How cytoskeletal crosstalk shapes the cell

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Mechanical stability and shape changes of cells are determined by the dynamic interplay of four distinct cytoskeletal networks, made of actin filaments, microtubules, intermediate filaments and septins. These four filamentous systems contribute different structural and dynamical properties, enabling specific cellular functions. However, there is growing evidence that they also exhibit strongly coupled functions necessary to polarize cells and orchestrate the shape changes required for cells to divide or migrate. Our aim is to understand the role of cytoskeletal interactions in cell mechanics and cell migration from a biophysical perspective. I will highlight our recent efforts to biochemically reconstitute the interplay of the different cytoskeletal networks using a bottom-up synthetic biology approach. This approach allows us to connect the collective mechanical properties of cytoskeletal networks to the underlying molecular interactions, which involve cytoskeletal crosslinkers, motor proteins, and the lipid bilayer membrane.