

Biography of José N. Onuchic

Published as part of *The Journal of Physical Chemistry virtual special issue "José N. Onuchic Festschrift"*.



Cite This: *J. Phys. Chem. B* 2023, 127, 7556–7557



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Dr. José N. Onuchic is the Harry C. & Olga K. Wiess Professor of Physics and Astronomy, Chemistry, and Biosciences at Rice University. He is also the co-Director of the Center for Theoretical Biological Physics and a Cancer Prevention and Research Institute of Texas (CPRIT) Scholar. Understanding the underlying mechanisms governing life processes has been, historically, an experimental effort. In the last decades, however, Dr. Onuchic has repeatedly shown how synergistic interactions between theory and experiments are needed to achieve progress in such complex problems.

Prof. Onuchic grew up in São Carlos, Brazil, where from an early age he demonstrated an interest in science and mathematics. Both of his parents were professors of mathematics at the Universidade de São Paulo (USP). He pursued his college education at the same institution, where he obtained bachelor's degrees in electrical engineering (1980) and physics (1981), followed by a master's in applied physics (1982).

Toward his goal of understanding problems at the interface of the life and physical sciences, Prof. Onuchic then moved to the California Institute of Technology (Caltech) where he earned his Ph.D. under the supervision of Prof. John Hopfield. After Caltech, he returned to São Carlos as an assistant professor for a few years before returning to the United States as an assistant professor in the physics department at the University of California, San Diego (UCSD), where he established a theoretical biological physics group.

Prof. Onuchic's research focuses on theoretical and computational methods for molecular biophysics, chemical reactions in condensed matter, genome structure, gene expression, gene networks, and theoretical modeling of cancer. His first scientific contributions during his Ph.D. and early years as a professor focused on the theory of electron transfer reactions in biomolecules. These reactions are central to the bioenergetic pathways of both animals (respiration) and plants (photosynthesis). One of the main achievements of this effort has been the accurate prediction of electronic coupling properties between the donor and acceptor sites in proteins. This was enabled by his development of a theoretical framework to quantitatively understand electron tunneling in proteins, which provided a new way to design proteins that are competent for electron transfer reactions.

Protein folding is probably the area for which Prof. Onuchic is most well-known. His research group introduced the concept of protein-folding funnels to show the types of amino acid sequences that can fold into unique protein structures. His theoretical advances have guided much of the experimental

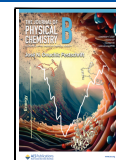
research in protein folding during the last three decades. Onuchic is a tireless advocate of using advanced techniques of statistical physics to tackle biological problems. He has also extended this energy landscape approach to understanding the underlying mechanisms governing molecular motors, such as kinesin and myosin.

Since 2002, Prof. Onuchic has co-directed the Center for Theoretical Biological Physics (CTBP). CTBP is an NSF Physics Frontiers Center that encompasses a broad spectrum of research and training activities at the forefront of the biology–physics interface, including molecular biophysics, statistical biophysics, and biological dynamics at the cellular/multicellular scale. This interdisciplinary research effort includes physicists, chemists, mathematicians, and biologists, and it has contributed to a better understanding of the underlying mechanisms governing complex biological systems. Under the auspices of CTBP, he has broadened his interests to stochastic effects in genetic networks with an emphasis in bacteria and cancer.

Prof. Onuchic joined the faculty at Rice University in 2011, where he relocated the NSF Physics Frontiers Center, CTBP. With this move, his research effort in cancer substantially increased as well. By further expanding his ideas coming from energy landscapes for protein folding, his group started to explore chromatin folding and function. He is currently very interested in understanding how genome structure and dynamics affect gene expression and other functional processes in the cell. In this direction, Prof. Onuchic is now working to connect efforts in this new field with cancer modeling approaches.

As one of the leaders in theoretical biological physics, Prof. Onuchic has received much recognition for his scientific achievements. He was elected to the National Academy of Sciences in 2006 for his contributions to the understanding of protein folding and electron tunneling inside proteins. He received the International Centre for Theoretical Physics Prize in honor of Werner Heisenberg in Trieste, Italy (1989), and the Beckman Young Investigator Award (1992). He is a fellow of the American Physical Society (1995), the American

Published: September 7, 2023



Academy of Arts and Sciences (2009), the Brazilian Academy of Sciences (2009), and the Biophysical Society (2012). He was also awarded the Einstein Professorship by the Chinese Academy of Sciences (2011). In 2014, he received the Diaspora Prize from the Ministry of Foreign Affairs and the Ministry of Industrial Development and Foreign Trade in Brazil. In 2015, he was awarded The International Union of Biochemistry and Molecular Biology (IUBMB) Medal. In 2017, he was elected fellow of the American Association for the Advancement of Science (AAAS), and in 2018, he was admitted to the Grã-Cruz class of the Ordem Nacional do Mérito Científico by the Brazilian Government. In 2019, he received the Max Delbrück Prize in Biological Physics of the American Physical Society and he received the title of Honorary Professor from his alma mater, USP São Carlos. In 2020, he was appointed by Pope Francis as an academician in the Pontifical Academy of Sciences. This year (2023), he received the Founders Award from the Biophysical Society for his outstanding achievements in biophysics.

Prof. Onuchic has also been heavily involved in advising scientific agencies, foundations, and universities. A few examples include his role as chair of the advisory committee for the Biological Sciences Directorate of the National Science Foundation (NSF) and a member of the council of the American Physical Society (APS). He served as a member on the advisory committee for the Mathematical and Physical Sciences Directorate, the Molecular Biophysics Panel for the National Science Foundation, and the American Physical Society's Panel of Public Affairs. He was also a council member for the National Academy of Sciences Board of Physics and Astronomy and the director of the College in Biophysics for the International Centre for Theoretical Physics at Trieste, Italy. Dr. Onuchic also served as president of the Biological Physics Commission of the International Union of Pure and Applied Physics. He has been involved in the editorial board of many scientific journals such as *PNAS* and *Biophysical Journal*, and until recently, he was the Deputy Editor for *Reports on Progress in Physics*. He had a role as member of the committee that prepared the National Academy of Sciences Decadal Survey in Biological Physics/Physics of Living Systems, and he is currently the chair-elect of the nomination committee of the American Physical Society.

It would be appropriate to conclude this biography by recognizing the enduring support provided by José's family. With both of his parents being professors of mathematics, they instilled a love of learning and discovery that has helped carry José through his career. However, his scientific efforts would not have been possible without the unwavering support of his wife, Mayra. José and Mayra married in 1982 and they have three sons: Lucas, Diego, and Paulo. Like José, Mayra has also focused her career on education as an elementary school teacher for most of her professional life. Following this family tradition, their sons are also involved in science, mathematics, and education. Together, they are a truly international family who love learning, while enjoying the best of Brazilian and American culture.

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