

MOLECULAR SYSTEMATICS

Instructor: Dr. J. Craig Bailey

Course: Molecular Systematics

Office: 2339 Center for Marine Science (ph: 962-2371)

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Course objectives: This course is designed to provide students with a firm grounding in the theory, assumptions, data gathering and analytical techniques that underlie the practice of molecular phylogenetic research.

Grading policy: Your grade will be based on seven scores, including three lecture examinations and four take-home assignments. Objectives and requirements for each take-home assignment will be described during lecture. Each exam is worth 100 points and each of the four assignments is worth 25 points. Thus, a total of 400 points are possible. *Extra credit work will not be granted under any circumstances.*

The following grade scale will be *strictly* enforced:

A+ 100%- 95% C+ 79.9%-75%

A 94.9%- 90% C 74.9%- 70%

B+ 89.9%- 85% D 69.9%- 60%

B 84.9%-80% F 59.9%- 0%

A special note about exams, assignments and grading: The Department of Biological Sciences recognizes that English composition is a fundamental element of education and expects students enrolled in biology courses to demonstrate a basic knowledge of grammar, spelling and other aspects of sentence structure. Hence, in Molecular Systematics exam questions that require written responses, whether

short answers (e.g., definitions) or essays, will be graded 95% on factual content and accuracy and 5% on correct grammar, spelling and other basic elements of English composition.

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TENTATIVE LECTURE TOPICS and COURSE ASSIGNMENTS

WEEK 1 Modes of speciation and biodiversification

WEEK 2 Systematics & phylogenetic classifications: use & utility; cladograms, phylograms and cluster analyses

WEEK 3 Homology assessment & data matrices

WEEK 4 Characters, character states & binary coding

ASSIGNMENT I: "Thingy" trees

EXAM I

WEEK 5 Fragment-based approaches: RFLP, AFLP, RAPDs, microsatellites & DNA-DNA hybridization

WEEK 6 Distance matrix methods: neighbor-joining

ASSIGNMENT II: Analysis of hamlet fish microsatellite data

WEEK 7 Cladistics I: theory, assumptions & rooting; gene trees vs. species trees

WEEK 8 Cladistics II: RI, CI, HI, g-statistics etc.; cladistic biogeography

WEEK 9 Node support: jackknife, bootstrap, decay values etc.

EXAM II

WEEK 10 PCR, gene isolation, DNA sequencing

WEEK 11 DNA alignment algorithms, secondary structure, nucleotide substitution

WEEK 12 Consensus tree methods

ASSIGNMENT III: Chromophyte 18S rRNA phylogeny

WEEK 13 Molecular clocks; coding vs. non-coding DNA, disparate rates of change; codon, G + C%, organellar, and tr/tn bias problems

WEEK 14 Analyzing protein-encoding genes

WEEK 15 Maximum likelihood approaches (Quartet puzzling)

ASSIGNMENT IV: Streptophyte *rbcL* phylogeny

WEEK 16 Research papers due

EXAM III