

Aim: What is speciation?



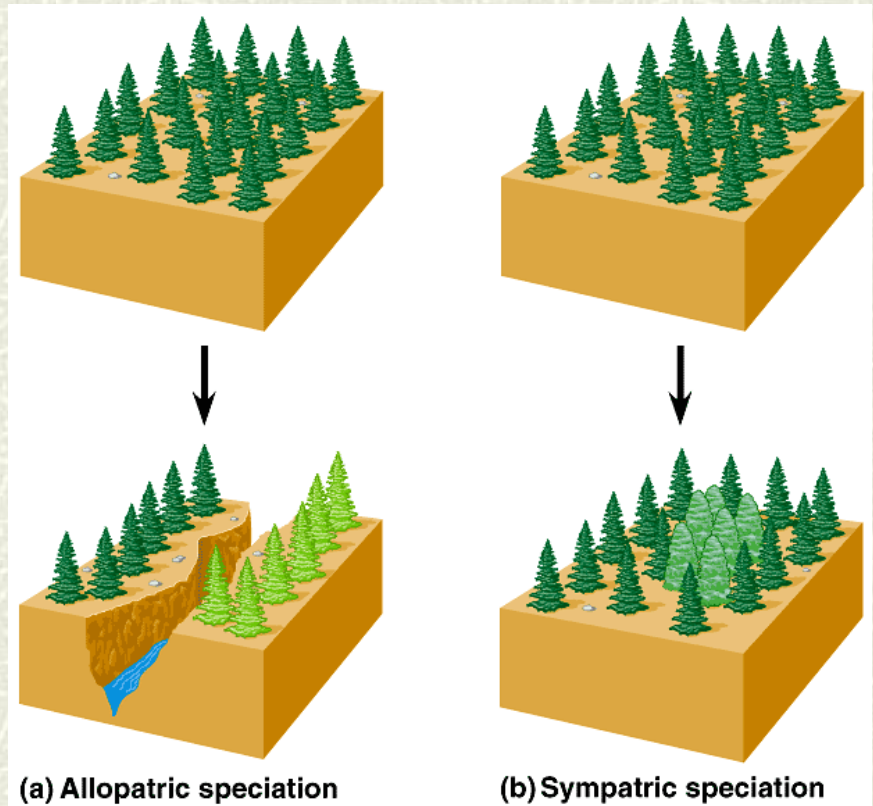
Allopatric Speciation

- Population is divided by a geographic barrier so that interbreeding between two groups is prevented.
- Gene frequencies diverge
- Barriers may be physical (mountains) or resource barriers (dry land due to drought)
- Once groups have changed significantly, effective reproduction ceases.



Sympatric speciation

- # Formation of new species without a geographic barrier
- # A) balanced polymorphism (green grasshoppers vs brown grasshoppers)



Sympatric speciation



- Polyploidy – more than two sets of chromosomes due to nondisjunction of a set of chromosomes during meiosis.

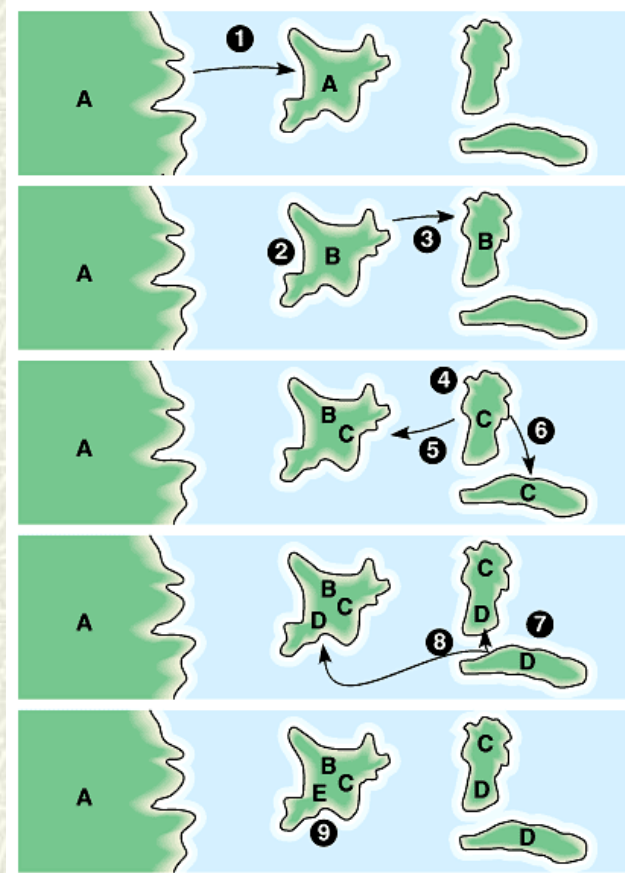
- In the early 1900s, botanist Hugo de Vries produced a new primrose species, the tetraploid *Oenothera gigas*, from the diploid *Oenothera lamarckiana*.



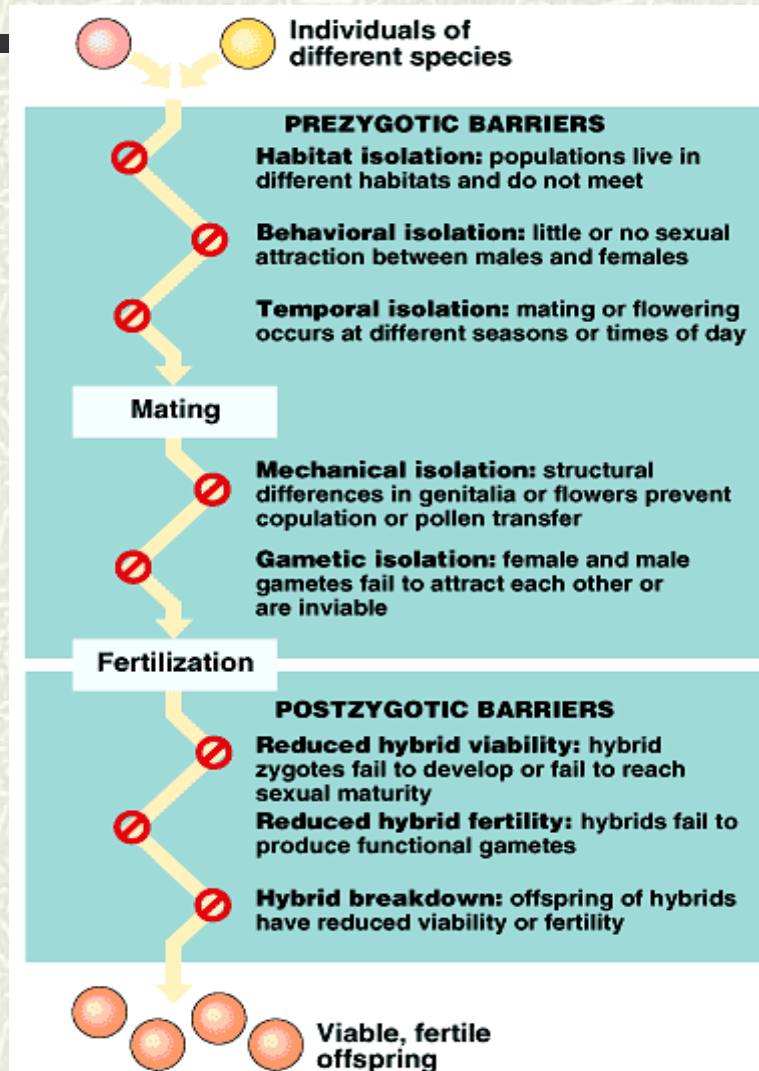
- This plant could not interbreed with the diploid species

Sympatric speciation

- ✦ Adaptive radiation – relatively rapid evolution of many species from a single ancestor.
- ✦ Galapagos Finches
- ✦ Variants of each ancestral species diverge as the populations specialize.

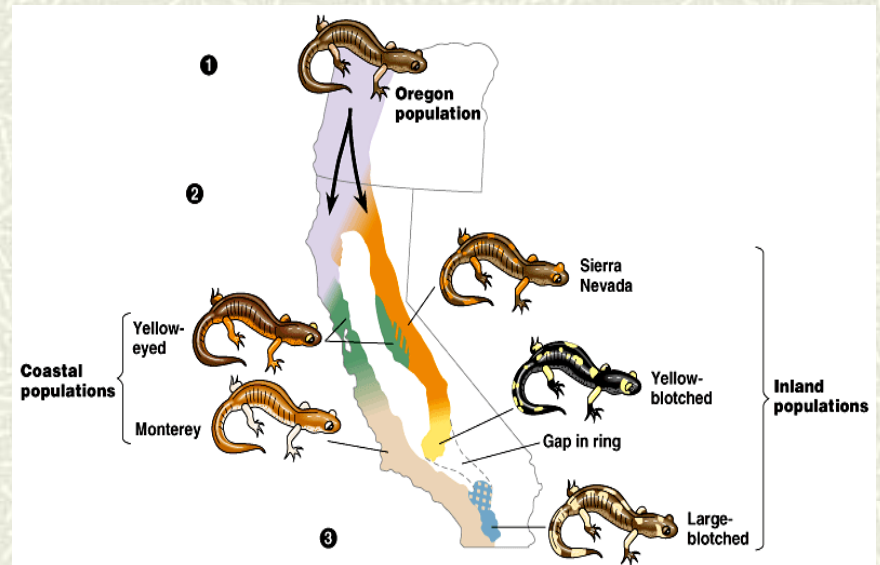


Reproductive isolation: an overview



Reproductive isolation leads to speciation

- ⌘ Prezygotic (before fertilization) isolation mechanisms prevent fertilization
- ⌘ A) habitat isolation – closely-related species do not encounter one another
- ⌘ B) seasonal isolation – closely-related species do not mate at the same time of day or year.



Prezygotic Isolation (continued)



- ⌘ C) behavioral isolation – closely-related species do not mate because they are not recognized as a mating partner.
- ⌘ D) mechanical isolation – have incompatible genitalia
- ⌘ E) gametic isolation – sperm cannot survive in the female environment.

Postzygotic Isolation

- # Postzygotic (after fertilization) isolation:
 - # 1) hybrid inviability: fertilization of an egg by the sperm of an unrelated species occurs but the embryo fails to develop.
 - # 2) hybrid sterility: fertilization occurs and the hybrid organism is created but is reproductively sterile (mules).
 - # 3) hybrid breakdown: offspring of 2 unrelated species have reduced viability or fertility.
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Patterns of Evolution

- # **1) Divergent Evolution** – 2 or more species originate from a common ancestor (allopatric speciation or adaptive radiation) These species are *homologous*.
 - # **2) Convergent Evolution** – 2 unrelated species share similar traits. No common ancestor. (sharks vs whales) These species are *analogous*.
 - # **3) Parallel Evolution** – 2 related species have similar evolutionary changes after their divergence from a common ancestor (chimps and gorillas)
 - # **4) Coevolution** – evolution of 2 ecologically dependent populations (predator/prey; flower/pollinators)
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Macroevolution

- # Macroevolution describes patterns of evolution for groups of species over extended periods of geologic time.
 - # 1) Gradualism (phyletic gradualism) – gradual accumulation of small changes continuously over time (Darwin’s concept)
 - # Fossil record shows glimpses of this and is considered by some rather incomplete.
 - # 2) Punctuated equilibrium – long periods of stasis followed by brief but extremely rapid and active evolution.
 - # Equilibrists argue that the fossil record shows only stasis and little of the rapid evolution in the periods that punctuate stasis.
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