ANSC 446 / IB 416: Population Genetics

Spring 2022

Dr. Alfred Roca
Department of Animal Sciences
432 Animal Sciences Laboratory
roca@illinois.edu
Office Hours Monday & Wednesday after class, with additional office hours before exams
Updates to syllabus: are not anticipated but would be summarized here

Course Description

Conceptual and mathematical approach to the genetics of populations: estimation of allele and genotype frequencies; Hardy-Weinberg principle; measures of genetic diversity and distance; selection; non-random mating; genetic drift; mutation; neutral theory; migration and population subdivision; linkage and recombination; coalescence and phylogenetic inference. Applications to animals, plants, human health and conservation. Course materials will be placed on Compass. All course materials including lecture notes, exams and problem sets are copyrighted and may not be distributed to others or to websites.

Pre-Requisite: An introductory genetics course (ANSC 221 or IB 204); one of MATH 220, MATH 221, or MATH 234; or consent of instructor.

Textbook: There is no required textbook for this course. For students seeking to explore topics further, the following book would be appropriate: Hedrick, P.W. *Genetics of Populations.* Fourth Edition. Sudbury, MA: Jones and Bartlett Publishers. Upon request, additional textbooks on population genetics can be recommended.

Course Schedule and Structure

This course schedule is below. Course materials will be uploaded to Compass.

Lectures

The lectures are critical for success in this course. Students should take detailed notes that include materials presented in slides in addition to other information presented verbally throughout the course. Keep track of the key points and concepts presented. Lecture slides and other relevant materials will be posted on *Compass* each week and will remain available for review throughout the semester. Additional credit for attendance may be provided but is not anticipated. Additional assignments for extra credit are not part of the course.

Exams 1 to 3 (20% each, 60% total; but for 4-credit option see below)

Lectures are organized into several units over the course of the semester, and will conclude with a final. Exams 1 to 3 are each worth twenty percent of your grade. Exams may be in a room different from the lecture room. Many questions will be similar to those of problem sets and previous exams. Preparation and study prior to the exams will be quite essential for success. Exams are closed-book, only a pencil and a simple calculator are allowed (the formula sheet will be provided with the exam).

Final (40% of total; but for 4-credit option see below)

This final will be cumulative for the semester and cover all course material. Many questions will be

similar to those of previous exams and finals. The final is closed-book, only a pencil and a simple calculator are allowed (the formula sheets will be provided with the final).

Problem sets and past exams

Problem sets and past exams will be posted on Compass and are a very strong necessity in preparing for exams and the final. While these are not graded, the answers will be provided on Compass. Please make sure that you keep up with these as they become available, so as not to fall behind, and to do well in the exams. Formula sheets will be provided that should be used when working on the problem sets and past exams; a copy of the formula sheet(s) will be provided with the exams and final.

Four-credit option (please ignore if taking the course for 3 credits)

Students registering for 4 credit hours must write a report that comprises 25% of the final 4-credit grade; this means that under the 4-credit option only, the proportion of the grade will be 15% each for exams 1-3 and 30% for exam 4. Two options are possible if taking the course for 4 credits: (1) a computer software or modeling project in some area of population genetics with a project report; or (2) a written review of the literature regarding the population genetics of a taxon, or a particular topic of interest to you in the field. Further details and due dates will be provided in a separate document, including the due date for a one paragraph summary or abstract of the proposed project, and the due date for the report. The final written report in the form of a scientific article with primary references. To switch between 3 and 4 credits: Go to Student Self-Service > Registration & Records > Add/Drop Classes. Click on the ANSC 446 or IB 416 link, change credit hours, click submit.

Course Schedule

There may be adjustments to the schedule below as the semester progresses.

Day	**Date***	**Topic****
Wed	1/19	Introduction (online)
Fri	1/21	Review (online)
Mon	1/24	Review and Probability
Wed	1/26	Probability
Fri	1/28	Hardy-Weinberg principle and allele frequencies
Mon	1/31	Hardy-Weinberg principle and allele frequencies
Wed	2/2	Bayesian probability
Fri	2/4	Hardy-Weinberg principle and allele frequencies
Mon	2/7	Genetic variation, diversity and distance
Wed	2/9	Genetic variation, diversity and distance
Fri	2/11	Genetic variation, diversity and distance
Mon	2/14	Selection
Wed	2/16	Selection
Fri	2/18	**FIRST EXAM, 1 hr 45 min, see note below*** **
Mon	2/21	Selection
Wed	2/23	Selection
Fri	2/25	Selection **(topic for 4-credit project due)**
Mon	2/28	Selection
Wed	3/2	Selection
Fri	3/4	Inbreeding
Mon	3/7	Inbreeding

Wed	3/9	Inbreeding
Fri	3/11	Genetic drift and effective population size
		Spring break week 3/12-20
Mon	3/21	Genetic drift and effective population size
Wed	3/23	Genetic drift and effective population size
Fri	3/25	**SECOND EXAM, 1 hr 45 min, see note below*** **
Mon	3/28	Genetic drift and effective population size
Wed	3/30	Mutation
Fri	4/1	Mutation
Mon	4/4	Neutral theory, coalescence and selection
Wed	4/6	Neutral theory, coalescence and selection
Fri	4/8	Neutral theory, coalescence and selection
Mon	4/11	Gene flow, **4-cr project due**
Wed	4/13	Gene flow & population structure
Fri	4/15	Gene flow & population structure
Mon	4/18	Linkage and recombination
Wed	4/20	Linkage and recombination
Fri	4/22	**THIRD EXAM, 1 hr 45 min, see note below*** **
Mon	4/25	Linkage and recombination
Wed	4/27	Molecular genetics/phylogenetics
Fri	4/29	Molecular genetics/phylogenetics
Mon	5/2	Phylogenetics (Revisions if any to 4-cr project due)
Wed	5/4	Molecular genetics/phylogenetics
MON	5/13	**FINAL, 8:00-11:00 AM, Room 107 ASL**

*Dates are approximate; Guest lecturers may be invited regardless of topic
**Classes are in 107 ASL unless otherwise listed or announced by instructor
***Exams are 1 hr 45 min. Students without a conflict at 2:00 can take them from 1:00-2:50 PM in 107 ASL. Students with a conflict at 2:00 will take them at another time on the same day (e.g., 12:00-1:50, or a different time scheduled with the instructor).

Course and University Policies

General

It is important that, long before each exam, the problem sets and previous exams are worked on, using the formula sheets provided. These are quite necessary for doing well on the course.

University of Illinois Student Code

Academic integrity will be maintained and upheld to the highest standard in this course. Infractions of academic integrity include but are not limited to cheating, fabrication, and plagiarism. It is the responsibility of the 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. Plagiarism constitutes intellectual dishonesty and undermines trust between members of the academic college community. It is the student's responsibility to understand and avoid plagiarism and cheating. Ignorance and lack of intent are not valid excuses. Penalties involving plagiarism are serious offenses

and can result in loss of grade, loss of class standing, and further disciplinary action on the campus level. Details on the University of Illinois policy can be found at http://studentcode.illinois.edu/

Students with Disabilities

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor as soon as possible. To ensure that disability-related concerns are properly addressed from the beginning of the course, students with disabilities who require assistance to participate in this class should contact Disability Resources and Educational Services (DRES) and contact the instructor as soon as possible. If you need accommodations for any sort of disability, please speak to the instructor after class, make an appointment to see him, or see him during scheduled office hours. DRES provides students with academic accommodations, access, and support services. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TDD), or e-mail a message to disability@uiuc.edu. http://www.disability.illinois.edu/.

Emergency Response Recommendations

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

Family Educational Rights and Privacy Act (FERPA)

Any student who has suppressed their directory information pursuant to the 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 http://registrar.illinois.edu/ferpa for more information on FERPA.