# AP Biology Unit 8—Evolutionary Biology

Key Terms

1. Evolution
2. Adaptive radiation
3. Divergent evolution
4. Convergent evolution
5. Fossil
6. Gene pool
7. Hardy-Weinberg Law
8. Natural selection
9. Embrylogy
10. Vestigial structure
11. Biogeography
12. Homologous structures
13. Analogous structures
14. Genetic variability
15. Mutation
16. Directional selection
17. Stabilizing selection
18. Disruptive selection
19. Genetic drif

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# General review

* Define the following:
  + Evolution
  + Microevolution
  + Macroevolution
  + Natural selection

# Evidence for evolution

Evidence for evolution is provided by the following five scientific disciplines. Describe and give examples for each of the disciplines.

1. **Direct Observation (give 2 examples)**
2. **The Fossil Record (Paleontology)**
3. **Biogeography**
4. **Embryology**
5. **Comparative anatomy, include homologous structures and analogous structure.**
6. **Molecular biology**

# Natural Selection

Define the following

* + **Natural selection**
  + **Adaptations**
  + **Fitness**

Darwin presented his theory for natural selection using the following arguments. Explain each one.

1. **Populations posses an enormous reproductive potential.**
2. **Population sizes remain stable.**
3. **Resources are limited.**
4. **Individuals complete for survival.**
5. **There is variation among individuals in a population.**
6. **Much variation is heritable.**
7. **Only the fit individuals survive.**
8. **Evolution occurs as advantageous traits accumulate.**

Natural selection may act upon a population in a variety of ways. Describe and explain each one, include a graph that represents the type of selection.

1. **Stabilizing selection**
2. **Directional selection**
3. **Disruptive selection**
4. **Sexual selection (no gragh)**
5. **Artificial selection (no graph, give an example)**

# Sources of Variation

In order for natural selection to operate, there must be variation among individuals in a population. Indeed, considerable variation exists in nearly all populations. The variation arises from or is maintained by the following mechanisms.

Describe and explain each of the following.

1. **Mutations (Formation of New Alleles)**
2. **Altering Gene number or Position**
3. **Sexual reproduction**
   1. **Include the following**
      1. **Genetic recombination**
      2. **Crossing over**
      3. **Independent assortment of homologues**
      4. **Random joining of gametes**
4. **Balancing Selection- Heterozygote Advantage**

**Why Natural Selection Cannot Fashion Perfect Organisms**

Though natural selection leads to adaptation, nature abounds with examples of organisms that are less than ideally suited for their lifestyles. Describe the four reason this is the case.

**1. Selection can act only on existing variations.**

**2. Evolution is limited by historical constraints.**

**3. Adaptations are often compromises.**

**4. Chance, natural selection, and the environment.**

**Causes of Changes in Allele Frequencies**

Natural selection was the mechanism that Darwin proposed for evolution. With the understanding of genetics, it became evident that factors other than natural selection can change allele frequencies and thus promote evolution. These factors, together with natural selection, are given below. **Describe** each one and **explain** how it causes changes in allele frequencies. (These are the five conditions for Hardy-Weinberg equilibrium)

1. **Natural selection**
2. **Mutations**
3. **Gene Flow**
4. **Genetic drift, include the founder effect and bottleneck**
5. **Nonrandoming mating**

**Genetic Equilibrium**

When the allele frequencies in a population remain constant from generation to generation, the population is said to be in genetic equilibrium, or Hardy-Weinberg equilibrium. At genetic equilibrium, there is no evolution. In order for equilibrium to occur, the factors that normally change gene frequencies do not occur.

List the five conditions required for Hardy-Weinberg equilibrium:

1.

2.

3.

4.

5.

**Maintaining Reproductive Isolation**

If species are not physically separated by a geographic barrier, various mechanisms commonly exist to maintain reproductive isolation and prevent gene flow. These mechanisms may appear randomly (genetic drift) or may be the result of natural selection.

There are two categories of isolating mechanisms. The first category, **prezygotic isolating mechanisms**, consists of mechanisms that prevent fertilization. Describe each of the following and give an example.

1. **Habitat isolation**
2. **Temporal isolation**
3. **Behavioral isolation**
4. **Mechanical isolation**
5. **Gametic isolation**

The second category, **postzygotic isolating mechanisms**, consists of mechanisms that prevent the formation of fertile progeny. Describe each of the following and give an example.

1. **Hybrid inviability (reduced hybrid viability)**
2. **Hybrid sterility**
3. **Hybrid breakdown**

# Pattern of Evolution

The evolution of species is often categorized into the following four patterns. Describe each of the following and draw a graph to illustrate each one.

1. **Divergent evolution**
2. **Convergent evolution**
3. **Parallel evolution**
4. **Coevolution**

**Macroevolution**

Define **macroevolution**:

The two distinct macroevolution theories listed below reflect different interpretations of fossil evidence and explanations for the development of evolutionary history. Summarize the two theories and draw a diagram to illustrate each one.

1. **Gradualism**
2. **Punctuated equilibrium**

**AP Biology Evolution -- Grid-In Questions**

**1. The radioisotope potassium-40 can be used to date past events older than 60,000 years. Potassium-40 has a half-life of 1.3 billion years, decaying into Argon-40. If the igneous rock layer that scientists wish to date shows a ratio of Potassium-40 to Argon-40 at one-fourth the current ratio, what is the age of the rock layer? Express your answer in billions of years.**

**Answer:\_\_\_\_\_\_\_\_\_\_**

**2. In a population of king snakes the banded pattern (B) is dominant to no banding (b). If 12% of the population shows no banding, what percentage of the population, to the nearest tenth, is heterozygous for banding?**

**Answer:\_\_\_\_\_\_\_\_\_\_**

**3. In a population of turtles, the allele that causes a yellow shell (Y) is dominant to the allele that results in a red shell (y). If the dominant allele is present in the population at the 0.72 level and the population is in Hardy-Weinberg equilibrium, what percent of the population would be expected to have a red shell? Express your answer to the nearest tenth of a percent.**

**Answer:\_\_\_\_\_\_\_\_\_\_**

**AP Biology Evolution Unit 8 Essay Question #1**

**Explain how evolution occurs; make sure you discuss Darwin’s theory of natural selection.**

**AP Biology Evolution Unit 8 Essay Question #2**

**Describe the process of speciation. Include a discussion of mechanisms that maintain reproductive isolation, include geographic barriers, adaptive radiation, polyploidy, and sexual selection.**

**AP Biology Evolution Unit 8 Essay Question #3**

**A number of experimental investigations have provided evidence that the conditions early in the Earth’s history provided an environment capable of generating complex organic molecules and simple cell-like structures.**

**(a) Describe one scientific model for the origin of organic molecules on Earth.**

**(b) Explain how RNA has the essential features of the earliest genetic material.**

**(c) Predict the effect that introduction of free oxygen in the atmosphere had on the prokaryotic species of the time.**