

The Role of Shape and Timing and Cell Decision-Making

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Abstract

Our lab is interested in how simple circuits generate complex emergent behaviors like cell polarity, motility, and all-or-none switches. In this talk, I will discuss two stories on how cells process information in space and time. Our first story focuses on the role of timing in immune cell activation. T cells have the important task of distinguishing proteins that originate from our own bodies from those that come from pathogens. The precise molecular logic of this self/non-self discrimination is not known. Using a light-controllable ligand that we developed for T cells, we show that timing of receptor interaction enables the detection rare pathogenic proteins in a sea of self-proteins. Our second story focuses on space—how cells control their shape. The actin cytoskeleton is a key regulator of cell shape and movement. We know some of the key proteins that control remodeling of the actin cytoskeleton, but the local rules of protein interaction that generate large-scale organization of cell shape and movement are not understood. Here we uncover an unexpected nanoscale self-assembly of a key actin regulator that potentially explains the shape and coherence of moving cells.