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The role of catch-bonds in acto-myosin mechanics and cell mechano-sensitivity UMUT AKALP, FRANCK J. VERNEREY, Univ of Colorado - Boulder — Contraction and spreading of adherent cells are important phenomena in range of cellular processes such as differentiation, morphogenesis, and healing. In this presentation, we propose a novel mechanism of adherent cell mechano-sensing, based on the idea that the contractile acto-myosin machinery behaves as a catch-bond. For this, we construct a simplified model of the acto-myosin structure that constitute the building block of stress fibers and express the stability of cross-bridges in terms of the force-dependent bonding energy of the acto-myosin bond. Consistent with experimental measurements, we then consider that the energy barrier of the acto-myosin bond increases for tension and show that this response is enough to explain the force-induced stabilization of an SF. The resulting model eventually takes the form of a force-sensitive, active visco-elastic material, powered by ATP hydrolysis. The model is used to investigate the organization and contraction of the actin cytoskeleton of cells laying on arrays of microposts. Upon comparison with experimental observations and measurements, simulations show that the catch-bond hypothesis is satisfactory to predict the sensitivity of adherent cells to substrate stiffness as well as the complex organization of the actin cytoskeleton.

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