Spectrochimie Infrarouge et Raman CNRS, Université de Lille1 Sciences et Technologies, Université Lille Nord de France, Villeneuve d'Ascq Cedex, France).
- *Dra. M. M. M. Raposo* (Centro de Química, Universidade do Minho, Braga,Portugal).
- *Dr. J. V. Grazulevicius* (Department of Polymer Chemistry and Technology, Kaunas University of Technology, Lithuania)
- *Dr. V. Jankauskas* (Department of Solid State Electronics, Vilnius University, Vilnius, Lithuania)

2.2.40. Peptides and Proteins: Physicochemical Studies (NanoBio)

Department Pharmacy and Pharmaceutical Technology and Physical-Chemical, Faculty Pharmacy and Food Sciences

Team

Victòria Girona Brumós (Full Professor)
Yolanda Cajal Visa (Associate Professor)
Josefina Prat Aixelà (Associate Professor)
Montserrat Pujol Cubells (Associate Professor)
Montserrat Muñoz Juncosa (Associate Professor)

SELECTED PAPERS

- **Article dexibuprofen biodegradable nanoparticles: One step closer towards a better ocular interaction study.** *Sánchez-López E., Esteruelas G., Ortiz A., Espina M., Prat J., Muñoz M., Cano A., Calpena A.C., Ettcheto M., Camins A., Alsafi Z., Souto E.B., García M.L., Pujol M.* **Nanomaterials**, 2020, 10(4)720

Research

Peptides and Proteins: Physicochemical Studies Group has been developing its activity in two research lines a) Biophysical studies of surface-active GBV-C peptides as potential inhibitors of HIV-1 FP peptide and b) The performance of biophysical and microbiological studies of multifunctional polycationic peptide constructions with membrane activity. Concerning HIV-1 FP inhibition, its research focused specifically on the effect of lipid phase in the process that takes place. Findings corroborate that 1) GBV-C peptides interact with HIV-1 FP providing a kind of peptide-peptide complex that produces a change of LE / LC phase extension and avoid the HIV-1 FP action at membrane level; 2) the interaction occurs at the LE / LC border.

The line of research on new antibiotic lipopeptides has developed new candidate molecules with MICs in the micromolar range for both Gram positive and Gram negative bacteria (patents WO2010/029196, WO2011/110716, PCT/ES2014/070286). Biophysical studies with model membranes in combination with flow cytometry and TEM observation in susceptible bacteria are indicative of a membrane-based mechanism of action. The project is part of the European consortium ENABLE (European Network for AntiBiotic Lead Engine). This is the one only project in Europe to develop new antibiotics against Gram negative bacteria funded by the Innovative Medicines Inititiave (IMI) (7th framework program and EFPIA, the European Federation of Pharmaceutical Industries and Associates; see http://www.imi.europa.eu/content/enable).

Selected projects

- **European Gram-negative Antibacterial Engine (ENABLE).** IP: *Francesc Rabanal Anglada*. Tipus de contracte/programa: COOPERATION. HEALTH. Seventh Framework Programme (FP7). Health. 2014-2020.

Singular scientific equipment

- Langmuir Balance KSV 5000 with Dipper and surface potential
- KSV – Nima Micro BAM

2.2.41. Pharmaceutical Nanotechnology (NanoPharmaMed)

Department Pharmacy and Pharmaceutical Technology and Physical-Chemical, Faculty Pharmacy and Food Sciences

Team

M. José García Celma (Full Professor)
Immaculada Dinarès Milà (Professor)
M. Àngels Salvadó Lladós (Professor)
Marta Monge Azemar (Adjunct Lecturer)
Esteban Figueroa Becerra (Predoctoral Researcher)

SELECTED PAPERS

- **Ethylcellulose nanoparticles as a new "in vitro" transfection tool for antisense oligonucleotide delivery.** *Leitner S., Grijalvo S., Solans C., Eritja R., García-Celma M.J., Calderó G.* Carbohydrate Polymers, 2020, 229, 115451
- **Biomedical perfluorohexane-loaded nanocapsules prepared by low-energy emulsification and selective solvent diffusion.** *Calderó G., Rodríguez-Abreu C., González A., Monge M., García-Celma M.J., Solans C.* Materials Science and Engineering C. 2020, 111
- **Formation and stabilization of multiple water-in-water-in-water (W/W/W) emulsions.** *Beldengrün Y., Dallaris V., Jaén C., Protat R., Miras J., Calvo M., García-Celma M.J., Esquena J.* Food Hydrocolloids. 2020, 102

Research

The research interests of the group have focused to the development of novel controlled drug delivery dosage forms based on nanostructured surfactant and polymeric systems. Important contributions are the studies on formation and characterization of hydrogels, microemulsions, nano-emulsions, highly concentrated emulsions as drug carriers and the use of some of these colloidal systems as templates for the preparation of nanoparticles and solid foams. Incorporation and release of drugs and biomolecules have been investigated in these nanostructured formulations. The effective incorporation of drugs and biomolecules can facilitate the therapy of various diseases or physiological disorders of high incidence in the population and/or difficult to treat. Ionic liquids have been developed to improve the water solubility of some drugs without affecting the pharmacological activity, and allowing the encapsulation of these drugs in the nanocarriers.

Selected projects

- **Estrategias de formacion y estabilizacion de emulsiones agua-en-agua para aplicaciones farmaceuticas y alimentarias innovadores.** CTQ2016-80645-R. IP: *C. González Azón* y *M.J. García-Celma*. Programa estatal de investigación, desarrollo e innovación orientada a los Retos de la Sociedad.2017-2019 (extedend: 2020)

Singular scientific equipment

- Vision® G2 Elite 8™ (Hanson Research): Dissolution tester with automated sampling
- MICROETTE™ AUTOMATED TEST SYSTEM (Hanson Research), with 6 Franz diffusion cells
- VASCO nanoparticle size analyzer (Cordouan): DLS
- Zetasizer Nano ZS (Malvern Instruments): DLS, zeta potential
- Heracell CO_2 incubator (Thermo Scientific)
- Biosafety cabinet
- Plasma reactor

International collaborations

The group maintains collaboration with important universities and research centers, which currently include the University of Lorraine and the University Paul Sabatier in Toulouse (France), Krakow University of Technology (Poland), Universidad de Guadalajara (México) and the University of Chile.

2.2.42. Physics in Nanobiophysics (NanoBio)

Department Condensed Matter Physics, Faculty Physics

Website: Physics in Nanobiophysics

Team

Aurora Hernandez Machado (Full Professor)
Josep Ferré (Industrial Predoctoral Researcher)
Carla Riera (Master Student)

Research

The research group is focused on dynamics of interfaces in nanotechnology, fluidics and biophysics, including the measure of the viscosity of Newtonian and nonNewtonian, being particularly interested on the rheology of blood, the stability and dynamics of biological membranes, vesicles, fluids and angiogenesis by both at the mathematical modeling level and experimentally.

SELECTED PAPERS

- **The dynamics of shapes of vesicle membranes with time dependent spontaneous curvature.** *Barrio R.A., Alarcon T., Hernandez-Machado A.* **PLoS ONE**, 2020, 15(1), e0227562
- **Controlling shapes in a coaxial flow focusing microfluidic device: Experiments and theory.** *Rodriguez-Trujillo R., Kim-Im Y-H., Hernandez-Machado A.* **Micromachines**, 2020, 11(1), 85
- **An integrated detection method for flow viscosity measurements in microdevices.** *Rodriguez-Villarreal A.I., Ortega-Tana L. Cid, J., Hernandez-Machado A., Alarcon T., Miribel-Catala P.L., Colomer-Farrarons, J.* **IEEE Transactions on Biomedical Engineering Transactions on Biomedical Engineering**, 01266, 2020

Selected projects

- **Microfluidica y Biomembranas: Experimentos y teoría.** PID2019-106063GB-I00. Ministerio de Ciencia, Innovación y Universidades. IP: *Aurora Hernandez Machado*. 2020-2023
- **Biomechanics of biofluids and biomembranes at the microscale: Experiments and theory.** Ministerio de Economia y Competitividad (MINECO), Programa Estatal de Fomento de la Investigacion Cientifica y Tecnica de Excelencia. FIS2016-78883-C2-1-P, 2017-20. IP: *A. Hernandez-Machado*. 2017-2020
- **Towards novel nano-scale technologies based on phoretic flow effects.** (NANOPHLOW) HORIZON 2020 FET-Open research and innovation actions (H2020-FETOPEN-1-2016-2017). European Union. Participant: *Aurora Hernandez-Machado* 2014-2020

2.2.43. Self-organized complexity and self-assembling materials (NanoBio, NanosMat)

Department Materials Science and Physical Chemistry, Faculty Chemistry
Website: SOC&SAM

Team

Francesc Sagués Mestre (Full Professor)
Jordi Ignés Mullol (Associate Professor)
Joan-Anton Farrera Piñol (Associate Professor)
Mohammad Tahghighi (Predoctoral Researcher)
Berta Martínez Prat (Predoctoral Researcher)
Ignasi Vélez Cerón (Predoctoral Researcher)

SELECTED PAPERS

- **Stability analysis of flow of active extensile fibers in confined domains.** *Zhao L., Yao L., Golovaty D., Ignés-Mullol J., Sagués F., Carme Calderer M.* **Chaos.** 2020, 30(11)
- **Active microfluidic transport in two-dimensional handlebodies.** *Hardoüin J., Laurent J., Lopez-Leon T., Ignés-Mullol J., Sagués F.* **Soft Matter.** 2020, 16(40)
- **Active, self-motile, and driven emulsions.** *Ignés-Mullol, J., Sagués, F.* **Current Opinion in Colloid and Interface Science.** 2020, 49, 16-26

Research

The Self-organized Complexity and self-assembling Materials Group (SOC&SAM) performs basic research in the field of soft Nanotechnology.

A significant part of the current effort is in the context of active soft materials, where the group have studied the aqueous gel that forms in-vitro when the molecular motor protein kinesin is combined with self-assembled microtubules of the cytoskeleton protein tubulin.

In the context of colloidal transport, the group has developed a strategy to command the self-assembly and to drive ensembles of microscale solid or liquid inclusions in confined geometries.

Selected projects

- **Materia blanda fuera de equilibrio: materiales activos y sistemas vivos.** PID2019-108842GB-C22. IP: *Jordi Ignés Mullol.* Ministerio de Ciencia, Innovación y Universidades (2020-2023)

2.2.44. Solar and Photovoltaic Energy Group (NanoEnergy)

Department Applied Physics, Faculty Physics
Website: Solar and Photovoltaic Energy Group

Team

Joan Bertomeu Balagueró (Full Professor)
José Miguel Asensi López (Associate Professor)
Julià López Vidrier (Tenure-Track Lecturer)
Thomas Tom (Predoctoral Researcher)

SELECTED PAPERS

- **Influence of co-sputtered Ag:Al ultra-thin layers in transparent V2O5/Ag:Al/AZO hole-selective electrodes for silicon solar cells.** *Thomas T., Ros E., López-Pintó N., Asensi JM., Andreu J., Bertomeu J., Puigdollers J., Voz C.* **Materials**, 2020, 13(21), 4905

Research

The Solar Energy Group of the University of Barcelona is focused on the research on new materials and structures for heterojunction solar cells based in crystalline silicon avoiding the use of doped layers. The aim is to substitute these layers by other materials that act as selective contacts (hole transport layers,

HTL, or electron transport layers, ETL) and can be deposited from simpler techniques and/or less dangerous precursor materials. In particular, several transition metal oxides are being investigated as HTL, and dipole interlayers deposited by spin coating are tested for ETL.

Also the study of alternatives to ITO, which is the most currently used material as transparent electrode, is being carried out, with the aim of avoid the use of critical raw materials as indium. Structures dielectric-metal-dielectric with ultrathin metal layers are being investigated for such application.

Selected projects

- **Contactos selectivos y capas activas para dispositivos de energía.** PID2019-109215RB-C43. IP: *Joan Bertomeu Balagueró*. Ministerio de Ciencia, Innovación y Universidades (2020-2023)

2.2.45. Solar Energy Materials and Systems (SEMS) Group (NanoEnergy)

Department Electronics and Biomedical Engineering, Faculty Physics

Team

Alejandro Pérez Rodríguez (Full Professor)
Lorenzo Calvo Barrio (Adjunct Lecturer)
Victor Izquierdo Roca (External Collaborator-Senior researcher at IREC)
Marcel Placidi (External Collaborator-Senior researcher at IREC)

Research

The activities of the Solar Energy Materials and Systems Group (SEMS Group) are centred on the development of new materials and processes for advanced thin film PV technologies compatible with the requirements of sustainability, compatibility with industrial mass-production with very low environmental impact, high efficiency and low manufacturing cost.

Main research lines active in the group are:

- **Development of new materials and device concepts for advanced cost-efficient PV:** Kesterites, wide band-gap chalcogenides, alternative thin film PV semiconductors, bifacial cells, semi-transparent devices, multijunction concepts, alternative flexible / light weight / ceramic substrates;
- **Low cost industrial compatible processes for sustainable high efficiency chalcogenide based technologies:** Sequential process (sputtering), Electrodeposition, spray pyrolysis, chemical bath deposition, printing;

SELECTED PAPERS

- **Vibrational properties of RbInSe2: raman scattering spectroscopy and first-principle calculations.** *Guc M., Kodalle T., Kormath Madam Raghupathy R., Mirhosseini H., Kühne T.D., Becerril-Romero I., Pérez-Rodríguez A., Kaufmann C.A., Izquierdo-Roca V.* Journal of Physical Chemistry C, 2020, 124(2)
- **Efficient Se-Rich Sb2Se3/CdS planar heterojunction solar cells by sequential processing: control and influence of se content.** *Vidal-Fuentes P., Placidi M., Sánchez Y., Becerril-Romero I., Andrade-Arvizu J., Jehl Z., Pérez-Rodríguez A., Izquierdo-Roca V., Saucedo E.* Solar RRL, 2020, 4(7)
- **UV-selective optically transparent Zn(O,S)-based solar cells.** *Lopez-Garcia A.J., Bauer A., Fonoll Rubio R., Payno D., Jehl Li-Kao Z., Kazim S., Hariskos D., Izquierdo-Roca V., Saucedo E., Pérez-Rodríguez A.* Solar RRL, 2020
- **Rear interface engineering of kesterite Cu2ZnSnSe4 solar cells by adding CuGaSe2 thin layers.** *Giraldo S., Fonoll-Rubio R., Jehl Li-Kao Z., Sánchez Y., Calvo-Barrio L., Izquierdo-Roca V., Pérez-Rodríguez A., Saucedo E.* Progress in Photovoltaics: Research and Applications. 2020

› **Advanced characterization methodologies in thin film PV technologies:** Development of techniques suitable for Quality Control & Process Monitoring (multi-wavelength resonant excitation Raman scattering, elastic light scattering, PL…)

Selected projects

- **DURACIS: Advanced global encapsulation solutions for long term stability in industrial flexible PV technologies** (PCIN-2017-041), 2017-2020. SOLAR-ERA.NET European Program. Acciones de Programación Conjunta Internacional, Agencia Estatal de Investigacion
- **INFINITE-CELL: International cooperation for the development of cost efficient kesterite/c-Si thin film next generation tandem solar cells** (H2020-MSCA-RISE.2017-777968). H2020. 2017-2021

Singular scientific equipment

Thin Film Photovoltaics Laboratory of the SEMS group: The Laboratory constitutes a platform for the modelling, development and evaluation of new processes and materials in advanced PV thin film technologies before their industrial implementation. The Laboratory has developed its own PV baseline technologies including electrodeposition based CIGS processes and two-step PVD based CZTS processes scalable up to 10x10 cm2 substrates with efficiency values that are among the highest ones achieved at world level in these technologies (> 11.8% efficiency for new Indium- and Gallium-free CZTS based devices with processes avoiding the use of hazardous compounds). The infrastructure available at the Laboratory includes: Three sputtering systems for the deposition of front and back contacts in PV technologies, thermal evaporator, a complete electrochemical and chemical workshop, reactive thermal treatment equipment, rapid thermal processes equipment, spray pyrolysis system under inert atmosphere, X-ray fluorescence, advanced Raman and Photoluminescence spectrometers, AAA solar simulator and spectral response.

International collaborations

The SEMS group has well consolidated international collaborations with a broad network of R+D centers that are among the world leading research groups in chalcogenide PV technologies, as HZB (Berlin, Germany), EMPA (Zurich, Switzerland), TNO (Holland), University of Luxembourg, Free University Berlin (Germany), Uppsala University (Sweden), IPVF (CNRS, Paris, France), ZSW (Stuttgart, Germany), IMEC (Belgium), Imperial College (UK), Northumbria University (UK), Martin-Luther University (Halle, Germany), Aix-Marseille University (France), CEA-LITEN (Grenoble, France), AIST (Japan), as well as with relevant European companies from the PV Technologies and Energy sectors as Flisom AG (Switzerland), Sunplugged Solare Energiesysteme GmbH (Austria), Manz CIGS Technology (Germany), IMRA (Toyota group, France), Advanced Coatings and Constructions Solutions (AC&CS, Belgium), Electricité de France (France), IBM (Yorktown Heights, NY, USA), AST Sistemas SL (grupo AYESA, Spain), FAE SAE (Spain), Ecopol Tech S.L. (Spain), Lenz Instruments SL (Spain), Eliosys S.A. (Belgium), Midsummer AB (Sweden), Onyx Solar (Spain). These collaborations have been enhanced by the strong activity of the SEMS group in the launching and coordination of international collaborative projects in these fields, including projects from the FP7 and H2020 programmes of the European Commission and from the SOLAR-ERA.NET European cooperative action.

2.2.46. Statistical Physics of Bio-Nano Systems and Complex Matter (NanoMet)

Department Condensed Matter Physics, Faculty Physics

Website: BioNanoComplex

Team

Giancarlo Franzese (Associate Professor)
Carlos Calero Borrallo (Tenure-Track Lecture)
Oriol Vilanova Gabarrón (Predoctoral Researcher)
Luis Enrique Coronas Serna (Predoctoral Researcher)

Research

The Group develops a in silico and in cogito approach for hydrated NanoBioSystems under realistic conditions (e.g., nanoparticles and protein solutions at physiological conditions over timescales up to hours). Within the framework of Interdisciplinary Statistical Physics, we combine theory and atomistic simulations of hydrated bio-interfaces (e.g., proteins or membranes) and nano-interfaces (e.g., nanoparticles and nanomaterials) with coarse-grain models for protein folding and design, protein adsorption, aggregation and crystallization, confined complex liquids, and hydrated nano-systems. We collaborate with several experimental groups worldwide to find answers for fundamental questions (Which properties make water unique for biological processes and life?) and applications (What makes a nanoparticle safe and sustainable by design? How can we develop Nanomedicine against cancer or neurodegenerative diseases? How can we improve nano-theranostics?). More about on Twitter @GFranzesePhD

SELECTED PAPERS

- **In Silico Evidence That Protein Unfolding is a Precursor of Protein Aggregation.** *Bianco V., Franzese G., Coluzza I.* ChemPhysChem, 2020, 21(5), 358-358
- **Network Topology in Water Nanoconfined between Phospholipid Membranes.** *Martelli F., Crain J., Franzese G.* ACS Nano, 2020, 14(7), 8616-8623
- **Water under extreme confinement in graphene: Oscillatory dynamics, structure, and hydration pressure explained as a function of the confinement width.** *Calero C., Franzese G.* Journal of Molecular Liquids. 2020, 317, 114027
- **Protein Unfolding and Aggregation near a Hydrophobic Interface.** *D. March, V. Bianco, and G. Franzese*, Polymers 13, 156 (2021) [Accepted on 24/12/2020] DOI: 10.3390/polym13010156
- **The Franzese-Stanley coarse grained model for hydration water in "Properties of water from numerical and experimental perspectives".** *L.E. Coronas, O. Vilanova, V. Bianco, F. de los Santos, and G. Franzese.* F. Martelli ed. (CRC Press, 2020), accepted. [Invited by the Editor; Available as e-print: arXiv: 2004.03646]

Selected projects

- **Física estadística para simulaciones a gran escala de sistemas bioinspirados hacia la erradicación de tumores.** (PGC2018-099277-B-C22) PI: *Giancarlo Franzese*. Ministerio de Ciencia, Innovación y Universidades (2019-2021)
- **Protein-Nanoparticle Corona Formation investigated by UV Resonant Raman spectroscopy.** (CALIPSOplus H2020-730872-proposal n. 20195350) PI: *Giancarlo Franzese*. Elettra-Sincrotrone Trieste within the European Union's Horizon 2020 program (2019-2021)
- **Statistical Physics for Biological Systems at the Nanoscale.** (EIN2020-112431) PI: *Giancarlo Franzese*. Ministerio de Ciencia e Innovación (2020-2021)

Singular scientific equipment

The group is co-responsible of a remarkable infrastructure dedicated to scientific computing, shared with three other PIs of the UB: the "Laboratorio de Supercomputación en Física Estadística", which is used to run the simulations and numerical calculations necessary for the development of scientific projects. Currently, this laboratory comprises two dedicated computing clusters: one cluster with 64-bit CPU machines, consisting of 39 nodes, for a total of 772 virtual cores working with Hyper- Threading Technology and 1404 Gb of RAM; and a second cluster of 9 GPU platforms, with INVIDIA GTX 460 (x6), 760, 780, 980, 1060 (x2) and RTX 2081Ti (x11) cards, for a total value of more than 200.000€.

International collaborations

The group has an extended network of active scientific collaborations with many highly prestigious scientific centers all over the world, such as Boston (US), University of Bristol (UK), IBM (UK), University College Dublin (IE), Royal College of Surgeons in Ireland (IE), Elettra - Sincrotrone Trieste (IT), Università di Rome La Sapienza (IT), Università di Torino (IT), National Hellenic Research Foundation (GR).

2.2.47. Supra and Nanostructured Systems Group (NanosMat)

Department Inorganic and Organic Chemistry, Faculty Chemistry

Website: SuNS

Team

Laura Rodríguez Raurell (Full Professor)
Inmaculada Angurell Purroy (Associate Professor)
Andrea Pinto Martínez (Predoctoral Researcher)
Araceli De Aquino Samper (Predoctoral Researcher)
Ariadna Lázaro Palacios (Predoctoral Researcher)
Guillermo Romo Islas (Predoctoral Researcher)

Research

The main research lines are:

› **Supramolecular Chemistry:** The group is developing luminescent systems able to give rise to the formation of gels, fibers, vesicles and other kind of supramolecular structures containing heavy metal atoms. The researchers are pioneers in this kind of supramolecules grown from discrete complexes. Applications as sensors, hydrogen production, liquid crystals, nanomaterials and biological properties have been developed. Great efforts are being done during this year regarding room temperature phosphorescence systems.

Selected projects

- **Herramientas supramoleculares para aumentar la emisión de fosforescencia.** (PID2019-104121GB-I00) PI: *Laura Rodriguez Raurell*. Ministerio de Ciencia, Innovación y Universidades (2020-2023)
- **Identification of supramolecular gold(I) aggregates involved in biological and molecular recognition purposes.** Reference: 2017082311. PI: *Laura Rodríguez Raurell*. Alba Synchrotron.
- **Effect of aggregation on the photophysical parameters of gold(I) supramolecular aggregates.** Reference: UC-CLL002537. PI: *Laura Rodríguez Raurell*. Founding Agency: Unión Europea- CLL-Laserlab Europe

SELECTED PAPERS

- **Luminescent PtII and PtIV Platinacycles with Anticancer Activity Against Multiplatinum-Resistant Metastatic CRC and CRPC Cell Models.** *Lázaro A., Balcells C., Quirante J., Badia J., Baldomà L., Ward J.S., Rissanen K., Font-Bardia M., Rodríguez L., Crespo M., Cascante M.* Chemistry - A European Journal. 2020, 26(9)
- **Facile morphology control of gold(0) structures from aurophilic assemblies.** *Aguiló E., Dalmases M., Lin M., Lima J.C., Gavara R., Figuerola A., Llorca J., Rodríguez L.* Dalton Transactions, 2020, 49(14)
- **Luminescent phosphine gold(I) alkynyl complexes. Highlights from 2010 to 2018.** *Marc Pujadas, Laura Rodríguez.* Coordination Chemistry Reviews 408 (2020) 213179
- **Influence of the Attachment of a Gold(I) Phosphine Moiety at the Upper Rim of a Calix[4] pyrrole on the Binding of Tetraalkylammonium Chloride Salts.** *Qingqing Sun, Gemma Aragay, Andrea Pinto, Elisabet Aguiló, Laura Rodríguez and Pablo Ballester.* Chem. Eur. J. 2020, 26, 3348 – 3357
- **Room-Temperature Phosphorescence and Efficient Singlet Oxygen Production by Cyclometalated Pt(II) Complexes with Aromatic Alkynyl Ligands.** *Ariadna Lázaro, Carla Cunha, Ramon Bosque, João Pina, Jas S. Ward, Khai-Nghi Truong, Kari Rissanen, João Carlos Lima, Margarita Crespo, J. Sérgio Seixas de Melo and Laura Rodríguez.* Inorg. Chem. 2020, 59, 8220−8230

Singular scientific equipment

- Spectrofluorimeter to perform measurements for samples emitting at UV-vis and NIR in solution and in solid state, at room temperature, 77 K and variable temperature
- Fluorescence and Optical Microscopy including polarizers for analysing samples at different polarization light angles
- Integrating sphere to record absolute quantum yields in solid state and solution
- Time-Correlated Single Photon Counting for lifetime measurements

International collaborations

- Same department: *Dr. Albert Figuerola*, *Dr. Margarita Crespo*, *Dr. Ramon Bosque*
- Spanish Universities or Research Centers: *Prof. Jordi Llorca* (Universitat Politècnica de Catalunya, Barcelona), *Prof. Enrique García-España* (Universitat de València), *Prof. Pau Ballester* (ICIQ-Tarragona), *Dr. Berta Gómez-Lor* (CSIC-Madrid)
- European Universities or Research Centers: *Prof. João Carlos Lima* (Universidade Nova de Lisboa, Portugal), *Prof. Antonella Dalla Cort* (Università La Sapienza, Roma, Italy), *Prof. Kari Rissanen* (University Jyväskylä, Jyväskyla, Finland), *Prof. Giulia Licini* (Università Padova, Padova, Italy)

2.2.48. Supramolecular Systems in Nanobiomedicine (NanoPharmaMed)

Department Pharmacology, Toxicology and Therapeutic Chemistry, Faculty Pharmacy and Food Sciences

Website: LINK

Team

M. Lluïsa Pérez Garcia (Full Professor)

David Limon Magaña (Adjunct Lecture)

Sandra Giraldo Clemente (Postdoctoral Researcher)

Bagherpour Saman (Predoctoral Researcher)

Research

The Supramolecular Systems in Nanobiomedicine group is interested in the design and evaluation of gold nanoparticles with different conjugates for the treatment of cancer and inflammatory skin diseases. Main research lines are:

- Supramolecular chemistry
- Template synthesis and self-assembly in organic synthesis
- Supramolecular hydrogels for drug delivery
- Functionalisation of micro/nanoparticles for tagging and actuate in living cells
- Nanobiosensors
- Nanoparticles for drug delivery
- Nanomaterials for photodynamic therapy
- Molecular machines and switches

SELECTED PAPERS

- **Enhancing singlet oxygen generation by self-assembly of a porphyrin entrapped in supramolecular fibers.** *Samperi, M.; Limón, D.; Amabilino, D. B.; Pérez-García, L.* Cell Reports Physical Science, 2020, 1, 100030 (1-16)
- **Lanthanide luminescence to mimic molecular logic and computing through physical inputs.** *Hernández-Rodríguez M.A., Brites C.D.S., Antorrena G., Piñol R., Cases R., Pérez-García L., Rodrigues M., Plaza J.A., Torras N., Díez I., Millán A., Carlos L.D.* Advanced Optical Materials, 2020
- **π-Donor/π-Acceptor interactions for the encapsulation of neurotransmitters on functionalized polysilicon-based microparticles.** *Giraldo S., Alea-Reyes M.E., Limón D., González A., Duch M., Plaza J.A., Ramos-López D., de Lapuente J., González-Campo A., Pérez-García L.* Pharmaceutics. 2020, 12(8)

Selected projects

- **(Bio)funcionalización de suspensiones de micro- y nanoherramientas avanzadas para aplicaciones intra- y extracelulares.** TEC2017-85059-C3-2-R. IPs: *Perez Garcia, M. Luisa* and and *Gomez Valentín, Elvira*. Ministerio de Economia y Competitividad. 2018-2020
- **Collaborating at Wireless communication with cells towards bioelectronic treatments of the future.** EP/R004072/1. EPSRC Healthcare Technologies Challenge Awards
- **Engineering and Physical Sciences Research Council (EPSRC).** 2018-2022
- **Functional molecular-based materials and applications at the nanoscale.**
- **Projectes de recerca per potenciar els grups de recerca consolidats.**
- **Agència de Gestió d'Ajuts Universitaris i de Recerca.** Generalitat de Catalunya. AGAUR. IP: *Nuria Aliaga* (CSIC). 20017SGR1277 2017-2019

International collaborations

- *Prof. Fraser Stoddart*, Northwestern University, Chicago (US)
- *Prof. David Russell and Dra. Ma J. Marin*, School of Chemistry, University of East Anglia, Norwich Research Park, Norwich (UK)
- *Dr. Frankie Rawson*, School of Pharmacy, University of Nottingham (UK)
- *Dr. David Scurr*, School of Pharmacy, University of Nottingham (UK)
- *Prof. Rasmita Raval*, School of Chemistry, University of Liverpool (UK)

2.2.49. Surface Engineering. Thin-layer Lab (NanosMat)

Department Applied Physics, Faculty Physics

Team

Arturo Lousa Rodríguez (Associate Professor)
Joan Esteve Pujol (Emeritus Lecturer)

Research

The main research of the group is hard coating:

- Vacuum technology applications.
- Sputtering PVD of nanometric multilayer coatings.
- Cathodic arc PVD of hard coatings.
- Plasma polymerization CVD of protective coatings.
- Microwave plasma assisted CVD of diamond coatings.
- Plasma surface treatments.
- Tribological characterization of coatings.
- Mechanical properties characterization through nanoindentation.

SELECTED PAPERS

- **δ-A15 and bcc phases coexist in sputtered chromium coatings with moderate oxygen contents.** *Peralta J., Esteve J., Lousa A.* Thin Solid Films, 2020, 693
- **Surface evolution of lithium titanate upon electrochemical cycling using a combination of surface specific characterization techniques.** *Rikarte J., Acebedo B., Vilalta-Clemente A., Bonilla F., Wilkinson A.J., Galceran M., Lousa A., Rubio-Zuazo J., Muñoz-Márquez M.Á.* Advanced Materials Interfaces, 2020

2.2.50. Theoretical physics of Nanoscopic Systems (NanoMet)

Department Quantum Physics, Faculty Physics

Team

Martí Pi Pericay (Full Professor)
Manuel Barranco Gómez (Full Professor)

Research

- Rotating superfluid droplets
- Ultrafast dynamic processes in superfluid He nanodroplets
- Structure and dynamics of doped superfluid He nanodroplets
- Quantum droplets made of Bosonic mixtures of ultracold, ultradilute gases

Selected projects

- **Gotas de helio y condensados de Bose-Einstein: estructura y dinámica a tiempo real. Una perspectiva común.** FIS2017-87801-P. IP2: *Manuel Barranco*. Ministerio de Economía y Competitividad (2018-2020).

International collaborations

- *Prof. F. Ancilotto*, U. of Padova: **Superfluid He nanodroplets and ultracold BEC gases**
- *Profs. M. Mudrich* (Aarhus, Denmark), *F. Stienkemeier* (Freiburg, Germany) and *J. Eloranta* (Northridge, CA, USA): **Ultrafast dynamic processes in superfluid helium droplets**
- *Prof. N. Halberstadt* (Toulouse): **Dynamics of dopants in superfluid He nanodroplets**

SELECTED PAPERS

- **Ultrafast relaxation of photoexcited superfluid He nanodroplets.** *Mudrich M., LaForge A.C., Ciavardini A., O'Keeffe P., Callegari C., Coreno M., Demidovich A., Devetta M., Fraia M.D., Drabbels M., Finetti P., Gessner O., Grazioli C., Hernando A., Neumark D.M., Ovcharenko Y., Piseri P., Plekan O., Prince K.C., Richter R., Ziemkiewicz M.P., Möller T., Eloranta J., Pi M., Barranco M., Stienkemeier F.* Nature Communications, 2020, 11(1)
- **Angular momentum in rotating superfluid droplets.** *S.M.O. O'Connell, R.M.P. Tanyag, D. Verma, Ch. Bernando, W. Pang, C. Bacellar, C.A. Saladrigas, J. Mahl, B.W. Toulson, Y. Kumagai, P. Walter, F. Ancilotto, M. Barranco, M. Pi, Ch. Bostedt, O. Gessner and A.F. Vilesov.* Phys. Rev. Lett., 2020, 124, 215301
- **Alkali atoms attached to vortex-hosting helium nanodroplets.** *E. García-Alfonso, F. Coppens, M. Barranco, M. Pi, F. Stienkemeier* and *N. Halberstadt*. J. Chem. Phys., 2020, 152 194109
- **Rotating mixed 3He-4He nanodroplets.** *M. Pi, F. Ancilotto J. M. Escartín, R. Mayol* and *M. Barranco*. Phys. Rev. B 2020, 102, 060502(R)
- **Towards a quantum Monte Carlo–based density functional including finite-range effects: Excitation modes of a 39K quantum droplet.** *V. Cikojevic, L. Vranjes Markic, M. Pi, M. Barranco, and J. Boronat. Phys.* Rev. A, 2020, 102, 033335

2.2.51. Thin Layer Stuctures for Spintronics (NanoMagnetics)

Team

Manuel Varela Fernández (Full Professor)
César Ferrater Martorell (Associate Professor)
M. Carmen Polo Trasancos (Associate Professor)

Research

- Deposition of epitaxial thin layers and heterostructures by pulsed lasers and catholic spraying
- Structural, chemical and functional characterization of the deposited materials
- Thin layers and epitaxial hetero-structures of functional materials based on oxides for magnetoelectronics and communications devices
- Magnetic and ferroelectric materials

2.2.52. Thin-film and Nanostructure electrodeposition group (NanosMat)

Department Materials Science and Physical Chemistry, Faculty Chemistry
Website: GeCPN

Team

Elvira Gómez Valentín (Full Professor)
Albert Serrà Ramos (Tenure-Track Lecturer)
Elisa Vallés Giménez (Collaborator)

Research

Thin Film and Nanostructure electrodeposition group (Ge-CPN) has wide experience in the electrodeposition processes, both in the analysis of the first stages, as in the material preparation. Catalytic, magnetic and photocatalytic materials are developed for implementation in different applications or photocatalysts.

Main research lines are the following:

- Electrochemical preparation of materials in the micro- and nano-level for applications;
- Preparation of enhanced surface-volume multifunctional nanostructures. Analysis of the solution influence using innovative media (liquids iònics, block-copolymers,...);
- Chemical and electrochemical synthesis of biomimetic photocatalysts for water decontamination;

SELECTED PAPERS

- **Electrodeposition of nanostructured cobalt films from a deep eutectic solvent: Influence of the substrate and deposition potential range.** *M. Landa-Castro, P. Sebastián, M. I. Giannotti, A. Serrà, E. Gómez.* **Electrochimica Acta** 2020, vol 359, p. 136928
- **Chemical selectivity in electrochemical surface oxidation enhanced Raman scattering.** *M. Pérez-Estebanez, S. Hernández, J. V. Perales-Rondón, E. Gómez, A. Heras, A. Colina.* **Electrochimica Acta** 2020, vol 353, p. 136560
- **Efficient magnetic hybrid ZnO-based photocatalysts for visible-light-driven removal of toxic cyanobacteria blooms and cyanotoxins.** *A. Serrà, P. Pip, E. Gómez, L. Philippe.* **Applied Catalysis B: Environmental** 2020, vol 268, p. 118745
- **Circular zero-residue process using microalgae for efficient water decontamination, biofuel production, and carbon dioxide fixation.** *A. Serrà, R. Artal, J. García-Amorós, E. Gómez, L. Philippe.* **Chemical Engineering Journal** 2020, vol 388, p. 124278
- **Hybrid Ni@ZnO@ZnS-microalgae for circular economy: A smart route to the efficient integration of solar photocatalytic water decontamination and bioethanol production.** *A. Serrà, R. Artal, J. García-Amorós, B. Sepúlveda, E. Gómez, J. Nogués, L. Philippe.* **Advanced Science 2020**, vol 7, p. 1902447

› Electrochemical preparation of biocompatible structures for intra-extracellular applications;
› Preparation of thin films, multilayers and composites with embedded micro or nanometric particles, which can contribute to the properties modification of the electrodeposited materials.

Selected projects

- **(Bio)funcionalización de Suspensiones de Micro- y Nanoherramientas Avanzadas para Aplicaciones Intra- y Extracelulares.** TEC2017-85059-C3-2-R. IPs: *Perez Garcia, M. Luisa* and *Gomez Valentín, Elvira*. Ministerio de Economia y Competitividad. 2018-2020
- **Fusión de técnicas espectroelectroquímicas avanzadas.** BU297P18. IP: *Aránzazu Heras*. JCLE - Junta de Castilla y León. 2019-2021

Singular scientific equipment

- Equipment for basic electrochemical study, electrochemical materials preparation and electrochemical *in-situ* characterization.
- X-ray Fluorescence Equipment

International collaborations

- *Dra. Laetitia Philippe*
  EMPA - Swiss federal laboratories for materials science and technology
- *Dra. L. Montes-Oca, M. Landa-Castro*
  Departamento de Materiales (UAM-México)
- *Dra. P. Sebastián*
  Department of Chemistry (University of Copenhagen)
- *Dra. Majdi Benamara*
  Laboratory of Physics of Materials and Nanomaterials Applied at Environment, University of Gabes-Tunisia
- *Prof. L. Magagnin, Dra. P.Cojocaru*
  Dipartimento di Chimica, Materiali e Ingegneria Chimica (Politecnico Milano-Italy)
- *M.N.M. Ibrahim*
  School of Chemical Sciences, University Sains Malaysia-Malaysia

3. researchers grouped by areas

3.1. NanoMet

- **Arango Restrepo, Andres**
  Predoctoral Researcher.
  Nanosystems Statistical Physics
- **Barranco Gomez, Manuel**
  Professor Full.
  Theoretical Physics Of Nanoscopic Systems
- **Blanco Portals, Javier**
  Predoctoral Researcher
  LENS-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Calero Borrallo, Carlos**
  Tenure-Track Lecturer
  Statistical Physics Of Bio-Nano Systems And Complex Matter (Bionanocomplex)
- **Castan Vidal, Maria Teresa**
  Professor Full
  Materials: Phase Transitions
- **Coll Benejam, Catalina**
  Predoctoral Researcher
  LENS-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Coronas Serna, Luis Enrique**
  Investigador Predoctoral En Formació BRD
  Statistical Physics Of Bio-Nano Systems And Complex Matter (Bionanocomplex)
- **Del Pozo Bueno, Daniel**
  Predoctoral Researcher
  LENS-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Estrade Albiol, Sonia**
  Associate Professor
  LENS-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Franzese, Giancarlo**
  Associate Professor
  Statistical Physics Of Bio-Nano Systems And Complex Matter (Bionanocomplex)
- **Iglesias Clotas, Oscar**
  Associate Professor
  Group Of Magnetic Nanomaterials
- **Lopez Conesa, Luis**
  Collaborator
  LENS-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Mañosa Carrera, Lluis**
  Professor Full
  Materials: Phase Transitions
- **Martin Malpartida, Gemma**
  Collaborator
  LENS-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Peiro Martinez, Francisca**
  Professor Full
  LENS-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Pi Pericay, Marti**
  Professor Full
  Theoretical Physics Of Nanoscopic Systems
- **Planes Vila, Antoni**
  Professor Full
  Materials: Phase Transitions
- **Porta Tena, Marcel**
  Adjunct Lecture
  Materials: Phase Transitions
- **Rebled Corsellas, Jose Manuel**
  Collaborator
  LENS-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Romanini, Michela**
  Researcher Juan De La Cierva
  Materials: Phase Transitions
- **Rubi Capaceti, Jose Miguel**
  Professor FullS
  Nanosystems Statistical Physics
- **Torruella Besa, Pau**
  External Collaborator
  LENS-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Vilanova Gabarron, Oriol**
  Predoctoral Researcher
  Statistical Physics Of Bio-Nano Systems And Complex Matter (Bionanocomplex)
- **Yedra Cardona, Lluis**
  Researcher Juan De La Cierva
  LENS-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)

3.2. NanoBio

- **Arro Plans, Montserrat**
  Associate Professor
  Genomics, Proteomics And Plant Metabolomics
- **Aubets Gil, Eva**
  Predoctoral Researcher
  Cancer Therapy Group
- **Bastida Armengol, Jaime**
  Professor Full
  Genomics, Proteomics And Plant Metabolomics
- **Bola Sampol, Raul**
  Predoctoral Researcher
  Biopt: Optical Trapping Lab - Grup De Biofotònica
- **Borrell Hernandez, Jordi**
  Professor Full.
  Nanostructure Of Biomembranes Group
- **Botet Carreras, Adrià**
  Predoctoral Researcher
  Nanostructure Of Biomembranes Group
- **Buruaga Ramiro, Carolina**
  Predoctoral Researcher
  Microbian Enzymes For Industrial Applications Group
- **Cajal Visa, Yolanda Carlota**
  Associate Professor
  Peptides And Proteins: Physicochemical Studies
- **Calo, Annalisa**
  Tenure-Track Lecturer
  Bioelectrical Characterization At Nanoscale
- **Castaño Linares, Oscar**
  Associate Professor
  Bioelectronics Unit And Nanobioeneering Lab
- **Cereceda Lopez, Eric**
  Predoctoral Researcher
  Magnetic Soft Matter Group
- **Ciudad Gomez, Carlos Julian**
  Professor Full
  Cancer Therapy Group
- **Diaz Lucea, Maria Pilar**
  Professor Full
  Microbian Enzymes For Industrial Applications Group
- **Domenech Cabrera, Oscar**
  Associate Professor
  Nanostructure Of Biomembranes Group
- **Egea Guri, Gustavo**
  Full Professor
  Laboratory of connective tissue signaling and genetic diseases (CTS-GD)
- **Farre Ventura, Ramon**
  Professor Full
  Biophysics And Bioengineering Unit
- **Fernandez Tiburcio, Antonio**
  Professor Full
  Genomics, Proteomics And Plant Metabolomics
- **Fernandez Busquets, Xavier**
  External Collaborator
  Nanomalaria Group
- **Ferre Torres, Josep**
  Predoctoral Researcher
  Physics In Nanobiophysics
- **Girona Brumos, Maria Victoria**
  Professor Full
  Peptides And Proteins: Physicochemical Studies
- **Gomila Lluch, Gabriel**
  Full Professor
  Bioelectrical Characterization At Nanoscale
- **Hernandez Machado, Aurora**
  Professor Full
  Physics In Nanobiophysics
- **Imperial Rodenas, Santiago**
  Associate Professor
  Nanomalaria Group
- **Jimenez Franco, Maria Abigail**
  Postdoctoral Researcher
  Mineral Resources Research Group
- **Mañosas Castejon, Maria**
  Researcher Ramon I Cajal
  Biomolecule And Small-System Physics: Small Biosystems Lab
- **Marsa Samper, Ferran**
  External Collaborator
  Biopt: Optical Trapping Lab - Grup De Biofotònica
- **Martin Badosa, Estela**
  Associate Professor
  Biopt: Optical Trapping Lab - Grup De Biofotònica
- **Martinez Martinez, Josefa**
  Associate Professor
  Microbian Enzymes For Industrial Applications Group
- **Martínez Prat, Berta**
  Predoctoral Researcher
  Self-Organized Complexity And Self-Assembling Materials (SOC&SAM)
- **Marzoa Dominguez, Antonio**
  Predoctoral Researcher
  Biopt: Optical Trapping Lab - Grup De Biofotònica
- **Melgarejo Draper, Joan Carles**
  Associate Professor
  Mineral Resources Research Group
- **Mir Llorente, Monica**
  Adjunct Lecture
  Bioelectronics Unit And Nanobioeneering Lab
- **Montero Barrientos, Maria Teresa**
  Associate Professor
  Nanostructure Of Biomembranes Group
- **Montes Usategui, Mario**
  Associate Professor
  Biopt: Optical Trapping Lab - Grup De Biofotònica
- **Muñoz Juncosa, Maria Montserrat**
  Associate Professor
  Peptides And Proteins: Physicochemical Studies
- **Navajas Navarro, Daniel**
  Emeritus Professor
  Biophysics And Bioengineering Unit
- **Noe Mata, Veronica**
  Full Professor
  Cancer Therapy Group
- **Ortiz Ambriz, Antonio**
  Adjunct Lecture
  Magnetic Soft Matter Group
- **Pastor Blasco, Francisco Ignacio Javier**
  Professor Full
  Microbian Enzymes For

Industrial Applications Group

- **Prat Aixela, Josefa**
  Associate Professor
  Peptides And Proteins: Physicochemical Studies
- **Proenza Fernandez, Joaquin Antonio**
  Associate Professor
  Mineral Resources Research Group
- **Pujol Cubells, Montserrat**
  Associate Professor
  Peptides And Proteins: Physicochemical Studies
- **Ritort Farran, Felix**
  Professor Full
  Biomolecule And Small-System Physics: Small Biosystems Lab
- **Roca Martinez, Carlota**
  Predoctoral Researcher
  Nanomalaria Group
- **Roca-Cusachs Soulere, Pere**
  Associate Professor
  Biophysics And Bioengineering Unit
- **Rodriguez Trujillo, Romen**
  Tenure-Track Lecturer
  Bioelectronics Unit And Nanobioeneering Lab
- **Rodriguez Lazaro, Miguel**
  Technician
  Biophysics And Bioengineering Unit
- **Roque Rosell, Josep**
  Associate Professor
  Mineral Resources Research Group
- **Sagues Mestre, Francesc**
  Professor Full
  Self-Organized Complexity And Self-Assembling Materials (SOC&SAM)
- **Samitier Marti, Josep**
  Professor Full
  Bioelectronics Unit And Nanobioeneering Lab
- **Tierno, Pietro**
  Associate Professor
  Magnetic Soft Matter Group
- **Torras Claveria, Laura**
  Associate Professor
  Genomics, Proteomics And Plant Metabolomics
- **Treptow, Dorian**
  Predoctoral Researcher
  Biopt: Optical Trapping Lab - Grup De Biofotònica
- **Valenzuela Mayorga, Susana Valeria**
  Adjunct Lecture
  Microbian Enzymes For Industrial Applications Group
- **Vázquez González, Martha Leticia**
  Adjunct Lecture
  Nanostructure Of Biomembranes Group
- **Vélez Cerón, Ignasi**
  Predoctoral Researcher
  Self-Organized Complexity And Self-Assembling Materials (SOC&SAM)
- **Veronica Cabañas, Lourdes**
  Predoctoral Researcher
  Microbian Enzymes For Industrial Applications Group
- **Viladomat Meya, Francisco**
  Professor Full
  Genomics, Proteomics And Plant Metabolomics

3.3. NanoPharmaMed

- **Abrego Escobar, Guadalupe Del Carmen**
  External Collaborator
  Nanobiopharma
- **Alvarado Bonilla, Helen Lissette**
  Adjunct Lecture
  Nanobiopharma
- **Bagherpour, Saman**
  Predoctoral Researcher
  Supramolecular Systems In Nanobiomedicine
- **Busquets Viñas, Maria Antònia**
  Associate Professor
  Colloids
- **Caballero Hernandez, Ana Belen**
  Tenure-Track Lecturer
  Bio-Inorganic Chemistry Research Group (QBI)
- **Calpena Campmany, Ana Cristina**
  Associate Professor
  Nanobiopharma
- **Cano Fernandez, Amanda**
  External Collaborator
  Nanostructured Systems For Controlled Drug Delivery
- **Caubet Marin, Amparo**
  Associate Professor
  Bio-Inorganic Chemistry Research Group (QBI)
- **Clares Maveros, Beatriz**
  External Collaborator
  Nanobiopharma
- **Dinarès Milà, M. Immaculada**
  Associate Professor
  Pharmaceutical Nanotechnology
- **Escoda I Torroella, Mariona**
  Predoctoral Researcher
  Group Of Magnetic Nanomaterials
- **Escribano Ferrer, Elvira**
  Associate Professor
  Drug Design And Response-Evaluation Within Pharmaceutical Nanostructured And Self-Ordered Systems Group
- **Espargaro Colome, Alba**
  Tenure-Track Lecturer
  Conformational Diseases Group
- **Espina Garcia, Marta**
  Associate Professor
  Nanostructured Systems For Controlled Drug Delivery
- **Espinoza Tituana, Lupe Carolina**
  External Collaborator
  Nanobiopharma
- **Estelrich Latras, Joan**
  Professor Full
  Colloids
- **Esteruelas Navarro, Gerard**
  Predoctoral Researcher
  Nanostructured Systems For Controlled Drug Delivery
- **Ferrari, Michele**
  External Collaborator
  Cellular Responses To Xenobiotics
- **Figueroa Becerra, Esteban**
  Predoctoral Researcher
  Pharmaceutical Nanotechnology
- **Gámez Enamorado, Patricio**
  ICREA Researcher
  Bio-Inorganic Chemistry Research Group (QBI)
- **Gamisans Linares, Fidencia**
  Adjunct Lecture
  Nanostructured Systems For Controlled Drug Delivery
- **Garcia Sala, Francesc Xavier**
  Adjunct Lecture
  Drug Design And Response-Evaluation Within Pharmaceutical Nanostructured And Self-Ordered Systems Group
- **Garcia Lopez, Maria Luisa**
  Professor Full
  Nanostructured Systems For Controlled Drug Delivery
- **Garcia Celma, Maria Jose**
  Professor Full
  Pharmaceutical Nanotechnology
- **Giraldo Clemente, Sandra**
  Postdoctoral Researcher
  Supramolecular Systems In Nanobiomedicine
- **Halbaut Bellowa, Lyda**
  Associate Professor
  Nanobiopharma
- **Kurniawan, Wawan**
  Predoctoral Researcher
  Cellular Responses To Xenobiotics
- **Limon Magaña, David**
  Adjunct Lecture
  Supramolecular Systems In Nanobiomedicine
- **Mallandrich Miret, Mireia**
  Postdoctoral Researcher
  Nanobiopharma
- **Mitjans Arnal, Montserrat**
  Associate Professor
  Cellular Responses To Xenobiotics
- **Monge Azemar, Marta**
  Adjunct Lecture
  Pharmaceutical Nanotechnology
- **Moran Badenas, Maria Del Carmen**
  Associate Professor
  Cellular Responses To Xenobiotics
- **Oliva Herrera, Mireia**
  Associate Professor
  Nanobiopharma
- **Perez Garcia, M. Luisa**
  Professor Full
  Supramolecular Systems In Nanobiomedicine
- **Sabate Lagunas, Raimon**
  Associate Professor
  Conformational Diseases Group
- **Salvado Llados, Ma. Angeles**
  Associate Professor
  Pharmaceutical Nanotechnology
- **Sanchez Lopez, Elena**
  Tenure-Track Lecturer
  Nanostructured Systems For Controlled Drug Delivery

- **Sarango Granda, Paulo Cesar**
  Predoctoral Researcher
  Nanobiopharma
- **Silva De Abreu, Marcella**
  External Collaborator
  Nanobiopharma
- **Suñer Carbó, Joaquim**
  Adjunct Lecture
  Nanobiopharma
- **Vinardell Martinez Hidalgo, Maria Pilar**
  Professor Full
  Cellular Responses To Xenobiotics

3.4. NanoMagnetics

- **Aguilà Aviles, David**
  Postdoctoral Researcher
  Magnetism And Functional Molecules Group (GMMF)
- **Aromi Bedmar, Guillem**
  Full Professor
  Magnetism And Functional Molecules Group (GMMF)
- **Barrios Moreno, Leoni Alejandra**
  Postdoctoral Researcher
  Magnetism And Functional Molecules Group (GMMF)
- **Batlle Gelabert, Javier**
  Professor Full
  Group Of Magnetic Nanomaterials
- **Conde Rubio, Ana**
  External Collaborator
  Group Of Magnetic Nanomaterials
- **Corbella Cordomi, Montserrat**
  Associate Professor
  Magnetic Interactions And Molecular Magnetism
- **Diego Creixenti, Rosa**
  Predoctoral Researcher
  Magnetism And Functional Molecules Group (GMMF)
- **El Fallah El Boufrahi, Mohamed Salah**
  Professor Full
  Magnetic Interactions And Molecular Magnetism
- **Escuer Fite, Alberto**
  Professor Full
  Magnetic Interactions And Molecular Magnetism
- **Ferrater Martorell, Cesar**
  Associate Professor
  Thin Layer Structures For Spintronics
- **Fraile Rodriguez, Maria Aranzazu**
  Associate Professor
  Group Of Magnetic Nanomaterials
- **Gabarró Riera, Guillem**
  Predoctoral Researcher. Magnetism And Functional Molecules Group (GMMF)
  Garcia Santiago, Antoni
- **Associate Professor. Magnetism**
  Hernandez Ferras, Joan Manel
  Associate Professor. Magnetism
- **Labarta Rodriguez, Amilcar Ramon**
  Professor Full
  Group Of Magnetic Nanomaterials
- **Langenberg Perez, Eric**
  Tenure-Track Lecturer
  Group Of Magnetic Nanomaterials
- **Macia Bros, Ferran**
  Researcher Ramon I Cajal
  Magnetism
- **Maniaki, Diamantuula**
  Predoctoral Researcher
  Magnetism And Functional Molecules Group (GMMF)
- **Moya Alvarez, Carlos**
  External Collaborator
  Group Of Magnetic Nanomaterials
- **Polo Trasancos, Maria Del Carmen**
  Associate Professor
  Thin Layer Structures For Spintronics
- **Rodríguez Álvarez, Javier**
  Predoctoral Researcher.
  Group Of Magnetic Nanomaterials
- **Sañudo Zotes, Eva Carolina**
  Associate Professor
  Magnetism And Functional Molecules Group (GMMF)
- **Tejada Palacios, Javier**
  Emeritus Professor
  Magnetism
- **Varela Fernandez, Manuel**
  Professor Full
  Thin Layer Structures For Spintronics
- **Velasco Amigo, Veronica**
  Adjunct Lecture
  Magnetism And Functional Molecules Group (GMMF)
- **Vicente Castillo, Ramon**
  Professor Full
  Magnetic Interactions And Molecular Magnetism

3.5. NanoPhotoElectro

- **Cabal Tato, Alexandre**
  Predoctoral Researcher
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Casals Guillen, Olga**
  Adjunct Lecture
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Cirera Hernandez, Albert**
  Full Professor
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Cornet Calveras, Albert**
  Professor Full
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Dieguez Barrientos, Angel**
  Associate Professor
  Instrumentation Systems And Communications (SIC)
- **Duocastella Sola, Marti**
  Tenure-Track Lecturer
  LASER-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Fàbrega Gallego, Cristian**
  Tenure-Track Lecturer
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Fernandez Pradas, Juan Marcos**
  Associate Professor
  LASER-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Frieiro Castro, Juan Luis**
  Predoctoral Researcher
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Garcia Del Muro Solans, Montserrat**
  Associate Professor
  Group Of Magnetic Nanomaterials
- **Garrido Fernandez, Blas**
  Professor Full
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Hernandez Ramirez, Francisco De P.**
  Adjunct Lecture
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Hernández Márquez, Sergi**
  Associate Professor
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Huguet Ferran, Adria**
  Predoctoral Researcher
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Lopez Aymerich, Elena**
  Predoctoral Researcher
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Marti Jerez, Ernest**
  Predoctoral Researcher
  LASER-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Moreno Sereno, Mauricio**
  Associate Professor
  Instrumentation Systems And Communications (SIC)
- **Navarro Urrios, Daniel**
  Associate Professor
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Pellegrino , Paolo**
  Associate Professor
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Prades Garcia, Juan Daniel**
  Full Professor
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Romano Rodriguez, Albert**
  Professor Full
  Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Serra Coromina, Pedro**
  Full Professor
  LASER-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Sopeña Martínez, Pol**
  Predoctoral Researcher
  LASER-Micro-Nanotechnologies And Nanoscopies For Electronics And Photonic Devices (MIND)
- **Vila Arbones, Ana Maria**
  Associate Professor
  Instrumentation Systems And Communications (SIC)

3.6. NanosMat

- **Alshaikh , Islam**
  Predoctoral Researcher
  Materials For Energy, Photonics And Catalysis (ENPHOCAMAT)
- **Amade Rovira, Roger**
  Tenure-Track Lecturer
  Materials For Energy, Photonics And Catalysis (ENPHOCAMAT)
- **Andujar Bella, Jose Luis**
  Associate Professor
  Materials For Energy, Photonics And Catalysis (ENPHOCAMAT)
- **Angurell Purroy, Inmaculada**
  Associate Professor
  Supra And Nanostructured Systems Group
- **Arteaga Barriel, Oriol**
  Researcher Ramon I Cajal
  Materials For Energy, Photonics And Catalysis (ENPHOCAMAT)
- **Bertran Serra, Enric**
  Professor Full
  Materials For Energy, Photonics And Catalysis (ENPHOCAMAT)
- **Bujaldón Carbó, Roger**
  Predoctoral Researcher
  Organic Materials Unit
- **Canillas Biosca, Adolfo**
  Professor Full
  Materials For Energy, Photonics And Catalysis (ENPHOCAMAT)
- **De Aquino Samper, Araceli**
  Predoctoral Researcher
  Supramolecular Systems In Nanobiomedicine
- **Esteve Pujol, Joan**
  Emeritus Professor
  Surface Engineering. Thin-Layer Lab
- **Estrader Bofarull, Marta**
  Researcher Ramon I Cajal
  Laboratory Of Nanostructured And Nanocomposite Materials
- **Farrera Piñol, Joan Antoni**
  Associate Professor
  Self-Organized Complexity And Self-Assembling Materials (SOC&SAM)
- **Ferrer Garcia, Montserrat Sofia**
  Associate Professor
  Mechanisms Of Reactions In Inorganic Chemistry
- **Figuerola Silvestre, Albert**
  Associate Professor
  Laboratory Of Nanostructured And Nanocomposite Materials
- **Garcia Amoros, Jaime**
  Associate Professor
  Organic Materials Unit
- **Gomez Valentin, Elvira**
  Professor Full
  Thin-Film And Nanostructure Electrodeposition Group
- **Gomis Brescó, Jordi**
  Tenure-Track Lecturer
  Materials For Energy, Photonics And Catalysis (ENPHOCAMAT)
- **Grabulosa Rodriguez, Arnald**
  Associate Professor
  Homogeneous Catalysis
- **Güell Vilà, Frank**
  Associate Professor
  Materials For Energy, Photonics And Catalysis (ENPHOCAMAT)
- **Gutierrez Gonzalez, Jose Maria**
  Associate Professor
  Engineering Of Colloidal Systems
- **Ignes Mullol, Jordi**
  Associate Professor
  Self-Organized Complexity And Self-Assembling Materials (SOC&SAM)
- **Josa Hidalgo, Dana**
  Predoctoral Researcher
  Homogeneous Catalysis
- **Lázaro Palacios, Ariadna**
  Predoctoral Researcher
  Supra And Nanostructured Systems Group
- **Lin, Mengxi**
  Predoctoral Researcher
  Laboratory Of Nanostructured And Nanocomposite Materials
- **Lousa Rodriguez, Arturo**
  Associate Professor
  Surface Engineering. Thin-Layer Lab
- **Maestro Garriga, Alicia**
  Associate Professor
  Engineering Of Colloidal Systems
- **Marti Gonzalez, Joan**
  Predoctoral Researcher
  Materials For Energy, Photonics And Catalysis (ENPHOCAMAT)
- **Martinez Lopez, Manuel**
  Professor Full
  Mechanisms Of Reactions In Inorganic Chemistry
- **Pascual Miralles, Esther**
  Professor Full
  Materials For Energy, Photonics And Catalysis (ENPHOCAMAT)
- **Pinto I Martínez, Andrea**
  Predoctoral Researcher
  Supra And Nanostructured Systems Group
- **Rodriguez Raurell, Laura**
  Professor Full
  Supramolecular Systems In Nanobiomedicine
- **Romo Islas, Guillerom**
  Predoctoral Researcher
  Supramolecular Systems In Nanobiomedicine
- **Serra Ramos, Albert**
  Tenure-Track Lecturer
  Thin-Film And Nanostructure Electrodeposition Group
- **Tahghighi Haji Alizadeh, Mohammad**
  Predoctoral Researcher
  Self-Organized Complexity And Self-Assembling Materials (SOC&SAM)
- **Valles Gimenez, Elisa**
  External Collaborator
  Thin-Film And Nanostructure Electrodeposition Group
- **Velasco Castrillo, Maria Dolores**
  Professor Full
  Organic Materials Unit
- **Vidal Ferran, Anton**
  ICREA Researcher
  Homogeneous Catalysis

3.7. NanoEnergy

- **Andreu Batalle, Jordi.**
  Associate Professor
  Solar And Photovoltaic Energy Group
  Asensi Lopez, Jose Miguel

- **Associate Professor. Solar And Photovoltaic Energy Group**
  Bertomeu Balagueró, Joan
  Professor Full. Solar And Photovoltaic Energy Group

- **Calvo De La Rosa, Jaume**
  Predoctoral Researcher
  Design And Improvement Of Processes And Materials (DIOPMA)

- **Calvo Barrio, Lorenzo**
  Adjunct Lecture
  Solar Energy Materials And Systems (SEMS) Group

- **Formosa Mitjans, Joan**
  Associate Professor
  Design And Improvement Of Processes And Materials (DIOPMA)

- **Homs Marti, Narciso**
  Professor Full
  Catalysis And Advanced Inorganic Materials (MATCAT)

- **Izquierdo Roca, Victor**
  External Collaborator
  Solar Energy Materials And Systems (SEMS) Group

- **Lopez Vidrier, Julià**
  Tenure-Track Lecturer
  Solar And Photovoltaic Energy Group

- **Martinez Alanis, Paulina Raquel**
  Adjunct Lecture
  Catalysis And Advanced Inorganic Materials (MATCAT)

- **Morante Lleonart, Joan Ramon**
  Professor Full
  Nanoenergy And Electronic Materials (M2E) Group

- **Padilla Sanchez, Jose Antonio**
  Adjunct Lecture
  Design And Improvement Of Processes And Materials

- **Pajares Rojas, Arturo**
  Predoctoral Researcher
  Catalysis And Advanced Inorganic Materials (MATCAT)

- **Perez Rodriguez, Alejandro**
  Professor Full
  Solar Energy Materials And Systems (SEMS) Group

- **Placidi, Marcel**
  External Collaborator
  Solar Energy Materials And Systems (SEMS) Group

- **Ramirez De La Piscina Millan, Maria Del Pilar**
  Professor Full
  Catalysis And Advanced Inorganic Materials (MATCAT)

- **Segarra Rubi, Merce**
  Professor Full
  Design And Improvement Of Processes And Materials (DIOPMA)

- **Serre, Christophe Georges Camille**
  Associate Professor
  Instrumentation Systems And Communications (SIC)

- **Tom, Thomas**
  Predoctoral Researcher
  Solar And Photovoltaic Energy Group

- **Wang, Yan**
  Predoctoral Researcher
  Catalysis And Advanced Inorganic Materials (MATCAT)

- **Xuriguera Martin, M. Elena**
  Associate Professor
  Design And Improvement Of Processes And Materials (DIOPMA)

4.

internal calls

4.1. Grants for Multidisciplinary Research (Ajuts a la Recerca Transversal-ART)

Internal call of collaborative research projects (Ajuts a la Recerca Transversal – ART). The aim of these calls is to promote transversal an innovative research among the research areas of the Institute between PhD researchers at the beginning of their career. On 2020, 2 ART grants have been awarded to the following proposals:

- **Routine characterization of clinical samples with a multiparametric SPM design** Involving: NanoBio Research Area (Faculty of Physics) and NanoPharmaMed Research Area (Faculty of Faculty of Medicine and Health Sciences).
- **Multitarget approach to develop antiprion drugs for transmissible spongiform encephalopathies (TSEs)** Involving: NanoPharmaMed from the Faculty of Chemistry and the Faculty Pharmacy and Food Sciences

4.2. Masters Fellowships

In order to stimulate scientific careers in master's students, in the frame of *Beques de Col·laboració UB (UB Collaborating Fellowhips)*, the Institute offers Master Fellowships to collaborate with IN²UB research groups and supports the students in the process of carrying out research and working on their master theses. During 2020, 4 students have been awarded.

4.3. Funding Scientific Associations

The IN²UB gives support to specific scientific associations of general interest for the Institute:

Since July 2009, the IN²UB is part of the scientific cluster SECPhO (Southern European Cluster of Photonics and Optics). The IN²UB collaborates with the costs and activities of the cluster through an annual fee and, when needed, funds attendance to specialized conferences by the cluster members belonging to the IN2UB. For further details about the SECPHO Cluster, please check www.secpho.net/secpho/index.jsp

5. events

5.1. International Research Seminars (IRS)

In frame of the cycle of International Research Seminars (IRS), once a month an international researcher is invited to impart a high-level research seminar, covering one of the subject areas from the Institute:

- **Nanoscale effects induced by mechanochemistry. Applications in catalysis** By *Prof. Jordi Llorca*, Institute of Energy Technologies (Universitat Politècnica de Catalunya) (January 2020)
- **Polypeptide-based Therapeutics** By *Dr. María J. Vicent*, Polymer Therapeutics Lab. Centro Investigación Príncipe Felipe (Valencia) (February 2020)
- **Scaling-up quantum computing with magnetic molecules** By *Prof. Fernando Luis*, Instituto de Ciencia de Materiales de Aragón, CSIC-Universidad de Zaragoza (Spain) (April 2020 - Telematic Session)
- **Nanoelectronic characterization of advanced materials using conductive atomic force microscopy** By *Prof. Mario Lanza*, Institute of Functional Nano & Soft Materials, Soochow University (China) (May 2020 - Telematic Session)
- **Neuronal-Nanotechnology: an overview of innovative biomedical tools for central nervous system disorders** By *Prof. Mattia Bramini*, University of Granada (Spain) (June 2020 - Telematic Session)
- **Magnetically driven micro- and nanoswimmers** By *Prof. Dr. Salvador Pané i Vidal*, Institute of Robotics and Intelligent Systems (IRIS), Swiss Federal Institute of Technology (ETH) Zurich (October 2020 – Telematic session)
- **Magnetic Particle Imaging Applications: Inflammation, Theranostics, and Cell Tracking** By *James Mansfield*, Scientific Director at Magnetic Insight Inc (November 2020 – Telematic session)

5.2. Other Seminars

- **Sub-Terahertz Spin Pumping from an Insulating Antiferromagnet** By *Dr. Enrique del Barco*, Physics Department, University of Central Florida, Orlando, Florida 32816, USA (February 2020)

6.
outreach

IN²UB is committed to transfer knowledge to society. In the year 2019, a **Permanent Commission of Outreach** was created and put to work in order reinforce this facet of the Institute. The outreach activities have, since then stepped up in amount relevance and diffusion.

Follow us at @In2Ub | IN²UB / IN²UB

6.1. Outreach Events

- 11 February **International Day of Women and Girls in Science: Women in scientific research** (Announcement)

Apart from this first event on February, all other projects have perfectly adapted to the pandemic situations and have been developed by telematic means

- **European Research Night** Researchers from the Institute participates in this project with different talks:
  - **Yes, you are right, there is a lot of space in the background, Mr. Feynman** by *Xavier Batlle Gelabert* (IN²UB-Faculty of Physics).
  - **Tallers NANO** by *Jordi Díaz-Marcos*
  - **Scientific Coffee - La nanotecnologia contra la COVID-19 i molt més enllà** (Organized by IN²UB)
- **Festival 10alamenos9 (10-9 Festival)** The Festival aims to bring the nanometric scale, its effects and how this knowledge is going to change our lives through countless applications and products, to all audiences. In frame of this festival, on 2020, **Vermú de Nanociencia** has been engaged; this activity offers short research seminars at a divulgation level for the general public
- **La nanotecnologia en el sector de l'alimentació: breu estat de l'art**, by *Jordi Díaz-Marcos* at the webinar **Nano in Food** on November 2020 organized by La Fundació Catalana per a la Recerca i la Innovació (FCRI), el Servei d'Innovació Agroalimentària del Departament d'Agricultura, Ramaderia, Pesca i Alimentació (DARP) i l'Institut de Nanociència i Nanotecnologia de la UB (IN²UB)
- **El grafè i la relació dels nous materials amb la ciència-ficció** by *Enric Bertran* (IN²UB-Faculty of Physics) in frame of **Setmana de la Ciència**

6.2. Outstanding News from Outreach

- *Sònia Estradé* (from Department Electronics and Biomedical Engineering, Faculty Physics and Coordinator of the Outreach Commission of the Institute until September 2020) has received the Menció M. Encarna Sanahuja YII, award for excellence in the inclusion of the gender perspective in university teaching practice (more information)
- *Jordi Díaz-Marcos,* Coordinator of the Outreach Commission of the Institute since October 2020, has been awarded with **Premio a la Difusión y Educación Científica en Materiales** from Sociedad Española de Materiales
- Festival 10alamenos9, coordinated by *Jordi Díaz-Marcos*, has been awarded with Campus Gutenberg 2020

7. PhD thesis defended

Most IN²UB researchers are involved in the doctorate training. This is the list of doctoral theses defended in 2020, supervised by IN²UB researchers:

- **A portable device for time-resolved fluorescence-based on an array of CMOS SPADs with integrated microfluidics**
  Author: *Canals, Joan*. Director: *Angel Dieguez Barrientos*.

- **Biomedical applications of PolyPurine Reverse Hoogsteen hairpins: immunotherapy and gene repair**
  Author: *Alejandro Jiménez Félix*. Director: *Verónica Noé Mata* and *Carlos Ciudad Gómez*.

- **Positive pressure therapy in respiratory diseases: telemedicine management in sleep apnea and quality control in noninvasive mechanical ventilation**
  Author: *Onintza Garmendia Sorrondegui*. Director: *Ramon Farré Ventura* and *Josep M. Montserrat Canal*

- **Estudio de la melatonina como agente preventivo del daño gastrointestinal inducido por antiinflamatorios no esteroideos**
  Author: *Aroha Belén Sánchez Milán*. Director: *Ana Cristina Calpena Campmany* and *Beatriz Clares Naveros*

- **Estrategias terapéuticas basadas en micro y nanoemulsiones para el tratamiento del Alzheimer y enfermedades inflamatorias de la piel**
  Author: *Lupe Carolina Espinoza Tituana*. Director: *Ana Cristina Calpena Campmany* y *Beatriz Clares Naveros*

- **High precision measurements of magnetic fields and synchronization in optomechanical cavities**
  Author: *Martin Colombano Sosa*. Director: *D. Navaro* and *MV Costache*

- **Laser-induced forward transfer for printed electronics applications**
  Author: *Sopeña i Martínez, Pol*. Director: *Serra Coromina, Pere* and *Fernández Pradas, Juan Marcos*

For further information on the achievement
of the institute and its researchers,
please have a look at our website
www.ub.edu/in2ub

Editorial Board and Scientific Management: IN²UB
Graphic Design and Layout: www.idoate.com

INSTITUT DE NANOCIÈNCIA I NANOTECNOLOGIA
Universitat de Barcelona IN²UB

Faculty of Chemistry
Diagonal 645, 08028 Barcelona (Spain)
Telephone: + 34 93 402 12 66

in2ub@ub.edu | www.ub.edu/in2ub

Institut de Nanociència i Nanotecnologia

UNIVERSITAT DE BARCELONA