

What Is Speciation and Reproductive Isolation?

Worksheet

Speciation occurs when reproductive isolation - prezygotic or postzygotic barriers that prevent gene flow - allows two populations to diverge genetically until they become separate species.

Questions

- Which of these is a prezygotic isolating mechanism?
 - Hybrid sterility
 - Hybrid inviability
 - Behavioral isolation (different courtship)
 - Hybrid breakdown
- Allopatric speciation is primarily driven by
 - Random mutation only
 - Geographic separation of populations
 - Identical environments
 - Increased gene flow
- A mule is sterile because of
 - Temporal isolation
 - Habitat isolation
 - Mismatched chromosome numbers disrupting meiosis
 - Behavioral incompatibility
- According to the biological species concept, two populations are different species if they
 - Look physically different
 - Live in different countries
 - Cannot produce fertile offspring together
 - Have different diets
- Two frog populations breed in the same pond, but one breeds in early spring and the other in early summer. What type of isolation is this, and what's the outcome?
- A horse ($2n=64$) mates with a donkey ($2n=62$), producing a mule with 63 chromosomes. The mule is almost always sterile. Which type of isolation is this?
- A river changes course and splits a lizard population into two isolated groups for 50,000 years. Later the river dries up and the groups reunite but no longer interbreed. What process occurred?
- Define: What is speciation?
- Define: What is reproductive isolation?
- Define: Difference between allopatric and sympatric speciation?

Answer Key

1. C) Behavioral isolation (different courtship) - Behavioral isolation prevents mating before fertilization; the others occur after.
2. B) Geographic separation of populations - Allopatric speciation begins when a physical barrier separates populations, stopping gene flow.
3. C) Mismatched chromosome numbers disrupting meiosis - Horse and donkey chromosome numbers differ, so mule chromosomes can't pair properly in meiosis.
4. C) Cannot produce fertile offspring together - The defining criterion is reproductive isolation - inability to produce fertile offspring.
5. Different breeding times = temporal isolation (a prezygotic barrier) Gametes never meet, so no hybrids form
Over time, the populations accumulate independent mutations
Given enough divergence, they become separate species
6. Fertilization occurs, so it is not prezygotic
The hybrid (mule) survives but cannot produce viable gametes
Mismatched chromosome number disrupts meiosis
This is reduced hybrid fertility - a postzygotic barrier
7. Physical separation = allopatric speciation via geographic isolation
Each group independently accumulated mutations and adapted to local conditions
Genetic divergence became large enough to create reproductive barriers
When reunited, they behave as two separate species (isolation persists)
8. The evolutionary process by which one species splits into two or more distinct species.
9. Any barrier that prevents members of different populations/species from successfully interbreeding.
10. Allopatric = geographic separation; sympatric = speciation without geographic separation, in the same area.

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