

Science attracts Spain

Spain takes its first important steps towards a knowledge-based economy in the premier league of European research

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The Barcelona Biomedical Research Park (PRBB) in Spain does not resemble the usual research institute (Fig 1). Located on the waterfront, the sophisticated oval building with its wooden panels and open balconies that face the beach looks like a residential or office building rather than the home of, among other facilities, the Centres for Genomic Regulation, for Regenerative Medicine, for Research in Environmental Epidemiology, and the Institute of Advanced Technology. The people of Barcelona took considerable interest in the building and those residing within it during the first PRBB open day in October 2008. Parents, students, passers-by and tourists visited the laboratories, extracted DNA from kiwi fruit, talked with the scientists and enjoyed refreshments, while they were shown the ways in which their tax money is being spent on scientific research. More recently, on June 16, INDAGANDO TV launched its web-based television channel (www.indagando.tv)—the first Spanish channel dedicated exclusively to scientific communication—that offers news, features and debates, including special reports on women in science. INDAGANDO and the PRBB are just two visible examples of the confidence and optimism that accompany Spain's growing interest and investment in science.

During the past few years, Spain has made considerable efforts to reinvigorate its research and development (R&D) sector, and to promote an economic model based on knowledge and innovation. Indeed, Spain is a rather late arrival in the international league of countries that regard science as an investment for the future. Since the 1930s, both Spanish society and scientific research have suffered the lasting effects of the 'dark age' of Francisco Franco's dictatorship, under which

the intellectual potential of the country was suppressed. Many scientists went into exile, including the Nobel Prize winner Severo Ochoa (1905–1993). The situation improved markedly when Franco died in 1975 and, after a short transition period, Spain adopted a constitution and became a democracy. Having joined the European Union (EU) and, bolstered by its economic growth, Spain is now shifting its priorities towards scientific research, in particular in the area of biomedical research, in order to meet the Lisbon Strategy goals for the European Research Area. As such, what strategies has Spain tried and what are the outcomes so far?

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Most notably, Spain has markedly increased its funding of scientific research: from a mere 0.4% of its gross domestic product (GDP) during Franco's regime to around 1.2% in 2008. Public expenses in R&D almost doubled from 1995 to 2006 (Monreal, 2009). Still, this represents only a first step towards achieving the EU average of 1.8% and the Lisbon Strategy goal of 3% by 2010—a goal that only a few countries have reached so far. In addition, the private sector contributes only 47% of R&D expenses, which is lower than the USA and UK, for example. The Socialist Party, which was re-elected in April 2008, has promised to continue to promote Spanish research and

to offer new incentives to industry to boost their investments in science. It created a new Ministry of Science and Innovation led by Cristina Garmendia, a molecular biologist, and founder and chief executive of the biotechnology firm Genetrix (Madrid, Spain). The aim is to spend 2% of the GDP for R&D by 2011. However, Spain is being hit hard by the current economic crisis and the government has already stepped on the brakes: the 2009 budget for R&D has increased by only 6.7% compared with 2008, significantly less than the planned increase of 25%. Recently, another €290 million was cut from the Ministry of Science and Innovation's budget.

Spain has also been able to attract external funding, for example, through the EU's Framework Programmes. It received €382 million through the Seventh Framework Programme, which corresponds to around 7% of the allocated budget for the 27 EU members (European Commission, 2009). In October 2008, Spanish institutions coordinated 78 of the 490 approved collaborative projects and networks of excellence (CDTI, 2008).

However, funding is not the only requisite for creating and maintaining a successful research environment, particularly in light of the looming recession; it also requires a stimulating research environment and the necessary brainpower.

Spanish universities are still stifled by bureaucratic red tape and inflexible systems for hiring research staff. During the past eight years, however, national and regional governments have created new autonomous public or private research centres—30 in Catalonia alone, one of the most industrialized regions in Spain. Several of these have succeeded in establishing themselves as competitive



Fig 1 | The Centre for Genomic Regulation, Barcelona Biomedical Research Park, at the open day in October 2008. © Laura Weill.

institutes, and creating new opportunities for Spanish and international scientists. As an example of a successful research unit, the Centre for Genomic Regulation (CRG), hosted in the PRBB building, is an interdisciplinary research institute founded in 2000 by the Catalan government and the Pompeu Fabra University. Led by Miguel Beato, the CRG runs six research programmes that cover diverse fields in biomedical science, from gene regulation and differentiation, to bioinformatics and systems biology.

The CRG is a truly international research unit. The Systems Biology programme has teamed up with the European Molecular Biology Laboratory (EMBL) in Heidelberg, Germany, and the Spanish Ministry is supporting this partnership with €1.4 million per year for nine years. Five out of six group leaders of the EMBL/CRG research unit do not have a Spanish passport and the

working language is English. Overall, the CRG has about 35% foreign scientists and almost 50% of the principal investigators are not Spanish.

One factor for its success in recruiting international experts is the fact that the CRG offers competitive salaries and is fully autonomous in hiring staff. 'No funcionarios'—no civil servants—was one of the conditions that Miguel Beato demanded when he became the CRG's first Director. In contrast to most Spanish professors, who are appointed through national exams and become civil servants for life, researchers do not have to pass the national exam but are selected by an independent panel, including external examiners. Similar to EMBL, most groups are hosted for a maximum of nine years to ensure a dynamic environment and the dissemination of scientific excellence from the institute. At the same time, the CRG supports

junior and talented group leaders by offering a start-up budget that covers personnel, consumables and equipment. This is a fundamental difference to the usual research grants from the Spanish government, which come with high administrative workload and are often limited to cover only one specific cost category—personnel or consumables or equipment—to run a research project.

An international PhD programme, supported each year by ten fellowships from the La Caixa savings bank, helps to attract excellent students from abroad; a multidisciplinary postdoctoral programme, which is sponsored by the European Commission, will also be launched next year. The fundamental ingredient for excellence is a transparent external review process for the research programmes every four years. Finally, an international Scientific Advisory Board has a crucial role in evaluating and

guiding research at the CRG, including the office of the Scientific Director.

Several other institutions—the Spanish National Cancer Research Centre (CNIO) in Madrid, the Institute for Research in Biomedicine (IRB), the Institute of Photonic Sciences (ICFO) in Barcelona, to cite but a few—have adopted similar policies of autonomy and excellence, including having no civil servants. These institutes have been able to attract scientists from other countries, as well as Spaniards back from abroad, including Miguel Beato, who returned from Germany, and Mariano Barbacid at the CNIO, who came back from the USA. However, more work needs to be done to attract young scientists back to start their careers as independent researchers. Among the 12 talented young scientists named as EMBO Young Investigators in 2008, three are Spaniards, but only one has his laboratory in Spain, perhaps not surprisingly, at the CNIO.

In addition to new research centres, the Spanish government has also created new research infrastructures. The old chapel of the University of Barcelona now hosts MareNostrum, one of the most powerful supercomputers in Europe. It is part of the Barcelona Supercomputing Centre, officially inaugurated in 2005, which represents the National Computing Facility in Spain. MareNostrum has already supported 400 research projects in diverse areas such as Earth science, life science, astronomy and engineering.

Not far from Barcelona, the ALBA Synchrotron Light Facility is scheduled to open in 2011. Funded by the Spanish and the Catalan governments, ALBA will host a team of more than 100 scientists and serve users from all over the world. Barcelona will also become the Spanish headquarters of the Genome Sequencing Laboratory, a new state-of-the-art centre dedicated to high-throughput sequencing. The Catalan government and the Ministry of Science and Innovation will allocate €30 million in the next three years. The new Spanish Laboratory will establish itself as a leading platform in the south of Europe to support public and private research, and international efforts devoted to medical research. The International Cancer Genome Consortium—a collaboration of many countries, including Australia, Canada, China, France, India, Japan, Singapore, the UK, the USA and Spain, with the aim of creating a

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comprehensive catalogue of all alterations in the genome of 50 different tumours—will benefit highly from the new technological platform. Spain will coordinate studies on chronic lymphocytic leukaemia, one of the most common cancers in Western countries. In the same line, the European Consortium gEUVADIS—coordinated by Xavier Estivill, Director of the Genes and Disease Programme at the CRG—plans to generate whole-genome sequence data for thousands of Europeans diagnosed with common diseases and the capacity of the new sequencing centre will be essential to achieve this task.

It seems that Spain is on its way to strengthening its potential for science and innovation, and to compete and cooperate with the more advanced European countries. These achievements have been rewarded with, among others, highly competitive grants from the European Research Council (ERC). During the first round of applications for young researchers—so-called ‘starting grants’—only 300 applicants received the award out of 9,167 submitted proposals; 8.5% of these awards went to scientists working at Spanish institutions, which places Spain sixth on the list of countries that initially received ERC grants. In addition, the Spanish government, similar to France, Italy and Switzerland, decided to support its ERC finalists who were not awarded grants owing to budget limitations for a temporary period.

The big question is therefore whether Spain will be able to sustain the growth in research and development, given, in particular, the current financial crisis and recession. However, it is not only the money; the fragmentation of scientific research throughout the various Spanish autonomous regions with little or no communication among them must also be solved. Improved coordination of research centres across the country would help to set standards for excellent research and working conditions, in addition to having more influence on political decisions. Although several new competitive institutes have been established, they are still not cooperating in the same way as do, for example,

the research institutes of the German Max Planck Society.

For Spain to establish itself as a scientific powerhouse and to compete at the international level, it is necessary not only to increase funding and coordinate the recently created institutes, but also to renovate the principal scientific centres: the Spanish National Research Council (CSIC) and the universities. The existence of new competitive institutes working under a completely different model to that of the civil servant model is clearly shaking up the system. However, the recent conversion of the Catalan centres from private to public foundations worries some scientists that the return of cumbersome bureaucratic procedures could be on the horizon. Another challenge for the Minister of Science and Innovation is to improve the coordination of basic science and industry to strengthen technology transfer, which would also result in an improvement in the economy and society. This is a golden opportunity for Spain, especially with the coming European Spanish Presidency in the first half of 2010, to catch up with the most industrialized countries. In any case, Spain has taken the first steps towards a knowledge-based economy.

ACKNOWLEDGEMENTS

This article is a collaborative effort thanks to the critical reading of Luis Serrano, Miguel Beato, Ben Lehner, Bruna Vives, Laia Cendros, Gloria Lligadas, Veronique Blanc, Xavier Estivill and Xavier Ruiz Serrano.

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doi:10.1038/embor.2009.174