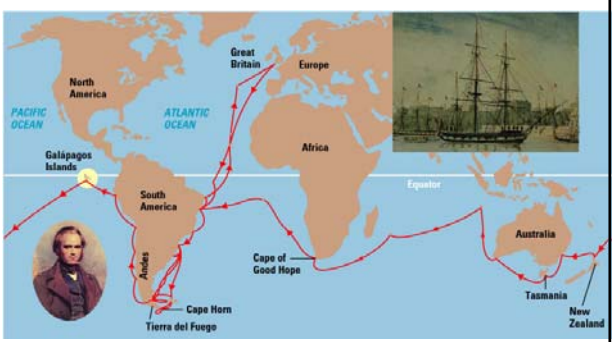
Evolution & Natural Selection

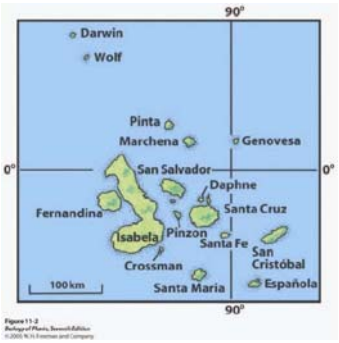
Lamarck & Fossils

Voyage of the *Beagle*



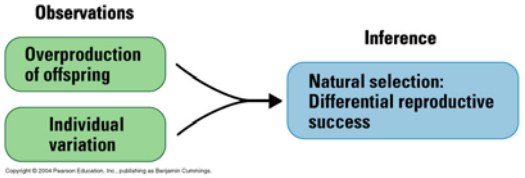
27 Dec. 1831 – 2 Oct. 1836

Galápagos Islands



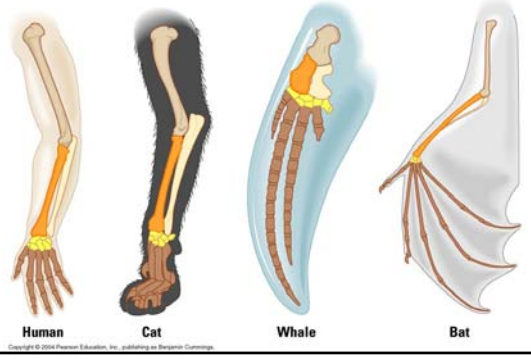
Darwin's Finches

Darwin's Observations



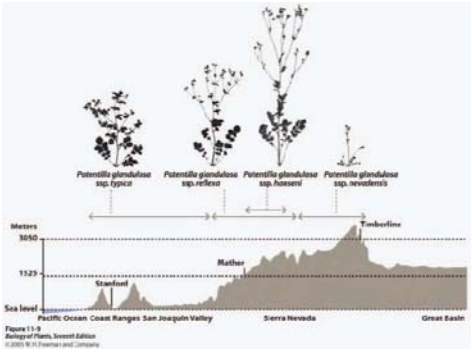
Artificial Selection

Homology

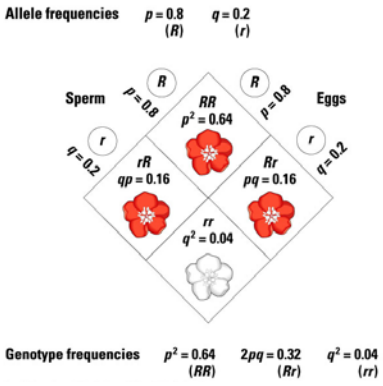


Convergent Evolution

Variation Along a Cline



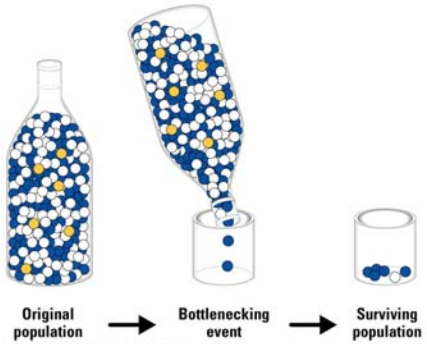
Hardy-Weinberg Equilibrium



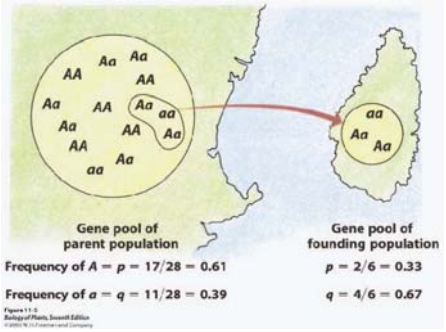
Hardy-Weinberg Assumptions

- Large population size
- Closed system (isolation)
- No mutations
- Panmixis (random mating)
- No natural selection

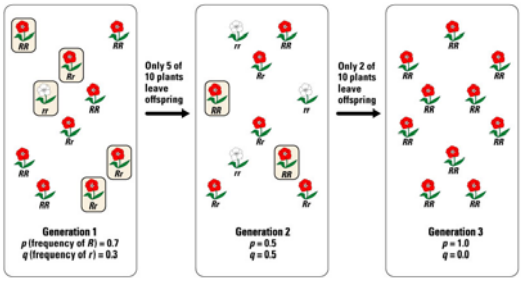
Genetic Bottleneck



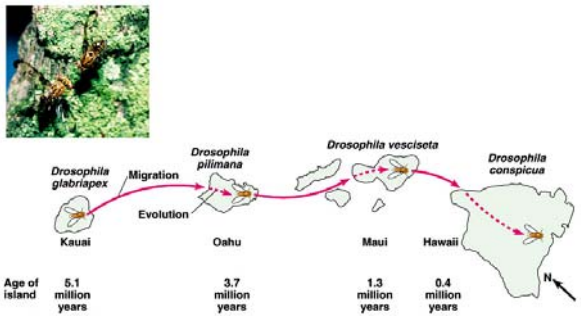
Founder Effect



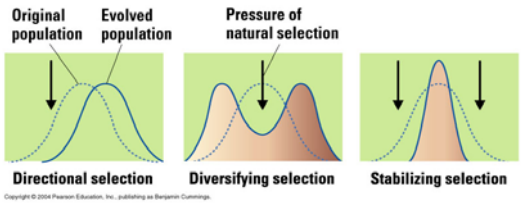
Genetic Drift



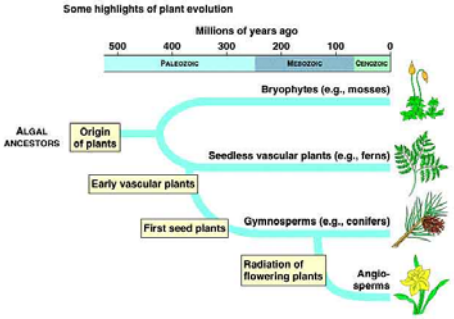
Migration



Types of Selection



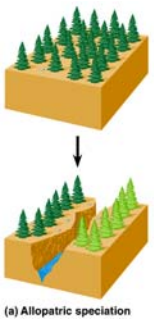
Time Scale for Land Plant Evolution



Speciation

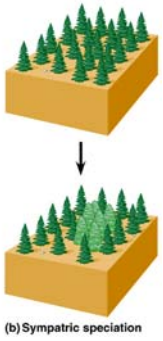
The creation or destruction (extinction, introgression) of species

Allopatric Speciation



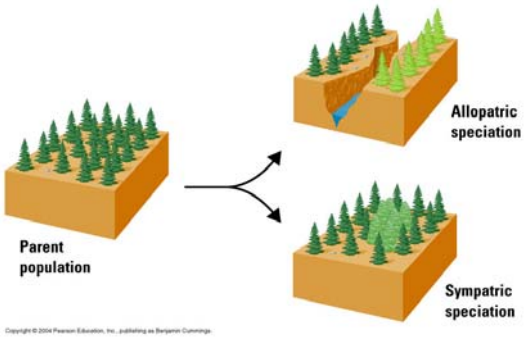
(a) Allopatric speciation

Sympatric Speciaton

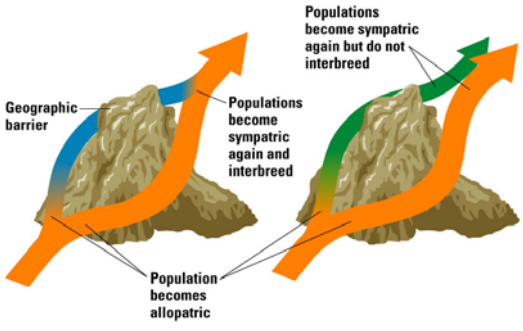


(b) Sympatric speciation

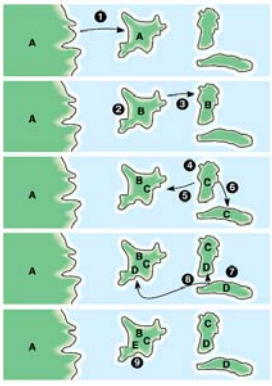
So there are options



Complications

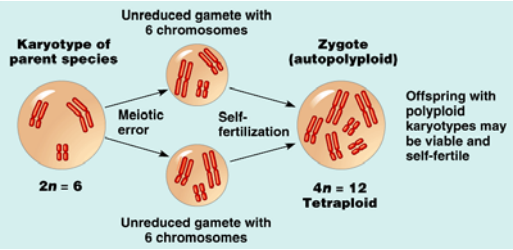


Adaptive Radiation



Autopolyploidy

Polyploid speciation from one parental species only

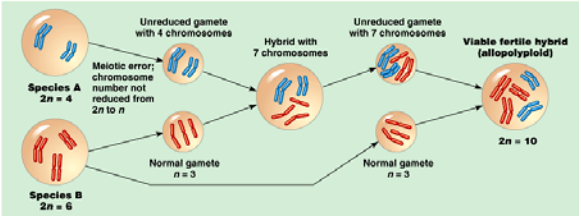


Autopolyploidy

Oenothera lamarckiana *Oenothera gigas*

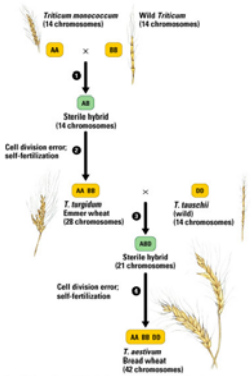
- **Early 1900s – produced tetraploid species**

Allopolyploidy



Polyploid speciation from multiple parental species

A Horticultural Example



A Real Life Speciation Event

- *Tragopogon* spp. introduced ~ 1900
- Hybrids first observed 1949
  - Eastern Washington State
- Production of *T. miscellus* & *T. mirus*
- Both are morphologically distinct & reproductively isolated from parent species
- Hybridization has occurred multiple times

T. miscellus 4n

T. mirus 4n

Modes of Evolution