RUTGERS
School of Environmental and Biological Sciences

COURSE SYLLABUS

COURSE INFORMATION:
Molecular Ecology
Meets in FS 109 and ENR 237 (see syllabus)
11:216:454 (undergraduate), 16:215:554 (graduate), Click here to enter text.

CONTACT INFORMATION:
Instructor: Malin Pinsky
Office Location: ENR 130
Office Hours: Tuesday 10:45am-11:45am
Phone: 848-932-8242
Email: malin.pinsky@rutgers.edu

COURSE MATERIALS:

Allendorf, Fred W., Gordon Luikart, and Sally N. Aitken. 2013. Conservation and the genetics of populations. 2nd Edition. Wiley-Blackwell, West Sussex, UK

Note that having the second edition is important. You will be responsible for the material in the second edition.

Other required readings, including primary research papers, will be posted on Sakai.

Pre-recorded lectures will be posted on Sakai. These lectures extend and supplement the reading and so should be watched after doing the reading.

COURSE DESCRIPTION:
Genetics and genomics have transformed cell biology, and we will investigate how it is revolutionizing ecology & evolution as well. We will explore population genetic theory and how it can help us to understand population dynamics, dispersal, natural selection, and ecological genetics. Basic mathematics and a comfort with algebra will be needed to succeed in this course. A substantial portion of the course will be devoted to a class research project with a transcriptomics dataset.

LEARNING OBJECTIVES:
1. You will be able to identify the major types of genetic variation, their function in the genome, and their utility for molecular ecological analyses
2. You will be able to explain how drift, mutation, migration, and selection shape patterns of variation across the genome
3. You will be able to summarize the strengths and limitations of molecular ecological methods, as well as the scientific questions that can be addressed
4. Starting from raw data, you will be able to perform standard population genetic analyses

ASSIGNMENTS/RESPONSIBILITIES & ASSESSMENT:
This course is run as a "flipped classroom," meaning that you will be responsible for watching pre-recorded lectures and doing the reading as your homework. In class, we will focus on synthesizing and mastering the material.

Attendance and participation during class meetings is required for everyone to get the most out of this course, and it is therefore a substantial part of your grade. Participation means constructive and insightful contributions to work in pairs and groups, as well as to full class discussions. To participate

effectively, you must have done the reading and watched the lectures. We will start with daily quizzes on the reading and lectures.

The remainder of each class period will include a question and answer session, problem sets (often done in groups), paper discussions, and/or data analysis labs.

Class participation	25%
Daily quizzes	10%
Problem sets	15%
Mid-term (open-book, completed individually)	25%
Final paper (written in pairs)	25%

ACADEMIC INTEGRITY:
Students will be responsible for adhering to the academic integrity policies found at http://academicintegrity.rutgers.edu.

It is important to me that students have the tools to succeed in this course. Please see me *as soon as possible* with any difficulties or questions regarding the course materials. In addition, the Office of Student Affairs is available at http://studentaffairs.rutgers.edu for any other needs or concerns.

COURSE SCHEDULE:
We will meet 9:15-10:35am in FS 109, except most Tuesdays in ENR 237.

#	Topic	Allendorf	Sakai	In class
1	Introduction			Syllabus and logistics
2	Genetic variation	3.0-3.2 4 12.0-12.1.2 12.1.4	Three online lectures	Quiz Group problem sets
3	Forensics and barcoding	22.0-22.1 22.3	Four online lectures	Quiz Lab: Species ID Prep for paper discussions
4	Parentage & kinship	22.4	Three online lectures Planes *et al.* 2009 PNAS	Quiz Paper discussion
5	Hardy Weinberg Principle (HWP)	5	Two online lectures	Quiz Lab: Finishing Species ID
6	Genetic drift and mutation	6 12.2.1	Two online lectures Roman & Palumbi 2003 Science	Quiz Paper discussion
7	Effective population size (N_e)	7.0-7.5 7.7	One online lecture	Quiz Lab: Analyzing genetic drift
8	Population dynamics	7.6 10.0-10.2 22.6	Three online lectures	Quiz Group problem sets

		Guest Box 7 (pp. 134-5) Guest Box 10 (pp. 203)		
9	Migration theory	9.0-9.9.3	Three online lectures	Quiz Lab: AMOVA
10	Migration applications	15.6	McRae & Beier 2007 PNAS	Quiz Paper discussion
11	Intro to bio-informatics		Haddock & Dunn pp. 47-66, 383-396 Read the lab	Quiz Lab: Data formats and basic command line Discussion: class project study design
12	Contemporary migration	22.5 9.9.4	Two online lectures	Quiz Problem sets
13	Transcriptome assembly		One online lecture Haddock & Dunn pp. 67-72, 75-76, 83-94, 396-405 Read the lab	Quiz Project: QA/QC and Assembly
14	The coalescent	7.8 A10	Two online lectures	Quiz Problem sets Mid-terms handed out
15	Read mapping	Complete the take home Mid-term		Project: Mapping and visualization
16	Phylogeography	16.2-16.4.3	Emerson *et al.* 2010 PNAS	Quiz Paper discussion
17	SNP Detection		One online lecture De Wit *et al.* 2012 Mol Ecol Res Read the lab	Quiz Project: SNP detection
18	Ancient DNA		Willerslev & Cooper 2005 PRSB Shapiro *et al.* 2004 Science	Quiz Paper discussion
19	Genotyping	A1-A3	One online lecture Read the lab	Quiz Project: Analyze genotypes
20	Selection theory	8 12.3-12.4 10.3-10.3.3		Quiz Problem sets
21	Approximate Bayesian Comp-utation (ABC)	A4-A9	Two online lectures	Quiz Due date for final paper Option Project: ABC with SNP data
22	Selection applications	Guest Box 8 (pp. 154-155) 10.5 17	Online lectures	Quiz Problem sets Option 2 Final paper group assignments
23	Ecogenomics	11	Online lectures	Quiz Project: Identify Fst outliers Option 1 Final paper

				group assignments Due date for Option 2 Final paper proposals
24	Microbial ecology	22.2	Beebe & Rowe 2008 pp. 278-285, 291-215 Costello *et al.* 2009 Science	Quiz Paper discussion
25	Annotation		Online lectures De Wit et al. 2012 (review)	Quiz Project: BLAST, plan final papers
	Thanksgiving Break			
26	Final project			Meetings on papers
27	Final project			Meetings on papers
	Final project			Peer meetings on papers (your choice of timing)
28	Course evaluation			Course evaluation discussion and surveys (bring a computer, smartphone or tablet) Peer meetings on papers all week
	Final project			Rough draft and peer review forms due to my mailbox in ENR
	Finals	Final paper due		