

II. Lecture 2.1. Answers.

1. Why does Johnston characterize *The Origin* as “the most revolutionary act in our intellectual history?”

“If we take Darwin's concept and develop it fully, then what is destroyed is the traditional concept of truth and the search for the truth becomes a vain endeavour. Just as in Darwin's theory, the term species loses any permanent definable meaning which might survive time, so any term ceases to have lasting meaning and the search for such terms becomes a denial of how the world works.”

2. What are the consequences that millions find unacceptable?

Difficulty in accepting “a vision of life which empties life of any higher purpose, progressive development, or permanent standards of any kind.”

3. If you disagree with Johnston’s conclusions, explain how one distinguishes good from evil, in a Darwinian universe?

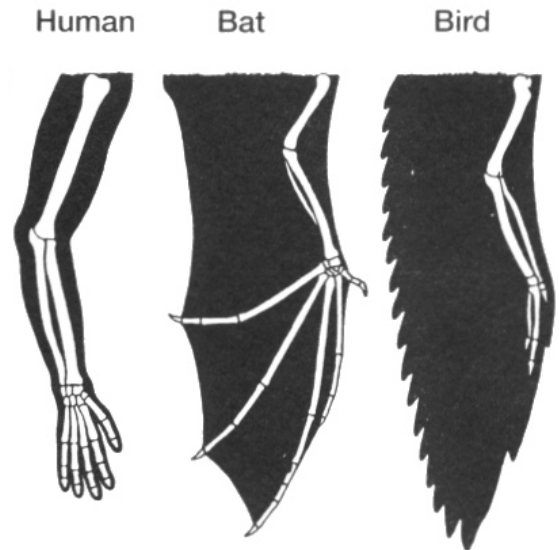
4. Consider the following observations often cited as supporting the assertion that “species change through time.” To each observation assign one of the following: **1.** Consistent with TSC. **2.** Consistent with TSC (may require a “stretch”), but more plausibly explained by DWM. **3.** Inconsistent with TSC and consistent with DWM.
- a. Most species have gone extinct. **1.**
 - b. Fossil species frequently resemble living species in the same area. **3 (2).**
 - c. Among contemporary species, relatedness more closely correlated with geography than with environment. **3 (2).**
 - d. Existence of transitional fossils – “missing links.” **3.**
 - e. Earth ancient. **1.**
 - f. Vestigial organs. **3.**
 - g. Populations and species changing today. **3.**

5. Which of Darwin's facts have anything to do with natural selection?

First and last.

6. The same genes determine eye development in fruit flies, cephalopods and humans. In flies & vertebrates, the structures are different; in vertebrates & cephalopods, superficially similar, but developmentally distinct. Give two possible evolutionary scenarios.
 - a. The common ancestor had simple eyes, probably no more complicated than pigmented, light sensitive spots. The development of these primitive eyes was controlled by the gene(s) ancestral to those that control eye development in living insects, cephalopods and vertebrates.**
 - b. The ancestral gene was involved in some other function and was independently co-opted for light-gathering in the three lineages.**

7. The picture at the right illustrates structural homologies in vertebrate forelimbs. **a.** What conclusion would an evolutionist deduce from the picture? **b.** What might an "intelligent designer" have to say about it?



An evolutionist would say that the homologies are evidence of modification of the same structure for different ends. An Intelligent Designer might agree. But, citing similar "homologies" in material objects, he might argue that descent with modification does not preclude the possibility of purposeful design.

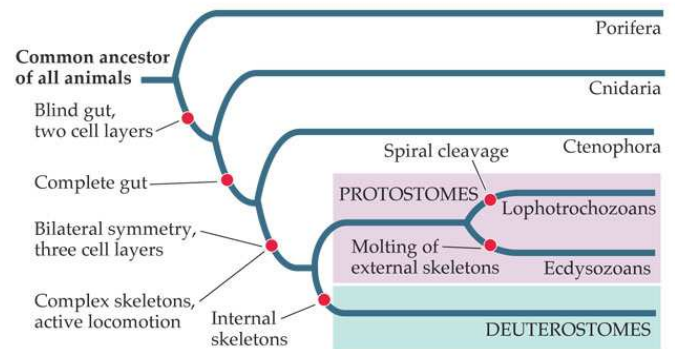
8. Every time paleontologists fill a gap, two new ones created. What do you make of that?

IMO: Gap-filling can never prove descent with modification. But as more and more gaps are filled, the case for DWM becomes undeniable.

9. If you were a Special Creationist, how many gaps would have to be filled to make you change your mind?
10. Which of the following scientists would most likely have been comfortable with the Eldredge-Gould model (punctuated equilibrium) of evolution? a. Cuvier; b. Darwin; c. Lamarck; d. Lyell.

Cuvier and Lyell.

11. According to the phylogeny at the right, sponges (porifera) are “primitive” in the sense that they lack so-called “derived” characters (gut, cell layers, bilateral symmetry, *etc.*), that distinguish “higher” Animalia. Contrast the different explanations that Darwin and Lamarck would have offered for the simplicity of sponges.



LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Figure 32.1 A Current Phylogeny of the Animals
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Darwin: contemporary sponges descended from ancient sponge-like creatures that never evolved.
Lamarck: sponges descended from simpler creatures (monads) recently arisen.

12. In the figure on the preceding page, *carbonaria* stands out against the lichen-encrusted tree trunk; *typica*, against soot-covered trunk. This is often held to be evidence supporting the bird predation hypothesis. Implicit in this assertion are implicit assumptions. What are they?

- a. Moths rest on tree trunks during the day.**
- b. Human and avian vision are essentially the same.**

As it turns out, both assumptions have been questioned. No one really knows where the moths rest; birds see further into the UV than humans.

13. List at least three additional mechanisms by which a mutation might confer drug resistance.

- a. Inactivate the drug.**
- b. Up-regulate the pathway that the drug blocks, *i.e.*, swamp the drug.**
- c. Use an alternative pathway.**
- d. Reduce drug uptake.**
- e. Increase drug excretion.**

14. List at least three practices that contribute to the increasing prevalence of drug-resistant bacteria.
- a. Indiscriminate use of antibiotics.**
 - b. Failure of patients to complete the prescribed course – allows for survival of partially resistant strains.**
 - c. Inclusion of antibiotics in animal feed.**
 - d. Inclusion of antibiotics in household cleaning products including soaps, disinfectants**
15. List three strategies for dealing with the problem.
- a. Responsible use of antibiotics.**
 - b. Use of non-antibiotic alternatives such as phage therapy, when feasible.**
 - c. New drug development.**
16. Give two factors increase the chances that an antibiotic's use will lead to infection by superbugs?
- a. Targeted strain already resistant.**
 - b. Drug is an efficient killer of non-resistant bacteria with which the resistant cells must compete.**

17. The emergence of antibiotic resistance has led to renewed interest in phage therapy (use of bacteriophage) as a way of dealing with superbugs. What are some pluses and minuses of this approach? (Requires outside reading – see, for example, Hausler, *Viruses vs. Superbugs: A Solution to the Antibiotics Crisis?*)

Advantage. Because of their ability to multiply *in situ*, phage can be more effective than antibiotics in treating infections in areas of the body that are poorly vascularized. Disadvantage. Bacteriophage are bacterial strain-specific. An effective phage needs to be identified before treatment can be started.

18. What is the purpose of the control plate in the Lederbergs' experiment?

Demonstrates that the felt-covered wood block transfers bacteria from all regions of the master plate to the replicates.

19. Changing beak morphology in Darwin's finches illustrates what Steve Gould called "the contingent nature of evolution." **a.** What did Gould mean by this? (You may have to look up the word contingent.) **b.** What are the implications for constructing a theory of evolution that predicts the broad outlines of the history of life on earth?

a. Change explicable in terms of known (or discoverable) processes, but alternative "triggers" difficult (impossible) to eliminate. b. Retrospective understanding possible, at least at a general level. Short-term prediction may also be possible, but long-term, not.

20. Many evolutionists maintain that evolution is neither goal directed nor progressive. Yet both cell / molecular biology and the fossil record show an overall increase in maximum size and complexity over the past 4.5 billion years. What do you make of that?

Various points of view. Here are two: 1. Evolution of body size / complexity is a random walk – equal chance of getting bigger (more complex) or smaller (less complex). Over time, the distribution spreads out. 2. Positive feedback.

Increasing body size advantageous, but requires greater complexity, which is consequently selected for. In turn, increasing complexity makes larger body size possible.

Natural selection is sometimes described as “survival of the fittest,” a term due to Herbert Spencer who ironically rejected natural selection as the principal driver of evolution. Spencer’s metaphor suggests competition for resources. Such competition can involve interference (male-male contests for mates, territoriality, *etc.*) or exploitation. Note the essential difference: In the first case, you out-compete your rival **by reducing his efficiency more than your own**. In the second case you out compete your rival by **increasing your efficiency** more than he can **a**. Consider the case of trees growing in a forest. Give an example of how they compete with each other by interference. Give an example of how they compete exploitatively. **b**. If selection favors traits that increase the fitness (reproduction and/or survival) of individuals, it would seem to follow that animals should not do things for the good of other animals aside from their offspring. Why not? **c**. How then do you account for altruism?

- a. Competition for light an example of interference competition – one tree overtops another, reducing its own photosynthetic output in the process, but not to the extent of its rival now forced to grow in the shade. Competition for nutrients in the soil an example of exploitative**

competition *provided roots don't actively interfere with each other.*

- b. Doing things for the benefit of other individuals generally has a cost – you could be spending the time, energy, *etc.*, on yourself or your offspring.**

- c. 1. Costs may only be apparent – you learn by helping, *e.g.*, helping at someone else's nest as a one year-old Mexican Jay may improve your parenting skills when you try it for real as a two year-old. 2. Beneficiaries may be your relatives – especially in small, inbred populations. 3. In social species, “you scratch my back, I scratch yours” arrangements may be operative, *i.e.*, altruism is reciprocal. These explanations not mutually exclusive. In the case of scrub jays, helping males are often related to the parents.**