

# PLB471: Introduction to Systems biology

## Syllabus 2011

**Lecturer:** Matt Geisler, Dept of Plant Biology Life Science II, rm 403, phone: 453-3212 [mgeisler@plant.siu.edu](mailto:mgeisler@plant.siu.edu)

**Lectures:** Tuesday and Thursday 12-1. SIUC campus: LSII rm. 430

**Lab:** Wednesday 5-7pm LSII rm. 449

### **Computer Laboratory:**

Be sure to bring a USB stick of at least 1 GB size. This will become your PLB471 stick for the semester. Do not put anything on your stick that is not relevant to the course. Your homework and lab assignments will be turned in on your stick, and returned to you on the next lab session.

### **Textbooks required:**

1. Systems Biology: Properties of Reconstructed Networks by Bernhard O. Palsson Cambridge University Press (January 16, 2006)
2. Bioinformatics: A practical approach by Shui Qing Ye. 2008 CRC Press

### **Recommended reading:**

1. Introduction to Bioinformatics by Anna Tramontano. 2007 CRC Press

### **Other reading material:**

See course web page for list of links to papers

### **Course Goals and Objectives:**

Systems biology is a new field which explores the world of genomes and post-genomic datasets and large databases. The goal of systems biology is to comprehensively understand development, physiology, metabolic and gene regulatory networks, by looking at all genes, proteins and metabolites in an organism simultaneously, rather than focusing on just one or two. We finally have all the components of biology laid out in front of us, the genes, transcripts, and proteins. It is now time to begin to learn how all these pieces interact to create the emergent properties of life. Your goals for the course should be to 1: be able to analyze genome wide expression using DNA microarray data 2: understand genome, transcriptome, proteome, metabolome and interactome level information. 3: Be able to work with metabolic, signaling and gene regulatory networks. 4: Use protein interactome data.

### **On Lectures**

Systems biology is a difficult subject and it is easy to get lost quickly, and never catch up. The lectures are an open forum format, and active student participation is encouraged. Please ask questions at any time during the lecture by raising your hand. Additional time will be dedicated to questions at the end of each lecture as well. Do not be afraid to ask anything, there are no such things as stupid questions in systems biology.

### **On the computer lab:**

There is a self-directed computer lab, which will be supervised by the lecturer (me), but should be pretty straight forward. Assignments will be given weekly. Please print out the assignment prior to lab, or fill in the answers online and save your work. I require all students to purchase a 1GB or larger USB memory stick as their workbook for this class. You will turn in your stick at the end of the lab. Students are encouraged to discuss the assignment amongst the lab group, and to help each other with the problems. However, the work you turn in for grades must be your own. This is not usually a problem as each student will be given a different gene, different organism or so on.

### **On plagiarism:**

*In the era of web information, cutting and pasting, and word processing it is very tempting and easy to plagiarize. This includes lifting whole paragraphs, or even a single sentence. Plagiarism inhibits learning. You need to be able to express your own thoughts and ideas in writing, which is part of the educational experience at SIUC and in this course. Your answers on worksheets and exams must be your own, and may be subject to electronic comparison to other work. If you have difficulty writing, please visit me at office hours or after class for additional help.*

**Reading assignments:** You will be given assignments to read each week. Please keep up with your reading.

**Exams:** The course will include a midterm and final examination. If you have a scheduling conflict and cannot attend an examination you must give written notice to the course instructor 10 days prior to the exam date for review. Make up examinations are subject to university policy and the instructors discretion. Emergency absence is also subject to university rules, please contact your instructor as soon as possible if an emergency occurs which will result in absence from an exam.

### **Grading:**

Lecture Exams (2)	200 points
Laboratory assignments	200 points
Total	400 points

Grades will not be subject to test score adjustments (curved), you are tested against the material, not fellow students.

#### Lectures PLB471

<i>Lecture</i>	<i>Topic</i>	<b>Text Reading</b>
1	Introduction	SB: Chapter 1
2	Online databases	BI: Chapter 1
3	Bioinformatics Basics I	BI: Chapter 3
4	Bioinformatics Basics II	BI: Chapter 3
5	Analysis of gene expression	BI: Chapter 5
6	Clustering of expression data	BI: Chapter 5
7	Use of orthologs	Papers
8	Proteomics	BI: Chapter 10
9	Functional annotation, AmiGO	BI: Chapter 11/12
10	Domains, SMART, PFAM	Papers
11	Metabolomics, MAPman, MetaCyc	SB: Chapter 2/3
12	<b>Midterm exam</b>	
13	Interactomics	Papers
14	Mining the bibliome	Papers
15	Gene regulatory networks	SB: Chapter 4
16	Signaling networks	SB: Chapter 5
17	Dynamics and Spatial compartmentalization	Papers
18	Morphogen gradients and auto-regulation	Papers
19	Mathematical models of networks	SB: Chapter 6/7
20	The feed forward and feedback loop	Papers
21	Network topology	Papers
22	Comparison of protein and neural networks	Papers
23	Inputs and decision making circuits	Papers
24	Robustness and redundancy	Papers
25	Reconstruction of networks from data	Papers
26	Systems biology analysis	Papers
<b>27</b>	Review	

#### Laboratory schedule PLB471

<i>Week</i>	<i>Topic</i>
1	Gene and Protein data handling
2	Genome Database navigation
3	Alignment and phylogeny
4	Ortholog identification
5	Large scale domain analysis
6	Downloading and manipulating transcriptomes
7	Transcriptome meta-analysis
8	Cis-regulatory element search algorithms
9	Interactome analysis and protein interaction domains
10	Motif searching for key interaction sequences
11	Reconstruction of a network project I
12	Reconstruction of a network project II
13	Reconstruction of a network project III
14	Group presentations
<b>15</b>	Review for exam

*Emergency Procedures. Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with the SIUC Emergency Response Plan and Building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on BERT's website at [www.bert.siu.edu](http://www.bert.siu.edu), Department of Safety's website [www.dps.siu.edu](http://www.dps.siu.edu) (disaster drop down) and in Emergency Response Guideline pamphlet. Know how to respond to each type of emergency.*

*Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. **It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.** The Building Emergency Response Team will provide assistance to your instructor in evacuating the building or sheltering within the facility.*