

# RESEARCH, COMPETITIVITY AND EXCELLENCE

➔ Research is one of the driving forces of the Catalan economy and over the last twenty years, the Catalan government has shown a clear commitment to supporting competitive, high-quality research. "As a result, we've become one of the top research hubs at the European level and a model at the global level," claims Francesc Subirada, General Director of Research. And the data back up his claim: in the last twelve years, the proportion of the country's population that is engaged in research and development has grown from 1.1% to almost 1.6%, while the Horizon 2020 programme ([www.horizon2020.es](http://www.horizon2020.es)), which funds research and innovation projects in diverse areas, and which has a budget of €80,000 million for the period 2014-2020, has devoted a total of €800 M to Catalonia, which is a far higher amount in proportion to its population in the sec-

tor. Since the 1990s, Europe has also increased its investment in research seven-fold, and its investment has multiplied by 13 in the Spanish state and by 29 in Catalonia.

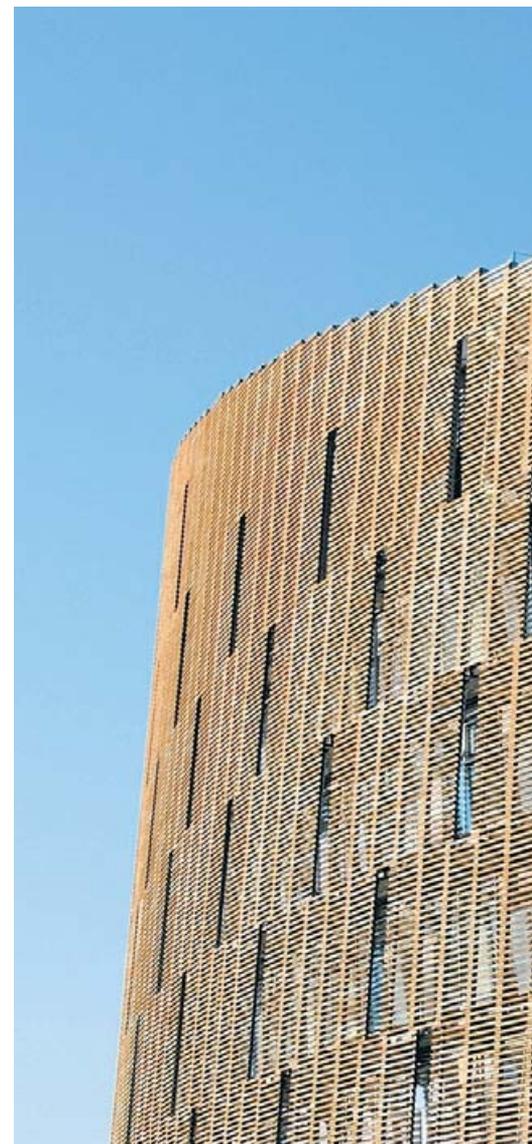
#### **LEADERS IN RESEARCH**

Some of the leading research areas are photonics, chemistry, computing, nanotechnology and many bio-related fields, with large research centers - such as the Center for Genomic Regulation, the Institute of Biomedical Research, hospitals, the Institute of August Pi i Sunyer Biomedical Research and the Biomedical Research Institute of Bellvitge - which make up a large area of research related to the biosphere. Subirada believes that the key to achieving a research ecosystem is: "The existence of a political consensus that has opted for research;

we have focused on creating, retaining and attracting talent, and we have a quality network of universities, research centers and large scientific facilities that work together synergistically".

#### **CERCA**

The CERCA Institute was created in 2010 in response to the specific needs relating to the development and funding of Catalan research centers. It covers 40 independent centers spread all over Catalonia that are involved in ground-breaking research in fields with a scientific and economic orientation and an impact on social and personal wellbeing. Each center receives stable funding through the Generalitat de Catalunya and can also count on periodic counseling and assessment by a committee of top-level international scientists. The result of these periodic assessments





A number of CERCA centers are concentrated in the Barcelona Biomedical Research Park. Petr Svarc



## MARENOSTRUM 4

**ONE OF THE MOST POWERFUL SUPERCOMPUTERS IN EUROPE**, managed by the Barcelona Supercomputing Center - National Supercomputing Center, capable of performing 11,100 billion operations per second, it takes up 160 m<sup>2</sup> and weighs 40 tons. The number 4 in its name corresponds to the fourth update of this supercomputer, which is dedicated to generating scientific knowledge, from research into climate change and the AIDS vaccine to new radiation therapies against cancer. There are guided visits to the facilities. Go to visit. It's located inside the ancient tower of Torre Girona Chapel (C/ Jordi Girona, 31). The contrast is spectacular!

determines the center's budget for the following four years. The goals of the institute are: to ensure the correct development of the system of Catalan research centers; promote synergies and strategic coordination and cooperation between the centers; enhance the positioning, visibility and impact of the research they carry out and facilitate dialog with public and private agents.

Lluís Rovira, the director of CERCA, makes a positive evaluation of the first few years of the institute: "Despite the crisis, the centers have grown continuously since 2011.

In five years, staff recruitment has grown by €30 million, which has allowed us to capture new talent and achieve projects of excellence, which entails more funding, publishing more papers in high-impact scientific journals and achieving

more prominence and leadership for our centers on the international scientific scene". The institute's short-term challenges are for its centers to perform competitive research and transfer the benefits of that to society. Other challenges are concerned with the socioeconomic impact of research and the need to ensure that the research carried out contributes to improving areas like health, demographics and environmental issues and that the country's sector of hi-tech companies grows thanks to the inputs from scientific research.

Mr. Rovira insists on the importance of the culture of innovation and on, "creating business opportunities based on the technology generated at our centers and that Catalan companies exploit the technologies that allow them to grow and invest part of their earnings in research".

### A MATURE ECOSYSTEM

In summary, we have a mature scientific and technological ecosystem that is richer and more attractive than it was even a few years ago. The country's scientific production can compete at the top international level, despite the fact that only 1.46% of Catalonia's GDP is spent on research - the figure is 1.19% in Spain - and the average in Europe is 2.03%. In order to carry on in this line, Mr. Rovira is clear that we need to continue to carry out high quality research and welcome new talent while ensuring that all research areas are as well covered as possible. He also stresses the importance of the role of consolidated, prestigious institutions that are firmly committed to research and of the importance of a sustainable increase in the research budget: "We have to match the European average in terms of investment in research", he concludes.

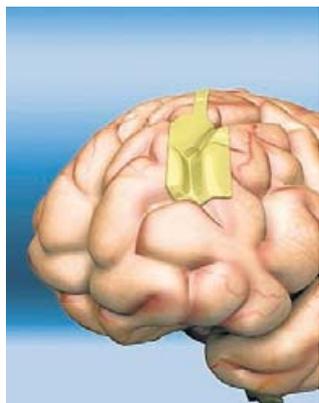
# TURNING RESEARCH INTO INNOVATION

Catalonia has one of the strongest research systems in Europe. After years of research we have knowledge and technology ready to be transferred into innovation. Francesc Subirada, General Director of Research of the Department of Enterprise and Knowledge of the Generalitat, believes that to carry out this transfer process, as well as economic resources, it is important to have an ecosystem to

accompany it. For there to be expert human capital involved in this process, you must opt for training and attracting transformative talent. At the Research department, they are working to develop their own transfer model. "We are creating our strategy, a model of innovation which, as well as adding economic value, contributes specific value to society," says Mr. Subirada.

## IMPLANTS FOR RECOVERING SPEECH

Over the last four years, the ICN2 (<http://icn2.cat>) has created five spin-offs, registered 10 patents and launched three products onto the market. At the last Mobile World Congress they presented the results of Brain-Com, a European project developing an ultrafine graphite film that will be implanted into the brains of patients who have suffered motor damage and have lost the ability to speak. The implant will be able to decode their communicative intent by mapping a large area of the brain. The electric device used records and stimulate the cerebral cortex, breaking down the electric signal into vowels, words and lines of thought. A synthesized voice will then vocalize what the person wishes to say. So far, this has been accomplished in mice and dwarf pigs, which only make sounds. The challenge for the coming years is to manage to decode human language.



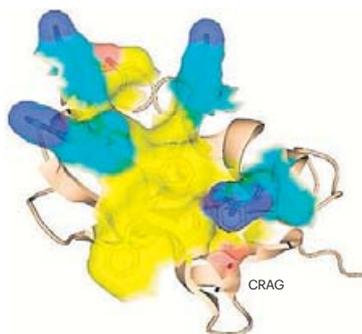
ICN2

## ELECTROCHEMICAL SENSORS FOR CONTROLLING ISCHEMIA

Ischemurg is a project by the IBEC Nanoengineering Group (<http://ibecbarcelona.eu>). It's a device consisting of a matrix of miniature electrochemical sensors that can monitor post-operative tissue ischemia. When a tissue is reconstructed, because of burns or other types of accident, part of a tissue is transplanted onto the affected part. If there is blood shortage in the tissue in the first 48 hours, it becomes degraded and new surgery must be performed with another tissue. So far the post-operative controls that are carried out tend to be subjective and result in delays, based as they are on observing the colour of the transplanted tissue and controlling its temperature. "With Ischemurg, a sensor is inserted with a needle between the two tissues, and is then able to monitor it constantly to detect problems early enough to solve them. A part of the sensor sends information wirelessly to a computer. A warning signal is sent once certain parameters have been crossed. That way you can reuse the same tissue and the surgery is improved," explains Dr. Mónica Mir, the senior researcher for the project. "After 48 hours, you pull on the part of the sensor that hangs out, which is a biocompatible thread, and the process is finished. We are now beginning to test the device on pigs. If all goes well, we can then think about marketing the system".

## NEW THERAPIES FOR CANCER

Maria Lois, CSIC researcher at CRAG ([www.cragenomica.es](http://www.cragenomica.es)), has always been focused on understanding how proteins communicate within the cell with the aim of modifying them when needed. For some years now, she has also worked on inducing the death of cells that are dividing uncontrollably because of cancer. To do so she applies technology derived from the study of SUMO plant protein, which modifies other proteins and has the same effect in animals. As proof of concept, her project responds to a medical necessity: the goal is to create a drug for acute myeloid leukemia, which until now has no effective functional treatment in patients of advanced age.



CRAG

## PROFIT- MAKING COMPANIES

CIMNE Tecnología ([www.cimnetecnologia.com](http://www.cimnetecnologia.com)) is a company that belongs to CIMNE, a public research center devoted to basic research. Since its creation in 2011, it has turned the technology and the results obtained into companies that triumph in the market. Its CEO, Javier Marcipar, explains that they are accompanying these new companies in the technology transfer process, looking for partners and investors, developing products and putting together a commercial network. The goal is to generate returns for the research center through the commercialization of the technology or the sale of the company once it has grown, depending on the individual case. During the seven years of its existence it has created 16 companies and sold three. Examples include Buildair ([www.buildair.com](http://www.buildair.com)), which makes large hangars for aircraft based on inflatable structures, and Inergy ([www.inergybcn.com](http://www.inergybcn.com)), an energy saving company, used by practically all the local councils in Catalonia.



Buildair