

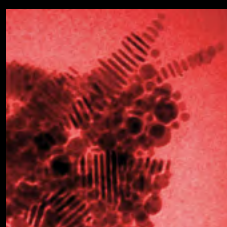
ICN ANNUAL REPORT 2009

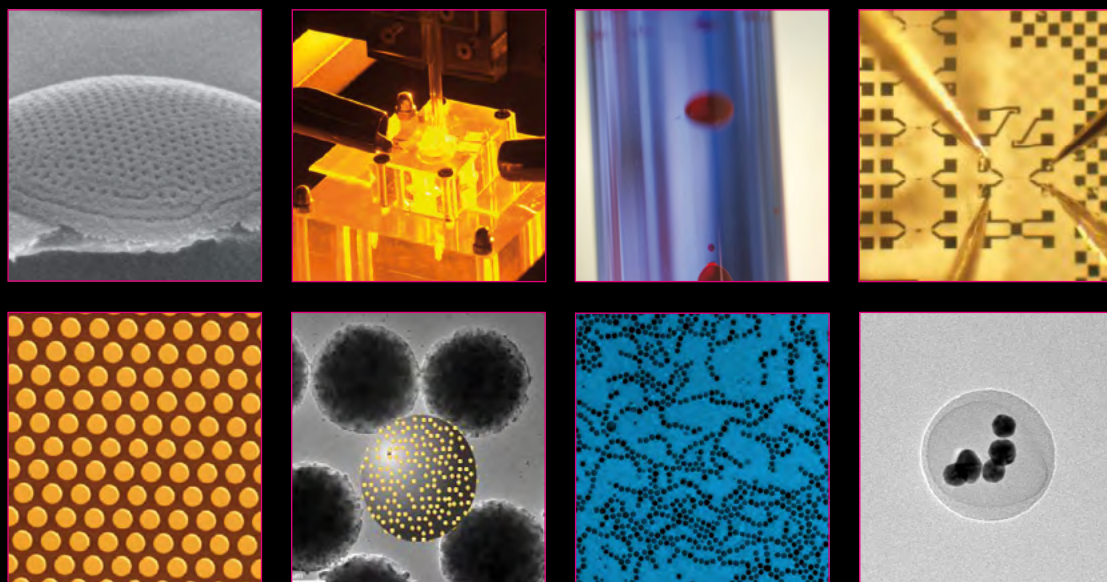
CREATING A DIMENSION OF INFINITE POSSIBILITIES



Institut Català
de Nanotecnologia

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LETTER FROM THE DIRECTOR 1



If there is one feature that characterised this year at the Institute, it was a year dedicated to consolidating existing activities. During 2009 no new research groups were incorporated, rather additional researchers and laboratory

technicians were recruited and the administration and support services were reinforced, resulting in a very significant increase in personnel (close to 43%). Two very interesting points to note; the increasingly international profile of our researchers (close to 50% are foreigners, coming from 23 different countries), and the relatively high ratio of females working in the Institute (more than one third of all staff). The most notable change during the year was the departure of Dr F. Moreno, a Ramon y Cajal researcher with an ERC Starting Grant who left to join the National Centre of Biotechnology (CNB).

Of particular distinction amongst the various awards and prizes received by members of the Institute is the prestigious IUPAP Young Scientists Award, awarded to Prof. Sergio O. Valenzuela for his important contribution to the implementation of methods of non-local detection of spin, especially the first ever detection of the Spin Hall effect and of pure spin currents.

Throughout the year our research groups continued to benefit from the continual acquisition of new, latest generation scientific equipment, which has given a considerable boost to the level of success in securing new projects in competitive calls. Some 20 new projects were secured, raising by 21% the average annualised funding from competitive sources. Of particular note is the significant increase in collaborative projects with private industry, which although still modest in economic terms, represents an increase of 104% over last year. From all these projects I am particularly pleased to highlight the project led by Prof. P. Gambardella and Dr

G. Ceballos to develop and build a chamber for the growth and characterisation of nanostructures combining morphological and spectroscopic studies utilising synchrotron light, which will complement the circular magnetic dichroic and resonant diffraction lines of the new ALBA synchrotron which is in the final stages of construction adjacent to the UAB campus.

In regards to research results, this year has continued the sustained trend of improvement in the average impact factor (IF) of the peer reviewed publications in which our research results were published, rising to 5.15. This increase of 9% in impact factor was not accompanied by an increase in number of publications, which would also be desirable, but nevertheless adheres to the Institute's philosophy to publish quality over quantity. Even more pleasing than the increase in average quality is that some of our articles were published in the most elite of international scientific journals.

Consolidation was also the theme in technology transfer. This year no new patent applications were filed, rather efforts were focussed on knowledge transfer and initiating new markets and collaborations with industry. Along this line, we embarked on the creation, in collaboration with LEITAT technology centre, of the Centre for NanoBioSafety and Sustainability (CNBSS) with the objective of providing services and facilitating the entry of nanotechnology into the industrial landscape.

In this Annual Report you will find a description of all the activities undertaken by scientific, technical and administrative staff of our Institute. We have made a good beginning and have enormous potential for the future, with bold researchers of the highest international calibre. Above all, we are lucky to have a great group of people, and it has been a great pleasure to work together with them in the construction of this ambitious project.

Jordi Pascual
Director

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).

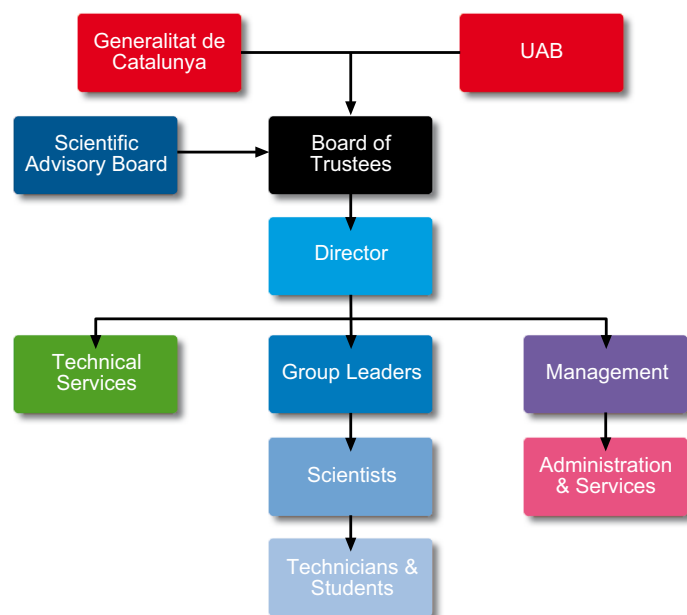
The ICN is led by its Director, Dr Jordi Pascual, who reports to the Board of Patrons and is advised by the Scientific Advisory Board, which consists of a number of distinguished international scientists.

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.

During 2009 the ICN had six core Groups:

- Atomic Manipulation and Spectroscopy Group
- Inorganic Nanoparticles Group
- Magnetic Nanostructures Group
- Nanobioelectronics and Biosensors Group
- Phononic and Photonic Nanostructures Group
- Physics and Engineering of Nanoelectronic Devices Group

2.2 Organisational Chart



2.3 Board of Patrons

PRESIDENT

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

VICE-PRESIDENT

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

MEMBERS

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

Mr. Ramón Moreno,
Director of CERCA Research Centers Programme.

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

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

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

2.4 Scientific Advisory Board 2009

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 Physics 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 Universitaire 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

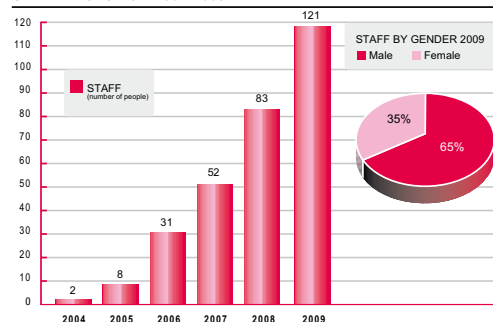
The ICN is defined by its people. From senior researchers through to administration staff, the ICN works as a team, committing creativity, energy, dedication and hard work to build and establish the Institute. The ICN prides itself on being an attractor of talent – it seeks to provide an environment and an image of excellence that attracts talented scientists, technicians and support personnel from all over the world.

Evidence of ICN success in attracting talent, besides from the high level of scientific output achieved, is given by the high numbers of ICN staff with top-level competitive recognition. 2009 saw further increases in external funding of highly qualified personnel by European, national and regional grants and commercial agreements. In 2009, national MICINN funding programs such as CONSOLIDER, FPI, Ramón y Cajal and Juan de la Cierva supported an increase of 4% of scientific personnel, while Catalan grants from AGAUR, ACC1Ó and VALTEC together with commercial agreements such as with private companies enabled the incorporation of an additional 36 pre- and post-doctoral graduates and technicians. In total, staff numbers at the ICN grew from 83 in 2008 to 121 by end of 2009.

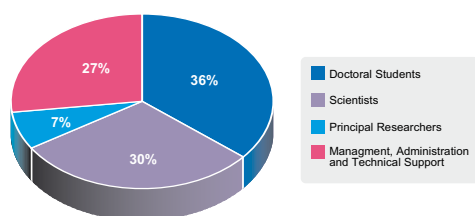
The ICN is an equal opportunity employer and seeks to encourage a workforce diverse in age, race, nationality and gender. In 2009 just under one half of the ICN's staff was of foreign nationality, and one third female.

2.6 Statistics

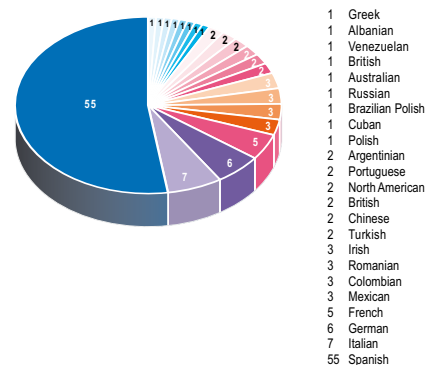
STAFF EVOLUTION 2004-2009



ICN STAFF BY ROLE 2009



ICN STAFF NATIONALITIES 2009



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 with synchrotron radiation spectroscopy 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, T. Balashov, A. Mugarza, M. Ollé, G. Ceballos, C. Krull, A. Lodi Rizzini, M. Miron and C. Nistor. Absent: J. Kavich

NEW PROJECTS & MILESTONES

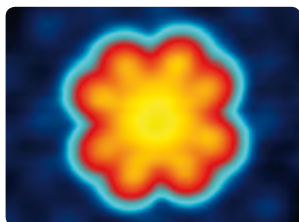
In 2009, the Group secured competitive funding for 4 new projects:

NOMAD - Nanoscale magnetization dynamics, ERC Starting Grant

To develop frontier approaches to control the magnetodynamic properties of nanometer-sized molecular and metallic elements.

Development and construction of a chamber for the growth and characterisation of nanostructures combining morphological studies and spectroscopy using Synchrotron light, MEC

The project consists of the design, construction and exploitation of an Ultra High Vacuum chamber for the fabrication and morphological and spectroscopic characterisation of nanostructured surfaces. The project is a collaboration between the ALBA and CIN2, and will serve to comple-



ment the lines of Circular Magnetic Dichroism and Resonant Diffraction which are under construction.

Element- and spatially-resolved nonlinear magnetization dynamics in ferrites, Acciones Integradas Hispano – Alemanas HA2007-009

The project brings together state-of-the-art expertise in magnetization dynamics and synchrotron radiation spectroscopy in order to investigate nonlinear dynamic phenomena in heterogeneous magnetic systems with both elemental and spatial resolution.

Synthesis and manipulation of two-dimensional molecular spin networks, MEC

This project aims at exploiting self-assembling processes for fabricating ultrathin magnetic films constituted by nanometer-sized functional molecular elements.

KEY PUBLICATIONS AND INVITED TALKS 2009

Simultaneous in-plane and out-of-plane exchange bias using a single antiferromagnetic layer, J. Nogués, S. Stepanow, A. Bollero, J. Sort, B. Dieny, F. Nolting, and P. Gambardella. *Appl. Phys. Lett.* 95, 152515 (2009)

Direct evidence of imprinted vortex states in the antiferromagnet of exchange biased microdisks, G. Salazar-Alvarez, J. J. Kavich, J. Sort, A. Mugarza, S. Stepanow, A. Potenza, H. Marchetto, S. S. Dhesi, V. Baltz, B. Dieny, A. Weber, L. J. Heyderman, J. Nogués and P. Gambardella. *Appl. Phys. Lett.* 95, 012510 (2009)

Double resonant x-ray and microwave absorption: atomic spectroscopy of precessional orbital and spin dynamics, G. Boero, S. Rusponi, P. Bencok, R. Meckenstock, J.-U. Thiele, F. Nolting, and P. Gambardella, *Phys. Rev. B* 79, 224425 (2009)

Supramolecular control of the magnetic anisotropy in two-dimensional high-spin Fe arrays at a metal interface. P. Gambardella, S. Stepanow, A. Dmitriev, J. Honolka, F. de Groot, M. Lingenfelder, S. Sen Gupta, D.D. Sarma, P. Bencok, S. Stanesco, S. Clair, S. Pons, N. Lin, A. P. Seitsonen, H. Brune, J.V. Barth and K. Kern. *Nature Materials* 8, 189 (2009)

Understanding the magnetic properties of metalorganic adsorbates with model cases: Cu-Phthalocyanine on Ag(100), A. Mugarza. 26th European Conference on Surface Science. Invited Talk

OTHER ACTIVITIES

Teaching:

Nanoscience and Nanotechnology Master, Universitat Autònoma de Barcelona: **Characterization Techniques in Surface Science.**

National School on Physics of Matter 2009, Chiavari, Italy: **Introduction to x-ray magnetic dichroism investigations of nanostructured magnetic materials.**

European School on Magnetism 2009, Timisoara, Romania: **Low-dimensional magnetic systems.**

Led by ICREA Prof. Víctor Puntès, 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.). This interaction allows particle modification and both witnessing and reporting results.



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

NEW PROJECTS & MILESTONES

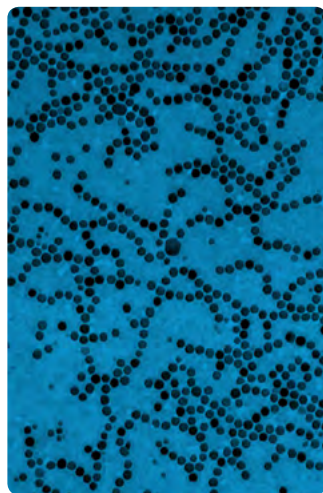
With nanotechnology in its nascent stages, control of the effective use of nanoparticles in medical and other applications has yet to be widely achieved. For this purpose, the Group has concentrated its efforts on the development of world-leading expertise in the manufacture and characterisation of high quality engineered inorganic nanoparticles for use in a wide range of applications.

Linked to this purpose, in 2009 the ICN and LEITAT Technological Centre were jointly granted €1.5 M to establish a new Centre for NanoBioSecurity and Sustainability (CNBSS), whose main objective will be the research and development of new tools for the management of the risks associated with nanotechnology, in order to improve safety and sustainable implementation at an industrial level and to reduce unwarranted perceptions of hazard.

Another key activity during 2009 was the scaling up of the synthesis of nanoparticle conjugates

3 RESEARCH GROUPS

3.2 Inorganic Nanoparticles Group



for drug delivery, from the milligram scale to gram quantities. The aim is to apply the technology to large animal models, such as pigs, and validate previous results for use in human clinical trials. These efforts were carried out primarily via two VALTEC projects awarded in 2009, and partially via an ongoing CONSOLIDER grant:

VALTEC – Vaccines, funded by ACC1Ó – Generalitat de Catalunya

VALTEC – Cisplatin, funded by ACC1Ó – Generalitat de Catalunya

CONSOLIDER – Subunit: In-Vitro Experimentation of nanoparticles based biofluids, funded by the Spanish Ministry of Education and Science.

KEY PUBLICATIONS AND INVITED TALKS 2009

Instability of Cationic Gold Nanoparticle Bioconjugates: The Role of Citrate Ions, I. Ojea Jiménez and V. Puntès. *Journal of the American Chemical Society*, 131, 37, 13320-13327 (2009)

Homogeneous Conjugation of Peptides onto Gold Nanoparticles Enhances Macrophage Response, NG, Bastus; E. Sánchez-Tillo; S. Pujals et al. *ACS NANO*, 3, 6, 1335-1344 (2009)

In vitro investigation of immunomodulatory effects caused by engineered inorganic nanoparticles - the impact of experimental design and cell choice, T. Pfaller; V. Puntès; E. Casals; A. Duschl and G. J. Oostingh. *Nanotoxicology*, 3, 1, 46-59 (2009)

Nanotechnology: from nanotoxicology to nanomedicine. V. Puntès. NanoSpain 2009, Zaragoza, Espanya. Març 9-12, 2009. Keynote Speaker

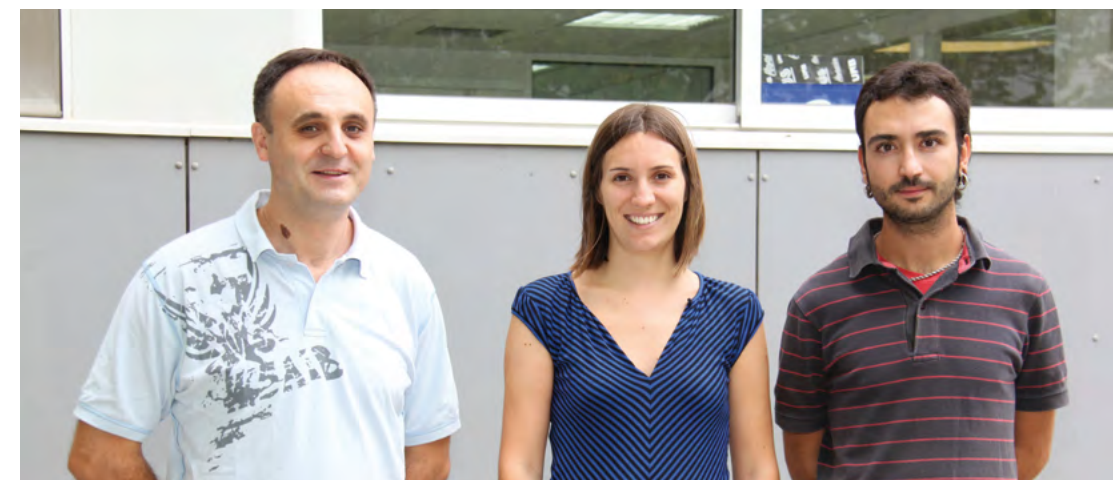
OTHER ACTIVITIES

Consolidation of the Nanowiki forum (www.nanowiki.info) for the dissemination of key findings in Nanotechnology.

RESEARCH GROUPS

3.3 Magnetic Nanostructures Group

Led by ICREA Prof. Josep Nogues, 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.

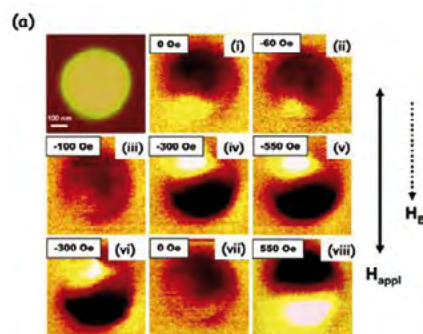
NEW PROJECTS & MILESTONES

In 2009, the Group worked on three different projects:

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

The objective of the research 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.

New ultra-high density magnetic storage media, based on the self-assembly of multi-level nanoparticles, MEC

The Group synthesised core/shell and multi-shell nanoparticles with different magnetic layers, self-assembling them to create a potential high-density patterned media. The different magnetic layers were designed to exhibit different coercivities leading

to the possibility to store several bits of information on each nanoparticle.

Exchange biased thin films, nanostructures and devices, SSF-Sweden

The project consisted, in collaboration with J. Åkerman (Royal Institute of Technology, Stockholm, Sweden), in studying the coupling between hard and soft ferromagnets through non-magnetic spacers for spintronic applications.

KEY PUBLICATIONS AND INVITED TALKS 2009

Direct magnetic patterning due to the generation of ferromagnetism by selective ion irradiation of paramagnetic FeAl alloys, E. Menéndez, J. Sort, M.O. Liedke, J. Fassbender, T. Gemming, A. Weber, L.J. Heyderman, K.V. Rao, S.C. Deevi, S. Suriñach, M.D. Baró and J. Nogués. *Small* 5, 229 (2009).

Magnetic proximity effect features in antiferromagnetic/ferrimagnetic core-shell nanoparticles, I.V. Golosovsky, G. Salazar-Álvarez, A. López-Ortega, M. A. González, J. Sort, M. Estrader, S. Surinach, M. D. Baró and J. Nogués. *Physical Review Letters* 102, 247201 (2009).

Direct evidence of imprinted vortex states in the antiferromagnet of exchange biased microdisks, G. Salazar-Álvarez, J.J. Kavich, J. Sort, A. Mugarza, S. Stepanow, A. Potenza, H. Marchetto, S. S. Dhesi, V. Baltz, B. Dieny, A. Weber, L.J. Heyderman, J. Nogués and P. Gambardella. *Applied Physics Letters* 95, 0125101 (2009)

Emergence of noncollinear anisotropies from interfacial magnetic frustration in exchange-bias systems, E. Jiménez, J. Camarero, J. Sort, J. Nogués, N. Mikuszeit, J. M. García-Martín, A. Hoffmann, B. Dieny, and R. Miranda. *Physical Review B* 80, 014415 (2009)

Nanoscale Magnetic Lithography in FeAl alloys by ion irradiation and nanoindentation, J. Sort, E. Menéndez, A. Varea, F. Pi, S. Suriñach, M. D. Baró and J. Nogués. *International Conference on Advanced Materials*. Rio de Janeiro, Brazil. Sept. 20 -25, 2009. Invited

Exchange bias and proximity effects in 'inverted' antiferromagnetic/ferrimagnetic core/shell nanoparticles, J. Nogués, I. Golosovsky, G. Salazar-Álvarez, A. López-Ortega, M. Estrader, J. Sort, S. Suriñach and M.D. Baró. *NANO2009*. San Sebastián, Spain. Sept. 28-30, 2009. Invited

OTHER ACTIVITIES

Member of the Advisory Editor Board of *Journal of Magnetism and Magnetic Materials*

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: M. Medina, M. Guix, M. Espinoza, M. Cadevall, A. de la Escosura, A. Puig, C. Parolo, S. Marín, G. Aragay, W. Cantanhede, B. Pérez and A. Merkoçi. Absent: M. Maltez, M. Sahin, F. Airo, A. Ambrosi, P. Kara, A. S. Legendre and G. Alarcón

NEW PROJECTS & MILESTONES

In 2009, the Group secured competitive funding for 2 new projects:

- IT2009-0092: Nanobiosensors for tumoral marker evaluation. Spanish-Italy collaboration project funded by MICINN.
- SFP 983807: Nanoparticle-based Sensors for Detection of Chemical and Biological Threats. Funded by NATO.

KEY PUBLICATIONS AND INVITED TALKS 2009

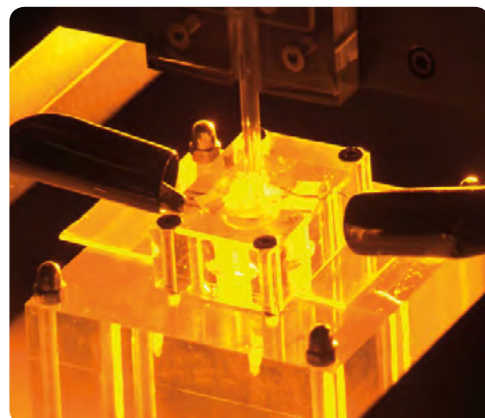
Rapid identification of tumour cells using a novel electrocatalytic method based in gold nanoparticles. A. de la Escosura Muñiz, B. Díaz Freitas, C. Sánchez Espinel, A. González-Fernández and Arben Merkoçi. *Analytical Chemistry*, 81, p. 10268-10274 (2009)

Lab-on-a-chip for ultrasensitive detection of carbofuran by enzymatic inhibition with replacement of enzyme using magnetic beads. X. Llopis, M. Pumera, S. Alegret and A. Merkoçi. *Lab Chip*, 9, p. 213 (2009)

Controlling the electrochemical deposition of silver onto gold nanoparticles: Reducing interferences and increasing the sensitivity of magnetoimmuno assays. A. de la Escosura-Muñiz, M. Maltez-da Costa and Arben Merkoçi. *Biosensors & Bioelectronics*, 24, p. 2475-2482 (2009)

BIOSENSING USING NANOMATERIALS – BIONANO. Arben Merkoçi. Edited by Arben Merkoçi, Published by Wiley-Interscience (2009)

Using nanoparticles makes an easier sensing and biosensing. A.Merkoçi. *AsiaSense 2009*, The 4th International Conference on Sensors. Converging Technology for Sensors application. Bangkok, Thailand. July 29th-31st, 2009. Invited talk



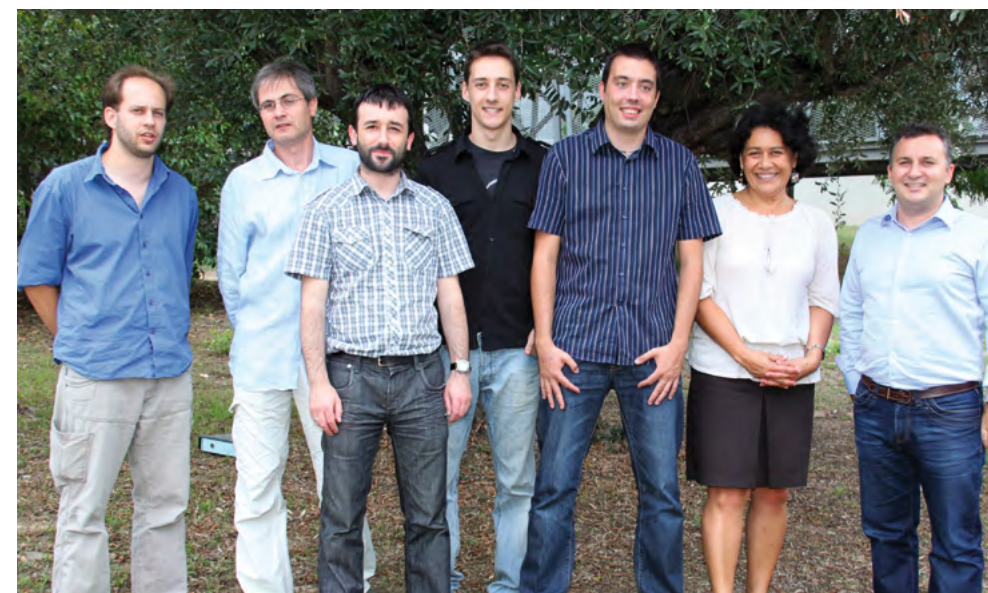
OTHER ACTIVITIES

Member of the Editorial Advisory Board of the journal *Cancer Nanotechnology, Translational and Clinical Research*, ISSN: 1868-6958 (print version), Journal no. 12645, Springer, Wien.
<http://www.springer.com/springerwiennewyork/chemistry/journal/12645?detailsPage=editorialBoard>

Highlight by Nanotechweb about the article **"Direct electrochemical stripping detection of cystic fibrosis related DNA linked through cadmium sulphide quantum dots"**, *Nanotechnology* 20 (2009) 055101 (6pp) doi:10.1088/0957-4484/20/5/055101". Published at: <http://nanotechweb.org/cws/article/tech/37255> on Jan 12, 2009

News on the article Rapid identification of tumour cells using a novel electrocatalytic method based in gold nanoparticles, A. de la Escosura-Muñiz, C. Sánchez-Espinel, B. Díaz-Freitas, A. González-Fernández, M. Maltez-da Costa and A. Merkoçi. *Analytical Chemistry*, 2009, 81, 10268–10274:
<http://www.rtve.es/noticias/20091122/nuevo-dispositivo-para-detectar-cancer-dos-minutos/301984.shtml>
http://www.elpais.com/articulo/sociedad/biosensor/identifica/cuenta/celulas/cancer/elpepisoc/20091119elpepisoc_5/Tes
http://www.elperiodico.com/default.asp?idpublicacio_PK=46&idioma=CAS&idnoticia_PK=664096&idseccio_PK=1477
<http://es.euronews.net/teletipos/76039-descubren-unos-biosensores-capaces-de-detectar-cAlulas-tumorales-en-2-minutos/>
<http://www.rtve.es/mediateca/videos/20100103/informatiu-cap-setmana-03-01-2010/660231.shtml>

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. The long term aim is to develop new information technology concepts where information processing is achieved with non-charged state variables.



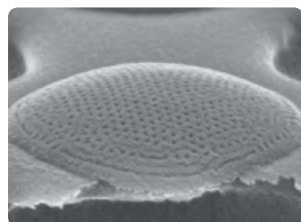
From L to R: P. O. Chapuis, F. Alsina, T. Kehoe, J. Cuffe, V. Reboud, C. M. Sotomayor Torres and N. Kehagias.
Absent: D. Dudek, Y. García, M Schmidt, H.H. Tao, S. Kennedy and L. Schneider

NEW PROJECTS & MILESTONES

In 2009, the Group secured funding for four new projects:

TAILPHOX: TAILoring photon-phonon interaction in silicon PHOXonic crystals: it addresses the design and implementation of silicon phoXonic crystals that allow a simultaneous control of photonic and phononic waves on the same platform.

CAPIN: Fabrication of Nanostructures for Research on Confined Acoustic Phonons: Its objective is to ascertain the conditions under which acoustic confined phonons are present and their impact on electrical and optical properties by obtaining their dispersion relations.



Collaboration between CSIC (CIN2) and the university of chile in Santiago de Chile: The objective of this project is to investigate the potential energy-related applications of intercalated compounds and oxide nanostructures.

Support for the phononic and photonic nanostructures group: The Group gained its recognition as a research group by

the Catalan agency AGAUR.

KEY PUBLICATIONS AND INVITED TALKS 2009

Bottom-up growth of fully transparent contact layers of indium tin oxide nanowires for light-emitting devices, C. O'Dwyer, M. Szachowicz, G. Visimberga, V. Lavayen, S. B. Newcomb, and C. M. Sotomayor Torres, *Nature Nanotechnology* 4, 239 - 244 (2009)

Site-Selective Self-Assembly of Colloidal Photonic Crystals, S. Arpiainen, F. Jonsson, J. R. Dekker, G. Kocher, W. Khunsin, C. M. Sotomayor Torres and J. Ahopelto, *Advanced Functional Materials* 19 (8), 1247-1253 (2009)

Resonance amplification of defect emission in ZnO inverted opal, W. Khunsin, M. Scharer, L. Aagesen, M. Anderson, R. P. H. Chang, C. M. Sotomayor Torres and S. G. Romanov, *Optics Letters* 34 (10) 1519-1521 (2009)

Reduced Surfactant Uptake in Three Dimensional Assemblies of VOx Nanotubes Improves Reversible Li+ Intercalation and Charge Capacity, C. O'Dwyer, V. Lavayen, D.A. Tanner, S.B. Newcomb, E. Benavente, G. González and C. M. Sotomayor Torres, *Advanced Functional Materials* 19 (11) 1736-1745 (2009)

Nanophotonics contributes to future industrial technologies, C. M. Sotomayor Torres, *Euronanoforum 2009: Nanotechnology for sustainable Economy*, Prague, 2-5 June, 2009 – Invited talk.

Nanoimprinted polymer-nanoparticle composites for photonic structures, C M Sotomayor Torres, 10th Int. Conf. on the Frontiers of Polymers and Advanced Materials, Santiago, Chile, 28 Sept-2 October 2009, Plenary Talk.

Fabrication of structures for nanophotonics/utilization of plasmon- exciton interactions in polymeric nanophotonic devices, N. Kehagias, *Nanofotónica: una herramienta de futuro*, Campus Catalunya, Tarragona, Spain, 1-3 July 2009 – Invited lecture.

Recent Advancements in Plasmonics and Metamaterials, V. Reboud, Int. Symp. Advanced Photonic Electronics, JSPS Photonic Electronics 130 Committee, Tokyo, Japan, 29 October 2009 – Invited talk.

Two-dimensional nanoimprinted photonic crystals for laser applications, V. Reboud, Trends in Nanotechnology TNT 2009 conference, Barcelona, Spain, 7-11 September 2009 – Invited talk.

Infrared Near-Field Optics. When the sample becomes the source, A. Babuty, A. Bousseksou, V. Moreau, P.-A. Lemoine, P.-O. Chapuis, I. Doyen, R. Colombelli, J.-J. Greffet, K. Joulain and Y. De Wilde, Int. Conf. on Photoacoustic and Photothermal Phenomena (ICPP 15), Leuven (Belgium), 19-23 July 2009 - Plenary talk.

OTHER ACTIVITIES

The interview of Prof. Dr. Sotomayor Torres by journalist Kimberley Clark was published in the January 2009 edition of *Euro-photonics*: "Champion for Nanophotonics - an interview with Clivia M. Sotomayor Torres".

PhD student John Cuffe won the Best Poster Award at the 5th Int. OSA Network of Students (IONS5), held in ICFO, in February 2009.

Led by ICREA Prof. Sergio O. Valenzuela, the Physics and Engineering of Nanoelectronic devices 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: M. Costache, S. Valenzuela and I. Neumann.

Absent: G. Bridoux

NEW PROJECTS & MILESTONES

In 2009, the Group welcome new members Mr. I. Neumann, and Dr. M.V. Costache, part of the lab equipment for magnetotransport experiments and finished setting up a research laboratory. The latter included the implementation of a nanofabrication area with electron beam-evaporators and plasma systems.

During this year the Group secured two competitive projects (MEC) to develop novel characterization techniques for spin-resolved tunnelling spectroscopy and to study spin transport in and tunnelling through nonconventional spintronic materials.

KEY PUBLICATIONS AND INVITED TALKS 2009

Pulse imaging and nonadiabatic control of solid-state artificial atoms, J. Bylander, M.S. Rudner, A.V. Shytov, S.O. Valenzuela, D.M. Berns, K. K. Berggren, L.S. Levitov, and W.D. Oliver. *Phys. Rev. B* 80, 220506 (Rapid Comm.) (2009). *Rapid Communications*.



Nonlocal spin detection, spin accumulation and the spin Hall effect. S.O. Valenzuela . Phys. B 23, 2413 (2009). Invited Review, Int. J. Mod.

Large amplitude driving of a superconducting artificial atom. W.D. Oliver and S.O. Valenzuela. Quantum Inf. Process. 8, 261 (2009) Invited Review.

Annual Meeting of the Spanish Club on Magnetism (CEMAG). Zaragoza, Spain. December 11, 2009. Invited Talk

Colloquium 'Microwave cooling and amplitude spectroscopy of a solid-state artificial atom', Sergio Valenzuela. Physics Colloquium, University of Basel. Germany. November 20th, 2009. Invited Talk

Colloquium 'Microwave cooling and amplitude spectroscopy of a solid-state artificial atom' Sergio Valenzuela. International Conference on

Magnetism 2009. Karlsruhe, Germany. July 26th-31st, 2009. Invited Talk

Microwave cooling, and amplitude spectroscopy in a solid-state artificial atom, V International Workshop on Nanomagnetism and Superconductivity, Comarruga, Spain. July 5th-9th, 2009. Invited Talk.

Quantum interference, microwave cooling, and amplitude spectroscopy in a solid-state artificial atom. Physics Colloquium, Universidad de Barcelona. June 10th, 2009. Invited Talk.

OTHER ACTIVITIES

In 2009, Sergio O. Valenzuela was awarded with the IUPAP Young Scientist Award with the following citation: "For significant contributions to nonlocal spin-detection methods, including the first electronic detection of the spin Hall effect and of pure spin currents."

3.7.1 Daniel Maspoch

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



From L to R: M. González, M. Rubio, I. Imaz, C. Carbonell i D. Maspoch.

The main focus of this project is the design, synthesis and study of metal-organic nanotubes (MONs) for which are envisioned a wide variety of properties and characteristics, ranging from magnetism to porosity and/or catalytic properties. The design and synthesis of MONs will be carried out through two novel template-based strategies, the so-called template synthesis and an approach based on a molecular template generated by Dip-Pen Nanolithography. Both techniques allow not only the control of composition but also of shape and dimensions (outside diameter, pore size, height, and thickness), which dictate the resulting magnetic, porous and catalytic properties.

During 2009, Dr. Maspoch successfully secured additional competitive research funds from CIDEM-ACC10 (Generalitat de Catalunya), MICINN and Gobierno de Aragón leading to significant growth of his team of researchers,

with the formative group adopting the title of Supramolecular NanoChemistry & Materials Group (NANO^{UP}). The group moved into new labs commissioned by the ICN and acquired new equipment, greatly increasing their research activity.

Some highlights of 2009 activities include the signing of several contracts with private companies focused on developing new products based on micro- and nanoencapsulation technologies.

HIGHLIGHTS 2009

Metal-organic spheres as functional systems for encapsulation, I.Imaz, J. Hernando, D. Ruiz-Molina and D. Maspoch. Angew. Chem. Int. Ed., 48, 2325. (2009)

Amino acid based metal-organic nanofibers, I. Imaz, M. Rubio-Martínez, W. J. Saletta, D. B. Amabilino and D. Maspoch. J. Am. Chem. Soc., 131, 18222 (2009)

Metal-organic spheres as new functional micro- and nanomaterials for encapsulation, M. Rubio, I. Imaz, J. Hernando, D. Ruiz-Molina and D. Maspoch. Nanospain 2009, Zaragoza (Spain). Poster exhibition.

Single-protein control on nanoarrays generated by dip-pen nanolithography, D. Maspoch, E. Bellido, D. Ruiz-Molina, R. De Miguel Viscasillas, A. Lostao. Nanotech 2009, Houston (USA), Oral Contribution.

DPN-based projects at the Institut Català de Nanotecnologia, D. Maspoch. NanoInk, Inc., 2009, Chicago (USA). Invited conference.

Materiales metalorgánicos nanoestructurados. I. Imaz, M. Rubio-Martínez, D. Maspoch. Universidad del País Vasco (EHU), 2009. Invited conference

Micro- and nanoencapsulation. I. Imaz. Private company, Montornés del Valles, Barcelona (Spain), 2009. Invited talk.



3.7.2 Ernest Mendoza

In 2009 work on immune-sensors development based on carbon nanotubes continued and efforts were focused on the study of

detection of diseases such as rheumatoid arthritis, as well as the integration of sensors in an automatic measurement.

During the year, Ernest Mendoza was awarded with a VALTEC grant for the **Scalation of gold clusters synthesis for catalysis applications project**. Together with Leonor Rodrigues, predoctoral chemical engineer, he developed a reproducible synthesis method based solely on humid chemical processes to obtain gold clusters with high catalytic activity, for which a patent was filed.

HIGHLIGHTS 2009

Evolution of the purification of multi-wall carbon nanotubes in concentrated nitric acid medium: morphology and magnetic properties, E. Pellicer, A.B. González, L.M. Lechuga, J. Nogués and E. Mendoza. *Carbon* 47 (2009) 758

Plasma-activated multiwalled carbon nanotube-poly-styrene composite substrates for biosensor devices, C. Fernández-Sánchez, J. Orozco, C. Jiménez-Jorquera, E. Pellicer, L.M. Lechuga and E. Mendoza. *Nanotechnology* 20 (2009) 3355501. This paper was featured on the specialist website Nanotechweb.



3.7.3 Fernando Moreno

2009 was the year of Fernando Moreno's transition from the Catalan Institute of Nanotechnology (ICN, Barcelona) to the National Centre of Biotechnology (CNB-CSIC, Madrid). In

2008, he secured a permanent position (Assistant Professor) at the CNB-CSIC and, on September 2009, he definitely moved to the new Hosting Institution.

During this time, he started assembling a group and building a lab to study DNA repair using single molecule technology based on Magnetic and Optical Tweezers and Atomic Force Microscopy.

HIGHLIGHTS 2009

Single molecule studies of AddAB: a molecular motor for repairing broken DNA. F. Moreno-Herrero. I Workshop on Nanobioscience, May 2009, Madrid, Spain. Talk.

Single molecule studies of AddAB: a molecular motor for repairing broken DNA. F. Moreno-Herrero, J. Yeeles and M.S. Dillingham. Cantoblanco Workshop on Molecular Mechanism of Genomic Stability. May 2009, Madrid, Spain. Poster.

Single molecule studies of AddAB: a molecular motor for repairing broken DNA. F. Moreno-Herrero. Joint congress of the Spanish and Portuguese microscopy societies, June 2009, Segovia, Spain. Talk.

Single molecule studies of AddAB: a molecular motor for repairing broken DNA. F. Moreno-Herrero. XXXII congreso de la Sociedad Española de Bioquímica y Biología Molecular, Septiembre 2009, Oviedo, Spain. Poster.

Using the Atomic Force Microscope to study DNA break repair. F. Moreno-Herrero. 1st winter workshop on Functional SPM in Bio and Chemical Physics, December 2009, Modena, Italy. Invited talk.

Dr. Fernando Moreno left the ICN in 2009 to join the Centro Nacional de Biotecnología, CSIC.



3.7.4 Aitor Mugarza

Aitor Mugarza's 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, nanoelectronics and spintronics.

The main technique used was low temperature scanning tunnelling microscopy and spectroscopy, but other complementary techniques were applied such as angle-resolved photoemission and X-ray circular magnetic dichroism, both carried out in synchrotron radiation facilities.

The scientific activity during 2009 focused on the following issues:

Water on metal surfaces

The first period of 2009 was devoted to finish the publication of results related to postdoctoral research activity carried out in the group of Prof. Salmeron at Lawrence Berkeley National Laboratory, where the wetting properties and stability of water adsorbed on metallic surfaces were studied. Low temperature scanning tunneling microscopy (STM) studies allowed us to induce the diffusion and dissociation of individual molecules by manipulation with the tip and study the energetic behind each process. The relevance of publications on the topic was reflected in several invited review articles published that year.

Adsorption of metal phthalocyanines on metallic surfaces

The main activity in the LT-STM lab during 2009 focused on the study of the growth of

two-dimensional molecular networks on metallic substrates and their electronic/magnetic properties. Metal phthalocyanines containing different transition metal ions were extensively investigated, performing local imaging, spectroscopy.

HIGHLIGHTS 2009

Organisation of the **10th International Conference on Atomically Controlled Surfaces**, Interfaces, and Nanostructures, both in the Organization Committee and in the Editorial board of the Proceedings.

Invited talk at the **26th European Conference on Surface Science**. Invited talk.

Invited papers:

Adsorción de agua en superficies, A. Mugarza, T. Herranz and M. Salmeron, *Revista Española de Física*, 23, 17, (2009)

Water growth on metal and oxides: binding, dissociation and role of hydroxyl groups, M. Salmerón, H. Bluhm, M. Tatarckhanov, G. Kettler, T. K. Shimizu, A. Mugarza, X. Deng, T. Herranz, S. Yamamoto and A. Nilsson, *Faraday Disc.*, 141, 221-229 (2009)



3.7.5 Carlos F. Sanz-Navarro

During 2009 Carlos F. Sanz-Navarro focused on four main goals:

- Implementation of the periodic boundary conditions in the in-house QM/MM code. This fortran code combines accurate QM calculations based on the density functional theory (DFT) approach implemented in SIESTA with fast classical force fields. This code will be distributed publicly for the first time during 2011.
- Together with Prof. Ordejón a collaboration along with the experimental research group leaded by Prof. Richard E. Palmer at the Nanoscale Physics Research Laboratory, The Birmingham University, started during 2009. The experimental group was interested in the understanding of the pinning of gold clusters on single vacancies on graphite surfaces. This nanostructured system was later aimed to be used for the immobilisation of individual proteins in biotechnological applications as well as a novel way to image single proteins.
- Improvement in the previous parametrisation of the ReaxFF force field for proteins: several drawbacks in a first parametrisation of the force field were found when it was applied to complex free energy calculations of the oxidative dealkylation of DNA. The PhD student from NTNU working on this project came under the HPC-Europa2 programme.

- Previous study on binding of metal clusters on carbon platelets was extended to carbon nanocones to study the effect of the curvature of the system.

HIGHLIGHTS 2009

The work mentioned above was presented in the following events:

14th International Workshop on Computational Physics and Materials Science, Trieste, Italy, January 2009. Poster

IMA Workshop, Minneapolis, USA, May 2009. Poster

ICMAT 2009, Singapore, July 2009. Oral contribution.

1st Nanoday Conference held in Singapore, August 2009. Oral contribution.

EUROMAT 200, Glasgow, UK September 2009. Poster



3.7.6 Albert Verdaguier

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 (KPFM)

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. The first part of the project focuses on the study of water adsorption effects on ionic crystals. MD will be used to study the molecular mechanisms that could explain the experimental observations. SPFM and KPM will be also used to study dielectric properties and contact potential of molecules in self assembled monolayer (SAM). SAMs with different chemical groups exposed to the environment will be studied and changes of these properties induced by water adsorption will be also investigated. The study includes other goals where the unique possibilities of SPFM/KPM will be applied 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 SAMs due to water adsorption on defects. To develop the project a commercial AFM will be modified to perform SPFM measurements and MD software will be upgraded to simulate the studied phenomena.

HIGHLIGHTS 2009

Influence of the macroscopic shape of the tip on the contrast in scanning polarization force microscopy images, G. M. Sacha, M. Cardellach, J. J. Segura, J. Moser, A. Bachtold, J. Fraxedas and A. Verdaguier. *Nanotechnology* 20(28), 285704 (2009)

Charging of graphene by Scanning Probe Microscopy and the effect of water at environmental conditions, A. Verdaguier, M. Cardellach, J.J. Segura, J. Moser, A. Bachtold and J. Fraxedas. *Appl. Phys. Lett.* 94, 233105 (2009)

Ion segregation and deliquescence of alkali halide nanocrystals on SiO₂, K. Arima, P. Jiang, D.-S. Lin, A. Verdaguier, M. Salmerón. *J. Phys. Chem. A.* 113, 9715-9720 (2009)

Amphiphilic Organic Crystals, A. Verdaguier, M. Cardellach, J.J. Segura, J. Moser, A. Bachtold and J. Fraxedas. *J. Am. Chem. Soc.* 131, 17853-17859 (2009)

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 2009, a total of 21 ICN funded researchers were collaborating with the following CSIC Research Groups;

- Nanostructured Functional Materials, led by Dr. Daniel Ruiz-Molina
- Nanobiosensors and Molecular Nanobiophysics, led by Dr. Laura Lechuga
- PLD & Nanoionics, led by Dr. Jose Santiso
- Quantum Nanoelectronics, led by Dr. Adrian Bachtold
- Small Molecules on Surfaces in Ambient and Pristine Conditions, led by Dr. Jordi Fraxedas
- Theory and Simulation, led by Dr. Pablo Ordejón

Some highlights of the scientific output of these research lines are:

HIGHLIGHTS 2009

Coupling Mechanics to Charge Transport in Carbon Nanotube Mechanical Resonators, B. Lassagne, Y. Tarakanov, J. Kinaret, D. García-Sánchez and A. Bachtold. *Science* 325, 1107 (2009)

Electron counting spectroscopy of CdSe quantum dots, M. Zdrojek, M. J. Esplandiú, A. Barreiro and A. Bachtold. *Phys. Rev. Lett.* 102, 228604 (2009)

Transport properties of graphene in the high-current limit, A. Barreiro, M. Lazzeri, J. Moser, F. Mauri and A. Bachtold. *Physical Review Letters* 103, 076601 (2009)

Cooling Carbon Nanotubes to the Phononic Ground State with a Constant Electron Current, S. Zippilli, G. Morigi and A. Bachtold. *Physical Review Letters* 102, 096804 (2009)

Fabrication of large addition energy quantum dots in graphene, J. Moser and A. Bachtold. *Appl. Phys. Lett.* 95, 173506 (2009)

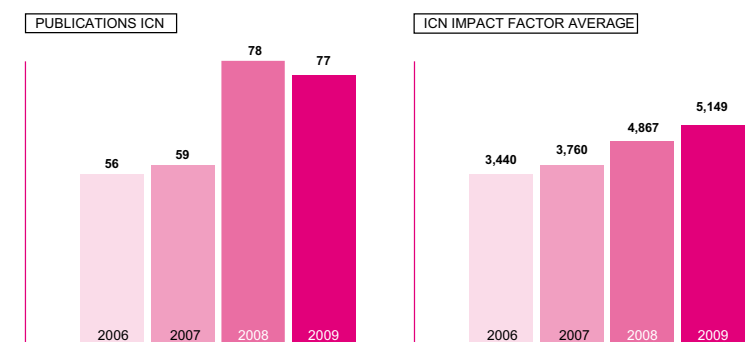
Charging and discharging of graphene in ambient conditions studied with scanning probe microscopy, A. Verdager, M. Cardellach, J.J. Segura, G.M. Sacha, J. Moser, M. Zdrojek, A. Bachtold and J. Fraxedas. *Appl. Phys. Lett.* 94, 233105 (2009)

Influence of the macroscopic shape of the tip on the contrast in scanning polarization force microscopy images, G.M. Sacha, M. Cardellach, J.J. Segura, J. Moser, A. Bachtold, J. Fraxedas and A. Verdager. *Nanotechnology* 20, 285704 (2009)

Thermal probing of energy dissipation in current-carrying carbon nanotubes, L. Shi, J. Zhou, P. Kim, A. Bachtold, A. Majumdar and P.L. McEuen. *J. Appl. Phys.* 105, 104306 (2009)

4.1 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			Impact Factor	5	10	15	20	25	30
Ranking Position	Journal Publication	Number of Papers							
1	Science	1	29747	[Bar chart showing impact factor]					
2	Nature Materials	1	29504	[Bar chart showing impact factor]					
3	Nature Nanotechnology	1	26309	[Bar chart showing impact factor]					
4	Angewandte Chemie Int. Ed.	1	11829	[Bar chart showing impact factor]					
5	Journal of the American Chemical Society	3	8580	[Bar chart showing impact factor]					
6	ACS NANO	1	7493	[Bar chart showing impact factor]					
7	Physical Review Letters	4	7328	[Bar chart showing impact factor]					
8	Advanced Functional Materials	2	6990	[Bar chart showing impact factor]					
9	Lab on a Chip	1	6342	[Bar chart showing impact factor]					
10	Small	2	6171	[Bar chart showing impact factor]					
11	Nanotoxicology	1	5744	[Bar chart showing impact factor]					
12	Biosensors & Bioelectronics	1	5429	[Bar chart showing impact factor]					
13	Analytical Chemistry	2	5214	[Bar chart showing impact factor]					
14	Carbon	2	4504	[Bar chart showing impact factor]					
15	Journal of Physical Chemistry C	1	4224	[Bar chart showing impact factor]					
16	Current Drug Metabolism	1	3989	[Bar chart showing impact factor]					
17	Chembiochem	1	3824	[Bar chart showing impact factor]					
18	Faraday Discssions	1	3700	[Bar chart showing impact factor]					
19	Applied Physics Letters	8	3554	[Bar chart showing impact factor]					
20	Toxicology Letters	1	3479	[Bar chart showing impact factor]					
21	Physical Review B	7	3475	[Bar chart showing impact factor]					
22	Analyst	1	3272	[Bar chart showing impact factor]					
23	Chemosphere	1	3253	[Bar chart showing impact factor]					
24	Molecular Immunology	1	3202	[Bar chart showing impact factor]					
25	Nanotechnology	4	3137	[Bar chart showing impact factor]					
26	Optics Letters	1	3059	[Bar chart showing impact factor]					
27	Journal of Physical Chemistry A	1	2899	[Bar chart showing impact factor]					
28	Electroanalysis	1	2630	[Bar chart showing impact factor]					
29	Journal of Applied Physics	3	2072	[Bar chart showing impact factor]					
30	Materials Research Society Bulletin	1	1879	[Bar chart showing impact factor]					
31	Surface Science	2	1798	[Bar chart showing impact factor]					
32	Journal of Materials Research	1	1667	[Bar chart showing impact factor]					
33	Appl. Phys. A	1	1595	[Bar chart showing impact factor]					
34	Microelectronic Engineering	3	1488	[Bar chart showing impact factor]					
35	Quantum Information Processing	1	1449	[Bar chart showing impact factor]					
36	Textile Research Journal	1	1096	[Bar chart showing impact factor]					
37	IEEE Transactions on Magnetics	1	1061	[Bar chart showing impact factor]					
38	PhysICA B	1	1056	[Bar chart showing impact factor]					
39	Other	9	-	[Bar chart showing impact factor]					

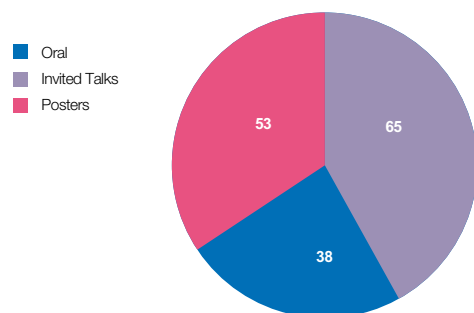
NUMBER OF INDEXED PUBLICATIONS: 77
IMPACT FACTOR AVERAGE: 5,149

4 SCIENTIFIC OUTPUT

4.2 Events Participation

During 2009 ICN researchers participated at various levels in 103 events related to Nanotechnology.

ICN CONTRIBUTION 2009



4.3 Events Organisation

III Jornada AIN – Aplicaciones Industriales de la Nanotecnología

Casa Llotja de Mar, Barcelona – May the 29th, 2009
170 participants, 15 oral contributions and 4 debates.

GDR09 - GDRI: Nanotubes and Graphene – Science and Applications

Coma-ruga, Tarragona – October 19th to 23rd, 2009
123 participants, 10 invited talks, 31 oral contributions and 72 posters.



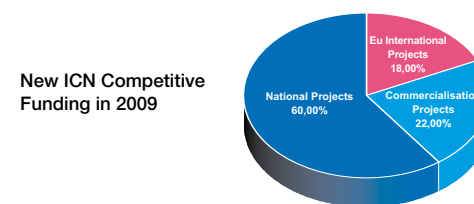
PROJECTS 5

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.

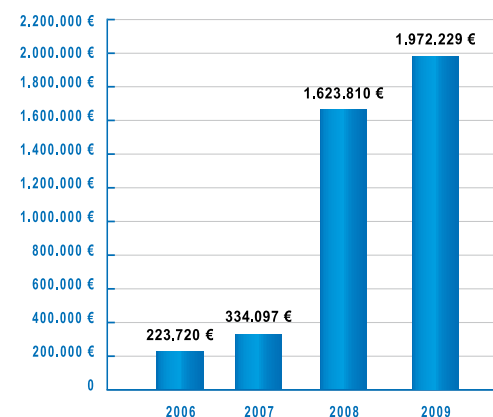
The ICN measures project funding growth using Average Annualised Funding, which is the sum of the total funds awarded in a project divided by each project lifespan, in order to account for fluctuations in grant concessions and varying project length. As can be seen in the chart, this funding continued to grow in 2009, with most new funding coming from a series of new significant national research projects.

Of particular note was the doubling of competitive funding secured for commercialisation projects, to help transfer ICN-developed technologies from the laboratory into a commercial setting. This was due to the efforts of ICN's small but consolidating technology transfer function.

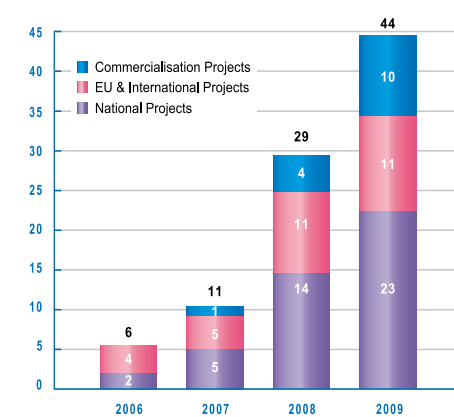
	2006	2007	2008	2009
Average Competitive Funds € (of active projects)				
EU	474.044	470.591	4.829.217	4.950.458
NATIONAL	483.253	572.189	1.351.993	1.659.785
COMERCIAL		30.000	319.633	653.404
TOTAL	957.297	1.072.780	6.500.842	7.263.647
Average Project Length (years weighted by project funds)				
EU	3,8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



ICN Average annualised approved competitive funding



Number of active ICN projects



The management and services team of the ICN perform a wide range of functions and provide 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.

During 2009 the ICN grew from 83 people to 121 people, representing a important increase in administrative workload. In order to meet this demand, prepare for future growth and comply with EU and national reporting requirements, a number of process improvement projects were enforced, including implementation of SAP and a new timesheet system. In order to house the increase of personnel and new labs the CM3 module was enlarged, and various public tenders were run to acquire new equipment.

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

A number of important functions, including legal, HR and senior financial reporting, are externalised to the FUAB, a foundation of the UAB which provides professional services to entities pertaining to the UAB. During 2008 the UAB began implementing the SAP accounting system, and via the FUAB this system was made available to the ICN, which enforced it throughout 2009.



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

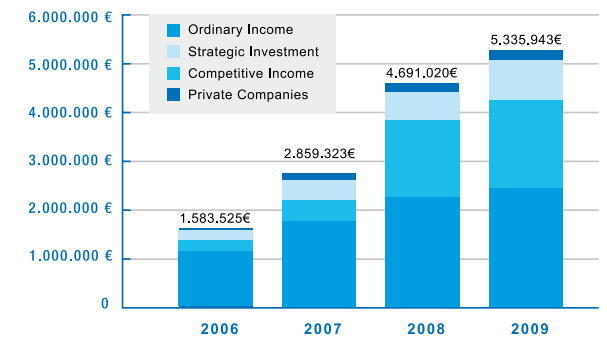
Absent: N. Baruch, C. Bértier, R. Cosialls, I. Chavarría, M. Ferres, F. García, M. González, N. R. Guerrero, M. Lechado, J. Nares, A. Puig, L. Solé and D. Tienda.

7.1 Financial accounts 2009

The financial statements for 2009 are written in accordance with Foundation's 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 operation expenses and depreciation. The annual result of 2009 was a surplus of 125.659€

Evolution of ICN funds



	2.009
Ordinary Income:	2.510.698€
Strategic Investment:	806.052€
Competitive Income:	1.850.806€
Private Companies	168.386€
Total incomes:	5.335.943€

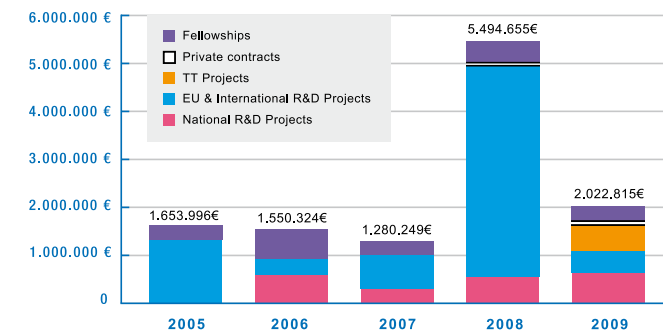
7.2 International competitiveness

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 has secured competitive funding from a number of entities, including the European Science Foundation, European Commission, North Atlantic Treaty Organisation (NATO), Spanish Ministry of Science and Innovation (M-CINN), Spanish Ministry of Industry, Tourism and Commerce, Spanish Ministry of Environment, Rural and Marine, and the Catalan Agency of Support for Universities and Research (AGAUR).

In 2009, although the dramatic results of 2008 (due to the awarding of 2 ERC Starting grants) were not repeated, nevertheless a strong growth over historical levels was achieved, with good distribution across local, national and international calls.

A total of 20 new projects were secured, 6 FP7 projects and 14 national projects, which include 2 TRACE and 1 National Plan among others. Additionally, several technology valorization projects and 3 contracts were signed with private companies to effect technology transfer.

Competitive funds awarded



7.3 Income

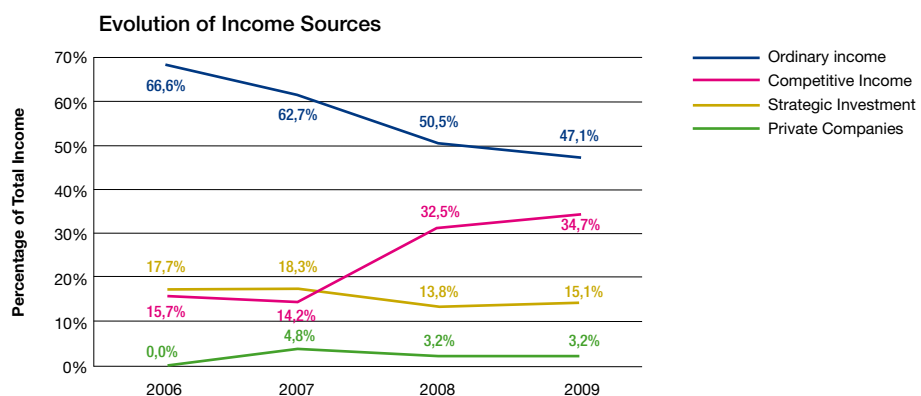
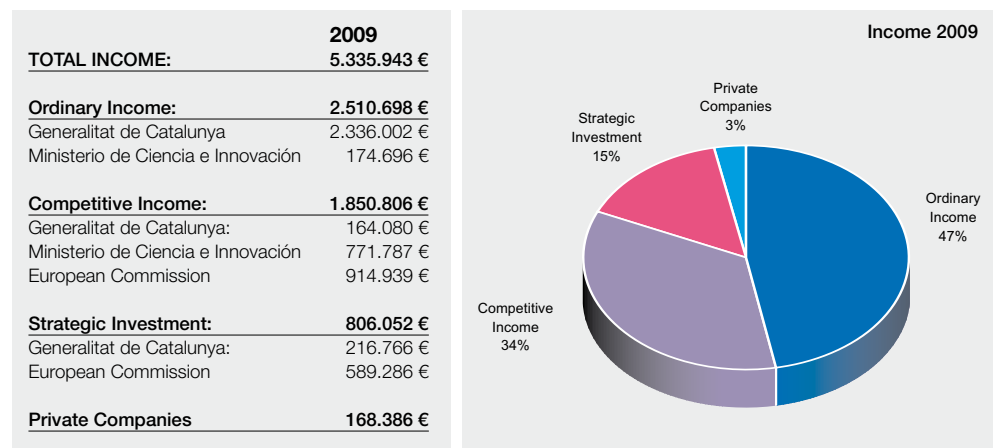
Total revenue for 2009: 5.335.943 euros, from 4 main headings:

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 de Catalunya, which finance the institute's technological infrastructure.

Private Companies: Funds from technology transfer, events, and activities funded by private companies.

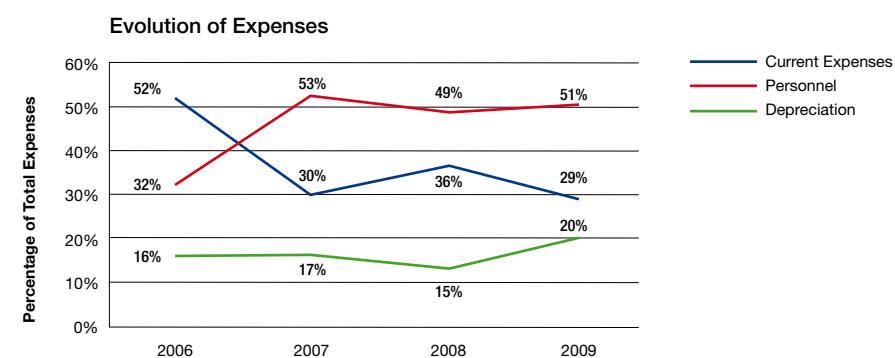
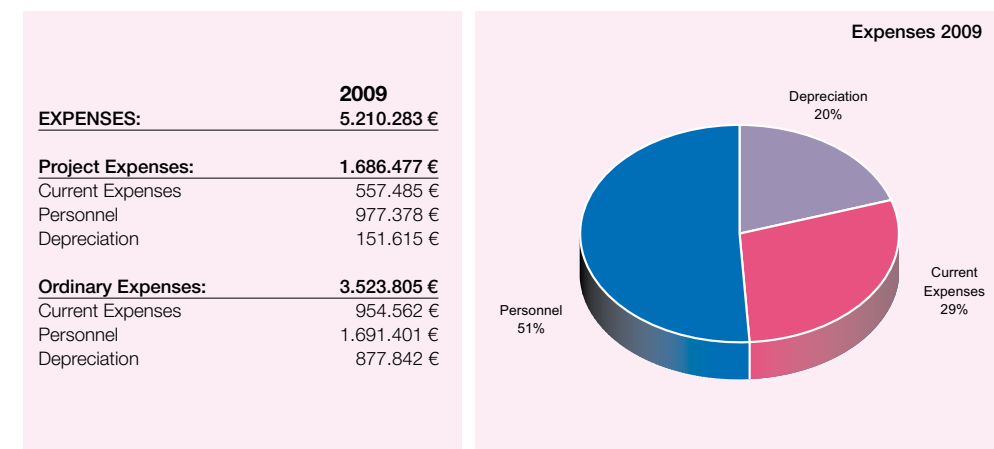


7.4 Expenses

Total expenditures for the year 2009 were: 5.210.282€ from 2 main headings:

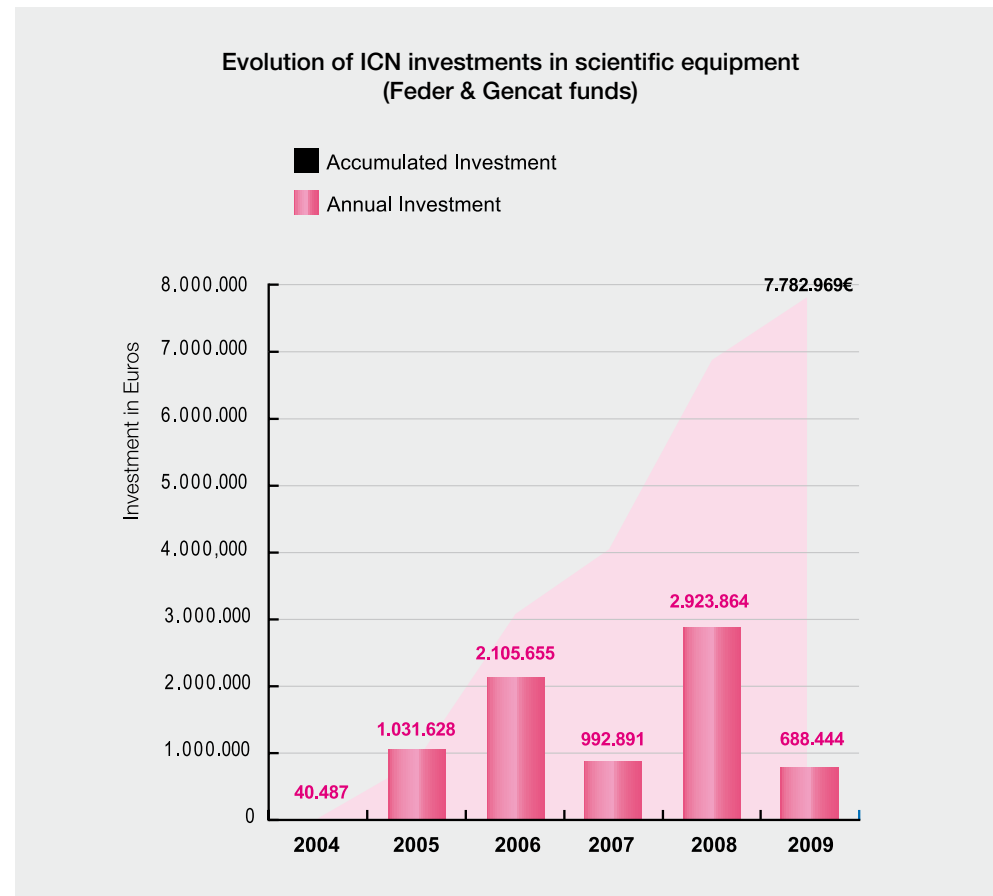
Project expenses: Expenses necessary to implement research and technology transfer: these include current expenses, staff costs and depreciation of equipment and installations.

Ordinary expenses: Expenses that fund management structure and services, the composition of spending is current expenditure, staff costs and depreciation.



In 2009 the ICN continued to invest in new equipment for scientific research. A total of 7.782.968€ was invested during the year. Key technology purchased included a high powered laser for photonics research, a low temperature cryostat and an order was placed for a helium liquefier system, to provide liquid helium for ultra-low temperature experiments.

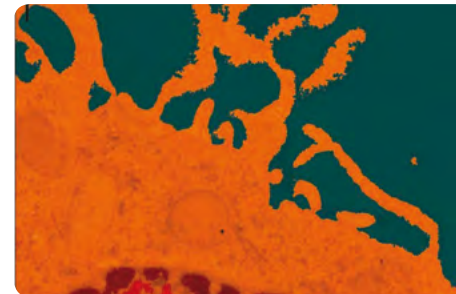
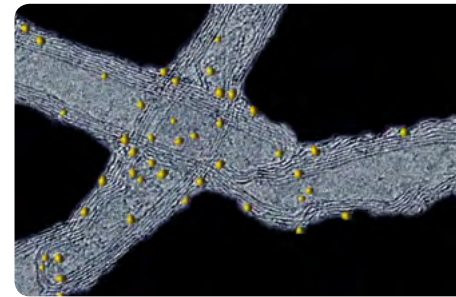
The ICN, as a public institute, adheres to the Law of Public Contracts and all purchases of equipment valued over €50.000 are conducted by tender process.



The ICN TTO (Technology Transfer Office) was consolidated in 2009 with the formal appointment of Jordi Reverter as full-time TT Manager.

During 2009 the following actions were taken:

- 7 new technologies were evaluated of which two proceeded to patent filings, three continued in feasibility studies and two were discarded. International PCT extensions were filed for 5 of the 6 priority patents previously filed in 2008.
- 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: Nanotech International (Tokyo), European Nanotech (Berlin), Nanospain (Zaragoza), TNT Trends in Nanotechnology (Barcelona), ECB European Congress on Biotechnology (Barcelona), Mataró-Innova and Biocat Forum (Barcelona).
- 15 collaboration projects with companies and research institutions were initiated.
- 3 MICINN TRACE project applications were submitted in collaboration with companies, of which two were granted.
- 5 ACC1Ó VALTEC project applications were submitted, of which 4 were granted. ICN has the highest VALTEC success rate, having 6 projects approved from 7 applications.
- 3 FECYT INNOCASH project applications were submitted.
- 4 R&D contracts with private companies were signed, 3 new and 1 extension.
- Organised and hosted the 3rd AIN workshop (Industrial Applications of Nanotechnology) on May 29th, in collaboration with INA (Nanoscience Institute of Aragon) and LEITAT Technological Center, under the NANOARACAT initiative.



Department	Position
Jordi Pascual	Director
MANAGEMENT AND SERVICES	
Marta Balza	Project Manager
Noemí Baruch	Group Project Manager
Céline Bértier	Assistant
Inmaculada Caño	Travel responsible
Oscar Cardenal	IT Systems Engineer
Ignasi Chavarría	Travel responsible
Ramon Cosialls	CIN2 Manager
Ana de la Osa	Communication Officer
Sandra Domene	Suppliers Responsible
Carlos Germán Domínguez	Maintenance Technician
Oliver Fernández	IT Assistant
Marta Ferrer	Assistant
Fran García	Communication Officer
Nestor Ruben Guerrero	Accountant
Rosa Juan	Human Resources Manager
Boaz Kogon	Strategy and Development Manager
Miguel Lechado	Assistant
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
Dulce Tienda	CIN2 Director Assistant
Stella Veciana	European Project Manager
Judit Vela	Accountant
TECHNICIANS	
Belén Ballesteros	Technical Engineer
Xavier Borrísé	Technical Engineer
Libertad Solé	Technical Engineer

Department	Position
ATOMIC MANIPULATION AND SPECTROSCOPY GROUP - ICREA Prof. Pietro Gambardella	
Pietro Gambardella	ICREA Research Professor and Group Leader
Timofey Balashov	Post-doctoral researcher
Gustavo Ceballos	Head of Support Laboratories
Jerald Kavich	Post-doctoral researcher
Cornelius Krull	Doctoral Student
Alberto Lodi Rizzini	Doctoral Student
Mihai Miron	Post-doctoral researcher
Aitor Mugarza	Ramon y Cajal
Corneliu Nistor	Post-doctoral researcher
Marc Ollé	Doctoral Student
INORGANIC NANOPARTICLES GROUP - ICREA Prof. Víctor F. Puntès	
Víctor F. Puntès	ICREA Research Professor and Group Leader
Eudald Casals	Doctoral Student
Joan Comenge	Doctoral Student
Lorena García	Doctoral Student
Edgar Emir González	Doctoral Student
Sonia Goy	Doctoral Student
Stephanie Lim	Post-doctoral Researcher
Xicotencatl López	Post-doctoral Researcher
Zoe Anna Megson	Doctoral Student
Isaac Ojea	Post-doctoral Researcher
Ralph Alexander Sperling	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
NANOBIOELECTRONICS AND BIOSENSORS GROUP - ICREA Prof. Arben Merkoçi	
Arben Merkoçi	ICREA Research Professor and Group Leader
Federico Airo	Student
Georgina Alarcón	Post-doctoral Researcher
Adriano Ambrosi	Post-doctoral Researcher

Department	Position
Gemma Aragay	Doctoral Student
Miquel Cadevall	Student
Welter Cantanhede	Post-doctoral Researcher
Alfredo de la Escosura	Post-doctoral Researcher
Marisol Espinoza	Doctoral Student
Maria Guix	Doctoral Student
Pinar Kara	Post-doctoral Researcher
Anne Stephanie Legendre	Doctoral Student
Marisa Maria V. Maltez	Doctoral Student
Sergio Marín	Post-doctoral Researcher
Mariana Medina	Doctoral Student
Claudio Parolo	Student
Briza Pérez	Post-doctoral Researcher
Melike Sahin	Doctoral Student

PHONONIC AND PHOTONICS NANOSTRUCTURES GROUP - ICREA Prof. Dr. Clivia M. Sotomayor

Clivia M. Sotomayor	ICREA Research Professor and Group Leader
Francesc Alzina	Post-doctoral Researcher
(Pierre-) Olivier Chapuis	Post-doctoral Researcher
John Cuffe	Doctoral Student
Damian Dudek	Post-doctoral Researcher
Achille Francone	Post-doctoral Researcher
Yamila García	Post-doctoral Researcher
Nikolaos Kehagias	Technical Engineer
Timothy Kehoe	Post-doctoral Researcher
Sinead Kennedy	Post-doctoral Researcher
Vincent Reboud	Post-doctoral Researcher
Lars Schneider	Technical Engineer
Hai-Hua Tao	Post-doctoral Researcher

PHYSICS AND ENGINEERING OF NANODEVICES - ICREA Prof. Sergio O. Valenzuela

Sergio O. Valenzuela	ICREA Research Professor and Group Leader
German Bridoux	Post-doctoral Researcher
Marius Costache	Post-doctoral Researcher
Ingmar Neumann	Doctoral Student

Department	Position
QUANTUM NANOELECTRONIC DEVICES GROUP - Dr. Adrian Bachtold	
Amelia Barreiro	Doctoral Student
Julien Chaste	Post-doctoral Researcher
Daniel García	Doctoral Student
Giuseppe Schiavone	Doctoral Student
Mariusz Zdrojek	Post-doctoral Researcher

RAMÓN Y CAJAL RESEARCHERS

Daniel Maspoch	Supramolecular NanoChemistry & Materials	Ramón y Cajal Researcher
Ernest Mendoza	Nanobiosensors and Bioanalytica Applications	Ramón y Cajal Researcher
Fernando Moreno	Nanobiosensors and Bioanalytica Applications	Ramón y Cajal Researcher
Aitor Mugarza	Atomic Manipulation and Spectroscopy Group	Ramón y Cajal Researcher
Carlos Sanz	Theory and Simulation	Ramón y Cajal Researcher
Albert Verdaguer	Small Molecules on Surfaces in Ambient and Pristine Conditions	Ramón y Cajal Researcher

RESEARCHERS IN COLLABORATIVE GROUPS

Juan Antonio Asensio	Supramolecular NanoChemistry & Materials	Post-doctoral Researcher
Marta González	Supramolecular NanoChemistry & Materials	Technical Engineer
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
Mari Carmen Estévez	Nanobiosensors and Bioanalytica Applications	Post-doctoral Researcher
Benjamin Gollnick	Nanobiosensors and Bioanalytica Applications	Doctoral Student
Ana Belen González	Nanobiosensors and Bioanalytica Applications	Doctoral Student
Inhar Imaz	Supramolecular NanoChemistry & Materials	Post-doctoral Researcher
M. Alberto Martínez	Nanostructured Functional Materials	Doctoral Student
Àlvar Nocete	Supramolecular NanoChemistry & Materials	Doctoral Student
Marinus Albertus Otte	Nanobiosensors and Bioanalytica Applications	Doctoral Student
LeonorRodrigues	Nanobiosensors and Bioanalytica Applications	Doctoral Student
Marta Rubio	Supramolecular NanoChemistry & Materials	Doctoral Student
Javier Saiz	Nanostructured Functional Materials	Doctoral Student
Borja Sepúlveda	Nanobiosensors and Bioanalytica Applications	Post-doctoral Researcher
Yu Youhai	Novel Energy-Oriented Materials	Post-doctoral Researcher
James Arturo Zapata	PLD & Nanoionics	Doctoral Student

Most relevant publications (by impact factor)

Coupling mechanics to charge transport in carbon nanotube mechanical resonators, B. Lassagne, Y. Tarakanov, J. Kinaret, D. García-Sánchez and A. Bachtold. *Science* 325, 1107 (2009)

Supramolecular control of the magnetic anisotropy in two-dimensional high-spin Fe arrays at a metal interface, P. Gambardella, S. Stepanow, A. Dmitriev, J. Honolka, F. de Groot, M. Lingenfelder, S. Sen Gupta, D. D. Sarma, P. Bencok, S. Stanescu, S. Clair, S. Pons, N. Lin, A. P. Seitsonen, H. Brune, J. V. Barth and K. Kern. *Nature Materials* 8, 189 (2009)

Bottom-up growth of fully transparent low refractive index top-contact layers of indium tin oxide nanowires for LEDs, C. O'Dwyer, M. Szachowic, G. Visimberga, V. Lavayen, S. B. Newcomb and C. M. Sotomayor. *Nature Nanotechnology* 4, 239-244 (2009)

Metal-organic spheres as functional systems for encapsulation, I. Imaz, J. Hernando, D. Ruiz-Molina and D. MasPOCH. *Angewandte Chemie-International Ed.* 48, 2325 (2009)

Identifying Spinel Phases in Nearly Monodisperse Iron Oxide Colloidal Nanocrystal, A. Corrias, G. Mountjoy, D. Loche et al. *Journal of the American Chemical Society* 113, 43 18667 (2009)

Instability of Cationic Gold Nanoparticle Bioconjugates: The Role of Citrate Ions, I. Ojea-Jiménez and V. Puntès. *Journal of the American Chemical Society* 131, 37 13320-133327 (2009)

Amino acid based metal-organic nanofibers, I. Imaz, M. Rubio-Martínez, W.J. Saletta, D. B. Amabilino and D. MasPOCH. *Journal of the American Chemical Society* 131, 18222 (2009)

Amphiphilic organic crystals, J. J. Segura, A. Verdager, M. Cardellac, J. Moser, A. Bachtold and J. Fraxedas. *Journal of the American Chemical Society* 131, 17853-17859 (2009)

Homogeneous conjugation of peptides onto gold nanoparticles enhance macrophage response, N. Gómez Bastus, E. Sánchez-Tillo, S. Pujals, et al. *ACS Nano* 3, 6 1335-1344 (2009)

Magnetic proximity effect features in antiferromagnetic/ferrimagnetic core-shell nanoparticles, I. V. Golosovsky, G. Salazar-Alvarez, A. López-Ortega, M. A. González, J. Sort, M. Estrader, S. Surinach, M. D. Baró and J. Nogués. *Physical Review Letters* 102, 247201 (2009)

For a full list of publications during 2009, please visit our website, www.icn.cat.

EU / INTERNATIONAL PROJECTS 2009

Project title: CARDEQ - Carbon nanotube devices at the quantum limit

Principal Researcher: Dr. Adrian BACHTOLD

Funding: European Commission - Sixth Framework Programme (FP6)

Project title: DIPNA - Development of an integrated platform for nanoparticle analysis to verify their possible toxicity and eco-toxicity

Principal Researcher: ICREA Prof. Víctor F. PUNTES

Funding: European Commission - Sixth Framework Programme (FP6)

Project title: Microscopic role of magnetism in high temperature superconductivity

Principal Researcher: ICREA Prof. Pietro GAMBARDELLA

Funding: National Science Foundation (USA)

Project title: Nano-ICT - Nano-scale ICT devices and systems coordination action

Principal Researcher: ICREA Prof. Clivia M. SOTOMAYOR

Funding: European Commission - Seventh Framework Programme (FP7)

Project title: NANOPACK - Nano packaging technology for interconnect and heat dissipation

Principal Researcher: ICREA Prof. Clivia M. SOTOMAYOR

Funding: European Commission - Seventh Framework Programme (FP7)

Project title: NaPANIL - Nanopatterning, production and applications based on nanoimprinting lithography

Principal Researcher: ICREA Prof. Clivia M. SOTOMAYOR

Funding: European Commission - Seventh Framework Programme (FP7)

Project title: NOMAD - Nanoscale magnetization dynamic

Principal Researcher: ICREA Prof. Pietro GAMBARDELLA

Funding: European Commission - Seventh Framework Programme (FP7)

Project title: Quantum devices based on carbon nanotubes. Marie Curie

Principal Researcher: Dr. Adrian BACHTOLD

Funding: European Commission - Seventh Framework Programme (FP7)

Project title: Quantum probes based on carbon nanotubes

Principal Researcher: Dr. Adrian BACHTOLD

Funding: European Science Foundation

Project title: SM-DNA-repair - New single-molecule techniques and their application in the study of DNA break repair

Principal Researcher: Ramón y Cajal Researcher Dr. Fernando MORENO

Funding: European Commission - Seventh Framework Programme (FP7)

Project title: TAILPHOX - Tailoring phonon-phonon interaction in silicon phoxonic crystals

Principal Researcher: ICREA Prof. Clivia M. SOTOMAYOR

Funding: European Commission - Seventh Framework Programme (FP7)

NATIONAL PROJECTS 2009

Project title: CAPIN - Fabricación de nanoestructuras para la investigación de fonones

acoustic confinados

Principal Researcher: ICREA Prof. Clivia M. SOTOMAYOR

Funding: MICINN (Ministry of Science and Innovation)

Project title: CNBSS

Principal Researcher: ICREA Prof. Víctor F. PUNTES

Funding: MICINN (Ministry of Science and Innovation)

Project title: Collaboration between CSIC and the University of Santiago de Chile

Principal Researcher: ICREA Prof. Clivia M. SOTOMAYOR

Funding: MICINN (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: MICINN (Ministry of Science and Innovation)

Project title: Development of ReaxFF reactive force fields and their application in the simulation of complex atomistic systems

Principal Researcher: Ramón y Cajal Researcher Dr. Carlos F. SANZ-NAVARRO

Funding: MICINN (Ministry of Science and Innovation)

Project title: Element- and spatially-resolved nonlinear magnetization dynamics in ferrites

Principal Researcher: ICREA Prof. GAMBARDELLA

Funding: MICINN (Ministry of Science and

Innovation)

Project title: Graphene-based Molecular Spintronics Devices

Principal Researcher: ICREA Prof. Sergio O. VALENZUELA

Funding: MICINN (Ministry of Science and Innovation)

Project title: Integrated lab-on-chip platforms for medical diagnostics

Principal Researcher: Ramón y Cajal Researcher Dr. Ernest MENDOZA

Funding: MICINN (Ministry of Science and Innovation)

Project title: Mecanoquantum simulations and proximity microscopies in actual problems of surfaces, complex materials, biomolecules and nanostructures

Principal Researcher: Ramón y Cajal Researcher Dr. Albert VERDAGUER

Funding: MICINN (Ministry of Science and Innovation)

Project title: MOLCHIP - Molecular Chips

Principal Researcher: Ramón y Cajal Researcher Dr. Daniel MASPOCH

Funding: MICINN (Ministry of Science and Innovation)

Project title: NANOBIOMED - Nanotechnologies in biomedicine

Principal Researchers: Ramón y Cajal Researcher Dr. E. MENDOZA, ICREA Prof. A. MERKOÇI, Dr. J. PASCUAL and ICREA Prof. V. PUNTES

Funding: MICINN (Ministry of Science and Innovation)

Project title: NANOCLEAN Determination of

the potential of different functionalised inorganic nanoparticles.

Principal Researcher: ICREA Prof. Víctor F. PUNTES

Funding: MAA (Ministry of Environment and Rural and Marine Affairs)

Project title: NANOWAVE - Nanowire based Microwave Emitters for Use in Monolithic Microwave Integrated Circuits

Principal Researcher: ICREA Prof. Pietro GAMBARDELLA

Funding: MICINN (Ministry of Science and Innovation)

Project title: Nanobiosensors for tumoral markers

Principal Researcher: ICREA Prof. Arben MERKOÇI

Funding: MICINN (Ministry of Science and Innovation)

Project title: New single molecule technologies for the study of DNA repair mechanisms

Principal Researcher: Ramón y Cajal Researcher Dr. Fernando MORENO

Funding: MICINN (Ministry of Science and Innovation)

Project title: SGR

Principal Researcher: ICREA Prof. Pietro GAMBARDELLA

Funding: AGAUR (Agència de Gestió d'Ajuts Universitaris i de Recerca)

Project title: SGR

Principal Researcher: ICREA Prof. Arben MERKOÇI

Funding: AGAUR (Agència de Gestió d'Ajuts Universitaris i de Recerca)

Project title: SGR

Principal Researcher: Dr. Aitor MUGARZA

Funding: AGAUR (Agència de Gestió d'Ajuts Universitaris i de Recerca)

Project title: SGR

Principal Researcher: ICREA Prof. Víctor F. PUNTES

Funding: AGAUR (Agència de Gestió d'Ajuts Universitaris i de Recerca)

Project title: SGR

Principal Researcher: ICREA Prof. Clivia M. SOTOMAYOR

Funding: AGAUR (Agència de Gestió d'Ajuts Universitaris i de Recerca)

Project title: SRTS - Polarized electrons tunnel spectroscopy: a new tool for the development of ultra-high density magnetic memories

Principal Researcher: ICREA Prof. Sergio O. VALENZUELA

Funding: MICINN (Ministry of 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: ICREA Prof. Pietro GAMBARDELLA

Funding: MICINN (Ministry of Science and Innovation)

Project title: Synthesis and manipulation of two-dimensional molecular spin networks

Principal Researcher: ICREA Prof. Pietro GAMBARDELLA

Funding: MICINN (Ministry of Science and Innovation)

Project title: Synthesis of nanoparticles and nanostructured materials by self-assembly

Principal Researcher: ICREA Prof. Víctor F. PUNTES

Funding: MICINN (Ministry of Science and Innovation)

Project title: Training in nanoscale manufacturing methods

Principal Researcher: ICREA Prof. Clivia M. SOTOMAYOR

Funding: MICINN (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: MICINN (Ministry of Science and Innovation)

Project title: WARMER - Water risk management in Europe

Principal Researcher: ICREA Prof. Arben MERKOÇI

Funding: AGAUR (Agència de Gestió d'Ajuts Universitaris i de Recerca)

Project title: Water multifunctional processing system based on nanoplateforms for ultrasensitive detection and purification of environmental pollutants

Principal Researcher: ICREA Prof. Arben MERKOÇI

Funding: MICINN (Ministry of Science and Innovation)

TECHNOLOGY TRANSFER 2009

Project title: Clinical oncologic translation of gold nanoparticles conjugated with CisPlatin: from in-vivo to phase I.

Principal Researcher: ICREA Prof. Víctor F. PUNTES

Funding: ACC1Ó (Generalitat of Catalonia)

Project title: Diagnostic system for detecting breast cancer

Principal Researcher: ICREA Prof. Arben MERKOÇI

Funding: ACC1Ó (Generalitat of Catalonia)

Project title: EVALICN

Principal Researcher: Dr. Jordi PASCUAL

Funding: ACC1Ó (Generalitat of Catalonia)

Project title: Encapsulation of fungicides in metalorganic micro- and nanosystems

Principal Researcher: Ramón y Cajal Researcher Dr. Daniel MASPOCH

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 metal-organic 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 nanoconjugats as adjuvant for flu vaccines

Principal Researcher: ICREA Prof. Víctor F. 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 2009

Project title: Development of fragrances encapsulation systems for laundry products

Principal Researcher: Ramón y Cajal Researcher Dr. Daniel MASPOCH

Funding: private company

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

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