



**You are cordially invited to attend the following seminar sponsored by
the Department of Mechanical Engineering:**

**Friday, September 29, 2006
114 Spencer Lab, 12:15 – 1:00 P.M.**

***Dr. X. Edward Guo
Columbia University***

MECHANICS AND MECHANOBIOLOGY OF BONE

Abstract:

Bone is one of the most clinically important components in human skeleton, which is affected by many metabolic diseases such as osteoporosis or bone loss in space. In addition, bone adapts in response to its mechanical environment. A quantitative characterization of the relationship between bone adaptation and mechanical loading and establishment of underlying cellular and molecular mechanism of bone adaptation are important in the understanding of the etiology of age-related bone fractures, optimal design of total joint replacements, and prevention of bone loss due to microgravity. In this presentation, mechanics of bone will be emphasized from both modeling and biological perspectives. Mechanical properties of trabecular bone will be examined from continuum to microstructural level. Both idealized and micro computed tomography (μ CT) based models of trabecular bone will be discussed in understanding mechanical properties of trabecular bone and their clinical and biological application. Three model systems for the study of mechanobiology of bone will be reviewed: an *in vivo* rat tail vertebrae model, an *in vitro* trabecular bone explant model, and an *in vitro* micropatterned osteocytic network model. In the first model system, an intact vertebral bone is subjected to controlled mechanical loading while in the *in vitro* trabecular bone explant model, osteocytes in their native trabecular bone matrix are maintained alive *in vitro* and allowed for controlled seeding of osteoblasts and/or osteoclasts. Combining with high-resolution micro image based finite element modeling techniques, a quantitative assessment of mechanotransduction mechanisms involving all three types of bone cells can be examined. In the second *in vitro* system, 2D and 3D osteocytes networks have been developed using modern microfabrication techniques while allowing controlled interactions with osteoblasts and/or osteoclasts. New experimental findings from these new *in vivo* and *in vitro* models regarding a century old hypothesis of trabecular bone adaptation: Wolff's Law, will be presented.

Refreshments will be served