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Regulation of an Actin Spring BARNEY TAM, Dept. of Physics, MIT, JENNIFER SHIN, Dept. of Mechanical Engineering, KAIST, RICARDO BRAU, Div. Biol. Eng., MIT, MATTHEW LANG, Div. Biol. Eng. & Dept. of Mech. Eng., MIT, L. MAHADEVAN, DEAS & Dept. of Systems Biol., Harvard, PAUL MATSUDAIRA, Whitehead Institute, Dept. of Biol., & Div. of Biol. Eng., MIT —
To produce motion, cells rely on the conversion of potential energy into mechanical work. One such example is the dramatic process involving the acrosome reaction of *Limulus* sperm, whereby a 60 μm-long bundle of actin filaments straightens from a coiled conformation to extend out of the cell in five seconds. This cellular engine and the motion it produces represent a third type of actin-based motility fundamentally different from polymerization or myosin-driven processes. The motive force for this extension originates from stored elastic energy in the overtwisted, pre-formed coil—much like a compressed mechanical spring. When the actin bundle untwists, this energy is converted to mechanical work powering the extension. We report on experiments probing the regulation of this actin spring by extracellular calcium. We find that extracellular calcium needs to be present for the spring to activate, and that calcium regulates the velocity of the extension.

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