

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 three 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. What is Mendel's law of independent assortment?
2. How did Mendel arrive at what he called *factors*?
3. What was the central disagreement in the Biometrician-Mendelian conflict?
4. What does the Hardy-Weinberg equilibrium describe?
5. In what respects is Fisher's treatment of population genetics similar to theories of the behavior of gases?
6. What were the primary differences in focus between Sewall Wright and Fisher?
7. What is meant by "genetic drift"?
8. How did the Spandrels of San Marco come to figure in discussions of evolution?
9. What do Gould and Lewontin mean calling adaptationist explanations "just-so" stories?
10. What are some (state at least two) of the factors, besides genes, that advocates of developmental systems theory identify as being inherited by organisms?
11. What is meant by the expression *species as individuals*?
12. What entities at a level of organization higher than individual genes have been considered as units of evolution? (Identify at least two.)
13. What is the major characteristic of genes that leads Dawkins to view them as *the* units of selection?
14. What is Simpson's Paradox?
15. Why are function attributions viewed as teleological?
16. Why are systems employing negative feedback sometimes viewed as teleological?
17. What role do laws play in the Deductive-Nomological Model of explanation?
18. What role does delineating phenomena play in developing mechanistic explanations?
19. How is the phenomenon of circadian rhythms delineated?
20. What was Achoff's cave experiment meant to establish?
21. What is the difference between localizing and decomposing a phenomenon?
22. Why was the suprachiasmatic nucleus thought to be the master clock?
23. What is the core process through which the gene *per* is thought to generate circadian rhythms?
24. What is it about mechanistic research that makes it reductionistic?

25. What does it mean to say that a mechanism, or a part of a mechanism, is conserved?
26. What is meant by *recomposing a mechanism*?
27. What is the distinction between complicated and complex systems?
28. What are the reasons (give at least two) to model complex biological mechanisms mathematically?
29. What does experimenting with a mathematical model involve?
30. What is a small-world network?

Part B. Address the following question in an essay (35 points).

On the actual exam, I will pick one 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? Why, 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 it 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 think ought to be considered but are neglected by the adaptationist programme? How might an adaptationist respond to their criticisms? Are the criticisms really telling against adaptationism?
4. What is the project of naturalizing teleology? Why have some theorists thought it important to do so? What are the main strategies for naturalizing teleological concepts (be sure to explain how the account offered by each strategy is a naturalized one)? Do teleological concepts, so construed, have a use in contemporary biology?

Part C. Address the following question in an essay (35 points).

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

1. Identify the main differences between the Deductive-Nomological and mechanistic accounts of explanation. Illustrate each type of explanation with an example. What is needed, on each account, to explain a phenomenon? What do scientists need to do, on each account, to explain a

phenomenon? What on each account links the explanatory account to the phenomenon being explained?

2. Using the circadian research we have discussed as an example, describe some of the main strategies for decomposing a phenomenon. What are these strategies meant to establish? What further investigations were needed after researchers identified one part of a mechanism? How far down do scientists need to go in decomposing a mechanism to explain the phenomenon they are interested in?

3. Using the circadian research we have discussed as an example, describe what is involved in recomposing a mechanism and why it is important to the project of explaining the phenomenon. What strategies can scientists use to recompose a mechanism? Can organization sometimes make a difference to how parts of a mechanism function? Should scientists limit recomposition to one level, or is it sometimes necessary to go up several levels?

4. Construct a dialogue, set in the present, between a vitalist/holist and a mechanist which brings out what you think are the best arguments for each position and the answers the other would give to those arguments. Your dialogue should be inspired by the traditional vitalist/holist objections to mechanism, but you may take liberties in bringing the position up to date as a criticism of recent mechanistic biology.