LAUFER CENTER
FOR PHYSICAL AND QUANTITATIVE BIOLOGY

Seminar 2017

Deep Linearity in Phenotypic Adaptation and Evolution:

Macroscopic Theory, Microscopic Simulation, and Bacterial Experiments

Quantitative characterization of plasticity, robustness, and evolvability is one of the most important issues in biology. Based on statistical physics and dynamical-systems theory, we present a macroscopic theory of fluctuation and responses in cellular states. By assuming that cells undergo steady growth, protein expression of thousands of genes is shown to change along a one-dimensional manifold in the state space in response to the environmental stress. This leads to a macroscopic law that cellular-state changes satisfy, as is confirmed by adaptation experiments of bacteria under stress. Next, we present proportionality between phenotypic changes by genetic evolution and by environmental adaptation, uncovered both in bacterial experiments and simulations. This relationship is then formulated by the hypothesis that phenotypic changes in adaptation and evolution are dominantly constrained along one-dimensional path. Possible extension of the theory to non-growing cellular states and to multi-level evolution for multicellularity will be briefly discussed.

Full abstract: http://laufercenter.stonybrook.edu/seminar

Kunihiko Kaneko
Director, Center for Complex Systems Biology
Universal Biology Institute
Professor, Department of Basic Science
University Tokyo

Friday April 21, 2017

2:30 PM Laufer Center 101

Host: Ken Dill

Refreshments: Hub 110 after seminar

Stony Brook University

For a disability related accommodation, please call 631-632-5400