Modeling Cell Rheology: microrheology of viscoelastic networks

Sebastian A. Sandersius
Timothy J. Newman

Arizona State University

Abstract: Recently, a computational model addressing cell biomechanics has been introduced, called the Subcellular Element Model (SEM). The model is primarily designed to represent deformable cells in multi-cellular systems, but can also be used to represent a single cell in more detail. Within the model framework, a cell is represented by a collection of elastically coupled elements, interacting with one another via short-range potentials, and dynamically updated using over-damped Langevin dynamics. We have tested whether the model yields viscoelastic properties consistent with those measured on single living cells and reconstituted cytoskeletal networks. Employing methods of microrheology we find that weak power law rheology emerges. With further phenomenology of treating the cytoskeleton as a viscoelastic network, we show here a novel one-dimensional model, which as well displays intermediate time regime/weak power law rheology.