

Evolution: The Darwinian Revolutions

BIOEE 2070 / HIST 2870 / STS 2871

Essay Assignment #3

You can choose one of the following five topics for your third essay (all essays should be 4-8 pages in length):

Extinction and Punctuated Equilibrium

Some paleontologists, for example Niles Eldridge and Stephen Jay Gould (see Ruse, *Darwin and Design*, chapter 11), assert that speciation occurs during brief periods of rapid change, followed by long periods of stasis. However, the “modern synthesis” model of speciation states that such changes occur gradually via micro-evolutionary mechanisms.

Evaluate carefully the relevance of extinction to this debate, as presented in David Raup's book, *Extinction: Bad Genes or Bad Luck?* Try to answer the following questions:

- What does the process of extinction imply about gradualism versus punctuationism?
- What does extinction have to do with diversity?
- What does the ubiquity of extinction say about the concepts of progress and purpose in evolution?

Speciation and Macroevolution

In his book, *Darwin's Dream Pond: Drama in Lake Victoria*, Tijs Goldschmidt discusses the fascinating problems underlying an understanding of speciation. He proposes a "synthetic" theory of speciation that includes sympatry, ecological niche specialization, and sexual selection. This theory differs in important respects from the "classical" theory of allopatric speciation as developed during the "modern synthesis."

Propose a scenario for the speciation of African cichlids during the past 12,000 years. Include a discussion of the cichlid species "flocks" in several rift valley lakes, including Lake Victoria and Lake Malawi. Propose the kinds of empirical evidence you would need to validate this scenario. You might want to address causes of natural selection, sexual selection, allopatric speciation, sympatric speciation, and isolating mechanisms in your paper.

Evolution in Four Dimensions: Genetic, Epigenetic, Behavioral, and Symbolic Evolution

In their book *Evolution in Four Dimensions*, Eva Jablonka and Marion Lamb explain how evolution takes place on at least four different levels: genes, phenotypes, behaviors, and symbols (the latter being restricted to humans), and provide examples of evolutionary processes happening at each level. Their book contains both direct and indirect challenges, extensions, and refutations of the “modern evolutionary synthesis” and points out how evolutionary theory has changed in recent decades, and how it may change in the future.

Explain how new discoveries in epigenetics, behavioral evolution, and human language relate to the patterns of macroevolutionary change that we have been discussing in class. In particular, try to answer the following questions:

- How do Jablonka and Lamb's explanations of evolutionary change at various levels (genes, phenotypes, behavior, and abstract symbols) differ from the theories upon which the “modern evolutionary synthesis” is based? Are such differences important, and if so, why?
- Do these new discoveries *necessarily* undermine the main concepts of the “modern evolutionary synthesis”? If so, how, and if not, why not?
- How might these new perspectives on the “dimensions of evolution” change how evolution is studied by scientists, and how its implications are interpreted by scientists, philosophers, and the general public?

Evolution and Design: Is There “Purpose” in Nature?

In his book *Darwin and Design*, Michael Ruse proposes that Darwin “put design back into biology” with his concept of natural selection. Ernst Mayr in this 1974 essay on “Teleology and Teleonomy” argues that the concept of “purpose” can legitimately be applied to adaptations that are produced by “programs” that guide the development of organisms.

Explain what Mayr and Ruse mean by “design” and “purpose”, and how these differ from the concept of “design” in current “intelligent design theory” (see Ruse/Darwin and Design, chapter 15), and try to answer these questions:

- How does Ruse distinguish between “design” and “purpose”, and why does Ruse argue that Darwin “put design back into biology,” but asserts that “purpose” does not exist in nature?
- What criteria can we use to determine if “design” or “purpose” is present or absent in something, including nature? Can the absence or presence of “design” or “purpose” in nature be *empirically* verified/falsified?
- Why do “intelligent design” supporters believe that “design” must be part of evolution? Do you agree?
- Can the kinds of “design and “purpose” described by Mayr and Ruse evolve as the result of a “non-designed/non-purposeful” process, such as natural selection?

Sociobiology and Evolutionary Psychology: Why do we do what we do?

One of the hottest areas of investigation in evolutionary biology for the past 30 years has been into the evolutionary dynamics of social behavior, including human behavior. Beginning with W. D. Hamilton’s landmark paper on kin selection in 1964, evolutionary biologists have formulated theoretical models explaining the evolution of social behavior, and tested those models via field observations and controlled experiments.

More recently, evolutionary theory has been directly applied to human psychology in the new and growing field of [evolutionary psychology](#). You have been provided with a brief overview of [evolutionary psychology](#) in an [article by Leda Cosmides and John Tooby](#) (included in the [Course Packet](#)), in which the authors explain the basic principles of [evolutionary psychology](#) and suggest how they can be used to investigate the evolutionary dynamics of human social behavior.

Evaluate the various theories explaining the evolution of social behavior, as outlined in the articles linked in the three paragraphs above, and including the various links included at the end of each article. Try to answer the following questions:

- How does sociobiology theory explain the evolution of altruism and cooperation, and how is that explanation reconciled with the emphasis on individual selection that is the basis for both Darwin’s theory and the “modern evolutionary synthesis?”
- Based primarily on the [article by Leda Cosmides and John Tooby](#), what are the implications of [evolutionary psychology](#) for the future understanding of human psychology and behavior?
- What are the implications of sociobiology and evolutionary psychology for human economics and politics? Should these implications be used to suppress further theoretical and experimental work in these fields? Why or why not?

**DATE DUE: ESSAY #3 IS DUE AT THE START OF LECTURE ON WEDNESDAY 1 AUGUST 2012
WARNING: ABSOLUTELY NO PAPERS WILL BE ACCEPTED AFTER WEDNESDAY 1 AUGUST!**