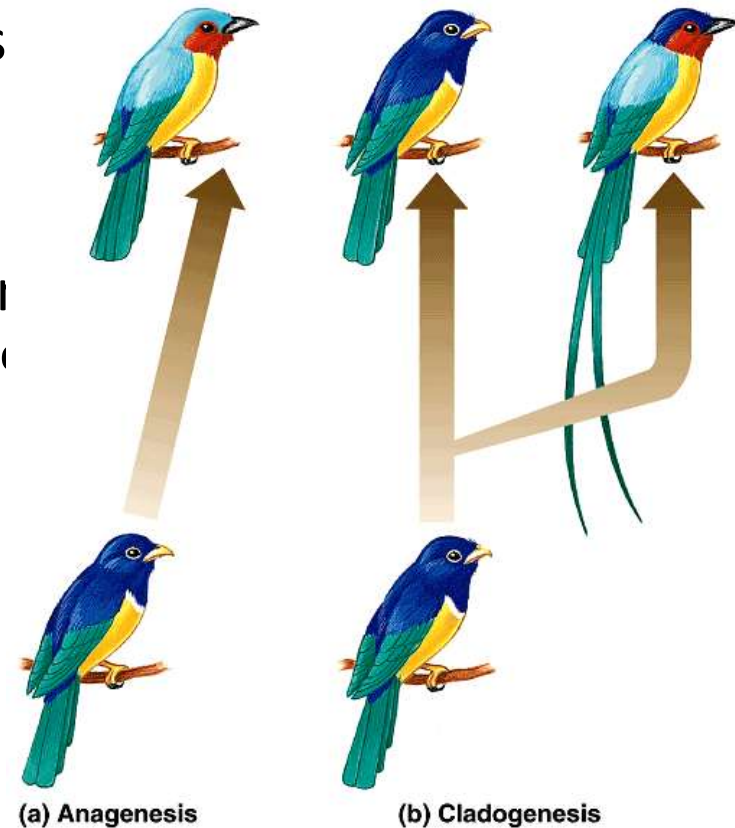




*The
Origin of
Species*

Macroevolution: *the origin of new taxonomic groups*

- Speciation: the origin of new species
- 1- *Anagenesis* (phyletic evolution): accumulation of heritable changes
- 2- *Cladogenesis* (branching evolution): budding of new species from a parent species that continues to exist (basis of biological diversity)



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What is a species?

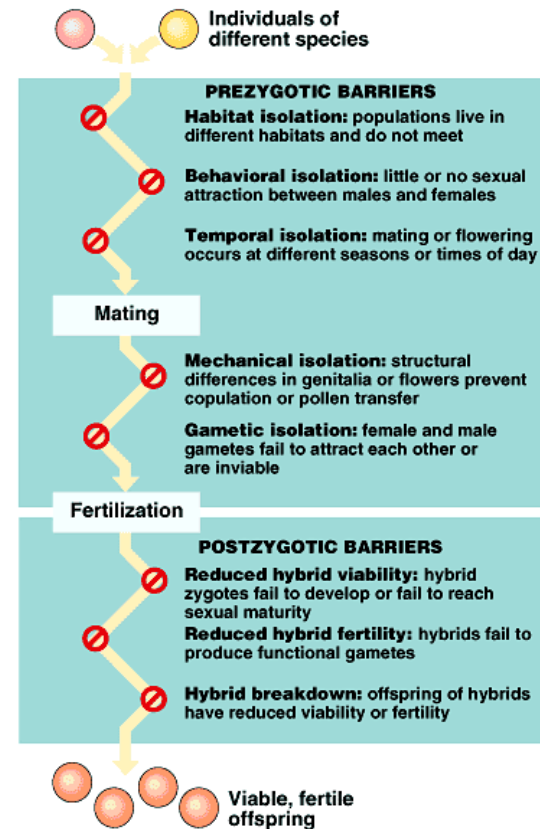
- *Biological species concept*

(Mayr): a population or group of populations whose members have the potential to interbreed and produce viable, fertile offspring (genetic exchange is possible and that is genetically isolated from other populations)



Reproductive Isolation (isolation of gene pools), I

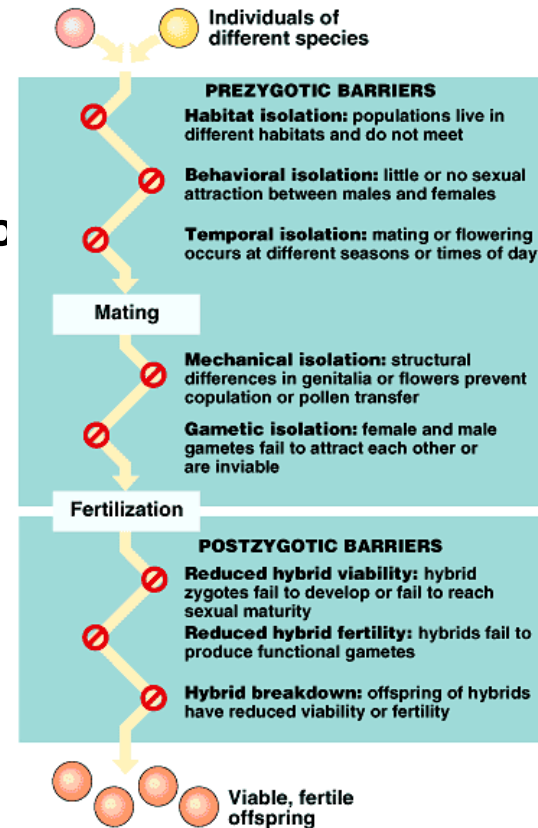
- Prezygotic barriers: *impede mating between species or hinder the fertilization of the ova*
- **Habitat (snakes; water/terrestrial)**
- **Behavioral (fireflies; mate signaling)**
- **Temporal (salmon; seasonal mating)**
- **Mechanical (flowers; pollination anatomy)**
- **Gametic (frogs; egg coat receptors)**



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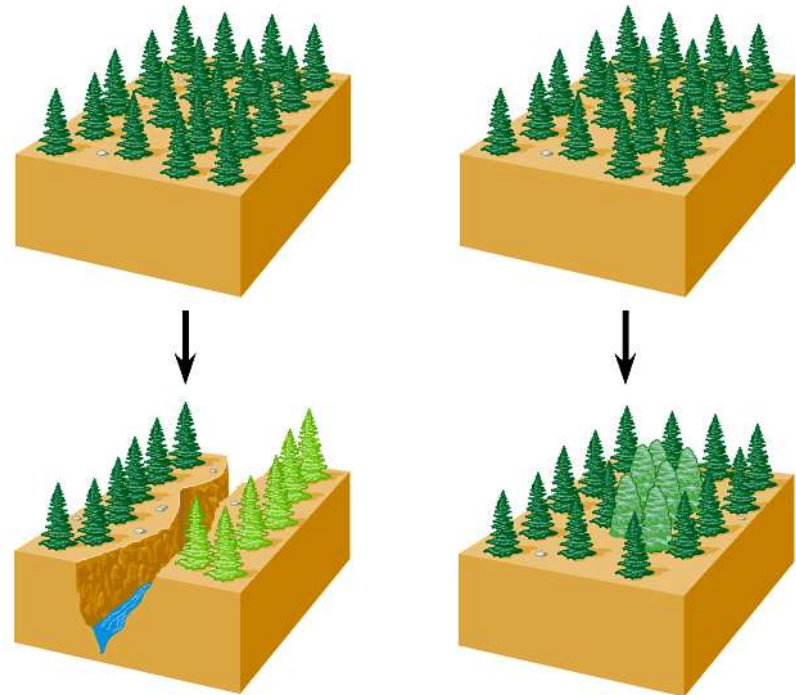
Reproductive Isolation, II

- Postzygotic barriers: fertilization occurs, but the hybrid zygote does not develop into a viable, fertile adult
- **Reduced hybrid viability** (frogs; zygotes fail to develop or reach sexual maturity)
- **Reduced hybrid fertility** (mule; horse x donkey; cannot backbreed)
- **Hybrid breakdown** (cotton; 2nd generation hybrids are sterile)



Modes of speciation (based on how gene flow is interrupted)

- **Allopatric:** populations segregated by a geographical barrier; can result in adaptive radiation (island species)
- **Sympatric:** reproductively isolated subpopulation in the midst of its parent population (change in genome); polyploidy in plants; cichlid fishes



(a) Allopatric speciation

(b) Sympatric speciation

Punctuated equilibria

- **Tempo of speciation:**
gradual vs. divergence in rapid bursts; Niles Eldredge and Stephen Jay Gould (1972); helped explain the non-gradual appearance of species in the fossil record

