SPECIATION

How Populations Evolve

What is a Species?

- A **species** is a group of organisms that are closely related and can mate to produce viable, fertile offspring.
- Scientists group organisms according to their similarities (anatomical and DNA).
- The most similar organisms belong to a species.
  - Ex: Humans belong to the species *Homo sapiens*.

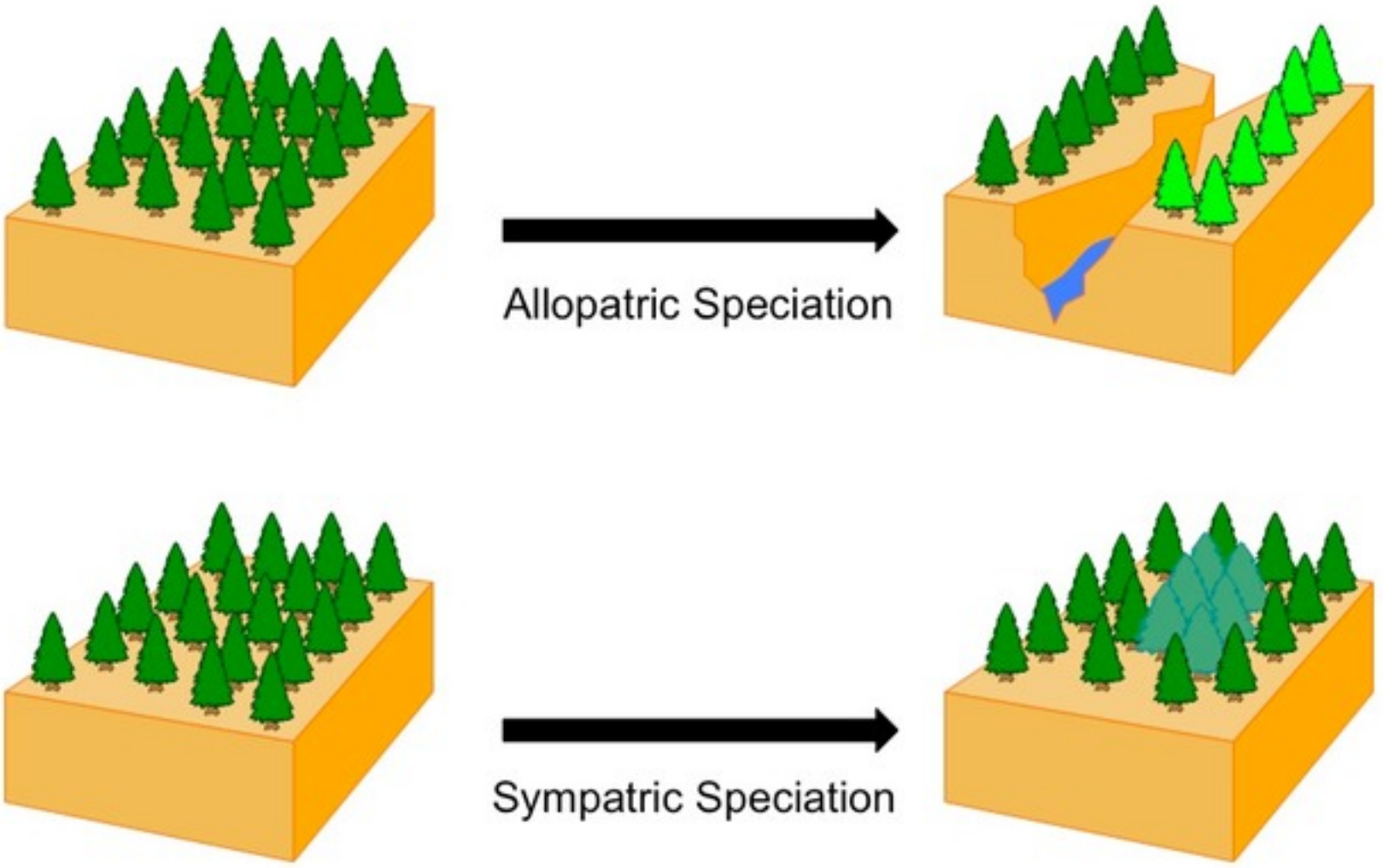
How Do New Species Evolve?

- **Speciation** is an evolutionary event that produces two or more separate species.

- Since being a member of one species is defined by the ability to successfully reproduce, speciation (the formation of a different species) must involve an inability to successfully reproduce (**sympatric speciation**) or the separation of one species geographically (**allopatric speciation**).

Two main modes of speciation:

Allopatric Speciation *"other" "homeland"*	Sympatric Speciation *"together" "homeland"*
Geographically isolated populations.	Populations within the same geographic area.
Gene flow between populations blocked by geographic isolation.	Gene flow between populations blocked by reproductive isolation.
Become genetically different based upon natural selection imposed in different environments.	No longer possible for individuals of species to produce viable, fertile offspring.


Allopatric Speciation
Sympatric Speciation

Sympatric Speciation

- A new species may form when one population of a species becomes **reproductively isolated** from another population of the same species.
  - **Reproductive isolation** is the result of barriers to successful breeding between population groups in the same area.
- Over time, evolutionary mechanisms occur that alter the gene pool of the isolated population so that it is no longer *reproductively compatible* with the original population.

Reproductive Isolation

- How does reproductive isolation occur?
  - **Prezygotic** (premating) mechanisms, such as:
    - **Temporal isolation**: Species reproduce in different seasons or at different times of the day.
    - **Behavioral isolation**: Species differ in their mating rituals (e.g. differing bird songs, mating colors, dances, pheromones).
    - **Mechanical isolation:** Body structure prevents mating.

Temporal Isolation

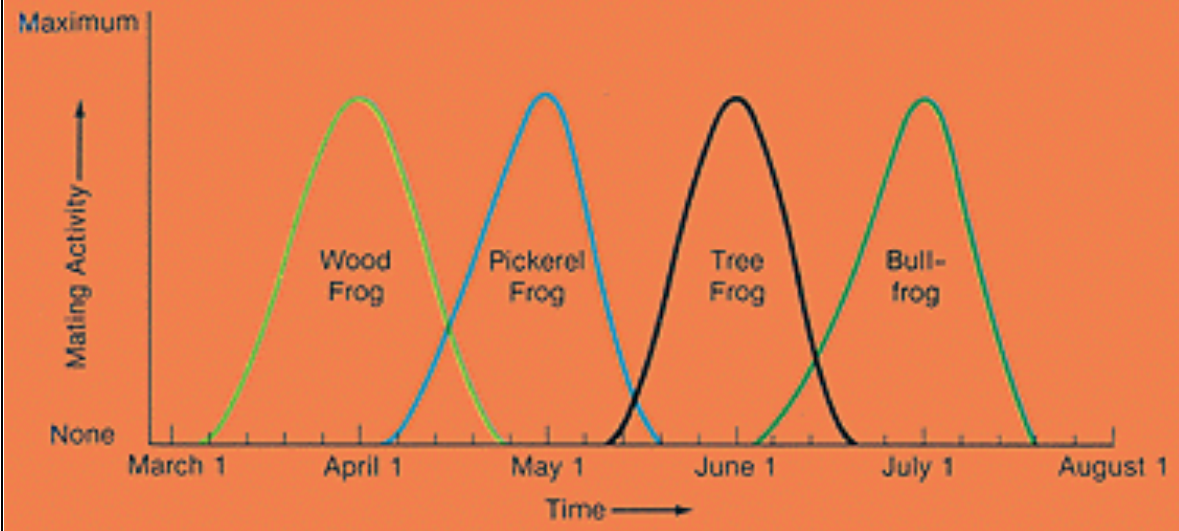


Figure 43-3 TEMPORAL ISOLATION IN BREEDING OF AMPHIBIANS.
Four kinds of frogs are seen to have maximal reproductive behavior at different times; this helps to ensure that interbreeding is reduced or absent.

Behavioral Isolation

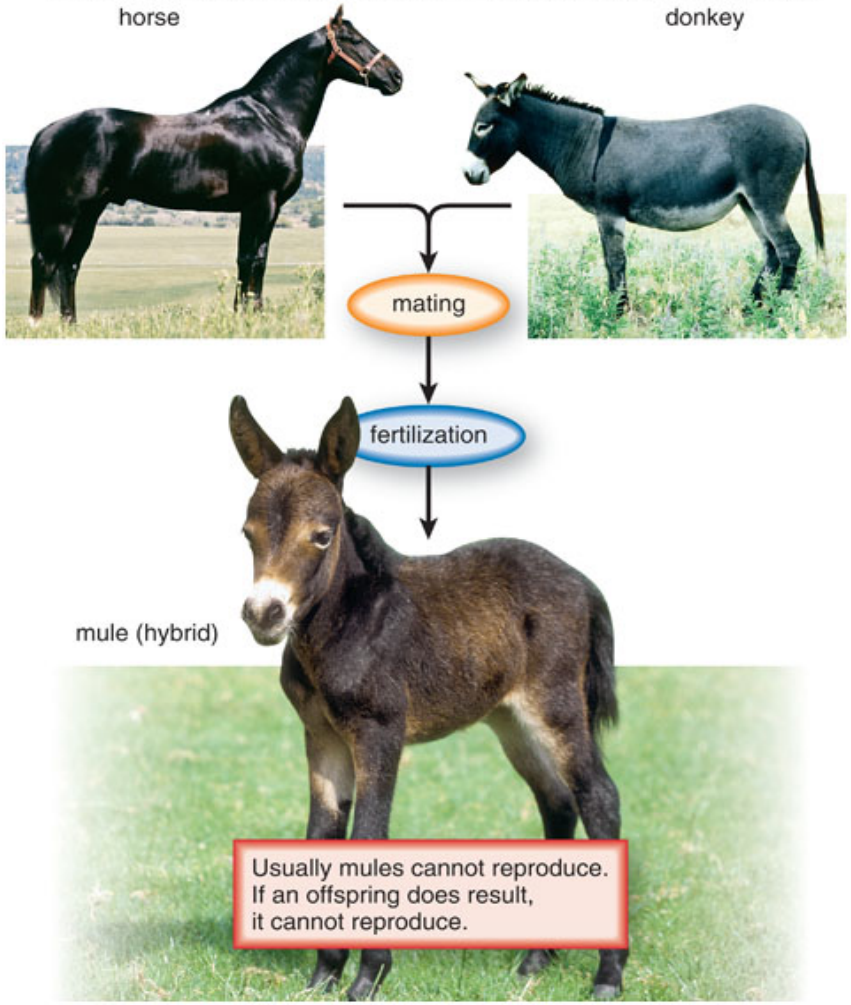
(a) Courting dance

(b) Pointing display

Reproductive Isolation

- **Postzygotic** (post mating) mechanisms, such as:
  - **Hybrid inviability:** offspring cannot survive
  - **Hybrid sterility**: offspring are infertile

Hybrid Sterility



Allopatric Speciation

- A new species may form when one population of a species becomes **geographically isolated** from another population of the same species.
  - **Geographic isolation** is the physical separation of members of a population
- Over time, habitats may become divided causing gene flow to stop, and genetic drift allows the populations to diverge and become incompatible for mating.

Geographic Isolation

Squirrels on opposite sides of Grand Canyon

Key Points:

- A species is a group of organisms that can produce viable, fertile offspring.
- Speciation occurs when new species form.
  - Can occur in two ways:
    - **Sympatric** – reproductive isolation
    - **Allopatric** – geographic isolation