

Active Learning Exercise 2A

Explanations of Evolution: Darwin vs. Lamarck

Reference: [Chapters 1, 22](#) (*Biology* by Campbell/Reece, 8th ed.)

Theme #7. The Core Theme: Evolution accounts for the unity and diversity of life.

Evolution is the process of change that has transformed life on Earth. The idea of evolution is not a new one—but Jean Baptiste Lamarck in 1809 (the year of Darwin's birth) and Charles Darwin (in a long essay in 1844 and then in more detail in *The Origin of Species* in 1859) were the first to propose explanations for how existing species evolved from earlier and less complex life forms.

1. How did Lamarck theory use the following principles to explain how life changes in his theory of evolution? Support each response with an appropriate example.

- a. *Use and disuse*

- b. *Inheritance of acquired characteristics*

- c. *Innate drive towards greater complexity*

2. Explain why Lamarck's theory was plausible when proposed but did not stand the test of time. (Hint: Gregor Mendel)

3. Lamarck, in part, based his erroneous theory of evolution on the passing of *acquired* characteristics from one generation to the next. Darwin's theory is based on the passing of *inherited* genetic characteristics from one generation to the next. Determine which of the characteristics listed below are acquired, inherited or involve both acquired and inherited components. Explain your choices.
- a. Increased proficiency in playing the clarinet: acquired or inherited or both (circle one)

 - b. Thick subcutaneous fat layer in arctic seals: acquired or inherited or both (circle one)

 - c. Attaining a height of 2 meters in humans: acquired or inherited or both (circle one)

 - d. Grizzly bears hibernating during the winter: acquired or inherited or both (circle one)
4. Discuss Darwin's theory of evolution by listing and describing in your own words the role played by the three main concepts behind Darwin's theory of natural selection: i.) Heritable variation naturally exists within every population; ii.) Struggle for existence due to over reproduction; iii.) Differential reproductive success: the environment selects those best suited for survival and reproduction.

5. One of the hallmarks of the evolution of ostriches from their primitive bird ancestors is the development of knee calluses. Calluses are important because they help protect against open sores and infections when kneeling (e.g. while nesting). Develop two explanations for the evolution of knee calluses in ostriches—first from the teleological Lamarckian perspective (which is of course incorrect), and secondly from a Darwinian perspective.

Lamarckian:

Darwinian:

6. Keeping in mind the major driving forces of Darwinian evolution (Darwin's 3 points) explain how the following characteristics could have evolved. (Note: It is *not* acceptable to simply state why these characteristics are nice to have. You must explain how they could have actually evolved, using Darwin's 3 points.)

a) Presence of thorns on rose bushes (ancestral plants had no thorns).

b) Evolution of extraordinarily large lung capacity and high red blood cell counts by the Incas that live high in the Andes—e.g. Cuzco, their ancient capital city is at over 11,000 feet)

c) Resistance to drugs in bacteria (e.g. there exists a strain of the tuberculin bacterium (causes tuberculosis in humans) that is resistant to all known antibiotics.)

7. Why is ***variation*** so important to the success of any population?

8. Give two examples from the Pacific Northwest where human activities have led to a decrease in variation of plant and/or animal populations and explain the potential long-term repercussions of decreasing variation.

9. What does “***fitness***” mean in evolutionary sense (as in “survival of the fittest”)?

10. Explain why the ***population*** and not the individual is the smallest unit that can evolve.

11. [Section 22.3 \(pp. 460 – 466\)](#) of your textbook briefly summarizes only a few of the many lines of evidence that support the theory of evolution: the ***fossil record***, ***comparative anatomy***, ***comparative embryology***, ***biogeography*** and ***molecular biology***. Which of these lines of evidence do *you* find the most convincing? Explain your reasoning below and on separate paper and staple to this ALE.