

DISTINGUISHED LECTURER SERIES

THE INSTITUTE FOR SYSTEMS RESEARCH



February 20, 10:00 a.m.

Dynamics in Genetic Networks

Leon Glass, FRSC, Isadore Rosenfeld Chair in Cardiology and Professor of Physiology, McGill University, Montreal, Canada

Genetic activity is partially regulated by a complicated network of proteins called transcription factors. I will describe a mathematical framework that can be used to relate the structure and dynamics of these genetic networks. The networks are represented by differential equations with switchlike nonlinearities. These equations are represented schematically using a directed graph on an hypercube. There are many advantages to these equations. Because of the discrete representation of the continuous dynamics, the numbers of different networks with N model genes can be counted and classified. The methods are helpful in identifying networks that have certain types of dynamic behaviors such as stable fixed points, stable cycles, and chaotic dynamics. These methods can be used to help design in vitro genetic networks that show oscillation and multistability. They can also be used to determine gene network structure based on the patterns of activation of genes. Finally, the framework offers novel ways to study the evolution of rhythmic patterns in model equations and also in electronic circuits that simulate the differential equations.

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Biography

A native of Brooklyn, New York, Leon Glass attended Brooklyn College and did graduate work at the University of Chicago. Before moving to McGill University, where he is currently the Isadore Rosenfeld Chair in Cardiology, he held postdoctoral positions at the University of Edinburgh, the University of Chicago, and Rochester University. He has been a visiting professor at the University of California, San Diego, Harvard Medical School, and Boston University. He is also the recipient of a Guggenheim Fellowship and the Prix Jacques-Rousseau for interdisciplinary research from Acfas. Dr. Glass' research focuses on the applications of mathematics to study biological function and rhythms in the cardiovascular system, and in complex genetic and neural networks.

He is the coauthor (with Michael Mackey) of *From Clocks to Chaos: The Rhythms of Life* (Princeton, 1988), which has been translated into Russian, Chinese and Portuguese, and (with Daniel Kaplan) of *Understanding Nonlinear Dynamics* (Springer-Verlag, 1995). In addition to his scientific interests, he plays the French horn in the I Medici di McGill orchestra, and is an avid hiker in the Adirondacks and other mountains.

Date and time

Lecture

Friday, February 20, 10:00 a.m.

Judith Resnik Lecture Hall

1202 Glenn L. Martin Hall

University of Maryland, College Park, MD 20742

Roundtable discussion

Friday, February 20, 2:00 p.m.

2168 A.V. Williams Building

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