

IB 270: EVOLUTION OF MOLECULES AND CELLS

FALL 2021

Discussion section time: MWF 11.00 - 11.50am (Natural History Building 4014)

Lab time: Wednesday 1pm – 5pm (Natural History Building 4016)

Required Text: Genomes 4 by T.A. Brown (full-text pdf available free through UIUC Library)

COURSE OVERVIEW

Life on earth is characterized by a mind-boggling organismal diversity. Incredibly, the same set of core molecules (DNA, RNA, proteins, carbohydrates, and lipids) is responsible for constructing all of this incredible organismal diversity. This IB Honors course, IB270: The Evolution of Molecules and Cells, explores how these fundamental building blocks shape life around us and delves into the technological advances that have helped us uncover and manipulate these processes. Through lectures and discussions, students are exposed to diverse research areas including molecular biology, genetics, genomics, bioinformatics, and systems biology. Laboratory activities reinforce how experimental and computational approaches are used to unravel how genotypes influences phenotypes, with a strong focus on student-directed learning. Historical and societal context for the research techniques and findings are discussed.

Learning Objectives

- Understand the scientific process of hypothesis testing, experimental design, data collection, and interpretation of results.
- Read critically primary literature on a range of topics.
- Hone writing skills for a range of audiences.
- Apply knowledge of molecular processes to design and complete an original research project.
- Describe the molecular and cellular processes responsible for regulating biological systems, and how these systems vary in different organisms.
- Understand both how these processes have evolved, and how these same processes in turn influence evolutionary outcomes.
- Appreciate how rapid technological advances in your lifetime have fundamentally re-shaped biological research.
- Integrate an understanding of diverse topics to build a systems-biology perspective of fundamental biological processes.
- Discuss the history of the field and modern-day ethical context of genome sequencing and editing.

CONTACT INFORMATION

Instructor: Dr. Eva K Fischer

Office location: Morrill Hall 683

Email: efischer@illinois.edu

One-on-one support: Tuesday 4.30 - 5.30pm (Morrill 683), Friday 12pm - 1pm (NHB 4014), or by appointment

About Me: I am faculty in the Department of Evolution, Ecology, and Behavior at UIUC. My research how the brain makes behavior and how behavior. To learn more and see some pictures of the awesome frogs we work with, visit ekfischerlab.com. I grew up in Colorado, got my BA at Cornell University, my PhD at Colorado State University, and spent time as a postdoc on both coasts (MA and CA). In between I worked and taught for a year in the middle east. In addition to science my favorite things are my friends and family, my very silly cat, being outside, and baked goods (making and consuming).

Teaching Philosophy: My teaching philosophy relies fundamentally on the idea that the classifications of teacher (one who has knowledge) versus learner (one who seeks knowledge) are context dependent and non-mutually exclusive. Teaching has been central to my own learning, often in ways that go beyond the immediate subject material. Diverse research and learning communities magnify the ability of all members to teach and learn, leading to more efficient and creative outcomes. As an educator, I strive to create communities of learning that instill students with curiosity and critical thinking skills and empower students to realize their potential as learners and architects of their own education.

Teaching Assistant: Faith Hardin

Office location: Morrill Hall 533

Email: fhardin2@illinois.edu

One-on-one support: by appointment

About Me: I am a first year PhD student with Dr. Eva Fischer in the Department of Evolution, Ecology, and Behavior at UIUC. I previously earned my Masters degree at Texas A&M University on the impact abandoned woodpecker nests have on secondary cavity nesting bird species (birds that require a cavity to nest in but can't create the cavity themselves), in southern Texas. As I begin my PhD I am interested in the parental behavior of the coqui frog, common in Puerto Rico, and an invasive species in Hawaii. Between my undergraduate degree and my Masters, I worked for four years as a wildlife technician and traveled all over the continental US. In my free time I like to cook weird foods, swim, and go hiking.

COURSE STRUCTURE

This is a 5 credit (!) course with both a lecture and a lab. Typically, each credit is ~3 hours of work a week, so you should plan on spending ~15 hours per week on this class. Note that actual time commitments will vary week to week, as well as depending on your input, needs, and study habits. All course material for both the lecture and the lab will be posted on Moodle, so make sure you familiarize yourself with the course site and check it often.

Lecture

We will have a flipped classroom this year. That means you'll watch lectures at home and do activities/assignments together in class. The goal here is to have a more active learning environment by taking advantage of class time for review, practice, and interaction.

The general structure will be the same each week:

Monday: Quiz of previous weeks material, review, group work.

Wednesday: Review, group work.

Friday: Discussion section. Assignment(s) due.

You are expected to (1) complete the lessons (i.e. short lecture videos and practice questions posted on Moodle) prior to coming to class on Wednesday and (2) to complete the discussion reading and write a discussion post each week by Thursday at 11.59pm. Only by looking at the material in advance will you be able to fully participate and to maximize gains from class time.

Lab

You will have a four-hour lab session each week. You **MUST** come to lab prepared, which means you will need to complete any pre-lab materials posted on Moodle **PRIOR** to coming to lab. Sometimes you will also have follow-up activities to complete after lab. For the first few weeks the lab will vary week-to-week, but once you get going on your independent Discovery Project you'll be working much more at your own pace. **NOTE**: this will include coming to regularly scheduled lab times as well as coming in outside of the regular lab session!

*** COVID SAFETY MEASURES ***

The health and safety of all students, faculty, and staff is a top priority of the University, the Department, and the course instructors. We will strictly adhere to the guidelines set out by the University with regards to testing, social distancing, and other safety measures. Make sure you are aware of these policies! covid19.illinois.edu.

We will specifically employ the following safety measures: **(1)** Social distancing will be practiced to the greatest extent possible. **(2)** Masks will be worn by students and instructors at all times. **(3)** Students will be asked to disinfect their hands as they enter the lab. **(4)** Surfaces will be disinfected before and after each lab section (which is good lab practice under all circumstances!). **(5)** No food or drink in the lab (which is also good lab practice under all circumstances!). **(6)** **DO NOT** come to lab if you feel sick or have contact with someone you know has COVID. Anyone who does not adhere to these guidelines will be asked to leave immediately.

COURSE SCHEDULE

Week	Date	Topic	Reading	Lab Activity
1	Aug. 23	Central Dogma: DNA, RNA, and proteins	Ch. 1	Orientation, Pipetting, Worms
2	Aug. 30	Studying Nucleic Acids	Ch. 2, 18.1	DNA Extraction, PCR, BLAST
3	Sep. 6	Studying Genomes 1: mapping and sequencing	Ch. 3, 4.1, 4.2	PCR gel, RNA extraction, DISCOVERY Project Planning
4	Sep. 13	Studying Genomes 2: assembly and annotation	Ch. 4.3, 4.4, 5, 6	qPCR Project Proposal DUE
5	Sep. 20	Studying Genomes 3: types of genomes	Ch. 7, 8.1, 8.2, 9.1	qPCR analysis, DISCOVERY Project Prep
6	Sep. 27	Genome Expression 1: DNA modification	Ch. 10, 11	DISCOVERY Project
7	Oct. 4	Genome Expression 2: transcriptomes	Ch. 12	DISCOVERY Project Methods Draft DUE
8	Oct. 11	Genome Expression 3: proteomes, metabolomes	Ch. 13	DISCOVERY Project
9	Oct. 18	Genome Evolution 1: generating variation	Ch. 18.2, 18.3, 18.4	DISCOVERY Project Introduction Draft DUE
10	Oct. 25	Genome Evolution 2: changing size and complexity	Ch. 14	DISCOVERY Project
11	Nov. 1	Genes in Cells & Organisms 1: environmental responses, development	Ch. 8.3 Readings	DISCOVERY Project Results Draft DUE
12	Nov. 8	Genes in Cells & Organisms 2: endosymbiosis and multicellularity	Readings	DISCOVERY Project Peer Review
13	Nov. 15	Genes in Cells & Organisms 3: microbiomes	Readings	DISCOVERY Project FULL DRAFT DUE
	Nov. 22	FALL BREAK		
14	Nov. 29	Manipulating the Genome	Readings	CRISPR Activity
15	Dec. 6	Ethics and Genomics	Readings	DISCOVERY PRESENTATION & FINAL DRAFT DUE
16	Dec. 13	FINALS WEEK		

COURSE ACTIVITIES

Lessons, Readings, and Resources

Lessons are designed to give an overview of the topic at hand. These lessons are primarily made up of mini-lecture videos, but also include text, pictures, and graphs, as well as questions that are meant for review and to help you study for weekly quizzes. Lessons will not be graded for correctness, but you will review points for completing them on time (i.e. prior to class on Monday). You can also use the in-lesson questions as a study tool. Lessons are supported by assigned readings from the textbook, primary literature, and other sources.

Discussion Section

Each week we will have a discussion section covering reading(s) on a specific topic. Participation in discussions will consist of three parts: (1) reading and commenting on the reading through Perusall, (2) attending and participating in the discussion section, (3) leading one of the discussion sections. Each reading/topic will have an explanation on Moodle of what you need to do to prepare and will be due on Thursday. For most of the readings we will be using Perusall. Perusall is a 'social e-reader' that lets you read, comments, and respond to the questions and comments of others. You can use Perusall through a web browser or their app. It's free, but you'll need to create an account and use our course access code: **FISCHER-YNJEY**

The goal is to jump-start discussion and deeper thinking about the material (and to help me know what things sparked your interest and/or confused you). I'll post a few questions to get you started, but good general topics include: What do you think is the logical next step/experiment for the research we discussed? What current issues do you see with the research and how could they be solved? What are the big-picture biological implications of this work and why? What are the societal implications of this topic?

Assignments

There are several activities in this course that will make up your Assignment grade. You will complete an assignment each week. These may be worksheets or other types of activities. The content and structure of the assignment will have a range of formats, but might include paragraph style answers, drawing diagrams, data interpretation, questions associated with completion of an on-line activity, computational exercises, and/or reflection. You'll typically start these during class, but will submit them through Moodle (due Fridays unless noted otherwise).

Quizzes

Each week you will have a quiz on the previous week's material. Quizzes will be a mixture of multiple choice, true/false, and short answer questions. Your top 12 of 14 quiz scores will count toward your final quiz grade.

Community Participation & Attendance

Community participation is essential to your commitment to the course and the honors program. Thus, 5% of your grade will come from participation in lecture and lab. Given the structure of the class, it is impossible to do well in the class without attending and participating. I hope you won't see 'participation' as just another box to check, but rather as an additional opportunity for learning and a meaningful way of building and engaging in our course community!

ASSESSMENT INFORMATION

Quizzes:	20%
Lecture Assignments:	20%
Lesson Questions:	5%
Discussion board:	5%
Lab Assignments:	5%
Community participation:	5%
Discovery Project:	40%
Project Proposal:	5%
Methods draft:	3%
Introduction draft:	3%
Results draft:	3%
Peer review:	3%
Full draft:	3%
Presentation:	5%
Final draft:	15%
TOTAL	100%

You will receive an automatic 0% on an assignment if you have caught cheating/plagiarizing! Completing assignment for others or having others complete your assignments is also considered cheating (by both parties).

GUIDELINES & EXPECTATIONS FOR COMMUNICATION

One of the biggest benefits of a flipped classroom is ample in-class time to get your questions answered. Take advantage! Outside of class, the Moodle Q&A forum is your first line of defense for all course related questions. Please post general questions about the course logistics and course materials here. This way you are mostly likely to get your questions answered as quickly as possible and others can benefit by being part of the discussion. Note that your instructors may move questions from email to the Q&A forum for this same reason. Questions of a private/personal nature can be sent to you instructors via email

We will always do our best to respond to email in a timely fashion. This means that we will get back to you within 24 hours or less Monday – Friday, 9am-6pm CST. Be aware that response times for emails sent late at night or on the weekends may be longer.

Assessment Feedback Turnaround Time

Please reference your Moodle grade book frequently to ensure your assessments are being submitted properly and that you are earning grades for your work. We recommend keeping all graded assignment until the end of the course in case of discrepancies. Please allow up to 1 week for quiz, assignment, and draft grading.

TIPS FOR SUCCESS

- Communicate, communicate, communicate. We are here to help and want you all to succeed and be well. The best way to ensure this is to communicate early and often about anything that you're worried about or struggling with.
- Log in to Moodle frequently to manage announcements, activities, and messages. If you let things pile up for three to four days, you might be overwhelmed. You should start working on new module content right away as it is posted.
- Stay on track. We've built in deadlines to help, but also recommend making a schedule for yourself to work through the material. This will help you manage your time better, especially in the flipped class-room format.
- Take good notes! Even with the online lecture format and slides provide taking notes is key. Did you know taking notes by hand may be better than typing:
<https://www.chronicle.com/blogs/wiredcampus/taking-notes-by-hand-benefits-recall-researchers-find/51411>
- Use the lecture materials as a guide for what you need to know. Lectures are geared toward the material your instructors think is most important.
- Focus! When you're studying, try to minimize distractions and do focused work for a chunk of them. Then take a mental break (check your phone, check the fridge, check in with a friend). Do NOT do both at the same time.
- Find a study buddy! Explaining things to other is one of the best ways to learn!
- Come to office hours! This is a great way to get your questions answered, learn by listening in on others' questions, and get to know your instructors.

ACADEMIC INTEGRITY

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: <http://studentcode.illinois.edu/>. Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

INCLUSIVITY

The effectiveness of this course is dependent upon the creation of an encouraging and safe classroom environment. Exclusionary, offensive or harmful speech (such as racism, sexism, homophobia, transphobia, etc.) will not be tolerated and in some cases subject to University harassment procedures. We are all responsible for creating a positive and safe environment that allows all students equal respect and comfort. I expect each of you to help establish and maintain an environment where you and your peers can contribute without fear of ridicule or intolerant or offensive language.

NETTIQUETTE

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 Chuq Von Rospach and Gene Spafford (1995):

- Remember that the person receiving your message is someone like you, deserving and appreciating courtesy and respect.
- Avoid typing whole sentences or phrases in Caps Lock.
- 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.

SUPPORT RESOURCES & SUPPORTING OTHERS

As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regards to their well-being or yours, we encourage you to refer this behavior to the Student Assistance Center (1-217-333-0050) or online at odos.illinois.edu/community-of-care/referral/

As a Community of Care, we want to support you in your overall wellness. We know that students sometimes face challenges that can impact academic performance (examples include mental health concerns, food insecurity, homelessness, personal emergencies). Should you find that you are managing such a challenge and that it is interfering with your coursework, you are encouraged to contact the Student Assistance Center (SAC) in the Office of the Dean of Students for support and referrals to campus and/or community resources. The SAC has a Dean on Duty available to see students who walk in, call, or email the office during business hours. For mental health emergencies, you can call 911 or contact the Counseling Center.

ACCOMODATIONS

To obtain disability-related academic adjustments and/or auxiliary aids, you must contact your 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, e-mail disability@illinois.edu or go to the DRES website.

SEXUAL MISCONDUCT POLICY AND REPORTING

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX and Disability Office. In turn, an individual with the Title IX and Disability Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: <https://wecare.illinois.edu/resources/students/#confidential>

Other information about resources and reporting is available here: wecare.illinois.edu

FAMILY EDUCATIONAL RIGHTS AND PRIVACY ACT (FERPA)

Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the privacy of their attendance in this course. See <https://registrar.illinois.edu/academic-records/ferpa/> for more information on FERPA.

EMERGENCIES

Emergency response recommendations can be found at the following website: <http://police.illinois.edu/emergencypreparedness/>. I encourage you to review this website and the campus building floor plans website within the first 10 days of class. <http://police.illinois.edu/emergency-preparedness/buildingemergency-action-plans/>.