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Network architectural conditions for prominent and robust stochastic oscillations JAEWOOK JOO, JINMYUNG CHOI, University of Tennessee — Understanding relationship between noisy dynamics and biological network architecture is a fundamentally important question, particularly in order to elucidate how cells encode and process information. We analytically and numerically investigate general network architectural conditions that are necessary to generate stochastic amplified and coherent oscillations. We enumerate all possible topologies of coupled negative feedbacks in the underlying biochemical networks with three components, negative feedback loops, and mass action kinetics. Using the linear noise approximation to analytically obtain the time-dependent solution of the master equation and derive the algebraic expression of power spectra, we find that (a) all networks with coupled negative feedbacks are capable of generating stochastic amplified and coherent oscillations; (b) networks with a single negative feedback are better stochastic amplified and coherent oscillators than those with multiple coupled negative feedbacks; (c) multiple timescale difference among the kinetic rate constants is required for stochastic amplified and coherent oscillations.

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