

**Molecular Ecology (Biology 327)**  
**Spring 2017**  
(T R 10:00 – 11:15 am ISC 136)

Molecular ecology is a young and exciting field that is taking advantage of the rapid development of new techniques in molecular genetics as well as advances in the theoretical and statistical approaches to interpreting the wealth of molecular data now available. These new techniques permit ecologists and evolutionary biologists to address questions in a wide variety of research areas, including phylogeography, population genetics, conservation genetics, behavioral ecology, microbial ecology, adaptation, ecological genetics, hybridization, and speciation. By providing new tools for testing hypotheses, the employment of molecular markers has revolutionized many of these research areas. While molecular ecology is a technologically rich discipline, its roots, and indeed its relevance, lie in one of the oldest scientific pursuits—natural history. Observations of the natural variation within and between organisms inspire the research questions pursued by molecular ecologists. These research efforts utilizing molecular approaches often help provide answers relevant to another long-lived scientific pursuit—the study of evolutionary processes and patterns. Through this course, I hope that in addition to appreciating the tools that molecular ecology employs, you will also marvel at the fascinating stories of natural history, evolution, and diversity that molecular ecology can tell.

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**Instructor:** Dr. Jennifer L. Apple                      Office:    ISC 258    Phone: 245-5442  
e-mail: applej@geneseo.edu                      Lab:        ISC 340  
Office hours: MW 10:00 - 11:30 am, R 11:30 am - 12:30 pm  
(I am also available to meet with students by appointment outside of office hours.)

**Required text:** *Molecular Ecology* (2<sup>nd</sup> ed, 2011) by Joanna R. Freeland, Heather Kirk, & Stephen D. Petersen

**Course website:** [canvas.geneseo.edu](http://canvas.geneseo.edu)

**Textbook website:** [www.wiley.com/go/freeland\\_molecular2e](http://www.wiley.com/go/freeland_molecular2e)

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**Learning Outcomes**

Successful students in this course will be able to:

- identify and describe the common contemporary molecular markers and analyses used to address ecological questions
- describe the wide range of research directions that comprise the field of molecular ecology and the common molecular approaches to these research questions
- interpret data from common analyses employed in molecular ecological studies
- effectively communicate the interpretation and significance of research findings
- thoughtfully discuss and evaluate the conclusions reached in scientific papers based on the presented results and proposed hypotheses
- explore, interpret, and synthesize the primary literature to develop a written proposal for addressing an original ecological or evolutionary research question using molecular tools

## **Grading**

Exams	40%
Written proposal	25%
Paper presentation and discussion leadership	10%
Participation in class discussions	10%
Homework, quizzes, and in-class exercises	15%

## **Grading scale**

A 93-100%	B 83-86.9%	C 73-76.9%
A- 90-92.9%	B- 80-82.9%	C- 70-72.9%
B+ 87-89.9%	C+ 77-79.9%	D 60-69.9%

I follow conventional rounding procedures, so a 92.94% would represent an A- (rounded down to 92.9%), while a 92.95% would be rounded up to 93.0% and an A.

## **Expectations**

### Class preparation

Regular attendance is expected and important to be successful in this course. Participation in announced and unannounced in-class activities will be a part of your grade (see below). You should read the textbook and any supplementary reading by the date indicated on the syllabus. On most days you will be given a graded mini-quiz (1-2 questions) about the day's reading. These mini-quiz questions will be selected from study questions that I will post in Canvas for each day's reading assignment. In addition to reviewing the posted study questions, I encourage you to work on the review questions at the end of each chapter which will reinforce the material (and may prepare you for quizzes); answers are provided at the end of the textbook. I will update reading assignments in class as adjustments in our schedule require; additional supplementary readings may be posted on Canvas. On some days I might ask you to bring in your laptops so that we can practice data analysis using freely available software that you can install on your own computers; make sure your computer battery is charged and install any necessary software as instructed for these activities. It is your responsibility to check Canvas and your e-mail frequently for course-related announcements. Make sure you set your notifications in Canvas to keep you up-to-date with course activities.

### Exams

Both exams for this course (a mid-term and final) will be take-home exams. You will be given each exam at least one week in advance of its due date. The exams may include a combination of essay questions, problem-solving exercises, data analysis using population genetics computer programs, and interpretation of data. You may use your textbook, notes, and other material to answer these questions, but you may not discuss the exam with classmates or seek help from anyone in responding to the questions. (You may ask questions of your instructor for clarification, if necessary.) You must cite information from all sources and observe the policy on plagiarism described below. I will be on the lookout for evidence of plagiarism and will not tolerate it.

### Written proposal

You will develop and write a proposal (8-12 pages) for a study that employs molecular tools to address a particular ecological or evolutionary question. The project you propose must be original and feasible. Detailed guidelines for this assignment are provided on Canvas.

### Paper presentation and discussion leadership

You will work with a partner to present and guide discussion on a primary research paper. Your presentation should be a brief ( $\approx$ 5-10 minutes) but well-organized introduction to the paper which provides relevant background about the study system and research question(s) including reference to previous work. It should also provide a brief overview of the methods and include effective visual aids to enhance our understanding of the study system and approach. You and your partner will facilitate participation of all class members in the discussion of the paper. More details are provided on Canvas.

### Participation in class discussions

We will be exploring the primary literature in molecular ecology through in-class discussion of original research papers. Everyone should read the discussion papers carefully and critically in preparation for these discussions. Verbal participation in these discussions is expected and will be 60% of your participation grade. On the day of the discussion, you must hand in three thoughtful questions or comments (a typed, hard copy) for *each* paper being discussed that day; these questions/comments will not be accepted late since their purpose is to prepare you to discuss the paper in class. You will also be given a short quiz on the reading (based on questions posted in advance). Scores on this quiz and your written questions/comments will make up 40% of your participation grade.

### Homework, quizzes, and in-class exercises

Throughout the course, we will have in-class activities or homework assignments that reinforce the concepts we are studying. Some of these exercises will require your laptop computers, as we work with software commonly used by molecular ecologists. Some in-class activities may require additional work outside of class that you will turn in as homework. Intermediate assignments related to your proposal will count toward your homework grade. In addition to the frequent “mini-quizzes” on daily reading, you will have three longer in-class quizzes on the course material. These will consist of multiple-choice, true/false, fill-in-the-blank, or short answer questions. You will be given a study guide for each quiz.

## **Course Policies**

### Absences, make-ups, and late assignments

Your attendance and participation in class is expected. Unexcused absences will negatively affect your participation grade. Please let me know as soon as possible about anticipated excused absences and consult with me about how to make up for work missed if your absence is excused. No make-ups will be offered for mini-quizzes or quizzes unless you are absent due to participation in college activities, family emergency, or illness, and *all* of these reasons must be documented in writing. At the end of the term I will drop your lowest mini-quiz score. Late assignments will not be accepted after graded work has been returned to students or answer keys have been provided. It is your responsibility to discover what you missed if you miss class and turn in late assignments before graded work is returned. Late assignments will be penalized by a loss of 10% of the total assignment’s points per day unless arrangements are made in advance with the instructor.

## Academic dishonesty

Plagiarism and other forms of academic dishonesty (cheating, turning in another student's work as your own) will not be tolerated. Evidence of academic dishonesty is grounds for a score of zero on any assignment and further action including notifying the department chair and Dean of the College, which can result a report filed with the Dean of Students.

According to the Student Code of Conduct ([http://www.geneseo.edu/dean\\_office/dishonesty](http://www.geneseo.edu/dean_office/dishonesty)), plagiarism includes the following:

- “A. direct quotation without identifying punctuation and citation of source;
- B. paraphrase of expression or thought without proper attribution;
- C. unacknowledged dependence upon a source in plan, organization, or argument.”

In SUNY Geneseo's policy, “Plagiarism is the representation of someone else's words or ideas as one's own, or the arrangement of someone else's material(s) as one's own.” Take care to properly cite sources of ideas, figures, data, etc. (including internet sources) in your writing and presentations. Even if you properly cite your source, when you *borrow wording or sentence structure from the original source and pass it off as your own (i.e., by not using quotation marks), you are guilty of plagiarism.* Learn how to paraphrase *in your own words* information from the original source and properly *cite all ideas* that are not your own. I will be on the watch for any evidence of plagiarism (I have my ways); do not risk being caught! I find that plagiarism does not improve the final product that a student turns in; it simply betrays your lack of preparation and understanding of the topic. Please see me if you have any confusion about what constitutes plagiarism.

## Accommodations

SUNY Geneseo will make reasonable accommodations for persons with documented physical, emotional, or cognitive disabilities. Accommodations will also be made for medical conditions related to pregnancy or parenting. Students should contact Dean Buggie-Hunt in the Office of Disability Services ([tbuggieh@geneseo.edu](mailto:tbuggieh@geneseo.edu) or 585-245-5112) and their faculty to discuss needed accommodations as early as possible in the semester.

## Mental health considerations

Diminished mental health, including significant stress, mood changes, excessive worry, or problems with eating and/or sleeping can interfere with optimal academic performance. The source of symptoms might be strictly related to your course work; if so, please speak with me. However, problems with relationships, family worries, loss, or a personal struggle or crisis can also contribute to decreased academic performance.

SUNY Geneseo provides mental health services to support the academic success of students. Counseling Services, a part of the Lauderdale Center for Student Health & Counseling, offers free, confidential psychological services to help you manage personal challenges that may threaten your well-being.

In the event I suspect you need additional support, I will express my concerns and the reasons for them, and remind you of resources (e.g., Counseling Services, Career Services, Dean of Students, etc.) that might be helpful to you. It is not my intention to know the details of what might be bothering you, but simply to let you know I am concerned and that help, if needed, is available.

Getting help is a smart and courageous thing to do -- for yourself and for those who care about you.

## Molecular Ecology – Spring 2017

### Course Schedule

Date	Topic/activity	Reading *	Major assignments
T 1-17	Introduction to molecular ecology		
Th 1-19	Molecular biology and genetics	<b>1:</b> 1-24, <b>2:</b> 35-50	
T 1-24	Molecular markers & methods	<b>2:</b> 50-75	
Th 1-26	Molecular markers & methods**	<b>1:</b> 24-34	
T 1-31	<i>Simulating evolutionary processes**</i>	<b>3:</b> 77-87	
Th 2-2	Literature research methods**; Population genetics: genetic diversity	<b>3:</b> 87-93	
T 2-7	Population genetics: effective population size, bottlenecks	<b>3:</b> 93-111	Quiz #1
Th 2-9	Population genetics: inbreeding, population subdivision	<b>3:</b> 111-128; <b>4:</b> 129-138	
T 2-14	Population genetics: gene flow	<b>4:</b> 139-159	
Th 2-16	Population genetics: factors affecting genetic structure; <i>Discussion:</i> instructor-led	<b>4:</b> 159-177; see list	
T 2-21	Behavioral ecology: parentage, relatedness	<b>7:</b> 271-295	Proposal topic with 3 primary sources due
Th 2-23	<i>Population genetics data analysis: Milne 104</i>	TBA	<i>Meet in computer lab</i>
T 2-28	<i>Discussion:</i> Population genetics	See list	
Th 3-2	Behavioral ecology: mating systems, dispersal, predator-prey interactions	<b>7:</b> 295-318	Quiz #2
T 3-7	<i>Behavioral ecology data analysis**</i>		Revised proposal topic with 3 primary sources
Th 3-9	Adaptive genetic variation: gene expression	<b>5:</b> 179-203	Midterm exam due <b>Friday, March 10</b>
<b>SPRING BREAK</b>			
T 3-21	Adaptive genetic variation: genomic approaches	<b>5:</b> 203-224	
Th 3-23	<i>Discussion:</i> Behavioral ecology	See list	Outline & annotated bibliography due <b>Friday, March 24</b>
T 3-28	Adaptive genetic variation: examples	TBA	
Th 3-30	<i>Discussion:</i> Adaptive genetic variation	See list	

\*\* bring laptop computer to class

<b>Date</b>	<b>Topic/activity</b>	<b>Reading *</b>	<b>Major assignments</b>
T 4-4	Phylogeography: generating genealogical data	<b>6:</b> 225-244	
Th 4-6	Phylogeography: interpreting trees, networks	<b>6:</b> 244-269	
T 4-11	Conservation genetics: genetic diversity, inbreeding	<b>8:</b> 319-348	Proposal draft due
R 4-13	<i>Discussion:</i> Phylogeography	See list	<b>Wednesday, April 12</b>
T 4-18	Conservation genetics: conservation strategies**	<b>8:</b> 348-366	
Th 4-20	Peer review panels: discuss proposal drafts		Quiz #3; Peer reviews due
T 4-25	<i>GREAT Day – no class</i>		
Th 4-27	Microbial ecology, metagenomics	TBA	
T 5-2	<i>Discussion:</i> Conservation genetics/Microbial ecology	See list	Proposal due <b>Wednesday, May 3</b>
F 5-5	Final exam period, 12-3 pm: short proposal presentations		Final exam due <b>Wednesday, May 10</b>

\*\* bring laptop computer to class

\* Chapters refer to the textbook, *Molecular Ecology*, by Freeland et al. Readings for discussions are available on the course website at [canvas.geneseo.edu](http://canvas.geneseo.edu). Additional readings from other sources may also be assigned and will be posted on Canvas.

The course schedule, reading assignments, and due dates may be revised throughout the semester as adjustments are needed. Updates will be posted on Canvas.