GENETICS and EVOLUTION (BIOB 272, Spring 2021)

Instructor

- Dr. Douglas Emlen, douglas.emlen@umontana.edu

Recitation Instructors

- Romain Boisseau (head TA) romain.boisseau@umontana.edu
- Nathanael Herrera nathanael.herrera@umontana.edu
- Jennifer Feltner jafeltner@gmail.com
- Conner Copeland conner.copeland@umontana.edu

COVID-19 POLICIES:

The University of Montana will be implementing steps similar to Fall 2020 to help mitigate the spread of COVID-19.

Current situational updates can be found at: https://www.umt.edu/coronavirus/

Day to day tracking of UM coronavirus cases can be found at:
https://www.missoulainfo.com/missoula-county

And tracking of daily Missoula County cases:
https://www.missoulainfo.com/covid-10-trends

The best place to track the pandemic globally is at the Johns Hopkins site:
https://coronavirus.jhu.edu/map.html

Class delivery given COVID-19 restrictions:

This class is large enough that face to face lectures were deemed unsafe & impractical, so the lecture portion of this class will be delivered remotely via zoom. Lectures have been pre-recorded and assembled using UM's licenses to Camtasia and Knowmia, and at each lecture time I will begin with live announcements and updates, and then "play" the pre-recorded lecture. This way you have access to high quality productions without the limitations of zoom cameras and streaming issues. Playing pre-recorded lectures will also permit me to run the chat room and answer questions as the lecture proceeds.

Attendance is mandatory, and will be assessed via zoom. Lectures will be archived in moodle so that you may go back to them after, but I expect you to attend the original presentation live. In case you are curious why, this is because studies examining student learning under the COVID restrictions last fall showed that a significant percent of students fell way behind when watching the lectures was left to them, so far behind that making up the missed work ended up impractical. I am requiring live attendance at the lectures via zoom in part to force you to structure your day around your classes and as a mechanism to keep you on track with the material. This class has numerous weekly assignments (see below), including readings and homework for the discussion sections, and weekly textbook chapters and assessments (to be

completed through the saplinglearning.com website; see below), so staying on top of the assignments will be critical to your success.

The synchronous/live zoom lectures (T/TH 11-12:30) will be supplemented with a 50-minute weekly discussion. For those who are able, these weekly discussions will be face-to-face, with class sizes capped at a maximum of 15 students. These will be held in rooms that have been set up to facilitate social distancing. ***Masks will be required over the nose in all cases***. For students who prefer to do the sections remotely, we have set up two of the sections as remote only (designated with an "R"). These section sizes will not be capped, but should be approximately 20 students.

What to do if you feel sick:

All students with cough/flu-like symptoms should NOT attempt to come to discussion section. This is important: Although you may still feel able to go to class, by doing so **you put others around you at risk**. As healthy undergraduates, you are not the most "at risk" sector of our population, but it is your responsibility to do your part to make sure that you do not transmit the virus to others who might be at high risk (including student peers with severe asthma, respiratory conditions, and/or compromised immune systems, and many faculty and staff who are older and are at much greater risk). If you think you might be sick, STAY HOME and we will find a way to accommodate the absence without penalty to your grade.

UM's Curry Health Center (http://www.umt.edu/curry-health-center/) provides free COVID-19 testing for students who are experiencing coronavirus symptoms. Students must call 406-243-2122 to make an appointment before coming in.

What to do if you have to quarantine or isolate:

Contact your TA and let them know that you have to miss discussion. For student privacy reasons you do not have to provide a doctor's note or any details, but as soon as you know you will be missing your section email your TA. We expect you to let your TA know **BEFORE** THE TIME OF YOUR REGULAR DISCUSSION SECTION.

You should still be able to attend the lectures (they are administered via zoom anyway!), and you should still plan to turn in your weekly homework for discussion through the standard moodle link for your section, and your weekly textbook assessment through sapling.learning.com. However, you should NOT attend your face-to-face discussion section. Instead, your TA will email you a link to the remote sections, and you should plan to attend one of the remote sections in lieu of your face-to-face class. That TA will record your attendance and make sure it gets to your regular TA.

Because there are extenuating circumstances that may require you to miss a discussion, each student will be granted *two absences* without cost to their final grade. I strongly suggest you hold on to these in case you actually DO get sick!!

Materials

- Textbook: *Evolution: Making Sense of Life,* D. Emlen & C. Zimmer, 3rd edition, 2020

- Macmillan Learning access key (for online assessment & resources using Sapling Plus)
- Class website on Moodle - https://moodle.umt.edu

Note: The Third Edition of the textbook is significantly updated and you must use this new edition (older editions will not suffice). You do not need to purchase a paper copy if you prefer electronic ones, ***but you must make sure you purchase a version that has the electronic access to "Sapling Plus".*** The UM bookstore should only sell versions that have this full access, but if you elect to purchase directly from Macmillan, make sure you get one with Sapling Plus. Macmillan also just released a version with a new and different assessment platform called "Achieve" but this is not set up for UM yet, so make sure you get electronic access to Sapling Plus, not Achieve. I do not think that copies sold through Amazon or other outside distributors have the electronic access key to Sapling Plus, so please make absolutely sure before you buy.

I do recognize that versions with electronic access to these resources are expensive. We put thousands of hours of effort into developing the question banks, and the educational videos and whiteboard videos, and this is what you get when you purchase the Sapling Plus access. I also recognize the possible conflict of interest, since I am a co-author of the textbook. Macmillan is working on ways to make sure that I do not earn any royalties from sales to UM students, but in the meantime I have agreed to donate the equivalent amount to a local charity. Last year my royalties due to sales to UM students totaled around $300, and we made a donation of more than that amount to the Missoula Butterfly House & Insectarium.

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., via ZOOM.
- https://umontana.zoom.us/meeting/register/tJYqfu2grzksG928locY1h5206SDKXN9QatX

- Attendance at lectures is an important part of this course, and **all students are expected to attend lectures regularly** (10 pts each, 250 total points).

- To accommodate the chaos of COVID and quarantine, each student will have three no-cost absences from lectures, so that they are expected to attend 25 of the 28 lectures. You do not need to get approval for absences from me or the TA's, but make sure you DO follow up and watch the lectures after they are posted into the Moodle shell.

Discussion groups

The topic in these groups will vary from week to week, as shown on the discussion group schedule (see Moodle). Your grade in the discussion group will be based on homework assignments and attendance and participation in class discussions. Attendance at weekly sections is mandatory and will count towards your grade. As with lectures, this spring each student is granted two absences from Discussion without penalty. You do NOT need to clear these absences with your TA (or the instructor). The two no-cost absences are built into the rubric to accommodate the sorts of extenuating circumstances that arise.

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 *9pm on the Monday before section*. **Late submissions will be penalized with point reductions**.

Review sessions

There will be an evening zoom 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 will also have access to accompanying materials through Macmillan Learning, which contains review questions, exercises, and tools for learning. Ten tutorial videos illustrate difficult concepts, and 7 "whiteboard" videos walk through the calculations of the most important population genetics equations.

Reading the textbook will count for a full 1/4 of your final grade in the course. One chapter is assigned each week of the term, and after reading the chapter students should take the online Learning Curve assessment exercise. This is an adaptive, student-centered bank of questions, complete with hints and feedback for wrong answers, all linked directly to relevant sections of the ebook version of the text. Students must earn 500 points via Learning Curve before 9PM on the Monday of each week. At the end of the semester these points will be scaled so that the 6000 point total from Learning Curve counts for up to 600 points of your final grade.

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, and will be expected to sign a statement promising they will not cheat at each exam. 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 devices must be turned off during lecture, during Discussion and Review sessions as well as during 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 **2280 points** you earn over the course of the semester.

(1) Lecture Attendance (10 pts each; **250 points total**)
(2) Learning Curve assessments (50 pts per week, **600 points total**)
(3) Discussion sections (180 points for attendance [20pts per week], eleven weeks minus two weeks with penalty-free absence); 450 points for homework [50 pts per week], **630 points total**). Note: There are actually 11 weeks with a Discussion Section, so the grading provides two "free" weeks to account for an unexcused absence (you do not need to clear these with your TA – they are designed to accommodate the extenuating circumstances that arise during a pandemic!).
(4) One mid-term exam (**350 points**)
(5) Comprehensive final exam (**450 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 2400 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: A- or better
- ≥80% of points: B- or better
- ≥70% of points: C- or better
- ≥60% of points: D- or better

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

Extra Credit

Students will have the option of making up points if they choose (50 pts, or 2%), by electing to complete one extra credit essay. This will require significant effort. In order to earn the extra credit you must pick one of the books on the "Recommended Reading" list, read it completely, and prepare a 1 page essay a) summarizing the main points of the book in a paragraph, and b) discussing your opinion regarding the relevance of the topic to your life today, in an additional paragraph, not to exceed 1 printed page total length. *Note: extra credit essays will be submitted electronically to databases like Chegg to check for plagiarism!*