

SYLLABUS
GENE 8150, Fundamentals of Evolutionary Genetics
Fall Semester 2021

MW 9:10 – 10:00 am (C130) & M 1:00 – 4:00 pm (C128)

Instructors: Casey Bergman (cbergman@uga.edu)
Jill Anderson (jta24@uga.edu)

Office Hours: By appointment. Remote meetings *via* zoom are strongly preferred. In-person meetings can be requested, but will be held exclusively outside.

Course Description: This 3-credit course will be taught in two modules: the first module will cover theoretical and experimental approaches to the study of population genetics and molecular evolution (weeks 1-7), and the second module will cover quantitative genetics (weeks 8-15). This course will blend lecture, practical, and discussion formats to provide you with an opportunity to become familiar with some important tools in evolutionary genetics, and to improve your quantitative reasoning skills in the context of evolutionary genetics. The course is intended to introduce you to modern advances and questions in evolutionary genetics, and to help you begin the transition from undergraduate to professional scientist. Students in this course should have had the equivalent of at least a one-semester course in evolutionary biology, introductory genetics, and be prepared to pursue independent reading and learning. Evolutionary genetics often uses mathematics, and so you should feel comfortable with algebra and basic statistics. However, this is not a course in mathematics – the goal is to appreciate how models and equations are used to understand evolution.

Course Logistics: Some classes will consist of question/answer sessions covering pre-recorded lectures. Viewing of pre-recorded videos in the first module prior to class is mandatory for passing the course. Other classes will consist of student-led discussions of readings from the primary literature. Participation in discussions is expected of all students and will affect your grade. Practical sessions will vary, with some introducing evolutionary or programming concepts, and others requiring analysis of data. Most practicals will be associated with a homework assignment that is due the following week. All classes will be streamed live on zoom (but not recorded) to allow remote participation.

Course Objectives and Expected Learning Outcomes:

During the course, students will:

- 1) Learn the fundamentals of evolutionary genetics/genomics
- 2) Be exposed the basic theoretical framework of evolutionary genetics/genomics
- 3) Learn some of the approaches used to address problems in evolutionary genetics
- 4) Learn how to approach new topics or ideas outside their area of familiarity
- 5) Learn how to solve problems and when to use mathematical and statistical approaches
- 6) Learn how to effectively utilize the literature
- 7) Develop both written and oral communication skills
- 8) Develop intellectual independence

Readings: We will assign readings from the primary literature throughout the course. All readings will be made available on eLearning Commons. There is no required textbook for this course, but you may find it helpful to refer to *Principles of Population Genetics* by D. L. Hartl and A. G. Clark, *Evolution* by D. Futuyma and M. Kirkpatrick, *Evolutionary Genetics* by J. Maynard-Smith, and *Elements of Evolutionary Genetics* by B. Charlesworth and D Charlesworth. In addition, Joe Felsenstein has an excellent book, *Theoretical Evolutionary Genetics*, which is available for download as a pdf from: <http://evolution.genetics.washington.edu/pgbook/pgbook.html>.

Exams: We will give one exam in this course, at the end of the first section of the course. Makeup exams will only be given in the case of a documented medical or extreme personal emergency. It is the student's responsibility to provide relevant documentation.

Assignments: Assignments will generally be given during lab sections and must be turned in either at the end of lab or *by the beginning of class* on the due date (generally the next lab period). Failure to turn in an assignment when due will result in zero points, except in the case of a documented medical or extreme personal emergency. You may work with other students in the course on the assignments, but names of all collaborators must be indicated on your turned-in work.

Attendance: Viewing of pre-recorded videos prior to class is MANDATORY for passing the course. There will be a live (non-recorded) zoom cast of all class sessions to allow remote participation. Participation in class sessions (either in-person or remote) is expected of all students and will affect your grade. In-person attendance for class sessions is OPTIONAL for the first module (weeks 1-7) and REQUIRED for the second module (weeks 8-15). You are responsible for course material on days when you are absent. Please do not attend class or office hours if you are sick.

Religious holidays: If you plan to miss a class to observe a religious holiday, you must talk to an instructor at least 14 days prior to the class to make arrangements to make-up missed work.

Grading: Assignments, participation in discussions, and the exam in each section of the course will be count as 1/2 of your final grade. In each section, the exam is worth 25% and the assignments and discussions are worth 25%.

Cell phones: Please TURN OFF your cell phones during class AND office hours.

Rigor, Reproducibility, and Transparency (RRT): Rigor, reproducibility, and transparency are the cornerstones of scientific research. This course will help you develop general RRT skills from the standpoint of evolutionary genetics and specifically by having you reproduce results from the primary literature in practical sessions. When reading primary literature for discussion sessions, critically evaluate the efforts that authors have made to ensure RRT in their publications. When using new software in practical sessions and developing responses to homework exercises, pay careful attention to maximizing RRT in your own work practices and written communication. Evolutionary genetics research is highly quantitative, exacting, and often requires analysis of large datasets, and thus training in RRT is a crucial part of learning to become a practicing evolutionary geneticist.

Academic Honesty: All academic work must meet the standards contained in "A Culture of Honesty." Students are responsible for informing themselves about those standards before performing any academic work. All suspected incidences of academic dishonesty will be treated following UGA guidelines (honesty.uga.edu).

Accessibility Statement: We are committed to helping every student succeed in this course. Your performance depends on active participation in classroom discussions, completion of lab activities, completion of assignments, and your mastery of the material as demonstrated on exams. If there are circumstances that may affect your ability to succeed, please speak with the instructors at the beginning of the semester so that we can develop strategies to meet both your needs and the requirements of the course. If you plan to request accommodations for a disability, please register with the Disability Resource Center, 114 Clark Howell Hall, Athens, GA 30602. Phone: 706-542-8719 Fax: 706-542-7719 Email: dsinfo@uga.edu.

Date	Preliminary Order of Topics (subject to change)	Instructor
M 23-Aug	Lecture 1: Hardy-Weinberg Equilibrium and Mutation Pressure Lab 1: Introduction to R	CB
W 25-Aug	Lecture 2: Natural Selection	CB
M 30-Aug	Lecture 3: Genetic Drift Lab 2: Population Genetics Simulation in R	CB
W 1-Sep	Lecture 4: Non-random mating and migration	CB
M 6-Sep	Labor Day, no class	---
W 8-Sep	Lecture 5: Coalescent theory	CB
M 13-Sept	Lecture 6: Molecular evolution I: patterns of molecular evolution and testing for selection using divergence data Lab 3: Lysozyme Lab	CB
W 15-Sept	Discussion 1: Lysozyme discussion	CB
M 20-Sept	Lecture 7: Molecular evolution II: Molecular clock and testing for selection using polymorphism and divergence data Lab 4: Plasmodium lab	CB
W 22-Sept	Discussion 2: Plasmodium discussion	CB
M 27-Sept	Lecture 8: Gene duplication Lab 5: Amylase lab	CB
W 29-Sept	Discussion 3: Amylase discussion	CB
M 4-Oct	Lab 6: Exam 1	CB
W 6-Oct	no class	---
M 11-Oct	Lecture and discussion: Complex traits and partitioning phenotypic variation	JA
M 18-Oct	Lecture and Lab 7: Complex traits II: Testing for genetic variation and heritability in complex traits	JA
M 25-Oct	Lecture and Lab 8: Selection on complex traits II: Measuring and inferring selection. Genetic response to selection	JA
M 1-Nov	Lecture and Lab 9: Mapping complex traits. QTL mapping for traits and fitness components	JA
M 8-Nov	Lecture and Lab 10: GWAS (Genome-wide Association Studies)	JA
M 15-Nov	Lecture and Lab 11: Life history theory and genetic tradeoffs	JA
M 22-Nov	Lecture and Lab 12: Life history theory II and phenotypic plasticity	JA
M 29-Nov	Lecture and Lab 13: Evolutionary consequences of global change	JA
M 6-Dec	no class	---

Coronavirus Information for Students for Fall 2021 Classes

Face coverings:

Following guidance from the University System of Georgia, face coverings are recommended for all individuals while inside campus facilities.

How can I obtain the COVID-19 vaccine?

University Health Center is scheduling appointments for students through the UHC Patient Portal (https://patientportal.uhs.uga.edu/login_dualauthentication.aspx). Learn more here: <https://www.uhs.uga.edu/healthtopics/covid-vaccine>.

The Georgia Department of Health, pharmacy chains and local providers also offer the COVID-19 vaccine at no cost to you. To find a COVID-19 vaccination location near you, please go to: <https://georgia.gov/covid-vaccine>.

In addition, the University System of Georgia has made COVID-19 vaccines available at 15 campuses statewide and you can locate one here: <https://www.usg.edu/vaccination>

What do I do if I have COVID-19 symptoms?

Students showing COVID-19 symptoms should self-isolate and schedule an appointment with the University Health Center by calling 706-542-1162 (Monday-Friday, 8 a.m.-5p.m.). Please DO NOT walk-in. For emergencies and after-hours care see: <https://www.uhs.uga.edu/info/emergencies>.

What do I do if I test positive for COVID-19?

If you test positive for COVID-19 at any time, you are **required to report it** through the [DawgCheck Test Reporting Survey](#). We encourage you to stay at home if you become ill or until you have excluded COVID-19 as the cause of your symptoms. UGA adheres to current Georgia Department of Public Health (DPH) quarantine and isolation [guidance](#) and requires that it be followed. Follow the instructions provided to you when you report your positive test result in DawgCheck.

Guidelines for COVID-19 Quarantine Period (As of 8/1/21; follow DawgCheck or see DPH website for most up-to-date recommendations)

Students who are fully vaccinated **do not** need to quarantine upon exposure unless they have symptoms of COVID-19 themselves. All others should follow the Georgia Department of Public Health (DPH) recommendations:

Students who are not fully vaccinated and have been directly exposed to COVID-19 but are not showing symptoms **should self-quarantine for 10 days**. Those quarantining for 10 days must have been symptom-free throughout the monitoring period and continue self-monitoring for COVID-19 symptoms for a total of 14 days. You should report the need to quarantine on [DawgCheck](#) (<https://dawgcheck.uga.edu/>), and communicate directly with your faculty to coordinate your coursework while in quarantine. If you need additional help, reach out to Student Care and Outreach (sco@uga.edu) for assistance.

Students, faculty and staff who have been in close contact with someone who has COVID-19 are no longer required to quarantine if they have been fully vaccinated against the disease and show no symptoms.

Well-being, Mental Health, and Student Support

If you or someone you know needs assistance, you are encouraged to contact Student Care & Outreach in the Division of Student Affairs at 706-542-7774 or visit <https://sco.uga.edu/>. They will help you navigate any difficult circumstances you may be facing by connecting you with the appropriate resources or services. UGA has several resources to support your well-being and mental health: <https://well-being.uga.edu/>

Counseling and Psychiatric Services (CAPS) is your go-to, on-campus resource for emotional, social and behavioral-health support: <https://caps.uga.edu/>, TAO Online Support (<https://caps.uga.edu/tao/>), 24/7 support at 706-542-2273. For crisis support: <https://healthcenter.uga.edu/emergencies/>. The University Health Center offers FREE workshops, classes, mentoring and health coaching led by licensed clinicians or health educators: <https://healthcenter.uga.edu/bewelluga/>

Monitoring conditions:

Note that the guidance referenced in this syllabus is subject to change based on recommendations from the Georgia Department of Public Health, the University System of Georgia, or the Governor's Office or. For the latest on UGA policy, you can visit coronavirus.uga.edu.