



**CH248 Aug 3:0**

## **Molecular Systems Biology**

### **Instructor**

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### **Teaching Assistant**

Email:

**Department: Chemical Engineering**

Course Time:

Lecture venue:

Detailed Course Page:

## **Announcements**

### **Brief description of the course**

Various topics highlighting experimental techniques and modeling approaches in systems biology for problems ranging from molecular level to the multi-cellular level will be covered.

### **Prerequisites**

The course is intended for Masters and PhD students. Undergraduates with sufficient background may approach the instructor regarding the course.

No prior knowledge of biology is needed but a non-biologist will have to self-educate.

Basic grasp of calculus, algebra and programming skills in C, Matlab or Mathematica is recommended.

### **Syllabus**

Topics: Properties of biomolecules, Biomolecular Forces, Single molecule experimental techniques,

Molecular motors, Molecular heterogeneity, Self-organization, Enzyme kinetics, Modeling cellular reactions

and processes, Fluctuations and noise in biology, Cellular variability, Biological networks, Modeling

dynamics of bioprocesses and cellular signaling.

### **Course outcomes**

Students taking this course will be:

Able to distill and model biomolecular interactions and biological phenomenon as mathematical models and simulate them.

Explain the various physical modeling approaches for biomolecules, biological pathways, regulation and networks.

Explain the various methods to measure the relevant molecular and network properties.

Model biological pathways like transcription networks, signal transduction pathways, and spatio-temporal differentiation programs.

## **Grading policy**

20% Assignments

30% Mid-term

50% Project

## **Assignments**

## **Resources**

Philip Nelson, Biological Physics: Energy, Information, Life, W. H. Freeman, 2007, ISBN-13: 978-0716798972.

Edda Klipp, Wolfram Liebermeister, Christoph Wierling, Axel Kowald, Hans Lehrach, Ralf Herwig, Systems Biology, Wiley-Vch, 2009, ISBN: 978-3527318742.

Uri Alon, An Introduction to Systems Biology: Design Principles of Biological Circuits, Chapman & Hall/CRC Mathematical & Computational Biology, 2006, ISBN: 978-1584886426.