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Encoding Mechano-Memories in Actin Networks LOUIS FOUCARD, UCLA, dpt of chemistry and biochemistry, SAYANTAN MAJUMDAR, James Franck institute, University of Chicago, dpt of Physics, ALEX LEVINE, UCLA, dpt of chemistry and biochemistry, MARGARET GARDEL, James Franck institute, University of Chicago, dpt of Physics — The ability of cells to sense and adapt to external mechanical stimuli is vital to many of its biological functions. A critical question is therefore to understand how mechanosensory mechanisms arise in living matter, with implications in both cell biology and smart materials design. Experimental work has demonstrated that the mechanical properties of semiflexible actin networks in Eukaryotic cells can be modulated (either transiently or irreversibly) via the application of external forces. Previous work has also shown with a combination of numerical simulations and analytic calculations shows that the broken rotational symmetry of the filament orientational distribution in semiflexible networks leads to dramatic changes in the mechanical response. Here we demonstrate with a combination of numerical and analytic calculations that the observed long-lived mechano-memory in the actin networks arise from changes in the nematic order of the constituent filaments. These stress-induced changes in network topology relax slowly under zero stress and can be observed through changes in the nonlinear mechanics. Our results provide a strategy for designing a novel class of materials and demonstrate a new putative mechanism of mechanical sensing in eukaryotic cells.

louis foucard
UCLA, dpt of chemistry and biochemistry

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