

## Principles of Systematic Biology - Biology 545 - Spring 2009

**Professors:** Dr. Jack Sullivan      LSS 257      5-9049      [jacks@uidaho.edu](mailto:jacks@uidaho.edu)  
Office Hours: Tuesdays, 10:30 – 11:30 & Wednesdays, 8:30 – 9:30

Dr. Luke Harmon      LSS 347      5-3046      [lukeh@uidaho.edu](mailto:lukeh@uidaho.edu)  
Office Hours: Tuesdays, 8:30-9:30 & Thursdays, 2:30-3:30

**Research Interests:** JS - Theoretical systematics; Speciation; Conservation genetics.  
LH - Macroevolution, comparative methods, ecology.

**T.A.:** Lydia Gentry      [gentry6824@vandals.uidaho.edu](mailto:gentry6824@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 amazing.

**Course Website:** <http://www.webpages.uidaho.edu/~jacks/PhylogeneticInference.html>. We 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. However, this is the fourth time through this course so, although they're getting better, they're still a bit rough and you can expect some delays.

**Goals:** The goals for the course are as follows: a. Provide you with the historical and, especially, theoretical background that will facilitate your understanding of current controversies in systematic biology. b. 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 we have been contacted prior to the exam.

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

### Grading:

|   |     |
|---|-----|
| Exams (there are two, each worth 100 pts.).....         | 200 |
| Participation in discussions of primary literature..... | 25  |
| Exercises (7 assignments, each worth 10 pts.).....      | 70  |
| Final Project: Poster Presentation .....                | 25  |

---

Total 320

## Lecture & Lab Schedules (Tentative)

|  |                                 |
|--|---------------------------------|
| 01/15 – 1. Introduction: Importance & History of Phylogeny |                                 |
| 01/20 – 2. Characters & Homology                           | Lab 1: Intro & Paper Discussion |
| 01/22 – 3. Alignment Strategies                            |                                 |
| 01/27 – 4. Optimality Criteria – Parsimony                 | Lab 2: Parsimony analyses       |
| 01/29 – 5. Optimality Criteria – ML & ME                   |                                 |
| 02/03 – 6. “Algorithmic” Approaches                        | Lab 3: Paper Discussion         |
| 02/04 – 7. Searching Tree Space                            |                                 |
| 02/06 – 8. Character Weighting in Parsimony                | Lab 4: Model-based Methods      |
| 02/08 – 9. Why Models of Sequence Evolution Matter         |                                 |
| 02/10 – 10. Models of Sequence Evolution                   | Lab 5: Paper Discussion         |
| 02/12 – 11. Model Selection                                |                                 |
| 02/17 – 12. Partitions and Mixtures                        | *Lab 6: Partitioned Analyses    |
| 02/19 – 13. Method Performance                             |                                 |
| 02/24 – 14. Support & Hypothesis Testing                   | Lab 7: Paper Discussion         |
| 02/26 – 15. Species Trees from Gene Trees                  |                                 |
| 03/03 – <b>Exam I</b>                                      | Lab 8: Support/Hypothesis Tests |
| 03/05 – 16. Introduction to comparative methods            |                                 |
| 03/10 – 17. Diversification I: Birth-death models          | Lab 9: Simulating evolution     |
| 03/12 – 18. Diversification II: Tree balance               |                                 |
| <b>Spring Break</b>  |                                 |
| 03/24 – 19. Diversification III: lineage through time      | Lab 10: Paper discussion        |
| 03/26 – 20. Continuous characters I: Brownian motion       |                                 |
| 03/31 – 21. Continuous characters II: multivariate         | Lab 11: Lineage-through-time    |
| 04/02 – 22. Continuous characters III: other models        |                                 |
| 04/07 – 23. Discrete characters I: The Mk model            | Lab 12: Paper discussion        |
| 04/09 – 24. Discrete characters II: Character correlations |                                 |
| 04/14 – 25. Quantitative genetics and comparative methods  | Lab 13: <i>Anolis</i> ecomorphs |
| 04/16 – 26. Characters and diversification                 |                                 |
| 04/21 – 27. Biogeography I: classic methods                | Lab 14: Paper Discussion        |
| 04/23 – 28. Biogeography II: modeling range evolution      |                                 |
| 04/28 – 29. Testing models of macroevolution               | Lab 15: Bisse                   |
| 04/30 – <b>Exam II</b>                                     |                                 |

\*Monday the Feb. 16th is Presidents' Day. We'll need to decide what to do (meet anyways or meet some other evening).

## 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.techfak.uni-bielefeld.de/bcd/Curric/MulAli/welcome.html>. This is a set of links to various web pages for multiple alignment pages. It's a little dated, but still useful.

<http://www.ebi.ac.uk/clustalw/> This is the ClustalW site. You can do on-line alignments from this site!