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Quantification of noise in signalling systems - importance of controlled signal degradation

The phenomena of stochasticity in biochemical processes has been intriguing life scientists for the last few decades. Studies revealed that living cells take advantage of stochasticity in some cases and counterbalance stochastic effects in others. The intrinsic source of stochasticity in biomolecular systems has been identified with random timings of individual reactions, which in a cumulative effect lead to the variability in outputs of such systems. In the presentation I will demonstrate how stochasticity of individual reactions contributes to the variability of system's output; and that some reactions have dramatically different effect on noise that others. Surprisingly, in the class of open conversion systems, that serve as an approximation model of signal transduction, degradation of an output contributes half of the total noise. We also demonstrate the importance of degradation in other relevant systems and propose a degradation feedback control mechanism that have capability of effective noise suppression. Our methodology constitutes novel, intuitive and simple framework to investigate stochastic effects in biochemical networks allowing for unprecedented insight into the origins of stochasticity.