Purdue University

SCHOOL OF CHEMICAL ENGINEERING

2009 KELLY LECTURE

Dr. Carol K. Hall

Camille Dreyfus Distinguished University Professor
North Carolina State University

Bio:

Professor Carol K. Hall is the Camille Dreyfus Distinguished University Professor of Chemical and Biomolecular Engineering at North Carolina State University. She received her B.A. in physics from Cornell University and her Ph.D. in physics from the State University of New York at Stony Brook. After postdoctoral training in the Chemistry Department at Cornell and a brief period as an economic modeler at Bell Laboratories, she joined the Chemical Engineering Department at Princeton University in 1977 as one of the first women to be appointed to a chemical engineering faculty in the U.S. In 1985 she joined the Chemical Engineering Department at North Carolina State University.

Hall's research focuses on applying statistical thermodynamics and molecular-level computer simulation to topics of chemical, biological or engineering interest involving macromolecules or complex fluids. Current research activities include self assembly of dipolar colloidal particles, nanoparticles for the delivery of cancer drugs, heteropolymers with adjustable monomer sequences, hybridization of DNA, and the formation of fibrils and other molecular aggregates of peptides and proteins. She is the author of over 190 publications, is a Fellow of the American Physical Society and was elected to the National Academy of Engineering in 2005.

Abstracts:

April 21, 2009
3:30 - 4:30 p.m. / FRNY G140

"Thermodynamics and Kinetic Origins of Alzheimer's and Related Diseases: A Chemical Engineering's Perspective"

The pathological hallmark of more than twenty neurodegenerative diseases, like Alzheimer's, Parkinson's and the prion diseases, is the presence within the brain of plaques containing ordered protein aggregates called fibrils. It is not yet known why these structures form in some individuals and not in others, or whether the plaques are toxic or Nature's way of sequestering toxic species. Dr. Hall will describe current thinking on the scientific underpinnings for this phenomenon, and her computational efforts to contribute to our knowledge of how and why proteins assemble into fibrils.

April 22, 2009
11:30 - 12:30 p.m. / FRNY 3059

"Self-Assembly of Dipolar Particles: Designing Smart Materials Using Computer Simulation"

Dipolar colloidal particles self-assemble into pre-defined microstructures and have the potential to serve as the foundation for a new generation of micro- and nano-structures of remarkable complexity. We use computer simulation to explore the self assembly, structure, crystallization and/or gelation of single-component and binary mixtures of colloid particles with permanent dipole moments. Many different types of phases are found, including ordered phases (FCC, HCP and BCT) at high packing fractions and fluid, string-fluid and gel phases at low packing fractions. The very low volume fraction gel phases and the well ordered crystal phases are promising for materials applications. The results of this study should help guide our experimental colleagues in their quest to design and engineer "smart" gels and materials.