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(I) Limiting noise in biochemical reaction networks

Tuesday, 7 June 2022 08:30 (30 minutes)

Biological processes are stochastic reaction networks that operate far from thermodynamic equilibrium. Furthermore, even the best-known biological processes are not completely characterized in terms of mechanistic interactions between components. This combination makes analyzing noise properties challenging because small differences in rate functions or network topology can drastically affect stochastic dynamics in complex systems. Instead of ignoring or guessing unknown details we analyze classes of systems that share some features but are left to vary arbitrarily in all unknown features. Such an approach allows us to derive inequalities that can reveal general trade-offs in controlling noise in biological processes. I will present proven or conjectured bounds on stochastic fluctuations in systems that achieve robust steady states, systems with finite molecular lifetimes, and systems that attempt to suppress spontaneous fluctuations in specific components.

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