Course Syllabus: BMEN6382 Systems Biology

Course Information
Course number: BMEN6382
Title: Systems Biology
Time: Friday 10am-12:45pm
Semester: Spring 2016

Instructor Information
Leonidas Bleris
Tel: 972-883-5785
Email (preferred mode of communication): bleris@utdallas.edu
Office hours: before and after class and by arrangement
Office location: NSERL 4.708

Course Description
This is an interdisciplinary course on the design principles of biological systems, with a focus on the experimental and theoretical tools used to shed light on biological circuits. The course will examine well-studied systems and synthetic biology prototypes (e.g. synthetic genetic switches), will highlight the latest research results (e.g. biocomputers, synthetic oscillators and counters), and will discuss key scientific and technological challenges.

Learning Outcomes
- Exposure to bottom-up and top-down design and analysis strategies for systems and synthetic biology
- Understanding of the basic circuitry in transcription regulation, signal transduction, and developmental networks
- A simple mathematical framework which can be used to understand and even design biological circuits
- Exposure to the latest results in systems & synthetic biology

Textbook
An Introduction to Systems Biology: Design Principles of Biological Circuits by Uri Alon, Chapman & Hall, ISBN 1-58488-642-0.

Contents
1. Transcription networks, basic concepts
2. Auto-regulation, a network motif
3. The feedforward loop network motif
4. Temporal programs and the global structure of transcription networks
5. Network motifs in developmental, signal-transduction and neuronal networks
6. Robustness of protein circuits, the example of bacterial chemotaxis
7. Robust patterning in development
8. Kinetic proofreading
9. Optimal gene circuit design
10. Rules for gene regulation based on error minimization
11. Simplicity in biology

Grading Policy
Grades will be based on the project reports, homework, exams, and classroom presentations

University Policies

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