

**UABDIVULGA**

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## Fernando Martín, head of the Medical Bio-computing Area of the Instituto de Salud Carlos III



“Our great challenge is to be able to contribute to the consolidation of Medical Bio-computing as an independent, scientific and recognised discipline”

Since 1998, Fernando Martín Sánchez has been responsible for the Area of Medical Bio computing in the Instituto de Salud Carlos III. There he has formed a team in charge of research into and the development of computer tools to aid the understanding and use of new forms of medicine based on genomics and its application in research, clinical practice and public health. A few examples would be DNA microarrays, the integration of clinical information and genetics, tools for decision making in genetic medicine, information systems based on Internet and the management of scientific knowledge. On 21 November 2007, in the Year of Computing, he gave a talk entitled “Computing in Biomedicine: history, current perspectives and advances in research”

Fernando Martín Sánchez is the head of the Medical Biocomputing Area at the Health Institute Carlos III. He holds a PhD in Computing and MD in Knowledge Engineering from the Universidad Politécnica de Madrid, and a B.S degree in Biochemistry and Molecular Biology from the Universidad Autónoma de Madrid. As well he has a DEA degree in Medicine from the Universidade de A Coruña. He did a postdoctoral stage in the Hospital of the Emory University. When he returned to Spain he joined the Health Institute Carlos III, as head of Information Systems and Technologies, and from 1998 he leads Medical Biocomputing Area of this institution.

He has coordinated the FIS' National Thematic Network of Cooperative Research on Medical Biocomputing (2003-2006) and he participates in several projects financed by the European Commission. He is member of several scientific societies, as the American Medical Informatics Association, the International Society of Computational Biology and the International Medical Informatics Association. In this association he is Chair of the Work Torce "Informatics in Genomic Medicine" and elected Vice-President for the period 2006-2009.

Dr. Martín Sánchez has published numerous articles and has edited several books on his work areas, and he is member of the Editorial Board of several international scientific publications.

### **First things first...what is Medical Bio-computing?**

Well, first things first, Bio-computing is the application of computing to the analysis of biological problems. Bio-computing was on of the main pillars of the Human Genome Project, from which we were able to obtain a great deal of data of interest to Medicine. And it was in the examination of genomics applications in medicine that Medical Bio computing was born: it is a special perspective of bio-computing, with a clear interest in providing solutions with a clinical use, such as for example attending patients or in public health.

### **Does computing bring doctors and patients closer? Is Internet the first step in a new type of medicine?**

We have to consider that we may be passing from medicine based on professionals to medicine based on the citizen. The first consequence is that the general public should be better informed and take decisions about their own health. The second is a change in the role of the health professional, as they have the knowledge they need for their job closer to hand, but at the same time the patient has access to the same information. Hence the gap between the doctor and patient is narrowed; in this aspect, computing does democratise medicine: the patient becomes a more active subject in terms of their own health. We are already talking about the doctor's new role as a filter between the information and the patients, always provided, that is, there are general levels of training and education.

### **Has genomics changed medicine, as was claimed so many times?**

The same thing has happened with genomics as has happened with other technologies, such as Internet in its day: there was a boom, later interest dropped off a little and then its development

stabilized. It is true that the great promise that our knowledge of the genome would mean a revolutionary change in medicine has not been borne out as was once thought, as the problem is much more complex and involves many more factors than just genetic ones.

The great advantage of this knowledge is that it will allow us, on the one hand, to better define illnesses, as we know their molecular level better, and on the other hand, it will allow us to individualize treatments a little more. We can form groups of persons with similar genetic characteristics and try to adapt treatments to these characteristics.

### **You are in charge of a research group called BIOTIC, can you explain what you do?**

BIOTIC is the Medical Bio-computing group at the Instituto de Salud Carlos III (ISCIII). We are a multi-disciplinary group, made up of researchers both from the life sciences and from technical backgrounds. Our main objective has been to research and develop computing systems that enable the development of medicine based on genomics and, through this, individualized medicine. Hence we are involved in various projects, at a national and European level, such as for example the coordination of a Thematic Cooperative Research Network of the FIS (Fund for Health Research) or our participation in INFOBIOMED, a European Network of Excellence in biomedical computer science, in which 17 groups from 10 countries have participated. This European network was inspired by the Spanish network, and it is one of the few networks of excellence which are coordinated from Spain and, specifically from Catalonia.

It is not easy to put forward this type of multi-disciplinary projects: the calls for projects still have a certain division in classical areas, and at times, the people who have to evaluate them do not know how to appreciate the value of inter-disciplinary work. Additionally, at an educational level the problem is even more severe and it is all too patent to see this division in classical areas, which hinders attempts at a multidisciplinary training. This is why we favour posting young researchers in centres which are complementary to their basic training. There they learn by practice, working on specific problems that require a wide ranging focus; and this focus is producing good results.

### **What is the relationship between BIOTIC and DNA microarrays, the so-called biochips?**

We were one of the first groups in Spain who were interested in what, at that time (the end of the 90's), was a new technique. In 2000 we managed to install the second machine that came into Spain to manufacture and analyse microarrays. Since then we have been working on various related projects, especially on projects related to clinical applications. We selected the field of microbiology, specifically the detection and identification of virus and bacteria, a line which is not very common in this area. This research is already having a decisive impact on the improvement of diagnostic procedures. We are working on the detection of the immune response to HIV (with protein arrays), on the detection of respiratory virus (by means of DNA and RNA analysis) and lastly we are cooperating with the Hospital Clínico de San Carlos (Madrid) on the analysis of data on colorectal cancer.

It is an area with a great deal of potential, which will have a lot to say even about the new forms of medicine. Microarrays will give way to nanoarrays; the trend is towards miniaturizing even more diagnostic devices and, if possible, giving a certain degree of "intelligence" to models or

systems which aid doctors to take clinical decisions. As I explained in my talk, the convergence of technologies is very important for this point.

### **Is there any potential danger in the application of computing to medicine?**

There are mainly problems of security. In medicine there are special requirements, as legislation must strictly protect the privacy of information: we have to make sure that nobody has access to unauthorized sensitive information. This fact has already meant a certain problem in the past, with respect to obtaining real data on patients for use in research. Today there are many people working on technologies which allow such information to be anonymous to protect access to systems.

Another problem could be guaranteeing quality. If we want genetic tests to be part of the clinical area, we have to have a system which guarantees quality, efficacy, sensitivity and the exactitude of such tests. So we are working shoulder to shoulder with genetisists, but there is still a lot to be done.

Lastly there is the fact that genetic tests, at the moment are not cheap. Hence we have to pay attention to availability, so that they are not just within the reach of a few in certain centres or in certain regions.

### **Is computing in medicine an opportunity for the pharmaceutical industry?**

Well, the pharmaceutical industry is having problems to produce new drugs and to reduce costs and development time. More and more they are looking to computing solutions in silico for prediction, toxicology and safety. What they are aiming for is the ability to predict early if a pharmaceutical candidate can be ruled out or not.

In this regard there is a very important initiative, the European Technological Platform for Innovative Medicines, which among its 4 basic pillars counts on Knowledge Management and its computing aspects. We are involved through the new Network which the FIS has provided us with.

### **What are your projects for the future?**

We have detected new trends in medical research, especially in terms of nanomedicine and regenerative medicine. In these two areas there are important challenges for computing, as an essential part of the research process. We are not only talking about a tool that can be used, for example, to create data bases; we are talking about modelling, designing, about tasks which at this level can only be carried out by computing. A couple of projects which have recently been approved will allow us to move into these fields.

### **What is your challenge?**

The great challenge facing our group is to be able to contribute (given that it is something we cannot do alone) to the consolidation of Medical Bio-computing as an independent, scientific and

recognised discipline. We would like to see educational programmes that will train the new generations of researchers with a trans-disciplinary focus, and calls for projects to recognise the value of inter-disciplinary work and we would like to aid companies and the industrial sector industrial to have access to these professionals. And, above all, we would like to convince decision makers and managers that we are miles behind with respect to the rest of the world: we have to pull our socks up, so to speak.

**Interview:** Guillermo Santamaría

**Photo:** Pierre Caufapé

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