Microrheology measurements can diagnose the state of cell: Probing the stochastic, motor-driven properties of the cytoplasm using force spectrum microscopy

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2015/1/16

Abstract:

Stochastic non-thermal fluctuations in living cell result in active diffusion. We have investigated energetic aspects of active diffusion trajectories in living cell. Recently, an experimental soft condensed matter group directed by David Weitz (Harvard Univ.) published a milestone paper for introducing force-spectrum-microscopy (FSM) [1]. The technique is based on microrheology [2], which measures rheological quantities using colloidal probes directly embedded in a soft material. When Mason and Weitz introduced a conceptual framework and measurement capabilities, a major shift occurred [3]. Non-thermal fluctuations in reconstructed cytoskeletal gels can be detected as nonequilibrium energy dissipation by active- and passive-microrheology techniques [4].

FSM can quantify random forces within the cytoplasm of cells and probe stochastic motor activity. Using FSM, the authors showed that force fluctuations substantially enhance intracellular movement of small and large component, and that the fluctuations are three times larger in malignant cells than in benign cells.

References:

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4. D. Mizuno *et al*., *Science* **315** (2007) 370.