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Activity 22.2 How do Darwin's and Lamarck's ideas about evolution differ?

Early in the 1800s Lamarck proposed a theory of evolution. He suggested that traits acquired during an organism's life—for example, larger muscles—could be passed on to its offspring. The idea of inheritance of acquired characteristics was popular for many years. No such mechanism is implied in Darwin's theory of evolution via natural selection, however. After Darwin published his work, scientists conducted many experiments to disprove the inheritance of acquired traits. By the middle of the 20th century, enough data had accumulated to make even its most adamant supporters give up the idea of inheritance of acquired characteristics.

Given your understanding of both Lamarck's and Darwin's ideas about evolution, determine whether the statements on the next page are more Lamarckian or more Darwinian. If the statement is Lamarckian, change it to make it Darwinian. Here are two example statements and answers.

EXAMPLES

A. The widespread use of DDT in the mid-1900s put pressure on insect populations to evolve resistance to DDT. As a result, large populations of insects today are resistant to DDT.

Answer: This is a Lamarckian statement. DDT worked only against insects that had no DDT-resistance genes. The genes for DDT resistance had to be present for insects to survive DDT use in the first place.

Suggested change: Wide-scale use of DDT in the mid-1900s selected against insects that had no resistance to DDT. Only the insects that were resistant to DDT survived. These insects mated and passed their resistance genes on to their offspring. As a result, large populations of insects today are resistant to DDT.

B. According to one theory, the dinosaurs became extinct because they couldn't evolve fast enough to deal with climatic changes that affected their food and water supplies.

Answer: This is a quasi-Lamarckian statement. Organisms do not purposefully evolve. (Genetic recombination experiments are perhaps an exception.) Once you are conceived, your genes are not going to change; that is, you are not going to evolve. The genetic composition of a species population can change over time as certain genotypes are selected against. Genes determine phenotypes. The environmental conditions may favor the phenotype produced by one genotype more than that produced by another.

Suggested change: According to one theory, the dinosaurs became extinct because their physiological and behavioral characteristics were too specialized to allow them to survive the rapid changes in climate that occurred. The climatic changes caused changes in the dinosaurs' food and water supplies. Because none of the dinosaurs survived, the genes and associated phenotypes that would have led to their survival must not have been present in the populations.

STATEMENTS

1. Many of the bacterial strains that infect humans today are resistant to a wide range of antibiotics. These resistant strains were not so numerous or common prior to the use of antibiotics. These strains must have appeared or evolved in response to the use of the antibiotics.

2. Life arose in the aquatic environment and later invaded land. Once animals came onto land, they had to evolve effective methods of support against gravity and locomotion in order to survive.

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3. A given phenotypic trait—for example, height, speed, tooth structure—(and therefore the genes that determine it) may have positive survival or selective value, negative survival or selective value, or neutral (neither positive nor negative) survival or selective value. Which of these it has depends on the environmental conditions the organism encounters.

4. The children of body builders tend to be much more athletic, on average, than other children because the characteristics and abilities gained by their parents have been passed on to the children.