# "Embryogenesis: A Cascade of Dynamical Systems"

**Wednesday**
**September 4, 2019**
**3:00 pm**
**Wu and Chen Auditorium**
**Levine Hall**

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**Abstract**

We aim to establish and experimentally test mathematical models of embryogenesis. While the foundation of this research is based on models of isolated developmental events, the ultimate challenge is to formulate and understand dynamical systems encompassing multiple stages of development and multiple levels of regulation. These range from specific chemical reactions in single cells to coordinated dynamics of multiple cells during morphogenesis. Examples of our dynamical systems models of embryogenesis – from the events in the Drosophila egg to the early stages of gastrulation – will be presented. Each of these will demonstrate what had been learned from model analysis and model-driven experiments, and what further research directions are guided by these models.

**Bio**

Stanislav Y. Shvartsman is a Professor of Chemical and Biological Engineering at Princeton University. He was born in Odessa, in the former Soviet Union, and studied Physical Chemistry and Chemical Engineering in the Moscow State University, Technion-Israel Institute of Technology, and Princeton University. After postdoctoral work at MIT, he opened his own laboratory at the Lewis-Sigler Institute for Integrative Genomics at Princeton. The Shvartsman group uses experiments, theory, and computational approaches to develop predictive models of dynamical processes in cells and tissues. Current projects in the group fall into three broad classes, related to enzyme kinetics, tissue morphogenesis, and developmental bioenergetics. The first class of projects aims to establish quantitative descriptions of enzyme kinetics in vivo. The experimental systems here are Drosophila embryos and reconstituted enzyme reactions and theory is based on more or less conventional models of chemical kinetics. The second class of projects explores the processes by which two-dimensional sheets of cells give rise to three-dimensional structures of tissues and organs. Here, experiments are done in developing Drosophila eggs and zebrafish embryos and theory relies on either continuum or discrete mechanical models of epithelial tissues. Projects in the third class study how developing systems manage their constant need for energy. This project is still very young and uses the early Drosophila embryo as a powerful experimental system for genetic, biochemical, and imaging studies of embryonic metabolism.