The Southwest Mechanics Lecture Series

at

Texas A&M University

ARE WE BUILT OF GLASS? SOFT SCIENCE, LIVING CELLS AND MECHANICS OF THE CYTOSKELETON.

JEFFREY FREDBERG

Professor of Bioengineering and Physiology

Physiology Program, Harvard School of Public Health, USA

Date: **Wednesday 26 March 2003**
Time: **4:00 p.m.**
Location: **Room 110 Civil Engineering Building**

We measured elastic and frictional moduli of a variety of cell types over a wide range of time scales and using a variety of biological interventions. In all instances elastic stresses dominated at frequencies below 300 Hz, increased only weakly with frequency and followed a power law; no characteristic time scale was evident. Frictional stresses paralleled the elastic behavior at frequencies below 10 Hz but approached a Newtonian viscous behavior at higher frequencies. Surprisingly, all data could be collapsed onto master curves, the existence of which implies that elastic and frictional stresses share a common underlying mechanism. These observations are consistent with the hypothesis that the cytoskeleton of the living cell behaves as a soft glassy material, wherein cytoskeletal proteins modulate cell mechanical properties mainly by changing an effective temperature of the cytoskeletal matrix. If so, then the effective temperature becomes an easily quantified determinant of the ability of the cytoskeleton to deform, flow and reorganize. Taken together, these findings define an integrative empirical framework for studying protein interactions within the complex microenvironment of the cell body, and appear to set limits on what can be predicted about integrated mechanical behavior of the matrix based solely on cytoskeletal constituents considered in isolation.

SOUTHWEST
MECHANICS LECTURE SERIES