

IB 271 – Organismal Biology, Spring 2023 Syllabus

Class meeting times: MWF 11-12 (lectures), W 1-5 (labs), 4014/4016 Natural History Building

Instructors:

| | |
|------------------------------|------------------------------------|
| Plant Section | Animal Section |
| Professor Li-Qing Chen | Professor Chris Cheng |
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Plant section – Dr. Li-Qing Chen (1st 7 weeks | January 17 – March 07, 2023)

About me:

I am an Assistant Professor in the Department of Plant Biology and affiliated with the Carl R. Woese Institute for Genomic Biology. My lab is interested in control of sugar flux in plants. We are studying how the process of sugar allocation from the photosynthetic tissues to non-photosynthetic tissues is controlled and regulated using molecular, biochemical and genetic tools. The ultimate goal is to improve global food security by engineering sugar flux in crops.

Section description:

What and how do we know about plant biology? This course is designed to provide you with a broad overview from different perspectives including plant cell biology, plant metabolism and plant developmental biology. You will be able to apply your gained knowledge to better explain phenomena in the plant biological world and better evaluate the challenge of global issues, such as food security, we are facing.

Section Objectives:

Upon completing this course, students will be able to

1. Distinguish how plants are different from other organisms.
2. Understand the primary metabolic processes in plants
3. Explain how plants respond to environmental cues.
4. Understand how plant physiology helps to resolve some issues we are facing.

Textbook:

The basic textbook is Campbell Biology by Lisa Urry, 12th ed, but 11th ed would work. Substantial other materials or readings will be provided by the instructor on Moodle.

Animal section – Prof Chris Cheng (2nd 7.5 weeks | March 08 – May 4, 2023)

About me:

I am a Professor in the Dept. of Evolution, Ecology and Behavior (EEB) in SIB. I study cool (literally) polar fishes, on how they evolve and adapt to freezing conditions in the Antarctic and Arctic waters. I also study how land insects survive winter. The unifying trait is a diversity of antifreeze proteins. I work at multiple levels of organization, from genes and genomes, to proteins, to whole animals and field biology. This integrative approach allows me to understand the interplay of environmental driving forces and animal response and adaptation, and the underlying mechanisms at the biochemical, molecular, genomic and evolutionary levels.

Section description:

This Section aims at achieving a solid understanding in two major related areas: (i) diversity and evolutionary relationships of major animal lineages, and (ii) fundamentals of physiology and physiology of animals in diverse environments. The goal is to instill an understanding and strong appreciation of the animal world, and the remarkable forms and functions they evolved that are compatible with life in their particular niches.

Section Objectives:

Upon completing this section, students are expected to:

1. Become familiar with the major phyletic lineages that comprise animal diversity
2. Understand evolutionary relationships among lineages through molecular phylogenetics reconstruction
3. Understand basic organ and system physiology of animals including human (partly).
4. Understand adaptive physiology of animals in different environments.

Textbook and instruction materials:

The basic text book is Campbell et al. BIOLOGY, 12th ed. Journal papers and instructor prepared information comprise a substantial part of the lecture material.

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| Grading components for each section - (50% for each section) |
|---|

| COMPONENT | COMPONENT SUBTOTAL | % of FINAL GRADE |
|--|-----------------------|---------------------|
| • Prelab/postlab activities (6 @ ~ 8.4 pts each) | 50 pts | 5% |
| • Lab reports/presentation: | 200 pts | 20% |
| - One formal lab report 120 points | | |
| - One popular science essay 50 points | | |
| - Lab poster/PPTX presentation 30 points | | |
| • Pre-lecture assessments/literature discussion and/or short writes (~10 @ ~5 pts each) | 50 pts | 5% |
| • Exams (2 @100 pts ach) | 200 pts | 20% |
| Section Total | 500 pts | 50% |

Extra Credit:

There are three ways to earn up to **4 % overall extra credit** for the whole course.

- **Lab journal submission (3 %):** You can choose to submit up to 6 (3 for the Plant Section, and 3 for the Animal Section) in-person lab journals, 5 points for each lab journal.
- **Student surveys (0.5 %):** We very much value your feedback for continually improving our teaching and this course! Participation in two formal (ICES) surveys, one for each section, will earn 0.25% each.
- **Five-minute writes (0.5 %):** You will be asked to address a few short questions after a lecture to assess your learning outcome from the lecture of the day several times, 1 point for each write-up.

Grades Assignment - will follow the +/- scheme.

Notes regarding expectations for written work:

IB271 is set up to satisfy the campus requirement of Advanced Composition for your degree program. This means, by completing IB271, it exempts you from having to take RHET233 separately. It aims to help you gain scientific writing skills. The advancement of science requires articulation of research studies and result outcomes in clear and understandable prose. You have started learning these skills in the first IBH core course. IB271 emphasizes further development of your skills in reading, synthesizing and writing scientific material. As you may have noted in the grading breakdown above, lab reports and lab presentation make up 40% of the final course grade, equal weight as the lecture exams. These exercises require significant writing effort on

the part of the students, and a significant commitment on the part of the instructors to give feedback. Be cognizant that your grade relies heavily on your written performance. Students are expected to make best effort in exam answers and lab reports to cite literature and examples that acknowledge contributions of scientists from diverse populations.

This course treats everyone with respect as valued students regardless of appearance or expressed gender preferences, as any race or gender can be a great contributing scientist.

Written assignments and exercises include the following:

1. Laboratory journals (optional for extra credit)– For any scientist, the daily record of her/his work – written in a way that it can be found and understood six months or six years from the date of the writing – is essential to progress. To be most effective, the journal entries really must be made during, or immediately after an experiment, observation or cogitation. In this course, you will be required to keep a laboratory notebook for in-person labs. Raw data and initial analyses will normally be recorded in a physical lab notebook. Processed data, summaries, conclusions and notes should be kept electronically. After every experimental lab period on Wednesday afternoon, you will have to upload the word file to Moodle on Thursday for evaluation if you wish to earn extra credit. The specific requirement for a lab journal submission will be posted on Moodle. The lab electronic notebooks will be returned on Friday. **Bear in mind, this is a transferable skill that will help you when you participate in the IBH required independent research (IB390, IB490) in a faculty lab, as record keeping of your work is always expected and needed.**

2. Prelab or postlab activities: Multiple choice questions or short answer questions will be given. For virtual labs, you will need to complete lab quizzes and/or postlab activities.

3. Lab reports:

(i) One formal lab report from each section, *i.e.* **two for the semester.**

For Plant Section - the formal report will be prepared from the results of lab 4 (Chloroplast Pigments and Proteins) in combination with the lab 3, or lab 5 (Photosynthesis/Starch).

For Animal Section - the formal lab report should be prepared from the results of either labs 1 and 3 (Evolutionary relationship analyses), or labs 4 and 5 (Osmotic strategies).

Guidance on writing – The culmination in formal scientific investigation is published research reports. To experience this, you will submit lab reports in the format of a journal manuscript. While you may discuss results with your peers, **the report must be single-authored.** The paper should be precisely patterned after and formatted as a journal publication, with the following general stipulations:

- Abstract – word limit 500; a very concise synopsis of why and how you did the study, what results you obtained, and an evaluation of whether they support your hypothesis.
- Introduction – background and any hypothesis/hypotheses that were specifically tested
- Materials and Methods – organized in subsections with subtitles
- Results and Discussion – organized in subsections with subtitles
- Conclusion – word limit 500.
- Bibliography

(ii) A shorter report/essay will be prepared from research literature on a topic relevant to the course. This short report will be **in popular science style.** Again, **the small report must be single-authored.**

- Make sure your writing is suited for a non-specialist audience;
- Make the title short and catchy;
- Begin with a general background introduction about your project;

- Describe the methods and techniques only briefly;
- Simplify results, but be accurate;
- Avoid jargon.

Writing feedback – To satisfy **Advanced Composition** requirement, each paper will be evaluated with the expectation of at least one subsequent revision. Students will submit a first draft of the reports at specified time (in the calendar at the end of this document) for comments by the TA and instructor. The final report should include improvement that incorporate TA/instructor suggestions.

4. Lab presentations:

- **Lab posters (Plant Section)** – You will pair with another student and prepare and present a poster on one lab (or set of labs) or research literature different from the one you use for pop sci. More specific instructions will be provided by the instructor/TA.
- **Lab oral presentations (Animal Section)** – You and your group members will prepare and give an oral PowerPoint presentation on a lab of your choice. More specific instructions will be provided by the instructor/TA.

5. **Pre-lecture assessments/short writes** – Pre-lecture assessments are chapter based. Each chapter has 20 multiple-choice questions. This assessment applies to both sections. For the plant section, in-class literature discussions are included to guide students on how to read a scientific paper. Short writes are homework writing exercises of one or two paragraphs or a problem set on a topic or particular interest relevant to class lectures.

6. **Exams** – Two exams are scheduled for each section. They will be **take-home exams**.

Attendance/participation:

Lectures and labs will be all in-person, unless notified otherwise. Students are expected to attend all scheduled classes and labs, participate in class discussion, quizzes, and perform all required lab activities. Students are required to mute phones, laptops, and tablets. Lecture slides will be posted on Moodle before classes. Slides are subject to revision after lectures are delivered. Please watch announcements in the news forum of Moodle or class emails closely for updates.

Statement of Academic Integrity

The Academic Integrity Policy and Procedure from the Student Code (<http://studentcode.illinois.edu/article1/>) will apply in all instances of academic misconduct committed by students. This applies to all exams, lab reports and quizzes. Infractions of academic integrity regulations are taken seriously and can result in severe consequences, including expulsion from the University. As a student of the University, it is your responsibility to become familiar with, understand, and abide by the Academic Integrity section of the Student Code. It should be noted that ignorance of these regulations is not a defense in cases of infringement of the rules of academic integrity.

Type of violation

See http://admin.illinois.edu/policy/code/article1_part4_1-402.html for complete definitions.

| Violation Type | Description |
|--|---|
| <input type="radio"/> 1-402a: Cheating | Using unauthorized materials or information, e.g. in an exam. |
| <input type="radio"/> 1-402b: Plagiarism | Representing the words or ideas of others as your own; includes coding. |
| <input type="radio"/> 1-402c: Fabrication | Submitting made-up information or false documents. |
| <input type="radio"/> 1-402d: Facilitating infractions by others | Helping others cheat, plagiarize, etc. |
| <input type="radio"/> 1-402e: Bribes, favors, and threats | With the intent to affect a record of a grade or evaluation of academic performance. |
| <input type="radio"/> 1-402f: Academic interference | Including but not limited to computer facilities, electronic data, required/reserved readings, reference works, or other library materials. |

Accommodations

Your success in studying this course is important to us. If you are unable to complete your lab reports or exams, because of professional or personal obligations or emergency situations, you should notify the instructor IMMEDIATELY. Accommodations must be clear and brief. Decisions will be made on an individual basis. If you have a disability, please send the instructor a Letter of Academic Accommodations within the first two weeks of the semester. You can learn how to get a Letter of Academic Accommodations from DRES by following this link (<http://disability.illinois.edu/academic-support/accommodations>).

***NOTE: Syllabus is subject to minor adjustments during the semester to build in flexibility.**

Chen - Plant Section Schedule:

| Date | Topic | Pre-class reading & assessment | Assignment schedule (may change as needed) |
|-------------|---|---|---|
| 01/18(W) | Introduction: why study plants? | Chapter 35 | Prelab 1 activity due before lecture |
| | Lab 1 - Greenhouse tour and scavenger hunt | | Postlab 1 activity due on Thursday |
| 01/20 (F) | Plant body establishment | | |
| 01/23 (M) | Plant growth | Chapter 8 | |
| 01/25 (W) | Energy flow (enzyme and cellular respiration) | Chapter 9 | Prelab 2 activity due before lecture |
| | Lab 2 - Enzyme | | Postlab 2 activity due on Thursday |
| 01/27 (F) | Literature discussion | | |
| 01/30 (M) | Energy flow (Photosynthesis 1) | Chapter 10 | Pop science draft due on Tuesday |
| 02/01 (W) | Energy flow (Photosynthesis 2) | | Prelab 3 activity due before lecture |
| | Lab 3 - Sugar and protein extraction and measurement | | Postlab 3 activity due on Thursday |
| 02/03 (F) | Energy flow (Photosynthesis 3) | | Pop science draft return Take home exam 1 post |
| 02/06 (M) | Energy flow (Photosynthesis 4 and photorespiration) | | Pop science due on Tuesday |
| 02/08 (W) | Sucrose, starch and phloem transport | Chapter 36 | Prelab 4 activity due before lecture |
| | Lab 4 - Chloroplast pigments and proteins | | Postlab 4 activity due on Thursday |
| 02/10 (F) | Literature discussion | | Pre-poster preparation Take home exam 1 due |
| 02/13 (M) | Water transport | Chapter 37 | |
| 02/15 (W) | Nutrient acquisition | | Prelab 5 activity due before lecture |
| | Lab 5 -Photosynthesis and starch | | Postlab 5 activity due on Thursday |
| 02/17 (F) | Plant growth regulation | Chapter 39 | |
| 02/20 (M) | Plant growth regulation | | Formal lab report-Results/Discussion draft due |
| 02/22 (W) | Responses to biotic stress | | Prelab 6 activity due before lecture |
| | Lab 6 - Transpiration and stomata | | Postlab 6 activity due on Thursday Formal lab report-Results/Discussion draft return on Thursday |
| 02/24 (F) | Literature discussion | | Formal lab report - Abstract/Intro draft due |
| 02/27 (M) | Response to abiotic stress | | Formal lab report - Abstract/Intro draft return Take home exam 2 post on Tuesday |
| 03/01 (W) | Response to abiotic stress | | |
| | Lab 7 - Poster preparation | | Form Lab report due on Thursday |
| 03/03 (F) | Poster presentation | | |
| 03/06 (M) | Poster presentation | | Take home exam 2 due on Tuesday |

Cheng - Animal Section Schedule:

| Date | Topics | Pre-class reading & assessment | Assignment schedule (may change as needed) |
|---------------|---|---|--|
| 03/8 (W) | Evolution of life and diversity on Earth | Chapter 26 | |
| | Lab1 – Evol analysis part 1_PCR amp and sequencing of mt COI | | |
| 03/10 (F) | Methods of reconstructing evolutionary relationships | Chapter 25 | |
| 03/14 – 03/18 | SPRING BREAK week | | |
| 03/20 (M) | Phylogenies of animal kingdom | Chapter 32 | |
| 03/22 (W) | Phylogenies of animal kingdom | | |
| | Lab2 – Anatomical survey of animals across kingdom | | |
| 03/24 (F) | Invertebrate diversity and evolution | Chap 33 | |
| 03/27 (M) | Invertebrates and Chordata diversity and evolution | Chapter 34 | |
| 03/29 (W) | Chordates and Vertebrate diversity and evolution | | |
| | Lab3 - Evol analysis part 2_phylogenetic reconstruction of species tree using mt COI sequences | | |
| 03/31 (F) | Vertebrate diversity and evolution | | |
| 04/03 (M) | Osmotic and ionic balance | Chapter 44 | |
| 04/05 (W) | Non-renal and renal osmoregulation | | Take home exam 1 posted |
| | Lab4 – Osmotic strategies part 1_set up experimental aquaria | | |
| 04/07 (F) | Non-renal and renal osmoregulation; excretion | | |
| 04/10 (M) | Sars-CoV2 briefing; Vertebrate Immune System | Chapter 43 | Take home exam 1 due |
| 04/12 (W) | Vertebrate Immune System | | Formal lab report choice1 (Labs1+3) draft due |
| | Lab5 - Osmotic strategies part 2_final osmolality and ion concentration measurements and analyses. (Acclimation of animals will take place between labs 4 and 5) | | |
| 04/14 (F) | Circulatory systems and physiology | Chapter 42 | |
| 04/17 (M) | Respiratory systems and function | | PopSci draft due |
| 04/19 (W) | Respiratory physiology and blood gas exchange | | Comments on formal lab report choice1 returned |
| | Lab 6 – O ₂ binding characteristics of invert. and vert. hemoproteins | | |
| 04/21 (F) | Digestive systems and functions | Chapter 41 | |
| 04/24 (M) | Digestive systems and functions | | PopSic final due |
| 04/26 (W) | Nervous systems and neuron structures | Chapter 48 | Formal lab report choice2 (Labs4+5) draft due |
| | Lab 7 - Data round table and Preparations for power point presentation | | |
| 04/28 (F) | Nerve signal transmission | | Final formal lab report choice1 due |
| 05/01 (M) | Sensory systems, signal transduction | Chapter 49 | |
| 05/03 (W) | Motor output | | Comments on formal lab report choice2 returned |
| | Lab7 – PPTX project presentation | | |
| 05/04 (Th) | READING DAY | | Take home Exam 2 posted |
| 05/09 (Tu) | | | Take home Exam 2 due |
| 05/12 (F) | | | Final formal lab report choice2 due |