

### Directions and Questions for First 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 did Aristotle mean by an essence?
2. What is meant by teleology?
3. What was one type of evidence Harvey invoked for circulation of blood?
4. What did Hooke observe in the microscope that led him to use the name *cell* for cells?
5. What problem did Schwann confront in attempting to extend the idea of cells as basic units to animals?
6. What role did crystals play in Schwann's understanding of cells?
7. What was meant by *phlogiston* and what phenomena was it used to explain?
8. How was fermentation understood prior to the discovery of yeast?
9. What view were Wohler and Liebig making fun of when they satirically proposed that yeast have bladders that look like champagne bottles and proposed "these infusoria gobble sugar, and discharge ethyl alcohol from the intestine and carbon dioxide from the urinary organs."
10. According to Liebig, what distinguishes the chemical reactions occurring in plants and animals? What motivated him to make this distinction?
11. What was meant by spontaneous generation? Why did it seem plausible?
12. What led Buchner to propose the existence of zymase? What did he take it to be?
13. What features of living organisms did Bichat point to as evidence that living organisms could not be understood mechanistically?
14. What surprising discovery did Bernard make when he tried to find the locus of the decomposition of sugar in animals?
15. What role did the commitment to determinism play in Bernard's experimental science?
16. What does Bernard mean by an "internal environment"?
17. What is Paley's watchmaker argument?
18. What was the basis for Cuvier making the claim "Give me one bone, and I can reconstruct the entire organism"?
19. What about Lamarck's conception of evolution makes it progressive?
20. Explain what was meant by transmutation of species.
21. What is Lyell's uniformitarian principle?
22. What role does artificial selection play in Darwin's account of evolution?
23. Why is variation so important to Darwin's proposed explanation of evolution?

24. What does Darwin mean by the “struggle for existence”?
25. What, for Darwin, is the relation between species and varieties?
26. Why was Darwin so concerned about how old the earth might be?
27. Why would blending inheritance be a problem for Darwin’s account of the origin of species?
28. What does “phylogeny recapitulates ontogeny” mean?
29. What is Galton’s principle of regression to the mean?
30. What is eugenics?

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

On the actual exam, I will pick one of the following questions:

1. What is it to adopt a mechanistic view of living organisms? How would a mechanist’s explanation of a living activity differ from one offered by an Aristotelian? Offer at least two examples of biological phenomena for which mechanists proposed explanations in the 19<sup>th</sup> century. Describe their explanations. How might an Aristotelian address the same phenomenon? What could a mechanist say in defense of their approach and against the Aristotelian?
2. In advancing his theory of the cell, Theodor Schwann considered himself to be a mechanist. What did he take to be central to being a mechanist and how did his cell theory exemplify a mechanist viewpoint? What about his account of fermentation led others to view him as a vitalist? How would Schwann go about defending the view that this account of fermentation was still mechanistic? Was he really a mechanist or a vitalist? Defend your answer.
3. Fermentation was the focus of extensive investigation by chemists and biologists in the 19<sup>th</sup> century. Describe the different views that were taken by some of the major investigators during the century (e.g., Lavoisier, Schwann, Liebig, Pasteur, and Buchner) and discuss the differing conceptions these entail of how biological phenomena should be investigated and explained. Does Buchner’s discovery of cell-free fermentation settle the issue, or was there still room for differing perspectives on fermentation?
4. Compare and discuss the ways of conceptualizing living phenomena advanced by Xavier Bichat (traditionally seen as a vitalist) and Claude Bernard (traditionally seen as a mechanist). Discuss the implications of each of their frameworks for the development of biology as a science. How successful do you think Bernard was in explaining the features of living organisms on which Bichat focused? Explain.

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

On the actual exam, I will pick one of the following questions:

1. Darwin commented on his reading of Paley that it was the only part of his college education that “was of the least use to me in the education of my mind.” Why was Paley so influential on Darwin? On what did Darwin agree with Paley and on what did he disagree? How did/would Darwin defend his explanation of the design of organisms as better than Paley’s?
2. On his voyage on the Beagle Darwin read Lyell’s *Principles of Geology*, from which he learned the principle of uniformitarianism. What is the principle of uniformitarianism and how did it apply to geology? Darwin sought to extend the principle to the attempt to understanding transmutation. What does uniformitarianism require of explanations of transmutation? How well does his theory of natural selection satisfy the uniformitarianism principle? What sort of defense could Darwin or others provide for insisting on uniformitarianism? How would scientific inquiry be different if one rejected it?
3. Although Darwin titled his book *On the origin of species*, in it he raises some questions about whether species are well demarcated. Why doesn’t Darwin just adopt traditional accounts of what species are (such as the one Linnaeus employed)? What does he mean by saying they are “tolerably well-defined objects” but that the essence of the term “species” is “undiscovered and undiscoverable”? What sort of understanding of species does he need both to capture the sorts of phenomena in nature he sought to explain and provide an account of their origin by means of natural selection?
4. Lamarck advanced a theory of evolution half a century before Darwin. Why did Darwin feel the need to put forward his own theory of evolution rather than simply endorsing Lamarck’s theory? Describe the major differences between their theories and why Darwin preferred his theory to Lamarck’s. (Note: Darwin on occasion invoked some of Lamarck’s ideas, such as inheritance of acquired characteristics. Make it clear what are some of the other aspects of Lamarck’s account of evolution that Darwin never accepted, and why.)