LA TALAIA

# Modesto Orozco Receives Advanced Grant from European Research Council

The European Research Council (ERC) has awarded an Advanced Grant in the Physical Sciences and Engineering category to scientist Modesto Orozco, a researcher at the Institute for Research in Biomedicine (IRB) in Barcelona. The ERC received 917 applications from all over Europe in this grant category, which generally accounts for 45% of the total Advanced Grant budget and makes an average of €2 to €3 million available to researchers for five years. The ERC has awarded these grants since 2007 to provide support to internationally renowned researchers doing frontier research in Europe. These grants are awarded to projects that are highly multidisciplinary in scope and have innovative applications in emerging fields.

In this specific case, SimDNA, the multidisciplinary project led by Modesto Orozco that has been awarded the grant within the Physical Sciences and Engineering category is in the specialized field of computational biology and chemistry, structural biology, biophysics and bioinformatics and will have direct applications in different areas of biomedicine such as the regulation of gene expression and epigenetic mechanisms.

Modesto Orozco leads the Molecular Modeling and Bioinformatics Group at the IRB Barcelona, is a professor of biochemistry and molecular biology at the Universitat de Barcelona, the Director of the Department of Life Sciences at the Barcelona Supercomputing Center (BSC), the Director of the IRB Barcelona/BSC joint program on computational biology, and the Director of the Structural Bioinformatics Node at the Spanish Bioinformatics Institute (INB).

Dr. Orozco is one of the leading European researchers on the simulation of biological systems and an international expert on the theoretical study of macromolecular systems, especially nucleic acids (DNA and RNA). Throughout his career, he has published more than 300 scientific articles and has developed a series of computational programs and algorithms that the entire international scientific community still benefits from today. His articles have nearly 9,000 citations and a very high impact index, as shown by his Hirsch index of 51, thus making him one of the most renowned computational chemists and biologists in the world. Dr. Orozco is an editor and a member of the editorial boards of the most prestigious international scientific journals in his field of knowledge. He also a member of assessment panels in Spain, Europe and the United States, and is a consultant

for different pharmaceutical companies. Dr. Orozco has received a number of awards in Spain and abroad for his work and has received financing from the Marcelino Botín Foundation for the last four years.

Dr. Orozco answered some of our questions about his research.

***IaTalaia:*** What is the simulation of biological processes? How can this specialized field be explained to the general public?
**Modesto Orozco:** It is a set of techniques that attempt to describe, simulate and explain biological systems at a global scale in which biological functions are understood to be the result of complex mechanisms that take place at different scales, ranging from the molecular level to the scope of an entire ecosystem. You could say that the simulation of biological systems is a new area of knowledge with a formidable projection for the future that attempts to represent, understand and predict the behavior of living systems using theoretic algorithms.

***IT:*** How will you put the award money from the ERC Advanced Grant to use?
**MO:** In terms of research, our objective with the SimDNA project is to develop a complete theoretical and computational framework that will allow the entire scientific community to simulate the behavior of DNA at different scales, from the atomic level to interaction with chromatin. If we are successful, our results could help answer questions about the effects of the physical properties of chromatin on gene regulation mechanisms. Besides that, it is also a very large grant that will help maintain most of my group at a time when it is very difficult to obtain funds for research.

***IT:*** How does all this research affect people's lives?
**MO:** Modeling and computational biology in general have a direct impact on people's lives. Very few drugs available at the pharmacy today have not been studied and even designed by a computer first. Many treatments for serious ailments are decided upon by doctors based on the theoretical study of the impact this treatment will have on a specific fraction of the population. We are heading toward personalized medicine in which doctors will regularly use simulation and genomic data to adjust the treatment in all cases of an individual patient. In a few years' time, we will even be able to use theoretical models of organs such as the brain and the heart to model better disease treatments and help doctors in their day-to-day practice.

***IT:*** One of the most important consequences of the science-society relationship in the 21st century is the consideration of science and technology as uncertainty factors, as argued by German sociologist Ulrich Beck. What do you think about that?
**MO:** The same thing that Werner Heisenberg thought.

***IT:*** Science and technology advance faster than society can assimilate and understand them. How can a scientist at your level help people understand that science and technology are not part of a science fiction movie?
**MO:** By helping ensure that channels of communication,

esp understand the importance of science and the need to transmit this knowledge to the general public. It's very disheartening to hear people defend their ignorance about science ("I'm a Humanities person") or to see others make fun of scientific discoveries. It should be unheard of in advanced societies.

***IT:*** Where is your research heading?
**MO:** Toward systematic simulation of proteins and nucleic acids. We apply the basic principles of physics and chemistry to create mathematical models that explain such things as how DNA is opened, copied and expressed, and how it is closed again. Or to examine an action as amazing as a string of amino acids forming a perfect three-dimensional structure that allows it to carry out a series of very specific functions. We study all these things with the aim of shedding more light on how nature works, i.e., as a result of scientific curiosity, but also, obviously, to make use of this knowledge to directly benefit people, in this case by designing drugs.

***IT:*** If you could interview a scientist from any historical period, who would you interview and what would you ask?
**MO:** Newton. I would ask him what led him to formulate his questions.