

## IB 502 Biological Networks

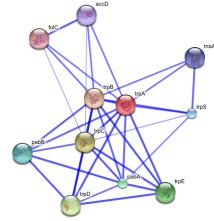
Credit: 2 hours

Instructor: Amy Marshall-Colon

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Class hours/week: M/@ 2:00 PM – 3:20 PM

Office hours: online, by appointment only



### 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: <https://studentcode.illinois.edu/>

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:

<https://studentcode.illinois.edu/article1/part4/1-401/>.

### Attendance Policy

Regular class attendance is expected of all students at the University as described by the student code:

<https://studentcode.illinois.edu/article1/part5/1-501/>

Missed presentations 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](mailto:disability@illinois.edu).

### Class Format

Classes each week will consist of lectures presenting the principles and fundamental knowledge necessary to understand the topic, followed by a discussion session or other activity to reinforce lecture topic. Some classes will be more focused on 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- and out-of-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

Participation	10 %
Lightening presentations	20 %
Final paper milestones	20 %
Final group project presentations	20 %
Final paper	30 %

### Grade Breakdown

#### 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.

#### Lightening Presentations (100 pts.)

Students will make two 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 interpretation of the data and results and present as a group. Each presentation is worth 50 points.

#### Final Paper Milestones (100 pts.)

At the end of each unit, there will be a set of questions derived from the lecture and/or related literature aimed at developing material for the final paper. The questions will largely ask the student to summarize the information learned and put it into the context of their own research interests.

#### Final Group Project (100 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 (150 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 – specific lecture topics may change over the 8 weeks

Week	Lecture	Date	Unit	Topic
1	N/A	01/15	Introduction to Biological Networks	No Class MLK Day
	N/A	01/17		No Class – reading assignment
2	1	01/22		Overview Systems Bio & Network Models
	2	01/24		Network Properties and Cytoscape – FPM Due: Final Paper Milestone
3	3	01/29	Gene Expression Networks	Co-expression Network Analysis
	4	01/31		Weighted Gene Coexpression Network Analysis
4	5	02/05		Clustering and Gene Ontology
	6	02/07		Group presentations: Gene networks Due: Final Paper Milestone
5	7	02/12	Protein Networks and Regulation	Regulatory elements & network motifs
	8	02/14		Assessing GRNs with ConnecTF – M. Brooks
6	9	02/19		Protein-Protein Interactions
	10	02/21		Group presentations: Regulatory networks Due: Final Paper Milestone
7	11	02/26	Multiscale Networks	Integrative and multiscale modeling
	12	02/28		TBD – flex day for spillover
8	13	03/04	Final Presentations	Final Presentations
	14	03/06	Final Presentations	Final Presentations Due: Final Paper

Grading Scale

Grade	Percent
A+	98-100
A	90-97
B+	87-89
B	80-86
C+	77-79
C	70-76
D+	67-69
D	60-66
F	<60

### Academic Integrity

Academic dishonesty will not be tolerated. Examples of academic dishonesty include the following:

- Cheating
- Fabrication
- Facilitating infractions of academic integrity
- Plagiarism
- Bribes, favors, and threats
- Academic interference
- Examination by proxy
- Grade tampering.

Non-original work: Should an incident arise in which a student is thought to have violated academic integrity, the student will be processed under the disciplinary policy set forth in the Illinois Academic Integrity Policy, using the FAIR system (<https://studentcode.illinois.edu/article1/part4/1-401/>). If you do not understand relevant definitions of academic infractions, contact your instructors for an explanation within the first week of class.

### Copyright

Student Content: Participants in University of Illinois courses retain copyright of all assignments and posts they complete; however, all materials may be used for educational purposes within the given course. In group projects, only the portion of the work completed by a particular individual is copyrighted by that individual. The University of Illinois may request that students' materials be shared with future courses, but such sharing will only be done with the students' consent. The information that students submit during a course may, however, be used for the purposes of administrative data collection and research. No personal information is retained without the students' consent.

Non-Student Content: Everything on this site and within University of Illinois courses is copyrighted. The copyrights of all non-student work are owned by the University of Illinois Board of Trustees, except in approved cases where the original creator retains copyright of the material. Copyrights to external links are owned by or are the responsibility of those external sites. Students are free to view and print material from this site so long as

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- the material is used for noncommercial purposes only; and
- copies of any material include the respective copyright notice.

These materials may not be mirrored or reproduced on non–University of Illinois websites without the express written permission of the University of Illinois Board of Trustees. To request permission, please contact the academic unit for the program.

### Student Behavior

- Student Conduct: Students are expected to behave in accordance with the penal and civil statutes of all applicable local, state, and federal governments, with the rules and regulations of the Board of Regents, and with university regulations and administrative rules. For more information about the student code and handbook, see academic integrity policy and procedure (<https://studentcode.illinois.edu/article1/part4/1-402/>).
- Netiquette: In any social interaction, certain rules of etiquette are expected and contribute to more enjoyable and productive communication. The following are tips for interacting online via e-mail or discussion board messages, adapted from guidelines originally compiled by Chuq Von Rospach and Gene Spafford (1995):
- Remember that the person receiving your message is someone like you, deserving and appreciating courtesy and respect.
- Be brief; succinct, thoughtful messages have the greatest effect.

- Your messages reflect on you personally; take time to make sure that you are proud of their form and content.
- Use descriptive subject headings in your e-mails.
- Think about your audience and the relevance of your messages.
- Be careful when you use humor and sarcasm; absent the voice inflections and body language that aid face-to-face communication, Internet messages are easy to misinterpret.
- When making follow-up comments, summarize the parts of the message to which you are responding.
- Avoid repeating what has already been said; needless repetition is ineffective communication.
- Cite appropriate references whenever using someone else's ideas, thoughts, or words.