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Interview

An Interview with Dr. Francisco J. Barrantes

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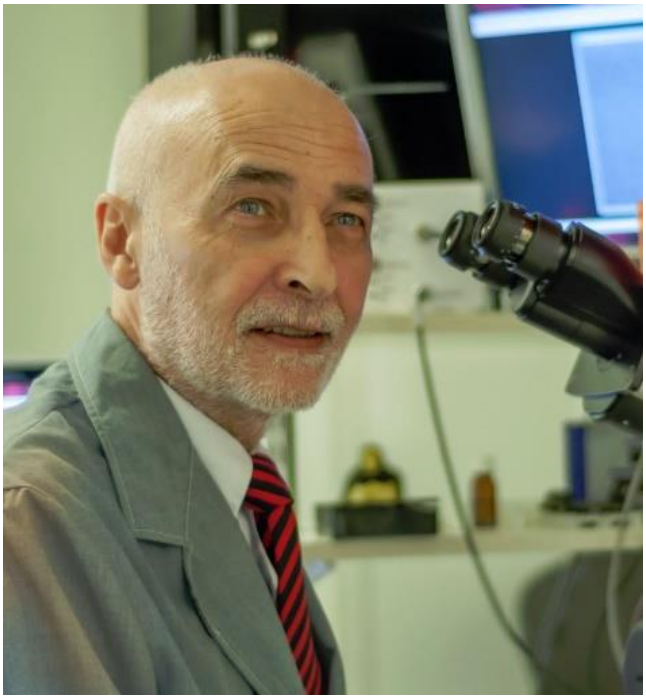

Dr. Francisco J. Barrantes

MD., Ph.D. Univ. B. Aires, Argentina; Professor and Head of Laboratory of Molecular Neurobiology, Institute for Biomedical Research, Pontifical Catholic University of Argentina, Argentina; Highest rank investigator, Argentinian Scientific and Technological Research Council.

Former joint head of Membrane Biophysics Unit (1978-1983) with Erwin Neher and Bert Sakmann (Nobel awardees Med. & Physiol. 1999), at Max-Planck Inst. for Biophys. Chemistry in Göttingen, Germany. Collaborations in Germany with Tom Jovin, Derek Marsh, Peter Zinghsheim and Joachim Frank (Nobel awardee in Chemistry 2017).

Former head, Scientific & Technol. Research Council of Argentina in Bahia Blanca. Chairholder, UNESCO Chair of Molec. Neurobiology & Biophysics.

Subsequent sabbatical periods in Göttingen led to a long-lasting collaboration with Stefan Hell (Nobel awardee in Chemistry 2014) on superresolution optical microscopy.

Awards: TWAS award in Biology; Fellow, Guggenheim Mem. Foundation; Human Frontier Sci. Progr. Fellow; Royal Society, UK; De Robertis Medal; A. von Humboldt Found. award; Premio Uniao Latina, Portugal; Konex Award; Sarojini Damodaran Intl. Trust, India; Consecration Medal, Acad. Sci. Argentina. Gregorio Weber award, Biophys. Soc.

Member of Natl. Acad. of Medicine and Natl. Acad. Sciences, Argentina; Brazilian Acad. Sci.; European Acad. Sci.; Indian Sci. Acad.; Latin American Acad. Sci.

1. What Is Your Main Research Area? How Did You First Become Interested in It? Is There a Particular Case Which Has Influenced You the Most?

My main research area is Molecular Neurobiology. I work on nicotinic acetylcholine receptors. My supervisor, cell biologist and neurobiologist Eduardo De Robertis, gave me ample freedom to choose the specific subject matter of my thesis work. He was very interested in a specialized type of subcellular organelle, the synapse. I started exploring the molecular constituents of the cholinergic synapse as an undergraduate and continue to be extremely interested in this area. I work on the nicotinic receptor, the protein that transduces the chemical signal conveyed by the neurotransmitter acetylcholine into an excitatory signal in a brain neuron or into a contraction of the skeletal muscle cell. Currently in our group we look at this molecule with a variety of microscopies to learn about their “social behavior”, metaphorically speaking, that is exploring the way individual molecules associate into the supramolecular assembly we call synapse. We currently know only a fraction of how the human brain develops, works, and is affected in disease. In my view, in order to deepen our understanding of the brain under its multiple “versions”, we need to understand its basic unit, the synapse, and the orchestration of its molecules.

2. Which Topics Are Included? In Your Opinion, What Challenges and Developments Can We Expect to See in among These Topics?

Molecular Neurobiology is at the forefront of scientific research. I am convinced that the next decades will witness an enormous expansion of our knowledge of the brain and the synapse.

3. Considering the Progress in Your Research Area, Could You Please Share Us Some Hot Topics or Cutting-edge Technologies in Your Research Field?

From the thematic point of view, the pathophysiological bases of many neurodegenerative diseases affecting the human brain remain largely unexplored and are therefore hot topics of research for years to come. Of course, this will require a deeper knowledge of the labyrinthic architecture of the human brain and its functional complexity, which is still at its infancy. From the methodological viewpoint, we need to develop new technologies to address these hot topics and increase the resolution of available methods far beyond their current capabilities. The challenge is enormous, but human ingenuity has no limits…

4. As an Experienced Researcher in This Field, What Do You Consider to Be Key Aspects of Research that Apply to Clinical Practice?

The precision and the reproducibility that are required in basic research are skills that also apply to clinical practice. The same applies to the use of rigorous statistical methods, which cannot be fully applied in clinical practice due to the number of individual cases at hand. Clinicians would benefit from routinely working in a basic research laboratory for short spells and maintain close contact with advances in the basic sciences. Fortunately, many already do so.

5. Do You also Offer Training and/or Further Education in Your Area?

Yes. My laboratory welcomes researchers and students from all over the world, and we were fortunate to receive several dozen postdoctoral students from Latin America at the UNESCO Chair of Biophysics and Molecular Biology when I was chairman of this body. On average, I have 2-3 Master students rotating in my lab, either from the Faculty of Medicine or from the Faculty of Engineering and Computer Sciences. Students from the computer sciences are mainly addressing the analysis of superresolution microscopy images, which requires intensive work with deep learning and machine learning approaches. We currently have two M.D/Ph.D. students from the Faculty of Medicine doing research on apolipoprotein E in Alzheimer disease and the effects of environmental enrichment in an animal paradigm of this disease, respectively. A student from Nigeria will hopefully join soon. We have also offered specialized training course in advanced microscopy methods.

6. How Do Patients Benefit from Your Research?

Basic research is permanently feeding new information to the clinic. I practice translational research, i.e., I attempt to draw information from our basic science studies to neurodevelopmental and neurodegenerative disease conditions like Alzheimer and Parkinson diseases, schizophrenia spectrum disorders, autistic spectrum disorders, and some forms of epilepsy, all of which involve pathophysiological abnormalities of the cholinergic system.

7. Let Us Know How You Balance Your Job with Privacy? What Are Your Secrets of Success for This?

I am not a good example; I am workaholic, and much of my work is conducted at home. The positive aspect is that I enjoy very much what I do in science. Fortunately, my wife not only tolerates my habits but has also helped me all along in my scientific career.

8. What Are Your Future Plans?

Over the course of my life as a scientist I have witnessed a couple of breakthroughs that were unimaginable 50 years ago, such as seeing biomolecules with an optical microscope, or a dendritic spine in a neuron dance in a live animal, or an image of an enzyme with true atomic resolution using cryo-electron microscopy... I have enjoyed what I do in science all along my career, and find the questions ahead about the functioning of the brain, the origin of life, or the birth of the Universe tremendously exciting. Life started at the micro-scale, so it is easy to predict that microscopists will have a niche in the "realm of the small" for years to come...