Which one of the following statements is accurate?

a. Natural selection works on variation already present in a population.

b. Natural selection works on non-heritable traits.

c. Individuals evolve through natural selection.

d. Organisms evolve structures that they need.

e. None of the statements are true.
Evolution: descent with modification

Evolution can take place at many different time scales within a species (microevolution) and above the species level (macroevolution)

Bembidion levettei
Bembidion zephyrum

1 million years ago
2 million years ago
3 million years ago
4 million years ago
5 million years ago
Speciation and Macroevolution

Website: http://evolution.berkeley.edu/
9. **Which is the most likely explanation for the presence of 13 different finch species on the Galápagos Islands today?**

A. Many years ago several different species of birds migrated to the islands and the 13 finch species that currently live there are the only species that survived.

B. Many years ago a small population of a single bird species migrated to the islands and evolved into the 13 species that live on the islands today.

C. Each of the 13 species has migrated to the islands at different times over the years.

D. A single bird species migrated to one island at around the time of Charles Darwin’s voyage to the Galápagos and then migrated to all 13 islands.
How did species of finches come into being?

Min 11:20-11:55

What is the definition of a species?

A population or group of populations whose members have the potential to interbreed in nature and produce viable, fertile offspring, but do not produce viable, fertile offspring with members of other such groups.
Process of Speciation

Step 1: Genetic Isolation
gene flow between
two populations is interrupted
(populations become
genetically isolated from each other)

Step 2: Populations diverge genetically
genetic differences gradually accumulate
between the two populations

Step 3: Reproductive isolation
Some of these genetic differences (traits)
will be reproductive barriers
(traits that prevent two individuals from interbreeding with each other)
10. How did the Grants test their hypothesis that differences in birds’ songs can keep different species of finches from breeding with each other?

Min 11:55- 14:00

A. They watched which birds were mating with each other and listened for the songs the birds were singing.

B. They recorded birds singing on the island of Daphne Major for an entire breeding season to see which type of song was used more often by each species.

C. They played the songs of medium ground finches and cactus finches through a loudspeaker at different times, when individuals from both species were present, to see which species responded to each song.

D. They played the song of the medium ground finch to medium ground finch males through a loudspeaker to see if they would respond; they then played the song of the cactus finch to cactus finch males to see if they would respond.
Genetic differences $\rightarrow$ phenotype differences $\rightarrow$ reproductive barriers

Reproductive barriers before the zygote forms or after the zygote forms
11. What type of reproductive barriers were observed in the Galapagos finches?

A. Prezygotic
B. Postzygotic
C. Both
What can cause speciation?

Gene flow is reduced due to a geographical barrier (Allopatric “other country” speciation)
Many geological and climatic events can produce geographic barriers causing speciation.

Mountain chains are uplifted
Major rivers change course
Sea level rises, creating islands
Climate warms, pushing vegetation up mountain slopes and fragmenting it
Climate dries, dividing large single lakes into multiple smaller lakes
Ocean current patterns shift
Islands are formed in sea by volcanism
What can cause speciation?

Switch in the use of a resource by some individuals reduces gene flow.

(Sympatric “same country” speciation)

In sympatric speciation, there is no geographic barrier to gene flow.
12. Speciation in the Darwin finches was:

A. Sympatric
B. Allopatric
Through descent with modification over 3.8 billion years, all organisms are *genetically related*.
How do scientists reconstruct these relationships?

Systematists are the detectives of life’s history

Evidence:
Observable characters need to be derived (unique) and shared
Such characters are called synapomorphies

Result:
Produce a tree-like diagram
Called phylogeny or cladogram
Part 3. Trees

Complete number 1
Other ways of representing a tree

A and B are sister groups

taxon A

taxon B

common ancestor of A and B

C is the outgroup to A and B

taxon C

Sp A  Sp B  Sp C  Sp D
2. Who is more closely related to crocodiles?
A. Lizards
B. Ostriches

3. Which animals have an amnion?
Tree thinking challenges

Complete number 5
Optional study guide

• Read chapter 24

• Complete
  Interactive question 24.1, 24.4
  Test your knowledge: 5, 9

• Read chapter 26.1-26.3

• Complete
  Test your knowledge: 3, 4, 6, 7