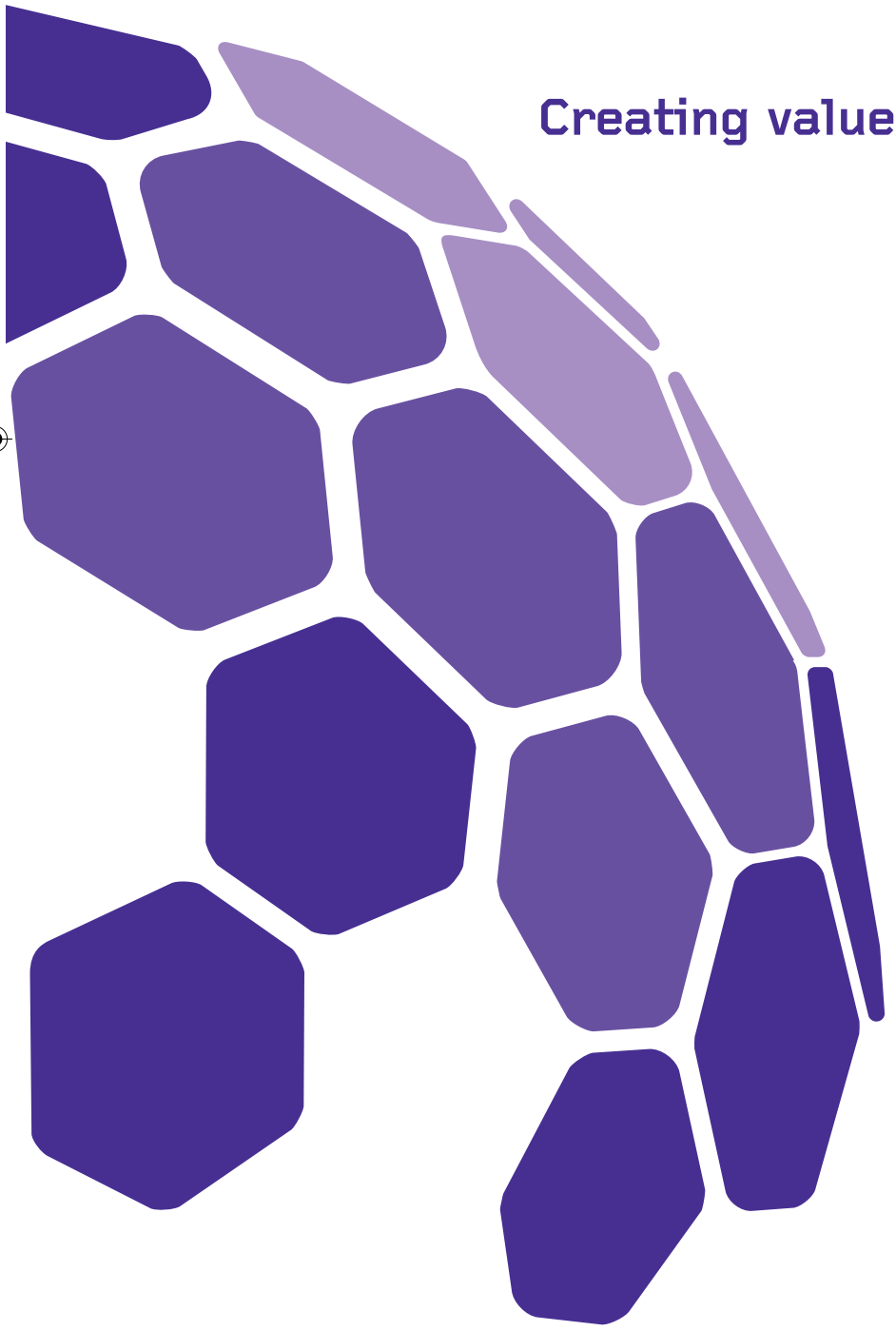
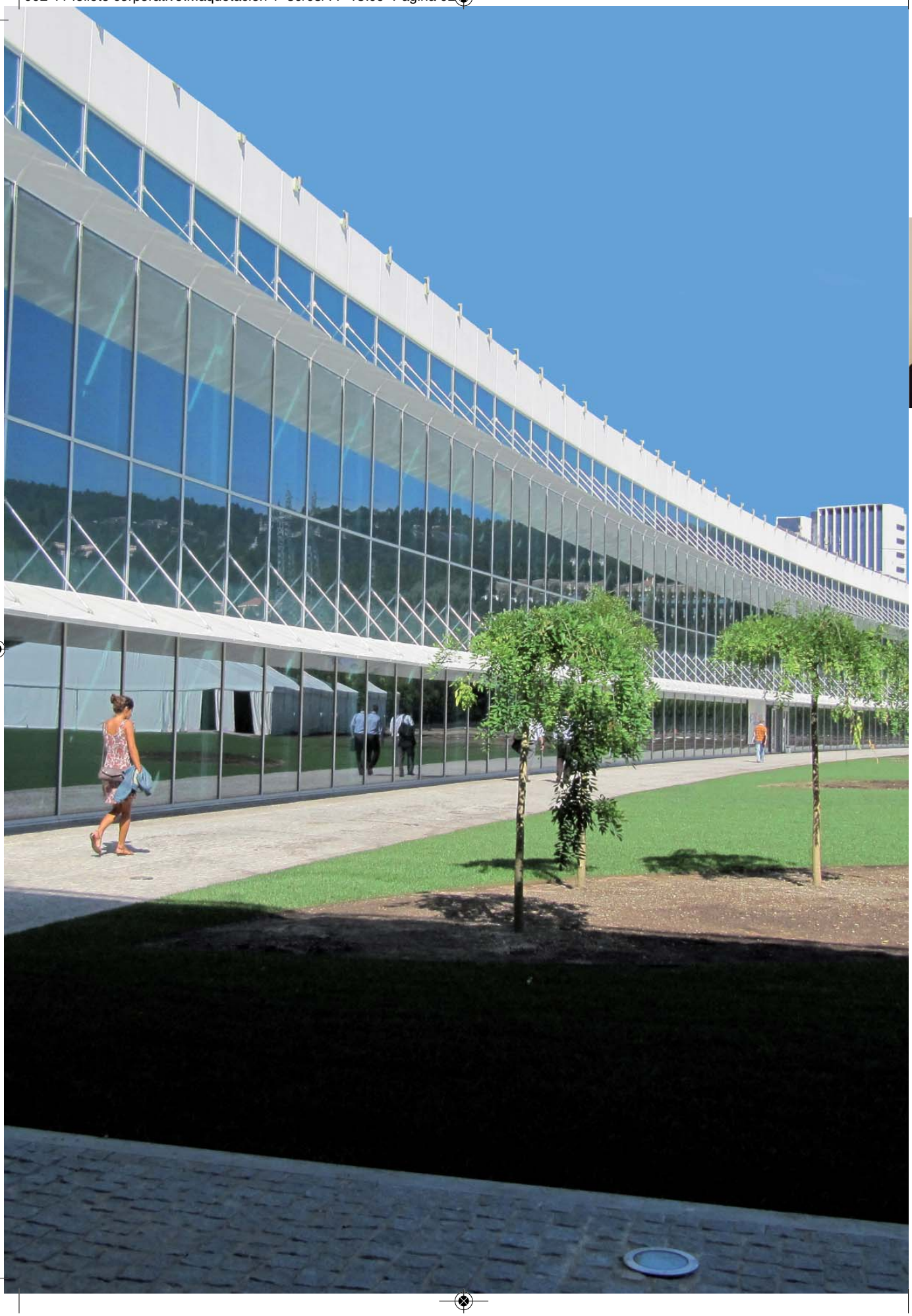
INTERNATIONAL IBERIAN
NANOTECHNOLOGY
LABORATORY



Creating value at nanoscale



INL
a step ahead in nanotechnology research

In November 2005, Portugal and Spain agreed to step ahead in nanotechnology research, enabling the creation of the International Iberian Nanotechnology Laboratory. It is a research organization established under international law, in the area of Nanotechnology.

We strongly believe that the work to be done by the scientists in our facilities as well as the work already in progress at universities and research centres all over the world with which INL has established partnerships, will strongly contribute to create the future. We believe that nanotechnology can and will change the way we relate to our world, with great impact on economy and society as a whole.

Almost five years have passed since the Portuguese and the Spanish Governments decided to build INL. All time is precious to start developing ground breaking scientific results, and innovative and profit-oriented projects that can have great impact on the global economy. We hope we can contribute to excellent science and to help building new and highly competitive enterprises that can stand on their own and work with the existing industries to pursue competitiveness.

400 people will work at INL, helping extend the frontiers of knowledge of mankind and to make the world a better place. I am delighted to be at the head of this organization, and I strongly wish that in a near future, countries from all over the world will join the Portuguese and Spanish vision as member states of our laboratory. Until then, we will pursue our work, searching for and attracting the world's most visionary, innovative, and top level scientists to develop excellent research in nanotechnology.

José Rivas

Director General of INL

Setting up INL

In November 2005, the Governments of Spain and Portugal announced the decision to build an International Research Laboratory on Nanotechnology under an agreement first signed by the two countries in 2003 for Scientific and Technological Co-operation.

The city of Braga, in Northern Portugal, was chosen for the location of the new research facility.
Less than four years later, in July 2009, the King of Spain and the President of Portugal celebrated, in Braga, the Official Presentation of the Laboratory, launching the first recruiting campaign of future INL Principal Investigators.

The establishment of International Iberian Nanotechnology Laboratory (INL) should be seen and perceived as an example of cooperation between countries investing in the progress of science and tomorrow's future assuring world class research excellence.

The recruitment of the talent that will work in the Lab should enhance diversity of nationalities and also different cultures and backgrounds in order to assure top class multidisciplinary research teams from the very beginning and to guarantee an immediate high reputation, enhancing the capability of further attracting top scientists and talented graduate students.

MISSION

To advance the frontiers of knowledge in Nanoscience and Nanotechnology, developing and transforming the associated technologies, through research and innovation, human capital development, and collaborative work, for the discovery of new knowledge and the creation of societal value and wealth.

EUROPE SUPPORTS PORTUGAL-SPAIN PARTNERSHIP

The INL facilities are funded by Portugal and Spain in equal parts. The new scientific infrastructure is also supported by the European Union through the European Regional Development Fund (ERDF). The Cross-border Cooperation Spain-Portugal 2007-2013 Program co-finances the construction while the scientific equipment and instruments is co-financed by the Portuguese North Regional Operational Program.

GOALS

- To build an internationally competitive research laboratory.
- To provide a challenging work environment, where people contribute to common objectives while responding to individual needs and aspirations.
- To develop a high-performance organizational model based on the management of competencies and respect for the individual.
- To become a world brand capable of attracting the best talent.
- To commit private equity and Companies to basic and applied research through establishing long term innovative and feasible funding relationships.
- To create a "smart network" organization, where the built-in talent has the distinct ability to mobilize individual members as well as special groups and the entire institution.

ONE OF A KIND

The International Iberian Nanotechnology Laboratory (INL) is an international scientific organization created to foster interdisciplinary research in Nanotechnology and Nanoscience. The laboratory will provide a state-of-the-art research environment promoting an interdisciplinary effort in addressing the major challenges in emerging areas of Nanotechnology.

The main goal of the Laboratory is to undertake ground-breaking scientific research in specific areas of nanoscience and nanotechnology, such as nanomedicine, and applications to environmental monitoring and food quality control. INL will closely network with universities, research centres and the industry to enhance the collaboration within a wide institutional "ecosystem" for the achievement of high impact excellent research and for identifying innovative key projects.

Taking advantage of its special status as a research organization established under international law, INL has the optimal framework for bringing together researchers from different countries in the world, for being a particularly adequate site of collaboration of different nations for major nanotechnology joint programs, and for establishing strong connections with investors worldwide, willing to fund spin-off enterprises or other ways of commercializing research results. Being an international organization, INL has an autonomy and independence that enables an efficient management of its tangible and intangible resources.

PARTNERSHIPS WITH UNIVERSITIES AND RESEARCH CENTERS

During the last two years, INL has established strategic partnerships with several research centres and universities from around the world. All of these joint ventures involve challenging research projects in the area of nanosciences and nanotechnology. The main purpose of this knowledge network is to create tight links between institutions sharing information, technologies, and resources, as well as to develop outstanding science to meet some of the current needs of global society.

These partnerships involve PhD students, postdoctoral researchers, and technicians, placed in several laboratories as well as the joint recruitment of several researchers. Among this young and talented new workforce, there are 10 nationalities represented from European, Asian and American countries. Already around 65% of INL postdoctoral researchers and technicians come from outside the Iberian Peninsula.

Multilateral Organization

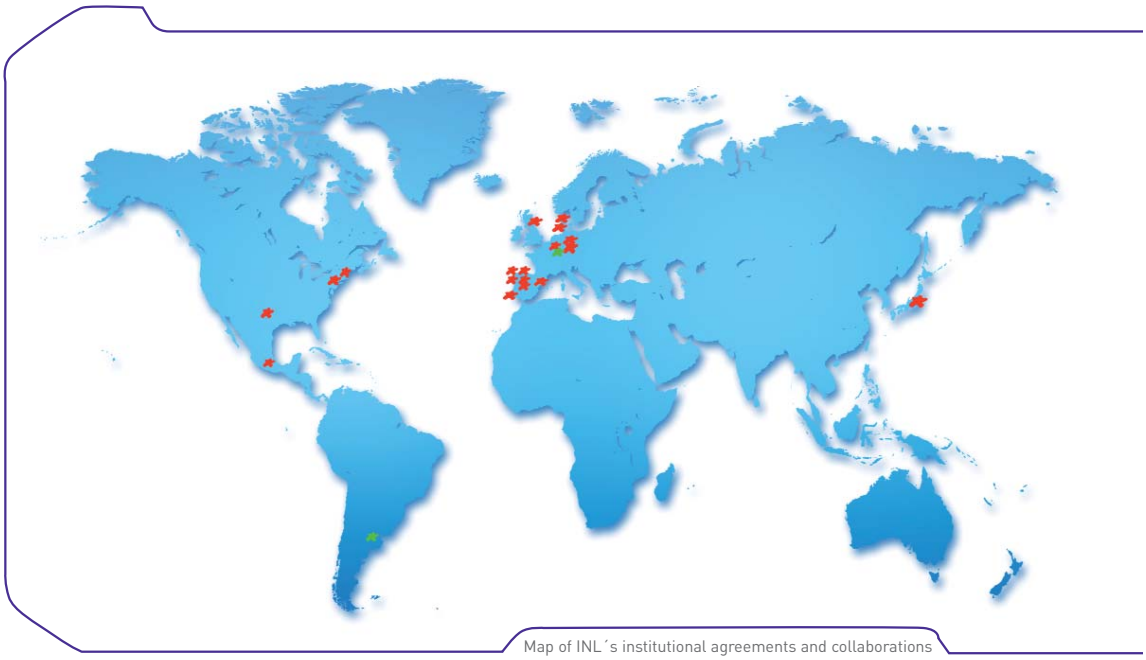
Besides its continuous and rigorous effort on Nanotechnology research, INL, as a multilateral organization opened to the membership of other countries and following the objectives gathered in its International Statues, is truly committed to the sponsorship of international collaborative programme:

- Promoting the development of outstanding nanoscience and nanotechnology research.
- Creating solid scientific communities between member and non-member states in the field of nanotechnology.
- Developing collaboration between universities and industries, as well as between public and private sectors, training researchers, and contributing to the development of a skilled work force for the nanotechnology industry.
- Supporting educational and training programs to assure a future skilled workforce of scientists and engineers.
- Organizing and sponsoring European and international co-operation in nanoscience and nanotechnology research.
- Guaranteeing a sustainable development of Nanotechnology and safe and reliable adoption of Nanotechnology based products by industries and consumers.

Since the very beginning, INL has been carrying out an intense activity in this regard. Firstly, establishing international and national collaborative networks formed by institutions interested in Nanotechnology progress. In a second stage, INL also approached agencies that administer and coordinate multi-laboratory research.

Significant steps were also given in the educational side with several Nanotechnology capacitating initiatives mainly focused on member states but opened to international candidates and with a major positive response from international students. Future actions will be given in this imperative key-factor of Nanotechnology development. INL hopes to enlarge its sphere of influence to other institutions and countries concerned with the role of Education in the expansion of their Nanotechnology National programme.

Last but not least concerns the engagement of industries and investors in nanotechnology advancement. Acknowledging the value of both players in the sustainable growth of Nanotechnology, INL adopted and active role acting as a promoter of the main collaborative network of nanocentres within the Iberian Peninsula. INL also worked on the design of common and appealing investing policies and frameworks for corporations, business angels, VCs and other investors. Confidential Agreements with financial and industrial entities were also established, aiming the constitution of "evergreen" financial mechanisms and Public-Private Partnerships (PPPs) to lead Nanotechnology progress.



Map of INL´s institutional agreements and collaborations

The INL International advisory board

CREDIBLE ADVICE

A research laboratory in the forefront of knowledge and technology needs advice of leading experts in its field. The members of the INL International Advisory Board are:

- **Roberto G.M. Caciuffo,** European Commission, Joint Research Centre, Karlsruhe
- **Thomas Jovin Max-Planck** Institute for Biophysical Chemistry, Göttingen
- **Emilio Mendez,** Center for Functional Nanomaterials, Brookhaven Nat. Lab, Upton, NY
- **Christopher B. Murray,** University of Pennsylvania, Philadelphia
- **Aristides A. G. Requicha,** University of Southern California, Los Angeles
- **Mihail C. Roco,** National Science Foundation, Arlington, Virginia
- **Heinrich Rohrer,** Nobel Prize in Physics 1986, Switzerland

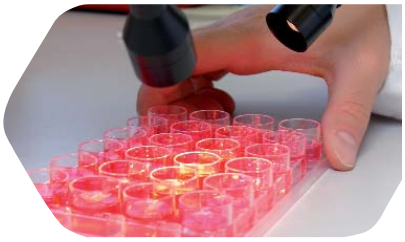
List of Collaboration agreements

Iberian
Instituto Universitario de Investigación en Nanociencia de Aragón-INA (Spain)
Instituto de Microelectrónica de Barcelona – IMB-CNM (Spain)
Institut Català de Nanotecnología-ICN (Spain)
CIC nanoGUNE (Spain)
Inesc-MN Lisbon (Portugal)
Instituto Madrileño de Estudios Avanzados – IMDEA (Spain)
Universidade do Minho (Portugal)
Universidade Porto (Portugal)
Universidade de Santiago de Compostela (Spain)

International
Center for Functional Nanomaterials-Brookhaven National Laboratory, (USA)
iNano-Aarhus (Denmark)
Max Planck Institute for (Chemistry- Gottingen (Germany)
Max Planck Institute for Microstructure Physics- Halle (Germany)
Max Planck Institute for Colloidal Chemistry- Potsdam (Germany)
MIT Massachusetts Institute of Technology (USA)
National Institute of Material Science (Japan)
Red Argentina de Nanotecnologia (Argentina)
Technical University of Denmark (DTU)
Universidad Nacional Autónoma de Mexico (Mexico)
University of Glasgow (UK)
University of Texas at San Antonio (USA)

The Scientific Program

NANOMEDICINE



The focus in nanomedicine is the study, design and fabrication of nanoscale structures and devices for the diagnosis, treatment, and prevention of diseases and genetic disorders. Advanced health technologies will be key drivers of the technological development in the future as the full impact of the genome and proteome research becomes available and new therapies and diagnosis procedures are required.

Nanomedical nanostructures will include: in-situ nanodevices for drug delivery; nanoparticles for selected cell destruction (e.g., hyperthermia in cancer treatment), imaging and diagnostic; DNA, protein and cell-chips; micro- and nanoelectrodes for neural and cortical implants; neuroelectronics; new biomedical imaging technologies (miniaturized NMR, MRI); and improved MEG and MCG systems.

This theme has a strong societal impact, and will stem from interdisciplinary research between existing teams of engineers, biologists, physicists, physicians, chemists, and others. A strong connection to Bioengineering Departments and Medical Schools of major Universities, as well as to Companies operating in the Biotech, Medical and Pharmaceutical fields will ensure that the research carried out at the INL has impact both in the education and in the industry.

ENVIRONMENT MONITORING, SECURITY AND FOOD QUALITY CONTROL

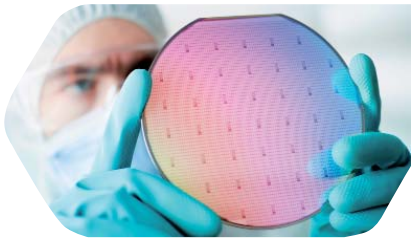
In the food industry, nanotechnology is being used to create better packaging and healthier foods. For example, researchers are working on creating food packages embedded with tiny materials specifically designed to alert consumers that a product is no longer safe to eat.

Farm applications of nanotechnology are also commanding attention. Nanomaterials that offer the opportunity to administer more efficiently and safely pesticides, herbicides and fertilizers are being developed.

Research in environment monitoring, security and food quality control will comprise the development of micro- and nanosystems. At a first stage, it will involve nanotransducer design and fabrication. These transducers will include micro- and nanoelectromechanical systems, and advanced single/few molecule transducers. The transducers will necessarily include chemically and biologically sensitive layers for specific detection of chemical and biochemical signals.

NANOELECTRONICS (beyond CMOS)

The focus in Nanoelectronics (beyond CMOS) will be the development of technologies and devices in the "beyond CMOS" area, focusing on the development of electronic devices (semiconductor-, magnetic-, or photonic-based) that incorporate novel materials, and unconventional structures.

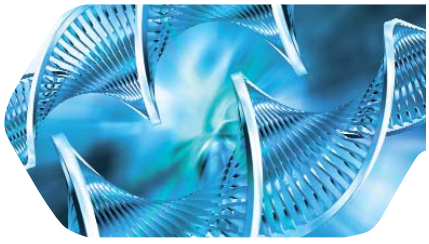


New electromechanical systems are required to support the previously mentioned strategic areas. These novel devices will include merging various state of the art devices and sensor technologies (spintronics, NEMS and MEMS, micro- and nanofluids, optical and semiconductor based devices) in multifunctional Microsystems and lab-on-chip platforms targeted in nanomedicine, environment monitoring and security and food quality control.

In a first stage, the nanoelectronic devices will support applications in biotechnology and medicine, as well as in environmental and food monitoring. In a second stage, it is envisaged that the nanoelectronic modules developed can be commercialized as such for incorporation in other products, thus establishing the basis for start-ups seeded by INL.

NANO-MACHINES AND NANOMANIPULATION

The INL considers strategic an activity of basic "blue-sky" research on nano-machines. The objective of the INL is to become one of the leaders in this field of research. Nanomachines are systems that can result from a combination of mechanical, sensorial, electronic, computational and communication functions.



This area of activity will encompass micro and nanofabricated NEMS structures (nanoactuactors, nano sensors, nano-fuel cells) targeted at single/few molecule manipulation, and biomolecule interaction detection.

The area also covers the design, synthesis and operation of molecular objects (self-assembly, biomimetic chemistry), and of instruments required to interact with these single molecule structures, such as miniaturized magnetic and optical tweezers). Externally modified self-assembly will be also a key point toward the fabrication of devices using nanoparticles as building blocks. Of major interest is the design of molecular bio-electronical devices, merging the physical principals of electronics and computer engineering with the functional and structural principles of biology.

The International Iberian Nanotechnology Laboratory

STATE OF THE ART FACILITIES

INL is located in Braga, Portugal. Braga is the third largest city of Portugal, strategically located between the cities of Porto (Portugal) and Vigo (Spain). Both cities have international airports (the one in Porto is just 20 min. by car), making it possible to easily access the laboratory from any part of the world.
Braga is strategically positioned near several universities and it also is a dynamic industrial area.
The INL Campus will occupy about 47,000m^2 of ground with a construction area of about 26,000m^2. This includes laboratories and cabinets with 7,500m2 and cleanrooms with 2,400m^2, an auditorium and other public areas with 4,800m^2, technical areas with 3,500m^2, and administrative areas with a total of 700m^2.

THE SCIENTIFIC BUILDING

The Main Scientific Building (MSB) is the "ex-libris" of the campus. Its architecture has been configured to have a high visual impact when seen from the outside, especially the iconic monolith of the cleanroom block. The remainder of the buildings have been configured to form meaningful exterior spaces between themselves and the MSB.

The scientific infrastructure of the MSB will comprise central laboratories (providing services for the INL resident research personnel and visiting scientists) and specialized laboratories associated with individual Principal Investigators (PIs) or research groups and research topics.
The central facility will consist of state-of-the-art nanofabrication and characterization facilities. The dedicated laboratories will further strengthen the worldwide competitiveness of the research environment with modern and highly capable instrumentation to address the most challenging research at the nanoscale.

Clean room

- 100kV direct-write e-beam tool capable of 10nm minimum features (200mm wafers)
- HRSEM for CD analisys (200mm wafers)
- Direct –write laser lithography (200mm wafers)
- Mask aligner (150mm wafers) and photoresist tracks for optical and e-beam lithography (200mm wafers)
- A dual beam FIB system
- Multi-target PVD tool for magnetic, oxide, metals (200mm wafers)
- Multi-target confocal PVD tool (small targets)
- Metalization cluster PVD tool (200mm wafers)
- PECVD tool for oxide and semiconductor deposition (200mm wafers)
- Reactive ion etchers for metal and oxide (200mm wafers)
- Deep reactive ion eatcher for Si (200mm wafers)
- Chemical mec wafershanical planarization tool (200 mm)
- Thin film characterization tools (thickness monitors, spectral ellipsometer, resistivity mapper)
- Ion beam milling with SIMS end point detection (200 mm wafers)
- Wet process bay, 6 benches, for wet processing
- Bio bay and spare bay

High Accuracy Lab

The High Accuracy Lab will allow in-house detailed structural characterization of thin films, interfaces, and nanostructures, including the following techniques/instruments:

- 200 kV HRTEM/STEM (with Cs aberration correction)
- Enviromental SEM
- Xray-Difraction Tools (SIM Films and SAXS)
- Interface and surface analysis (XPS)
- Scanning Probe Microscopy (SPM) for advanced applications and development of new techniques (2 systems for materials and biological samples)
- Confocal optical microscopy

Biological and Biochemical Characterization Support

The Central Biology and Biochemistry facility will provide support for groups developing biology and biochemistry activities. It will contain:

- Equipment for FPLC/HPLC protein purification
- Spectrophotometry, mass spectrography with gas chromatography, flow cytochemistry and cell sorting
- Real-time PCR
- Confocal microscopy and centrifugation (ultra and low-speed) and cell culture
- The facility will also include the necessary supporting infrastructure, as optical and fluorescence microscopes, different low temperature chambers and freezers, a dark room, a sterile chamber with laminar flow, extraction benches, etc.

Dedicated Laboratories

The dedicated laboratories will be associated with particular Principal Investigators and topical needs (spintronics, NEMS, photonics, high frequency device characterization, nanomaterial synthesis laboratories, etc.).

Other Core Laboratories and Laboratory Support

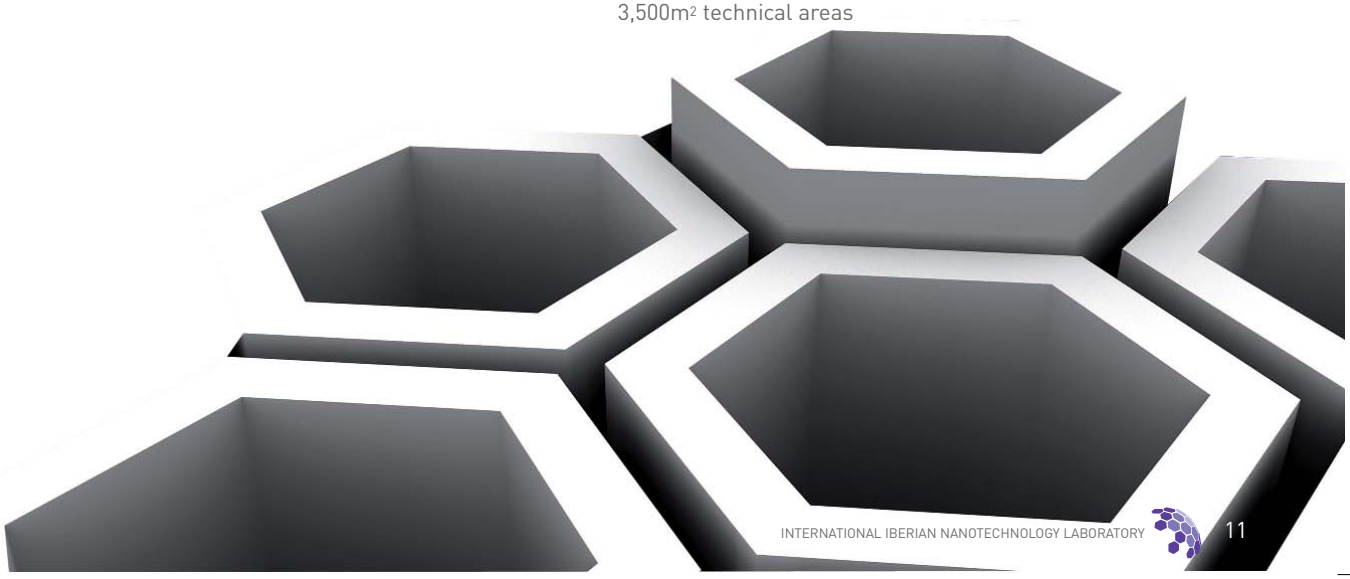
Other common capabilities will support the Nanofabrication Cleanroom, Principal Investigator laboratories, and the Characterization Cores. These include:

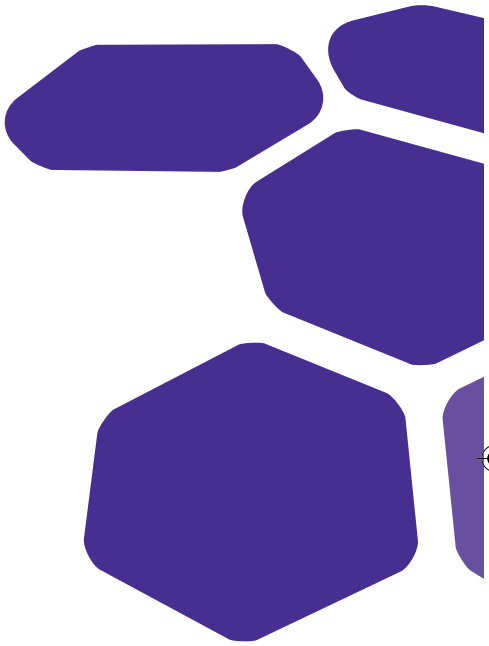
- Device Assembly and packaging Lab
- Magnetometry lab (VSM/Torque, SQUID, 2T magnetic anneal system, hyperthermia setup)
- Radio frequency and electrical characterization laboratory
- Nanochemistry nad particle synthesis laboratory

Apart from the Main Scientific Building, where all major scientific facilities and offices for researchers, as well the administration, will be located; the INL Campus comprises also a Social Support Building, that will include a residence, a cafeteria, a kindergarten, fitness center as well as other related facilities; the Incubator and Start-Ups Building, that will house new knowledge-based companies; and The «Ciência Viva» Center and Conference Building.

INL in numbers

47,000 m^2 of campus area
26,000 m^2 research areas
2,400 m^2 of clean room and high accuracy labs
Up to 200 researchers 400 total staff
4,800m^2 public areas
3,500m^2 technical areas





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