Spring 2-1-2019

BIOB 272.00: Genetics and Evolution

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GENETICS and EVOLUTION (BIOB 272, Spring 2019)

Location

- T/TH 11:00-12:20
- ULH 101

Instructor

- Dr. Douglas Emlen, douglas.emlen@umontana.edu
- BioResearch Building 105, 243-2535
- Office hours: TBA or by appointment (email me)

Recitation Instructors

- Romain Boisseau romain.boisseau@umontana.edu (head TA)
- Jill del Sol jillian.delsol@umconnect.umt.edu
- Jennifer Feltner jafeltner@gmail.com
- Lauren Foltz lauren.foltz@umconnect.umt.edu

Materials

- Textbook: *Evolution: Making Sense of Life,* C. Zimmer & D. Emlen, 2nd edition, 2016
- Study Guide accompanying textbook, by Alison Perkins, 2016
- Class website on Moodle -https://moodle.umt.edu

Introduction

The first part of our course will briefly introduce the study of evolution and then focus on the basic principles of genetics. We will begin with the classic work of Mendel and then continue through the discoveries of modern genomics. The second part of the course deals with evolution. As the prominent geneticist Dobzhansky famously put it, “Nothing in biology makes sense except in the light of evolution.” The study of evolution is therefore all-inclusive, and draws upon many scientific disciplines -geology, chemistry, physics, mathematics, anthropology, botany, zoology, and computer science -in order to develop a comprehensive understanding of the diversity of life on Earth.

These two topics -genetics and evolution -are treated as a single integrated field of scientific inquiry. Genetic change is the basis of evolution. Our understanding of evolution, therefore, requires a basic understanding of genetics. The converse is true as well. The sequence of the entire human genome was published in 2001 (Venter et al., 2001, Science 291:1304-1351), ushering in the age of large-scale genomics with broad implications for the study of human health and disease. Since this time, the genome sciences have come to dominate the fields of genetics and evolution. Complete genome sequences have been generated for 1,000s of species from a broad diversity of life, including dozens of mammals. Current efforts are underway to sequence 1,000s of human genomes and over 10,000 genomes from a diverse collection of animals. The basic principles of genetics and evolution form the foundation of these exciting frontiers in biology.

Specific case studies of the relevance of evolution (and genomics) will be discussed at length, including: the domestication of crops, livestock, and pets; the evolution of resistance to chemical pesticides/herbicides/antibiotics; the rapid, recent rise in obesity/type II diabetes and autoimmune diseases; cancer, and influenza.

Learning outcomes

This course will emphasize biological principles, scientific concepts, and the synthesis of information. Expected outcomes are:

1 To understand the fundamental mechanisms of transmission genetics and inheritance.
2 Learn and apply the principles of population genetics to understand microevolution.
3 Develop an understanding of how the principles of transmission genetics and population genetics relate to human evolution, health, and disease.
4 Understand the principles of quantitative genetics.
5 Develop a basic knowledge of the history of life on Earth.
6 Understand how microevolutionary phenomena scale to macroevolutionary patterns.
7 Develop an understanding of how the principles of transmission genetics and population genetics relate to the origin and persistence of biological diversity.

Lectures

- T/TH, 11:00 a.m., Urey Lecture Hall (ULH) 101
- Attendance at lectures is an important part of this course, and **all students are expected to attend lectures regularly**.

Discussion groups

The topic in these groups will vary from week to week, as shown on the discussion group schedule (see Moodle). Attendance at weekly sections is mandatory and will count towards your grade. Prior arrangements should be made *with your teaching assistant* (not the professor) if a discussion period will be missed. Your grade in the discussion group will be based on homework assignments and attendance in class discussions.

There will be a homework assignment due at the beginning of each week. Homework will generally involve reading the assigned paper(s) for that week and answering a series of questions related to the paper(s). You must turn in your answers to these questions through Moodle before *5pm on the Monday before section*. **Late submissions will not be accepted**.

Review sessions

There will be an evening review session scheduled at least two days prior to each exam. These sessions provide an additional opportunity to ask questions on the lectures, readings, and problems.

Reading Assignments

There will be regular and extensive reading assignments throughout the semester. These include relevant chapters from the textbook (indicated on the Lecture Outline), as well as one to two papers each week assigned for the discussion section. Students are encouraged to develop a routine for integrating these reading requirements into their daily schedule, as they are likely to involve at least 2-4 hours of out-of-classroom work per week. In addition to the textbook, students should also have the accompanying study guide, which contains review questions, exercises, and tools for learning.

Exam questions *will cover* material from the textbook chapters listed on the Lecture Outline. In addition, some of the questions from the study guide will be included in the exam (note that since the answers to SG questions are printed in the back of the guide, this means that students who use the study guide will have an advantage on the exam).

Miscellaneous information

- **Accommodations -**The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you have a disability that adversely affects your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or 406.243.2243. I will work with you and Disability Services to provide an appropriate modification. Typically this will involve the student picking up the exam at the beginning of class and taking it to DSS, where they can take the exam in a quiet room for an extended period. Completed exams will then be delivered by DSS to the Division of Biological Sciences front office.

- **Academic misconduct** will be reported and handled as described in the University of Montana Student Conduct Code. All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code

- **Dropping course or changing grading option**: Students will not be able to change to an audit after the 15th day of classes. Dropping the course will not be allowed after the 45th day of classes. Dropping the course after this date may be requested by petition, but the petition must be accompanied by documentation of extenuating circumstances.

- **Student Behavior**: To maximize their likelihood of success, students should attend each lecture, and complete any assigned readings before class. When in class students are expected to behave in a manner that is respectful of others. **All disruptive electronic devicesmust be turned off during lecture, during Discussion and Review sessions as well asduring exams.** If you prefer, you may use laptops or tablets to take notes during lecture – please be respectful of others when doing so.

Grading

Exams will be designed to encourage synthesis of subject matter and not to simply test your ability to recall details. Make-up exams in case of emergency or illness will only be administered if requests are made **prior** to the exam. You must contact your TA *at least one week before an exam* if you need to make other arrangements to take an exam because you will be off campus due to other University activities (track, ROTC, etc.).

Grades will be based how many of **900 points** you earn over the course of the semester.
(1) Two mid-term exams (150 points each; 300 points total)
(2) Discussion groups (100 points for attendance [10pts per week]), 300 points for homework [30 pts per week] – 400 points total). Please tell your TA *before class* if you are not able to attend a meeting; points will be subtracted from your score for each discussion meeting that you miss without informing the TA before the section meets. Note: There are actually 11 weeks with a Discussion Section, so the grading provides one "free" week to account for an unexcused absence.
(3) Comprehensive final exam (200 points). The Final Exam will be comprehensive and test material covered throughout the semester.

Final grades will be based on your total points as a percentage of the 900 total points possible.

Pluses (+) and minuses (–) will be used (**A, A–, B+, B, B–, C+, C, C–, D+, D,** and **D–**) in the assignment of letter grades will be determined by the distribution of total scores, following these guidelines:

- ≥90% of points (810): A-or better
- ≥80% of points (720): B-or better
- ≥70% of points (630): C-or better
- ≥60% of points (540): D-or better

These cutoffs may be adjusted downward (in favor of the student) to better reflect natural breaks in the class scores.