Katy Heath
Plant Biology/Integrative Biology
Office: 249 Morrill Hall
Office hours: TBD
Email: kheath@illinois.edu

IB 405, Spring 2021
T/Th: 11:00-12:20 PM
Online only

Integrative Biology 405: Evolution of Traits and Genomes
Course Moodle: https://learn.illinois.edu/

Course introduction: Tackling the major challenges facing biology today, including global climate change, world food supply, and conservation, requires understanding organisms and how they evolve. Understanding evolution requires that we investigate the **genetic underpinnings of ecologically-relevant traits in natural populations**. This is truly the heart of a diffuse field, centered in evolutionary biology, but straddling ecology, evolution, genetics, and genomics, while increasingly incorporating molecular biology and bioinformatics, and with relevance to applied sciences in medicine, agriculture, conservation and beyond.

IB405 is designed to be of use to you, independent of where you go next – whether you are already in graduate school in biology, aim to do research in graduate school, or even if you graduate from college and do something completely different. Thus the learning objectives of this course center on two **teaching goals**:

1) Expose you to current work in evolutionary biology through research questions, approaches, and key research findings that are typical of this field.
2) Build your generalizable skill set: both scientific skills, as well as the attributes that all

employers want from recent graduates (AACU).

Course learning objectives: Course content, activities, and assessments are designed to help you:

1) gain mastery of evolutionary biology, including basic quantitative genetics, population genetics, coevolution, and evolutionary genomics.
2) improve problem-solving, intellectual agility, and written/verbal communication skills.
3) get into graduate school in biology and/or succeed once you are there, if that's your goal.
4) work effectively in a team (via negotiation, listening, conflict resolution)
5) develop into a working scientist/evolutionary biologist!

Below is the breakdown of how we tackle these course objectives each week:
In 2021, we are online, so this is my current plan, but we might shake things up:

A. Lecture and Book readings (asynchronous: ~2 short recorded lectures per week): Lectures and accompanying readings are my main avenue for communicating course content. Lectures are designed to give you an overview of the types of research questions and approaches typical of research in this field. Lectures will complement and highlight, not duplicate, book readings. **Plan to do your book readings - I promise you they are worth it**. Weekly book readings (as opposed to discussion papers - see below) are mostly from the Conner and Hartl text, though we will cover additional topics. Reading assignments (book) and/or PDFs (other) will be posted on each week's page in Moodle, and a full course schedule is here and copied below.

B. Tuesday formative assessments (alternating weeks): Every other Tuesday, I will ask you to synthesize course materials from the previous 2 weeks - including lectures, book, and discussion readings. Tuesday activities will take the form of ***problem sets, mini proposals, mini papers, etc.*** These are all forms of formative assessment, which force you to apply concepts or equations, synthesize materials, and otherwise interact with the course content more actively than in a lecture. These formative assessments are designed to help you confront how well you understand material before the exams. Activities will happen individually, in groups, or both. We will work together in Zoom breakout rooms in groups of various sizes depending on the format that week, and you will hand in work via Moodle. If we don't finish during class time, these assessments can be turned in after class, as long as you attended the synchronous session.
**Since lectures and book readings happen asynchronously (on your own time) each week, we will use alternating Tuesdays as office hours, check-ins, and additional discussion time.*

C. Paper discussions (Th each week): Reading, processing, and discussing the primary literature reinforces course content and builds critical skills useful in science and elsewhere (Soranno 2010). ***Pre-class contributed discussion questions*** help both of us assess your understanding of the paper and prepare you for a lively discussion.

D. Exams (one midterm and a non-cumulative final): In addition to formative assessments, the ***two exams*** will require that you spend some time reflecting on course material, assessments and readings, and synthesize the course content across units.

E. Final radio spot project: During the latter half of the semester, you will have the opportunity to apply your evolutionary understanding to a more specific topic of your own choosing in preparing a radio spot. In the final weeks of the semester, this work may take the place of Tuesday formative assessments.

Why this format? My philosophy: I want you to engage with the course material each week, rather than passively listen until you need to study for an exam, since we know that's not how we learn (Handelsman et al. 2007). I try to accomplish this by reducing the emphasis on lecture and exams and increasing the emphasis on weekly readings and discussions, writing, and in-class work. *Thus you should expect to stay on top of lectures and readings so you're prepared for formative assessments.*

Course text: Conner J.K., and Hartl, D.L. 2004. A primer of ecological genetics. Sinauer Associates, Inc. Sunderland, MA.

Final grades will be assigned as follows:
Tuesday formative assessments ……. 30%
Thursday paper discussions (forum question) …….. 15%
Thursday discussions (attendance & participation) …….. 10%
Exams (2) …….. 30%
Draft radio spot ……. 5%
Peer feedback on radio spots …… 5%
Final radio spot ……. 5%

Grading scale: Generally, 90% and up will receive an A, 80% and up a B (and so on). I will assign +/- as well using a standard scale (90-92 is A-, 87-89 is B+ and so on).

This course will follow all policies in the Student Code:
http://studentcode.illinois.edu

Attendance: Your attendance in class is mandatory for both participation and graded formative assessment points (*i.e.* assessments may not be performed asynchronously and turned in for credit). If you need to be excused for any reason, please talk to me. You will need approval from me and/or documentation (doctor's note, athletic department note, emergency dean approval) in order to make up missed assignments. In the case of absences, excused or otherwise, it is your responsibility to get caught up on content that you missed by getting notes from your peers, reading, etc. and contact me about make-up assignments and/or pro-rates (depending on the nature of the missed work and the length of illness). Please do this as soon as possible after missing, or in advance if you know you will miss class.

Academic integrity: See Article 104 (1-401 through 1-406) of the Student Code. This rule defines infractions of academic integrity, which include but are not limited to cheating, fabrication, and plagiarism. To learn more, including possible penalties, see the following website. You are responsible for being knowledgeable about what these infractions are and for following these guidelines. http://www.admin.illinois.edu/policy/code/article1_part4_1-401.html

Accommodations: If you require special accommodations, please tell me within the first two weeks of class. All accommodations will follow the procedures as stated in Article 1-110 of the Student Code:
http://www.admin.illinois.edu/policy/code/article1_part1_1-110.html

References:

Handelsman, J., Miller, S., and Pfund, C. 2007. Scientific teaching. W.H. Freeman and Company. New York, NY.
Soranno., P.A. 2010. Improving student discussions in graduate and undergraduate courses: transforming the discussion leader. J. Nat. Res. Life Sci. Ed. 39: 84-91.

Week of Class	**Topic**	**Book reading**
Week of January 25	Pop Gen 1: Genetic variation and Hardy-Weinberg review	Chapter 1 and 2
Week of February 1	Pop Gen 2: Balance of neutral forces	Chapter 3 (to pg. 66)
Week of February 8	Pop Gen 3: Selection and intro to molecular evolution	Chapter 3
Week of February 15	Quant Gen 1: Additive model and variance partitioning	Chapter 4 (to pg. 150)
Week of February 22	Quant Gen 2: G x E	Finish Chapter 4
Week of March 1	Quant Gen 3: Genetic correlation	Chapter 5 (to pg. 170)
Week of March 8	Quant Gen 4: Mapping	Finish chapter 5
Week of March 15	***Midterm Tuesday March 16 (covers Quant Gen 3)***	
Week of March 22	Selection on traits 1: Phenotypes	Chapter 6 (to pg. 216)
Week of March 29	Selection on traits 2: G matrix and the evolutionary response	Finish chapter 6
Week of April 5	Ecological Genomics	Hohenlohe 2010
Week of April 12	Community Genetics	Crutsinger et al. 2016
Week of April 19	Coevolutionary Genomics	Thompson 2005 ch 1 & 5
Week of April 26	Applied Evolution	Chapter 7
Week of May 3	***Exam 2 Tuesday May 4 (Quant Gen 4 - Applied Evolution)***	