

A Computational Strategy for Systems Biology

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Systems biology can be explored by development of computational tools and capabilities which enable us to understand complex biological systems. Scientific contributions are strongly anticipated to produce practical benefits such as biomedical applications, solutions for environmental problems, etc. For this purpose, gene networks will play a central role in systems biology and computational challenges to inferring, modeling and simulating biological systems are receiving more attentions. In this talk, we give a computational strategy focused on gene network analysis by reviewing our recent contributions.

Advances in measurement technology have enabled genome-wide biological data production. Fig. 1 shows some aspects of data and computational towards understanding of biological systems. Our challenge in this scope is comprised of two approaches. The first is 'how to create gene network information.' For this direction, we have developed computational methods for inferring gene networks from gene expression profile data obtained from various perturbations such as gene disruptions, shocks, etc. The second is how to model and simulate gene networks. Obviously, an important challenge is a creation of a platform with which scientists in Biology can comfortably model and simulate dynamic causal interactions and processes in the cell such as gene regulations, metabolic pathways, and signal transduction cascades. For this direction, we have developed a software tool *Genomic Object Net* (<http://www.genomicobject.net/>) for biopathway modeling and simulation. As an application of such efforts in computational methods in systems biology, we have recently succeeded in discovering a drug target gene by analyzing gene networks constructed from gene expression profile data based on gene disruptions and drug doses. We shall sketch how this was achieved with gene network inference methods and laboratory works.

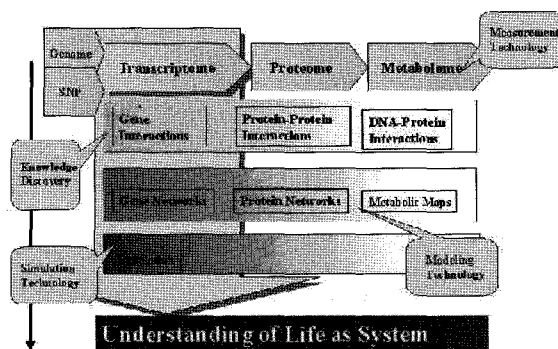


FIG. 1. Genome-wide data and computational issues towards understanding of life.