

## Section 4: Speciation and Isolation Mechanisms - Notes

### Objectives:

- Describe species as reproductively distinct groups of organisms.
- Analyze the role that geographic isolation can play in speciation.
- Describe how the degree of kinship between species can be inferred from the similarity in their DNA sequences.
- Describe the relationship between environmental changes and changes in the gene pool of a population.

### Warm-up:

- Do similar looking organisms belong to the same or different species? How do we know?

### Species and Speciation:

- **Species:** organisms that are capable of \_\_\_\_\_ that results in \_\_\_\_\_.

- A species has to be able to \_\_\_\_\_ itself.

- There are cases where two different species are able to \_\_\_\_\_ and \_\_\_\_\_.

- However, their offspring are not able to \_\_\_\_\_.

- These offspring are called \_\_\_\_\_.

- Examples: \_\_\_\_\_

- **Speciation:** a \_\_\_\_\_ that results in a new genetically distinct \_\_\_\_\_.

- Speciation is caused by \_\_\_\_\_.

- **Reproductive Isolation:** the \_\_\_\_\_ of individuals from two populations to produce \_\_\_\_\_ offspring with each other.

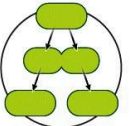
- Makes it impossible for \_\_\_\_\_ to occur.

### THE BIOLOGICAL SPECIES CONCEPT DOESN'T ALWAYS WORK

The biological species concept is remarkably useful when describing most plants and animals, but it doesn't work for distinguishing all life forms.

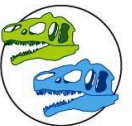
#### 1 CLASSIFYING ASEXUAL SPECIES

Asexual reproduction does not involve interbreeding, so the concept of reproductive isolation is no longer meaningful.



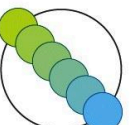
#### 2 CLASSIFYING FOSSIL SPECIES

Differences in size and shape of fossil bones cannot reveal whether there was reproductive isolation between the individuals from whom the bones came.



#### 3 DETERMINING WHEN ONE SPECIES HAS CHANGED INTO ANOTHER

There is rarely a definitive moment marking the transition from one species to another.



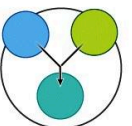
#### 4 CLASSIFYING RING SPECIES

Two non-interbreeding populations may be connected to each other by gene flow through another population, so there is no exact point where one species stops and the other begins.



#### 5 CLASSIFYING HYBRIDIZING SPECIES

Hybridization—the interbreeding of closely related species—sometimes occurs and produces fertile offspring, suggesting that the borders between the species are not clear cut.



- There are two different types of reproductive isolation:
  - Prezygotic barriers: mechanisms that \_\_\_\_\_ from occurring.
  - Postzygotic barriers: mechanisms that reduce the \_\_\_\_\_ or reproductive capacity of \_\_\_\_\_ offspring.



#### PREZYGOTIC BARRIERS

- Individuals are physically unable to mate with each other.
- OR
- If individuals are able to mate, the male's reproductive cell is unable to fertilize the female's reproductive cell.



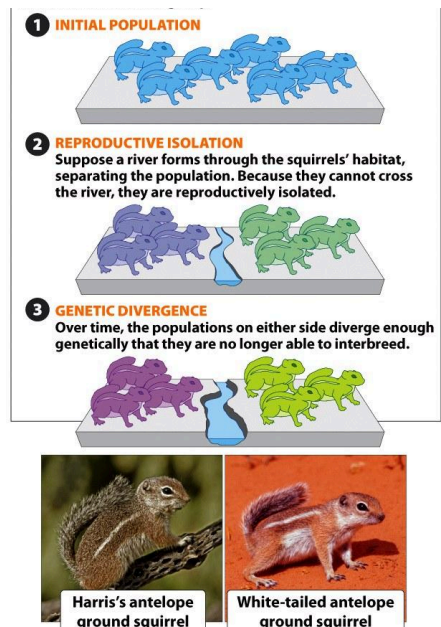
#### POSTZYGOTIC BARRIERS

- Matings produce hybrid individuals that do not survive long after fertilization.
- OR
- If hybrid offspring survive, they are infertile or have reduced fertility.

**Check for Understanding:** Two different salamanders were found in different locations. After spending some time together, it was found that they can produce fertile offspring with one another. Are they the same species?

#### Isolation Mechanisms:

- There are a few different ways that \_\_\_\_\_ barriers could cause reproductive isolation. These are referred to as isolating mechanisms.
  - Isolating Mechanisms: features of \_\_\_\_\_, morphology, or \_\_\_\_\_ that prevent \_\_\_\_\_ or breeding between two different species.
    - Temporal Isolation: individuals are \_\_\_\_\_ at different \_\_\_\_\_ of the day, \_\_\_\_\_, or mating periods.
    - Geographical Isolation: individuals only mate in their specific \_\_\_\_\_.

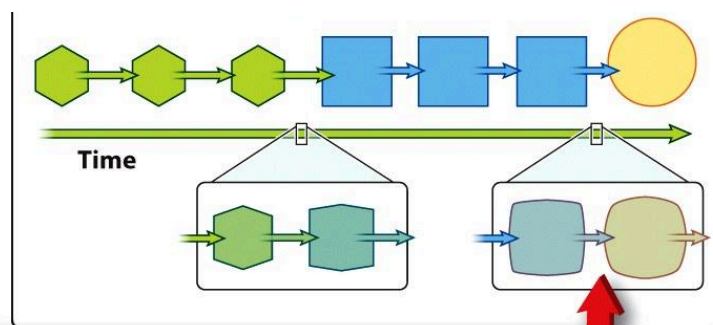
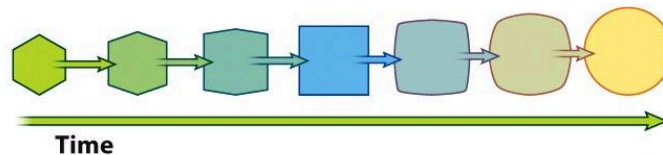


- **Behavioral Isolation:** when there are no sexual \_\_\_\_\_ between representatives of the species.
- **Mechanical Isolation:** when there is no \_\_\_\_\_ during attempted mating.
- **Gametic Incompatibility:** when there is sperm transfer without \_\_\_\_\_ occurring.

**Check for Understanding:** The eastern spotted skunk mates in late winter and the western spotted skunk mates in late summer. Even though their geographic ranges overlap, the species do not mate with each other. What type of isolation is occurring in this situation?

### How Species Evolve:

- Organisms change over time based on the different \_\_\_\_\_ they may face. There are two proposed explanations for how this change may move forward:
  - **Gradualism:** a proposed explanation that states that new species arise from the result of \_\_\_\_\_ over many generations.
- **Punctuated Equilibrium:** a proposed explanation that states that species are generally \_\_\_\_\_ over long periods of times. Occasionally there are \_\_\_\_\_ that affect some species which can quickly result in a new species.



Even though this period of rapid evolutionary change may only cover 1% of the species' evolutionary history, it still may cover hundreds or thousands of generations. This could take tens of thousands of years in a primate or a matter of months in bacteria.

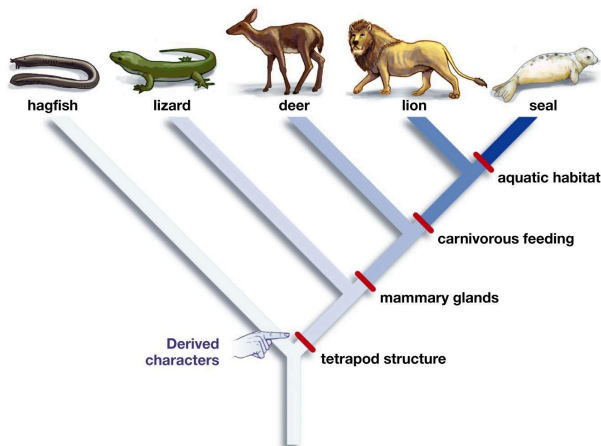
- **Adaptive Radiation:** the \_\_\_\_\_ of a small number of species into a much larger number of species.

- Adaptive radiation can be caused by:

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

### Phylogenetic Trees:

- **Phylogenetic Tree:** a \_\_\_\_\_ diagram that shows the inferred evolutionary \_\_\_\_\_ among various species based upon \_\_\_\_\_ and differences in their physical or genetic characteristics.
- Also called an \_\_\_\_\_.
- Phylogenetic trees can also be used to show when certain traits, called \_\_\_\_\_, first appeared.



- Phylogenetic trees use many lines of \_\_\_\_\_ to show how closely two species may be related to one another.
- Phylogenetic trees can also show the evolutionary relationship between \_\_\_\_\_.

