NUS National University of Singapore

Department of Biological Sciences
Faculty of Science

SEMINAR

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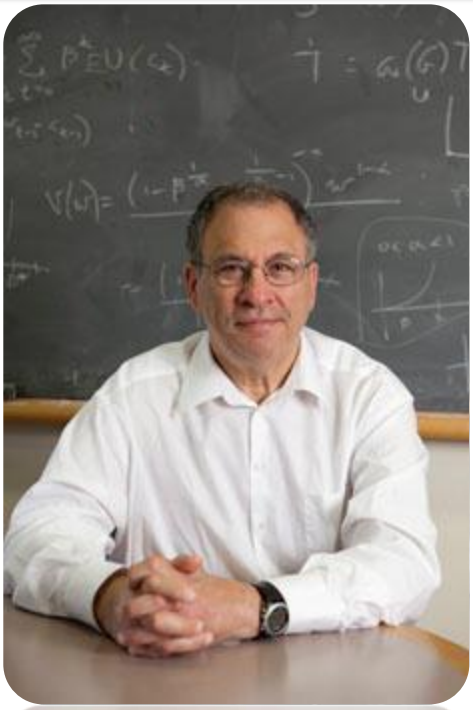
Hosted by Dr Ryan Chisholm



Simon A. Levin is the George M. Moffett Professor of Biology at Princeton University in the Department of Ecology and Evolutionary Biology, and the Director of the Center for BioComplexity in the Princeton Environmental Institute. His research examines the structure and functioning of ecosystems, the dynamics of disease, and the coupling of ecological and socioeconomic systems. Levin's awards include the Heineken Prize for Environmental Sciences, Kyoto Prize in Basic Sciences, Margalef Prize for Ecology, and the Ecological Society of America's MacArthur and Eminent Ecologist Awards.

CHALLENGES IN MATHEMATICAL ECOLOGY: SCALING AND COLLECTIVE PHENOMENA

Simon Levin

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The subject of mathematical ecology is one of the oldest in mathematical biology, having its formal roots a century ago in the work of the great mathematician Vito Volterra, with links, some long before, to demography, epidemiology and genetics. Classical challenges remain in understanding the dynamics of populations and connections to the structure of ecological communities. However, the scales of integration and scope for interdisciplinary work have increased dramatically in recent years. Metagenomic studies have provided vast stores of information on the microscopic level, which cry out for methods to allow scaling to the macroscopic level of ecosystems, and for understanding biogeochemical cycles and broad ecosystem patterns as emergent phenomena; indeed, global change has pushed that mandate well beyond the ecosystem to the level of the biosphere. Secondly, the recognition of the importance of collective phenomena, from the formation of biofilms to the dynamics of vertebrate flocks and schools to collective decision-making in human populations poses important and exciting opportunities for mathematicians and physicists to shed light. Finally, from behavioral and evolutionary perspectives, these collectives display conflict of purpose or fitness across levels, leading to game-theoretic problems in understanding how cooperation emerges in Nature, and how it might be realized in dealing with problems of the Global Commons. This lecture will attempt to weave these topics together and both survey recent work, and offer challenges for how mathematics can contribute to open problems.

Artwork by Ann Nee, DBS, NUS