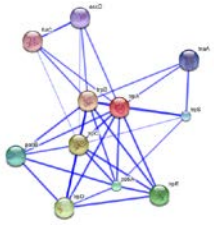
IB 502 Biological Networks



Credit: 2 hours
Instructor: Amy Marshall-Colon
Contact: amymc@illinois.edu
Class hours/week: T/R 12:30 AM – 1:50 PM
Office hours: 193 ERML, by appointment

Course Description
Today we enjoy a wide range of technologies and computational tools that facilitate our ability to organize, integrate, and analyze data describing the complexity of biological systems. This is a taxon neutral course, in which the goal is to teach you about different cellular components and train you to collect, organize, and integrate "omic" scale data (i.e. transcriptome and proteome) into network models. You will be trained to analyze these network models using available tools to determine biological significance and function of the resulting network interactions. During this course, we will also review and discuss current literature exploring advances in systems biology.

Student Learning Outcomes
i) Understand how large-scale datasets are obtained and analyzed.
ii) Apply bioinformatics tools for the analysis of –omic data.
iii) Perform research on a transcriptome dataset and present results.

Prerequisites:
This is an advanced course in systems biology and requires basic familiarity with molecular and cellular biology.

Optional textbook
A First Course in Systems Biology. Eberhard O. Voit. eBook ISBN: 9781136215100. Students have the option to purchase or rent the eBook for the semester.

Journal articles
Readings from primary literature for discussion and further information about computational tools we will use in class will all be made available online.

Academic Integrity
All students should follow University of Illinois "Code of Policies and Regulations Applying to All Students." The Code is available online at: http://www.admin.uiuc.edu/policy/code/index.html
According to the Student Code, `It is the responsibility of each student to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions.' Please know that it is my responsibility as an instructor to uphold the academic integrity policy of the University, which can be found here: http://studentcode.illinois.edu/article1_part4_1-401.html

Attendance Policy
Regular class attendance is expected of all students at the University as described by the student code: http://studentcode.illinois.edu/article1_part5_1-501.html. Missed quizzes cannot be made up; however, prorates will be given for valid excuses as outlined by the student code. Likewise, final projects and final papers must be turned in by the due date. You must let the instructor know during the first week of class if you plan on missing class due to scheduled meetings or religious observances. Failure to notify the

instructor during the first week of class will result in unexcused absences. Late assignments will not receive full credit.

Disability Accommodations

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TTY), or e-mail a message to disability@illinois.edu.

Class Format

The first class session each week will combine short lectures presenting the principles and fundamental knowledge necessary to understand the topic, followed by a discussion session or other activity to reinforce lecture topic. The second class session each week will begin with an introduction to data analysis or network tools used to address the type of data discussed that week, followed by an assignment that provides hands-on training in data collection, analysis, and visualization. Throughout the semester we will incorporate group project work utilizing learned unit tools that will become a part of the students' final project and presentation.

Computer Requirement

Students are required to have a laptop computer to complete in-class computational assignments. If a student cannot bring her/his laptop then he/she must pair up with someone who has a laptop for in-class assignments and discussion. Much of the work in this class will require computer access in and out of class.

Grading

In class assignments	10 %
Lightening presentations	30 %
Final paper	20 %
Final presentation	30 %
Discussion Participation	10 %

Grade Breakdown

Discussion/participation (50 pts.)

Student's grade will be determined in part by: weekly logs for group projects; active peer review and discussion of lightening presentations; active discussion on lecture material and any assigned reading.

Assignments (50 pts.)

Assignments for applying skills learned in the lectures will be given throughout the term. Students with valid reasons (those listed above) for missed assignments will be given an opportunity to make up the assignment at the discretion of the instructor.

Lightening Presentations (150 pts.)

Students will make short, 5-10 minute presentations at the end of every unit (except introduction unit) to demonstrate knowledge and skills learned during that unit. Each unit will introduce students to a method or tool to analyze data relevant to the unit topic through mini-lectures and tutorials. Students will then choose their own data to perform an analysis, then present the results to the class. Assessment is based on professor evaluation, group work log, and peer evaluation, both scores given by peers and quality of each students' written peer evaluation for their classmates.

Final Group Project (150 pts.)

Students will choose a dataset to focus their meta-analysis based project. Students will use tools and techniques introduced in lectures and class assignments to build and analyze an interactome of their model species. Each team member will accumulate knowledge throughout the semester that will be incorporated into the final project. Projects will be assessed by an acceptable outline of the proposed project including hypotheses (30 pts); a group presentation of 20 minutes (90 pts); and active participation in peer review (30 pts).

Final Individual Manuscript (100 pts.)

Individual group members will independently summarize the group project into a mini-manuscript consisting of: abstract, introduction, materials and methods, results, and conclusions.

Course Calendar

Week	Lecture	Date	Unit	Topic
1	1	01/15	Introduction to Biological Networks and Systems Biology	Overview of Systems Biology
	2	01/17		Overview of Network Models
2	3	01/22		Cytoscape Tutorial
	4	01/24		Getting familiar with databases & open source tools
3	5	01/29	Gene Expression Networks	*Siobhan Brady Seminar 12-1 PM (612 IGB) Transcriptomics overview (1410 IGB)
	6	01/31		Transcriptome data and processing: GEO2R
4	7	02/05		Transcriptome data and processing: Galaxy
	8	02/07		Clustering and Gene Ontology
5	9	02/12		Group projects: Gene network analysis
	10	02/14	Protein Networks	Network regulation and miRNAs
6	11	02/19		Proteomic approaches and techniques
	12	02/21		Modeling protein-protein interactions
7	13	02/26		Group projects: Protein models; final project outline due at end of class
	14	02/28	Data Integration	Overview of data integration approaches; group work on final presentation
8	N/A	03/05	Final Presentations	Final Presentations
	N/A	03/07	Final Presentations	Final Presentations; Final manuscript due