

The Department of Biomedical Engineering

Presents:

**Water and Life:
Effects of the Changes in Water Hydrogen Bond Networking on Solutes,
Macromolecules and Cells**

By

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ABSTRACT:

The mostly anomalous characteristics of water – its phases, thermodynamic, and kinetic transitions – reveals the fundamentals of many biological processes. Water molecules continuously form short lived hydrogen bonds (HB's), which govern the physical, chemical and thermodynamic properties of water. The HB network of water changes very drastically in the presence of solutes, and surfaces. Thus, when water is confined in a very small volume, it behaves very differently than that in the bulk so much so that it does not even freeze, but stays as a liquid down to -140°C.

In this presentation, we focus on our recent findings, which show that the altered kinetics of confined water (encapsulated in silica gels) directly dictate the motions of isolated as well as cytoplasmic macromolecules. We also analyze the recent evidence for the presence of confined water clusters in supercooled carbohydrate solutions, offering a mechanism to connect the stabilization effects of carbohydrates to the characteristics of confined water clusters they form. Later, we extend our analysis to show that the presence of water clusters is actually not limited to carbohydrate solutions but is observed in many polar solutions even at room temperatures. Finally, we explain how that these findings, in addition to explaining certain biophysical phenomena, enable us to devise new technologies for protein stabilization and separation.

3:35 – 4:30 P.M.

Monday, October 12, 2009

Room 2-101 NHH

BME n 8601 Graduate Seminar

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