PURDUE UNIVERSITY
Discovery Park

Bindley Bioscience Center

Invites You to a Presentation by

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Wednesday, December 3rd
11:00 am – 12:00 pm
Burton Morgan Center, Room 121

Refreshments will be served

Modeling Regulatory Processes in Cells: An Approach Based on Goal- Directedness

Abstract

Metabolism is subject to strict regulation by selective expression of genes. The modeling of gene expression involves regulation by signaling molecules and transcription factors which produce a cascade of intracellular reactions involving the different nucleic acids and lead eventually to the synthesis of an associated protein. The resulting model involves several coupled stochastic differential equations even for the expression of a single gene. As the nucleic acid infrastructure of a cell is fixed in its capacity, modeling regulatory processes through the action of the entire genome using the foregoing stochastic framework would necessarily involve several thousand stochastic differential equations and hence would be exceedingly difficult to solve. Understanding metabolism by comprehensive inclusion of regulatory processes is therefore not a workable proposition.

Based on the idea that regulatory activity must occur towards satisfying some goal such as the survival of the cell or that of a multicellular organism to which it belongs, this talk will discuss the performance over the years of such models. The theory exploits an optimal control formulation of postulated dynamic objectives to make diverse predictions of a variety of metabolic phenomena including the behavior of mutant strains from a model of the wild-type organism. Experimental tracking of regulatory processes, generally accomplished by gene expression profiles, represents an interesting avenue, at least in trend, to compare with dynamic predictions of metabolic systems. That a theory without genes can address observed trends of gene expression profiles is a testimonial to teleology that has frequently served to explain biological phenomena in the past!