Biology 484/584 - Molecular Evolution
Winter 2018

Professor: Matthew Barber, mfbarber@uoregon.edu
  ● Office hours: Tuesday and Thursday 3:20 - 3:50 (Straub 251) and Friday 10:00 - 10:30 AM (Pacific 321)

GE: Allison Fuiten, afuiten@uoregon.edu
  ● Office hours: Thursday 10:00 - 11:00 AM (Onyx 360)

Time and Location: Tuesday and Thursday 2:00 - 3:50 PM, Straub 251

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. A recommended textbook (Molecular and Genome Evolution, Dan Graur) is available for purchase at the Duck Store. One copy is on reserve at the Science Library. Required readings will be drawn from primary journal articles and will be posted on Canvas.

Required supplies: Please bring 4x6 inch index cards to write 'minute-papers.'

Course Description:
In this course we will explore how evolution occurs on a molecular scale. Guided largely by discussion of primary literature, students will gain an understanding of the forces and mechanisms by which genes, proteins, and genomes change over time. As an upper-level course, students will both assimilate and apply 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 molecular approaches. Topics include mutation, genetic drift, tests of 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. Understand molecular processes that contribute to evolutionary change.
  2. Describe techniques used to study molecular evolution.
  3. Synthesize, present, and critique primary research in the field of molecular evolution.
  4. Use primary literature to propose an original research project in the area of molecular evolution.
Evaluation:
1. Questions before class (20%)
   ○ Questions for required readings will be posted on Canvas, answers must be submitted before each class.
2. Leading class discussion (15%)
   ○ Beginning in the second week, students will introduce the paper(s) for discussion using a Powerpoint (or similar) presentation. A rubric and guidelines for presentations will be provided.
3. Minute-papers (10%)
   ○ At the end of each class, students will be asked to write a short (1-3 sentence) answer to specific prompts relating to the discussion that day.
4. Abstract on paper topic (15%)
   ○ Students will prepare and submit a proposed topic for their final paper mid-way through the course. Instructions will be posted on Canvas.
5. Lab activity (10%)
   ○ We will dedicate one class to a ‘lab’ activity performing analyses using DNA sequence.
6. 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.

Total: 100%

Class preparation:
It is expected that you complete assigned readings and review any posted sources before attending class. Please bring a copy of the papers (preferably a hard copy) to be discussed in class. Canvas question responses are due by noon before lecture. Students are responsible for bringing index cards for minute papers.

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.

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:

- be open to the views of others.
- honor the uniqueness of their colleagues.
- appreciate the opportunity that we have to learn from each other.
- value each other’s opinions and communicate in a respectful manner.
- keep confidential discussions that the community has of a personal (or professional) nature.

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.

Schedule:

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

<table>
<thead>
<tr>
<th>Date</th>
<th>Subject</th>
<th>Papers</th>
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<tbody>
<tr>
<td>1/9</td>
<td>Molecular genetics background, course logistics</td>
<td>-</td>
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<tr>
<td>1/11</td>
<td>Population genetics background, demonstration on paper presentations</td>
<td>-</td>
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<td>1/23</td>
<td>Positive selection, adaptive evolution</td>
<td>Yang and Bielawski 2000, Sawyer 2005* [7,8]</td>
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<td>1/25</td>
<td>Polymorphism and divergence</td>
<td>McDonald and Kreitman 1991*, Fay Wyckoff Wu 2002 [9,10]</td>
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<td>Page</td>
<td>Topic</td>
<td>References</td>
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<td>2/1</td>
<td>Phylogenetics</td>
<td>Simion 2017*, Felsenstein 1981 [13,14]</td>
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<td>2/6</td>
<td>Comparative genomics</td>
<td>Pease 2016* [15]</td>
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<td>2/8</td>
<td>Population genomics</td>
<td>Myers 2005*, Myers 2010* [16,17]</td>
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<tr>
<td>2/13</td>
<td>Gene duplication, fusion, loss</td>
<td>Force 1999*, Hittinger 2007 [18,19]</td>
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<td>2/15</td>
<td>Lab activity</td>
<td>N/A</td>
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<tr>
<td>2/20</td>
<td>Evolution of protein function</td>
<td>Bridgham 2006, Bridgham 2010* [20,21]</td>
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<tr>
<td>2/22</td>
<td>Evolution of protein function (part 2)</td>
<td>Barber 2014*[22]</td>
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<td>3/8</td>
<td>Eukaryotic genome evolution</td>
<td>Fontaine 2015* [31]</td>
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<td>3/13</td>
<td>Sex chromosomes</td>
<td>Vicoso 2013*, Bachtrog 2014 [32,33]</td>
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<tr>
<td>3/15</td>
<td>Molecular evolution in action</td>
<td>Levy 2015*, Venkataram 2016 [34,35]</td>
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**Citations:**


