This course will review some of the tremendous variety of methods for constructing phylogenetic trees using morphological and molecular data. The various options are outlined and critically examined, along with relevant software. There will be a lectures on a series of relevant topics followed by practical classes where both morphological and molecular data will be explored through a series of exercises. The uses of the resulting phylogenetic trees (e.g., evolutionary and ecological transformations, biodiversity measurements, biogeography, systematics and taxonomy) are further examined through an independent project. A presentation as a talk or poster a short write-up of the project are required at the end.

There is no textbook. Reading will be assigned as needed. If you want to do some background reading, have a look at the free electronic resource through the UCSD library: E.O. Wiley & Bruce S. Lieberman 2011. Phylogenetics: theory and practice of phylogenetics systematics. 2nd edition. http://roger.ucsd.edu/record=b7094662~S9

Assessment

Midterm At Home Quiz in Week 5 = 10%
Practical Work = 20%. Submit this twice in the Quarter
Project (~5 page max.: 30%); poster/talk presentation (10%) = 40%.
Final exam: At Home Open Book = 30%. Wed. March 17

The project writeup is due Friday March 12 (end of week 10).

Academic Integrity is expected. Cheating will not be tolerated.

https://academicintegrity.ucsd.edu/forms/form-pledge.html
Lectures

Week 1.
January 4  Introduction to systematics, tree-thinking, basic terminology.
January 6  Morphology, characters and parsimony analysis, similarity and homology-statements, basic tree calculations, tree rooting.

Week 2.
January 11 Parsimony, tree searching, multiple equally parsimonious trees & consensus.
January 13 Assessing support for trees; bootstrap, jackknife. Character coding. Transformations, AccTran, DelTran.

Week 3.
January 18 Martin Luther King, Jr. Holiday
January 20 Molecular sequence data 1. Alignment, Clustal Muscle, MAFFT

Week 4.
January 25 Molecular Sequence Data 2. Alternatives to Parsimony: Distance methods, Models and Maximum Likelihood.
January 27 Molecular sequence data 3. Bayesian methods. (Practice quiz)

Week 5.
February 1 Combining data; causes and issues with incongruence
February 3 Hypothesis testing (and Midterm Quiz =10%).

Week 6.
February 8 The comparative method and phylogenetic trees.
February 10 Historical biogeography/Phylogeography.

Week 7.
February 15 Presidents' Day Holiday.
February 17 Fossils, molecular clocks and dating on trees.

Week 8.
February 22 Key innovations/diversification rates/cospeciation.
February 24 Current Nomenclature; Biodiversity measurement; Surrogacy.

Week 9.
March 1 Species.
March 3 Biodiversity and DNA barcoding.

Week 10.
March 8 Next Gen Approaches to Phylogenetics
March 10 Presentations.

Practicals

Week 1

Week 2
January 11. Continue using PAUP, Mesquite & FigTree to become familiar with the programs. Tree Searching, Consensus trees and Tree support methods; Bootstrap and Jacknife analysis; Beardworms and Ventworms, Vertebrates, Parrots.
January 13. Tracing the history of character evolution. Cirratuliform worms; Sharks and Rays. Fruit forms and habitats; Spiders mutilation and cannibalism.

Week 3
January 18. Martin Luther King, Jr. Holiday

Week 4
January 27 (Practice quiz) Phylogenetic analysis of molecular data 3. MP and Likelihood (Anglerfish) and then Bayesian Statistical approaches to tree building; jModelTest and Bayesian approaches (MrBayes). Primates.

Week 5
February 1 Review of methods to date. Giant clams.
February 3 Midterm Quiz for 10%. Combining Data and Hypothesis testing. Featherworms.
Send PracWork as PDF to Marina

Week 6
February 8 Comparative method and trees exercises. Correlated evolution revisited. Syngnathidae and Sea dragons.
February 10 Integrating geography & DNA I: Historical biogeography Crayfish and Iguanas.
Week 7
February 15 Presidents' Day Holiday
February 17 Integrating geography and DNA II: Phylogeography. Sea slugs, featherstars, seastars.

Week 8
February 21 Molecular clocks and divergence times (Primates and boneworms).
February 23 Diversification rates (*Conus*), and cospeciation.

Week 9
March 1 Revise methods session: Penguins/ Start Individual projects.
Send PracWork as PDF to Marina
March 3 Individual projects and consultation with Greg and Marina.

Week 10
March 8 Individual projects and consultation with Greg and Marina.
March 10 Presentations/Posters: ~10 minutes each.