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Experimental Approaches to Understanding Networks

The Mechanism for Polarity Control and Its Influence on Gradient Detection

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Abstract:
Eukaryote cells can polarize in response to external cues. But, how the polarization is controlled and created as a single one, is not fully understood. The external cues can be in a gradient or a homogeneous form; for instance, yeast cells polarize in a homogeneous field of pheromone. This excludes the possibility that the polarization is controlled by gradient detection. Moreover, the rate of a single polarity formation increases with the dosage of pheromone. This again rules out the possibility that the single polarity is mediated by a strong internal asymmetry because if this is the case, the polarity formation should be slowed down since at high dose pheromone concentration, every part of the cell has a saturated activation and the inhomogeneity will be weaken. Thus, we use yeast cell as a model system to address why a single polarity can form in a uniform field and whether it has any influence on the gradient detection. We used genetic manipulations to investigate the protein interaction network and realize the roles of different proteins in the spatial-temporal control of polarity formation. Microfluidic chambers are also used to study the gradient response. Our results suggest that there are two different mechanisms to control the polarity formation and maintenance at different spatial and temporal scales. Moreover, we show that these mechanisms can destroy the precision in gradient detection. Hence, eukaryote gradient detection and polarity formation might occur at different time scales.