From siesta to SIESTA

Cultural values spread from a given country to its neighbors can often be identified after the words exported from the country's main language. France's appreciation of delicate food has resulted in terms such as *chef* or *gourmet* being currently understood all over the world. The British love for physical education, combined with their passion for competition, conveyed the words *football* and *rugby* to the most remote corners of the globe.

One of the most popular words provided by the Spanish dictionary to other languages is *siesta*, a short nap usually taken after lunch, quite common in warm countries. Another one is *guerrilla*, a form of warfare adopted by small groups of combatants that pretend to beat an enemy often superior in size and resources. The term *guerrilla* was coined in the Spanish-French war, at the beginning of the XIXth century, when unorganized bands of Spanish fighters struggled against Napoleon's powerful army. Guerrilla tactics require extreme mobility, flexibility, and imagination. The *guerrilleros* do not follow orthodox planning, but they rather base their actions on improvised decisions taken on the spot.

In the past, those Spaniards brave enough to pursue scientific research were often forced to follow guerrilla tactics. Historically, Spain lacks scientific tradition. For several reasons, the scientific and technological development that impregnated the western countries from the end of the XVIIIth century was minor in the Iberian Peninsula. Exception made of few and short-in-time efforts, public institutions showed a scarce interest in science and rarely provided the necessary funds to create high-level laboratories. Counting on insufficient means, Spanish researchers had to compensate with flexibility, improvisation, and quickness. This led to some success stories but obviously was not fertile soil for enduring scientific activity.

Fortunately, the vigorous growth of the Spanish economy in the last thirty years has been accompanied by a parallel effort in the development of institutions and infrastructures for higher education and scientific research. The scientific output of Spain in the period 2004-2008, that can be roughly estimated from the number of published papers, is 3.44% of the world total. This figure is higher than the Spanish share of the world GDP (2.24% in 2010) and shows that, thanks to long-term scientific policies from the Spanish government, the regional autonomous governments and other local institutions, conditions for scientific practice in Spain have changed. Scientists in Spain are not anymore *desperados* fighting for a decent place

where to develop research, but they are currently working in well-equipped research centers, many of them with international reputation.

The flexibility and dynamism inherited by the scientists in Spain from their research ancestors is, however, an important asset not to be lost. Scientific activity in the XXIst century is increasingly collaborative, international, and interconnected. Communication among scientists working in the same field is frequent and intense, and the steps required to make progress in many lines of research are substantially shorter. Therefore, researchers and institutions have to learn how to develop and use skills to act dynamically and, if needed, change plans during the course of action.

In this respect, agreements between different institutions to create and develop specialized research centers have shown to be a fruitful endeavor. An example of this generous cooperation is the Materials Physics Center (CFM, from its name in Spanish, Centro de Física de Materiales). The CFM is a young center that started activity in the Basque Country in 1999 as a joint center between the University of the Basque Country (UPV/EHU) and the Spanish Research Council (CSIC). When it was created, all research positions in the CFM belonged to the UPV/EHU except but one. Nowadays, and following a firm commitment by the CSIC, equilibration of weights between both institutions in the CFM personnel has been reached. A subsequent milestone in the CFM life span took place in December 2010, when a brand new building was inaugurated, again as a result of combined efforts by the UPV/EHU and the CSIC. The new CFM building is strategically situated in the UPV/EHU Campus of Ibaeta, in Donostia – San Sebastián, surrounded by various research centers and institutes (DIPC, CIC nanoGUNE, UPV/EHU Chemistry Faculty, Tecnun, and UPV/EHU Korta Center).

With a current workforce of approximately 100 people (36 of them permanent scientific staff), the CFM research activity is mostly focused into basic and basic-oriented research in Materials Science and Condensed Matter Physics. Materials science and, in particular, the study of nanosystems and nanomaterials, are core areas of research with profound economical implications due to their technological potential. Materials science is one of the fastest growing fields of research. Despite the economic recession, R&D expenditure in materials science is estimated to have grown globally a 10% in the last three years.

In addition to the natural support from its two mother institutions, the UPV/EHU and the CSIC, the CFM also receives funds and financial help from recent Excellence Programs developed by the Basque Government. Four staff scientists in the CFM are research professors hired by Ikerbasque, a Foundation promoted by the Basque Government to attract, retain and

consolidate senior researchers in the Basque public system. The Materials Physics Center is also one of the few research centers selected as a Basque Excellence Research Center (BERC Program) by the Basque Government.

Scientific collaboration of the CFM teams with researchers from international universities and centers is much facilitated by the strong links it maintains with the Donostia International Physics Center (DIPC). The DIPC is a research center with a singular institutional and financial structure, in which private and public funds coexist. It is an open institution linked to the UPV/EHU and currently participating in the International Campus of Excellence Euskampus. One of the main goals of the DIPC is to promote and catalyze high-level scientific activity through mobility and internationalization. Cooperation between the CFM and the DIPC is based on these grounds, but also extends to other initiatives related to the two other pillars of modern research centers: training and outreach.

In summary, the CFM is a representative example of a new generation of research centers remarkably productive in Spain. These are centers with a well defined scientific focus, selective in the hiring of young and senior researchers, flexible and dynamic to adjust their research activity to hot topics, but with scientific personality strong enough not to follow into the traps of empty fashions. Most importantly, these are centers open to join efforts with other institutions for the sake of scientific progress.

Guerrilla times for Spanish researchers are almost over. And, in the scientific milieu, the word *siesta* is currently known not only as the one designing a nap but also as the name of a specialized software for electronic structure calculations (*SIESTA* = Spanish Initiative for Electronic Simulations with Thousands of Atoms). SIESTA is used by hundreds of researchers all over the world, and is partially developed by CFM researchers in a collaborative effort with other Spanish institutions. From *siesta* times we are heading now into SIESTA times.

=== SIDE BOX ===

As covered in the Strategic Plan 2010-2013, the CFM has internally transformed its previous methodology-oriented structure into a problem-oriented structure. Four general lines of research have been so defined:

- *Chemical Physics of Complex Materials*: A theoretical and experimental line that addresses the structural and electronic properties of complex nanostructured materials. The main focus is in understanding the formation and features of nanostructured self-assembled surfaces, as well as other types of nanostructures.

- *Electronic Properties at the Nanoscale*: A theoretical research line on the electronic properties of solids, surfaces, and low-dimensional systems. Particular emphasis is placed on size, border, and dimensionality effects that can change the properties of nanosized materials.

- *Photonics*: A research line dealing with the study of the interaction between radiation and matter from two different and complementary approaches: (i) confining and engineering electromagnetic fields on the nanoscale, and (ii) optical properties of new materials and elements to modify and tune laser-based phenomena.

- *Polymers and Soft Matter*: A research line on the structure and dynamics of polymer and glass-forming systems at different length and time scales. Methodological approach is based on the combination of relaxation techniques, neutron and X-ray scattering, microscopy techniques and molecular dynamics simulations.