Experiments show that the orientation of stress fibers in cells is dependent on the rigidity [1,2] of its environment. This may provide cues for stem cell differentiation that is similarly influenced by the rigidity [3] and even the viscoelasticity of the substrate [4]. Previous models that describe cell-cell and cell-substrate interactions in terms of elastic interactions of active force dipoles have so-far focused on statics. We consider the dynamics of these effects as related to the finite speed of sound and viscoelastic effects of the medium. Here, we present a two phase model for a cell that consists of an elastic network (semi flexible polymers) and liquid solvent. Due to the dissipative interactions between these two phases, a locally contractile force dipole gives rise to an elastic field in the network whose propagation can be modified from wave-like to diffusive-like motion. This has implications for the dynamics of orientation of another force dipole located at some distance from the first. We predict the time scale for the effective interactions of the two dipoles as a function of their spacing and discuss their implications for the dynamical aspects of cell mechanics.

References:


