Philosophy of Biology
Phil 147
Winter 2016

Directions and Questions for the Final Exam

Bring ***two*** bluebooks available in the university bookstore with ***nothing*** written in or on them (not even your name). These may be redistributed at the time of the exam.

The exam will consist of the two parts, for which the instructions are as follows:

Part A. Answer each of the following six questions in two to three sentences each (do not go on at length—you will *not* receive extra credit for going beyond a basic answer). Each question is worth up to 5 points (30 points total).

The actual questions will be drawn from those listed below:

1. Why was Darwin so concerned with how old the earth might be?
2. Why would blending inheritance be a problem for Darwin's account of the origin of species?
3. What does "ontogeny recapitulates phylogeny" mean?
4. What is eugenics?
5. What was Mendel's objective in carryout out breeding experiments?
6. How did Mendel arrive at what he called *factors*?
7. What was the central disagreement in the Biometrician-Mendelian conflict?
8. How did Fisher provide a solution to the problem of blending inheritance that had confronted Darwin?
9. What were the major differences in the ways Wright and Fisher construed populations?
10. What is meant by "genetic drift"?
11. What is meant in calling a trait an adaptation?
12. Why is finding a trait found in all and only members of a species not sufficient to establish that trait as the essence of the species
13. What does it mean to claim that species are individuals?
14. How do the species as sets or kinds and species as individuals differ as to whether there could be a new Dodo Bird (assuming Dodo Birds are extinct)?
15. What entities at a level of organization higher than individual genes have been considered as units of evolution? (Identify at least two.)
16. Why are attributions of purposes to humans easier to understand than attributions of purpose or function to biological organisms more generally?
17. Why do many see systems biology as a holistic endeavor?
18. What are the components of a graph representation of a biological system?
19. What is the characteristic path length of a network?
20. What do *degree* and *degree distribution* refer to when discussing networks?
21. What is a small-world network?
22. What are provincial and connector hubs?
23. What is meant by a motif?
24. What is a major reason to model complex biological mechanisms mathematically?
25. What is meant by calling a model a *how-possibly* model?

Part B. Address the following question in an essay (70 points).

On the actual exam, I will pick two of the following questions for you to write on:

1. What made de Vries, Bateson, and others construe Mendel as providing an alternative to Darwin's account of the origin of species? What alternative account of the origin of species did they offer? What, especially for a plant or animal breeder, would make such a non-Darwinian alternative seem plausible? Why would it seem to them more promising than the approach of the biometricians? Be specific about what in particular about the biometrician's approach made it seem implausible as an account of new species.

2. What is meant by the evolutionary synthesis as it appeared in the work of Fisher? What was synthesized and why did these approaches have to be synthesized? What role did population genetics play in producing the synthetic account of evolution? How do you suppose Darwin would have responded to the Fisher's account? Are there ways he would have seen Fisher as improving on his own account of evolution? Are there important features of Darwin's view of evolution that are not adequately incorporated into Fisher's account?

3. What do Gould and Lewontin mean by the "adaptationist programme" and what is their critique of it. What are some of the other approaches to understanding the evolution of species that they and the proponents of the extended evolutionary synthesis think ought to be considered but are neglected by standard evolutionary theory? How do proponents of standard evolutionary theory respond? How, in particular, might an adaptationist respond to Gould and Lewontin?

4. Suppose someone asserts that the function of kidneys is to remove excess fluid and waste products from the body. In light of the different ways to analyze function that we discussed, identify at least two different ways of interpreting that statement. What sort of evidence would be required to show that that is the function of the kidneys on each view? Defend a view as to which more useful in guiding research on kidneys, or argue that biologists abandon talking of organs like kidneys as having a function.

5. Systems biology is sometimes portrayed as holistic in contrast to traditional mechanistic biology, which is viewed as reductionistic. In what ways does network analysis, at both macro- (whole network) and micro- (sub-graph) scales, reflect a holistic perspective? Are these network approaches competitors or complements to mechanistic approaches?

6. What is meant by calling computational models, such as the dynamical systems models of stem cell differentiation discussed by Green et al., *how-possibly models*? What does such a model try to show? How does it differ from a detailed mechanistic account? Does a dynamical model provide explanatory value that a mechanistic model does not? What sort of evidence would be required to render a computational model into a *how-actually model*?