Investigating the interplay between the organization and function of cellular interaction networks

Réka Albert
Department of Physics and Huck Institutes of the Life Sciences
Pennsylvania State University
University Park, PA 16802
rza1@psu.edu

ABSTRACT

A cell's behavior is a consequence of the complex interactions between its numerous constituents, such as DNA, RNA, proteins and small molecules. Cells use signaling pathways and regulatory mechanisms to coordinate multiple processes, allowing them to respond to and adapt to an ever-changing environment. The large number of components, the degree of interconnectivity and the complex control of cellular networks are becoming evident in the integrated genomic and proteomic analyses that are emerging. It is increasingly recognized that the understanding of properties that arise from whole-cell function require integrated, theoretical descriptions of the relationships between different cellular components.

Recent theoretical advances allow us to describe cellular network structure with graph concepts, and have revealed organizational features shared with numerous non-biological networks. The research on cellular interaction networks is focused on three lines of enquiry: (i) How do we quantitatively describe a network of hundreds or thousands of interacting components? (ii) Does the observed topology of cellular networks give us clues about their evolution? and (iii) How does the cellular networks' organization influence their function and dynamical responses? This lecture will offer a sample of emerging answers to all three of these questions.

Keywords

Biological networks, gene regulation, signal transduction, mathematical modeling

1. ACKNOWLEDGMENTS

Research in the Albert group is supported by a Sloan Research Fellowship and NSF grant DMI-0537992.

NetSci2006, May 22–25, 2006, Bloomington, IN, USA.
.