What is Adaptation and Speciation?

Worksheet

Adaptation is a trait shaped by natural selection to fit an environment; speciation is the formation of new, reproductively isolated species from a common ancestral population, often driven by geographic separation and accumulated adaptations.

Questions

1. Which type of speciation requires a geographic barrier?

A) Sympatric
B) Allopatric
C) Polyploid
D) Instant

2. Darwin's finches developing different beak shapes on different islands is an example of

A) genetic drift only
B) adaptation via natural selection
C) sympatric speciation
D) mutation without selection

3. What best defines reproductive isolation?

A) Living in different countries
B) Inability to produce fertile offspring together
C) Having different fur color
D) Eating different foods

4. Polyploidy leading to instant speciation without geographic separation is an example of

A) allopatric speciation
B) sympatric speciation
C) adaptation only
D) genetic drift

5. Darwin's finches on the Galpagos Islands evolved different beak shapes. Explain how adaptation led to their diversity.

6. Two populations of a fish species are separated when a lake splits into two by a new land ridge, 50,000 years ago. Assuming no gene flow, are they likely to be considered separate species today, and why?

7. A polyploid plant (4n) arises suddenly from a diploid (2n) parent population via a chromosome-doubling error. Can it interbreed with the parent population? What kind of speciation is this?

8. Define: What is an adaptation?

9. Define: What is speciation?

10. Define: What's the difference between allopatric and sympatric speciation?

Answer Key

1. B) Allopatric - Allopatric speciation happens when populations are physically separated, preventing gene flow.

2. B) adaptation via natural selection - Beak shapes matched local food sources because natural selection favored beaks suited to each island's diet.

3. B) Inability to produce fertile offspring together - Reproductive isolation means two populations can no longer successfully interbreed, a key step toward speciation.

4. B) sympatric speciation - Polyploid organisms are immediately reproductively isolated from their diploid parents while living in the same place - sympatric speciation.

5. Ancestral finches colonized different islands with different food sources. Beak-shape variation existed among individuals. Birds with beaks suited to local food (seeds, insects, cactus) survived and reproduced better. Over generations, each island population adapted its beak shape, eventually forming distinct species.

6. 50,000 years of isolation with no gene flow allows independent mutation and selection. Each population adapts to its own lake conditions. Over enough generations, genetic divergence can lead to reproductive isolation. If they can no longer interbreed successfully, they meet the biological species concept separate species.

7. 4n 2n crosses often produce sterile triploid (3n) offspring. The polyploid plant is instantly reproductively isolated from its 2n parents. This is sympatric speciation (same location, instant isolation) via polyploidy - common in plants.

8. A heritable trait, shaped by natural selection, that improves an organism's fitness in its environment.

9. The evolutionary process by which one population splits into two or more genetically distinct, reproductively isolated species.

10. Allopatric requires geographic separation; sympatric occurs without any physical barrier, often via polyploidy or niche specialization.