

Biology 484/584 - Molecular Evolution

Fall 2020

Professor: Matthew Barber, PhD

- Email: mbarber@uoregon.edu
- Office Hours: Tuesday and Thursday 3:45-4:15PM via Zoom

Time and Location: Tuesday and Thursday 10:15-11:45AM via Zoom

Course Description:

In this course we will explore how evolution occurs on a molecular scale. Guided by discussion of scientific research articles, students will gain an understanding of the mechanisms by which genes, proteins, and genomes change over time. As an upper-level course, students will integrate knowledge in molecular evolution to evaluate and propose new areas of investigation in the field. We will cover classical studies as well as recent research using modern genetic, computational, and experimental approaches. Topics include mutation, genetic drift, natural selection, molecular phylogenetics, genomics, evolution of protein function, gene regulation, and chromosome evolution.

Learning Goals:

Upon completing this course, students will be able to:

1. Describe molecular processes that contribute to evolutionary change.
2. Present, interpret, and evaluate primary research in the field of molecular evolution.
3. Propose techniques to answer new research questions in molecular evolution.

Email: Please include "Bio484" in the subject line, so your email can be attended to in time. I will try to answer your email in a timely manner; however I do not often check our email in the evenings or during weekends.

Website: Syllabus, course materials, assignments and grades will be posted to the course Canvas site.

Textbook: There is **no required textbook** for this course. An optional textbook (Molecular and Genome Evolution, Dan Graur) is available for purchase at the Duck Store. A copy is also on reserve at the Science Library. Required readings will be drawn from primary journal articles and will be posted on Canvas.

Required supplies: Personal computer with internet access.

Evaluation:

- Canvas questions due before class (15%)
 - Students will submit answers to three questions relevant to the paper before arriving at class each day.
- Participation in class discussion (15%)
 - Students are expected to arrive at class each day having read the paper(s) for discussion. Please bring a copy of the paper to class (electronic is fine).

You do not need to have mastered the paper, but you should have a firm idea of the area of study and what the authors did! During or after class discussion students must post replies on the Discussion section in Canvas.

- Leading class discussion (15%)
 - Beginning in the second week, students will **either** introduce or summarize the paper(s) for discussion using a Powerpoint (or similar) presentation. A rubric and guidelines for presentations will be provided.
- Paper summary (5%)
 - Students will identify a primary research article related to the topic of interest for their final paper. A short summary of the research article will be provided, introducing the area of study, why the study was performed, what the results of the study showed, and the student's conclusions from the results of the study. A PDF copy of the article must also be provided.
- Abstract on paper topic (10%)
 - Students will prepare and submit a proposed topic for their final paper mid-way through the course. Instructions will be posted on Canvas.
- Lab activity (10%)
 - We will dedicate one class to a 'lab' activity performing analyses using DNA sequence.
- Final paper (30%)
 - The paper will consist of a literature review on a topic of interest in molecular evolution, as well as a short proposal of original work in this field. **This paper will be due on Friday of the last week of class.**

Total: 100%

Class preparation:

It is expected that you complete assigned readings, Canvas questions, and review any posted sources before attending class. Please have a copy of the papers to be discussed in class available.

General policy on missed assignments:

Assignments must be turned in on time. The grading system is designed to allow some flexibility if you miss class or a homework assignment. If you anticipate an extended absence please contact the instructor.

No Extra Credit:

There will be no opportunities for extra credit. Please do not ask for exceptions.

Schedule:

Note: papers denoted with a * will be the focus of student-led discussion.

Week	Date	Subject	Readings
1	9/29	Course logistics, molecular biology review	-
1	10/1	Evolutionary genetics review, demonstration on paper presentations	-
2	10/6	The neutral theory of molecular evolution	Kimura 1968*, King and Jukes 1969*, Kimura and Ohta 1974
2	10/8	Nearly neutral theory, molecular clock	Ohta 1973, Ohta and Gillespie 1996, Kumar and Hedges 1998*
3	10/13	Positive selection, adaptive evolution	Yang and Bielawski 2000, Barber and Elde 2014*
3	10/15	Polymorphism and divergence	McDonald and Kreitman 1991*, Fay Wyckoff Wu 2002
4	10/20	Linkage and recombination	Begun 1992*, Hunter 2016
4	10/22	Molecular phylogenetics PAPER SUMMARY DUE	Simion 2017*, Felsenstein 1981
5	10/27	Lab activity	
5	10/29	Comparative genomics	Pease 2016*
6	11/3	Population genomics	Myers 2005*, Myers 2010*
6	11/5	Gene duplication	Force 1999*
7	11/10	Evolution of protein function	Harms and Thornton 2010, Harms and Thornton 2014*
7	11/12	Evolution of protein function 2 PAPER ABSTRACTS DUE	Bloom and Arnold 2009, Thyagarajan and Bloom 2014*
8	11/17	Evolution of gene regulation	Coolon et al. 2014*, Wittkopp 2012
8	11/19	Transposons and mobile DNA	Chuong 2016*, Chuong 2017
9	11/24	Microbial evolution	Elena and Lenski 2003, Blount et al., 2012*
9	11/26	No class – Thanksgiving Holiday	
10	12/1	Chromosome evolution	Vicoso and Bachtrog 2015*, Bachtrog 2014
10	12/3	Molecular evolution in action	Levy 2015*, Venkataram 2016
10	12/4	FINAL PAPER DUE	-

Classroom etiquette:

Please arrive on time. Lectures and discussions begin promptly on the hour. Please do not leave early as this is disruptive to everyone. If you have an unusual circumstance and must leave early, please inform the instructor, and sit near the exit so your leaving is not disruptive. Finally, please be respectful of your fellow students.

Academic Integrity:

You are expected to do your own work on homework, class presentations, and papers. Academic misconduct, including cheating and plagiarism, will not be tolerated. You are encouraged to discuss ideas with other students and study together, but do not copy someone else's work or allow anyone to copy yours. All students are expected to conform to the Student Conduct Code. Please note that Instructors are required to file a written report of any academic misconduct with the Director of Student Conduct and Community Standards.

Inclusive Learning:

In this class we aim to build an inclusive learning environment. We understand that our members represent a rich variety of backgrounds and perspectives. We are committed to providing an atmosphere for learning that respects diversity. While working together to build this community we ask all members to:

- honor the uniqueness of their colleagues.
- value each other's opinions and communicate in a respectful manner.
- keep confidential discussions that the community has of a personal (or professional) nature.

Classroom courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Class rosters are provided to the instructor with the students' legal names. We will gladly honor your request to address you by an alternate name or gender pronoun. Please advise us of this preference early in the quarter (or before) so that we may address you properly.

Students with disabilities: If there are aspects of the instruction or design of this course that result in barriers to your participation, please let us know as early as possible, in person or via email. You may also wish to contact Accessible Education Services in 164 Oregon Hall, by phone at (541) 346-1155 or uoaec@uoregon.edu. We welcome the chance to help you learn, and will work with you to make it a positive experience.

Discrimination and Harassment*Prohibited Discrimination and Harassment Reporting*

Any student who has experienced sexual assault, relationship violence, sex or gender-based bullying, stalking, and/or sexual harassment may seek resources and help at safe.uoregon.edu. To get help by phone, a student can also call either the UO's 24-hour hotline at 541-346-7244 [SAFE], or the non-confidential Title IX Coordinator at 541-346-8136. From the SAFE website, students may also connect to Callisto, a confidential, third-party

reporting site that is not a part of the university.

Students experiencing any other form of prohibited discrimination or harassment can find information at respect.uoregon.edu or aaeo.uoregon.edu or contact the non-confidential AAEO office at 541-346-3123 or the Dean of Students Office at 541-346-3216 for help. As UO policy has different reporting requirements based on the nature of the reported harassment or discrimination, additional information about reporting requirements for discrimination or harassment unrelated to sexual assault, relationship violence, sex or gender based bullying, stalking, and/or sexual harassment is available at [Discrimination & Harassment](#).

Specific details about confidentiality of information and reporting obligations of employees can be found at titleix.uoregon.edu.

Reporting

The instructor of this class is a Student Directed Employee. As such, if you disclose to me, I will respond to you with respect and kindness. I will listen to you, and will be sensitive to your needs and desires. I will not judge you. I will support you. As part of that support, I will direct students who disclose sexual harassment or sexual violence to resources that can help. I will only report the information shared to the university administration when you as the student requests that the information be reported (unless someone is in imminent risk of serious harm or is a minor). Please note the difference between 'privacy' and 'confidentiality.' As a Student Directed Employees I can offer privacy because I am not required to report certain information to the university. However, I cannot be bound by confidentiality in the same way that a counselor or attorney is. Confidential resources such as these means that information shared is protected by federal and state laws. Any information that we as student-directed employees receive may still be accessed by university or court proceedings. This means, for example, that I could still be called as a witness or required to turn over any related documents or notes that I keep. Please note also that we are required to report all other forms of prohibited discrimination or harassment to the university administration.

Mandatory Reporting of Child Abuse

UO employees, including faculty, staff, and GEs, are mandatory reporters of child abuse. This statement is to advise you that your disclosure of information about child abuse to the instructor may trigger my duty to report that information to the designated authorities. Please refer to the following links for detailed information about mandatory reporting: [Mandatory Reporting of Child Abuse and Neglect](#).

Safe Ride

541-346-7433 ext 2
pages.uoregon.edu/saferide

Safe Ride is an assault prevention shuttle that works to provide free, inclusive, and accessible alternatives to traveling alone at night for UO students, faculty, and staff.

We are a schedule-ahead service and riders can (1) call once we open to schedule a ride with a dispatcher or (2) leave a voicemail on the day of their ride request. We do not call riders ahead

of time to confirm due to capacity constraints, but riders are always welcome to call us to double-check that their ride was scheduled. We are a feminist, 'for-the-students/by-the-students' organization and operate out of the Women's Center in EMU 12F.

Operating hours:

Spring term Sunday - Thursday | 7p - midnight
Friday + Saturday | 7p - 2a
Summer term Sunday - Thursday | 9p - midnight
Friday + Saturday | 9p - 2a
Fall/Winter term Sunday - Thursday | 6p - midnight
Friday + Saturday | 6p - 2a

Policy and rules:

1. We are a schedule-ahead service, we do not call ahead, and we can only wait for riders for 5 minutes at their pick-up time and location.
2. We only give rides to groups of 3 or less to prioritize groups that are at higher risk.
3. We are a free service and do not accept tips.