BCATS Keynote Speaker

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Biography

Gerard Ateshian is a Professor of Mechanical Engineering and Biomedical Engineering at Columbia University. He received his PhD in Mechanical Engineering at Columbia University in 1991, and was appointed to Assistant Professor at Columbia in that year. He helped establish the Department of Biomedical Engineering and served as the Vice-Chair of the Biomedical Engineering program from 1999 to 2002.

Dr. Ateshian received the Y.C. Fung Young Investigator Award from the American Society of Mechanical Engineering (ASME) in 1997, and the Great Teacher Award from the Society of Columbia Graduates in 2002. He became a member of the American Institute of Medical and Biological Engineers in 2003 and a Fellow of ASME in 2007. Serving as director of the Musculoskeletal Biomechanics Laboratory at Columbia, Dr. Ateshian is a leading authority in the field of cartilage mechanics and biotribology, joint mechanics and imaging, soft tissue mechanics and transport, cell mechanics, and tissue engineering.

Keynote Address

Computational modeling of biological tissues using mixture theory: Positing new hypotheses and testing them experimentally

The application of continuum mechanics to the analysis of biological tissues and cells continues to expand today, incorporating modern concepts of mixture theory to understand the complex interactions of solid, solvent and solute constituents. The complexity of these mixture models naturally increases with the need to describe complex mechanics phenomena at the tissue and cellular levels, such as the frictional properties of porous-permeable articular cartilage, partial volume recovery of cells to osmotic loading, and residual stresses in the arterial wall resulting from growth and remodeling. Analytical solutions to canonical problems, which are essential for understanding these mechanisms, become more difficult to formulate when modeling multiple mixture constituents and accounting for osmotic and electromechanical effects, due to their inherent nonlinear nature. Computational models which can address such coupled mechano-electrochemical phenomena remain in their infancy. Their widespread dissemination will bring new and essential tools for biomedical engineers in their effort to understand biological and physiological phenomena. These computational tools may help formulate important new hypotheses to describe observed phenomena hitherto considered too difficult to interpret. In this presentation examples will be provided where novel scientific hypotheses were posited on the basis of theoretical and computational predictions from mixture models, and subsequently validated experimentally.