Evolution

Vocabulary

evolution
natural selection
speciation
genetic drift
competition
extinction
allele frequency
analogous structure
homologous structure
isolating mechanisms
embryology
genetic migration
endosymbiosis
fossils
founder effect
gradualism
population dynamics
punctuated equilibrium
selective breeding
vestigial structure

Concepts to Know

What are evolution and natural selection?

Evolution is how species change over time in response to the environment.

Natural selection is the mechanism by which species evolve.

Play a Game! ... "Who Wants to Live A Million Years?"

- Go to http://science.discovery.com/interactives/literacy/darwin/darwin.html
- Click "Learn About Natural Selection" and go through the short tutorial.
- After tutorial, play the "Survival Game" and answer the questions that follow.

1. Draw the three critters you initially selected for your population.

2. Did you choose them for any particular reason? Why?

3. As the years progressed, what environmental changes occurred?

4. How did your species' population change over time, through natural selection?

5. Did your species' population survive a million years? Why do you think it did, or it didn't?

6. If you were to do the game again, what would you do differently?

7. Now take the quiz. Record your answers to the questions below as you take the quiz.

1. B	3. C	5. B	7. B	9. D
2. D	4. D	6. A	8. D	10. D

What was your final score on the quiz? ____

So... traits are due to an organism's genes. In the "Survival Game", the critters with genes that made them better adapted to their environment (and environmental changes), survived longer and reproduced. All of the genes and their ***alleles*** present in a population is referred to as a ***gene pool***.

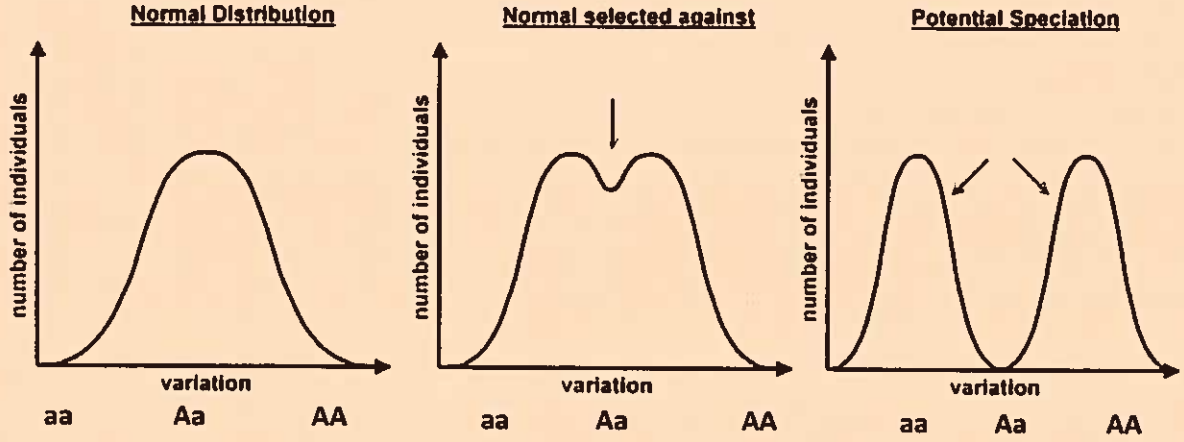
8. Over time, as a result of natural selection, what happens to the amount (or frequency) of favorable alleles in the pool? To the unfavorable genes?

They ↓

They ↑

Factors Affecting Gene Frequencies

Migration, mutation, and genetic recombination do change the frequency of certain alleles within a gene pool. Some of the genetic variations produce traits harmful to the individual organism, some have no effect, and a few improve the chances of the individual surviving and reproducing within the environment. The frequency of genes that are adaptive will increase in the population with time because the bearers of such genes will reproduce more successfully than those without the adaptive genes. When environmental conditions change, a new set of alleles may prove of high survival value, and the gene distribution within the population can change within a relatively short period of time. This is natural selection. Thus environmental factors exert pressure for selection of certain genes and affect gene frequencies within the population.



9. Looking at the graphs above, there are three genotypes present in a population. What are the three genotypes?

aa Aa AA

10. Which genotype is not favorable for survival?

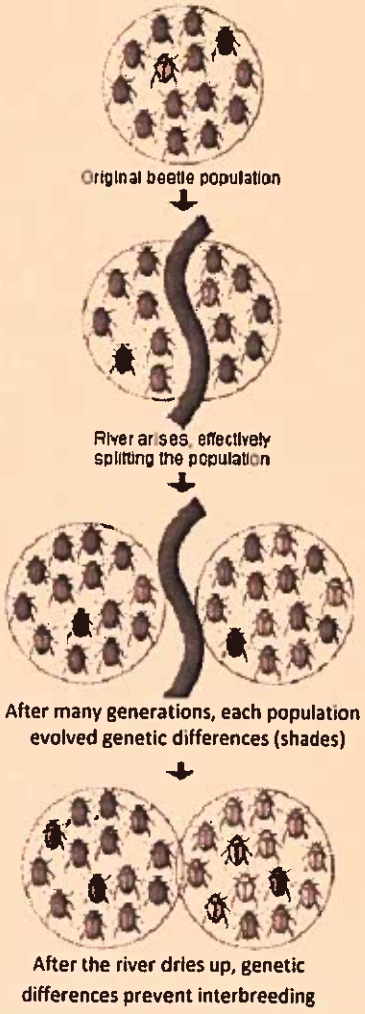
aa AA Aa

11. How has the population changed over time?

Homos Become More Common

Speciation

Speciation is the formation of new species over time as a result of evolution. Isolation of a population affects gene frequencies. Isolation may be caused by ***geographic factors*** (like a mountain forming dividing a population into two). As conditions change in the two areas, the two populations will experience natural selection separately, facing slightly different environmental conditions. When species have evolved separately enough that they could no longer breed successfully with each other, then the two groups have become ***reproductively isolated***. Once the populations are reproductively isolated, they are generally considered to be now different species. **Thus one species split into two species – one similar to the original, and one new and different.**



12. Other than mountains, what else could cause geographic isolation?

H_2O Canyon

13. Briefly explain an example of reproductive isolation.

North & South Rim of The Grand Canyon

What evidence supports evolution?

14. Match the statement with the type of evidence.

A. Fossil
B. Anatomical
C. Physiological
D. Embryological
E. Biochemical
F. Universal genetic code

A A record of ancient life forms in rock.
E The hemoglobin in blood of humans and chimpanzees is remarkably similar.
D A seal's flipper and the similar bat's wing are ***homologous structures***.
F All organisms have DNA built from the same nucleotides (A,T,G,C).
D Early stages of development in many species with backbones is very similar.
B ***Vestigial structures*** remain in some organisms, and no longer serve any apparent function.

Mechanisms of Evolution

Check out this really good explanation... http://glencoe.mcgraw-hill.com/sites/9834092339/student_view0/chapter20/animation_-_mechanisms_of_evolution.html

Related questions:

15. Do individuals evolve, or do (populations) evolve?

16. Complete the chart

Mechanism	Definition	Example
Genetic Drift	Δ in gene pool of a small pop 2° Chance Bottle Necks	Large % Removed from Pop 2° disease, overhunting or natural Disasters Genetic Drift - Founder Effect - small # start a new Colony
Gene Flow	Movement of Alleles From one Pop To another	immigration
Mutations	Δ in DNA in Gametes	Source of Genetic Variability
Nonrandom Mating	Favors Certain Traits which will accumulate in a pop.	Peacock

Peppered Moths

Looking at the photo at the right...

17. Which moths will survive better (not get eaten by predatory birds) and reproduce?

Light

18. Over time, what color moths do you expect to only find living in a region with light colored trees? With dark colored trees?

Light Dark

Lamarck was Darwin's rival, and came up with his own theory of natural selection called "use and disuse." Lamarck's theory is not widely supported by scientific evidence.

Examine the scene below, comparing the sides.

Early giraffes probably had short necks that they stretched to reach food.

Their offspring had longer necks that they stretched to reach food.

Eventually, the continued stretching of the neck resulted in today's giraffe.

a. Lamarck's proposal

Early giraffes probably had necks of various lengths.

Natural selection due to competition led to survival of the longer-necked giraffes and their offspring.

Eventually, only long-necked giraffes survived the competition.

b. Darwin's theory

19. What is the main problem with Lamarck's theory? HINT: Remember only traits that can be inherited will affect the survival of future generations.

Traits aquired during LifeTime are NOT passed onto offspring

Phylogenic Tree | Explorer

Homologous vs Analogous | PP

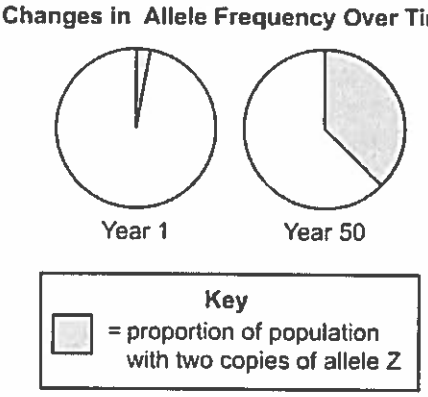
DNA Comparisons | Chrome

Radioactive Dating | Word

Practice Questions:

Use the circle graphs to the right to answer the question.

1. The graphs illustrate change in a lizard population over time. Which process **most likely** led to the change in the lizard population?
   A. natural selection acting on a harmful trait
   B. natural selection acting on a beneficial trait
   C. natural selection acting on a dominant trait
   D. natural selection acting on a recessive trait



2. In North America, the eastern spotted skunk mates in late winter, and the western spotted skunk mates in late summer. Even though their geographic ranges overlap, the species do not mate with each other. What **most likely** prevents these two species from interbreeding?
   A. habitat isolation
   B. gametic isolation
   C. geographic isolation
   D. reproductive isolation

3. A mutation occurs in the genes that code for coat color in deer. Which change will **most likely** result from this mutation?
   A. a change in the selection pressures acting on coat color
   B. a change in the coat-color genes of deer predator species
   C. an increase in coat-color diversity in the population
   D. an increase in the number of genes for coat color in the population

4. Two continental plates collide and begin to build up a mountain range. Gradually, a species of lizards becomes separated by the mountain range. The members on one side can no longer interact with members on the other side. Due to their separation, the two populations of lizards
   a. will evolve in exactly the same manner and remain as one species.
   b. will likely become extinct within one year.
   c. will likely evolve into separate species over millions of years.
   d. will begin hunting one another for food.

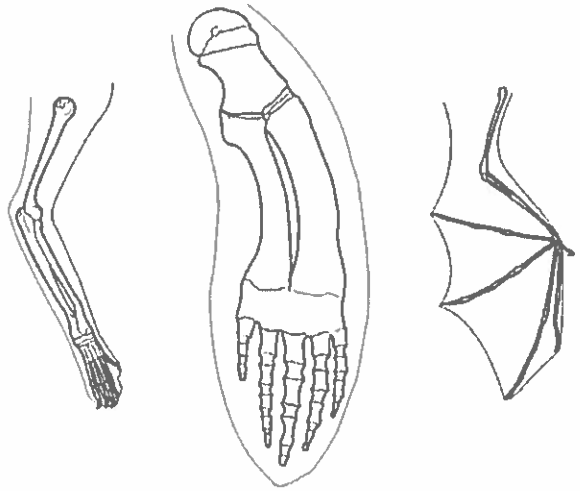
5. According to the theory of natural selection, which of the following organisms is most likely to survive in the given environments?
   a. a rabbit with short, brown fur in a cold, snowy, arctic environment
   b. a large, leafy plant with shallow roots in a hot and dry desert biome
   c. a bird with a short beak in an area where insects live deep within the ground
   d. a lizard that exhibits the same coloration as its surrounding plant life

6. What information do fossils provide about the history of organisms on Earth?
   a. Organisms have stayed exactly the same since the Earth was formed.
   b. Organisms on Earth have not evolved or changed during the last 200 years.
   c. Fossils do not provide any information about the history of organisms on Earth.
   d. Organisms on Earth have evolved and changed significantly over time.

Use the illustrations to the right to answer the question.

7. The skeletons of mammalian forelimbs represent variations of a structure that was present in their common ancestor. These are examples of _____?
   A. analogous structures
   B. convergent structures
   C. homologous structures
   D. vestigial structures

Mammalian Forelimbs



cat whale bat

Use the table below to answer the question.

Sequence Difference Between COII Genes in Some Animals

Animal	Number of Base Differences from a Rat
Mouse	101
Cow	136

8. The gene COII is in the genome of many organisms. A comparison of the number of base differences between the COII gene in a rat and that of two other animals is shown.

   Part A: Based on the data, describe a possible evolutionary relationship between rats, mice, and cows.

Rats Are More Closely Related To Mice Than Cows

   Part B: Describe how different organisms having a common gene such as COII supports the theory of evolution.

Common Genes Come From Common Ancestors

   Part C: The COII gene of a monkey has 203 base differences from the same gene in a rat and 210 base differences from the same gene in a mouse. Compare the evolutionary relationships between the monkey, the rat, and the mouse.

The Monkey is More Closely Related To the rat because There are Fewer differences between Them.