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Stochasticity in cell biology: Modeling across levels

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Effective modeling of biological processes requires focusing on a particular level of description, and this requires summarizing de details of lower levels into effective variables and properly accounting for the constrains that other levels impose. In the context of stochasticity in gene expression, I will show how the details of the stochastic process can be characterized by a few effective parameters, which facilitates modeling but complicates interpretation of current experiments. I will show how the resulting noise can provide advantageous or deleterious phenotypic fluctuation and how noise control in the copy number control system of plasmids can change the selective pressures. This system illustrates the direct connection between molecular dynamics and evolutionary dynamics.