BIOL 504: Molecular Evolution: Fall 2009

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Class Hours: Monday, Wednesday, Friday 3:30pm - 4:20pm, TLC 144

Office Hours: Monday 4:30 – 5:30, Wednesday 4:30 – 5:30, or by appointment, LSS 346

Course Website: http://people.ibest.uidaho.edu/~bree/BIOL504.html. Readings will be posted as assigned. Lecture powerpoints will be posted after the fact as study aids – this is not a substitute for taking notes in class. This will be an interactive class and there is no substitute for attending lectures and participating in discussions.

Course Format: This will be a lecture-based course, however we will often have interactive discussions and exercises on Fridays. I expect student participation in all aspects of the course.

Course Description: This graduate course in Molecular Evolution will focus on a) understanding evolutionary processes acting at the molecular level and b) utilizing molecular patterns to reconstruct the evolutionary history of genes, genomes, populations, and species. We will discuss both theoretical and empirical approaches to the study of molecular evolution. We will first focus on the microevolutionary processes involved in shaping genetic variation. We then evaluate the macroevolutionary patterns generated by these processes by studying the variation and complexity of genomes. Throughout the course we will highlight current advances and controversies in the field and discuss practical applications to research of using molecular patterns to decipher the signature of evolutionary processes.

Course prerequisites: No prerequisites for graduate students, upper division undergraduates by permission of instructor.

Textbook: Graur and Li: Fundamentals of Molecular Evolution, Second Edition, available at the bookstore. This textbook is a good overview of the field of Molecular Evolution. However, the textbook was published in 2000, so will not expose you to recently acquired knowledge in the field. The course will therefore rely heavily on additional readings.

Additional Readings: We will read a large number of review papers and primary research articles, which will be posted on the course website.

Assignments and Grading:
Exams: There will be two mid-term exams (~50 points each) and one final exam (~75 points)
Term Project (written): There will be a term project (~75 points) consisting either of a) a molecular evolution analysis of real data or b) a grant proposal. Students are encouraged to use this assignment to develop ideas for a molecular component to their research. Think of a topic that you could conduct a literature review, identify an area in need of further exploration, and propose a specific project to address a knowledge gap. There will be intermediate deadlines for
Each student will be responsible for serving as a peer-reviewer for other projects.

**Participation:** Class participation (~10 points) will take many forms including presenting primary literature papers, working collaboratively on class exercises, etc.

**Make-up Policy and Late Assignments:** No make-up exams will be given unless there is a valid excuse (e.g., illness, family emergency) documented in writing within 3 school days of the missed exam (e.g., by Student Health). Late assignments will be penalized 5 points each day. Questions about grading must be submitted in writing within 3 school days of receiving the graded assignment or exam.

**Academic honesty:**
This is a graduate level course that will contribute to your training as a scientist. You are encouraged to interact with your fellow students by forming study groups, discussing course material, and reviewing your classmate’s writing. However, all of your work must be purely your own, and you are expected to adhere to the highest standards of academic honesty.

**Rough Lecture Schedule**

**Foundations**
- **Week of Aug 24**: Introduction and historical underpinnings
- **Week of Aug 31**: Early evolution of life and foundations of the molecular world

**Unit I: Microevolutionary Processes**
- **Week of Sept 7**: Mutation (no class Sept 7th)
- **Week of Sept 14**: Drift
- **Week of Sept 21**: Selection (Midterm I)

**Unit II: Patterns and ME**
- **Week of Sept 28**: Diversity indices
- **Week of Oct 5**: Sequence evolution
- **Week of Oct 12**: Tests for selection
- **Week of Oct 19**: Historical reconstruction (Midterm II, Project Topics Due)

**Unit III: Macroevolutionary Patterns and Genomic Architecture**
- **Week of Oct 26**: Genome size and chromosomal evolution
- **Week of Nov 2**: Organelle genome evolution
- **Week of Nov 9**: Mobilome evolution
- **Week of Nov 16**: Regulatory element evolution (Rough Draft Projects Due)
- **Week of Nov 23**: No class – Thanksgiving Break

**Unit IV: Synthesis and New Horizons**
- **Week of Nov 30**: Modularity, Complexity, and Evolvability
- **Week of Dec 7**: Review and Synthesis

Final December 14th - details TBA (Final Projects Due).