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Mitochondrial fluctuations as a measure of active biomechanical properties of mammalian cells[1] WENLONG XU, ELAHEH ALIZADEH, JORDAN CASTLE , ASHOK PRASAD, Colorado State Univ — A single-cell assay of mechanical properties would give significant insights into cellular processes. Force spectrum microscopy is one such technique, which involves both active and passive particle tracking microrheology on the same cells. Since active microrheology requires expensive instruments, it is of great interest to develop simpler alternatives. Here we study an alternative using endogenous mitochondrial fluctuations, rather than fluorescent beads, in particle tracking microrheology. Mitochondria of the C3H-10T1/2 cell line are labeled and tracked using confocal microscopy, their mean square displacement (MSD) measured, and mechanical parameters calculated. We found that the MSD of mitochondria resembles that of particles in viscoelastic media. However, comparisons of MSD between controls and cells disrupted in the actin or microtubule network showed surprisingly small effects, while ATP-depleted cells showed significantly decreased MSD, and characteristics of thermally driven fluctuations. Active fluctuations are distinguished from passive fluctuations by treatment with ATP synthesis inhibitors, both of which were fed into the determination of force spectrum. With similar results to published studies, this method is potentially very useful due to its simplicity.

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