

Evolution of Living Things Study Guide

Key vocabulary terms:

Natural selection
Charles Darwin
Selective breeding
Species
Evolution
Fossil
Fossil record
Embryo
Variation

Adaptation
Artificial selection
Population
Homologous structure
Analogous structure
Vestigial structure
Generation time
Speciation

Change over time

1. What is the difference between homologous structures and analogous structures? **Provide examples of each.**

Homologous structures are similar structures that serve a similar purpose and share a common evolutionary origin (similar structure).

Ex. the whale arm, human arm, car arm

Analogous structures are similar structures that also serve a similar purpose, but they do *not* share an evolutionary origin (different structure).

Ex. wings of an butterfly and a bird.

2. Define vestigial structure. Give 2 examples.

Genetically determined **structures** or attributes that have apparently lost most or all of their ancestral function in a given species, but have been retained during the process of evolution.

Ex. Appendix, wisdom teeth, eyes in blind cavefish, pelvic bone in whales

3. Why is the fossil record considered incomplete?

Only dead organisms that are buried in sediment quickly can become fossils. After remains have been buried and preserved, they may still be destroyed by geological processes, or exposed and weathered away before people can find them.

4. How does the fossil record show that species have changed over time?

Each new fossil contains additional clues that increase our understanding of life's history and help us to answer questions about their evolutionary story.

5. List (4) pieces of evidence for evolution.

Part 1: Evidence from the Fossil Record

Part 2: Evidence from Molecular Biology (DNA)

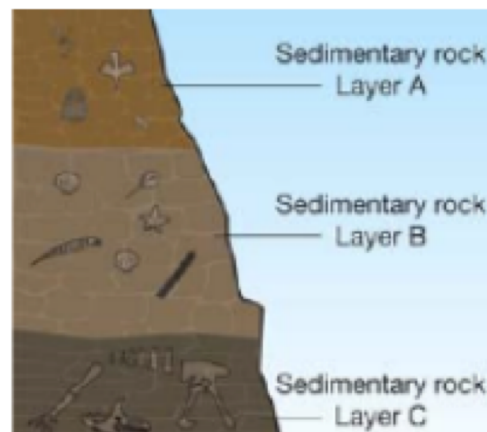
Part 3: Evidence from Homologous Structures and Vestigial Organs

Part 4: Evidence from Embryology

6. An adaptation is an **inherited** trait that helps an organism survive. Which statement best describes adaptation?
- a lily suddenly mutates its tissues to store more water in a drought
 - fish swim away from a sudden source of pollution
 - a beetle hatches during a food shortage with a mutation that allows it to digest a greater variety of food**
 - environmental factors are a cause of natural selection in which there are only favorable traits

7. Which of the following layers is youngest?

- Layer B
- Layer C
- Layer A**



How does evolution happen?

1. Where did Darwin conduct his research?

Galapagos islands (off the coast on Ecuador)

2. What are some things that Darwin concluded when studying the finches?

Darwin identified 13 species of Finches among the Galápagos Islands that were primarily differentiated by beak size. In contrast, only one species of this bird existed on the mainland South America to the east. Darwin thus concluded that the different beaks were adaptations to different diets available among the islands.

Darwin ultimately generalized the observation from the finches that any population consists of individuals that are all slightly different from one another.

3. Organisms that are well suited to their environment.....(finish the sentence)

have a phenotype characteristic providing an advantage and thus will be more likely to stay alive in order to successfully reproduce and will pass their phenotype traits more frequently to the next generation. Over time and generations the traits providing reproductive advantage become more common within the population.

4. Define natural selection.

The differential survival and reproduction of individuals due to differences in phenotype.

5. What are some examples that could cause competition among species?

Food, mates, water, land

6. Compare artificial selection to natural selection.

Artificial selection is when mankind chooses certain traits in plants and animals and breeds to enhance that trait. Natural selection is also a process where traits are selected for, but that selection is based upon a trait that gives the organism a mating or survival advantage and this allows them to pass down the traits they possess (naturally).

7. Does natural selection act on phenotypes or genotypes? Explain.

Genotypes, inherited traits are not passed on from one generation to the next (two body builders will not produce a baby with “muscles”, tanned skin)

8. Describe the four parts of natural selection in your own words (feel free to be creative with an example)

a. Populations over-reproduce

All organisms produce more offspring than can survive to adulthood and reproduce. This means that many of those off offspring will die without reproducing. Survivors that are able to reproduce pass their traits on to their offspring.

b. Individuals in a population vary

There is random variation in traits among individuals in a population of a species. The variations each individual possesses happen by chance. Those variations are inherited.

c. Struggle to survive

The changing environment causes a selection of favorable traits (adaptations) and those individuals who do not possess the favorable trait will struggle to survive and reproduce.

d. Successful reproduction (favorable adaptations accumulate)

Favorable adaptations accumulate over many generations and thus allow for certain individuals to reproduce

9. Give an example of how a random mutation in an organism could give it an environmental edge over other members of its species.

Resistance: insecticide/antibiotic, organisms acquire a random mutation which can give them an “edge” over the rest of the population and thus the ability to survive and reproduce

10. A population of beetles eats only red flowers. Most of the beetles are red but a few of them are yellow. The red beetles are hidden from hungry, beetle-eating birds. The beetles eat up all of the red flowers and now there are only yellow flowers left. What would you expect to happen to the traits of the beetle population over time? What process would cause this to happen?

This change would mean that predators would eat the red beetles while the yellow beetles blend in. Over time, you could expect to see the yellow beetle population increase and the red beetle trait would decrease. The process of natural selection would cause this to happen because the favorable adaptation of being yellow would allow the yellow beetles to reproduce at a higher rate.

11. The dog breeds we have today were developed through:
- natural selection
 - artificial selection (selective breeding)**
 - sexual selection
 - acquired selection
12. The size of a white-footed mouse population is influenced by:
- the availability of acorns, a main source of food
 - an increase in the owl population, a primary predator
 - an extremely dry summer leading to a severe drought
 - all of the above**
13. Variation in a population:
- is not random and occurs due to an environmental change
 - describes only changes in the behavior of a species
 - is acquired throughout an organism’s lifetime
 - happens by chance and is passed on to offspring**
14. Darwin referred to selective breeding as _____ because the breeders selected the desired traits to produce changes in a species over a few generations.
- natural selection
 - artificial selection**
 - magic
 - extinction
15. Thomas Malthus had an argument that helped support Darwin’s ideas about evolution. What was Malthus’ argument?
- overproduction of food causes populations to decrease
 - food supplies usually grow faster than human populations
 - human populations tend to grow slower than their food supply
 - human populations tend to grow faster than their food supply**

Natural selection in action

1. What are three ways in which speciation can occur?

Speciation occurs when there is some type of barrier that prevents members of the same population from successfully interbreeding. This barrier can be either a physical barrier such as a new mountain, river or ocean form separating the population into sub-populations. Or the barrier can be genetic, such as a mutation that no longer allows members of the population to breed with the non-mutated members. After the separation has occurred the sub-populations continue to develop different mutations and adapt to different environments and eventually, even if the initial barrier was removed, they can not mate with their parent population - they have become a new species.

2. Explain how isolation of populations can lead to speciation. **Provide examples.**

Over time, the two populations acquire random mutations and become so different from one another they become sub-populations. For example, if one species of birds somehow got stranded on two different islands, the species may eventually break off into two separate, distinct species. Causes may include different needs based on the environment. For example, if one island only had tough nutshells, the species may select for a bigger, stronger beak in order to more easily break the shells.

3. What factors indicate that a population has evolved into two separate species?

If the two separate species cannot interbreed (ex. birds with different mating dances) or if they can interbreed but not produce viable offspring.

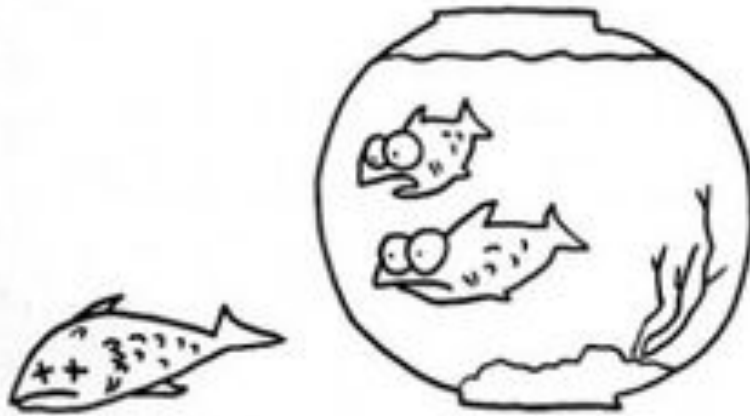
4. Most cactuses have spines, which are leaves modified to protect the plant. The spines cover a juicy stem that stores water. Explain how cactus leaves and stems might have changed through the process of natural selection.

The first cacti would have had unprotected stems and leaves. Then maybe one of the offspring mutated to have some sort of covering for the stem. This trait would have been advantageous to the survival of the cactus and hence that cactus would live on long enough to reproduce and pass on its traits. If this catches on, then after millions of years and generations, gradual changes are made and the plants begin to evolve to have spines. Meanwhile, the more primitive plants without spines die out because they have less advantageous characteristics to survive in the environment

5. Describe how a short generation time in insects leads to pesticide resistance.

When a pesticide is first used, a small proportion of the pest population may survive exposure to the material due to their distinct genetic makeup. These individuals pass along the genes for resistance to the next generation. Subsequent uses of the pesticide increase the proportion of less-susceptible individuals in the population. Through this process of selection, the population gradually develops resistance to the pesticide quicker than other populations because the generation time is so short for new generations to develop.

6. As environmental conditions change over time, which population will have a better chance of survival?
- a. a population with a high level of variation
 - b. a population with several very fit and genetically similar organisms
 - c. organisms that mutate very rarely
 - d. a population that feeds exclusively on one type of food
7. A group of mice becomes separated by the formation of a river. Over time, the northern mice became smaller and whiter, while the southern mice became larger and browner. This is an example of:
- a. analogous structures
 - b. homologous structures
 - c. embryology
 - d. speciation



... then he yelled "evolution!"
and simply jumped out ...