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Probing the directional structure and intracellular microrheology of the eukaryotic cytoplasm KATHRYN OSTERDAY, MANUEL GOMEZ-GONZALEZ, JULIE LI, GERARD NORWICH, JUAN C. LASHERAS, SHU CHIEN, JUAN C. DEL ALAMO, University of California, San Diego — The rheological properties of the cytoplasm of animal cells play an important role in cell functions such as migration, mechanotransduction, etc. The magnitude of these properties is important because it sets the level of intracellular deformation in response to stress. The directionality of these properties is equally important because it allows the cell to modulate the stress-strain relation differently along different directions. We aim to elucidate the relation between the structural organization of the cytoplasm and the directionality of its rheological properties by 1) measuring the local orientation of fluorescently labeled intracellular filaments and 2) determining the local directions of the maximum and minimum intracellular viscosity. Directional intracellular viscosities are measured by tracking the random motion of endogenous particles in 2D and applying novel microrheology formulae obtained by studying the motion of a microsphere in a transversely isotropic fluid. Our results indicate that the local viscosity is lowest along the direction parallel to the filaments and that the viscosity in the perpendicular direction is approximately 5 times larger. Under these conditions previous microrhelogy methods that assumed Stokes drag for the particles have errors in excess of 500%.

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