

Workshop: *Deconstructing Biochemical Networks*  
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*A Kinetic Switch Underlies Mating  
Differentiation in Yeast*

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**Abstract**

Cell differentiation requires the ability to detect and respond appropriately to extracellular signals. Here we investigate a differentiation switch induced by changes in the concentration of a single stimulus. Yeast cells exposed to a high dose of pheromone undergo cell division arrest, but continue to expand in a polarized manner (shmoo morphology). Cells exposed to an intermediate dose become elongated, grow slowly, and divide in the direction of a pheromone gradient (chemotropic-growth). The pheromone responsive MAP kinase Fus3 is activated slowly and exhibits a steeper dose-response relationship than the other pheromone responsive MAP kinase, Kss1. We use experimental analysis and mathematical modeling to investigate how these distinctive kinetic features of Fus3 activity mediate the developmental switch from chemotrophic growth to mating. We further demonstrate that the scaffold protein Ste5 is responsible for slowing the rate of Fus3 activation and is therefore a key regulator of this developmental decision.