

METHODS IN MOLECULAR PHYLOGENY

BIOLOGY 445/545 3 Credits

WINTER 2008

Instructor: Craig L. Moyer
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Office Hours: T, R Noon-1:00pm; and by appt., BI 406

Class Meetings: W, 1:00pm to 3:00pm & F, 3:00pm to 5:00pm
(plan is 2 hours lecture, 2 hours computer lab)

Mandatory Text:

Inferring Phylogenies, Joseph Felsenstein, 2004

Note: Updated information & reading assignments to be posted on the class web site:
<http://fire.biol.wvu.edu/cmoyer/cmoyer.courses.html>

Course Goals:

- Historical Perspective of Molecular Phylogeny
- Microbial Diversity's Revolutionary Impact on the Hierarchy of Life
- Molecular Evolution of Biological Macromolecules
- Phylogenetic Algorithms as Models of Evolutionary Processes
- Reconstruction of Evolutionary History from Genes and thereby inferring Organisms
- Origins of Life and the Implications on Prokaryotic Evolution

Tentative Class Schedule (2 hours/week):

Week 1	Overview and Organizational; A Brief History of Phylogeny	
Week 2	Recent Revolution in Microbial Diversity; Introduction to Molecular Evolution	
Week 3	Lessons from the BIG TREE of Life; Overview of Molecular Methods	
Week 4	Trees: Nomenclature and Informational Content; More on Trees: Cladistics & Phenetics	
Week 5	Genes: Organization, Function & Evolution; Measuring Genetic Change	
Week 6	Inferring Molecular Phylogeny; Algorithms as Models of Evolution	***Topic Proposals DUE
Week 7	Models of Molecular Evolution: Neutral Theory; Applications of Molecular Phylogenetics	***Topic Outlines DUE

- Week 8 Molecular Perspectives on the Origins of Life;
Implications for Functional Genomics & Bioinformatics
- Week 9 Group Discussions of Molecular Phylogenetic Topics
- Week 10 Group Discussions of Molecular Phylogenetic Topics;
Course Summary, Review & Final Thoughts
*** Term Papers DUE; P/U Take Home Final

Tentative Laboratory Schedule (2 hours/week):

- Week 1 Overview and Organizational Orientation;
Molecular Biology Overview & Sequencing Strategies
- Week 2 Introduction to the Ribosomal Database Project (RDPII)
- Week 3 Building Contig Files using BioNumerics
- Week 4 Sequence Similarity Measures using BioEdit
- Week 5 RDP & NCBI/GenBank Workshop: Similarity Screening
- Week 6 Chimera Checking & Secondary Structure Analysis
- Week 7 Choosing of Taxa to Define Your Taxon; Sequence Alignments: File Formats
- Week 8 Application of Algorithms: Character & Distance Data
- Week 9 Generating Phylogenetic Trees
- Week 9 Bootstrapping Analyses & Measures of Confidence;
Interpreting Data & Final Tree Analysis
- Week 10 No Formal Labs Scheduled Dead Week
***Catch-Up & Finish-Up Projects If Needed

Course Description:

This course will explore the effects of the recent revolutionary discoveries in microbial diversity, the reconstruction of evolutionary history at both molecular and organismal levels, and the implications of the origins of life on prokaryotic evolution. The course will emphasize applications of phylogenetic theories and methods to the understanding and “modeling” of the evolutionary progression of life. Multiple phylogenetic reconstruction algorithms will be closely examined and scrutinized. Course will meet twice a week for 2 hours each time. The first will be for lecture and the second for computer laboratory exercises.

Course Evaluation and Grading:

Class participation, including participation in discussion groups (**15%**); Midterm exam (**15%**); Final Take-Home Exam (**20%**); Laboratory Notebook & Final Trees (**30%**); Term paper, 5-7 pages, 8–10 pages for grad students, including standardized references (**20%**).

Graduate Students will each be expected to lead multiple group discussions develop and expanded term paper and will be given additional laboratory assignments (i.e., additional sequence data for analysis, etc.). **Every student** will be expected to undertake a project that will be included in a group discussion **AND** producing a term paper on a related topic of interest agreed upon by student and instructor ahead of time. The discussion groups will consist of 2-3 assigned papers from the primary literature a week ahead of time for the entire class to read and then discussing the applicability of those papers to molecular phylogeny during the designated class period.