

# Biology 484/584 - Molecular Evolution

## Spring 2023

**Professor:** Michael Shavlik

- Email: [mshavlik@uoregon.edu](mailto:mshavlik@uoregon.edu)
- Office Hours: Wednesday 1:00 pm in Willamette 342

**Time and Location:** Tuesday and Thursday 12:00-1:20 in 214 FR (Friendly Hall)

### All are welcome here:

First and foremost, we want to create a warm and welcoming classroom for people of all identities and backgrounds. No matter your race, nationality, sexual orientation, gender identity, culture, political affiliation, or age, YOU have a place in science and a place in this class. As your instructor, I will do my best to help guide us in creating this environment and include everyone in an equitable class. As student learners, I ask that you also strive to include your classmates and be respectful of opinions and identities that differ from your own. If we all collaborate to create this type of environment, our class will be a much more enjoyable place and we will have the freedom to express ourselves!

While I will have a class roster with each person's legally given name, I am happy to address each of you by whatever name and pronouns you are most comfortable with. If you are uncomfortable with letting the whole class know these preferences, you are more than welcome to talk with me one-on-one and let me know.

### What you can expect in this course:

In this course we will explore how evolution occurs on a molecular scale. Guided by discussion of scientific research articles, you all will gain an understanding of the mechanisms by which genes, proteins, and genomes change over time. As an upper-level course, we 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.

### How to have a fruitful class experience:

Most of our class will be discussion based. We won't be taking any tests, and I want us to focus more on digging in and *thinking* about how molecules evolve each class period! I know it's tempting to just skim through the readings, but the **depth** that you read will correspond to the **depth** of discussion as a class. I totally get that life happens sometimes and I never want you to over-sacrifice a piece of yourself, but I ask that when you have the space to give the effort, please give the effort! College and life can be stressful, and I'm always open to whatever level of transparency you want to share with me. Let's chat and work together to figure out a plan for success in the course!

### **Through this course we 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.

### **How to contact me:**

I always welcome emails from you all! While you can send me an email at whatever time of the day/week you need, I try not to check my email after ~6:00 pm during weekdays or on the weekends. So, just keep in mind I may be less responsive to those emails!

**Students with disabilities:** If there are aspects of the instruction or design of this course that result in barriers to your participation, please let me know as early as possible, in person or via email. If you have any accessibility needs that aren't being met, please chat with me! I want to make this class a positive and comfortable learning environment for all of you. You may also wish to contact Accessible Education Services in 164 Oregon Hall, by phone at (541) 346-1155 or uoac@uoregon.edu.

### **Where can you find the course materials?**

Everything will be posted to the canvas course site: syllabus, grades, assignments, rubrics, etc.

### **Do you need a 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. This book is solely for you to read extra resources if you want. All of our required readings will be through primary journal articles that I will post to canvas.

### **What do you need to bring to class?**

Personal computer that can access the internet. Your brain and a willingness to learn!

### **How will you be graded?**

- Canvas questions due before class (15%)
  - You will submit answers to three questions relevant to the paper before arriving at class each day.
- Participation in class discussion (15%)

You 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! At the end of class we will submit a "minute paper" reflection on canvas for discussion at the start of the next class.
- Leading class discussion (15%)
  - Beginning in the second week, you will introduce/summarize the paper(s) for discussion using a Powerpoint (or similar) presentation. A rubric and

guidelines for presentations will be provided.

- Paper summary (5%)
  - You will identify a primary research article related to the topic of interest for their final paper. **This is:** 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 your conclusions from the results of the study. You also need to include a PDF of the article.
- Abstract on paper topic (10%)
  - You will prepare and submit a proposed topic for their final paper mid- way through the course. I will post detailed instructions on canvas!
- Lab activity (10%)
  - We will dedicate one class to a 'lab' activity performing analyses using DNA sequences.
- 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%**

**General policy on missed assignments:**

Please turn in each assignment 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 me as soon as you can.

**No Extra Credit:**

I haven't built in any opportunities for extra credit in this class so do not anticipate any 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	4/4	Course logistics, molecular biology review	-
1	4/6	Evolutionary genetics review, demonstration on paper presentations	-
2	4/11	The neutral theory of molecular evolution	Kimura 1968*, King and Jukes 1969*, Kimura and Ohta 1974
2	4/13	Nearly neutral theory, molecular clock	Ohta 1973, Ohta and Gillespie 1996, Kumar and Hedges 1998*
3	4/18	Positive selection, adaptive evolution	Yang and Bielawski 2000, Barber and Elde 2014*
3	4/20	Polymorphism and divergence	McDonald and Kreitman 1991*, Fay Wyckoff Wu 2002
4	4/25	Linkage and recombination	Begun 1992*, Hunter 2016
4	4/27	Molecular phylogenetics <b>PAPER SUMMARY DUE</b>	Simion 2017*, Felsenstein 1981
5	5/2	Lab activity	
5	5/4	Comparative genomics	Pease 2016*
6	5/9	Population genomics	Myers 2005*, Myers 2010*
6	5/11	Gene duplication	Force 1999*
7	5/16	Evolution of protein function	Harms and Thornton 2010, Harms and Thornton 2014*
7	5/18	Evolution of protein function 2 <b>PAPER ABSTRACTS DUE</b>	Bloom and Arnold 2009, Thyagarajan and Bloom 2014*
8	5/23	Evolution of gene regulation	Coolon et al. 2014*, Wittkopp 2012
8	5/25	Transposons and mobile DNA	Chuong 2016*, Chuong 2017
9	5/30	Microbial evolution	Arella 2021*
9	6/1	Chromosome evolution	Vicoso and Bachtrog 2015*, Bachtrog 2014
10	6/6	Molecular evolution in action	Levy 2015*, Venkataram 2016
10	6/8	Viral protein dynamics/COVID19	Kudriavtsev 2022*
10	6/9	<b>FINAL PAPER DUE</b>	-

### **How punctual do I need to be?**

Please arrive on time. We will start our discussions and lectures promptly on the hour. If you need to use the restroom while in class, don't hesitate to leave, no need to ask permission! If you have an unusual circumstance and must leave early, please inform the instructor, and try to sit near the exit so your leaving is not disruptive. Finally, please be respectful of your fellow students.

### **How to be collaborative with 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, and since we will be writing a paper, peer-review and bouncing ideas off your fellow classmates is totally okay and encouraged as well! However, 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 as an instructor, I am required to file a written report of any academic misconduct with the Director of Student Conduct and Community Standards.

### **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](https://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](https://respect.uoregon.edu) or [aaeo.uoregon.edu](https://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](https://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 are 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](http://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.