Living Cell as a Microsized Chemical Reactor

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Abstract

Origins and consequences of cell-to-cell variability are essential to the understanding of diverse biological processes underlying the development, aging, immune response, and tumorigenesis, just to name a few. As a micrometer-sized chemical reactor, living cells call for analytical frameworks that respect the stochasticity of biochemical reactions and discrete nature of macromolecules. In the earlier part of the talk, I propose some rationales of genetic noise for tuning the functional stability of a simple synthetic gene switch. The latter part of the talk will focus on the effects of zygosity of diploid cells, which adds another dimension to stochastic gene expression. I will introduce the diploid gene expression systems with homo- and heterozygous combination of alleles in the cis-regulatory sequences and characterize the noise profiles associated with zygosity. An emerging feat of heterozygosity is its counterintuitive capacity for genetic noise control, which offers a novel insight into the rich repertoire of balancing selection enriched in the regulatory sequences of the immune response genes.