

## Principles of Systematic Biology - Biology 545 - Spring 2019

**Professor:** Dr. Jack Sullivan Office: LSS 345 Phone: 5-9049 email: [jacks@uidaho.edu](mailto:jacks@uidaho.edu)  
Office Hours: Tuesdays, 10:30 – 11:30 & Wednesdays, 8:30 – 9:30

**Research Interests:** Theoretical systematics; Molecular evolution, Comparative phylogeography, Speciation.

**T.A.:** Megan Ruffley email: [ruff6699@vandals.uidaho.edu](mailto:ruff6699@vandals.uidaho.edu)

**Text:** Felsenstein, J. 2003. *Inferring Phylogenies*. Sinauer, Sunderland, Massachusetts. This is by far the best book out there for a graduate course. Joe has been the main driving force behind the statistical approach to phylogenetics and the book is excellent.

**Course Website:** <http://www.webpages.uidaho.edu/~jacks/Biol545.html>. I will post lecture notes, lab handouts, old exams, and papers from the primary literature on this site. The lecture notes will be in pdf format and will actually be the notes I lecture from. This is my 10<sup>th</sup> time teaching this course and the notes are in pretty good shape. However, the field is incredibly dynamic and you can expect some delays as I update lectures to incorporate emerging material.

**Goals (a.k.a. Learning Outcomes):** The goals for the course are as follows: **a.** Provide you with an understanding of the central role that systematics plays across the biological disciplines. **b.** Provide you with the historical and, especially, theoretical background that will facilitate your understanding of controversies in systematic biology. **c.** Provide the expertise and experience that will enable you to address questions in biology using modern, cutting-edge phylogenetic analyses.

**Make-up Policy:** Make-up exams will be given only if I have been contacted prior to the exam.

**Late Assignments:** One point will be deducted for every day that an assignment is late.

### Grading:

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| Exams (there are two, each worth 100 pts.).....          | 200 |
| Participation in discussions of primary literature ..... | 50  |
| Exercises (5 assignments, each worth 10 pts.).....       | 50  |
| Final Project: Poster Presentation .....                 | 50  |

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Total 350

## Lecture & Lab Schedules (Tentative)

|   |                                  |
|---|----------------------------------|
| 01/10 – 1. Introduction: Importance of Phylogeny      |                                  |
| 01/15 – 2. History of Phylogenetic Inference: Schools | 1/14 - Intro & Paper Discussion  |
| 01/17 – 3. Characters: Homology, Morphology           |                                  |
| 01/22 – 4. Characters: Molecular                      | 1/21 - Paper Discussion          |
| 01/24 – 5. Alignment Strategies                       |                                  |
| 01/29 – 6. Optimality Criteria – Parsimony            | 1/28 Lab 1: Alignments           |
| 01/31 – 7. Optimality Criteria –ML/ME                 |                                  |
| 02/05 – 8. Optimality Criteria – ML/ME                | 2/4 - Paper Discussion           |
| 02/07 – 9. Optimality Criteria – ML/ME                |                                  |
| 02/12 – 10. “Algorithmic” Approaches                  | 2/11 Lab 2: Parsimony analyses   |
| 02/14 – 11. “Algorithmic” Approaches                  |                                  |
| 02/19 – 12. Searching Tree Space                      | 2/18 - Review for Exam           |
| 02/21 – <b>Exam I</b>                                 |                                  |
| 02/26 – 13. Why Models of Sequence Evolution Matter   | 2/25 Lab 3: Model-based Analyses |
| 02/28 – 14. Simple Models of Sequence Evolution       |                                  |
| 03/05 – 15. Increasing Model Complexity               | 3/4 - Paper Discussion           |
| 03/07 – 16. Model Complexity/Model Selection          |                                  |
| <b>Spring Break</b>                                   |                                  |
| 03/19 – 17. Model Selection                           | 3/18 Lab 4: Nodal Support        |
| 03/21 – 18. Method Performance                        |                                  |
| 03/26 – 19. Consensus and Nodal Support               | 3/25 - Paper Discussion          |
| 04/28 – 20. Consensus and Nodal Support               |                                  |
| 04/02 – 21. Hypothesis Testing                        | 4/1 Lab 5: Species Trees         |
| 04/04 – 22. Molecular Clocks                          |                                  |
| 04/09 – 23. Multiple Data Sets: Partitions/Mixtures   | 4/08 - Review for Exam           |
| 04/11 – <b>Exam II</b>                                |                                  |
| 04/16 – 24. Multiple Data Sets: Partitions/Mixtures   | 4/15 - Paper Discussion          |
| 04/18 – 25. Species Trees                             |                                  |
| 04/23 – 26. Species Trees                             | 4/22 - Project Help              |
| 04/25 – 27. Non-Tree Approaches: Networks & Spectra   |                                  |
| 04/30 – 28. Ancestral Character State Reconstruction  | 4/29 - Project Presentations     |
| 05/01 – 29. Taxon sampling                            |                                  |

## Internet Resources

There is an ever-growing array of resources available to those wishing to estimate phylogenies. Some of these are web-based, whereas others are downloadable. This array is constantly changing, but there are a few sites on the Internet that provide updated lists, descriptions, and links.

<http://evolution.genetics.washington.edu/phylip/software.html>. Joe Felsenstein provides one of the best compilations of a diverse array of phylogeny programs (at least 194 of them) at this site. Programs included in this listing are those that do some type of phylogenetic analysis.

<http://www.ebi.ac.uk/Tools/msa/>. This site provides access to lots of different alignment programs (ClustalW, Toffee, Kalign, MAFFT, and Muscle). It allows you to do alignments online.