Joel Velasco
Phil 249/349
(Graduate students and upper level undergrads)

Topics in Philosophy of Biology:

Evidence and Evolution

This seminar will be focused around the new book by Elliott Sober – Evidence and Evolution: The Logic Behind the Science. We will read the entire book as well as related readings. The broad goal of the book (and thus of our seminar) is to understand the concept of evidence and how it is used in science and in particular, in biology.

This seminar will begin with a general consideration of the concept of evidence, using tools from probability theory. In this early part of the seminar, we'll consider Bayesian, likelihoodist, and frequentist ideas. The rest of the seminar will apply these tools to questions about evidence that arise in connection with evolutionary theory. One topic we'll consider briefly is creationism and intelligent design, but the rest are internal to evolutionary biology. The main focus will be on questions that arise in connection with testing (i) hypotheses about phylogenetic relationships (e.g., why think that the species we currently observe have common ancestors?) and (ii) hypotheses about natural selection.

For details, go to the course website at http://stanford.edu/~joelv/teaching/249

Readings:

Unit 1: The Concept of Evidence

Week 1: Probability Basics

Week 2: Bayesianism and Likelihoodism
E&E 1.1–1.3, B. Fitelson, "Likelihoodism, Bayesianism, and Relational Confirmation." *Synthese* (2007) 156: 473-489; D. Steel, "Bayesian Confirmation Theory and the Likelihood Principle." *Synthese* (2007) 156: 53-77.

Week 3: Frequentism
E&E 1.4-1.6, S. Goodman and R. Royall, "Evidence and Scientific Research." *Amer J. of Public Health* (1988) 78: 1568-1574; S. Goodman, "Toward Evidence-Based Medical Statistics I – the P-value Fallacy" *Ann Intern Med.* (1999) 130: 995-1004;. S. Goodman, "Toward Evidence-Based Medical Statistics 2 – the Bayes Factor." *Ann. Intern. Med.* (1999) 130: 1005-1013.

Week 4: Models and Model Selection Theory: E&E 1.7-1.9; M. Forster and E. Sober, "How to Tell When Simpler, More Unified, or Less *Ad Hoc* Theories will Provide More Accurate Predictions." *Br. J. Phil. Sci.* (1994) 45: 1-36.

Unit 2: Intelligent Design

Week 5: E&E, ch. 2.

Unit 3: Natural Selection

Week 6: Selections from Darwin, *The Origin of Species*, Philip Kitcher, Darwin's Achievement;" in *In Mendel's Mirror*. Oxford UP, 2005, pp. 45-93; M.J.S. Hodge, "Natural Selection as a Causal, Empirical, and Probabilistic Theory." In L. Kruger, G. Gigerenzer, and M. Morgan (eds.), *The Probabilistic Revolution*, vol. 2, MIT Press, 1987, pp.233-270

Week 7: E&E 3.1-3.6. Selections from Harvey and Pagel, *The Comparative Method in Evolutionary Biology*

Week 8: E&E, 3.6-3.12. Selections from Harvey and Pagel, *The Comparative Method in Evolutionary Biology*

Unit 4: Common Ancestry

Week 9: Similarity as evidence for common ancestry: E&E 4.1-4.7; D. Penny, L. Foulds, M. Hendy, "Testing the theory of evolution by comparing phylogenetic tress constructed from five different protein sequences," *Nature* (1982) 297: 197-200. D. Penny, M. Hendy, and A. Poole, "Testing Fundamental Evolutionary Hypotheses," *Journal of TheoreticalBiology* (2003) 223: 377-385..

Week 10: Other kinds of evidence for common ancestry: E&E 4.8, 4.9, Conclusion, Phylogenetic Inference**:** M. Steel and D. Penny, "Parsimony, Likelihood and the Role of Models in Molecular Phylogenetics," *Molecular Biology and Evolution* (2000) 17: 839-850; J. Huelsenbeck, F. Ronquist, R. Nielsen, J. Bollback, "Bayesian Inference of Phylogeny and Its Impact on Evolutionary Biology." *Science* (2001) 294: 2310-2314.