



DEPARTMENT OF MATHEMATICAL SCIENCES

Colloquium

Qing Nie

University of California, Irvine

Data-driven multiscale modeling of cell fate dynamics

ABSTRACT: Cells make fate decisions in response to different and dynamic environmental and pathological stimuli. Recent technological breakthroughs have enabled biologists to gather data in previously unthinkable quantities at single cell level. However, synthesizing, analyzing, and understanding such data require new mathematical and computational tools, and in particular, dissecting cellular dynamics emerging from molecular and genomic scale details demands novel multiscale models. In this talk, I will present our recent works on analyzing single-cell molecular data, and their connections with cellular and spatial tissue dynamics. Our mathematical approaches bring together optimization, statistical physics, ODEs/PDEs, and stochastic simulations along with machine learning techniques. By utilizing our newly developed computational tools along with their close integrations with new datasets collected from our experimental collaborators, we are able to investigate several complex systems during development and regeneration to uncover new mechanisms, such as novel beneficial roles of noise and intermediate cellular states, in cell fate determination.

BIO: Dr. Qing Nie is a Chancellor's Professor of Mathematics, Developmental and Cell Biology, and Biomedical Engineering at University of California, Irvine. Dr. Nie is the director of the new NSF-Simons Center for Multiscale Cell Fate Research jointly funded by NSF and the Simons Foundation – one of the four national centers on mathematics of complex biological systems. In research, he uses systems biology and data-driven methods to study complex biological systems with focuses on single-cell analysis, multiscale modeling, cellular plasticity, stem cells, embryonic development, and their applications to diseases. Dr. Nie has published more than 130 research articles and served in many NIH and NSF review panels, maintaining a well-funded interdisciplinary research program. In training, Dr. Nie has supervised more than 40 postdoctoral fellows and PhD students, with many of them working in academic institutions. Dr. Nie is a fellow of the American Association for the Advancement of Science and a fellow of American Physical Society.

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11:00AM-12:00PM
Stratton Hall 203