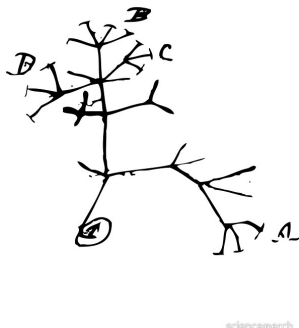


SIO147-Applications in Phylogenetics: 6 units Winter 2018: Mon. & Wed.**Lecture: 12:30-1:50pm; Lab: 2-5:50pm****Location: Eckart Building (Bldg 8755, Formerly SIO Library)****Room 225, Computer Lab****Course Instructor: Greg Rouse: grouse@ucsd.edu****Office hour Friday 1.30-2.30pm; SIO Hubbs Hall room 2170****Teaching Assistant: Julia Busch: jubusch@ucsd.edu***I think*

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 10-minute presentation and a short write-up of the project are required at the end.

There is no textbook required. 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>

Getting to Eckart

From the main campus, catch the SIO Shuttle, which leaves every 15 minutes.

<https://transportation.ucsd.edu/shuttles/sio.html>

Note: the Shuttle has **limited** capacity so if you all try and get the 12.15 shuttle some of you will miss out! So my advice is to plan on the 11.45 or 12.00 shuttles and go for the 12.15 only as last option. Get off the Shuttle on **La Jolla Shores** and walk down to Eckart; the computer lab is upstairs on the 2nd floor. Please try to have eaten your lunch by the time you get to the lab. No food or drink are allowed to be consumed in the lab. There is a nice place to eat your lunch next to Eckart and enjoy the view.

Assessment

Midterm Quiz in Week 5 = 10%; there will be a short 'practice' (no marks) quiz in week 4 to familiarize students with exam question style and content.

Project write-up (~5 page max.; 30%) and presentations (10%) = **40%**.

Final exam = 50%. Likely to be March 21

The project writeup is due March 16 (end of week 10).

Lectures

Week 1.

January 8 Introduction to systematics, tree-thinking, basic terminology.

January 10 Morphology, characters and parsimony analysis, similarity and homology- statements, basic tree calculations, tree rooting.

Week 2.

January 15 Martin Luther King, Jr. Holiday

January 17 Parsimony, tree searching, multiple equally parsimonious trees & consensus.

Week 3.

January 22 Assessing support for trees; bootstrap, jackknife and Bremer support. Character coding. Transformations, Acctran, Deltran.

January 24 Molecular sequence data 1. Alignment, Clustal Muscle, MAFFT

Week 4.

January 29 Molecular Sequence Data 2. Alternatives to Parsimony: Distance methods, Models and Maximum Likelihood.

January 31 Molecular sequence data 3. Bayesian methods. (Practice quiz)

Week 5.

February 5 Combining data; causes and issues with incongruence

February 7 Hypothesis testing (and Midterm Quiz =10%)

Week 6.

February 12 The comparative method and phylogenetic trees.

February 14 Historical biogeography/Phylogeography.

Week 7.

February 19 Presidents' Day Holiday.

February 21 Fossils, molecular clocks and dating on trees.

Week 8.

February 26 Key innovations/diversification rates/cospeciation.

February 28 Current Nomenclature; Biodiversity measurement; Surrogacy.

Week 9.

March 5 Species.

March 7 Biodiversity and DNA barcoding.

Week 10.

March 12 No lecture work on projects.

March 14 Presentations.

Practicals

Week 1

January 8. Parsimony analysis. Hand exercises using Caminalacules & Parrots; Taxonomy exercises involving trees.

January 10. Introduction to PAUP* and Mesquite. Data entry, Nexus format, Tree manipulation, Character tracing. Executing files, Managing data (include exclude taxa, characters, annotations footnotes and images). Defining assumptions, Searching for trees. Describing trees, Searching methods under parsimony, Saving trees. Rooting trees. Vertebrates, Parrots.

Week 2

January 15. Martin Luther King, Jr. Holiday

January 17. Continue using PAUP, Mesquite & FigTree to become familiar with the programs. Tree Searching, Consensus trees and Tree support methods; Bootstrap and Jackknife analysis; Running Autodecay for Bremer support. Beardworms and Ventworms, Vertebrates, Parrots.

Week 3

January 22. Tracing the history of character evolution. Cirratuliform worms; Sharks and Rays. Fruit forms and habitats; Spiders mutilation and cannibalism.

January 24. Molecular data 1. Basic Alignment and Parsimony Analysis. GenBank. Using Clustal and MUSCLE in Mesquite. Species exercise. What is the status of the Polar bear?

Week 4

January 29 Molecular data 2. Distance and Neighbor-Joining. Incorporating models of molecular evolution into datasets. Using jModelTest. Maximum Likelihood in RaXML. Long branch attraction. Ursidae; Strepsiptera.

January 31 (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 5 Review of methods to date. Giant clams.

February 7 Midterm Quiz for 10%. Combining Data and Hypothesis testing. Featherworms.

Week 6

February 12 Comparative method and trees exercises. Correlated evolution revisited. Syngnathidae and Sea dragons.

February 14 Integrating geography & DNA I: Historical biogeography Crayfish and Iguanas.

Week 7

February 19 Presidents' Day Holiday

February 21 Integrating geography and & DNA II: Phylogeography. Sea slugs, featherstars, seastars.

Week 8

February 26 Molecular clocks and divergence times (Primates and boneworms).

February 28 Diversification rates (*Conus*), and cospeciation.

Week 9

March 5 Revise methods session: Penguins/ Individual projects.

March 7 Individual projects.

Week 10

March 12 Individual projects.

March 14 Presentations: ~10 minutes each.

I think

