DNA-based active gels

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Abstract:

Cells are capable of a variety of dramatic stimuli-responsive mechanical behaviors. These capabilities are enabled by the pervading cytoskeletal network, an active gel composed of cross-linked structural filaments (e.g. actin) that are acted upon by motor proteins (e.g. myosin). I will discuss our efforts to replicate these features using non-cytoskeletal components, and thus to create artificial active gels. Such systems could be useful as models for understanding the physics of active fluctuations within the cytoskeleton and/or the nucleus. In particular, I will describe the synthesis and characterization of a gel formed from self-assembled DNA filaments, and activated by DNA motor proteins. The DNA gel stiffens upon activation, and displays non-equilibrium, yet quasi-diffusive, dynamics. Both features match theory and measurements of the cytoskeleton, highlighting the universal aspects of non-equilibrium, motor-driven networks.