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IB 405, Spring 2019
T/Th: 11:00-12:20 PM
2020B NHB

Integrative Biology 405: Ecological Genetics
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 Ecological Genetics, a diffuse field that straddles ecology, evolution, and genetics, and increasingly incorporates molecular biology, bioinformatics, and genomics.

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 Ecological Genetics through research questions, approaches, and key research findings that are typical of this field.
2) Build your 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/ecological geneticist!

Below is the breakdown of how we tackle these course objectives each week!

A. Lecture (T and Th each week): Lectures and accompanying readings (from the Conner and Hartl 2004 text) are my main avenue for communicating course content. Both are designed to give you an overview of contemporary research questions and approaches, as well as the knowledge base (facts!) already acquired through research in this field. Lectures will complement and highlight, not duplicate, book readings. Never fear - though I study plants and microbes, I incorporate a range of taxa into lectures.

B. Tuesday formative assessments (T each week): Tuesdays I will ask you to synthesize course materials from the previous week. Tuesday activities will take the form of ***mini proposals, mini papers, mini presentations, case studies, and/or problem sets*** – all forms of formative assessment. These weekly activities let you apply/interact with the course content and give you feedback about how well you understand it. Activities will be performed in groups, individually, or both.

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. In addition, writing ***three critical reviews*** during the semester will help you improve your critical analysis and scientific writing.

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

BUT WHY?! I recognize that the format of this course is a little different – that's the whole point. 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. Because of this format, *you should expect to stay on top of lectures and readings and be held accountable for the readings and lecture materials each time I see you*.

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

Assignments (see A-C above for more explanation):

Tuesday assessments (drop lowest score):	20 pts x 12 weeks = 240 pts
Paper discussions (attendance, participation, forum question)	5 pts x 12 weeks = 60 pts
Critical reviews (three per semester):	20 pts x 3 = 60 pts
Exams:	50 pts x 2 exams = 100 pts
Final paper (1st draft):	25 pts
Peer workshop feedback	25 pts
Final paper (final draft):	50 pts
TOTAL:	***560 pts***

Late assignments will not be accepted.

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: You will be responsible for daily assignments and thus cannot afford to miss class sessions. If you need to be excused for any reason, please talk to me. You will need prior approval from me and/or documentation (doctor's note, athletic department note, emergency dean approval) in order to make up any missed assignments. In the case of absences, excused or otherwise, it is your responsibility to 1) get caught up on content that you missed by getting notes from your peers, reading, etc., and 2) contact me about make-up assignments and/or pro-rates, depending on the nature of the missed work and the length of illness, and within 1 week of missing the activity.

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

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Schedule of topics:
*In most weeks, Tuesday will feature formative assessment (on previous week's material) followed by lecture, and Thursday will feature lecture followed by paper discussion. Variation from that schedule is indicated in some weeks below. You will interact with the syllabus, quizzes, dates, and paper assignments on the **Moodle page**, where I post detailed activities.*

Week of January 14: Genetic variation & Population genetics. 1: Hardy-weinberg
Week of January 21: Population genetics 2
Week of January 38: Population genetics 3: mutation and drift
Week of February 4: Population genetics 4: natural selection and intro to molecular evolution
Week of February 11: Quantitative genetics 1: the additive model and variance partitioning
Week of February 18: Quantitative genetics 2: G x E and genetic correlation (end of Exam 1 material)
Week of February 25: Quantitative genetics 3: mapping
Week of March 4: Exam 1
Tuesday March 5: EXAM 1
Week of March 11: Measuring selection 1: phenotypes
Week of March 18: Spring break!
Week of March 25: Selection and the evolutionary response
Week of April 1: Ecological genomics: molecular tests of selection
Week of April 8: Community genetics
Week of April 15: Coevolutionary genomics
Week of April 22: Applied ecological genetics
Week of April 29: Last class, Exam 2
Tuesday April 30: Non-cumulative EXAM 2

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.