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 relative 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 nanostuctures 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,
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. Bernt 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, aside 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 Catalonian grants from AGAUR, ACC1Ó and VALTEC together with commercial agreements such as with a 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


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-
RESEARCH GROUPS

3.1 Atomic Manipulation and Spectroscopy Group

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


Understanding the magnetic properties of metalorganic adsorbates with model cases: Cu-Phthalocyanine on Ag(100), A. Mugarza. 38th European Conference on Surface Science. Invited Talk

OTHER ACTIVITIES

Teaching:

Nanoscience and Nanotechnology Master, Universitat Autonoma 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.

RESEARCH GROUPS

3.2 Inorganic Nanoparticles Group

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

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...
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.

**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 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 focused 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


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.

RESEARCH GROUPS
3.4 Nanobioelectronics and Biosensors Group

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


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

BIOSENSING USING NANOMATERIALS – BIONANO.


OTHER ACTIVITIES


RESEARCH GROUPS
3.5 Phononic and Photonic Nanostructures Group
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.


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.
RESEARCH GROUPS

3.5 Phononic and Photonic Nanostructures Group

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


OTHER ACTIVITIES

- The interview of Prof. Dr. Sotomayor Torres by journalist Kimberley Clark was published in the January 2009 edition of Europhotonics: “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 (IONS) held in ICFO, in February 2009.
**3.6 Physics and Engineering of Nanodevices**


**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.”

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**3.7.1 Daniel Maspoch**

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

The main focus of this project is the design, synthesis and study of metal-organic nano-tubes (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 (NANOUP). 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 nanocapsulation technologies.

**HIGHLIGHTS 2009**


3.7 Ramón y Cajal Researchers

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 Rodríguez, pre-doctoral 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 awarded.

3.7.3 Fernando Moreno

2009 was the year of Fernando Moreno’s transition from the Catalán 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


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 post-doctoral 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.
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 nancones 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


- EUROMAT 200, Glasgow, UK September 2009. Poster

3.7.6 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 (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 KPFM 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/KPFM 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


RESEARCH GROUPS
3.8 ICN Researchers in Collaborative Groups

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


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:

[Graphs showing publications and impact factor over the years]

4.2 Impact Factor

[Table showing impact factor distribution by journal]

[Table showing number of indexed publications by year]
4.2 Events Participation
During 2009 ICN researchers participated at various levels in 103 events related to Nanotechnology.

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.

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.

- Average Competitive Funds € (of active projects)
  - EU: 474,044, 470,191, 4,829,217, 4,953,458
  - NATIONAL: 460,055, 872,189, 1,557,363, 1,520,785
  - TOTAL: 937,100, 1,342,380, 6,386,580, 7,333,243

- Average Project Length (years weighted by project funds)
  - EU: 3.8, 3.4, 4.0, 4.2
  - NATIONAL: 4.0, 3.3, 3.3, 2.7
  - TOTAL: 3.9, 3.2, 4.0, 3.7

- Average Annualised Funding €/year
  - ICN: 223,720, 334,097, 1,623,810, 1,972,229
  - EU: 474,044, 470,191, 4,829,217, 4,953,458
  - 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

- New ICN Competitive Funding in 2009
- National Projects: 60.00%
- Eu International Projects: 18.00%
- Commercialisation Projects: 22.00%

- 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 significant 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.

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€.

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 (MICINN), 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.
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.

<table>
<thead>
<tr>
<th>Income Source</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinary Income</td>
<td>2,510,698 €</td>
</tr>
<tr>
<td>Competitive Income</td>
<td>1,850,806 €</td>
</tr>
<tr>
<td>Strategic Investment</td>
<td>806,052 €</td>
</tr>
<tr>
<td>Private Companies</td>
<td>168,386 €</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Expenses 2009</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Expenses</td>
<td>1,686,477 €</td>
</tr>
<tr>
<td>Current Expenses</td>
<td>977,378 €</td>
</tr>
<tr>
<td>Depreciation</td>
<td>151,615 €</td>
</tr>
<tr>
<td>Ordinary Expenses</td>
<td>3,523,805 €</td>
</tr>
<tr>
<td>Current Expenses</td>
<td>1,691,401 €</td>
</tr>
<tr>
<td>Depreciation</td>
<td>877,842 €</td>
</tr>
</tbody>
</table>
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.
## Personnel (by department)

### ATOMIC MANIPULATION AND SPECTROSCOPY GROUP
- **Department:** ATOMIC MANIPULATION AND SPECTROSCOPY GROUP
- **Position:** ICREA Research Professor and Group Leader
  - Pietro Gambardella
- **Position:** Post-doctoral researcher
  - Timofey Balashov
  - Gustavo Ceballos
  - Jerald Kavich
  - Cornelius Krull
  - Alberto Lodi Rizzini
  - Mihai Miron
  - Aitor Mugarza
  - Corneliu Nistor
  - Marc Olle

### INORGANIC NANOPARTICLES GROUP
- **Department:** INORGANIC NANOPARTICLES GROUP
- **Position:** ICREA Research Professor and Group Leader
  - Victor F. Puntes
- **Position:** Doctoral Student
  - Eudald Casals
  - Joan Comenge
  - Lorena Garcia
  - Edgar Emir Gonzalez
  - Sonia Goy
  - Stephanie Lim
  - Xicotencatl Lopez
  - Zoe Anna Megson
  - Miriam Varon

### MAGNETIC NANOSTRUCTURES GROUP
- **Department:** MAGNETIC NANOSTRUCTURES GROUP
- **Position:** ICREA Research Professor and Group Leader
  - Josep Nogues
- **Position:** Doctoral Student
  - Boaz Kogon
  - Miguel Lechado
  - Javier Nares
  - Matias Pueyo
  - Anna Puig
  - Jordi Reverter
  - Anabel Rodriguez
  - Xavier Ros
  - Dulce Tienda
  - Stella Veciana
  - Judit Vela

### INORGANIC NANOPARTICLES GROUP
- **Department:** INORGANIC NANOPARTICLES GROUP
- **Position:** Doctoral Student
  - Marta Balza
  - Noemí Baruch
  - Céline Bértier
  - Inmaculada Caño
  - Oscar Cardenal
  - Ignasi Chavarría
  - Ramon Cosials
  - Àlia de la Osa
  - Sandra Domene
  - Carlos Germán Dominguez
  - Oliver Fernández
  - Marta Ferrés
  - Fran Garcia
  - Nestor Ruben Guerrero
  - Rosa Juan
  - Boaz Kogon
  - Miguel Lechado
  - Javier Nares
  - Matias Pueyo
  - Anna Puig
  - Jordi Reverter
  - Anabel Rodriguez
  - Xavier Ros
  - Dulce Tienda
  - Stella Veciana
  - Judit Vela

### TECHNICIANS
- **Department:** TECHNICIANS
- **Position:** Technical Engineer
  - Belén Ballesteros
  - Xavier Boniste
  - Libertad Solé

### MANAGEMENT AND SERVICES
- **Department:** MANAGEMENT AND SERVICES
- **Position:** Director
  - Jordi Pascual
- **Position:** Project Manager
  - Marta Balza
- **Position:** Group Project Manager
  - Noemí Baruch
- **Position:** Assistant
  - Céline Bértier
- **Position:** Travel responsible
  - Inmaculada Caño
- **Position:** IT Systems Engineer
  - Oscar Cardenal
- **Position:** Communication Officer
  - Ignasi Chavarría
- **Position:** Suppliers Responsible
  - Sandra Domene
- **Position:** Maintenance Technician
  - Carlos Germán Dominguez
- **Position:** IT Assistant
  - Oliver Fernández
- **Position:** Assistant
  - Marta Ferrés
- **Position:** Communication Officer
  - Fran Garcia
- **Position:** Accountant
  - Nestor Ruben Guerrero
- **Position:** Human Resources Manager
  - Rosa Juan
- **Position:** Strategy and Development Manager
  - Boaz Kogon
- **Position:** Assistant
  - Miguel Lechado
- **Position:** Accountant
  - Javier Nares
- **Position:** Managing Director
  - Matias Pueyo
- **Position:** Group Project Manager
  - Anna Puig
- **Position:** Technology Transfer Manager
  - Jordi Reverter
- **Position:** Assistant
  - Anabel Rodriguez
- **Position:** General Services Manager
  - Xavier Ros
- **Position:** CIN2 Director Assistant
  - Dulce Tienda
- **Position:** European Project Manager
  - Stella Veciana
- **Position:** Accountant
  - Judit Vela

### TECHNICIANS
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### TECHNICIANS
- **Department:** TECHNICIANS
- **Position:** Technical Engineer
  - Belén Ballesteros
  - Xavier Boniste
  - Libertad Solé
<table>
<thead>
<tr>
<th>Department</th>
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<tbody>
<tr>
<td>Gemma Aragay</td>
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<tr>
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**QUANTUM NANOELECTRONIC DEVICES GROUP - Dr. Adrian Bachtold**

<table>
<thead>
<tr>
<th>Member</th>
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<tbody>
<tr>
<td>Amelia Barreiro</td>
<td>Doctoral Student</td>
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<tr>
<td>Julien Chaste</td>
<td>Post-doctoral Researcher</td>
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<tr>
<td>Daniel García</td>
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<td>Giuseppe Schiavone</td>
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<tr>
<td>Mariusz Zdrojek</td>
<td>Post-doctoral Researcher</td>
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**RAMÓN Y CAJAL RESEARCHERS**

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<tr>
<th>Member</th>
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<tbody>
<tr>
<td>Daniel Manso</td>
<td>Supramolecular NanoChemistry &amp; Materials Ramón y Cajal Researcher</td>
</tr>
<tr>
<td>Ernest Mendoza</td>
<td>Nanobiosensors and Bioanalytica Applications Ramón y Cajal Researcher</td>
</tr>
<tr>
<td>Fernando Moreno</td>
<td>Nanobiosensors and Bioanalytica Applications Ramón y Cajal Researcher</td>
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<tr>
<td>Altor Mugarza</td>
<td>Atomic Manipulation and Spectroscopy Group Ramón y Cajal Researcher</td>
</tr>
<tr>
<td>Carlos Sanz</td>
<td>Theory and Simulation Ramón y Cajal Researcher</td>
</tr>
<tr>
<td>Albert Verdaguer</td>
<td>Small Molecules on Surfaces in Ambient and Pristine Conditions Ramón y Cajal Researcher</td>
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**RESEARCHERS IN COLLABORATIVE GROUPS**

<table>
<thead>
<tr>
<th>Member</th>
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<tbody>
<tr>
<td>Juan Antonio Asensio</td>
<td>Supramolecular NanoChemistry &amp; Materials Post-doctoral Researcher</td>
</tr>
<tr>
<td>Marta González</td>
<td>Supramolecular NanoChemistry &amp; Materials Technical Engineer</td>
</tr>
<tr>
<td>Carlos Carbonell</td>
<td>Supramolecular NanoChemistry &amp; Materials Doctoral Student</td>
</tr>
<tr>
<td>Mar Cardellach</td>
<td>Small Molecules on Surfaces in Ambient and Pristine Conditions Doctoral Student</td>
</tr>
<tr>
<td>Arnau Carmé</td>
<td>Supramolecular NanoChemistry &amp; Materials Doctoral Student</td>
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<tr>
<td>Mari Carmen Estève</td>
<td>Nanobiosensors and Bioanalytica Applications Post-doctoral Researcher</td>
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<td>Benjamin Golnich</td>
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<td>Ana Belen González</td>
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<td>Ihsar Imaz</td>
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<td>M. Alberto Martínez</td>
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<td>Akar Nocete</td>
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<td>Maríus Abertus Otte</td>
<td>Nanobiosensors and Bioanalytica Applications Doctoral Student</td>
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<tr>
<td>LeonorRodrigues</td>
<td>Nanobiosensors and Bioanalytica Applications Doctoral Student</td>
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<td>Marta Rubio</td>
<td>Supramolecular NanoChemistry &amp; Materials Doctoral Student</td>
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<tr>
<td>Javier Saiz</td>
<td>Nanostructured Functional Materials Doctoral Student</td>
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<tr>
<td>Borja Sepúlveda</td>
<td>Nanobiosensors and Bioanalytica Applications Post-doctoral Researcher</td>
</tr>
<tr>
<td>Yu Youhai</td>
<td>Novel Energy-Oriented Materials Post-doctoral Researcher</td>
</tr>
<tr>
<td>James Arturo Zapata</td>
<td>PLD &amp; Nanionics Doctoral Student</td>
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**PHYSICS AND ENGINEERING OF NANO DEVICES - ICREA Prof. Sergio O. Valenzuela**

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<tbody>
<tr>
<td>Sergio O. Valenzuela</td>
<td>ICREA Research Professor and Group Leader</td>
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<tr>
<td>German Bridoux</td>
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<td>Marius Costache</td>
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<tr>
<td>Ingmar Neumann</td>
<td>Doctoral Student</td>
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**PHONONIC AND PHOTONICS NANOSTRUCTURES GROUP - ICREA Prof. Clivia M. Sotomayor**

<table>
<thead>
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<th>Member</th>
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<tbody>
<tr>
<td>Clivia M. Sotomayor</td>
<td>ICREA Research Professor and Group Leader</td>
</tr>
<tr>
<td>Francesc Alzha</td>
<td>Post-doctoral Researcher</td>
</tr>
<tr>
<td>(Pierre-) Olivier Chapuis</td>
<td>Post-doctoral Researcher</td>
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<tr>
<td>John Cuffe</td>
<td>Doctoral Student</td>
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<tr>
<td>Damian Dudek</td>
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<tr>
<td>Achille Francone</td>
<td>Post-doctoral Researcher</td>
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<tr>
<td>Yamila García</td>
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<tr>
<td>Nikolaos Kehagias</td>
<td>Technical Engineer</td>
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<tr>
<td>Timothy Kehoe</td>
<td>Post-doctoral Researcher</td>
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<tr>
<td>Siread Kennedy</td>
<td>Post-doctoral Researcher</td>
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<tr>
<td>Vincent Reboud</td>
<td>Post-doctoral Researcher</td>
</tr>
<tr>
<td>Lars Schneider</td>
<td>Technical Engineer</td>
</tr>
<tr>
<td>Hui-Hua Tao</td>
<td>Post-doctoral Researcher</td>
</tr>
</tbody>
</table>
Most relevant publications (by impact factor)


For a full list of publications during 2009, please visit our website, www.icn.cat.
acousticos continados
Principal Researcher: ICREA Prof. Claudia M. SOTOMAYOR
Funding: MICINN (Ministry of Science and Innovation)

Project title: CNBSS
Principal Researcher: ICREA Prof. Victor 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. Claudia 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: 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. Pietro 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: Mecanoquantic 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: NANOBIOMED Determination of the potential of different functionalised inorganic nanoparticles.
Principal Researcher: ICREA Prof. Victor 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: 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 optoelectromechanical 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: Sythesis 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. Victor 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: WARIMER - 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 nanoplaformas for ultra-sensitive 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. Victor 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. Victor F. PUNTES
Funding: ACC1Ó (Generalitat of Catalonia)

COMMERICALISATION 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