Chapter 4: Review Answers

Student Textbook pages 144–145

Answers to Understanding Concepts Questions

1. The theory of evolution by natural selection is based on the observation that individuals with physical, behavioural, or other traits that helped them survive in their local environment were more likely to have offspring and pass those traits on to the next generation. The environmental conditions that favour those traits over others are said to exert "selective pressure" on the population by those favouring individuals with certain traits, which become predominant over time if the environmental conditions continue.

2. The more visible a field mouse is within its environment, the more likely it is to be preyed upon. The field mice that have been selected for phenotypes that allow them to camouflage successfully will increase in frequency because of their adaptive success.

3. If a mutation becomes heritable (passed through the gametes of sexually reproducing organisms), it could lead to a positive mutation. The new, mutated DNA sequences could code for the protein synthesis needed for a better adapted trait that gives the new individual better competing success.

4. Individuals within a population will exhibit many variations of their physical characteristics. These variations are heritable and are passed from generation to generation. The variations that are the most successful in a particular environment will help the population become better adapted. These variations will make each subsequent population more successfully adapted over time, though this process is slow. This process of variations becoming successful adaptations over time is known as natural selection.

5. Darwin noted that the flora and fauna that he was accustomed to in England and the rest of Europe was very different from the regions the *Beagle* visited. For example, the rodents of South America were very similar to each other on that continent but very different from the rodents of Europe. The finches and tortoises that he observed on the Galapagos Islands looked very similar at first, but as he made more careful observations, he was able to see, for example, that each type of finch fed upon different food. He began to surmise that these may be different species of finches that had arisen from a common ancestral form.

6. Darwin used this terminology because of the influence of geologists and paleontologists Hutton, Lyell, Smith, and Malthus. He adopted some of their ideas and streams of research and the terminology of the times.

7. Lamarck would have used the proposal of acquired characteristics. If the Ord's kangaroo rat needed to jump to 2m in the air to hop away from predators, successful

leapers would pass the trait on to their offspring. Darwin would account for the origin of the long hind legs of the Ord's kangaroo rat by explaining that phenotypic and genotypic variations within the individuals would allow for different adaptive and survival traits to be tested. If the kangaroo rats that were able to jump 2m in the air were more successful in avoiding predators, this selective advantage would have allowed them to reproduce more, and thus more individuals in the next generations would inherit this adaptive variation.

8. A bird wing and an insect wing are not homologous structures. Birds and insects do not share a common ancestor. Bird wings have internal skeletons, while insect wings are made of chitin.

9. When 2 species are very similar in regards to their anatomy, it suggests that they arose from a common ancestor and that they are close on the phylogenetic tree.

10. These similarities point to a common ancestral origin. All vertebrate embryos have paired pharyngeal pouches and a tail. In fish, these develop into gills, whereas in humans, they become parts of the ears and throat. The shared features in the embryo suggest evolution from a distant, but common, ancestor.

11. Rapid shifts in the abiotic and biotic conditions of the environment will promote more rapid speciation. For example, rapid changes in the environment can promote extinction, as well as speciation. The new environments that are created will select for new adaptive traits, and if populations are kept apart by geographical, reproductive, or behavioural barriers, new species can arise from common origins.

Answers to Applying Concepts Questions

12. Through the use of artificial selection, an individual could continually select the best milk producers. These new cows could be interbred to continue producing better milk producers. This would not produce a new species, as the cows that were artificially selected for would still be able to interbreed with the original populations.

13. The two populations have access to each other through the connecting tube so they are not geographically isolated. However, because they are genetically very different, they may develop as separate species as a result of biological barriers. Biological barriers include different courtship and/or mating rituals that would prevent mating. If individuals of the two populations mated, the resulting eggs might not be viable. In either case, the exchange of genetic information cannot take place between the two populations and they develop as separate species.

14. (a) The seed's large size ensures it has more of its needed start-up nutrients for survival. It gives the plant an edge in competing for the needed abiotic factors, such as sunlight and water.

(b) Larger seeds would be more visible to birds or rodents, and thus would be eaten before they could grow and reproduce. Smaller seeds may be better able to withstand freezing temperatures during the winter, or less vulnerable to mold and fungi.

(c) The gardener could remove the smaller seeds prior to germination, which would ensure the larger seeds had a selective advantage. Another strategy the gardener could use would be to harvest only the larger seeds each year. By using only larger seeds in subsequent years, the gardener would be applying selective pressure favouring plants that produce larger seeds.

15. (a) Baboon: 5 different amino acids—33% difference in amino acid sequence.

Chimpanzee: 0 different amino acids —0% difference in amino acids sequence.

Lemur: 7 different amino acids—47% difference in amino acid sequence.

(b) The chimpanzee and the human have the identical amino acid sequence for this specific protein. Based on this information, one could infer that the mammal most closely related to the human is the chimpanzee. The lemur and the human have the greatest variation in the sequence of amino acids; this suggests that the lemur and human are not closely related.

(c) No. An evolutionary biologist would look at many other characteristics before drawing any conclusions on the relatedness of these mammals.

16. These two garter snakes are likely to remain separate species because they are biologically isolated. Even though these snakes live in the same general area, they use different habitats, and therefore encounter each other rarely, if at all. This is different from a geographic barrier because there is no physical impediment keeping the populations apart.

Answers to Making Connections Questions

17. Students could use the fossil evidence for the development of the modern toothed whale (Figure 4.11 page 129). An example that students could look up would be the Cenozoic horses. These horses demonstrate sequential evolution quite clearly.

18. Students need to understand that when a population of bacteria is exposed to an antibiotic, only the resistant bacteria can survive. Lists should include finishing all the course of treatment, taking the correct dosage, and not using antibiotics to treat viral diseases.

19. Student memos should mention that a biologist needs to know exactly where a species was found, so that its environmental niche and range can be established. The unique characteristics of the species can only be linked to the biotic and abiotic elements in their environment if the environment is noted in detail. The time of year the plant was found is also needed in order to see traits such as

breeding cycles (annual or perennial, flowering season) and different stages in its life cycle.