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BIOB 272.00: Genetics and Evolution

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GENETICS and EVOLUTION (BIOB 272, Spring 2022)

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COVID-19 POLICIES:

The University of Montana will be implementing steps similar to Fall 2021 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/copy-of-data-dashboard>

And tracking of daily Missoula County cases:

<https://www.missoulainfo.com/copy-of-epidemiological-reports>

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 meets in a large lecture hall (Urey Underground) and there should be room for students to space themselves comfortably. **Masks will be required**, at least for the beginning of the term. Hopefully, once omicron surges through we will be able to relax this restriction but until this happens everyone will be required to wear a mask over their nose and mouth.

Because omicron is spreading fast, I will need to make a fixed seating chart by day 1. ***If you care where you sit come early and make sure you find a seat that you like, because from the first class forward this will be your assigned seat for the semester.*** I will pass around a sign-up sheet for you to put your name and seat number (the lecture hall has just been

renovated and there are row and seat designations). I will make a formal chart based on this for the County Health Department. When I learn of someone testing positive I will email students sitting in the immediate vicinity to alert them to a possible exposure. Masks and spacing should mean that risk of exposure in class is small, but omicron is impressively contagious and sitting in one spot for 80 minutes means that if masks are loose fitting or poor quality than some transmission might occur. I will alert anyone who sat close to an infected student as soon as I learn of it, and in that case please monitor yourself for symptoms and go to Curry for testing if you feel at all sick in the next few days.

Last spring, when everything was virtual, I pre-recorded all of the lectures in UM's OneButton Studio and assembled them into YouTube style movies using UM's licenses to Camtasia and Knowmia. This means I have high quality recorded versions of all of the lecture material. I will make all of these lectures available in moodle.

If you are not willing to wear a mask, or you are uncomfortable with the risk of attending a large in person lecture, or you are required to quarantine, you may watch the recorded versions of the lectures instead. I will not be taking attendance, so this is your choice, but I strongly encourage you to attend the actual live lectures when you can. This is a fast-moving class with lots of weekly assignments, and it is very easy to fall behind if you opt to watch the lectures on your own schedule.

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 <https://achieve.macmillanlearning.com/start> website; see below), so staying on top of the assignments will be critical to your success.

Two weekly 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 18 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 one of the sections as remote only (designated with an "R"). Any students who are required to quarantine may attend this virtual section during this period.

[What to do if you feel sick:](#)

All students with cough/flu-like symptoms should NOT attempt to come to class or 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/) (<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 plan to turn in your weekly homework for discussion through the standard moodle link for your section, and your weekly textbook assessment through [achieve.macmillanlearning.com](https://www.achievethecore.com). However, you should NOT attend your face-to-face discussion section. Instead, your TA will email you a link to the remote section, and you should plan to attend the remote section 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 Achieve)
- 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 "Achieve"**. 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 Achieve access. I do not think that copies sold through Amazon or other outside distributors have the electronic access key to Achieve, so please make absolutely sure before you buy.

You will need to set up your account with Macmillan/Achieve before you can complete the weekly reading assessments: <https://achieve.macmillanlearning.com/courses/x2qdj2>
If you run in to problems, Macmillan has a tech support office that specializes in walking students through the process: **Tech Support** 800.936.6899

I do recognize that versions with electronic access to these resources are expensive. I put thousands of hours (*really*, not exaggerating) of effort into developing the text, the question banks, and the educational videos and whiteboard videos, and this is what you get when you purchase the Achieve 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., Urey Underground Lecture Hall (the big room under the coffee shop).

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. 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, 10 points per day.**

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 Achieve 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 Achieve before 9PM on the Monday of each week. At the end of the semester these points will be scaled so that the 7000 point total from Achieve counts for up to 700 points of your final grade.

Learning Assistants

This year for the first time we will be integrating six UM undergraduate learning assistants. One of them will be embedded within each of the 12 discussion sections, to help facilitate discussions and to serve as a peer resource. In addition, during two of the lecture periods, **February 17** and **April 14**, they will lead guided discussion and activities related to controversial topics that bridge the biology of this course with ethics and medicine (gene editing, stem cells). **For these two class periods attendance will be required** (50 pts per class, 100 pts total), and there will also be a mid-semester survey worth 50 points. For students attending class remotely, we will set up a hybrid classroom with a zoom link for these two class periods, and online attendance will be required as well.

Miscellaneous information

- **Accommodations** - The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and the Office for Disability Equity. If you have a disability that adversely affects your academic performance, and you have not already registered with ODE, please contact them at Lommasson Center 154 or (406) 243-2243. I will work with you and ODE to provide an appropriate modification. Typically this will involve me emailing a PDF of the exam to

ODE, where you can take the exam in a quiet room for an extended period. Completed exams will then be delivered by ODE 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](#)
- **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 **3120 points** you earn over the course of the semester.

- (1) **Learning Curve assessments** (50 pts per week, **700 points total**)
- (2) **Discussion sections** (220 points for attendance [20pts per week], thirteen weeks minus two weeks with penalty-free absence); 650 points for homework [50 pts per week], **870 points total**). Note: There are actually 13 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!).
- (3) **In class LA structured activities (150 points)**
- (4) **One mid-term exam (700 points)**
- (5) **Comprehensive final exam (700 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 3120 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:

- $\geq 90\%$ of points: A- or better
- $\geq 80\%$ of points: B- or better
- $\geq 70\%$ of points: C- or better
- $\geq 60\%$ 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 (100 pts, or 3%), 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!*