

The Idea of Systems Biology: Unraveling Cellular Dynamics

Kwang-Hyun Cho

College of Medicine and Korea Bio-MAX Institute, Seoul National University, Seoul, Korea

The fundamental problem, addressed by Systems Biology, is to understand the nature of the 'organization and dynamics' of living systems. This can be achieved not by cataloguing and characterizing physical components but mainly through mathematical modeling and simulation of the signal- and information-flow in 'pathways' that are the result of interacting components. Pathways are a fundamental concept by which scientists describe processes and relationships in biomolecular systems. Mathematical modeling and simulation of intra-cellular dynamics based on the concept of pathways has gained renewed interest in the area of systems biology. In this presentation, 'dynamic modeling' of a signal transduction pathway is to be used as a guide for discussion on what the challenges are if we are to study pathways as dynamic systems. While acknowledging the enormous complexity of such systems, the lack of reliable, accurate and sufficiently rich data sets, and the inadequacies of our methodologies we find that even simple simulations and the modeling process itself can provide the life scientist with useful information, guiding experimental design and generating new hypotheses, and help identify which variables to measure and why.