

Name \_\_\_\_\_

Period \_\_\_\_\_

Regents Biology

Date \_\_\_\_\_

### REVIEW 6: EVOLUTION

1. Define evolution: \_\_\_\_\_

2. Modern Theory of Evolution:

a. Charles Darwin:

- Was not the first to think of evolution, but he did figure out how it works (mostly).
- However, Darwin didn't know about genes, so he couldn't know about mutations.

b. The modern theory (which combines Darwin's ideas with our modern understanding of genetics and other new ideas) contains the following ideas:

- Earth is very old (4.55 billion years) and is constantly changing.
- Variation: \_\_\_\_\_
  - No variation = no evolution or natural selection, as there is nothing to "select."
  - Species with no variation are usually the first to die when the environment changes
- Inheritance: \_\_\_\_\_  
\_\_\_\_\_
- Over-production: \_\_\_\_\_
- Competition for limited resources \_\_\_\_\_  
\_\_\_\_\_
- Adaptations: \_\_\_\_\_  
\_\_\_\_\_
- Survival & Reproduction of the Fittest: \_\_\_\_\_  
\_\_\_\_\_
  - NOTE: Traits are inherited randomly. Individual offspring of "fit" parents can still inherit "unfit" traits (although that individual will be less likely to survive and reproduce). It is only by looking at the ENTIRE population that you will see the "fit" traits become more common in the group.
- All of these factors are summarized in the mechanism that causes species to change over time, which is called \_\_\_\_\_
  - **Note:** This "natural selection" is not a conscious act — no one is "choosing" who survives and who doesn't. Individuals had to inherit the "fit" traits by the "luck of the draw". And the conditions of the organism's environment select who can compete better.
  - **Common Descent:** Modern species evolved from earlier, different species and share a **common ancestor**.

- Species that do not have adaptations become \_\_\_\_\_.
- New traits (variation) come out of two mechanisms:  
\_\_\_\_\_ and \_\_\_\_\_

3. **Environment and Evolution:** Species usually evolve when the environment changes.

- a. Changes need to be long term — species do not evolve because of changes in the season.
- b. Changes can include:
  - Climate change
  - Change in temp
  - Change in water availability
  - Change in food availability
  - Introduction of new species (new food, new predator, new disease, new parasite)
  - Species may be moved to a new location/environment (accidentally taken to an island for example)
- c. Environmental change **DOES NOT CAUSE** evolution to occur. A temperature or climate change does not itself force a species to change its inherited characteristics.
  - If this were the case, then all species would be able to adapt to the new environment, and extinction would be a very rare event.

4. **Evidence of Evolution:** Evidence in support of evolution comes from many fields:

- a. **Fossil record** — preserves extinct species as well as transitional forms between different types of organisms.
- b. **Radiometric Dating** — of rocks consistently confirm the age of the Earth and fossils
- c. **Comparative Studies** — Comparisons of the anatomy (physical structures), embryology (development), chemistry (proteins) and genes (DNA) of species confirm expected relationships
  - Branching tree diagrams are often used to show evolutionary relationships
- d. **Direct observation:** Humans have seen evolution occur both in nature and in the lab. Examples include:
  - **Bacteria** evolving resistance to antibiotics.
  - **Insects** evolving resistance to pesticides.
  - Modeling natural selection with selective breeding to alter a species' traits.

## 5. Common Mistakes

- a. “Stronger organisms are more fit than weak ones.”

*Evolutionary fitness is not physical fitness. Fitness is determined by who is better adapted to survive in a particular environment and who can pass on their genes. Stronger is not always better. There are many examples of species for whom it is better to be slow, weak, or timid, than fast, strong or brave. It all depends on the environment they are in.*

- b. “The organism evolved to live in its environment.”

*Individual organisms do not evolve. Only populations can evolve. Individual organisms are selected to survive or not to survive.*

- c. “The organism could not adapt and it went extinct.”

*Individual organisms die; they cannot go extinct. Only species can become extinct.*

- d. “The bacteria became resistant to antibiotics when they were exposed to them”

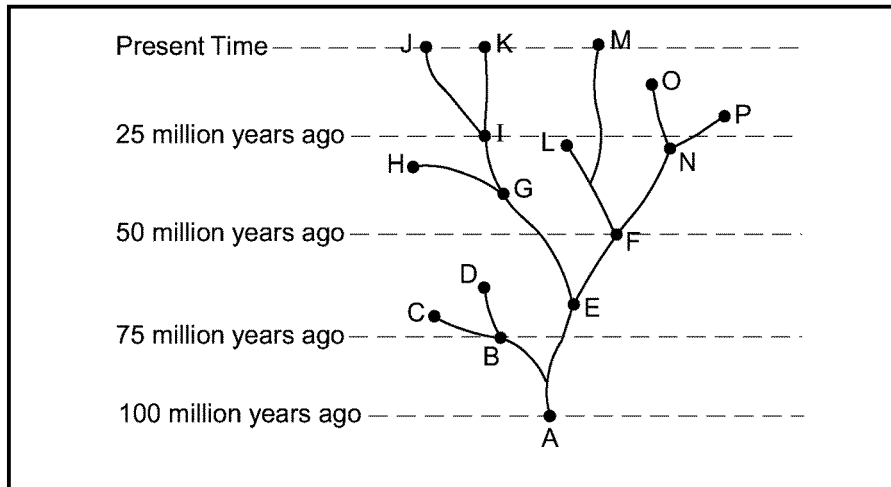
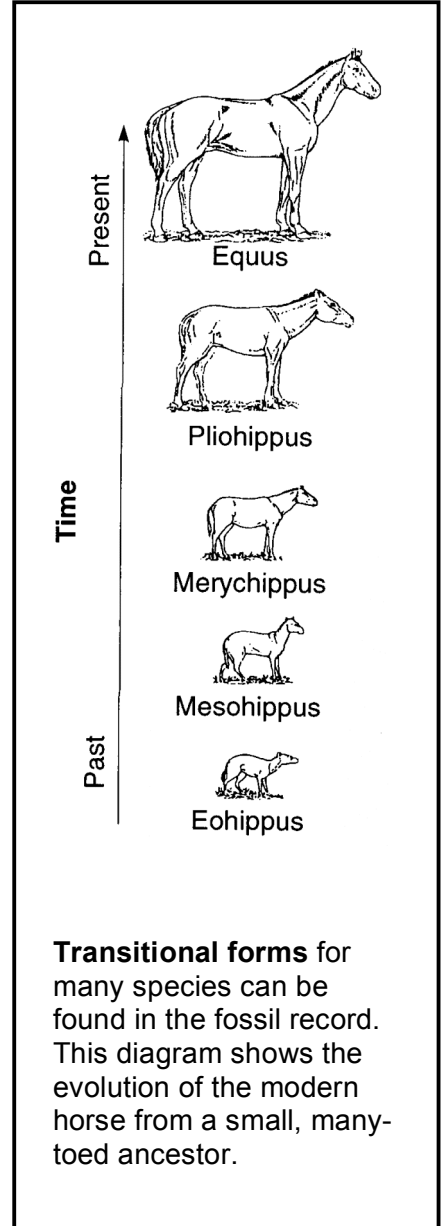
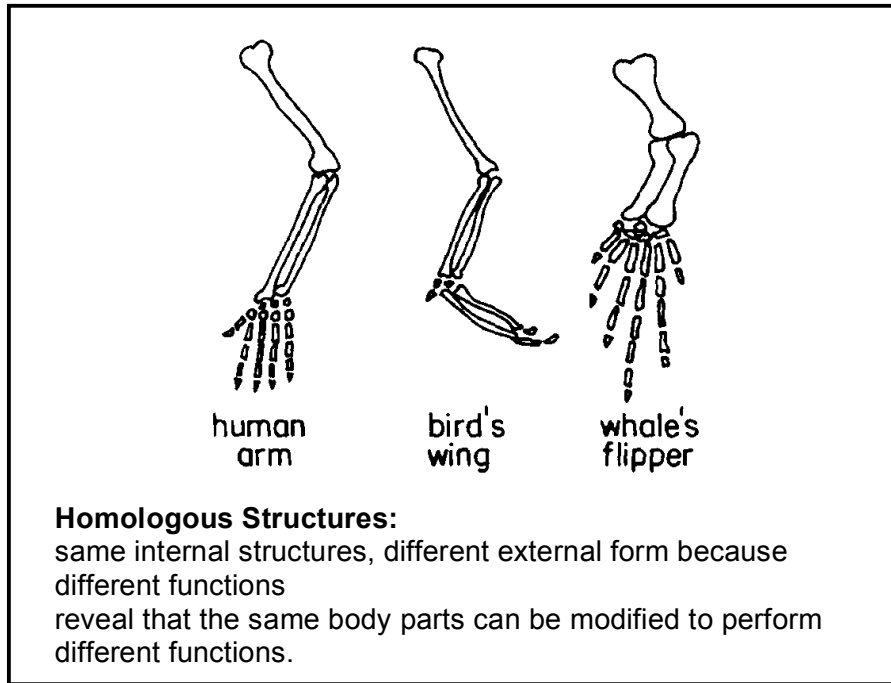
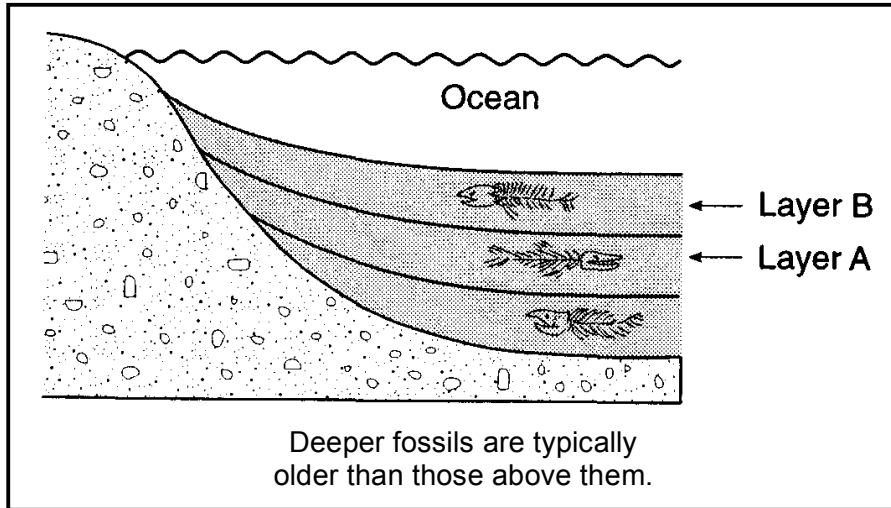
*To evolve, variations must exist in a species BEFORE the environment changes (pre-adaptation). Bacteria who did not already have a resistance to antibiotics would die when exposed to them, a Chihuahua who is left out in the cold will not grow long, warm fur and a squirrel who plays in traffic will not evolve automobile resistance.*

- e. “Giraffes got long necks because they needed them to eat leaves at the tops of trees.”

*Species do not evolve traits because they need them — Life would be much better if we could! Short-necked giraffes were never given long necks any more than slower antelopes are given speed when confronted by a predator. The reason there are no short-necked giraffes (or slow antelope) is that they were out-competed by members of their species with more fit traits.*

*Better answers are:*

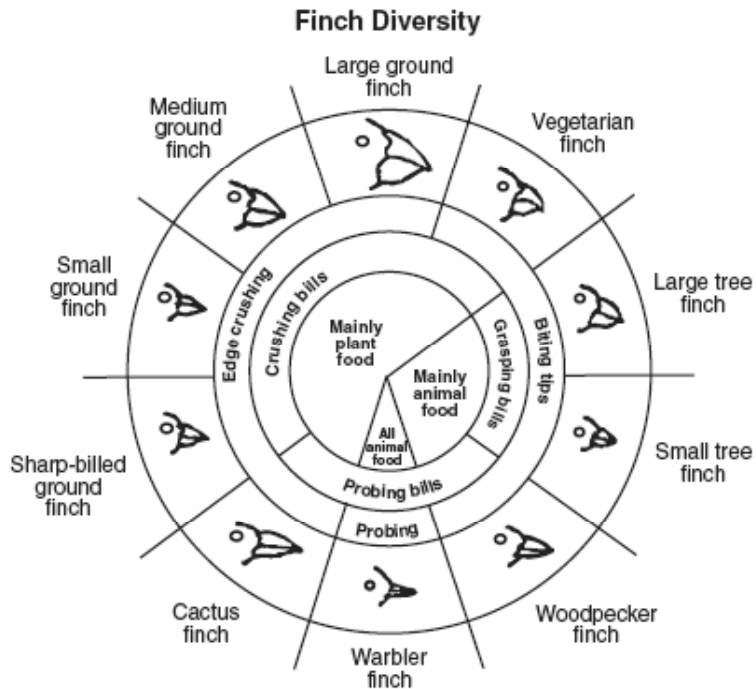
- “Giraffes evolved long necks because the ones with longer necks inherited an adaptation that helped them to get food better than short neck giraffes.”
- “Giraffes evolved long necks because more short-necked giraffes died, and more long-necked giraffes lived and reproduced.”



**Evolutionary trees** can show the relationship between living and extinct species.

**QUESTIONS**

Base your answers to the following question on the finch diversity chart below, which contains information concerning the finches found on the Galapagos Islands.



1. Identify one bird that would most likely compete for food with the large tree finch. Support your answer.

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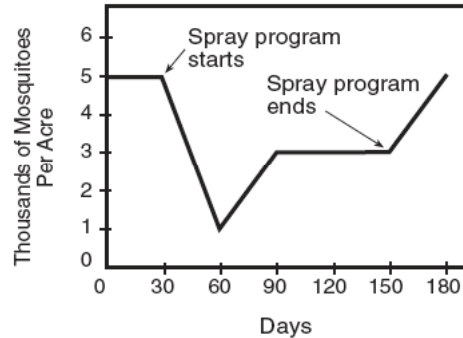


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2. Which population of organisms would be in greatest danger of becoming extinct?
- a. A population of organisms having few variations living in a stable environment.
  - b. A population of organisms having few variations living in an unstable environment.
  - c. A population of organisms having many variations living in a stable environment.
  - d. A population of organisms having many variations living in an unstable environment.

3. Which factor contributed most to the extinction of many species?
  - a. changes in the environment
  - b. inability to evolve into simple organisms
  - c. changes in migration patterns
  - d. lethal mutations

**Questions 4–7.** A small village was heavily infested with mosquitoes. The village was sprayed weekly with an insecticide for a period of several months. The results of daily counts of the mosquito population are shown in the graph below.



4. Explain why some mosquitoes survived after the first spraying.

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5. Describe what has happened to the effectiveness of the insecticide by the end of the spray program.

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6. Explain why the insecticide became less effective with each spraying.

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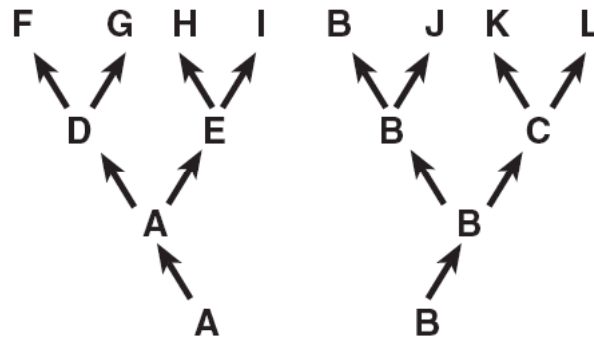
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7. Offer another method of mosquito control besides spraying that the village could use.

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8. Which statement is *not* part of the concept of natural selection?
- Individuals that possess the most favorable variations will have the best chance of reproducing.
  - Variation occurs among individuals in a population.
  - More individuals are produced than will survive.
  - Genes of an individual adapt to a changing environment.

Base your answers to questions 14 through 16 on the diagram below and on your knowledge of biology. Letters A through L represent different species of organisms. The arrows represent long periods of geologic time.



9. Which two species are the most closely related?
- J and L
  - G and L
  - F and H
  - F and G
10. Which species was best adapted to changes that occurred in its environment over the longest period of time?
- A
  - B
  - C
  - J
11. Which two species would most likely show the greatest similarity of DNA and proteins?
- B and J
  - G and I
  - J and K
  - F and L