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Force Transmission in the Actin Cytoskeleton

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The ability of cells to sense and generate mechanical forces is essential to numerous aspects of their physiology, including adhesion, migration, division and differentiation. To a large degree, cellular tension is regulated by the transmission of myosin II-generated forces through the filamentous actin (F-actin) cytoskeleton. While transmission of myosin-generated stresses from the molecular to cellular length scale is well understood in the context of highly organized sarcomeres found in striated muscle, non-muscle and smooth muscle cells contain a wide variety of bundles and networks lacking sarcomeric organization. I will describe the *in vitro* and *in vivo* approaches we use to study force transmission in such disordered actomyosin assemblies. Our *in vivo* results are showing that highly organized stress fibers contribute surprisingly little to the overall extent of cellular tension as compared to disordered actomyosin meshworks. Our in vitro results are demonstrating the mechanisms of symmetry breaking in disordered actomyosin bundles that facilitate the formation of contractile bundles with well-defined "contractile elements." These results provide insight into the self-organization of actomyosin cytoskeleton in non-muscle cells that regulate and maintain cellular tension.