Rosa Barrio, José Luis Zugaza, Javier Aizpurua and Ángel Moreno are four young Basque researchers – exemplifying a number of others – who have spent several years training abroad. They have come home to contribute their knowledge and experience and collaborate in the advancement of research in the Basque Country. The first two work at CIC bioGUNE, the new bioscience research center located at the Technology Park of Bizkaia, inaugurated in January. The other two have joined the Donostia International Physics Center (DIPC), which promotes resources and spaces for scientific research, and collaborates with such institutions as the University of the Basque Country.

ANGEL MORENO — **Simulations for understanding specific properties**

«I'm in a good place for applying what I've learned»

Ángel Moreno, aged 33, was born in Bilbao and studied Physics at the School of Science at Lejona. He later earned his PhD through the Physics of Materials Department at Donostia, writing his thesis on polymer physics under the direction of Juan Colmenero and Ángel Alegría. "I conducted an experiment using neutron dispersion techniques, which means that I had to go elsewhere since we don't have the kind of large-scale facilities needed for this kind of work here. I've done experiments at the Laue Langevin Institute in Grenoble, France, at the IFF in Juelich, Germany, and at the Rutherford Appleton Laboratory in Chilton, England, on atomic movements in polymers. A polymer is a very long flexible molecule, like a chain, consisting primarily of carbon and hydrogen. We find the most common example in plastics."

After completing his thesis, supported by a grant from the Basque Government, he went on to work in field of molecular dynamics simulations techniques. "The idea," he explained, "is to presuppose what the intermolecular forces in material are like, and then to use a computer to calculate how molecules move under the effect of these forces. Based on the movements we can calculate physical quantities in a real laboratory experiment. If there is agreement between the simulation and the experiment, it means the forces you presupposed are correct. The mechanical properties of materials are a direct result of forces, and by means of simulations you can understand the origin of the properties much less expensively than by carrying out an experiment."

Moreno worked with this technique for two years at Laboratoire des Verres in Montpellier, France, and then for a year and a half at Università di Roma La Sapienza. Just a few days before the Pope passed away he left Rome for Donostia. "I had the opportunity to come back and it seemed like a good place for me to put into practice what I'd learned. This line of research has become pretty important lately in the polymers physics group headed by Juan Colmenero."

The new Donostia researchers thinks that the decision he made three and a half years ago to continue his scientific career after finishing his thesis was a good one. "If I had to go back and do it all over I'd make the same choice. The post-doctoral experience was a very positive one. I got to work with people who were highly-qualified experts and good human beings." Both Ángel Moreno and Javier Aizpurua have five-year Fellow Gipuzkoa contracts with the DIPC.

JAVIER AIZPURUA

Theoretical study of the world on a small scale

Javier Aizpurua is 34 years old and has returned to Donostia after being away for nearly five years. After completing his undergraduate degree in Physical Science at Zaragoza, the Basque Government awarded him a grant which allowed him to write his thesis at the Physics of Materials department of the School of Chemistry under the supervision of Pedro Miguel Etxenike and Alberto Rivacoba. His thesis, entitled "The Electron Microscope," was a theoretical description of the energy loss of fast electrons in the electron microscope. Following approval, Aizpurua began his forays abroad, also supported by the grant program.

«I'm at a very promising stage right now»

He then set out on a more extensive journey: a short stint at the University of Cambridge Cavendish Laboratory, where the electron was first discovered over a century ago, and two years at the Chalmers University of Technology in Sweden. Here he worked as post-doctoral researcher on a project funded by the European Commission which involved six institutes, aimed at describing electromagnetic interactions in the scanning tunneling microscope. "It was very interesting because it gave me the opportunity to travel all over Europe for two years and collaborate with groups from Irish universities in Belfast and Dublin, the University of Kiel in Germany, the Dutch University of Nijmegen, and the University of Marseilles in France, among others." Then came the North American experience, where he worked with a group of nanophotonics and nanoptics experts led by Dr. Bryant at the National Institute of Standards and Technology (NIST) in Washington D.C., a federal agency dedicated to the promoting measurement, standards, and technology. He ended up staying on for three years.

So, what is his really all about? "I work with nanoparticles – minute particles – which have electronic and optical properties with potential applications in nanoelectronics and biology. For instance, particles of this kind can be injected in biological environments where certain cancerous cells adhere to these nanoparticles. By introducing laser in the system, the cancerous cells that have attached to the nanoparticles are selectively destroyed by laser. It's like a selective bombardment of laser on the nanoscale, in which nanoparticles help us get the target right. We are studying which nanoparticles can be used, where the resonance lies, what influence the resonance environments have, and all of this has different applications, such as biomedics," explains Javier Aizpurua.

In short, what this young researcher and his group do is "a theoretical study of the world on a very very small scale, where relationships and physical laws are governed by quantum physics, in which the laws are very different from the ones that govern the our world in terms of meters and kilometers."

The Fellows Gipuzkoa program, sponsored by the provincial government, has enabled Javier Aizpurua to return to the DIPC to continue developing his knowledge and to set up an area of study in nanophotonics and nanoptics, "a subject that is really hot right now in Europe, the United States and Japan."

When asked what he sees for his future, Aizpurua explained that "the problem of stability is there, both on a personal level and with regard to the situation of researchers in this country. Right now I'm at a transitional stage. It's very promising, though, because we are at the right place to be able to stabilize our situation for the future. What is missing on the political level is a program of stabilization in the Basque Country, a program which would allow researchers trained at the highest levels, with the help of government subsidies, to become a stable creative body of researchers, and in this way generate wealth in the medium to long term.

To be fair, he added "things could be done better, but some good things have come from public institutions. As I said before, I got started with a pre-doctoral fellowship awarded by the Basque Government in 1994, a program that was created when there was nothing of the kind around here. I think Pedro Miguel Etxenike was one of the spearheads of the research grant programs, which have been a model for the rest of Spain. The DIPC itself is supported by the government, and then there are the grant programs, research projects.... Investments are being made. The problem is that we have a historical deficit in allocating resources to basic and applied research."

In this institute of physical theory and simulation development, there's no such thing as white lab coats; our basic tools are pencils, paper and computers. Javier Aizpurua uses a latest-generation computer to perform high-level calculations.

ROSA BARRIO

Oriented basic research

«Research in model organisms often leads to important discoveries in humans»

Donostiarra and specialist in molecular biology, Rosa Barrio completed her studies at the Autonomous University in Madrid, where she also finished her thesis with help from a grant from the Basque Government. The subject of her thesis was the Drosophila melanogaster, that little fruit fly we so often see hovering over a bowl of fruit. "The fruit fly is commonly used in research because it is a relatively simple organism that we have a lot of genetic information about. It's easy to manipulate, accessible and inexpensive to keep in the laboratory; that's why so many of us choose it as a model. By models I mean that when it's not feasible to experiment on people animals are used in research to study how genes function. The secret is that we're actually very much like flies, worms and rats, so most of the research that's done on, say, a worm can be extrapolated to humans," explained Barrio.

Rosa Barrio wanted to do her post-doctoral work with Biology Professor Fotis Kafatos, who taught at Harvard while at the same time overseeing a laboratory in his native country of Greece. "First I went to the United States and afterwards I spent two years in Greece on a grant from the European Union. Professor Kafatos was then appointed Director-General of the European Molecular Biology Laboratory (EMBL), a cutting-edge multinational research center located in Germany. So I went there and spent five years supported by a grant from the Spanish Ministry of Education and with funding from the center itself. All of my post-doctoral work revolved around the Drosphila, but with a different family of genes. That's the work I'll continue with now."

While she was working in Madrid with Professor José Felix de Celis, who in turn worked under Antonio García Bellido, one of the most prestigious scientists in Spain, Rosa Barrio heard about a possible opening at the bioGUNE center in the Derio Technology Park in Bizkaia, and has been working there since December 1st 2004 on oriented basic research. To explain what she does, Barrio gave us an example: "If cancer is an alteration in the normal growth process of cells, and you know how the process works, then you can understand the reason behind an abnormal process in cancer. I can't say I work in cancer research per se, but my research is related and helps me understand the processes that occur when there's a malfunction in the human organism. I've also been studying the nervous system of the Drosophila and there are a lot of people doing the same in complex biological processes like memory or learning. Research in model organisms of inferior animals is very important and in many cases leads to discoveries in humans."

Rosa Barrio said that research work builds character since the work is usually long-term. "People say that obsessive people make good scientists. And in addition to obsessive, methodical and patient, because you just keep at it until you find the answer.

Barrio never imagined she would have the chance to work in the Basque Country. "It was totally unexpected. It would have been difficult for me to pack my bags and head to another country. And I'm glad because I think this center is going to work. There are all sorts of people from different backgrounds here. The management has a positive spirit and I think our prospects look good.

JOSÉ LUIS ZUGAZA — **Works with embryonic stem cells**

«Euskadi needed a center like BioGUNE»

After earning his undergraduate degree in Biology at the University of the Basque Country, José Luis Zugaza went to Galicia to study Pharmacy at the University of Santiago de Compostela, where he completed his thesis at the Department of Medicine. He then spent two and a half years working with the Imperial Cancer Research Fund in London. In the last quarter of 1997 he left England to work in Paris for three years with the Center for Pharmaceutical Studies at the University of Paris XI School of Pharmacy. In 2001 he joined the University of Salamanca Cancer Research Center. After ten years outside of the Basque Country, José Luis Zugaza returned in 2004 to become part of BioGUNE.

There are three other people in the group led by Zugaza: two PhD students and a new technician, each involved in a different project. One is on why and how normal cells become cancerous; another, in collaboration with Lezoualc'h from INSERM U446, is on molecular mechanisms in Alzheimer; the third centers on a series of proteins that could regulate the clonal proliferation of T-lymphocytes.

"When I went to Salamanca in January 2001 I was given a contract associated with a project, and in 2003 I was hired as researcher for the University of Salamanca Ramón y Cajal project sponsored by the Ministry of Education. I found out that CIC bioGUNE was in the process of being set up and that they would be looking for researchers for the center. I sent in my resume and went through the selection process." Today José Luis Zugaza is in charge of a laboratory where he trains doctorate students, works on his own personal project, and collaborates on another project organized by the center. "the center invests money in developing projects whose results will work to the benefit of society. Right now we're asking the Basque Government for funding to support a macroproject which will involve different institutions. The goal of the project is to study at the molecular level how neurodegenerative disorders, such as Parkinson's disease, are produced. The symptomatology in Parkinson's disease patients is unmistakable: a loss of voluntary movement. In addition, at the histology level, there is a progressive death of dopaminergic neurons. To develop the study we're going to work with embryonic stem cells to differentiate into dopaminergic neurons; the first objective is to make them functional to use as cell therapy in humans," explained José Luis Zugaza.

Among the partners in this macroproject are Valencia Infertility Institute Research Foundation, headed by professor Simón, pioneer in Spain in cultivating human embryonic stem cells; professor Luisa Ugedo from the University of the Basque Country; Doctor A. Villarroel from the Biophysics Unit, and Doctor L. Castaño from Cruces Hospital and CIC bioGUNE, in addition to José Luis Zugaza, Luis Parada, María Vivanco, Robert Kypta, David Gubb, James Sutherland, Rosa Barrio and José María Mato. Over the next three years Zugaza will also immersed in developing a study of liver dysfunctions, along with ongoing projects and any new projects he is asked to take on.

With so many projects, José Luis Zugaza sees a bright future ahead. "This center," he assured, "is just as good, if not better, than the places I've worked at before; the Basque Country needed a place like this. We know that there are some excellent, well-prepared groups working out of the university, but the area of biotechnology was lacking. CIC bioGUNE is one of the contributions in this area. It was important for there to be a center that could bring together the other biotechnology centers that are now cropping up." The 43-year-old scientist born in Durango said that he also enjoyed pre- and post-doctoral grants from the Basque Government while working his way to the research position he now holds.