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Dynamics of a microsphere in an anisotropic gel: a frontier in intracellular microrheology MANUEL GOMEZ-GONZALEZ, KATHRYN OSTERDAY, JUAN C. DEL ALAMO, University of California San Diego — Particle tracking microrheology determines the properties of a viscoelastic medium from the measured resistance of a moving, immersed microsphere. A crucial assumption in this method is that the medium is isotropic and the sphere experiences Stokes drag. However, the intracellular domain usually presents a pronounced directional structure and anisotropic rheological properties. Current lack of understanding of the dynamics of the probe in this complex environment challenges the application of microrheology to live cells. To overcome this difficulty, we study the drag force experienced by a microsphere in an anisotropic viscoelastic network (the cytoskeleton) permeated by a background liquid (the cytosol). In the limit of strong frictional coupling between the network and the liquid, the flow around the sphere is modeled with a generalized Stokes equation using several viscosity parameters. We solve this equation analytically to provide new closed-form microrheology formulae that relate the resistance measured experimentally to the anisotropic properties of the network. For high levels of anisotropy, such as those encountered in live cells, previous methods that assume Stokes Drag with different effective viscosities along different directions become ill-posed due to the incompressibility of the background liquid.

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