The 2005 Ralph and Helen Oesper Awardee

Honoring

V. Adrian Parsegian

National Institutes of Health

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Working to strengthen the biology/physics interface, V. Adrian Parsegian is Chief of the Laboratory of Physical and Structural Biology at the National Institute of Child Health and Human Development. The theme of his studies has been the theory and measurement of intermolecular forces in the context of biological macromolecules such as DNA, phospholipid membranes, proteins, and polysaccharides.

He received his Ph.D. in Biophysics in 1965 from Harvard University with a healthy dose of thermodynamics during 1962-1964 at the Weizmann Institute of Science with Aharon Katchalsky and Shneior Lifson. Following two post-doctoral years at MIT (1965-1967) with Irwin Oppenheim, he moved to the NIH, where he has dedicated himself to formulating and measuring the electrostatic, electrodynamic (van der Waals), solvation, and entropic forces that govern cellular organization and transport.

From 1977 to 1981 he was Editor of the Biophysical Journal and founding Editor (1978 - 1986) of the Biophysical Discussions. A former President of the Biophysical Society (1983-4), he received the Society's Distinguished Service Award in 1995. In addition to many scientific papers, he has recently written a book, Van der Waals Forces: A Handbook for Biologists, Chemists, Engineers, and Physicists, labeled by a friend "quantum electrodynamics for the people." This is the first of an intended series of texts to make the physics of intermolecular forces accessible to those without a background in advanced physics. He has begun a text that he wishes he could title "thermodynamics for busy people."

Nourished by Noise, the organizing power of random fluctuations

This is about van der Waals or charge-fluctuation forces, what has been learned over the past fifty years and what might be done in the next fifty. The delightful mental paradox in these forces that create order is that they are inherently linked to the "noise" of electronic, atomic, and molecular motion. The seemingly random dance of the electrical charges that compose matter creates attraction. By looking at the noise in materials, we can see their capacity to create order.

When you begin to think about it, it seems as though everybody owns van der Waals forces. At least one of my three children heard about them in junior high. Biological theorists feed them to computers in order to see how proteins fold and how lipids pack. Chemists place them at the center of theories of solids and liquids. Chemical engineers work constructively to use their action to stabilize suspensions and surfaces. Physicists see them in the darkest corners, where they are intrinsically linked to blackbody radiation.

Yet the theory has always been difficult. Thwarted by complex physics, most people have used vastly simplified approximations. Beginning about fifty years ago, when theorists reformulated van der Waals forces so that they could harness the noise seen in spectroscopy for computation, the theory has been developed, applied, and sometimes accurately simplified. Most important, motivated by the need to create nano-scale devices, liberated by better spectroscopy, informed by newly friendly physics, we face a happy prospect of building new connections between practical applications and fundamental theories.

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