BIOMATERIALS

Forces in Biomolecular Systems SFB 863

Mechanics of dense branched actin networks

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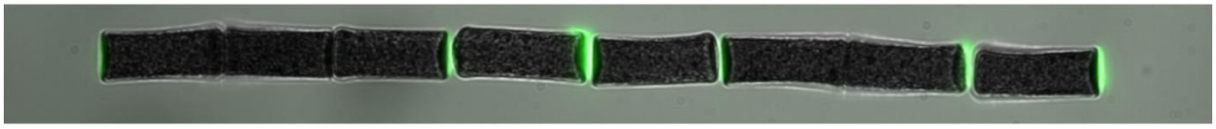
Abstract:

Cell mechanics is fundamental in many cellular processes both in physiological and pathological situations. The actin cytoskeleton is responsible for the main part of this mechanics. In cells, actin filaments are very dynamic polymers spatially organized by many different partners. Rheological studies have been devoted to the understandings of the mechanical properties of actin gels assembled in absence or in presence of actin binding partners showing very interesting behaviors. We developed a new approach based on magnetic particles and the use of the Arp2/3 machinery to assemble and study mechanically actin networks which are close to the ones found in the lamellipodium of a migrating cell. The idea is to use dipolar attractive forces that develops between superparamagnetic micro-sized objects to deform in a controlled way dense branched actin networks grown from the surface of the particles. The main advantage of this technique in the context of biophysics is its high throughput that allows reliable measurements to be performed. We carried out a first study which established the link between elastic properties of these networks and their architecture and give insights into the origin of the elasticity in dense branched actin networks assembled from a mix of purified proteins. We also began to study actin networks assembled from yeast extracts with more than 80 proteins present in the network. This kind of gels shows a strong plasticity which was absent from the purified system. We also developed new particles with flat surfaces that allow non linear measurements to be done and growth under constraints to be followed. These new developments open the ways to study cell mechanics at the scale of isolated cells and even at the scale of a tissue.



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