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Characterization of Intracellular Streaming and Traction Forces in Migrating Physarum Plasmodia SHUN ZHANG, JUAN C. DEL ALAMO, MAE Dept, UC San Diego, ROBERT D. GUY, Math Dept. UC Davis, JUAN C. LASHERAS, MAE Dept, UC San Diego — Physarum plasmodium is a model organism for cell migration that exhibits fast intracellular streaming. Motile amoeboid physarum plasmodia were obtained from dish cultures of Physarum Polycephalum, a slime mold that inhabits shady cool moist areas in the wild, such as decaying vegetable material. The migrating amoebae were obtained by cutting successively smaller pieces from the growing tips of the cultured parent mold, and their size ranged 0.2 to 0.5 mm. Single amoebae were seeded and let adhere on flexible polyacrilamide gels that were functionalized with collagen, contained 0.2-micron fluorescent beads, and were embedded in an aqueous medium. Soon after adhering to the gel, the amoeabe began crawling at about 1mm/hr. Joint time-lapse sequences of intracellular streaming and gel deformation were acquired respectively in the bright and fluorescent fields of a confocal microscope at 20X magnification. These images were analyzed using particle-tracking algorithms, and the traction stresses applied by the amoebae on the surface were computed by solving the elastostatic equation for the gel using the measured bead displacements as boundary conditions. These measurements provide, for the first time, a joint characterization of intracellular mass transport and the forces driving this transport in motile amoeboid cells.

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