Professors:
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Meeting Times:

Class meeting times are Mon, Wed, and Fri, 2:00–4:00pm in 3083 VLSB.
Office hours for all professors and the GSI are by appointment. E-mail is often the easiest way to contact us or just track us down before or after class to schedule an appointment.
Our class webpage is **http://ib.berkeley.edu/courses/ib200/**
please check this often as it will have class announcements and answers to questions about the course material

Readings & Lecture:

Each lecture you will be provided with a handout outlining the key concepts to be covered that day. Prior to each lecture there will be one or two short required readings, which will give some background on the topic and facilitate discussion of these concepts during the lecture. The required readings will be posted on the class webpage and/or sent to your e-mail address and should be read before class. The class webpage will also list several additional important readings for each topic so that you may delve deeper into those topics which interest you most or which may be related to your final project.

Labs:

Lab exercises will be done on personal computers – you must have access to one that you can bring to class, a laptop is obviously preferable. Handouts will be given for each lab highlighting the program and specific assignments for the day. Prior to labs you will be asked to download programs and files onto your computer. It is to your advantage to download all software prior to your arrival in lab in order to maximize the time spent exploring the program capabilities and minimize troubleshooting.

Grading:

(1/3) **Participation.** Do the reading, come to each class and lab, and participate in discussions. A few homework assignments will also be given.
(1/3) **Quizzes.** Two equally-weighted, one-hour quizzes will be given that emphasize problem solving and conceptual understanding.
(1/3) **Final Project.** An oral presentation during the minisymposium and a written report in a professional journal format. [See below]

Final Project:

This will be a substantive, tree-building and comparative analysis using data from a group of the student's choice (with approval of the instructors; we encourage the study of thesis-related or other study groups). Based on phylogenetic trees that you generate, the project should apply all appropriate comparative methods to evaluate several types of comparative questions. There should also be a rigorous critique of previous comparative literature on the organismal group of choice. A written report will be turned in during finals week, in the form of a professional journal publication, that is, with an introduction (containing the literature review and critique), materials and methods section, results (using summary figures – no raw data), and a discussion (being sure to compare results from the different methodologies applied, and to reach some biological conclusions). We will schedule a minisymposium at the end of the term (scheduled for May 9th) where students will give a short presentation of their results.

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Week 1:
Jan. 22. Introduction - contemporary issues in phylogenetics - what is at stake? (KWW, BDM, & DDA)
LAB: discussion: student interests; get acquainted roundtable
Jan. 24. What is systematic biology? history & philosophy (BDM)
LAB: Tour of systematics collections, labs, and resources in VLSB
Week 2:
Jan. 27. The Hennig Principle: homology; synapomorphy; rooting; integrating fossils; Character analysis -- what is a data matrix? (BDM)
LAB: discussion about homology
Jan. 29. Morphological data I: ontogeny & structure of plants vs. animals (BDM)
LAB: Introduction to Mesquite (esp. data matrix functions)
Jan. 31. Morphological data II: Character coding [primary homology, polarity, additivity, etc.]; (KWW)
LAB: Introduction to Mesquite, continued (tree functions)
Week 3:
Feb. 3. Molecular data I: General introduction; types of molecular data (immunological distance; DNA hybridization; allozymes; restriction sites, DNA sequences, ESTs; genomics) (BDM)
LAB: **PROJECT TOPIC DUE -- discuss in class**
Feb. 5. Molecular data II: Sequence alignment (KWW)
LAB: Introduction to GENBANK, Clustal; Muscle; sequence analysis and alignment processing
Feb. 7. Phylogenetic trees I: reconstruction; models, algorithms & assumptions (BDM)
LAB: Introduction to PAUP; Nexus, Newick, FASTA files
Week 4:
Feb. 10. Phylogenetic trees II: Phenetics; distance-based algorithms (KWW)
LAB: UPGMA and neighbor-joining using PAUP
Feb. 12. Phylogenetic trees III: Parsimony; Measures of support and robustness (KWW)
LAB: CIPRES supercomputer web interface; bootstrap, jackknife, and Bremer support
Feb. 14. Phylogenetic trees IV: Maximum likelihood; molecular evolution and phylogenetics (KWW)
LAB: Maximum likelihood applications using PAUP and Modeltest
Week 5:
Feb. 19. Phylogenetic trees V: Bayesian methods (TLG)
LAB: Mr Bayes
Feb. 21. Phylogenetic trees VI: Dating in the 21st century: clocks, & calibrations; proper use of fossils (KWW)
LAB: testing molecular clock, r8s, BEAST
Week 6:
Feb. 24. Phylogenetic trees VII: Tree-to-tree comparisons; consensus methods; supertrees (KWW)
LAB: Tree comparisons & consensus; tree viewing & manipulating (FigTree, TreeGraph 2, etc.)
Feb. 26. Introduction to Statistical Thinking (DDA)
LAB: Introduction to R
Feb. 28. Qualitative character evolution within a cladogram I: discrete states; ancestral state reconstructions (DDA)
LAB: discussion of application papers (**students to bring papers from their groups**)
Week 7:
Mar. 3. Qualitative character evolution within a cladogram II: comparing two or more characters (DDA)
LAB: discussion of application papers continued.
Mar. 5. Quantitative character evolution within a cladogram I: intro; ancestral trait reconstruction; phylogenetic conservatism (DDA)
LAB: Intro to R continued; Phylogenetic conservatism; correlation of discrete characters
Mar. 7. Quantitative character evolution within a cladogram II: independent contrasts and trait correlations (DDA)
LAB: Continuous characters; independent contrasts (R)
Week 8:
Mar. 10. Phylogenetics and adaptation (DDA)
LAB: discussion of adaptation (all)
Mar. 12. Classification I -- introduction to phylogenetic classifications; monophyly, information content (KWW)
LAB: Online systematic databases I: nomenclature, geography, phylogeny (e.g.TreeBase)
Mar. 14. Classification II -- phylogenetic taxonomy including incorporation of fossils; Phylocode (BDM)
LAB: discussion of the role of systematics and classification in modern biology (all)

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Week 9:
Mar. 17. Classification III -- species concepts; speciation (BDM)
LAB: discussion of species concepts
Mar. 19. Classification IV -- DNA barcoding and DNA taxonomy (KWW)
LAB: **discuss progress on projects in class**
Mar. 21. Classification V -- nomenclature; Zoological & Botanical Codes; practical systematics, monography (KWW)
LAB: Online systematic databases II: specimens; **QUIZ 1** handed out (due that evening)

Mar. 24-28. SPRING BREAK

Week 10:
Mar. 31. Evolution and development - heterochrony (DDA)
LAB: discussion of role of heterochrony in evolution
Apr. 2. Molecular evolution (BDM)
LAB: analysis of molecular evolution; substitution models, Modeltest, etc.
Apr. 4. Gene family evolution; comparative genomics; evo-devo (BDM)
LAB: tools for comparative genomics (BLAST), evo-devo, etc.
Week 11:
Apr. 7. Phylogenetic trees VIII: Below the "species level;" phylogeography; dealing with reticulation (BDM)
LAB: discussion of coalescence theory; applications in population genetics and phylogeography
Apr. 9. Comparing sister clades within a cladogram: the shape of evolution (DDA)
LAB: generating random trees; testing cladogram imbalance
Apr. 11. Adaptive radiations (DDA)
LAB: lineages through time; diversification analyses
Week 12:
Apr. 14. Tempo and mode in macroevolution; patterns of diversification and extinction (BDM)
LAB: **discuss progress on projects in class; present initial analysis of project dataset**
Apr. 16. Phylogenies and Community Ecology (DDA)
LAB: picante, Phylocom
Apr. 18. Phylogenetics and conservation biology (BDM)
LAB: introduction to BIODIVERSE
Week 13:
Apr. 21. Biogeography I: basic principles; ecological vs. historical approaches (KWW)
LAB: discussion on levels of selection (all)
Apr. 23. Biogeography II: vicariance biogeography; detecting dispersal (KWW)
LAB: Biogeographic software; DIVA, Lagrange, BioGeoBEARS
Apr. 25. Biogeography III: phylogenetics and range modeling; biome recognition and other spatial issues (BDM)
LAB: BIODIVERSE; phylogenetic beta-diversity, measuring phylogenetic turnover, mapping
Week 14:
Apr. 28. Comparing cladograms; cospeciation methods (DDA)
LAB: cospeciation methods; Brooks parsimony
Apr. 30. Coevolution; symbiosis (DDA)
LAB: **discuss progress on projects in class**
May 2. Glimpses of the future - integrating genetics, genomics, physiology, ecology, and evolution (DDA, BDM, & KWW)
LAB: final discussion; **QUIZ 2** handed out (due that evening)

Weeks 15 & 16: READING & FINALS WEEKS
May 5. Course summary and perspectives on the future (DDA, BDM, KWW, TLG and class members)
May 9. **Student minisymposium**
May 14. **Final projects due**

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