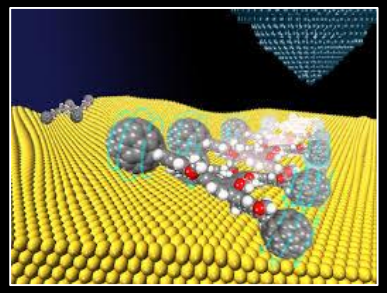
Program in ENG/CBET

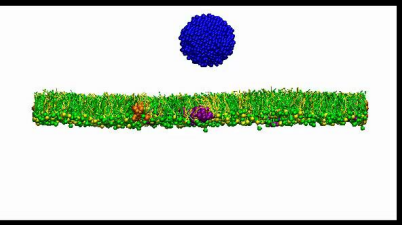
Biological and Environmental Interactions of Nanoscale Materials

Program Goal: support research focused on fundamental and quantitative understanding of the interactions of biological and ecological matrices with nanostructured materials and nanosystems



- ***Characterization of interactions at the interfaces*** **between nanomaterials and nanosystems with surrounding biological and environmental media, including both simple nanoparticles and complex and/or heterogeneous composites;**
- ***Development of predictive tools*** **based on the fundamental behavior of nanostructures within biological and ecological matrices to advance cost-effective and environmentally benign processing and engineering solutions over full life material cycles;**
- ***Examining the transport, interaction, and impact*** **of nanostructured materials and nanosystems on biological systems;**
- ***Simulations of nanoparticle behavior*** **at interfaces, in conjunction with experimental comparisons, and *new theories and simulation approaches* for determining the transport and transformation of nanoparticles in various media.**

Sample Award
CAREER: Biophysical Mechanisms of Pulmonary Surfactant and its Interactions with Therapeutic Agents
Yi Zuo, University of Hawaii
CBET 1560767



Sample Award
CAREER: Multiscale Study of the Structure and Dynamics of Nanoparticle-Protein Coronae
Feng Ding, Clemson University
CBET 1553945

Program Director: Nora Savage, nsavage@nsf.gov

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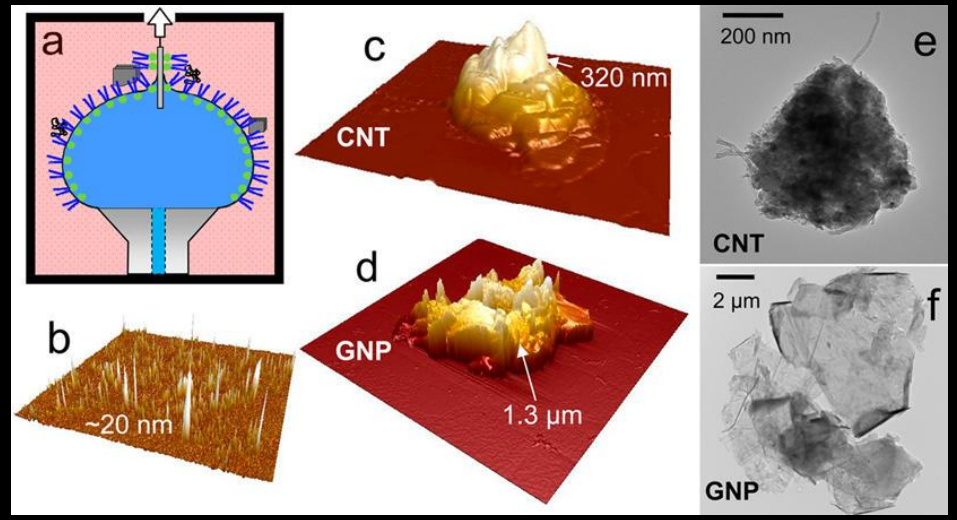
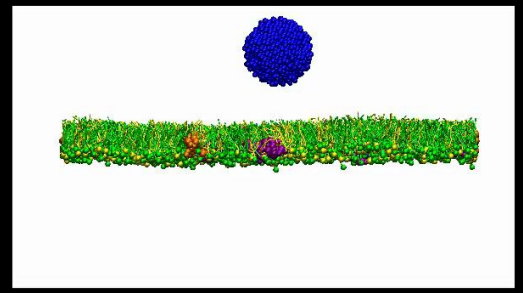


Imaging nano-bio interactions at the PS film. (a) Schematic of the in situ Langmuir Blodgett (LB) transfer technique integrated into the CDS. The surfactant film at the airwater interface of the droplet is transferred onto a small piece of freshly peeled mica sheet at a lifting speed of 1 mm/min, under controlled environmental conditions in the chamber. (b) AFM topographic image (20 20 µm) of a pure Infasurf film that shows uniformly distributed multilayer structures. (c, d) AFM topographic images of the Infasurf film exposed to CNT (10 10 µm) and GNP (20 20 µm) aerosols, respectively. Both images show the adsorption of large aggregates onto the surfactant film. (e, f) TEM images of CNT and GNP aerosols recovered from the chamber. Both size and morphology of these CNM aerosols match the large aggregates found at the surfactant film.

Formation of a lung surfactant lipoprotein corona on a negatively charged hydrophobic nanoparticle



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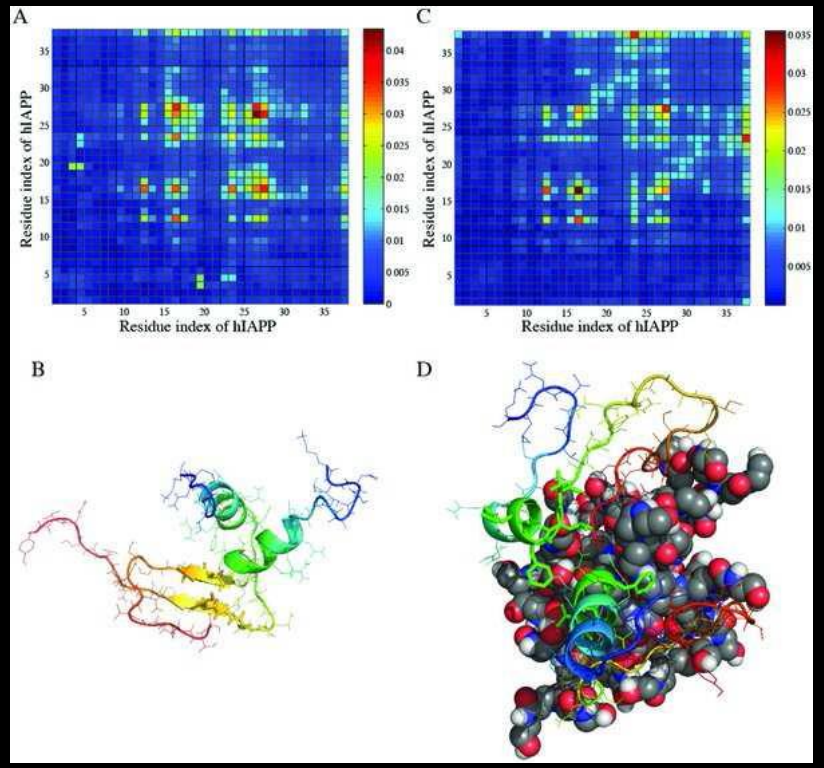

Sample Award

CAREER: Multiscale Study of the Structure and Dynamics of Nanoparticle-Protein Coronae

Feng Ding, Clemson University
CBET 1553945

Human islet amyloid polypeptide (hIAPP, or amylin) forms amyloid deposits in the islets of Langerhans, a phenomenon that is associated with type-2 diabetes impacting millions of people worldwide. Accordingly, strategies against hIAPP aggregation are essential for the prevention and eventual treatment of the disease. Here, it is shown that generation-3 OH-terminated poly(amidoamine) dendrimer, a polymeric nanoparticle, can effectively halt the aggregation of hIAPP and shut down hIAPP toxicity in pancreatic MIN6 and NIT-1 cells as well as in mouse islets.