

# Systems Biology Concentration

**Multidisciplinary Research:** Interface of Biology, Physics, Chemistry, Biophysics, Mathematics, CS&E.

## Modeling & Simulation

Data Driven Analysis and Simulation  
Modularity and Multistate Complexes  
Modeling cellular processes in space and time; Agent-based Modeling;  
Stoch Modeling and Discrete Particles

**PIs:** Agmon, Blinov, Cowan, Guertin, Loew, Mendes, Moraru, Slepchenko, Vera-Licona

## Optical Imaging

Virtual Microscopy; Fluorescent Correlation Spectroscopy;  
Optical Probe Development  
Non-linear Optical Microscopy  
Single Molecule Imaging

**PIs:** Acker, Cowan, Mayer, Mohler, Loew, Rodionov, Wu, Yan, Yu, Carson\* (emeritus)

Experiment

Analysis

Theory

Computer Science

## Omics analysis

Pathway Analysis; Gene regulatory Networks; Gene expression & Proteomics analysis; Large scale modeling; Molecular Medicine

**PIs:** Blinov, Guertin, Kshitiz, Mattada, Mendes, Moraru, Vera-Licona

## Cell Biology & Biophysics

Signal Transduction; Biological Signaling Platforms; Single Molecule and Particle Tracking; Cytoskeletal Dynamics and Morphogenesis

**PIs:** Cowan, Kshitiz, Loew, Mattada, Mayer, Mohler, Rodionov, Wu, Yu

## Systems Biology Area of Concentration:

- ✓ Multidisciplinary Faculty
- ✓ Multi-mentor graduate training
- ✓ Special courses:
  - Introduction to Systems Biology
  - Optical Microscopy and Bioimaging
  - CAM Journal Club/Research in Progress
- ✓ Located in a new state-of-the art facility (R&D Magazine's "Renovated Lab of the Year 2011")
- ✓ Shares facility with Genetics AoC & Technology Incubator.



Cell Analysis and Modeling Center (CCAM): <https://health.uconn.edu/cell-analysis-modeling/>

Center for Quantitative Medicine (CQM): <https://health.uconn.edu/quantitative-medicine/>

AoC: <http://health.uconn.edu/graduate-school/academics/programs/ph-d-biomedical-science/cell-analysis-and-modeling-graduate-program/>

Program Director: Dr. Michael Blinov ([blinov@uchc.edu](mailto:blinov@uchc.edu)). Associate Director: Dr. Yi Wu ([yiwu@uchc.edu](mailto:yiwu@uchc.edu))

# Systems Biology Courses

## Introduction to Systems Biology (MEDS-6455)

A biology world as seen by engineers, physicists, mathematicians and computer scientists. The goal is to provide the necessary background to read modeling papers, choose computer resources that will help in biological projects, and be able to select a modeling technique appropriate for a given biological project.

- Predictive mathematical models and their dynamical behavior;
- Resources needed to start building a model;
- Models exchange, simulation and visualization;
- Public databases and software tools available for a modeler.
- Stability, switching and stochasticity of a biological system;

## Optical Microscopy and Bio-imaging (MEDS-6450)

This is an introductory course to help students understand the broad array of optical microscopy techniques employed in current biological literature.

- We will begin with an overview of geometrical optics and optical and fluorescence microscopy, with an emphasis on instrumentations.
- The bulk of the course will focus on state-of-the-art imaging techniques including Confocal microscopy, nonlinear optical processes, optical sensors, optogenetics and super-resolution imaging.
- Interdisciplinary topics. Learn physics, protein engineering and computational concepts.
- Literature-based learning.
- Three labs to gain some hands-on experiences.

## Molecular Genomics Practicum (MEDS-5420)

Learn to:

- Comfortably navigate the command line.
- Use scripting to automate processing and analysis of genomics data.
- Align sequencing reads to reference genomes.
- Retrieve and analyze publicly available genomic data sets.
- Visualize genomics data on a browser.
- Perform alignment, peak calling, and motif analysis starting of raw ChIP-seq data.
- Perform alignment, differential expression, and gene set enrichment analysis of raw RNA-seq data.

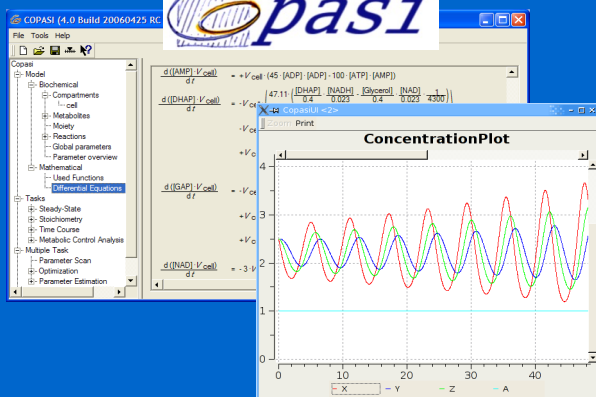
## Practical Microscopy and Modeling (MEDS-5382 )

Hands-on experience in wide variety of microscopy techniques and related mathematical modeling

## Systems Biology Journal Club (MEDS-6497)

Discussion of papers, current research and attended meetings.

## COPASI – biochemical simulator



## Virtual Cell – spatial modeling environment

