

Chemistry in Spain—Much Achieved and Much to Be Done

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In December 2011, Spain celebrated the 33rd anniversary of its new constitution. The new laws brought a new way of living for a country with a thirst for freedom. But the advent of democracy has also had a strong impact on science in Spain. Actually, the revival of Spanish science over the last thirty years is only comparable to that undergone during the first third of the 20th century with the creation of the “Junta para Ampliación de Estudios e Investigaciones Científicas” in 1907. To this time belong renowned chemists such as Miguel Catalán, Antonio Madinaveitia, and Enrique Moles.

After the Spanish Civil War (1936–1939), science in Spain during Franco’s dictatorship of almost forty years was isolated from the international scientific scenario and some of the most brilliant scientists decided to emigrate. Although during this “black period”, some chemists were able to develop important research advances (such as Manuel Ballester, Manuel Lora-Tamayo, Antonio González, and Rafael Usón), it was not until the advent of democracy in Spain in 1978 that Spanish chemistry underwent a real advance, particularly with the publication of the “law for science” in 1986 by the government of Felipe González. Names such as José M. Maravall, Javier Solana, Juan Rojo, and Luis Oro are among those who put down the solid base for the revival of science in Spain. Today, Spanish science has reached an appropriate position according to its scientific tradition and

economic development. Our country has moved from 30th place to 9th in the world ranking of leading scientific countries. This impressive rise is only comparable to that undergone by China. With more than 36 000 publications per year, Spain currently produces slightly over 3 % of the world’s scientific papers.

Despite being encouraging, these numbers are still low compared to those of other more scientifically consolidated European countries. For the sake of comparison, the current R&D investment in Spain only reaches the 1.37 % of the gross domestic product. This is certainly small when compared to other European countries’ efforts, but it must be emphasized that twenty years ago this figure was only 0.6 %.

The Spanish science system is still fragile, and financial support should be maintained as much as possible, even under the current critical economic conditions. However, it is crucial that research policy be selective, with resources focused on excellence in order to foster a Spanish science system that can compete internationally at the highest level.

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A significant and refreshing initiative in the promotion of excellence has been the development of a new policy by some regional governments to establish new research institutes on specific areas. Such policy has been particularly effi-

cient in Catalonia, the Basque Country, and Madrid, where brand-new research institutes are attracting a large number of foreign scientists, as well as Spanish scientists who are working abroad, through their respective foundations (ICREA, Ikerbasque, IMDEA). To accomplish this, the foundations follow a recruitment method that significantly differs from that of the universities, by offering senior research positions based on the scientific quality of the researcher. Importantly, after certain periods of time (usually five years), their research merits are appraised and, if they fulfill the criteria required by the scientific advisory board, the researchers can continue (rolling tenure). Junior researchers, however, usually have to leave after some years (from five to nine, depending on the institute), a situation that is not satisfactory for young scientists as mobility is still very low and finding positions elsewhere in the country is not guaranteed. This is particularly worrying in a country that has one of the highest figures of unemployed young people within Europe.

What is the current role of universities and OPIs (public research organizations) within the Spanish research system? Most of the scientific production of Spain (around 60 % in the last ten years) stems from universities, despite the teaching load for a professor at a Spanish university being 240 hours per year. This situation is in sharp contrast to that of the new research institutes as well as the CSIC (Consejo Superior de Investigaciones Científicas, the largest OPI in Spain), and it clearly hinders the

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research activity that is often based on a strong personal commitment from the professor or researcher. As is well known, most academics and researchers at universities and OPIs are civil servants with jobs for life. In this regard, despite the big success of the recruiting programs “Juan de la Cierva” and “Ramón y Cajal” launched by the government a decade ago, much more hiring flexibility and mobility is needed. Meritocracy should be mandatory for the whole system of science in Spain if we want to improve research efficiency and quality at universities. Furthermore, the recruitment system of young professors at the universities should be thoroughly revised in the search for excellence.

Spanish scientists are excited by the recently approved “law for science”. This law involves the creation of a new “Research Agency” which, under the new government, will hopefully bring our research system in line with scientific norms of other European countries, hopefully by following the very successful European Research Council (ERC) model.

Research should be considered an essential aspect for the development of a modern economy by the new Spanish government. In this regard, the abolishment of the “Ministry for Research and Innovation” and the relocation of R&D into the new ministerial flowchart as a branch of the new “Ministry of Economy and Competitiveness” is not necessarily a negative sign, if the new Ministry assumes that basic and applied research are two faces of the same coin, and that shortcuts do not help in the long run for science. However, the recent cut of 600 million Euros to research is certainly discouraging.

What about Chemistry in Spain?

During the period 2000–2010, Spanish chemistry is ranked 9th in the world based on the number of published scientific articles, whereas this position is improved to 7th when considering the number of citations. Furthermore, Spanish chemical production represents 3.91% of that produced worldwide during the last ten years. These numbers place chemistry among the most successful scientific areas at a national level and suggest that the Spanish chemical research community is competitive. However, funding investment in chemistry by the Spanish government was not always as strong as expected in comparison to other apparently not so competitive areas. Unfortunately, not all the numbers are so positive. Thus, only five chemists in Spain (E. Coronado, P. W. N. M. van Leeuwen, L. M. Liz Marzan, J. Santamaría, and F. Martín) have received an ERC Advanced Grant, and Spanish chemistry steps down to below the 20th world position when the number of industrial patents produced is considered.

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Although public investment in chemistry could be considered reasonable, this is not the case, however, for the private sector. Actually, despite the favorable legal framework for private companies, their R&D investment is surprisingly low. Thus, whereas roughly two-thirds of companies in Europe invest regularly in some kind of R&D, only one-third of Spanish companies do so. This pulls

Spain to the bottom of the eurozone countries. Furthermore, only roughly 5% of companies collaborate regularly with universities in innovative projects. It is therefore very urgent to make basic scientific knowledge a useful tool for competitive development in Spain; furthermore, R&D and innovation investments should be based on excellence criteria, thus favoring the transfer to the private sector.

Chemistry in Latin America

Spanish Chemistry is fully integrated into the European framework. However, Spain also maintains a long-standing historical and cultural relationship with all Latin-American countries. This puts Spain in a privileged position which, unfortunately, has not been sufficiently exploited from both sides so far.

Chemistry in some Latin-American countries has undergone a spectacular development in the last recent years and is occupying, step by step, an important position within the scientific scenario in its own right. This is particularly true in countries such as Brazil, Mexico, Argentina, Chile, or Colombia, whose scientific production has significantly increased. In this regard, the 2011 Latin-American ranking shows that the number of educational higher institutions (those that have published a scientific document indexed in the Scopus base) in the period 2005–2009 grew from 607 to 1369. Based on these data, Brazil (with 163 000 documents) is the spearhead of the research carried out at the Latin-American universities.

Since the quantity of scientific papers has reached a certain level in Latin America, the time has come to improve the quality. Spain should help here with the backup of both Spanish and European administrations.