MSE-Colloquium@NTU

12 November 2014, 4.00pm (refreshments will be served at 3.30pm)

Lecture Theatre 4, Nanyang Technological University

Cooperative Function in Atomically Precise Nanoscale Assemblies

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About the Talk

We use molecular design, tailored syntheses, intermolecular interactions, and selective chemistry to direct molecules into desired positions to create nanostructures, to connect functional molecules to the outside world, and to serve as test structures for measuring single or bundled molecules. Interactions within and between molecules can be designed, directed, measured, understood, and exploited at unprecedented scales. Such interactions can be used to form precise molecular assemblies, nanostructures, and patterns, and to control and to stabilize function. We selectively test hypothesized mechanisms by varying molecular design, chemical environment, and measurement conditions to enable or to disable function and control using predictive and testable means. Critical to understanding these variations has been developing the means to make tens to hundreds of thousands of independent single-molecule/assembly measurements in order to develop sufficiently significant statistical distributions, while retaining the heterogeneity inherent in the measurements. We measure the electronic coupling of the molecules and substrates by measuring the polarizabilities of the connected functional molecules. The next step in such devices is to learn to assemble and to operate molecules together, both cooperatively and hierarchically, in analogy to biological muscles. We discuss our initial efforts in this area, in which we find both interferences and cooperativity.

About the Speaker

Professor Weiss received his S.B. and S.M. degrees in chemistry from MIT in 1980 and his Ph.D. in chemistry from the University of California at Berkeley in 1986. He was a postdoctoral member of technical staff at Bell Laboratories from 1986-88 and a visiting scientist at IBM Almaden Research Center from 1988-89. Before joining UCLA in 2009, he was a Distinguished Professor of chemistry and physics at the Pennsylvania State University. His interdisciplinary research group includes chemists, physicists, biologists, materials scientists, mathematicians, electrical and mechanical engineers, and computer scientists. Focusing on the ultimate limits of miniaturization, his team has developed new techniques to expand the applicability and chemical specificity of scanning probe microscopies. They have applied these and other tools to the study of catalysis, self- and directed assembly, and molecular and nanoscale devices, advancing nanofabrication down to ever smaller scales and greater chemical specificity in order to operate and to test functional molecular assemblies, and to connect these to the biological and chemical worlds. Two current major themes in his laboratory are cooperativity in functional molecules and single-molecule biological structural and functional measurements. He has over 300 publications, holds over 20 patents, and has given over 500 invited, plenary, keynote, and named lectures.

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