Department of Biology & Wildlife  
Department of Philosophy & Humanities  
University of Alaska, Fairbanks

BIOL-PHIL FE1 494/694 "Conceptual Issues in Evolutionary Biology"  
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Spring 2002  
Time & Place: TR 6:00 – 7:30 PM;  
nscl 136

Office Hours: to be announced

Overview

Scientific theories are difficult things to deal with, mainly because they not only explain the way things are, but they also restrict the way things can be. Evolutionary theory, for instance, tells us that there cannot be functional structures that spring into existence without ancestry (if there are eye structures, there had to be ancestral eye-like structures). We do not expect either to see adaptations that promote their own genetic demise (it is very unlikely that the urge to kill relatives, or to prefer mating with siblings will evolve). Similarly, adaptations that have nothing to do with fitness cannot evolve by natural selection. To make matters worse, theoretical constraints are not always obvious or clear. For instance, we are still not sure about whether or not there are such things as biological species, group level adaptations, or why should (or should not be) sexual reproduction.

One might wish to think that these are academic nuances that need not bother the researcher. But this is not the case. Science works because scientists theorize, derive predictions, and perform experiments. And only a solid understanding of a given theoretical framework can generate good hypotheses and experiments. Needless to remark also that for science to progress we need theoretical development and that the latter requires theoretical understanding. All in all, for the biologist, a solid understanding of the processes that shape life (those described in evolutionary theory) is a necessary requirement. This is why you should understand the conceptual nooks and crannies of evolutionary theory.

Topics Overview

Week 1 -- The role of models, laws, and theories in science.  
The Scientific Method.  
Models, Laws, & Theories.

Week 2 -- Darwin’s theory I.  
Newtonian Science and Darwin’s Ideals

Week 3 -- Darwin’s theory II.  
The “long argument” in The Origin
Week 4 – Modern Evolutionary Biology & Scientific Explanation in General
Biology & Physics.
Patterns and Processes.
Historical Explanations.

Week 5 – Just a Theory? The Creationism Case
Paley’s Watchmaker.
The Argument from Design.
Hume’s answer.
Selection and Chance.

Week 6 – Fitness I
Probability interpretation.
Measuring fitness.
Tautology Problem.

Week 7 -- Fitness II
Adventageousness.
Teleology.
Teleology Naturalized.

Week 8 – The Units of Selection I
Hierarchies.
Benefit versus Adaptation.
Parts and Wholes.

Week 9 – The Units of selection II
Red Herrings.
Correlation.

Week 10 – Adaptation I
Adaptationism
Genes For.
Untestability?

Week 11 – Adaptation II
Complex Systems.
Optimality.
Game Theory.

Week 12 – Systematics I
The Death of Essentialism.
The Species Problem.

Week 13 – Systematics II
Systems of Classification.
Phylogenetic Inference.
Parsimony.

Week 14 – Biological Determinism
Determinism.
Genes and Robots.

Week 15 – Sociobiology
Science and Ideology.
Human Nature.
**Week 16 – Cultural Evolution**

*Memes.  
Culture and Other “Evolvers.”*

**Texts**

- *Essay Collection* – prepared by the instructor.

**Requirements**

Readings for each class will be assigned in advance. You will be expected to critically study this material before class (i.e. read it seriously enough to be able to participate in class discussions by answering and having questions regarding the material). My lectures will not repeat the reading material but critically analyze and supplement it. Attendance to class is mandatory and class participation is highly recommended.

**Evaluation**

**Three Exams (20% each for undergraduates, 10% each for graduates)**

These exams will consist of short essay questions. Exams will cover:

- the reading material,
- the supplementary material provided during class discussions and
- the creative application of all of the above.

These exams will be about four weeks apart and refer to the material discussed in their particular (+/-) four-week period.

**Final Exam (30% -- for undergraduates, 20% for graduates).** This exam will cover material of the entire course.

**Research Paper (40% -- for graduates).** Work on this assignment will be supervised by the professor – via email and office hours. Topics, readings, and a schedule for an outline, drafts, and final version will be individually discussed. We will begin discussions regarding the research paper after the third week of class.

**Attendance & Class Participation (10%).** Attendance will be taken regularly. Only 6 unjustified absences will be permitted -- more will result in 0 attendance/class participation points.