



a place of mind

FACULTY OF EDUCATION

Department of  
Curriculum and Pedagogy

# **Biology**

# **Evolution:**

# **Natural Selection I**

Science and Mathematics  
Education Research Group

# Natural Selection I

Natural selection, in a nutshell:

Yum! Green beetles! Our favorite!

...generations later...



...generations later...



Green beetles have been selected against, and brown beetles have flourished.

# Question 1

Natural selection is one of the five theories which Darwin described in his book, *On the Origin of Species*. Which of the following statements is true about natural selection?

- A. All life forms evolved from a single cell.
- B. Populations of animals and plants reproduce by cloning.
- C. Populations of a species that become isolated from others will inbreed within the population and have a better chance to reproduce and pass on their genes to the next generation.
- D. Individuals with a trait that allows them to get more food or to avoid being killed will have a better chance to reproduce and pass on their traits to the next generation.
- E. All of the above.

# Solution I

**Answer: D**

**Justification:**

Charles Darwin`s natural selection states that if an individual has a trait that increases the chance of its survival, it will have a greater chance of reproducing. As a result, more of the next generation will inherit that trait.

Therefore, the correct answer is D.

In addition, only a few types of plants and animals reproduce by cloning, and inbreeding usually decreases the survival of the inbreeding species due to loss of genetic variation (they cannot adapt as easily to new changes). Also, it is Cell theory which states that all life forms evolved from a single cell.

# Question II

Which of the following are components of Darwin's theory of evolution by natural selection?

- I. Popularity among the opposite sex
- II. Differential survival and reproduction
- III. High rate of population growth
- IV. Variation within populations

- A. I
- B. II & IV
- C. I, II, & III
- D. I, II, & IV
- E. II, III, & IV

# Solution II

**Answer: E**

## **Justification:**

Darwin`s process of natural selection has four components.

1. Variation within populations – Genetic variations in a population (which can affect the appearance, behavior, etc. of individuals) permit flexibility and survival of a population in the face of changing environment, predation, competition, etc.
2. High rate of population growth – The individuals in a high growth rate population will struggle for resources (e.g. food) and only “fit” individuals will survive by natural selection.
3. Differential survival and reproduction – Individuals with suitable traits to deal with local resources will have a higher survival rate and have a chance to produce offspring.
4. Inheritance – Individuals with stronger inherited traits will have a higher chance to survive and reproduce through natural selection.

Therefore, the answer is E.

# Question III

In the concept of Natural Selection, an individual's fitness is determined by...

- A. The ratio of body fat to muscle weight.
- B. The phenotype of the individual.
- C. The ability of that individual to survive in a fast changing environment.
- D. The probability that an individual will contribute its genes to the next generation.
- E. The probability that an individual will attract a mate.

# Solution III

**Answer: D**

## **Justification:**

The term, fitness is central to natural selection. Individuals that are more “fit” have a better potential for survival and success rate at reproducing. For instance, if an individual lives half as long as others of its species, but delivers twice as many offspring surviving to maturity, its genes will have higher probability of passing on to the following generation.

Therefore, the correct answer is D.



# Question IV

Which one of the following populations would most likely live in an environment that is stable for a long time?

- A. a population with directional selection
- B. a population with disruptive selection
- C. a population with stabilizing selection
- D. a population with adaptive radiation
- E. a population with hybridization

# Solution IV

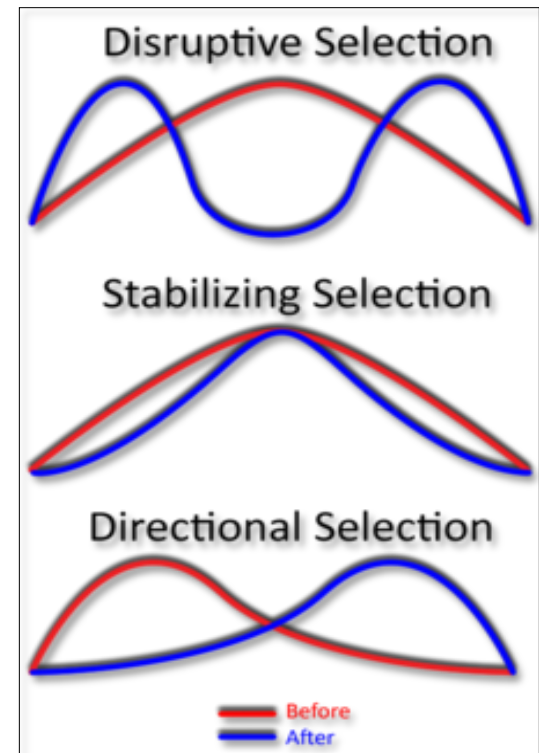
**Answer: C**

## **Justification:**

Directional selection, disruptive selection, and stabilizing selection are three types of natural selection.

Stabilizing selection occurs when natural selection favors a particular trait over time. This type is the most common action for natural selection because most traits do not have drastic changes.

Directional selection occurs when natural selection favors one extreme trait over other traits and over time the favored trait becomes more common.



# Solution IV Continued

Similarly, disruptive selection occurs when natural selection favors both extreme traits. Over time, the two extreme traits will be more common and other traits in the population will be less common or lost. Disruptive selection usually leads to an increase in genetic variation and can lead to speciation.

Adaptive radiation occurs when a species diversifies rapidly into a variety of new forms, this process happens when a change in the environment provides new resources or creates new challenges.

Hybridization is the sexual crossing process between individuals of different species, which can create novel offspring with different traits. Though infrequent, it can be a driver of evolution.

Therefore, the correct answer is C.

# Question V

Natural selection is...

- A. the elimination of the largest organisms by natural effects.
- B. the selection of the biggest and strongest organisms in a population.
- C. the selection of organisms with the most popular trait to attract its opposite sex.
- D. the survival and reproduction of the strongest organisms in a population.
- E. the survival and reproduction of organisms with traits most fitted to their environment.

# Solution V

**Answer: E**

**Justification:**

Natural selection is the process whereby organisms better adapted to their environment tend to survive and produce more offspring. Because they have the best “fitted” traits, they have a higher survival rate and chance of reproduction.

Therefore, the correct answer is E.