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Mansoor A Haider* (m_haider@ncsu.edu), Dept. of Mathematics. Box 8205, NCSU, Raleigh, NC 27695-8205, **Eun Jung Kim** (ekim3@ncsu.edu), Dept. of Mathematics. Box 8205 North Carolina, NCSU, Raleigh, NC 27695-8205, and **Farshid Guilak** (guilak@duke.edu), 375 MSRB, Box 3093, Duke University Medical Center, Durham, NC 27710. *Multiscale biphasic continuum mixture models of the pericellular microenvironment in articular cartilage.*

Articular cartilage is the primary load-bearing soft tissue in joints. Cartilage extracellular matrix (ECM) can be idealized as a biphasic continuum mixture of interstitial water and a solid ECM comprised of collagen fibers and proteoglycan macromolecules. The ECM is maintained by a sparse population of cells (chondrocytes) that are encapsulated by a thin, stiff layer called the pericellular matrix. Mechanical variables in the vicinity of the chondrocytes strongly influence cell metabolic activity and, in turn, the progression of matrix degradation due to osteoarthritis. We present multiscale models for biphasic deformation in the pericellular microenvironment of a cartilage layer. A weak formulation of the parabolic system of governing PDEs is employed, and implemented using the finite element method. The computational model is applied to simulate biphasic deformation in a zoned microscopic domain consisting of a single chondrocyte, its pericellular matrix, and surrounding ECM. Boundary conditions are prescribed using a macroscopic solution for dynamic compressive loading of a cartilage layer. Quantitative descriptions of mechanical variables are presented, and the role of the pericellular matrix in influencing mechanical signals perceived by cartilage cells is evaluated. (Received August 29, 2006)