Control of shape and movement is essential for cell physiology, from cell migration to control of tissue shape. The mechanical behaviors of living cells are controlled by materials constructed by protein-based assemblies within the cell interior. These soft materials both regulate how forces generated by individual mechanoenzymes are transmitted to cell and tissue scales as well as how mechanical properties evolve, or adapt, over time to allow for smooth transitions. I will describe my lab’s recent efforts to understand the design principles of the active, soft materials that drive multi-cellular dynamics. In particular, I will describe our progress to reveal design principles by which the actin cytoskeleton senses, generates, and adapts to mechanical force. Hopefully, I will convince you that the materials within cells provide a rich playground to understand design principles of active and adaptive soft materials.

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