

Noise-induced oscillations of NF- κ B shuttling

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Short Abstract — NF- κ B is a pleiotropic protein whose nucleo-cytoplasmic trafficking is tightly regulated by negative feedback loops embedded in its signaling network. We present numerical evidence for a universal dynamic behavior of NF- κ B, namely oscillatory nucleo-cytoplasmic shuttling, due to the fundamentally stochastic nature of the NF- κ B signaling network. We simulated the effect of extrinsic and intrinsic noise and demonstrate that extrinsic noise diversifies the shuttling patterns of NF- κ B response, whereas intrinsic noise induces oscillatory behavior in many of the otherwise non-oscillatory patterns. We identify two key model parameters which significantly affect the NF- κ B dynamic response and deduce two-dimensional phase-diagrams of the NF- κ B response as a function of these parameters.

Keywords — Noise-induced oscillations, extrinsic noise, intrinsic noise, phase diagram, bifurcation

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