

Carnegie Mellon

Materials Science and Engineering Seminar Series

Materials Research at Carnegie Mellon

Prof. Robert Ritchie

UC Berkeley

“Role of Aging and Disease on the Fracture of Bone”

Friday, November 17, 2006

11:00 A.M. Seminar in Doherty Hall 1212

Refreshments precede seminar at 10:30 A.M. in 2325 Wean Hall

The age-related deterioration of both the fracture properties and the architecture of “hard” mineralized tissue, such as bone, coupled with increased life expectancy, are responsible for increasing incidences of bone fracture in the elderly segment of the population. In order to facilitate the development of effective treatments that counter this elevation of the fracture risk, an understanding of how fracture properties degrade with age is essential. In this talk, the origins of the toughness of human cortical bone (and dentin, a primary constituent of teeth and simple analog of bone) are examined by considering the salient micro-mechanisms of failure over a broad range of characteristic dimensions from molecular to macroscopic length-scales. It is argued that although structure at the nanoscale is important, it is microstructural features at the scale of one to hundreds of microns that are most important in determining fracture risk. It is further shown that biological aging, disease states, and certain therapeutic treatments, e.g., steroids, can cause deterioration in “bone quality” which markedly raises this fracture risk, principally by affecting the toughening mechanisms over a broad range of dimensions.

Robert O. Ritchie is the H.T. & Jesse Chua Distinguished Professor of Engineering and Chair of the Department of Materials Science and Engineering at the University of California in Berkeley; he is also Head of Ceramic Materials in the Materials Sciences Division of the associated Lawrence Berkeley National Laboratory. He received his B.A., M.A. and Ph.D. degrees in physics and materials science from Cambridge University from 1966 to 1973, and the Sc.D. degree in 1990. He is known for his research in the fields of materials science, fracture mechanics and particularly fatigue. He is a member of the National Academy of Engineering and a Fellow of the Royal Academy of Engineering.