

Evolution: The Darwinian Revolutions

BIOEE 2070 / HIST 2870 / STS 2871

How to Answer Essay #1

Essay question #1 begins by asking you to evaluate Darwin's arguments for descent with modification and natural selection. To do this, you should find citations in the *Origin of Species* in which Darwin presents his definitions for these two processes and provides evidence that they have occurred. This should take about two pages (double-spaced, 1 inch margins, 12 point font, Times New Roma preferred).

Then the question continues:

"Is it the case that acceptance or rejection of one of these proposed processes necessarily validates or invalidates the other? Why or why not, and upon which evidence do you base this conclusion?"

This question is first asking whether or not the two parts of Darwin's theory – descent with modification (what Darwin called evolution, or change in species over time) and natural selection (Darwin's proposed mechanism for descent with modification) – are validated or falsified by the evidence Darwin presents to support them.

There are four possibilities:

- 1) both descent with modification and natural selection might be falsified (shown to be "false");
- 2) descent with modification might be validated (shown to be "true") but natural selection might be falsified;
- 3) descent with modification might be falsified (shown to be "false") but natural selection might be validated; or
- 4) both descent with modification and natural selection might be validated.

Your first task in your essay will be to decide which of these four possible outcomes you think Darwin has accomplished, based on the evidence provided in the first four chapters of the *Origin of Species*. This should also take about two pages (double-spaced, 1 inch margins, 12 point font).

The second part of the question is asking whether validation or falsification of one part of Darwin's theory necessarily affects the validity of the other part.

Again, there are four possibilities:

- 1) descent with modification is falsified, and this necessarily also invalidates natural selection;
- 2) descent with modification is falsified, but this has no necessary bearing on the validity of natural selection;
- 3) natural selection is falsified, and this necessarily also invalidates descent with modification; or
- 4) natural selection is falsified, but this has no necessary bearing on the validity of descent with modification.

Your second task in your essay will be to decide which of these four possible outcomes you think pertains, based on your answer to the first part of the essay question and the evidence provided in the first four chapters of the *Origin of Species*. This should also take about two pages (double-spaced, 1 inch margins, 12 point font).

The essay question then shifts gears and focuses on the "problem of purpose". This is the problem of assuming that pre-existing purpose has played any part in either of the two parts of Darwin's theory. We have discussed in class the idea that all other natural processes happen according to laws of natural cause and effect and that naturalistic explanations of such processes therefore do not include any reference to purposes or intentions.

For example, a physicist today would not explain the movement of a falling rock by saying "the rock is falling *in order to* reach the ground". In this explanation the phrase "in order to" isn't necessary to explain why the rock is falling to the ground. Instead, physicists say that the force of gravity *causes* the rock to fall to the ground.

"The force of gravity" is what is known in Aristotle's philosophy as an "efficient" cause, and the fact that material objects such as rocks (and planets) produce the gravitational force is what is known in Aristotle's philosophy as a "material" cause. However, in addition to material and efficient causes, Aristotle also asserted that all phenomena have two other causes:

- a formal cause (what the ideal form or rule for the phenomenon is), and
- a final cause (what the purpose or intention of the phenomenon is)

Since at least the time of Isaac Newton (the originator of the theory of universal gravitation), all physical scientists have eliminated any reference to formal and final causes in their explanations of natural phenomena, restricting their explanations to material and efficient causes only.

In the same way, Darwin's theory of evolution by natural selection eliminates purpose as part of the explanation for the origin of apparently purposeful adaptations, such as eyes, wings, fur, reproduction, etc. Prior to the *Origin of Species*, naturalists would explain something like the origin of the wings of bats by saying "bats have wings in order to fly". However, since the acceptance of Darwin's theory, almost all scientists now explain the origin of the wings of bats without reference to purpose/final causes: "bats have wings because their parents passed on to them the trait of having wings" (material cause) and "bats have wings because they have a heritable genetic and developmental program that produces wings" (efficient cause).

Your task in the second part of the essay is to explain why Darwin's theory of evolution by natural selection provides a solution to the "problem of purpose" as outlined above, and whether or not you think that his explanations (and the evidence he has provided to support them in the first four chapters of the *Origin of Species*) have indeed eliminated any reference to formal and (especially) final causes/purposes in biology. You may also wish to discuss whether or not the concept of purpose or intention has any bearing on the question of descent with modification. There are again four possibilities:

- 1) Darwin's theory eliminates purpose/intention as part of the explanation of descent with modification and the origin of adaptations;
- 2) Darwin's theory eliminates purpose/intention as part of the explanation of descent with modification, but includes some reference to purposes/intentions in the the origin of adaptations;
- 3) Darwin's theory includes some reference to purposes/intentions in the explanation of descent with modification, but eliminates purpose/intention as part of the explanation of the origin of adaptations; or
- 4) Darwin's theory includes some reference to purposes/intentions in both the explanation of descent with modification and the origin of adaptations.

Your third and final task in your essay will be to decide which of these four possible outcomes you think Darwin has accomplished, based on your answer to the first and second parts of the essay question and the evidence provided in the first four chapters of the *Origin of Species*.

We will be happy to go over drafts of the first essay with you before it is due. Please give yourself and us enough time to revise your original draft **before** it is due in class.