Synchronizing Biomolecular Networks in Multi-Cell Systems

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In a multi-cell system, all cell components exhibit intracellular noise on account of random births and deaths of individual molecules, and extracellular noise because of environment perturbations. Gene regulation in particular, is an inherently noisy process with transcriptional control, alternative splicing, translation, diffusion and chemical modification reactions, all of which involve stochastic fluctuations. Such stochastic noises may not only affect the dynamics of the entire system but may also be exploited by living organisms to actively facilitate certain functions, such as cooperative behavior and synchronization. In this work, we provide a general model and an analytic tool to examine the cooperative behavior of a multicell system with both intracellular and extracellular stochastic fluctuations. A multicell system with a synthetic gene network is adopted to demonstrate the effects of noises and coupling on collective dynamics.

References

