Juan de Pablo

Liew Family Professor
Deputy Director for Education and Outreach

Areas of Research Expertise

Protein folding and aggregation, DNA folding and hybridization, glassy materials, block copolymers, liquid crystals, development of advanced molecular simulation methods

Research Overview: de Pablo Group

Using advanced multiscale simulation techniques and powerful computers, the de Pablo group seeks to predict the properties of fluids and solids from a fundamental understanding of molecular interactions across multiple length scales. The group's interests encompass materials behavior at equilibrium and far-from-equilibrium behavior. Building on that atomic and molecular-level understanding, the group relies on sophisticated computational algorithms to design functional materials systems with engineered structures and functions.

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Research

Juan de Pablo is a leader in developing models and simulations of molecular and large-scale phenomena. He and his team use their findings to understand, design, and find applications for new materials.

One area of focus in the de Pablo lab is DNA structure and dynamics, including the phenomena of how DNA molecules arrange and organize themselves and interact with other DNA molecules or proteins. Another area of investigation is protein aggregation and its relationship to various diseases, including type II diabetes and several neurodegenerative disorders.

Other areas of research in the de Pablo group include the study of highly anisotropic liquid crystalline materials, and how their response to external cues can be engineered by relying on interfaces and applied fields, the study of self-assembly in block polymers and polyelectrolytes, and the study of glasses and other disordered media.

de Pablo is the author or coauthor of approximately 500 publications, and a textbook on Molecular Engineering Thermodynamics. He holds over 20 patents on multiple technologies, including nine jointly with Paul Nealey, the Brady W. Dougan Professor at IME. The International Technology Roadmap for Semiconductors has identified one of de Pablo and Nealey's collaborative inventions for directed self-assembly as a technology critical to the semiconductor industry's miniaturization goals. Another of de Pablo's patents has been licensed by a major health and nutritional products company, and is used throughout the world to stabilize proteins and cells in glassy materials over extended periods of time without refrigeration.

Bio

de Pablo earned his BChE from the Universidad Nacional Autónoma de México, and his PhD in Chemical Engineering at the University of California, Berkeley. He conducted postdoctoral research at the Swiss Federal Institute of Technology (ETH) in Zurich and joined the faculty of the University of Wisconsin–Madison in 1992, where he was the Howard Curler Distinguished Professor and the Hilldale Professor of Chemical Engineering before joining the Institute for Molecular Engineering in 2012.

de Pablo received the DuPont Medal for Excellence in Nutrition and Health Sciences in 2016, the Intel Patterning Science Award in 2015, and the Charles Stine Award from the American Institute of Chemical Engineers in 2011. He currently chairs the Mathematical and Physical Sciences Advisory Committee of the National Science Foundation, and the Committee on Condensed Matter and Materials Research at the National Research Council. He is the founding editor of *Molecular Systems Design and Engineering*, and co-director of the new Center for Hierarchical Materials Design.

Pablo was inducted into the National Academy of Engineering in 2016 for "design of macromolecular products and processes via scientific computation." He is a fellow of the American Academy of Arts and Sciences, and of the American Physical Society. de Pablo was elected as Foreign Correspondent Member of the Mexican Academy of Sciences in 2014.