Yale Institute for Nanoscience and Quantum Engineering

Friday-January 20, 2017

12:00-1:00 PM

BECTON SEMINAR ROOM

Light lunch will be served at 11:45 a.m.

Shun-ichiro Karato
Geology and Geophysics, Yale University

"Recent Development of Experimental Studies of Plastic Deformation at High-Pressure and Temperature: Some Geophysical Applications"

Slow deformation of rocks inside the Earth and other planets controls the way in which Earth loses its heat. The resultant large-scale motion of rocks is responsible for most of geological activities including mountain building, earthquakes and volcanism. Such slow deformation occurs throughout the solid interior of Earth down to ~3000 km from the surface. Pressure and temperature conditions in these areas are extreme (P to ~135 GPa, T to ~4000 K) and the resistance for plastic deformation could change by several orders of magnitude under these conditions. However, experimental studies on plastic deformation under these conditions are challenging, and until recently very little was known on the plastic properties of rocks under the deep Earth conditions. During the last ~10-15 years, a major progress has been made to develop new techniques for studying plastic deformation under high-pressure and temperature conditions using synchrotron X-ray facility combined with a newly developed equipment. In this presentation, I will provide a historical review of progress in this area and show some of the recent findings including (i) the large pressure effects on plastic deformation, (ii) large contrast in the creep strength of two co-existing minerals in the deep interior of Earth, (iii) the role of grain-size reduction during a phase and (iv) the pressure-induced change in the slip system in MgO.

Michael Murrell
Department of Biomedical Engineering, Yale University

"Mechanics of the Cell Cytoskeleton"

While the molecular interactions between myosin motors and Factin are well known, the relationship between Factin organization and myosin-mediated force generation remains poorly understood. Here, we explore the accumulation of myosin-induced stresses within a 2D biomimetic model of the actomyosin cortex, where myosin activity is controlled spatially and temporally using light. By controlling the geometry and the duration of myosin activation, we show that contraction of disordered actomyosin is highly cooperative, telescopic with the activation area and generates a pattern of mechanical stresses consistent with those observed in contractile cells. We quantitatively reproduce these properties using an in vitro isotropic model of the actomyosin cytoskeleton, and explore the physical origins of telescopic contractility in disordered networks using agent-based simulations.

Host: Professor Eric Altman