

BEYOND BIOPHYSICS

Translational Biophysics

A conversation with Antonio Ferrer-Montiel

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From the bench to societal wealth... Bio-scientists do research because we really like and enjoy unveiling the secrets of how nature works. At the beginning, we love carrying out our research on the bench, and later and most of the time, leading and managing research programs. We all face plenty of obstacles when doing science; if we actually did not like it, scientists would have been *extinct* long ago. However, of course, as rare specimens, we love and enjoy our work on a daily basis.

This is the central motivation to overcome the large number of difficulties that we encounter every day. If, on top of it, we add the possibility that our work can deliver perceptible benefits to society, the gratification is extraordinary.

Biophysics research, health, society, i.e., *translational biophysics*. Is it possible? The answer is simply and overwhelmingly, yes!

Antonio Ferrer-Montiel (Callosa d'en Sarrià, 1962) joined the [University Miguel Hernández](#) in 1997. He is full professor in Biochemistry and Molecular Biology and Director of the [Institute of Molecular and Cellular Biology – IBMC](#). If we want to discuss about translational biophysics, he is definitely the right person to talk with. Why? He is the founding partner of several start-up biotech companies, such as Diverdrugs, Ilice Biotech, Prospera Biotech, AntalGenics and FastBase Solutions. He has 11 granted patents, 12 patents under evaluation, and 15 patents in exploitation. Apart from more than 100 publications, 25 reviews and 16 directed Ph.D. dissertations, he is involved in the scientific management of many founded projects from both institutional and industrial entities. He is also well known for his active compromise with different scientific societies and at the moment holds the presidency of the [Biophysics Society of Spain – SBE](#).

Antonio has always shown an interest on understanding how membrane proteins work in terms of their underlying structure. First, he focused on membrane transporters and later he moved to the

field of ion channels. Since its incorporation to the IBMC, he has centred his research interests in the field of sensory neurobiology, aiming to uncover the role of ion channels in pain signalling. He uses this knowledge to identify novel therapeutic targets amenable for pharmacological modulation. This has prompted the development of a drug discovery platform that combines *in silico* screening and modelling, along with high throughput assays. As a result, several active molecules have been identified and one of them is currently under human clinical assays.

Which is the road leading from basic to translational research? We will try to unravel this apparently tortuous process. Let us start at the very beginning: Biophysics; what is biophysics? Biophysics can be

defined as the border of physics, biology and chemistry, encompassing everything connected between these fields; i.e. the quantitative understanding of how biological processes work at the

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molecular, cellular and system levels. Biophysics has evolved from the development and application of techniques, to monitor biological processes, to a discipline that aims to uncover the physical principles of biological function. This knowledge is essential for

Antonio, knowing the relationship between *applied* and *basic* science, could you tell us which was your motivation to focus your research in science and, particularly, in biophysics?

“ *The main motivation to become a scientist was my curiosity for understanding how nature works. Every time I look at nature's achievements, from physical to biological processes, I am astonished and have the necessity to understand them. I was attracted to biological processes because it amazed me how simple principles can be orchestrated to produce complex biological functions and, ultimately, life. I was captivated by the underlying mechanisms of cellular communication and, in particular, neuronal signalling. Truly amazing, yet, poorly understood processes are temperature and touch sensing, proprioception, nociception, cognition and learning. Thus, unveiling their molecular and physical principles is essential for intervening when they dysfunction (pain, cognitive disorders, etc). Undoubtedly, understanding how our brain works and encodes the information and its decision-making is a very exciting challenge.*



Professor Antonio Ferrer-Montiel.

Very soon you realized the possibility of linking the basic research that you were pursuing with application in biotechnology and biomedicine. What moved you to include the word translational in your research?

“ *It probably was the realization that knowledge has a tremendous value beyond its publication in a scientific journal. As Ikuro Nonaka says “In an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge” As scientists, we like to disseminate our discoveries to the scientific community for its valuation and recognition. Notably, we also like to finish most of our papers with a significant statement (usually at the end of the discussion section) emphasizing the biotechnological and/or biomedical importance of our findings. In essence, virtually all scientists know that their results have potential important applications. I realized this and learned the ways to translate the generated knowledge into products and services for the benefit of our society.*

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It appears to me that there are scientific fields like biotechnology, chemistry, biomedicine, pharmacology, where translation is readily foreseen and heavily pursued, but it does not seem that clear for biophysics. What is translational biophysics?

“ *In my opinion, biophysics is not different from other scientific disciplines. It generates knowledge on how biological processes work and how their dysfunction contributes to human diseases. In the past years, the progress of biophysics has been enormous, and with the development of more precise and sophisticated technology we are now examining biology at an unprecedented level, from single molecules to systems dynamics. We will witness that the biophysical knowledge obtained will have a huge impact on current societal challenges.*

Research is to not only discovering molecular structures and determining their function, but also to glimpse the different possibilities that can be obtained by changing those structures or even imagining new ones: *exploit the known, imagine the unknown and make it happen* . Such an innovative person like you, what is really in your mind: imagination...? Or, is it something that comes rolled along with research?

“ *I believe that is a blend of everything. When thinking on a project I always like to look at the potential implications for society, and focus on understanding an specific problem, because with that knowledge comes the power to propose solutions and to transfer them for a societal benefit. Thus, what I hold in my mind is the necessity to make available and useful the scientific findings. When I do it, I feel that I am accomplishing something important. And, I should mention that exploiting the knowledge is not to reach an economical profit, but to make it accessible for those in our society that may need it.*

Often society is not able to discern the value of basic science. However, many products that people use in everyday life, not to mention everything related to health and wellness, are owed to it. What do you think that we, as scientists, have to say in order to show that applied research, what the society really sees, is due solely to basic research, what the society does not see?

“ We have to disseminate that there is good and bad science, and that good science gives rise to good applications for the benefit of society. I do not believe in the duality basic-applied science. It is clear that our society is only aware of the applications, and this is probably because scientists have not communicated in lay terms the scientific advances, their significance and their implications. Fortunately, this is rapidly changing with the implementation of out-reach activities sponsored by scientific societies, universities, research centres and researchers, as well as with the development and use of social networks. We are currently facing a revolution on science communication, and the society is understanding the importance of generating good scientific knowledge for increasing their wealth.

**There is good and bad science.
Good science gives rise to good applications**

We, scientists, may have a different perception of life, because, like it or not, we feel and see life in a different way. You, at the maturity of your life, after a long career in science but with many years still ahead, how much more could you ask in science?

“ In general, there are still plenty of societal challenges that need knowledge-based solutions, primarily, in medicine. Many diseases are yet without treatment or poorly treated; many current drugs have limited use because of adverse side effects. And with the increase in life-expectancy in our society, other maladies are becoming more prevalent. Thus, I see plenty of necessities for unveiling the molecular and cellular basis of diseases, identifying and validating biomarkers for diagnosis and prognosis, validating new therapeutic targets and developing better drugs, especially for chronic diseases. I believe that with the current technological developments the time is ripe for biophysics to take a lead in both, the generation and translation of knowledge.

From the beginning to the end, from the biophysical bench to societal wealth... *through* translational biophysics. Throughout this conversation Antonio has shown us that it is possible nowadays to really perform translational research in biophysics; go from basic to applied research in a direct way. Perhaps many of us still do not realize the potential that biophysics has. So, we can only say one last word: Apply it!

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