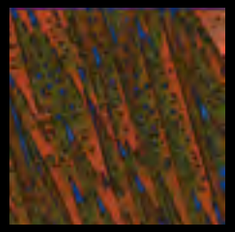
ICN ANNUAL REPORT 2010

CREATING A **DIMENSION** OF INFINITE **POSSIBILITIES**

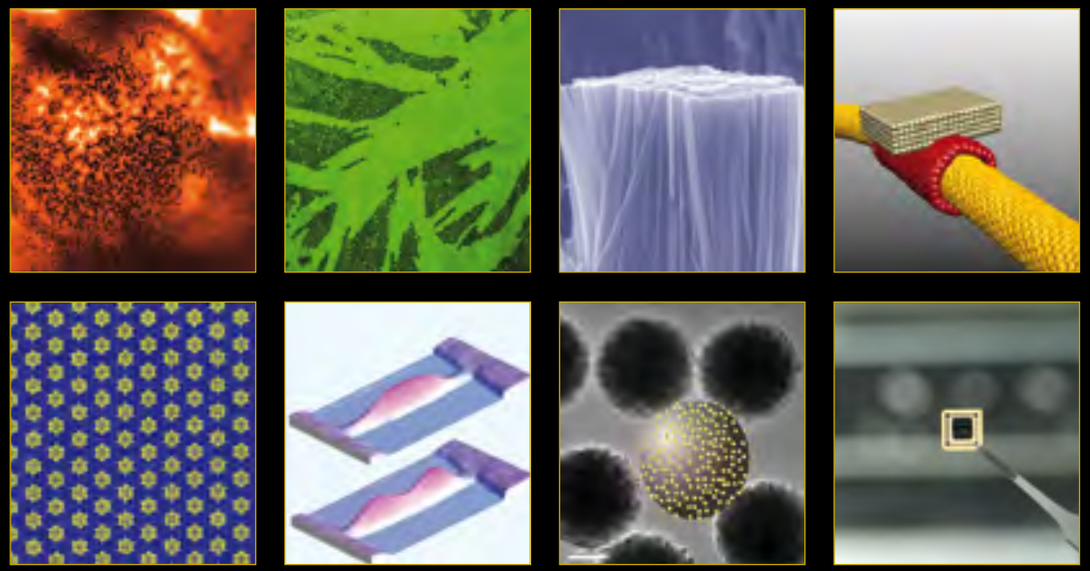
ICN

Institut Català
de Nanotecnologia

CONTENTS



Annual Report 2010
Institut Català de Nanotecnologia
ICN Communication Department



LETTER FROM THE DIRECTOR 1

During 2010, two new research groups were created. The experimental group Quantum Nanoelectronics, led by Prof. A. Bachtold and the theoretical group Theoretical and Computational Nanoscience, led by new ICREA researcher, Prof. S. Roche. This significantly boosted ICN´s research capacity in physical properties (in particular, transport properties) of carbon nanotubes and graphene.

Three new research support and development divisions were created; Electronic Microscopy, led by Dr B. Ballesteros, Nanofabrication, led by Dr N. Kehagias, and Nanoscience Instrument Development, led by Dr G. Ceballos who also oversees the other divisions and all common technical services. In addition to offering scientific-technical support, the Divisions have the mission to develop new techniques and processes in their respective areas. This internal commitment to support research has been accompanied with participation in infrastructure platforms at the European level, for example Q-Nano in respect of safety tests for nanomaterials.

2010 saw continued growth in personnel, mainly via research projects, resulting in an overall increase of 12% over last year. Of note, some 43% are students and, as per the Institute´s founding philosophy of internationalisation, 50% of members are of foreign origin representing 30 different nationalities.

ICN continues to be a pole for attracting projects, with a recent report listing ICN amongst the highest ranking Spanish institutions with competitive funds secured under the EU´s 7th Framework Program. We have also secured projects of significant national scope, such as the new Consolider project led by ICN´s Prof. C. Sotomayor.

This success is also reflected in scientific publications which increased (16%) over 2009. Most importantly the average impact factor also grew (12%), reaching an extraordinary 5.77, due to the regular publication of works in international journals of highest prestige. This success in the publications was accompanied and ratified by the prestige by which our researchers are held in their respective fields; of 102 works presented in international conferences, some 50% were invited talks. 2010 also saw ICN organise its first international conferences, as further detailed in this Annual Report.

In technology transfer we have also been active, filing four new patents, whilst in parallel actively pursuing knowledge transfer to private industry via collaboration agreements and R&D contracts. Particularly promising is the successful industrial scale-up of the encapsulation of various chemicals.

Asides from purely scientific tasks, our researchers expanded their dissemination and outreach activities, teaching at various levels such as undergraduates, masters, international schools, and capacity building networks, and also engaging with society as exemplified by the publication by Prof. V. Puntes of Balancing the Promises, and the awarding of various photographic prizes to ICN researchers.

I am pleased to say that this was a very satisfying year for ICN, showing continued growth and development of cutting-edge research in various fields of nanotechnology and in which new frontiers were opened in both research and support activities.

Jordi Pascual
Director

2 ORGANISATION AND PEOPLE

2.1 Organisation

The Catalan Institute of Nanotechnology (ICN) is a non-profit international research institute located in Barcelona, Spain. It was created in July 2003 by the Ministry of Universities, Research and Information Society of the Catalan Government (DIUE) and the Autonomous University of Barcelona (UAB).

The ICN is led by its Director, Dr. Jordi Pascual, who reports to the Board of Patrons and is advised by the Scientific Advisory Board, which consists of a number of distinguished international scientists.

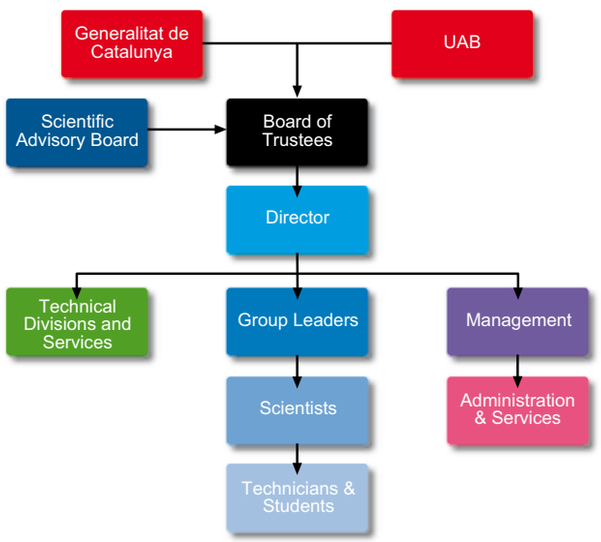
Research activities are directed by Research Group Leaders, senior scientists of international repute, who lead research teams focussed on their respective areas of expertise, and are supported by specialised laboratory engineers, technical and administrative staff.

In 2010 the ICN increased its research lines from six to eight core Groups and one Emerging Group:

- Atomic Manipulation and Spectroscopy Group
- Inorganic Nanoparticles Group
- Magnetic Nanostructures Group
- Nanobioelectronics & Biosensors Group
- Phononic and Photonic Nanostructures Group
- Physics and Engineering of Nanoelectronic Devices Group
- Quantum Nanoelectronics Group
- Theoretical and Computational Nanoscience Group
- Supramolecular Nanochemistry and Materials (Emerging Group)

Also during the year, three technical platforms were created: the Electron Microscopy division, the Nanofabrication division and the Nanoscience Instrument Developement division.

2.2 Organisational Chart



2.3 Board of Patrons

PRESIDENT

Josep Huguet i Biosca,
Minister of Education and Universities, Government of Catalonia.

VICE-PRESIDENT

Ana Ripoll,
Chancellor of the Universitat Autònoma de Barcelona (UAB).

MEMBERS

Joan Roca i Acín,
General Director of Research of the Ministry of Innovation, Universities and Enterprises.

Ramón Moreno,
Director of CERCA Research Centers Programme.

Jordi Marquet Cortés,
Vice Chancellor for Strategic Projects of the Autonomous University of Barcelona (UAB).

Miquel Salmerón,
Principal Researcher in the Lawrence Berkeley Laboratory, Berkeley, California, U.S.A.

M. Dolors Baro,
Professor of Physics at the Universitat Autònoma de Barcelona (UAB).

2.4 Scientific Advisory Board 2010

PRESIDENT

Prof. Miquel Salmerón,
Principal Researcher in the Lawrence Berkeley Laboratory, Berkeley, California, U.S.A.

MEMBERS

Prof. Jeff Bokor,
Department of Electrical Engineering and Computer Sciences. University of California at Berkeley and Deputy Director for Science,The Molecular Foundry, Lawrence Berkeley National Laboratory.

Prof. Fernando Briones,
Professor of Research in the Microelectronics Institute of Madrid (IMM - CSIC), Madrid, Spain.

Prof. Carlos Bustamante,
Researcher of the Howard Hughes Medical Institute, University of California, Berkeley, U.S.A.

Prof. Manuel Cardona,
Co-founder and emeritus professor of the Max Planck Institut, Stuttgart, Baden-Württemberg, Germany.

Prof. Sylvia Daunert,
Department of Chemistry. University of Kentucky. College of Arts and Sciences. Prof. of Chemistry, Pharmaceutical Sciences, Biological and Bioanalytical Chemistry.

Prof. Bengt Kasemo,
Professor of Pysics at the Department of Physics, Chalmers University of Technology, Gothenburg, Sweden.

Prof. Jean-Pierre Launay,
Professor at the Université Paul Sabatier and at the Institut Universitarire de France. Director of CEMES.

Prof. Ernst Meyer,
Professor of the Institut für Physik, University of Basel, Basel, Switzerland.

Prof. Peter Vettiger,

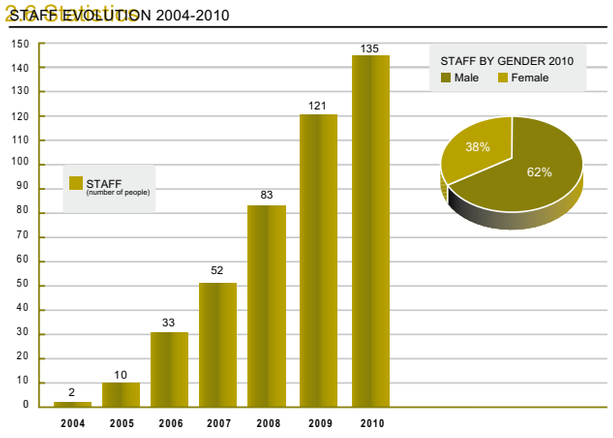
IBM Zurich Research Laboratory.

2.5 People of the ICN

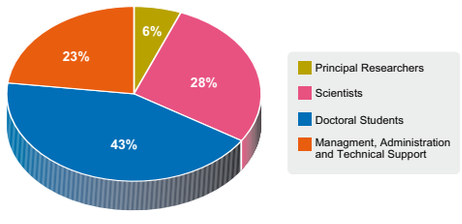
ICN is defined by its people. From senior researchers through to administration staff, ICN works as a team, committing creativity, energy, dedication and hard work to build and establish the Institute. ICN also prides itself on being an attractor of talent, seeking to provide an environment and an image of excellence that attracts talented scientists, technicians and support personnel from all over the world. Evidence of success in attracting talent, asides from the high level of scientific output achieved, is given by the high numbers of ICN staff with top-level competitive recognition.

In 2010 the strong growth in competitive funding drove a significant increase in scientific staff, and facilitated the incorporation of additional support personnel in administration. In total, staff numbers at the ICN grew from 121 in 2009 to 135 by the end of 2010.

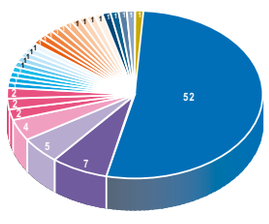
ICN is an equal opportunity employer and seeks to encourage a workforce diverse in age, race, nationality and gender. In 2010, ICN personnel came from 30 different countries and over one third were female.



ICN STAFF BY ROLE 2010



ICN STAFF NATIONALITIES 2010



Albanian	1	Swiss	1
Australian	1	Greek	1
Belgian	1	Irish	1
Brazilian	1	Venezuelan	1
Chilean	1	N American	1
Cypriot	1	Polish	1
French & Swiss	1	Russia	1
Iranian	1	Mexican	2
Peruan	1	Portuguese	2
Swedish	1	Romanian	2
Thailand	1	German	4
Turkish	1	Italian	5
Argentinian	1	French	7
British	1	Spanish	52
Colombian	1		
Cuban	1		

Led by ICREA Prof. Pietro Gambardella, the Atomic Manipulation and Spectroscopy Group investigates fundamental concepts in magnetism and molecular electronics, in order to control the interplay of the structural, electronic, and magnetic properties of nanosized systems. The Group combines scanning tunnelling microscopy techniques, synchrotron radiation spectroscopy, and electron transport measurements in order to link microscopic phenomena to macroscopic observables that are relevant for the understanding and design of new materials and devices.

From L to R:. P. Gambardella, A. Mugarza, T. Balashov, G. Ceballos, C. Krull, M. Miron, K. Garello, C. Nistor, M. Ollé, S. Schmaus and A. Lodi Rizzini. Absent: J. Kavich

NEW PROJECTS & MILESTONES

In 2010, the Group secured competitive funding for 2 new projects:

Materials for Enhanced Spin-Orbit Effects in Spintronics (MESO-ES), Spanish Ministry of Science and Innovation.
Methods to manipulate the magnetization of ferromagnets by means of local current-injection allow for the design of integrated spintronic devices with reduced dimensions and energy consumption compared to conventional magnetic field actuation. Recently, intrinsic current-induced magnetic fields have been observed in magnetic structures lacking inversion symmetry due to the relativistic coupling between the conduction electron spin and orbital motion. This project aims at investigating the growth, structural, and magnetic properties of thin films and nanostructures characterized by enhanced spin-orbit (Rashba and Dresselhaus) interactions. The synthesis of new layered compounds is proposed as a means to increase spin-orbit effects at the interface between ferromagnetic and nonmagnetic materials, leading to strong coupling between elec-

tric currents and magnetization at room temperature. A final goal is to observe current-induced torques in such compounds and examine the relationship between magnetocrystalline anisotropy, Rashba, and Dresselhaus interface energy terms as a function of composition and interface structure. These studies have direct implications on the design of devices that store and process magnetic information.

NANOWAVE - Nanowire Based Microwave Emitters for Use in Monolithic Microwave Integrated Circuits. Spanish Ministry of Science and Innovation.
The project involves the use of a unique self-assembled planar nanowire array configuration to investigate dc current-induced spin wave mediated microwave generation in nanocontacts. The key novel aspect of the project is in the use of a planar array of ferromagnetic nanowires formed by means of a self-assembly-like technique. The second ferromagnetic layer is applied to form contacts Ferromagnet-Normal Metal Spacer-Ferromagnet along the nanowires. The geometry of the nanocontact is substantially different to other structures employed for studies of microwave generation by spin torque. The unique geometry allows probing of experimental configurations that cannot be probed in conventional spin-torque experiments. This will facilitate a much deeper understanding of the phenomenon and in particular the issue of coherent (phase locked) coupling between Spin Torque Oscillators (STO).

KEY PUBLICATIONS AND INVITED TALKS 2010

Orbital specific chirality and homochiral self-assembly of achiral molecules induced by charge transfer and spontaneous symmetry breaking, A. Mugarza, N. Lorente, P. Ordejón, C. Krull, S. Stepanow, M.-L. Bocquet, J. Fraxedas, G. Ceballos and P. Gambardella, Phys. Rev. Lett. 105, 115702 (2010).

Correlated electrons step by step: itinerant-to-localized transition of Fe impurities in free-electron metal hosts, C. Carbone, M. Veronese, P. Moras, S. Gardonio, C. Grazioli, P. H. Zhou, O. Rader, A. Varykhalov, C. Krull, T. Balashov, A. Mugarza, P. Gambardella, S. Lebeque, O. Eriksson, M. I. Katsnelson and A. I. Lichtenstein, Phys. Rev. Lett. 104, 117601 (2010).

Current-driven spin torque induced by the Rashba effect in a ferromagnetic metal layer, I. M. Miron, G. Gaudin, S. Auffret, B. Rodmacq, A. Schuhl, S. Pizzini, Jan Vogel and P. Gambardella, Nature Mater. 9, 230 (2010).

Magnetic properties of ultrathin metal-organic layers on metal surfaces: supramolecules and macrocycles, P. Gambardella, March Meeting of the American Physical Society, Portland, USA, March 15-19 (2010). Invited Talk

Enhanced spin-torque efficiency in ferromagnetic metal systems characterized by Rashba-type structural inversion asymmetry, M. Miron, March Meeting of the American Physical Society, Portland, USA, March 15-19 (2010). Invited Talk

Spin-spin and spin-orbital coupling effects at metallic interfaces, P. Gambardella, Passion for Knowledge-Workshop on Chemical Physics at Interfaces, Donostia, Spain, Sept. 27 - Oct.1 (2010). Invited Talk

OTHER ACTIVITIES

A writable magnetic element -Elément magnétique inscriptible, G. Gaudin, I.M. Miron, P. Gambardella, A. Schuhl, ICN, CNRS, and ICREA, **US Patent 12/899,072 (06.10.2010), French Patent FR 10/03122 (26.07.2010).**

A writable magnetic element -Elément de mémoire magnétique, G. Gaudin, I.M. Miron, P. Gambardella, A. Schuhl, ICN, CNRS, and ICREA, **US Patent 12/899,091 (06.10.2010), French Patent FR 10/03123 (26.07.2010).**

Teaching:
Characterization techniques in surface science, Nanoscience and Nanotechnology Master, Universitat Autònoma de Barcelona. P. Gambardella
Metal-organic molecules on metal surfaces: assembly and magnetic properties. III European School on Molecular Nanoscience, Miraflores de la Sierra, Madrid, Spain.
Magnetic nanostructures. Summer School on Condensed Matter Research, Paul Scherrer Institut, Zuoz, Switzerland.

Led by ICREA Prof. Víctor Puntes, the Inorganic Nanoparticles Group works on the synthesis, characterisation and applications of engineered inorganic nanoparticles. By controlling the size, structure and shape of the inorganic core and manipulating the linking of organic molecules to the nanoparticle surface, the Group aims to design nanoparticles that interact with a variety of systems (biological, medical, materials, etc.).

From L to R: I. Ojea, J. Comenge, Z.A. Megson, V. Puntes, L. García, M. Varón, X. López, S. Lim, E. M. González and E. Casals.
Absent: M. Busquets and S. Goy.

NEW PROJECTS & MILESTONES

Many of the results in 2010 were related to the use of engineered inorganic nanoparticles with biological systems. In particular, nanotoxicology, immunology and drug delivery of antitumoral drugs, as reflected in the granted projects and published papers.

As a consequence of the Group´s ongoing international collaboration efforts on nanotoxicology, in 2010 the Group commenced work under the NANOPOLYTOX and NANOTOES projects, and formal approval was achieved for Q-NANO which will launch in 2011. These are, respectively, a small-medium focused research project, an Initial Training Network (ITN), and a Research Infrastructure project under the 7th Framework Programme of the European Union. The Group´s contribution is to monitor the evolution of inorganic NP signatures exposed to biological media and to unveil the mechanisms of the interaction of inorganic and organic matter at the nanoscale.

KEY PUBLICATIONS AND INVITED TALKS 2010

Time evolution of the nanoparticle protein corona, E. Casals, T. Pfaller, A. Duschl, G.J. Oostingh and V. Puntes. ACS Nano, 4, pp. 3623-3632 (2010)

Synthesis of platinum cubes,polypods, Cuboctahedrons, and Raspberries Assisted by Cobalt Nanocrystals , S.I. Lim, I. Ojea-Jiménez, M. Varón, E. Casals, J. Arbiol and V. Puntes. Nano Letters, vol. 10, pp. 964-973, (2010)

Nanotoxicity associated to engineered inorganic nanoparticles, I. Ojea-Jiménez. The Technion-nanoGUNE-Barcelona Symposium, RBNI, Technion, Haifa, Israel, May 26, 2010. Oral Contribution.

When the synthesis is over. Assessing the full cycle of inorganic nanoparticles. V. Puntes. NaNaX4: Nanoscience with Nanocrystals, Tutzing – Munich, Germany, April 13, 2010.

Dipolar Driven Spontaneous Self Assembly of Superparamagnetic Co Nanoparticles into Micrometric Rice-Grain like Structures, M. Varón, L. Peña, L. Balcells, V. Skumryev, B. Martine and V. Puntes. Langmuir, pp. 109-116, (2010)

OTHER ACTIVITIES 2010

First prize in the Micro(scale) Category in the 8th National Scientific Photography Contest (FOTOCIENCIA) was awarded to the Inorganic Nanoparticles Group. Title of the photography: Van Gogh's Starry Night.

Published **"Balancing the Promises",** an e-book exploring the issues around the potential benefits and dangers of nanotechnology, based on contributions to the Nanowiki forum during the previous year.

Safety of Nanomaterials. In "Impact of Nanotecnology in Cosmetics", scientific-technical workshops organised by the Spanish Society of Cosmetic Chemicals (SEQC). Barcelona, Spain, November 11, 2010.

Led by ICREA Prof. Josep Nogués, the Magnetic Nanostructures Group investigates different types of magnetic nanostructures with the aim of improving their functional properties. The Group combines state of the art lithographic or chemical synthesis methods with structural, morphological and magnetic characterisation to focus on three areas; magnetic properties of lithographed magnetic nanostructures, magnetic nanoparticles, and other magnetic systems.

From L to R: J. Nogués, M. Estrader and A. López.

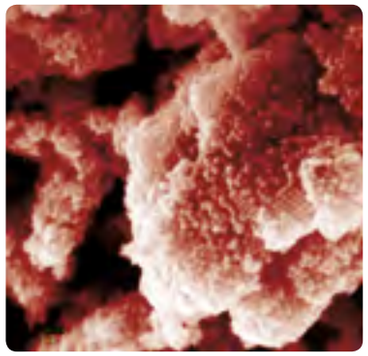
NEW PROJECTS & MILESTONES

In 2010, the Group worked on two different projects:

Using magnetic interactions to tailor the magnetic properties of nanostructured systems, MEC

The objective of the research is to investigate different types of magnetic interactions in patterned magnetic nanostructures and nanoparticles to tailor and improve the magnetic properties of magnetic composite nanostructured systems by making use of the extra degrees of freedom introduced by the interactions.

In particular, the Group focussed on the correlation between structural (e.g., size, shape, distance, microstructure) and magnetic parameters (e.g., types of materials, anisotropies). For example, it was demonstrated that the magnetization reversal of ferromagnetic/antiferromagnetic lithographed structures and nanoparticles can be controlled by shape and interface exchange interaction.



Further, the Group studied other effects such as the generation of magnetism in non-magnetic materials by ion irradiation.

ONDA - Ordered hetero- and Nano-structures with Epitaxial Dielectrics for magnetic and electronics Applications

The project brings together Spasnish, French and Italian groups with two Russian institutes to study ultrathin nanostructured dielectric materials for advanced electronic applications. In particular, our group is involved in the study of magnetically ordered nano-heterostructures on epitaxial antiferromagnetic fluoride surfaces.

KEY PUBLICATIONS AND INVITED TALKS 2010

Size-dependent passivation shell and magnetic properties in antiferromagnetic/ferrimagn-etic core/shell mno nanoparticles, A. López-Ortega, D. Tobia, E. Winkler, I.V. Golosovsky, G. Salazar-Álvarez, S. Estradé, M. Estrader, J. Sort, M.A. González, S. Suriñach, J. Arbiol, F. Peiro, R.D. Zysler, M.D. Baro and J. Nogués. Journal of the American Chemical Society 132, 9398–9407 (2010)

Making flexible magnetic aerogels and stiff magnetic nanopaper using cellulose nanofibrils as templates, R.T. Olsson, M.A.S. Aziz Samir, G. Salazar-Álvarez, L. Belova, V. Ström, L.A. Berglund, O. Ikkala, J. Nogués and U.W. Gedde. Nature Nanotechnology 5, 584-588 (2010)

Synthesis of compositionally graded nanocast NiO/NiCo2O4/Co3O4 mesoporous composites with tunablemagnetic properties, M. Cabo, E. Pellicer, E. Rossinyol, M. Estrader, A. López-Ortega, J. Nogués, O. Castell, S. Suriñach and M.D. Baro. Journal of Materials Chemistry 20, 7021-7028 (2010)

Continuously graded anisotropy in single (Fe53Pt47)100–xCux films, C.L. Zha, R.K. Dumas, Y.Y. Fang, V. Bonanni, J. Nogués and J. Åkerman. Applied Physics Letters 97, 182504 (2010)

Controlling magnetic vortices in circular dots using exchange bias, J. Nogués, G. Salazar-Álvarez, J.J. Kavich, M. Tanase, A. Mugarza, S. Stepanow, A. Potenza, H. Marchetto, S.S. Dhesi, V. Baltz, A. Weber, L.J. Heyderman, A.K. Petford-Long, O. Heinonen, M.D. Baró, B. Dieny, K.S. Buchanan, A. Hoffmann, P. Gambardella and J. Sort. NordicSpin Gimo, Sweden, May, 7-9, 2010. Invited talk

Exchange bias, size and proximity effects in inverted, antiferromagnetic/ferrimagnetic core/shell MnO. J. Nogués, A. López-Ortega, M. Estrader, D. Tobia, E. Winkler, S. Estradé, I. Golosovsky, J. Sort, G. Salazar-Álvarez, J. D. Ardisson, W. A. A. Macedo, K. L. Krycka, J. A. Borchers, J. Arbiol, F. Peiró, S. Suriñach, R.D. Zysler and M.D. Baró. Conference on Magnetism and Magnetic Materials, Atlanta, USA. Nov. 14-18, 2010. Invited talk.

OTHER ACTIVITIES

Member of the editorial review board of IEEE Magnetics Letters

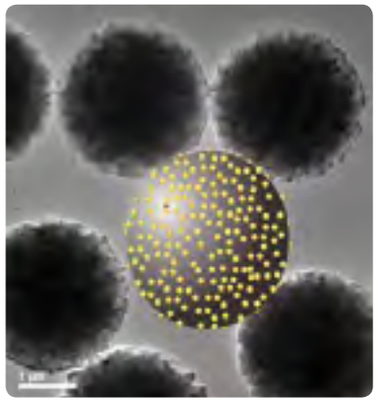
Led by ICREA Prof. Arben Merkoçi, the Nanobioelectronics & Biosensors Group works on the design of novel sensors and biosensors based on nanomaterials and their applications in fields like clinical analysis, environmental monitoring and other industries. Metallic nanoparticles modified with antibodies or DNA are used as electroactive labels to follow immunoreactions or hybridizations with interest for immunosensors and DNA sensors. In addition carbon nanotubes are also used as building blocks for sensing applications.

From L to R, back row: W. Cantanhêde, A. Merkoçi, A. Puig, M. Espinoza, C. Parolo, B. Pérez, H. Montón, G. Aragay and A. de la Escosura. Front row: M. Medina, M.Cadevall, M. Guix and S. Marin. Absent: M. Maltez, W. Chunglok and C. Mayorga.

NEW PROJECTS & MILESTONES

In 2010, the Group secured competitive funding for 3 new projects:

Nanosystems for early diagnosis of neurodegenerative diseases (NADINE). Funded by European Commission.



Multifunctional nanoplatforms for high sensitive pollution control and purification of water. Spanish-Japan collaboration funded by MICINN.

Evaluación del receptor sensor de calcio como potencial nuevo gen supresor de tumores y diana terapéutica en neuroblastoma. Funded by CELLEX foundation.

KEY PUBLICATIONS AND INVITED TALKS 2010

Immunosensing using nanoparticles, Alfredo de la Escosura-Muñiz, Claudio Parolo and Arben Merkoçi. Materials Today, 13, p. 24-34 (2010)

Enhanced gold nanoparticle based ELISA for a breast cancer biomarker, Adriano Ambrosi, Federico Airo and Arben Merkoçi. Analytical Chemistry, 82, p. 1151-1156 (2010)

Nanoparticle based enhancement of electrochemical DNA hybridization signal using nanoporous electrodes, Alfredo de la Escosura-Muñiz and Arben Merkoçi. Chemical Communications, 46, 1710-1714 (2010).

Gold nanoparticle-based electrochemical magneto immunosensor for rapid detection of anti-hepatitis B virus antibodies in human serum, Alfredo de la Escosura-Muñiz, Marisa Maltez-da Costa, Christian Sánchez-Espinel, Belén Díaz-Freitas, Jonathan Fernández-Suárez, África González-Fernández and Arben Merkoçi. Biosensors and Bioelectronics 26, p. 1710–1714. (2010)

Nanomaterials for fast DNA, protein and cell analysis, BIOSENSORS 2010, 20th Anniversary World Congress on Biosensors, Glasgow, UK. 26-28 May (2010). Plenary Lecture

OTHER ACTIVITIES

Arben Merkoçi, member of "Nanotech 2010 Scientific Committee" in 'Nanotech 2010', CA, USA (June 21-25, 2010) .

News on the article: **Enhanced Gold Nanoparticle Based ELISA for a Breast Cancer Biomarker**; Adriano Ambrosi, Federico Airo, Arben Merkoçi. Analytical Chemistry, 82, 1151–1156. 2010.La Vanguardia, Europa Press, ADN, ABC, QUE, Terra, Yahoo, El Confidencial, El Economista, Gente, La Información, Hoy, El Comercio, Las Provincias, Deia, El Diario Montañés, Nanotecnológica, Diario de Salud, Ideal and BarcelonaReporter

http://www.lavanguardia.es/ciudadanos/noticias/20100118/53873002341/un-equipo-de-investigadores-barcelones-descubre-una-alternativa-para-mejorar-el-diagnostico-del-canc.html
http://www.europapress.es/catalunya/noticia-descubren-tecnica-mejora-eficacia-kits-diagnostico-cancer-20100118142629.html

http://www.abc.es/agencias/noticia.asp?noticia=239459

Organizer of **I Workshop Spain-Japan 'NANOJASP 2010': Nanomaterials based biosensors and biosystems. Improving the quality and security of citizen's life,** Barcelona (Spain), 29-30 November 2010.

Led by ICREA Prof. Dr. Clivia M. Sotomayor Torres, the Phononic and Photonic Nanostructures Group investigates the interaction of photons, phonons and electrons in nano-scale condensed matter underpinned by research in nanofabrication, especially nanoimprint lithography and nanometrology. The long term aim is to develop new information technology concepts where information processing is achieved with non-charged state variables. The dynamics of the photoexcited electron-hole pairs has been proven in graphene from the two-phonon Raman processes, allowing to determine the ratio of electron-phonon coupling parameters as well as to monitor the electron-electron scattering contribution with increasing charge concentration.

From L to R: P.O. Chapuis, F. Alzina, N. Kehagias, V. Reboud, T. Kehoe, C.M. Sotomayor Torres, J. Cuffe, D. Dudek, N. Baruch, L. Schneider and Y. García.

NEW PROJECTS & MILESTONES

In 2010, the Group secured the start of 8 new projects:

ACPHIN: Study Of Confined Acoustic Phonons in Fabricated Nanostructures: Research on their spectrum, dispersion relations and impact on electrical, electronic and optical properties.

SEAL, Semiconductor Equipment Assessment Leveraging Innovation: in the area of semiconductor manufacturing equipment, SEAL combines efforts, resources and expertise to assess novel equipment supported by cross-cut R&D.

LAMAND, Large Area Molecularly Assembled Nanopatterns for Devices: aims to provide a manufacturable and verifiable process using functionalised macromolecular systems over large substrate areas for beyond state-of-the-art applications in the ICT sector.

NANOPOWER, Nanoscale Energy Management for Powering ICT devices: targets energy efficiency research to identify new directions for energy-harvesting technologies at the nanometre and molecular scale for integration in autonomous nanoscale systems.

NANOFUNCTION, Beyond CMOS Nanodevices for Adding Functionalities to CMOS: the aim is to integrate research laboratories to strengthen scientific and technological excellence in the field of novel nanoelectronic materials, devices and circuits in More than Moore domain.

Towards a phonon source based on opto-mechanical crystals: The goal of this project is to create a phonon source or phonon emitter using optomechanical crystals. The interaction of light with matter will be tailored using a common cavity for light, a photonic crystal, and for phonons, a phononic crystals. In this way we can drive and select the mechanical vibrations of our nanofabricated structures.

NANO-TEC, ECOSYSTEMS TECHNOLOGY and DESIGN for NANOELECTRONICS: aims to build a community to enable discussions, exchanges and joint work coordinating excellent research among academic and research organisations in the field of Beyond CMOS.

NanoTHERM: Tailoring electronic and phononic properties of nanomaterials: Towards ideal Thermoelectricity. This CONSOLIDER project has the objective of the nanoTHERM project is to study novel nanoscale-controlled materials and structures to acquire a better understanding of the underlying physics of the connection between the thermal and electrical transports, in order to optimize the design of thermoelectric materials.

KEY PUBLICATIONS AND INVITED TALKS 2010

BOOK CHAPTER:

Chapter 4: "Advances in Nanoimprint lithography" in: Nanotechnology, Volume 8: Nanostructured Surfaces, V Reboud, T Kehoe, N Kehagias and C M Sotomayor Torres, Editor: Lifeng Chi, Publisher: Wiley-VCH Verlag (Weinheim, Germany), ISBN: 978-3-527-31739-4, pp165-205 (2010)

ARTICLES:

Tuning the Intensity of Metal-Enhanced Fluorescence by Engineering Silver Nanoparticle Arrays, B. Yang, N. Lu, D. Qi, R. Ma, Q. Wu, J. Hao, X. Liu, Y. Mu, V. Reboud, N. Kehagias, C. M. Sotomayor Torres, F. Y. C. Boey, X. Chen, L. Chi, , Small, 6 (9), 1038–1043 (2010)

Damaging graphene with ozone treatment: a chemically tunable memtal insulator transition, N. Leconte, J. Moser, P. Ordejón, H. Tao, A. Lherbier, A. Bachtold, F. Alsina, C. M. Sotomayor Torres, J. C. Charlier and S. Roche. ACS Nano, 4 (7), 4033-4038 (2010)

Layer-by-layer all-inorganic quantum-dot-based LEDs: a simple procedure with robust performance, J. S. Bendall, M. Paderi, F. Ghigliott, N. Li Pira, G. Lambertini, V. Lesnyak, N. Gaponik, A. Eychmüller, C. M. Sotomayor Torres, G. Visimberga, M.E. Welland, C. Gieck and L. Marches, Advanced Functional Materials, 20 (19), 3298-3302 (2010)

TALKS:

Phonon Engineering, C M Sotomayor Torres and P.-Olivier Chapuis, Summer school on Energy harvesting and noise in dynamical systems at micro and nanoscale, La Tenuta de Ciclamini, Avigliano Umbro (Italy), August 1-6, 2010

Sensitivity of Sub-wavelength diffraction metrology to three dimensional imprinted line profile, T Kehoe, NNT2010 (9th International Conference on Nanoimprint and Nanoprint Technology), Copenhagen, October 13-15 2010 (Invited talk)

Nanometrology: enabling applications of nanotechnology, C. M. Sotomayor Torres, T. Kehoe, V. Reboud, N. Kehagias and D. Dudek, Trends in Nanotechnology, 10th September 2010, Braga, Portugal (Invited Keynote)

OTHER ACTIVITIES

Prof. Dr. Sotomayor Torres directed the 2010 ICREA workshop on Phonon Engineering, held in Sant Feliu de Guixols, Girona, from 24 to 27 May 2010.

Dr. Damian Dudek from the P2N won the art section of the 2010 Raith Micrograph Award with the SEM picture titled "Time space bending on nanoimprinted polymer".

Led by ICREA Prof. Sergio O. Valenzuela, the Physics and Engineering of Nanodevices Group focuses on the development of novel devices, primarily spintronics, specifically designed to gain insight into physical properties of materials at the nanoscale, combining state of the art lithographic and chemical methods with magnetic and electrical transport characterisation.

From L to R: I. Neumann, M. Costache, S. O. Valenzuela and G. Bridoux
Absent: J. Van De Vondel

NEW PROJECTS & MILESTONES

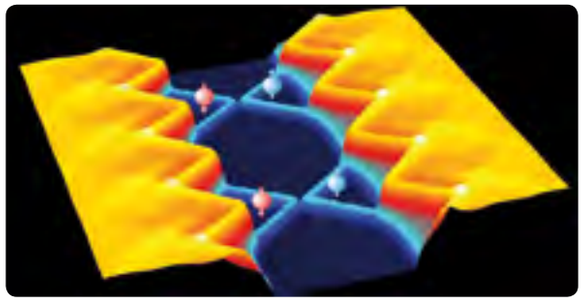
In 2010, Dr. Germán Bridoux became member of the Group and competitive projects on several spintronic topics were tackled:

Spin-resolved tunnelling spectroscopy [EXPLORA (MICINN)]

The project aims at developing novel characterization techniques to study and enhance the spin polarization of electrons through tunnelling barriers. The results have implications in the performance of magnetic random access memories (MRAM).

Spin transport and magnetization dynamics in nanostructures (MICINN)

The project covers the interaction between the magnetization of nanomagnets and spin-polarized currents and spin transport in non conventional spintronic materials. In particular, the project studies the degree of spin current absorption by a nanomagnet and the generation of spin injection via spin pumping from a precessing nanomagnet magnetization. The Group is also developing a novel spin detection method for semiconductors, and low conductivity materials in general such



as graphene, with an efficiency that is largely immune to the interface properties between the semiconductor and the detector.

Within this project the Group has realised the first demonstration of a spin ratchet, as reported in Science. In analogy to a ratchet wrench, which provides uniform rotation from oscillatory motion, such ratchets achieve directed spin transport in the presence of a signal or perturbation without a bias.

Beyond CMOS Nanodevices for Adding Functionalities to CMOS (NANOFUNCTION, FP7-EU)
The project explores thermoelectric devices based on ferromagnetic nanostructures, where the thermoelectricity results from the conversion of a spin electrochemical potential difference to a voltage.

KEY PUBLICATIONS AND INVITED TALKS 2010

Experimental spin ratchet, M.V. Costache and S.O. Valenzuela, Science 330, 1645 (2010)

X Meeting on nanostructures materials and surfaces, Bariloche, Argentina. May 12 14, 2010. Invited talk - Plenary

Nanospain 2010, Málaga, Spain. March 24th , 2010. Invited talk - Keynote Speaker

International workshop on spin current and spin caloritronics, Institute for Materials Research (IMR), Tohoku University, Sendai, Japan. February 8 -10, 2010. Invited Talk

VI Spanish meeting on solid state physics, Zaragoza, Spain. February 3 -5 , 2010

OTHER ACTIVITIES

New challenges and applications in magnetism. UIMP Summer School, A Couruña, Spain. July 19th – 23rd, 2010.

IMDEA Nanociencia, Madrid, Spain. April 20th, 2010

Universidad Complutense de Madrid, Madrid, Spain. April 19th, 2010

Quantum nanoelectronics seminar, CNRS, Grenoble, France. March 9th, 2010

Led by Prof. Adrian Bachtold, the Quantum NanoElectronics Group specialises in the electrical and mechanical properties of carbon nanotubes and graphene. These structures are so tiny that quantum effects start to play a dominant role. For example the energy levels are quantised, just like in atoms and molecules. Interestingly, these structures are large and robust enough to be implemented in a variety of different microfabricated devices, which allow the tuning of their quantum properties.

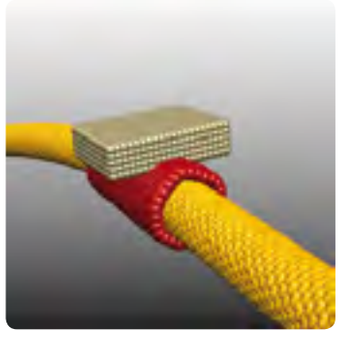
From L to R: M.J. Esplandiu, S. Pons , M. Sledzinska, J. Moser, M. Zdrojek, J. Chaste, A. Bachtold and A. Eichler.
Absent: A. Afshar and I. Tsioutsios

NEW PROJECTS & MILESTONES

In 2010, the Group focused on the EURYI Quantum proves based on carbon nanotubes project and the Marie Curie project Quantum Devices based on Carbon Nanotubes.

Throughout the year, the Group secured one new project:

RODIN - Suspended Graphene Nanostructures, which seamlessly integrates experimental, industrial and theoretical work, is organized around the concept of suspended single-and few-layer graphene nanostructures and annealed diamond-like carbon films. These structures are ideal for accessing and engineering the intrinsic material properties of graphene. In particular this project will focus on engineering and measuring the mechanical and electromechanical properties. This



will be done through sculpting of the suspended structures to desired shapes as well as using thermal post-processing methods. Initially, the graphene will be obtained using standard prototype techniques such as exfoliation and plasma assisted chemical vapor deposition.

KEY PUBLICATIONS AND INVITED TALKS 2010

Probing the electron-phonon coupling in ozone-doped graphene by Raman spectroscopy , F. Alzina, H. Tao, J. Moser, Y. García, A. Bachtold and C. M. Sotomayor Torres. Phys. Rev. B 82, 075422 (2010).

Current-voltage characteristics of graphene devices: interplay between Zener-Klein tunneling and defects, N. Vandecasteele, A. Barreiro, M. Lazzeri, A. Bachtold and F. Mauri. Phys. Rev. B 82, 045416 (2010).

Ground-state-cooling vibrations of suspended carbon nanotubes with constant electron current, S. Zippilli, A. Bachtold and G. Morigi. Phys. Rev. B 81, 205408 (2010)

Damaging graphene with ozone treatment: a chemically tunable metal-insulator transition, N. Leconte, J. Moser, P. Ordejon, HH. Tao, A. Lherbier, A. Bachtold, F. Alsina, C. M. Sotomayor Torres, JC. Charlier and S. Roche. ACS Nano 4, 4033 (2010).

Magnetotransport in disordered graphene exposed to ozone: from weak to strong localization, J. Moser, H. Tao, S. Roche, F. Alzina, C. M. Sotomayor Torres and A. Bachtold. Phys. Rev. B 81, 205445 (2010).

OTHER ACTIVITIES

Electromechanical resonators based on nanotube and grapheme by A. Bachtold at Nano-Opto-Electro-Mechanical Systems Approaching the Quantum Regime. Italy. September 2010. Invited talk

NEMSs based on nanotubes: from thermal motors to resonators by A. Bachtold at the XXII SITGES CONFERENCE on Statistical Mechanics: Energy Conversion: From Nanomachines to Renewable Sources. Sitges, Spain. June 2010 Invited Talk.

Nanotube ElectroMechanics by A. Bachtold at the INC6 - The Sixth International Nanotechnology Conference on Communications and Cooperation. Grenoble, Switzerland. May 2010. Invited Talk

Nanotube resonator by Adrian Bachtold at the Gordon Research Conferences. Texa, USA. March 2010. Invited Talk

ElectroMechanical resonators based on nanotube and graphene by A. Bachtold at the XXVth International winter-school on electronic properties of novel materials. Kirchberg, Germany. March 2010. Invited Talk

Led by ICREA Prof. Stephan Roche, the Theoretical and Computational Nanosciences Group theoretically explores exotic quantum transport phenomena in low dimensional structures and complex materials including carbon nanotubes, DNA , graphene, organic crystals and topological insulators. Targets of interest include the investigation of the effect of chemical and topological disorders, as well as electron-phonon coupling and spin-orbit interaction on quantum interferences, localization phenomena, decoherence mechanisms, electromechanical coupling between charges flow and vibrations of systems. Methodological developments target innovative quantum transport approaches to describe charge, spin, phonon or polaron dynamics in complex matter.

NEW PROJECTS & MILESTONES

The challenges that the Group aims to tackle, within the context of charge, spin, phonon or polarons dynamics in complex states of matter and low dimensional structures are twofold. First, it tackles quantum (transport) phenomena beyond conventional semiclassical treatments and mean field approaches. And second, it develops multiscale computational strategies, keeping the accuracy of state-of-the-art ab initio methods, but allowing the calculation of physical observables in realistic models.

Within this Group's main research lines, such as: Graphene Electronics and Spintronics, Carbon Nanotubes and Nanoresonators and Topological Insulators-TI and Multiscale Quantum Simulation of Nanodevices, funding has been secured through the award of two projects:

TRAIN - Transpyrenees Action on Advanced Infrastructures for Nanosciences and Nanotechnologies, whose objective is to position the southwest of Europe as a competitive region by pooling existing infrastructures, at two levels: nanomaterials preparation and characterization.

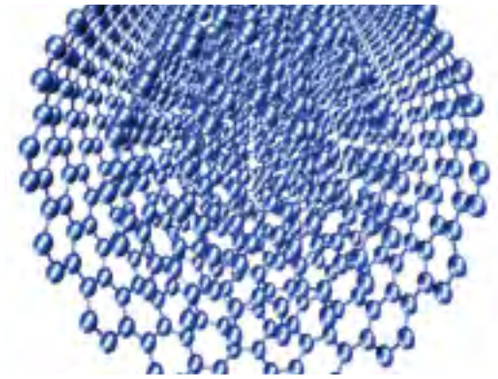
PICASSO Multiscale Simulation of Graphene Field Effect Transistors. France/Spanish Joint Call.

KEY PUBLICATIONS AND INVITED TALKS 2010

Ozone treatment of graphene : a route towards the control of metal-insulator transition, N. Leconte, J. Moser, P. Ordejón, H. Tao, F. Alsina, A. Lherbier, C. M. Sotomayor Torres, J.C. Charlier, A. Bachtold, S. Roche, ACS Nano 4, 4033 (2010)

Electron-hole transport asymmetry and conduction gaps in edge-defected graphene nanoribbons, S. Dubois, J.C. Charlier, A. López-Bezanilla, A. Cresti, F. Triozon, B. Biel and S. Roche. ACS Nano 4 (4),1971-1976 (2010)

Inelastic transport in vibrating disordered carbon nanotubes: scattering times and temperature dependent decoherence effects, H. Ishii, S. Roche, N. Kobayashi, H. Hirose, Phys. Rev. Lett. 104, 116801 (2010)
Enginneering carbon chains from mechanically stretched graphene-based materials, E. Erdogan, I. Popov, C. G. Ro-



cha, G. Cuniberti, S. Roche and G. Seifert. Phys. Rev. B 83, 041401 (Rapid Communication) (2010)

Edge magneto-fingerprints in disordered graphene nanoribbons, J.-M. Poumirol, A. Cresti, S. Roche, W. Escoffier, M. Goiran, X. Wang, X. Li, H. Dai and B. Raquet. Phys. Rev. B 82, 041413 (Rapid Communication) (2010)

Effcient linear scaling method for computing the thermal conductivity of disordered materials, W. Li, H.Sevincli, G. Cuniberti and S. Roche. Phys. Rev. B. 82, 041410 (Rapid Communication) (2010)

Magneto-transport in disordered graphene: from weak to strong localization, J. Moser, H. Tao, S. Roche, F. Alsina, C.M. Sotomayor Torres and A. Bachtold. Phys. Rev. B. 81, 205445 (2010)

Modeling graphene based nanoelectromechanical devices, M. Poetschke, C. G. Rocha, L. E. F. Foa Torres, S. Roche and G. Cuniberti. Phys. Rev. B 81, 193404 (2010)

Tuning the bandgap of semiconducting carbon nanotube by an axial magnetic field, G. Fedorov, D. Smirnov, P. Barbara, D. Jimenez and S. Roche. Applied Physics Letters 96, 132101 (2010)

Quantum transport properties of chemically functionalized long semiconducting carbon Nanotubes, A. López-Bezanilla, X. Blase and S. Roche. Nano Research 3, 288-295 (2010)

Simulation, modelling and characterisation of quasi-ballistic transport in nanometer sized field effect transistors: from TCAD to atomistic simulation, S. Roche, Th. Poiroux, G. Lecarval, S. Barraud, F. Triozon, M. Persson and Y.M. Niquet. International Journal of Nanotechnology Vol. 7, p. 348 (2010)

Mobility gaps in disordered graphene-based materials: an ab initio-based tight-binding approach to mesoscopic transport, B. Biel, A. Cresti, R. Avriller, S. Duboi, A. López-Bezanilla, F. Triozon, X. Blase, J.-C. Charlier and S. Roche. Phys. Status Solidi C 7, No. 1112, 26282631 (2010)

Conductance of functionalized nanotubes, graphene and nanowires: from ab initio to mesoscopic physics, X. Blase, C. Adessi, B. Biel, A. López-Bezanilla, M.-V. Fernández-Serra, E. R. Margine, F. Triozon and S. Roche. Phys. Status Solidi B 247, Nos. 1112, 29622967 (2010)

Transport properties of doped, functionalized and damaged graphene based materials by S. Roche at the EMRS2010 Symposium: Science and technology of nanotubes, nanowires and graphene. Strassbourg, France. June 7-11, 2010. Invited Talk

When chemistry meets nanoelectronics: graphene, a new playground for science and innovation by S. Roche at NANOSPAIN CONF2010. Málaga, Spain. March 23-26, 2010. Invited Talk.

OTHER ACTIVITIES

Member of the ELECMOL 2010 (MINATEC 6-13/12, 2010), http://www.elecmol.com/

Member of the Scientific Board of the "Graphene and Nanotubes: science and applications" ("GNT") group, a national research group (GDR 3217) and an international coordination network (GDRI) cross-linking research on nanotubes and graphene; http://www.graphene-nanotubes.org/

Led by Dr. Belén Ballesteros, the Electron Microscopy Division was formed in 2010 and focuses on the use of electron microscopy techniques for nanoscience and nanotechnology research and applications. The main aim of the Division is to provide scientific-technical support to the ICN research lines and to neighbouring research centres, as well as developing and implementing novel related techniques. The laboratory has been selected by FEI as a Centre of Reference for development of joint experiments and workshops related with electron microscopy.

RESEARCH ACTIVITIES & MILESTONES

Electron microscopy has become a key characterisation tool since it provides structural, chemical and morphological information of a wide range of nanomaterials and nanostructures. Recent developments in both scanning and transmission electron microscopes have dramatically improved their image and nanoanalysis capabilities, making feasible for instance the day-to-day study of crystallographic periodicity of structures at the atomic level and the study of high-vacuum incompatible specimens by SEM working in environmental mode, among others.

In this context during 2010, the Division focused on:
- High resolution imaging (SEM, TEM, Z-contrast STEM)
- Chemical analysis at the nanoscale (EDS, EELS, EFTEM)
- Structural characterisation by electron diffraction
- Electron tomography

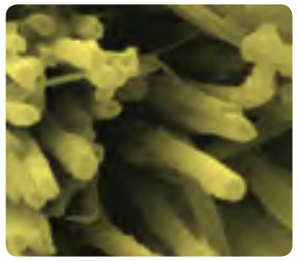
SERVICES

The Division's facilities were acquired during 2010 and are detailed below:

• FEI Tecnai G2 F20 S-TWIN HR(S)TEM is a 200kV field emission gun (FEG) high resolution and analytical TEM/STEM. The field emission source means this microscope is ideal for applications requiring high coherency, high brightness at high magnification, or small focused probes. It is a versatile and flexible microscope and combines high performance in TEM, EFTEM and STEM modes with ease of operation in a multi-user research environment. The analytical capabilities are provided by an EDAX system for EDS and a last generation Gatan Imaging Filter (GIF Quantum) for EELS and EFTEM analysis. High-resolution electron tomography is performed using a dedi-

cated high-tilt tomography sample holder.

• FEI Magellan 400L XHR SEM is a Field Emission Scanning Electron Microscope equipped with a newly developed electron column with UC (UniColore) Technology. This microscope features excellent capabilities in the more traditional high energy (15-30 kV) SEM and STEM imaging, but also has an outstanding performance at low beam energies with subnanometer resolution for unmatched surface sensitive imaging.



• FEI Quanta 650FEG ESEM is a versatile field scanning electron microscope which provides high resolution imaging at low-vacuum and also extended vacuum (environmental) for the characterization of all type of samples (conductive and non-conductive) and performing in-situ dynamic experiments. This microscope features a large chamber compatible with 8 inches wafers.

KEY PUBLICATIONS AND INVITED TALKS 2010

Carbon nanocapsules: blocking materials inside carbon nanotubes. Gerard Tobias, Belén Ballesteros and Malcolm L. H. Green. Physica Status Solidi C 7 (11-12) 2739-2742 (2010)

Filled and glycosylated carbon nanotubes for in vivo radioemitter localization and imaging. Sung You Hong, Gerard Tobias, Khuloud T. Al-Jamal, Belén Ballesteros, Hanene Ali-Boucetta, Sergio Lozano-Pérez, Peter D. Nellist, Robert B. Sim, Ciara Finucane, Stephen J. Mather, Malcolm L. H. Green, Kostas Kostarelos and Benjamin G. Davis. Nature Materials 9, 485–490 (2010)

pH-triggered release of materials from carbon nanotubes using functionalized fullerenes as removable "corks". Patraporn Luksirikul, Belén Ballesteros, Gerard Tobias, Mark G. Moloney and Malcolm L. H. Green. Carbon 48, 1912-1917 (2010)

Led by Dr. Nikolaos Kehagias, the Nanofabrication Division was formed in 2010 and focuses on the design and development of nanofabrication methods and techniques for nanoscience and nanotechnology research and applications. The mission of the Division is two-fold: (a) to create and provide a flexible nanofabrication platform capable of processing a large variety of materials and substrates and (b) to provide high quality services to both internal and external users. An important task of the Division is to offer the opportunity for process development or prototyping of novel nanostructures and devices with the aim of transferring research output to commercial foundries. it is essential for the ICN fabrication division to combine lithography techniques and materials to support research in achieving high impact results.

RESEARCH ACTIVITIES & MILESTONES

The key to progress in nanoscience and nanotechnology is the ability to design and fabricate samples for the experimental work. In order to understand the fundamentals of the science fabrication of nanostructures in a variety of materials with accuracy in the nanometer scale and sometimes in the molecular scale is essential. To this effect the ICN Nanofabrication Division has infrastructure for different lithography methods, including lithography based on electron beams and focus ion beams, thermal and UV light-assisted nanoimprint lithography, self assembly techniques, metal evaporation techniques and etching processes. The ICN Nanofabrication Division supports the Institute's research groups in: nanoelectronics, nanophononics, nanophotonics, spintronics, nanobioelectronics and biosensors.

In this context during 2010, the Division has focused on 3 main research lines:
- Novel nanopatterning methods.
- Flexible processing.
- Collaboration with national and international entities.

Throughout the same year, Dr. Kehagias started research for the LAMAND – Large Area Molecularly Assembled Nanopatterns for Devices Project, awarded to his division in the year 2009 and funded by the European Commission. The concept of the project is to provide a manufacturable and verifiable process whereby functionalised macromolecular systems can act as a molecular factory for the placement of functional nanomaterials of precise dimension and structure over large substrate areas for the delivery of beyond state-of-the-art applications in the ICT sector.
In addition to the mentioned EU project Dr. Kehagias has established a joint research collaboration with a private company. This Project focuses on the development of conductive transparent electrode structures on flexible substrates which could be used for photovoltaic and/or light emitting displays. The fabrication processes focuses on nanoimprint based methods with the aim to scale up by employing roll to roll based techniques.

Besides the participation in the above mentioned projects the Division has strong collaborations with world leading companies and entities, among them: Intel (Ireland), Fiat Research Centre

(Italy), Microresist Technology GmbH (Germany), LTM-CNRS (Grenoble, France), VTT, Glasgow University, Tyndall National Institute, etc.

SERVICES

- Lithography: Thermal and UV Nanoimprint – Obducat 3 inch
- Lithography: Hot embossing machine.
- Lithography: UV Nanoimprinting module.
- Lithography: SEM/Litho – FEI/Raith
- Lithography: Self assembly growth set up.
- Deposition: Ebeam evaporator 1 (Au, Ag, Al, Cr, Ti, Pt, Al2O3) - AJA International
- Deposition: Ebeam evaporator 2 (magnetic materials) – AJA International
- Deposition: ITO-Molecular beam epitaxy
- Deposition: Sputter (Au) coater – Edmunds
- Deposition: Spin coater – Laurel
- Characterisation: Atomic force microscope – Veeco Instruments
- Characterisation: Optical microscope – Nikon Eclipse LV100
- Characterisation: Au ball bonder – Delvotek
- General: Plasma cleaner – PVA Tepla PS210
- General: Oven – Memmert
- General: Hot plates

KEY PUBLICATIONS AND INVITED TALKS 2010

Nanoimprinted plasmonic crystals for light extraction applications, V. Reboud, N. Kehagias, T. Kehoe, G. Leveque, C. Mavidis, M. Kafesaki and C. M. Sotomayor Torres, Microelectronic Engineering, 87, 5-8, 1367-1369 (2010)

Tuning the intensity of metal-enhanced fluorescence by engineering silver nanoparticle arrays, B. Yang, N. Lu, D. Qi, Renping Ma, Q. Wu, J. Hao, X. Liu, Y. Mu, V. Reboud, N. Kehagias, C. M. Sotomayor Torres, F. Yin Chiang Boey, X. Chen and L. Chi. Small 6(9) 1038-43 (2010)

PSSQ templates fabricated by RUVNIL technique for di-block copolymer graphoepitaxy, N. Kehagias, R. A. Farrell, M. Zelsmann, A. Francone, M. Chouiki, R. Schoeftner, V. Reboud, J. D. Holmes, M. A. Morris and C. M. Sotomayor Torres. Nanoimprint and nanoprint technology conference. Oresund & Copenhagen, Denmark, 13-15 October 2010. Poster

Fabrication of 2D and 3D metal structures by reverse transfer UV nanoimprint lithography, N. Kehagias, V. Reboud, T. Kehoe and C. M. Sotomayor Torres. Micro & Nano Engineering (MNE) conference, Genoa, Italy, 19-22 September 2010. Poster

Exciton-plasmon coupling in nanoimprinted plasmonic crystals for light extraction coupling, V. Reboud, G. Leveque, T. Kehoe, N. Kehagias, A. Z. Khokhar, N. Gadegaard and C. M. Sotomayor Torres. EIPBN conference, Anchorage, Alaska, USA, 1-4 June 2010. Talk

Optimized reactive ion etching for fabrication of PhoXonic crystals, D. Dudek, V. Reboud, N. Kehagias, J. Cuffe, F. Alsina and C. M. Sotomayor Torres. EIPBN conference, Anchorage, Alaska, USA, 1-4 June 2010. Poster

Surface-directed dewetting of a nanostructured block copolymer for fabricating highly uniform nanostructured micro-droplets and concentric nano-rings, R. A. Farrell, N. Kehagias, M. T. Shaw, V. Reboud, M. Zelsmann, J. D. Holmes, M. A. Morris and C. M. Sotomayor Torres, 2010 MRS Spring Meeting, San Francisco, USA, 5-9 April 2010. Talk

Combined top-down and bottom-up lithography techniques for the realisation of highly uniform polymeric nanostructures, N. Kehagias, R. A. Farrell, V. Reboud, M. Zelsmann, J. D. Holmes, M. A. Morris and C. M. Sotomayor Torres, INTERNATIONAL WORKSHOP: SOLID STATE LASERS. 50 YEARS AFTER, Tarragona, Spain, 17-20 March 2010. Talk

Led by Dr. Gustavo Ceballos, the Nanoscience Instrument Development Division was formed in 2010 and focuses on the design, development, improvement and deployment of advanced state-of-the-art instruments for nanoscience and nanotechnology. The main aim is the creation of an integrated scientific and technical platform with a highly qualified multidisciplinary team capable of addressing challenging instrumental projects both for basic nanoscience research as well as for nanotechnological applications. The Division acts as an active collaboration partner for ongoing experimental research efforts within the ICN and neighbouring research institutions, developing new leading-edge instruments and techniques, and providing valuable support for the potential migration of developed scientific instruments to commercial-ready technological products.

RESEARCH ACTIVITIES & MILESTONES

The development of scientific instruments is indispensable for scientific research. Over 70% of the Nobel Prizes in physics, chemistry, biology and medicine were achieved with the help of different kinds of advanced instruments. The advance of modern science and in particular nanotechnology will depend more and more on the development of scientific instruments and the ICN Nanoscience Instrument Development Division devotes efforts into this purpose.

Research activities include:

- Collaboration with the major research lines of the ICN.
- Collaboration with the Spanish Synchrotron Light Source (ALBA) and other neighboring research institutions.
- Further instrumental development.

SERVICES

The Division, once it has reached its final conformation, will offer a scientific and technical assistance based on a high qualified team of experts in applied physics, precision instrumentation, micro engineering, nanotechnology, metrology, scientific computing, and 3d-design of precision devices to address challenging instrumental projects both for basic nanoscience research as well as for applied technology.

KEY PUBLICATIONS AND INVITED TALKS 2010

Orbital specific chirality and homochiral self-assembly of achiral molecules induced by charge transfer and spontaneous symmetry breaking, A. Mugarza, N. Lorente, P. Ordejón, C. Krull, S. Stepanow, J. Fraxedas, G. Ceballos and P. Gambardella. Phys Rev Lett, 105 115702 (2010)

5.1.1 Daniel Maspoch

Functional Metal-Organic Nanotubes: Controlling the Composition, Dimensions and Shape through Template Synthesis.

From L to R: I. Imaz, M. González, C. Carbonell, D. Maspoch, I. Solè, J.A. Asensio, A. Carné and M. Rubio

The team's research interests are focused on controlling the supramolecular assembly of molecules, biomolecules and nanoscale building blocks at the nanometer scale for the design and synthesis of novel functional architectures. The use of supramolecular chemistry to control the fabrication of new nanomaterials is a key aspect for the future of Nanoscience and Nanotechnology. The team is interested in developing new technologies that enables the synthesis of complex integrated supramolecular assemblies and bioinspired architectures with unprecedented structures and interesting physical and biological properties. Supramolecular chemistry is used as the underlying approach for exploring new materials and applications, in several private companies, in diverse areas, including micro- and nanoencapsulation, drug-delivery systems, contrast agents and the development of novel sensors and magnetic platforms.

HIGHLIGHTS 2010

HIGHLIGHTED PUBLICATIONS

Controlling the number of proteins with Dip-Pen Nanolithography, E. Bellido, R. de Miguel, D. Ruiz-Molina, A. Lostao and D. Maspoch, Advanced Materials 2010, 22, 352-355.

Infinite coordination polymer particles as potential drug delivery systems, I. Imaz, M. Rubio-Martínez, L. García-Fernández, F. García, D. Ruiz-Molina, J. Hernando, V. Puntes and D. Maspoch, Chemical Communications 2010, 46, 4737-4739.

FUNDED PROJECTS

Long-lasting disinfectants, funded by MICINN – TRACE, agreement number: TRA2009-0370_01

NANO-SCENT, controlled release fragrances, funded by MICINN-TRACE, agreement number TRA2009-0325

NANOAQUA, use of nanospheres as a vehicle for the administration of immunostimulants in species of interest to aquaculture, funded by Proyectos Ramón Areces

CONTRACTS WITH COMPANIES

Encapsulation of biocides in in micro- and nonosystems to prolong the biocidal activity.

Encapsulation of fungal micro-and nanosystems, with a private company

Encapsulation of fragrances for textile applications.

First technology transference contract related to the **"Micro- and Nanoencapsulation Technology for Fragrances"** signed in February 25th of 2010 through which a private company and the Catalan Institut of Nanotechnolgy (ICN) establish a long-term research collaboration in the micro- and nanoencapsulation field.

5.1.2 Ernest Mendoza

During 2010 further research on the functionalisation of carbon nanotubes as well as their utilisation as electrochemical immunosensors was conducted. In addition, the first virus sensor based on autoassembled peptide nanotubes was developed. Collaborations were also undertaken in the development of a method for the micro/nanofabrication using wet lithography and in the study of the destiny of metallic nanoparticles in living organisms. Finally, a method for the synthesis of clusters of gold with very high catalytic activity was developed and patented.

Projects developed during 2010 were:

- Advanced Analysis Microsystems development by integrating micro/nano sensors and optic detectors, funded by MEC.
- Production of a recombinant hormone for veterinary application, funded by MEC.
- Synthesis scale-up gold clusters for catalysis applications, funded by ACC1Ó.
- Integrated Lab on a Chip Platforms for Medical Diagnosis, funded by MEC.

HIGHLIGHTS 2010

Bioinspired target-specific crystallization on peptide nanotubes for ultrasensitive pb ion detection, R. De la Rica, E. Mendoza and H. Matsui. SMALL, 6, 1735. 2010.

Fabrication of microelectrodes for biosensing applications by E. Mendoza at the MC2 Access Workshop. University of Chalmers. Goteborg, Sweden (2010) Invited talk.

Electrochemical immunosensors based on functionalised carbon nanotub – polymer composites by E. Mendoza, M. García-Villa, C. Jiménez-Jorquera and C.Fernández-Sánchez at Nanomedicine, BIT Lifesciences. Peking, China (2010) Invited talk.

P201030040 - Conductive materials by means of polymers functionalisation with conductor nanomaterials. Inventors: M. Gutiérrez Capitan, A. Llobera, C. Fernández-Sánchez y E. Mendoza. Solicitud: P201030040. Spain.

Co-chairman at the nanobioelectronics session from electronics, biology to medicine. Nanomedicine 2010 congress. (Pequí, Xina)

Dr. Ernest Mendoza left the ICN in 2010 to join the Centre de Recerca en Nanoenginyeria, UPC.

5.1.3 Aitor Mugarza

During 2010 scientific activity focused on the electronic and magnetic properties of nanostructures at the interface with metallic substrates. The research lines covered topics such as, organic and inorganic self-assembly, nanoeletronics and spintronics. The main technique used in the research was low temperature scanning tunnelling microscopy and spectroscopy using as well complementary techniques, such as: angle-resolved photoemission and X-ray circular magnetic dichroism, both carried out in synchrotron radiation facilities

HIGHLIGHTS 2010

The main scientific activity during 2010 focused on the study of the growth, electronic and magnetic properties of metal-organic molecules at the interface with metals. The study of the adsorption and self-assembly, and electronic and magnetic properties of metal phthalocyanines (MPc) on Ag(100) lead to several publications (1 Phys. Rev. Lett., 1 Phys. Rev. B).

• Electronic and magnetic properties of metal phthalocyanines:
The local electronic and magnetic properties of individual MPcs adsorbed in metallic surfaces were studied. Anomalous magnetic properties of the molecule were found at the interface with a metal, where spins can be induced at the organic ligand via charge transfer from the metallic substrate. The results provided essential information on spin coupling and relaxation channel mechanisms at moleculemetal interfaces.

• Modification of the electronic and magnetic properties of metal phthalocyanines by alkali doping:
Following the systematic investigation carried out with MPcs, the study extended to manipulatation of their electronic and magnetic structure by doping single molecules with Li atoms. A combined STM and XMCD study showed how magnetism in these molecules could be switch on and off, depending on the metal ion of the molecule.

Orbital specific chirality and homochiral self-assembly induced by adsorbate-substrate charge transfer in achiral molecules, A. Mugarza, N. Lorente, C. Krull, S. Stepanow, M.-L. Bocquet, P. Ordejón, J. Fraxedas, G. Ceballos and P. Gambardella, Phys. Rev. Lett., 105, 115702, (2010)

Giant spin and orbital moment anisotropies of a Cu-phthalocyanine monolayer, S. Stepanow, A. Mugarza, G. Ceballos, P. Moras, J. C. Cezar, C. Carbone and P. Gambardella, Phys. Rev. B, 82, 014405 (2010)

Correlated electrons step by step: Itinerant-to-localized transition of fe impurities in free-electron metal hosts, C. Carbone, M. Veronese, P. Moras, S. Gardonio, C. Grazioli, P. H. Zhou, O. Rader, A. Varykhalov, C. Krull, T. Balashov, A. Mugarza, P. Gambardella, S. Lebegue, O. Eriksson, M. I. Katsnelson and A. I. Lichtenstein, Phys. Rev. Lett., 104, 117601, (2010)

Exotic Kondo effect in metalorganic complexes controlled by ion-substrate interaction, A.Mugarza, C.Krull and P. Gambardella, Passion for Interfaces, September 27 - October 1, 2010, Donostia-San Sebastian (Spain). Oral.

Understanding the electronic and magnetic properties of metalorganic adsorbates with scanning tunnelling spectroscopy, Laboratoire Matériaux et Phénomènes Quantiques, Université Paris-Diderot, Paris (France), 20th May 2010.

Synchrotron experiments: **Molecular exchange bias,** ID8 beamline at ESRF, June 6-15, 2010.

Member of the scientific committee of: VII Congreso de Fuerzas y Túnel, September 27-29, 2010, Tarragona (Spain).

5.1.4 Carlos F. Sanz-Navarro

During 2010 four main goals were focused:

• Further improvements implementation in the in-house QM/MM code. In particular, some improvements in the methodology for reducing the computational cost considerably and an efficient parallelisation of the SIESTA code. The new version of the QM/MM was tested in typical model systems to test the accuracy of the approach: “An efficient implementation of a QM–MM method in SIESTA”, C.F. Sanz-Navarro et al., Theor. Chem. Acc. DOI: 10.1007/s00214-010-0816-5.

• Further work on binding of gold clusters, which started in 2009, over all 2010.
Several orientations of the gold cluster with respect to the graphite surface were simulated. Some of the simulations were extremely slow to converge.

• In collaboration with the 6-month visiting postdoc, Dr. Ermin Malic, and Prof. Pablo Ordejón, the dipole induced on the spiro and mero forms of an azobenzene-based chromophore were calculated. The final goal was the study of this system as an individual transistor in optoelectronic devices. Different techniques were used to calculate the dipole: hydrogen termination of the carbon nanotube, capped nanotubes, hydrogen termination following the Clar’s sextet rule [M. Baldoni et al, Chem. Phys. Lett. 464, 202 (2008)] and the Berry’s phase. Only the latter two methods provided reliable values and their results were published later that year.

• A new collaboration with Dr. Manolo Pastor, leader of the Computer Drug Design Lab at the PRBB, was initiated at the end of 2010. The goal was to study the effect of the change in the hybridisation of selected ligands in the active site of target proteins. Classical MD simulations based on the ReaxFF force field as well as DFT calculations were carried out. The ReaxFF parametrisation developed over 2008-2009 was employed.

HIGHLIGHTS 2010

The work resulted in the following publications and presentations:

Molecular dynamics simulations of metal clusters supported on fishbone carbon nanofibers, C. F. Sanz-Navarro, P.-O. Åstrand, D. Chen, M. Rønning, A. C. T. van Duin and W. A. Goddard III, J. Phys. Chem. C 114, 3522-3530, 2010.

An efficient implementation of a QM-MM method in SIESTA, C. F. Sanz-Navarro, R. Grimali, A. García, E. A. Bea, A. Soba, J. M. Cela and P. Ordejón. Theoretical Chemistry Accounts. DOI: 10.1007/s00214-010-0816-5.

Poster at the Workshop Cecam “Approximate Quantum-Methods: Advances, Challenges & Perspective”, held in Bremen, Germany, September 2010.

5.1.5 Albert Verdaguer

Study of the influence of water adsorption on electrostatic properties of surfaces at nanometer scale using Scanning Polarization Force Microscopy (SPFM), Kelvin Probe Force Microscopy (KBFM) and Molecular Dynamics (MD) simulations.

Wetting phenomena are related to the contact between liquids and solids. The properties of the liquid-solid interface determine to a large extent the way the whole system interacts with the environment. Any surface under ambient conditions is covered by a thin film of water, from a monolayer to many molecular layers depending on the conditions and the substrate. The main objective of the project is to study the effect of these liquid films on the surface properties of different materials. One part of the project focuses on the study of water adsorption effects on ionic crystals. Various tools and methodologies (MD, SPFM, KPM, etc.) have been used to study the molecular mechanisms that could explain the experimental observations. Another part of the project applied SPFM/KPM to two important questions in different scientific areas: the study of surface anion segregation on alkali halide solutions and the study of the degradation of selfassembled monolayers due to water adsorption on defects.

HIGHLIGHTS 2010

Two-dimensional wetting: the role of atomic steps on the nucleation of thin water films on BaF2(111) at ambient conditions, M. Cardellach, A.Verdaguer, J. Santiso and J. Fraxedas. J. Chem. Phys. 132, 234708 (2010)

Charging and discharging of graphene in ambient conditions: a scanning probe microscopy study by A. Verdaguer, J.Fraxedas, M. Cardellach, J.J. Segura, J. Moser, A. Bachtold, M. Zdrojek and G.M. Sacha at the XXVII ECOSS Conference. Groningen, Holland (2010) Communication presentation

Amphilic organic crystals by J.J. Segura, A. Verdaguer, M. Cobian, R. Hernández and J. Fraxedas at the XXVII ECOSS Conference. Groningen, Holland (2010) Communication presentation

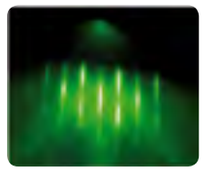
Thin water films grown at ambient conditions on BaF2(111) and CaF2(111): the role of steps and lattice mismatch in the stabilization of ice-like structures by M. Cardellach, A. Verdaguer, J.J. Segura and J.Fraxedas at the XXVII ECOSS Conference. Groningen, Holland. (2010) Poster

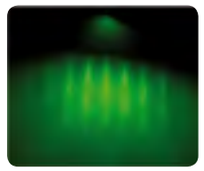
Loading and downloading of graphene sheets under ambient conditions studied by scanning probe microscopy by A. Verdaguer, J.Fraxedas, M. Cardellach, J.J. Segura, J. Moser, A. Bachtold, M. Zdrojek, G. Sauthier and G.M. Sacha at the Fuerzas y Tunel 2010 congress. Tarragona, Spain. (2010) Poster

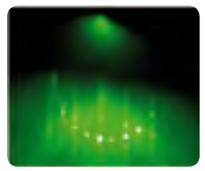
Amphiphilic character study of L-alanine with AFM by J.J. Segura, A. Verdaguer, M. Cobian, R. Hernández and J. Fraxedas at the Fuerzas y Tunel 2010 congress. Tarragona, Spain. (2010) Communication presentation.

Stabilization of ice structures on BaF2 (111) and CaF2 (111) surfaces: the importance of the network parameter and steps by M. Cardellach, A. Verdaguer, J.J. Segura and J.Fraxedas at the Fuerzas y Tunel 2010 congress. Tarragona, Spain. (2010) Communication presentation.

Dr. A. Verdaguer left the ICN in 2010 to join the CIN2.







Through the CIN2 collaboration with CSIC, the ICN has placed quite a number of young researchers in Groups led by senior CSIC scientists. This form of collaboration serves to augment the capabilities of the research groups and enables the researchers to take advantage of the resources made available by both organisations.

In 2010, three of our ICREA professors, two ICN funded Ramón y Cajal researchers, 3 doctoral students and a doctored technician were collaborating with the following CSIC Research Groups;

- Nanobiosensors and Bioanalytical Applications, led by Dr. Laura M. Lechuga.
- Nanostructured Functional Materials, led by Dr. Daniel Ruiz-Molina.
- Small Molecules on Surfaces in Ambient and Pristine Conditions, led by Dr. Jordi Fraxedas.
- PLD & Nanoionics, led by Dr. Jose Santiso
- Theory and Simulation, led by Dr. Pablo Ordejón

COLLABORATIVE GROUPS MOST RELEVANT PUBLICATIONS

Effect of crystalline disorder on quantum tunneling in the single-molecule magnet mn12 benzoate, C. Carbonera, F. Luis, J. Campo, J. Sánchez-Marcos, A. Camón, J. Chaboy, D. Ruiz-Molina, I. Imaz, J. van Slageren ,S. Dengler and M. González. Phys. Rev. B, 81, 014427 (2010)

Coordination polymer particles as potential drug delivery systems, Inhar Imaz, Marta Rubio-Martínez, Lorena García-Fernández, Francisca García, Daniel Ruiz-Molina, Jordi Hernando, Víctor Puntes and Daniel Maspoch Chem. Commun. , 46, 4737 - 4739 (2010)

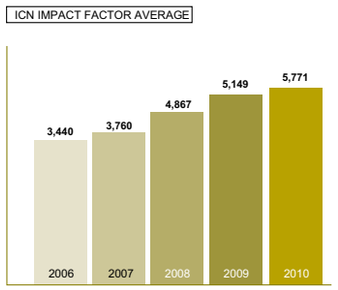
Orbital specific chirality and homochiral self-assembly of achiral molecules induced by charge transfer and spontaneous symmetry breaking, A. Mugarza, N. Lorente, P. Ordejón, C. Krull, S. Stepanow, M.-L. Bocquet, J. Fraxedas, G. Ceballos and P. Gambardella. Phys. Rev. Lett. , 115702, 105 (2010)

Metal-radical chains based on polychlorotriphenylmethyl radicals: synthesis, structure, and magnetic properties Nans Roques, Neus Domingo, Daniel Maspoch, Klaus Wurst, Concepció Rovira, Javier Tejada, Daniel Ruiz-Molina and Jaume Veciana Inorg. Chem, 49 (7), 3482–3488 (2010)

Nanoscale positioning of inorganic nanoparticles using biological ferritin arrays fabricated by dip-pen nanolithography, Elena Bellido, Rocío de Miguel, Javier Sesé, Daniel Ruiz-Molina, Anabel Lostao and Daniel Maspoch, Scanning, 32, 35-41 (2010)

6.1 Publications

The number, quality and relevance of publications produced by the researchers that form the ICN continue to grow strongly year upon year as can be seen in the following graphs:



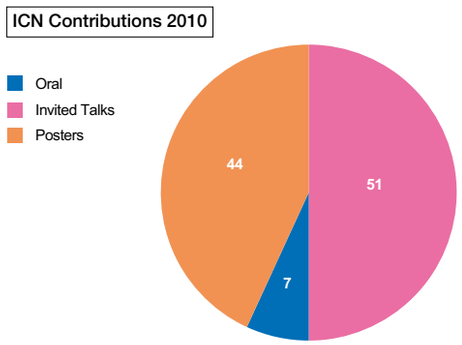
IMPACT FACTOR

Ranking Position	Journal Publication	Number of Papers	Impact Factor
1	Science	1	29.747
2	Nature Materials	2	29.504
3	Nature Nanotechnology	1	26.309
4	Materials Today	1	11.452
5	Nano Letters	1	9.991
6	Journal of the American Chemical Society	2	8.580
7	Advanced Materials	1	8.379
8	ACS Nano	6	7.493
9	Physical Review Letters	3	7.328
10	Advanced Functional Materials	3	6.990
11	Small	3	6.171
12	Nanotoxicology	1	5.744
13	Chemical Communications	2	5.504
14	Biosensors & Bioelectronics	4	5.429
15	Chemistry of Materials	1	5.368
16	Analytical Chemistry	1	5.214
17	Journal of Materials Chemistry	1	4.795
18	Inorganic Chemistry	1	4.657
19	Carbon	1	4.504
20	Nano Research	1	4.370
21	Electrochemistry Communications	2	4.243
22	Journal of Physical Chemistry C	4	4.224
23	Journal of Hazardous Materials	1	4.144
24	Physical Chemistry Chemical Physics	1	4.116
25	Langmuir	2	3.898
26	Applied Physics Letters	5	3.554
27	Physical Review B	14	3.475
28	New Journal of Physics	1	3.312
29	Analyst	1	3.272
30	Nanotechnology	1	3.137
31	Journal of Chemical Physics	1	3.093
32	Sensors and Actuators B	1	3.083
33	Electroanalysis	1	2.630
34	Theoretical Chemistry Accounts	1	2.584
35	Journal of Alloys and Compounds	1	2.135
36	Journal of Molecular Structure	1	1.551
37	Microelectronic Engineering	2	1.488
38	Journal of Materials Science	1	1.471
39	Scanning	1	1.256
40	International Journal of Nanotechnology	1	1.234
41	Journal of Molecular Structure: Teochem	1	1.216
42	Journal of Magnetism and Magnetic Materials	1	1.204
43	Physica Status Solidi B-Basic Solid State Physics	1	1.150

NUMBER OF INDEXED PUBLICATIONS: 89
IMPACT FACTOR AVERAGE: 5,771

6.2 Events Participation

During 2010 ICN researchers participated at various levels in 102 events related to Nanotechnology.



6.3 Events Organisation

ICREA WORKSHOP ON PHONON ENGINEERING 2010,
Sant Feliu de Guixols , Girona, Spain – May 24 -27, 2010
68 Participants, 28 Oral contributions and 28 Posters.

NANOJASP 2010, Nanomaterials based Biosensors and Biosystems. Improving the quality and security of citizen's life.
Workshop SPAIN-JAPAN, Barcelona – November 29 -30, 2010. 65 Participants, 24 Oral contribution and 38 Posters.

IV Jornada AIN – Aplicaciones Industriales de la Nanotecnología
Casa Llotja de Mar, Barcelona – June 9th, 2010
298 Participants, 14 Oral contributions, 39 Posters, 5 AIN Award proposals presented and 4 Debates.

7 PROJECTS

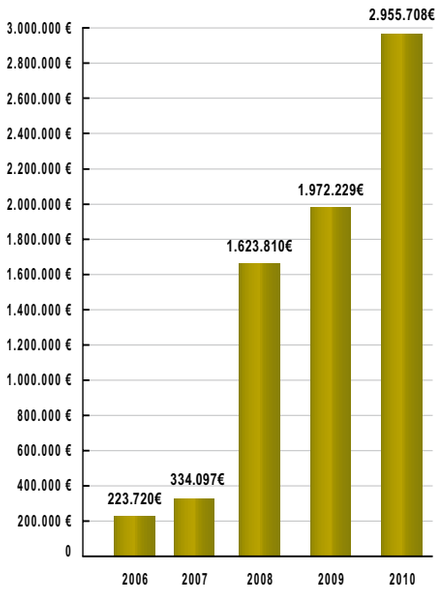
Competitive research funding is vital not only for the financial viability of the ICN but also as an indicator of the quality and international competitiveness of its research activities.

The ICN measures project funding growth using Average Annualised Funding, which is the sum of the total funds awarded in a project divided by each project lifespan, in order to account for fluctuations in grant concessions and varying project length. As can be seen in the chart, this funding continued to grow in 2010, with most new funding coming from a series of new national research projects.

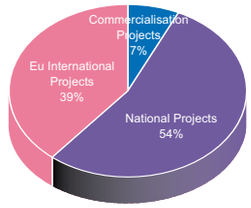
Particularly pleasing was the continued strong growth in competitive funding secured for commercialisation projects, to help transfer ICN-developed technologies from the laboratory into a commercial setting.

	2006	2007	2008	2009	2010
Average Competitive Funds € (of active projects)					
EU	474.044	470.591	4.829.217	4.950.458	5.316.686
NATIONAL	483.253	572.189	1.351.993	1.659.785	3.746.313
COMERCIAL		30.000	319.633	653.404	974.606
TOTAL	**957.297**	**1.072.780**	**6.500.842**	**7.263.647**	**10.037.606**
Average Project Length (years weighted by project funds)					
EU	3,8	3,4	4,3	4,2	3,7
NATIONAL	4,8	3,1	3,3	2,7	3,2
COMERCIAL		2,0	2,6	2,1	2,2
TOTAL	**4,3**	**3,2**	**4,0**	**3,7**	**3,4**
Average Annualised Funding (€/years)					
ICN	**223.720**	**334.097**	**1.623.810**	**1.972.229**	**2.955.708**

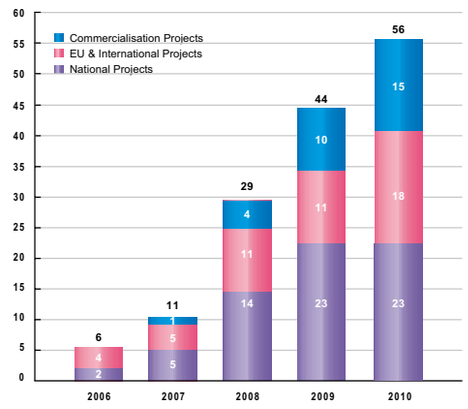
ICN Average annualised approved competitive funding



New ICN Competitive Funding in 2010



Number of active ICN projects



8 MANAGEMENT AND SERVICES

From L. to R.: J. Vela, S. Domene, A. Rodríguez, R. Juan, I. Caño, O. Cardenal, A. de la Osa, C. G. Domínguez, J. Reverter, O. Fernández, M. Pueyo, S. Veciana, M. Balza, B. Kogon, X. Ros, X. Borrisé and B. Ballesteros.

Absent: N. Baruch, C. Bértier, R. Cosialls, I. Chavarría, M. Ferres, F. García, M. González, N. R. Guerrero, M. Lechado, J. Nares, A. Puig, L. Solé and D. Tienda.

The management and services team of the ICN performs a wide range of functions and provides numerous support services to the Research Groups. Management is led by the ICN Manager, Matias Pueyo, supported by the Strategy and Development Manager, Boaz Kogon, and comprises several departments;

Finance – responsible for daily accounting activities and travel bookings.

IT – responsible for all IT services both for ICN and CIN2.

General Services – responsible for building services and general maintenance both for ICN and CIN2.

Communication – responsible for internal and external communication and marketing activities.

Project Management – responsible for administrative management of competitive projects.

Technology Transfer – responsible for commercial relationships and patents.

HR - responsible for managing personnel contracts, training and related issues.

During 2010 the ICN grew from 121 to 135 people, with a corresponding increase in activity across all administrative areas. Systems development continued, with further modules of SAP brought online, a new website launched, and projects initiated to select intranet and CRM platforms.

CIN2

The collaboration with CSIC is managed by Ramon Cosialls, and the CIN2 management team includes a number of other ICN personnel covering administrative and communication roles.

External Services

During 2010, thanks to the new capabilities provided by the SAP system, the ICN made significant progress in internalising a number of financial functions that were previously externalised. Also, in order to cope with the increasing complexity and number of legal issues, external legal services were shifted from the FUAB to highly specialised legal bureaus in the areas of technology commercialisation, human resources and public sector contracting.

9.1 Financial accounts 2010

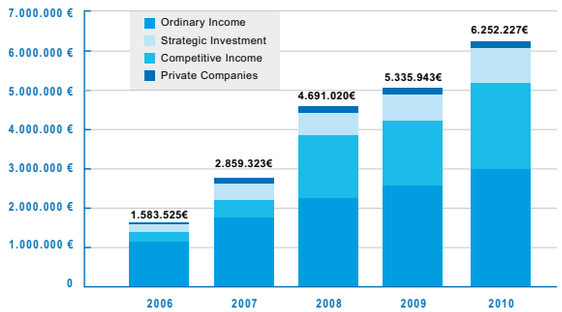
The financial statements for 2010 are written in accordance with the Spanish General Accounting Plan 2007.

The operating budget of ICN is composed of revenues from contributions from public administrations and agencies, Competitive Grants and income from companies (technology transfer).

These revenues fund the operational activities of the Institute. The main items are personnel costs, general operating expenses and depreciation.

The annual result was a surplus of 89.822€

Evolution of ICN funds

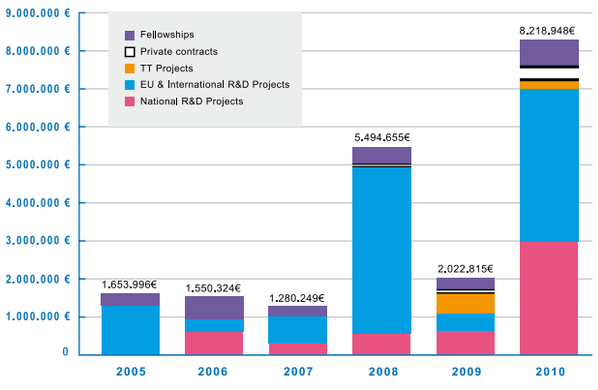


	2.010
Ordinary Income:	2.996.547€
Strategic Investment:	911.837€
Competitive Income:	2.174.239€
Private Companies	169.605€
Total Incomes	6.252.227€

9.2 International competitiveness

A key objective of the ICN is to be highly competitive at the International level, both in the quality of science produced and the levels of competitive funding secured. To date the ICN hast secured competitive funding from a number of entities, including the European Commission, ACC1Ó, Spanish Ministry of Science and Innovation (MICINN), The Catalan Agency of Support for Universities and Research (AGAUR).

Competitive funds awarded



ICN has to date signed 5 contracts for technology transfer with private companies. The total funding committed from both competitive research projects and technology transfer reached €8,2 million in 2010.

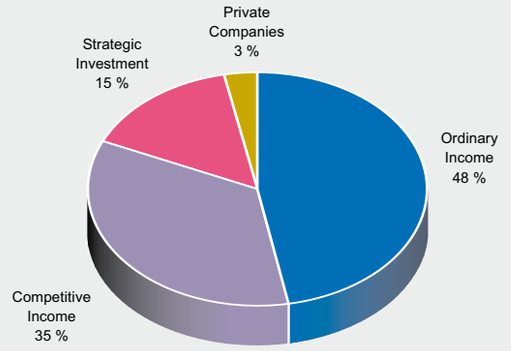
9.3 Income

The total revenue for 2010: €6.252.227, from 4 main sources.

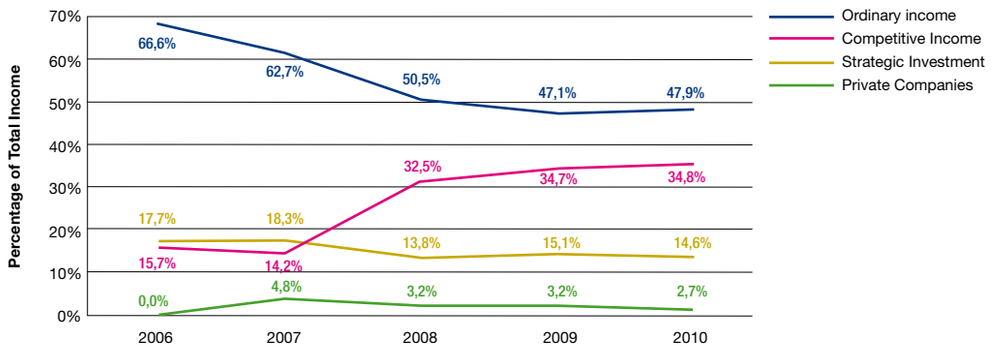
Ordinary income: Funds that finance management structure and services of the institute.
Competitive Income: Funds that finance research projects, which have been obtained in competitive funding from the European Union, ministries and regional governments.
Strategic Investment: Funds from the EU, or Generalitat, which finance the institute's technological infrastructure.
Private Companies: Funds from technology transfer, events, and activities funded by private companies.

	2010
TOTAL INCOME:	**6.252.227 €**
Ordinary Income:	**2.996.547 €**
Generalitat de Catalunya	2.603.517 €
Ministerio de Ciencia e Innovación	393.030 €
Competitive Income:	**2.174.239 €**
Generalitat de Catalunya	220.276 €
Ministerio de Ciencia e Innovación	809.797 €
European Commission	1.144.166 €
Strategic Investment:	**911.837 €**
Generalitat de Catalunya	464.877 €
Ministerio de Ciencia e Innovación	99.366 €
European Commission	347.594 €
Tech Transfer & Services:	**169.605 €**

Income 2010



Evolution of Income Sources



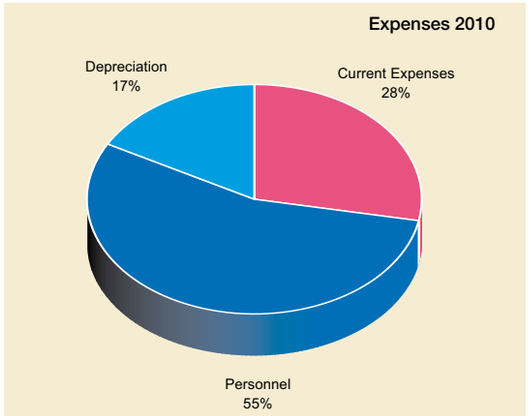
9 FINANCE

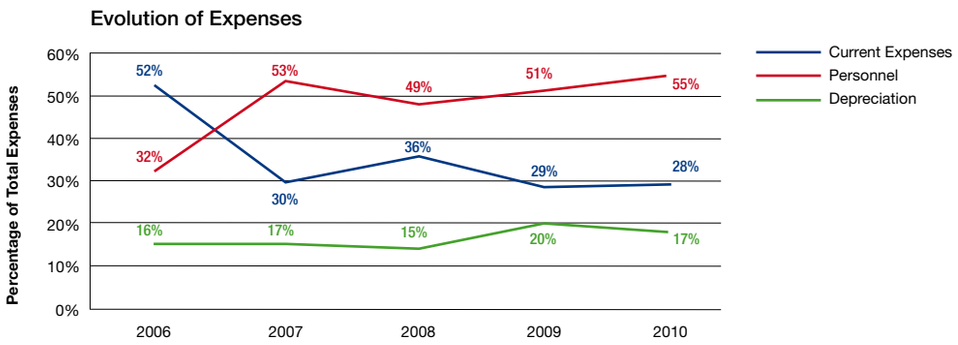
9.4 Expenses

Total expenditures for the year were €6.162.405. These are classified as follows:

Project expenses: Expenses necessary to implement research and technology transfer: these include current expenses, staff costs and depreciation of equipment and installations.
Ordinary expenses: Expenses that fund management structure and services, the composition of spending is current expenditure, staff costs and depreciation.

	2010
EXPENSES:	**6.162.405 €**
Project Expenses:	**2.154.366 €**
Current Expenses	620.531 €
Personnel	1.352.030 €
Depreciation	181.806 €
Ordinary Expenses:	**4.008.039 €**
Current Expenses	1.106.125 €
Personnel	2.041.644 €
Depreciation	860.270 €



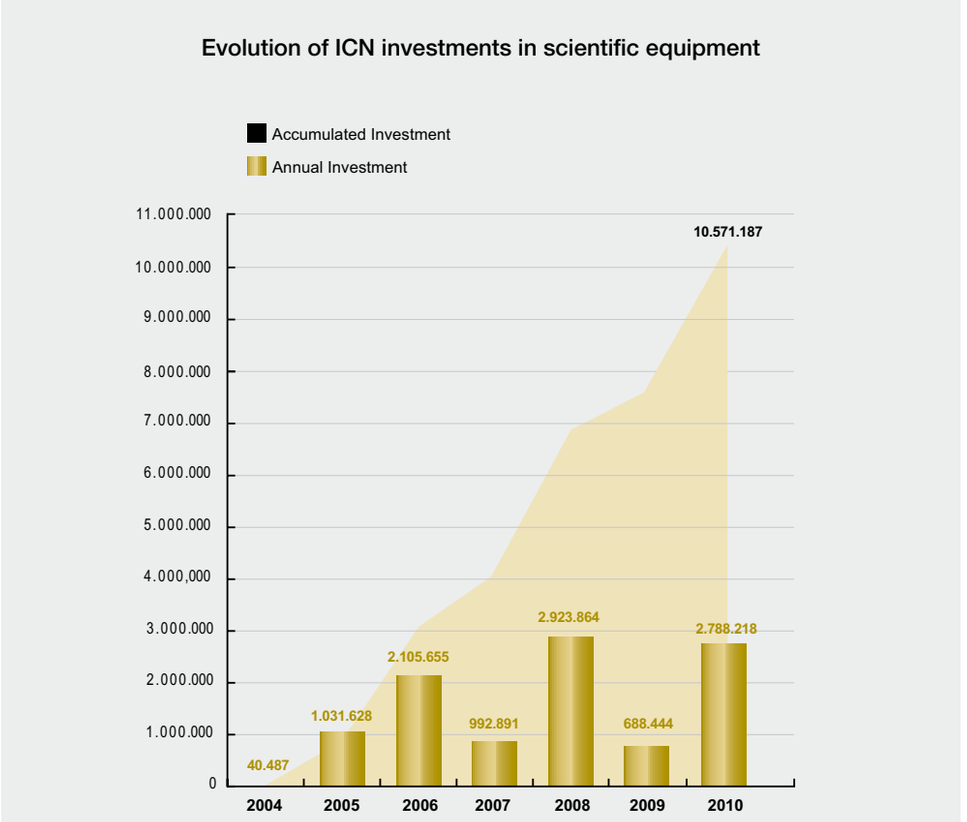


FACILITIES AND EQUIPMENT 10

During 2010, the ICN initiated investment of €2.1 million in scientific infrastructure and common services via the European Union funded PO FEDER Catalunya 2007-2013 program.

The amount was dedicated to establishing a state-of-the-art Electron Microscopy facility with four FEI microscopes, together with the purchase of a MOKE measuring system, an HE3 cryo-stat and a liquid helium system, among other .

The contracts were awarded following a lengthy public tender process which began in 2009.



11 TECHNOLOGY TRANSFER

The ICN TTO (Technology Transfer Office) grew in 2010 with the incorporation of a TT Officer.

During 2010 the following actions were taken:

- A new Spanish patent was filed and three French patents were filed in co-ownership with CNRS.
- 6 new technologies were evaluated, of which four proceeded to patent filings, one was withdrawn and one continued in feasibility study.
- A Spanish patent was granted on July 28th 2010.
- The first Know-How licensing agreement was signed on March 1st 2010, related to the encapsulation for textile applications. A long-term R&D agreement was also signed to apply the technology to other products of the company.
- Significant efforts were devoted to the assessment of new technologies and the commercialisation of existing ones. As a result, ICN actively participated in several congresses, workshops and partnering events: Nanospain (Malaga), BIO (Chicago), Gennesys (Barcelona), Nanofutures (Gijón), Nanotech NSTI (Anaheim), European Biotechnology Meeting (Montpellier) and Biocat Forum (Barcelona).
- 11 oral presentations and 6 posters were presented.
- 16 NDA contracts were signed.
- 15 collaboration projects with companies and institutions were formalised.
- Contacts with international institutions were initiated: Canadian University of Victoria, National Cancer Institute (NCI), Korean Institute of Science and Technology (KIST) and the University of California, Los Angeles-California NanoSystems Institute (UCLA-CNSI).
- 4 AGAUR VALOR project applications were submitted, one of them granted in collaboration with UAB.
- A RECERCAIXA project was applied for and granted.
- 7 previously granted ACC1Ó-AGAUR VALTEC and VALOR projects continued activity during 2010.
- 4 R&D contracts with private companies were signed, 3 new and 1 extension.
- Organised and hosted the 4th AIN workshop (Industrial Applications of Nanotechnology) on June 9th, in collaboration with INA (Nanoscience Institute)

APPENDIX 12

12.1 Personnel (by department)

Department	Position
Jordi Pascual	Director
MANAGEMENT AND SERVICES	
Marta Balza	Project Manager
Noemí Baruch	Group Project Manager
Stewe Bekk	Project Manager
Xavier Borrisé	Technical Engineer
Laura Camarero	Assistant
Inmaculada Caño	Travel responsible
Oscar Cardenal	IT Systems Engineer
Ramon Cosialls	CIN2 Manager
Ana de la Osa	Communication Officer
Sandra Domene	Suppliers Responsible
Carlos Germán Domínguez	Maintenance Technician
Oliver Fernández	IT Assistant
Marta Ferres	Assistant
Carlo Ferri	Administration
Beatriz García	Assistant
Montserrat Garrés	Communication Officer
Marta González	Group Project Manager
Cristina Granadero	ICN Director Assistant
Jordi Hernando	IT Assistant
Rosa Juan	Human Resources Manager
Boaz Kogon	Strategy and Development Manager
Miguel Lechado	Assistant
Cecilia López	Group Project Manager
Javier Nares	Accountant
Matias Pueyo	Managing Director
Anna Puig	Group Project Manager
Jordi Reverter	Technology Transfer Manager
Anabel Rodríguez	Assistant
Xavier Ros	General Services Manager
Libertad Solé	Technical Engineer
Dulce Tienda	CIN2 Director Assistant
Stella Veciana	European Project Manager
Judit Vela	Accountant

Department	Position
ATOMIC MANIPULATION AND SPECTROSCOPY GROUP - ICREA Prof. Pietro Gambardella	
Pietro Gambardella	ICREA Research Professor and Group Leader
Santos Francisco Alvarado	Post-doctoral researcher
Gerard Ariño	Student
Timofey Balashov	Post-doctoral researcher
Kevin Garello	Post-doctoral researcher
Jerald Kavich	Post-doctoral researcher
Cornelius Krull	Doctoral student
Alberto Lodi Rizzini	Doctoral student
Jie Luan	Student
Joan Martínez	Student
Sonia Matencio	Doctoral student
Mihai Miron	Post-doctoral researcher
Corneliu Nistor	Post-doctoral researcher
Sergey Odintsov	Student
Marc Ollé	Doctoral student
Stefan Schmaus	Doctoral student
INORGANIC NANOPARTICLES GROUP - ICREA Prof. Víctor Puntes	
Víctor Franco	ICREA Research Professor and Group Leader
Martí Busquets	Doctoral student
Eudald Casals	Doctoral student
David Casas	Student
Joan Comenge	Doctoral student
Lorena García	Doctoral student
Edgar Emir González	Doctoral student
Stephanie Lim	Post-doctoral researcher
Xicotencatl López	Post-doctoral researcher
Zoe Anna Megson	Doctoral student
Isaac Ojea	Post-doctoral researcher
Miriam Varón	Doctoral student
MAGNETIC NANOSTRUCTURES GROUP - ICREA Prof. Josep Nogués	
Josep Nogués	ICREA Research Professor and Group Leader
Marta Estrader	Post-doctoral researcher
Alberto López	Doctoral student

Department	Position
NANOBIOELECTRONICS AND BIOSENSORS GROUP - ICREA Prof. Arben Merkoçi	
Arben Merkoçi	ICREA Research Professor and Group Leader
Gemma Aragay	Doctoral student
Luis Miguel Baptista	Doctoral student
Miquel Cadevall	Student
Welter Cantanhede	Post-doctoral researcher
Serdar Çevik	Doctoral student
Wilanee Chunglok	Student
Alfredo de la Escosura	Post-doctoral researcher
Marisol Espinoza	Doctoral student
Maria Guix	Doctoral student
Nikolas Kleovoulou	Doctoral student
Adaris Maria López	Doctoral student
Marisa Maria V. Maltez	Doctoral student
Sergio Marín	Post-doctoral researcher
Carmen Clotilde Mayorga	Post-doctoral researcher
Mariana Medina	Doctoral student
Sandrine Miserere	Post-doctoral researcher
Helena Montón	Doctoral student
Claudio Parolo	Doctoral student
Briza Pérez	Post-doctoral researcher
Maëlle Perfezou	Student
Tiziana Placido	Doctoral student
Lourdes Josefina Rivas	Doctoral student
PHONONIC AND PHOTONIC NANOSTRUCTURES GROUP - ICREA Prof. Dr. Clivia M. Sotomayor	
Clivia M. Sotomayor	ICREA Research Professor and Group Leader
Francesc Alzina	Post-doctoral researcher
Joel Betorz	Student
(Pierre-) Olivier Chapuis	Post-doctoral researcher
Emigdio Chávez	Doctoral student
Cristian Cisneros	Student
John Cuffe	Doctoral student
Damian Dudek	Post-doctoral researcher
Yamila García	Post-doctoral researcher
Jordi Gómis	Post-doctoral researcher

Department	Position
Javier Jiménez	Student
Timothy Kehoe	Post-doctoral researcher
Vincent Reboud	Post-doctoral researcher
Lars Schneider	Technical Engineer
PHYSICS AND ENGINEERING OF NANODEVICES - ICREA Prof. Sergio O. Valenzuela	
Sergio Valenzuela	ICREA Research Professor and Group Leader
German Bridoux	Post-doctoral researcher
Marius Costache	Post-doctoral researcher
Ingmar Neumann	Doctoral student
Joris Van De Vondel	Post-doctoral researcher
QUANTUM NANOELECTRONIC DEVICES GROUP - Prof. Dr. Adrian Bachtold	
Adrian Bachtold	ICN Professor
Ali Afshar	Doctoral student
Julien Chaste	Post-doctoral researcher
Alexander Eichler	Post-doctoral researcher
Joel Moser	Post-doctoral researcher
Stephanie Pons	Student
Giuseppe Schiavone	Doctoral student
Marianna Sledzinska	Doctoral student
Ioannis Tsioutsios	Doctoral student
Mariusz Zdrojek	Post-doctoral researcher
THEORETICAL AND COMPUTATIONAL NANOSCIENCE GROUP - ICREA Prof. Stephan Roche	
Stephan Roche	ICREA Research Professor and Group Leader
ELECTRON MICROSCOPY DIVISION	
Belén Ballesteros	Technical Engineer
NANOFABRICATION DIVISION	
Nikolaos Kehagias	Technical Engineer
NANOSCIENCE INSTRUMENT DIVISION	
Gustavo Ceballos	Technical Engineer

Department		Position
RAMÓN Y CAJAL RESEARCHERS		
Inhar Imaz	Supramolecular NanoChemistry & Materials	Ramón y Cajal
Daniel Maspoch	Supramolecular NanoChemistry & Materials	Ramón y Cajal
Ernest Mendoza	Nanobiosensors and Bioanalytical Applications	Ramón y Cajal
Aitor Mugarza	Atomic Manipulation and Spectroscopy Group	Ramón y Cajal
Carlos Sanz Navarro	Theory and Simulation	Ramón y Cajal
Albert Verdaguer	Small molecules on surfaces in ambient and pristine conditions	Ramón y Cajal
RESEARCHERS IN COLLABORATIVE GROUPS		
Javier Ariñez	Supramolecular NanoChemistry& Materials	Doctoral student
Juan Antonio Asensio	Supramolecular NanoChemistry & Materials	Post-doctoral researcher
Antonia Maria Cano	Supramolecular NanoChemistry & Materials	Post-doctoral researcher
Carlos Carbonell	Supramolecular NanoChemistry & Materials	Doctoral student
Mar Cardellach	Small molecules on surfaces in ambient and pristine conditions	Doctoral student
Arnau Carné	Supramolecular NanoChemistry & Materials	Doctoral student
Ana Belen González	Nanobiosensors and Bioanalytical Applications	Doctoral student
Lidia Pinilla	Supramolecular NanoChemistry & Materials	Student
Kevin Ponce	Supramolecular NanoChemistry & Materials	Student
Leonor Rodrigues	Nanobiosensors and Bioanalytical Applications	Doctoral student
Gal.la Rouras	Supramolecular NanoChemistry & Materials	Student
Marta Rubio	Supramolecular NanoChemistry & Materials	Doctoral student
Àngels Ruyra	Supramolecular NanoChemistry & Materials	Doctoral student
Javier Saiz	Nanostructured Functional Materials	Doctoral student
Isabel Solé	Supramolecular NanoChemistry & Materials	Post-doctoral researcher

Most relevant publications (by impact factor)

Experimental spin ratchet, M.V. Costache and S.O. Valenzuela, Science 330, 1645 (2010)

Current-driven spin torque induced by the Rashba effect in a ferromagnetic metal layer, M. Miron, G.Gaudin, S. Auffret, B. Rodmacq, A. Schuhl, S. Pizzini, J. Vogel and P. Gambardella. Nature Materials 9, 230 (2010)

Filled and glycosylated carbon nanotubes in vivo radioemitter localisation and imaging, S. Y. Hong, G. Tobias, K. T. Al-Jamal, B. Ballesteros, H. Ali-Boucetta, S. Lozano-Perez, P. D. Nellist, R. B. Sim, C. Finucane, S. J. Mather, M. L. H. Green, K. Kostarelos and B. G. Davis. Nature Materials, 9, 485–490 (2010)

Making flexible magnetic aerogels and stiff magnetic nanopaper using cellulose nanofibrils as templates, R. T. Olsson, M.A.S. Aziz, G. Salazar, L. Belova, V. Ström, L. A. Berglund, O. Ikkala, J. Nogués and U. W. Gedde. Nature Nanotechnology 5, 584-588 (2010)

Immunosensing using nanoparticles, A. de la Escosura-Muñiz, C. Parolo and A. Merkoçi. Materials Today 13, p. 24-34 (2010)

Synthesis of platinum cubes, polypods, cuboctahedrons and raspberries assisted by cobalt nanocrystals, S.I. Lim, I. Ojea-Jiménez, M. Varón, E. Casals, J. Arbiol and V. Puntes. Nano Letters 10, 964-973 (2010)

Spin and orbital magnetic moment anisotropies of monodispersed bis (phthalocyaninato) terbium on a copper surface, S. Stepanow, J. Honolka, P. Gambardella, L. Vitali, N. Abdurakhmanova, T.C. Tseng, S. Rauschenbach, S. L. Tait, V. Sessi, S. Klyatskaya, M. Ruben and K. Kern. Journal of the American Chemical Society, 132, 11900 (2010)

Controlling the number of proteins with dip-pen nanolithography, E. Bellido, R. de Miguel, D. Ruiz-Molina, A. Lostao and D. Maspoch. Advanced Materials 22, 352-355 (2010)

Electron-hole transport asymmetry and conduction gaps in edge-defected graphene nanoribbons, S. Dubois, J. C. Charlier, A. López-Bezanilla, A. Cresti, F. Triozon, B. Biel and S. Roche. ACS Nano 4, 1971-1976 (2010)

Time evolution of the nanoparticle protein corona, E. Casals, T. Pfaller, A. Duschl, G. J. Oostigh and V. Puntes. ACS Nano, 4, 3623-3632 (2010)

Ozone Treatment of Graphene : A Route towards the Control of Metal-insulator Transition, N. Leconte, J. Moser, P. Ordejón, H. Tao, F. Alsina, A. Lherbier, C. M. Sotomayor Torres, J. C. Charlier, A. Bachtold and S. Roche. ACS Nano 4, 4033 (2010)

Damaging graphene with ozone treatment: a chemically tunable metal insulator transition, N. Leconte, J. Moser, P. Ordejón, H.H. Tao, A. Lherbier, A. Bachtold, F. Alzina, C. M. Sotomayor, J.C. Charlier and S. Roche. ACS Nano, 4, 4033-4038 (2010)

Correlating physico-chemical with toxicological properties of nanoparticles: the present and the future, P. Rivera Gil, G. Oberdörster, A. Elder, V. Puntes, W. J. Parak. ACS Nano, 4, 5527-5531 (2010)

Inelastic transport in vibrating disordered carbon nanotubes: scattering times and temperature dependent decoherence effects, H. Ishii, S. Roche, N. Kobayashi and H. Hirose. Phys. Rev. Lett. 104, 116801 (2010)

Correlated electrons step by step: itinerant-to-localized transition of Fe impurities in free electron metal hosts, C. Carbone, M. Veronese, P. Moras, S. Gardonio, C. Grazioli, P.H.Zhou, O. Rader, A. Varykhalov, C. Krull, T. Balashov, A. Mugarza, P. Gambardella, S. Lebeque, O. Eriksson, M. I. Katsnelson and A. I. Lichtenstein, Phys. Rev. Lett. 104, 117601 (2010)

Orbital specific chirality and homochiral self-assembly of achiral molecules induced by charge transfer and spontaneous symmetry breaking, A. Mugarza, N. Lorente, P. Ordejón, C. Krull, S. Stepanow, M.-L. Bocquet, J. Fraxedas, G. Ceballos and P. Gambardella. Phys. Rev. Lett. 105, 115702 (2010)

Nanocrystalline electroplated Cu-Ni: metallic thin films with enhanced mechanical properties and tunable magnetic behaviour, E. Pellicer, A. Varea, S. Pane, B. J. Nelson, E. Menéndez, M. Estrader, S. Suriñach, M.D. Baro, J. Nogués and J. Sort. Advanced Functional Materials, 20, 983-991 (2010)

Layer-by-layer all-inorganic quantum-dot-based LEDs: a simple procedure with robust performance, J.S. Bendall, M. Paderi, F. Ghigliott, N. Li Pira, G. Lambertini, V. Lesnyak, N. Gaponik, A. Eychmüller, C.M. Sotomayor Torres, G. Visimberg, M.E. Welland, C. Gieck, L. Marches, Advanced Functional Materials, 20 (19), 3298-3302 (2010)

Magnetic nanoparticles modified with carbon nanotubes for electrocatalytic magneto-switchable biosensing applications, B. Pérez and A. Merkoçi. Advanced Functional Materials, 21, 255-260 (2010)

Tuning the intensity of metal-enhanced fluorescence by engineering silver nanoparticle arrays, B. Yang, N. Lu, D. Qi, R. Ma, Q. Wu, J. Hao, X. Liu, Y. Mu, V. Reboud, N. Kehagias, C. M. Sotomayor Torres, F. Y. C. Boey, X. Chen, L. Chi, Small 6 (9), 1038-1043 (2010)

For a full list of publications during 2010, please visit our website, www.icn.cat.

EU & INTERNATIONAL PROJECTS 2010

Project title: LAMAND - Large area molecularly assembled nanopatterns for devices
Principal Researcher: Dr. Nikolaos Kehagias
Funding: European Comission

Project title: Microscopic role of magnetism in high temperature superconductivity
Principal Researcher: ICREA Prof. Pietro Garmbardella
Funding: National Science Foundation (USA)

Project title: NADINE - Nanosystems for the early diagnosis of neurodegenerative diseases
Principal Researcher: ICREA Prof. Arben Merkoçi
Funding: European Comission

Project title: NANOFUNCTION – Beyond CMOS nanodevices for adding functionalities to CMOS
Principal Researcher: ICREA Prof. Dr. Clivia M. Sotomayor
Funding: European Comission

Project title: Nano-ICT - Nano-scale ICT devices and systems coordination action
Principal Researcher: ICREA Prof. Dr. Clivia M. Sotomayor
Funding: European Comission

Project title: NANOPACK - Nano packaging technology for interconnect and heat dissipation
Principal Researcher: ICREA Prof. Dr. Clivia M. Sotomayor
Funding: European Comission

Project title: Nanoparticle-based sensors for detection of chemical and biological threats
Principal Researcher: ICREA Prof. Arben Merkoçi
Funding: NATO

Project title: NANOPOLYTOX – Toxicological impact of nanomaterials derived from processing, weathering and recycling of polymer nanocomposites used in various industrial applications
Principal Researcher: ICREA Prof. Víctor F. Puntes
Funding: European Comission

Project title: NanoPOWER - Nanoscale energy management for powering ICT devices
Principal Researcher: Dr. Pierre Olivier Chapuis
Funding: European Comission

Project title: NANOTEC - Ecosystems technology and design for nanoelectronics
Principal Researcher: ICREA Prof. Dr. Clivia M. Sotomayor
Funding: European Comission

Project title: NANOTOES - Nanotechnology: training of experts in safety
Principal Researcher: ICREA Prof. Víctor F. Puntes
Funding: European Comission

Project title: NaPANIL - Nanopatterning, production and applications based on nanoimprinting lithography
Principal Researcher: ICREA Prof. Dr. Clivia M. Sotomayor
Funding: European Comission

Project title: NOMAD - Nanoscale magnetization dynamic
Principal Researcher: ICREA Prof. Pietro Gambardella
Funding: European Comission

Project title: ONDA - Ordered hetero- and nano-structures with epitaxial dielectrics for magnetic and electronics applications
Principal Researcher: ICREA Prof. Josep Nogués
Funding: European Comission

Project title: Quantum devices based on carbon nanotubes
Principal Researcher: Prof. Dr. Adrian Bachtold
Funding: European Comission

Project title: Quantum probes based on carbon nanotubes
Principal Researcher: Prof. Dr. Adrian Bachtold
Funding: European Science Foundation

Project title: SEAL - Semiconductor equipment assessment leveraging innovation
Principal Researcher: Dr. Timothy Kehoe
Funding: European Comission

Project title: SM-DNA-repair
Principal Researcher: Ramón y Cajal Researcher Dr. Fernando Moreno
Funding: European Comission

Project title: Suspended graphene nanostructures
Principal Researcher: Prof. Dr. Adrian Bachtold
Funding: European Comission

Project title: TAILPHOX - Tailoring photon-phonon interaction in silicon phoxonic crystals
Principal Researcher: ICREA Prof. Dr. Clivia M. Sotomayor
Funding: European Comission

NATIONAL PROJECTS 2010

Project title: ACHPIN – Study of Confined Acoustic Phonons in Fabircated Nanostructures
Principal Researcher: ICREA Prof. Dr. Clivia M. Sotomayor
Funding: Ministry for Science and Innovation

Project title: CNBSS
Principal Researcher: ICREA Prof. Víctor F. Puntes
Funding: Ministry of Science and Innovation

Project title: Collaboration between CSIC and the University of Santiago de Chile
Principal Researcher: ICREA Prof. Dr. Clivia M. Sotomayor
Funding: Ministry for Science and Innovation

Project title: Design of inorganic conjugated nanoparticles: new tools for cancer treatment
Principal Researcher: ICREA Prof. Víctor F. Puntes
Funding: Ministry of Science and Innovation

Project title: DESPRO NANO - Long lasting disinfectants
Principal Researcher: Ramón y Cajal Researcher Dr. Daniel Maspoch
Funding: Ministry of Science and Innovation

Project title: Development of novel nanomaterial based targeting approaches as emerging universal platforms with interest to develop biosensors.
Principal Researcher: ICREA Prof. Arben

Merkoçi
Funding: Ministry of Science and Innovation

Project title: Diagnostic system for detecting breast cancer
Principal Researcher: ICREA Prof. Arben Merkoçi
Funding: ACC1Ó (Generalitat of Catalonia)

Project title: Graphene-based Molecular Spintronics Devices
Principal Researcher: ICREA Prof. Sergio O. Valenzuela
Funding: Ministry of Science and Innovation

Project title: ICREA workshop on phonon engineering
Principal Researcher: ICREA Prof. Dr. Clivia M. Sotomayor
Funding: Institució Catalana de Recerca i Estudis Avançats (ICREA)

Project title: Integrated Lab-On-Chip Platforms for Medical Diagnostics
Principal Researcher: Ramón y Cajal Researcher Dr. Ernest Mendoza
Funding: Ministry for Science and Innovation

Project title: MOLCHIP - Molecular chips.
Principal Researcher: Ramón y Cajal Researcher Dr. Daniel Maspoch
Funding: Ministry of Science and Innovation

Project title: Multifunctional nanoplatforms for high sensitive pollution control and purification of water
Principal Researcher: ICREA Prof. Arben Merkoçi
Funding: Ministry of Science and Innovation

Project title: NANOAQUA, use of nanospheres as vehicles for immunostimulant administration in aquaculture
Principal Researcher: Ramón y Cajal Researcher Dr. Daniel Maspoch
Funding: Fundación Ramón Areces

Project title: NANOBIOMED Nanotecnologies in biomedicine
Principal Researcher: ICREA Prof. Arben Merkoçi
Funding: Ministry for Science and Innovation

Project title: Nanobiosensors for tumoral markers
Principal Researcher: ICREA Prof. Arben Merkoçi
Funding: Ministry of Science and Innovation

Project title: NANOCLEAN Determination of the potential of different funtionalised inorganic nanoparticles
Principal Researcher: ICREA Prof. Víctor F. Puntes
Funding: Ministry of Environmental and Rural and Marine

Project title: NANO-SCENT - Controlled release of fragrances
Principal Researcher: Ramón y Cajal Researcher Dr. Daniel Maspoch
Funding: Ministry of Science and Innovation

Project title: nanoTHERM - Tailoring electronic and phononic properties of nanomaterials: Towards ideal Thermoelectricity
Principal Researcher: ICREA Prof. Dr. Clivia M. Sotomayor
Funding: Ministry for Science and Innovation

Project title: NANOWAVE - Nanowire based Microwave Emitters for Use in Monolithic Microwave Integrated Circuits
Principal Researcher: ICREA Prof. Pietro Garmbardella
Funding: Ministry for Science and Innovation and National Science Foundation (USA)

Project title: New single molecule technologies for the study of DNA repair mechanisms
Principal Researcher: Ramón y Cajal Researcher Dr. Fernando Moreno
Funding: Ministry for Science and Innovation

Project title: Safety food - development of novel technologies based on phages for controlling salmonellosis
Principal Researcher: Ramón y Cajal Researcher Dr. Daniel Maspoch
Funding: Obra Social La Caixa, Programa Recercaixa.

Project title: SGR
Principal Researcher: ICREA Prof. Dr. Clivia M. Sotomayor
Funding: Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR)

Project title: SGR
Principal Researcher: ICREA Prof. Pietro Garmbardella.
Funding: Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR)

Project title: SGR
Principal Researcher: ICREA Prof. Arben Merkoçi
Funding: Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR)

Project title: SGR
Principal Researcher: ICREA Prof. Víctor F. Puntes
Funding: Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR)

Project title: SRTS - Polarized electrons tunnel spectroscopy: a new tool for the development of ultra-high density magnetic memories
Principal Researcher: ICREA Prof. Dr. Sergio O. Valenzuela
Funding: Ministry for Science and Innovation

Project title: Study of the optoelectromechanic properties of individual molecules and the effect of electrodes coupling and the interaction with other molecules in their integration into real devices.
Principal Researcher: Ramón y Cajal Researcher Dr. Aitor Mugarza
Funding: Ministry of Science and Innovation

Project title: Synthesis and manipulation of two-dimensional molecular spin networks
Principal Researcher: ICREA Prof. Pietro Garmbardella
Funding: Ministry of Science and Innovation

Project title: Using magnetic interactions to control the magnetic properties of nanostructured systems
Principal Researcher: ICREA Prof. Josep Nogués
Funding: Ministry of Science and Innovation

Project title: WARMER - Water risk management in Europe
Principal Researcher: ICREA Prof. Dr. Arben Merkoçi
Funding: Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR)

Project title: Water multifunctional processing system based on nanoplataforms for ultra-

sensitive detection and purification of environmental pollutants
Principal Researcher: ICREA Prof. Arben Merkoçi
Funding: Ministry of Science and Innovation

TECHNOLOGY TRANSFER 2010

Project title: Clinical oncologic translation of gold nanoparticles conjugated with CisPlatino: from in-vivo to phase I.
Principal Researcher: ICREA Prof. Víctor F. Puntes
Funding: ACC1Ó (Generalitat of Catalonia)

Project title: EVALICN -Technology Transfer
Principal Researcher: Prof. Jordi Pascual
Funding: ACC1Ó (Generalitat of Catalonia)

Project title: Evaluation of the biocompatibility and toxicity of micro and nanoparticles
Principal Researcher: Ramón y Cajal Researcher Dr. Daniel Maspoch
Funding: ACC1Ó (Generalitat of Catalonia)

Project title: Evaluation of the encapsulation of fragrances, clothes adhesion and friction liberation of metalorganic micro-and nanoparticles for softeners
Principal Researcher: Ramón y Cajal Researcher Dr. Daniel Maspoch
Funding: ACC1Ó (Generalitat of Catalonia)

Project title: In vivo evaluation of potential nanoconjugates as adjuvant for flu vaccines
Principal Researcher: ICREA Prof. Víctor Puntes
Funding: ACC1Ó (Generalitat of Catalonia)

Project title: Scale up of gold clusters synthesis for catalysis applications
Principal Researcher: Ramón y Cajal Researcher Dr. Ernest Mendoza
Funding: ACC1Ó (Generalitat of Catalonia)

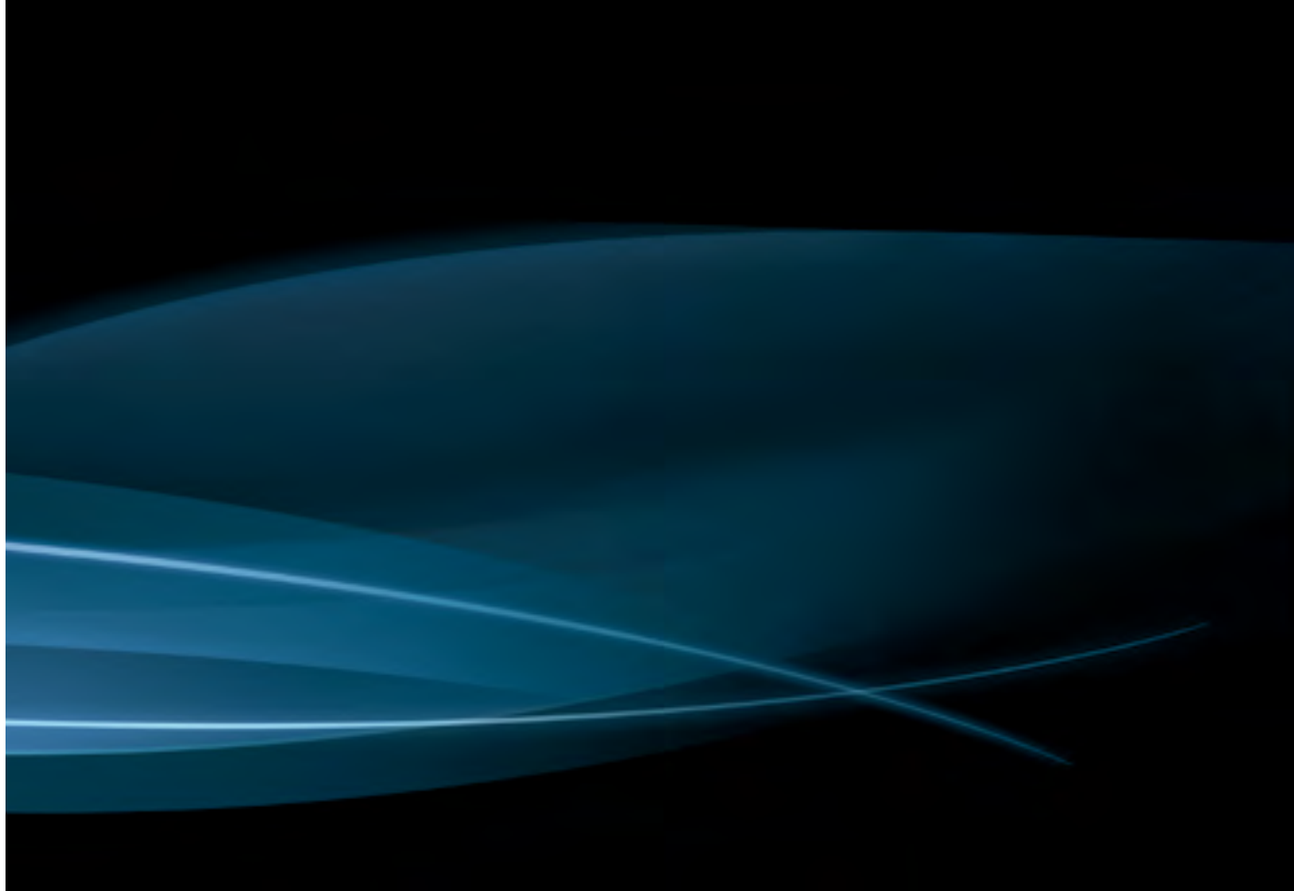
COMMERCIALISATION CONTRACTS 2010

Project title: Encapsulation of biocides in metal-organic micro- and nanosystems to extend their biocidal activity
Principal Researcher: Ramón y Cajal Researcher Dr. Daniel Maspoch
Funding: Private company

Project title: Encapsulation of fragrances in metal-organic microsystems for controlled release in textiles
Principal Researcher: Ramón y Cajal Researcher Dr. Daniel Maspoch
Funding: Private company

Project title: Encapsulation of fungicides in metal-organic micro- and nanosystems
Principal Researcher: Ramón y Cajal Researcher Dr. Daniel Maspoch
Funding: Private company

Project title: Development of fragrances encapsulation systems for laundry products
Principal Researcher: Ramón y Cajal Researcher Dr. Daniel Maspoch
Funding: Private Company



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