DYNAMICS OF PHAGOSOME WITH INTERNALIZED MAGNETIC NANOPARTICLES

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Cytomagnetometry using magnetic nanoparticles is effective in probing the mechanisms of intracellular motion and rheological properties of the cytoplasm in living cells. We propose a model to describe intracellular magnetic field-driven motion of endosomes and phagosomes with internalized magnetic nanoparticles (MNPs). Utilizing different types of creep functions ($J(t)$) measured for a living cell, we calculate the time dependences of the phagosome displacement and velocity. In particular, it is found that for a power-law $J(t)$ the velocity as a function of time exhibits a wide plateau after which it falls to zero. For experimentally reachable magnetic field gradients the maximal phagosome velocity is found to be dozens micrometers per second which is two orders of magnitude larger than typical organelles velocities in living cells. The proposed model allows us to find the viscoelastic parameters of cytoplasm by experimentally detecting the phagosome displacements and then by fitting the obtained time dependence to those calculated for a given creep function. For application in cancer therapy we discuss the possibilities of cell cytoskeleton destroying by a high speed moving phagosome under pulses of gradient magnetic fields.

9.7 cm

13.4 cm

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