# Data-based modeling of on/off switch mechanism arising from biochemical network

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**Abstract**

Signal transduction network is a biochemical system to sense, sort and transfer a variety of extracellular information to transcription factors in the nucleus to regulate gene expression for cell determination. Interestingly, signaling pathways often control this process in a nonlinear manner and, in some cases, analogous graded doses of extracellular stimuli promote digital activation of transcription factors. Spatio-temporal molecular network plays an essential function to realize the response. In this talk, based on experimental data observation and ODE modeling, a mechanism of digital activation of transcription factor NF-$\kappa$B, will be discussed. In antigen-stimulated BCR response, NF-$\kappa$B activity is controlled by two positive feedback loops within the signaling pathway to produce a switch-like activation of NF-$\kappa$B. These feedback loops contribute to determine the threshold for NF-$\kappa$B-mediated B cell proliferation, suggesting that the mechanism is important for B cell lineage commitment. Digital activation of transcription factors may be beneficial in a noisy cellular environment for accurate control of cell fate decision. Our studies suggest that cellular complexity might arise from combinatorial regulation of binary states of transcription factors.

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