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A Mathematical Exploration of MAP Kinase Behavior[1] RHYS ADAMS, GABOR BALAZSI, MD Anderson, CELLULAR HETEROGENEITY AND INFORMATION PROCESSING(CHIP) LAB TEAM — Mitogen-Activated Protein (MAP) kinase pathways are highly conserved from yeast to humans and are implicated in cell survival and cell death. Signaling through these pathways starts with the phosphorylation of the most upstream component (MAP kinase kinase kinase, MAPKKK), continues with phosphorylation of a MAP kinase kinase (MAPKK), and ends with phosphorylation of the target MAP kinase (MAPK). Theoretical studies over the past few decades have generated important insights into the dynamical behavior and signal processing capability of these pathways, including bistability, oscillations, signal amplification, etc. Prompted by the possibility of complex behavior in simpler signaling units than a full MAP kinase pathway, we investigate the possibility of In-Band Detection (IBD) within a single step of the cascade. We show that a basal rate of target phosphorylation can lead to IBD in a simpler system than the one described before, and define a precise relationship between the various reaction rates that is necessary to obtain IBD.

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