AEROSPACE & MECHANICAL ENGINEERING

Founded 1842

2012 COLLOQUIUM 2013

SEMINARS ARE OPEN TO THE PUBLIC

UNIVERSITY OF NOTRE DAME, NOTRE DAME, INDIANA 46556

SPEAKER: **Professor Gerard A. Ateshian**
Department of Mechanical Engineering
Columbia University
New York, New York

TOPIC: **MIXTURE FRAMEWORK FOR MODELING CONTINUUM MECHANICS OF GROWTH IN BIOLOGICAL TISSUES AND CELLS**

DATE: Tuesday, November 27, 2012

TIME: 3:30 p.m.

PLACE: Lower Level Auditorium, Geddes Hall

RECEPTION: 3:00 – 3:30 p.m. – Coffee House, Geddes Hall

ABSTRACT

Biological tissue growth is a process driven by chemical reactions among various fluid and solid constituents of a mixture. For example, a cell may use amino acids that are present in a culture environment to build a protein and release it into the extracellular space; this protein subsequently may bind to the extracellular matrix, increasing its mass. In this example, amino acids are considered to be fluid constituents (solutes in solution) whereas the extracellular matrix is considered to be the solid constituent. Thus, growth alludes to changes in the mass of the solid matrix of the mixture as a result of mass exchanges with the fluid constituents. For porous mixtures, this mass exchange may occur in the interstitial space of the solid matrix, through which the fluid constituents may flow. Therefore such processes are described as interstitial growth, or equivalently, volumetric growth.

Fundamentally, interstitial growth is a process by which mass is deposited or removed from the interstitial space of a mixture. This process can be described by the equation of balance of mass, taking into account mass exchanges among various constituents. Therefore, a natural framework for describing growth of biological tissues is the theory of mixtures, which may account for any number of fluid and solid constituents in a continuum analysis. Mixture theory encompasses the classical frameworks of solid and fluid mechanics, and its formulation may be generalized to account for chemical reactions among the constituents.

This presentation provides an overview of the modeling of growth processes using the framework of mixture theory. A unified framework is presented which may account for biological growth of extracellular matrix, growth of cells, and the evolution of residual stresses induced by the growth process.

NOTE: ***If you are interested in meeting individually with Prof. Ateshian, please contact Linda at 631-5431***