

# The Evolution of Populations

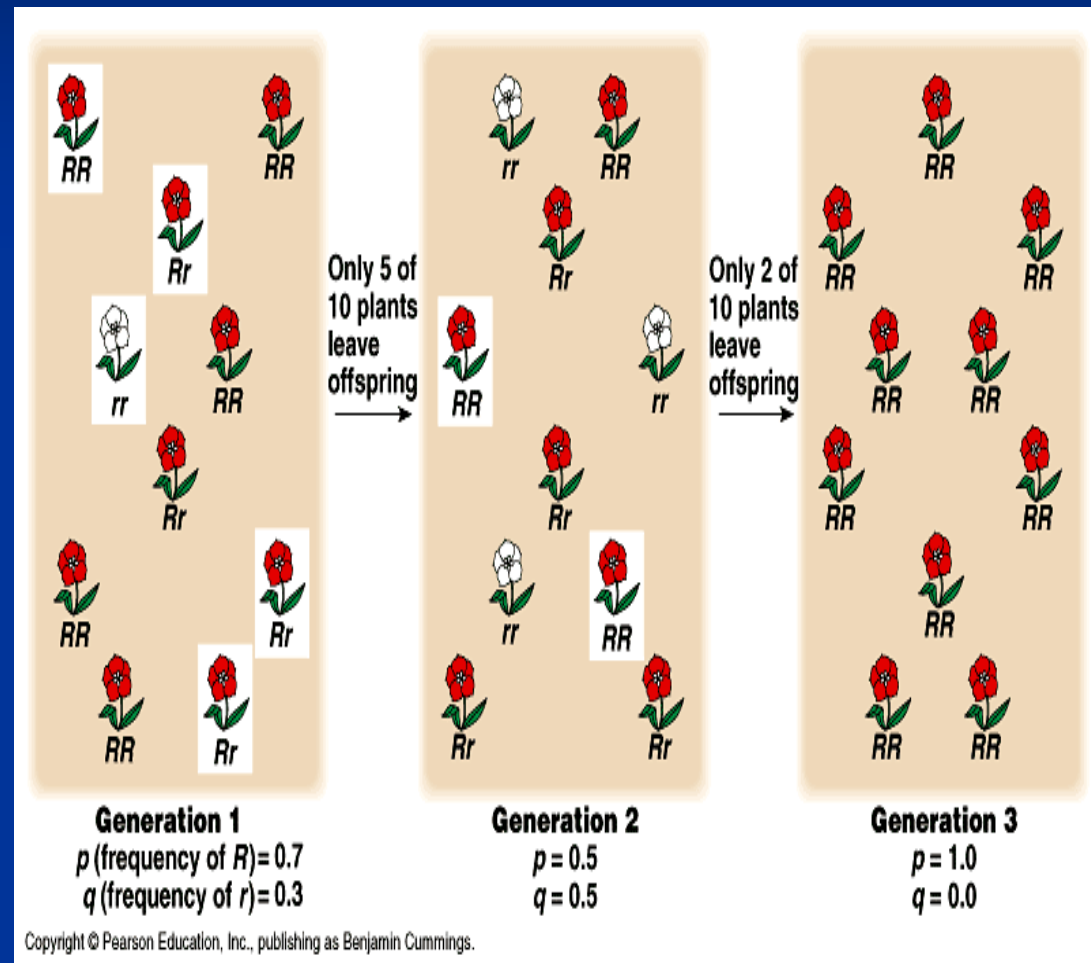


# Population genetics

- Population: a localized group of individuals belonging to the same species
- Species: a group of populations whose individuals have the potential to interbreed and produce fertile offspring
- Gene pool: the total aggregate of genes in a population at any one time
- Population genetics: the study of genetic changes in populations
- “Individuals are selected, but populations evolve.”

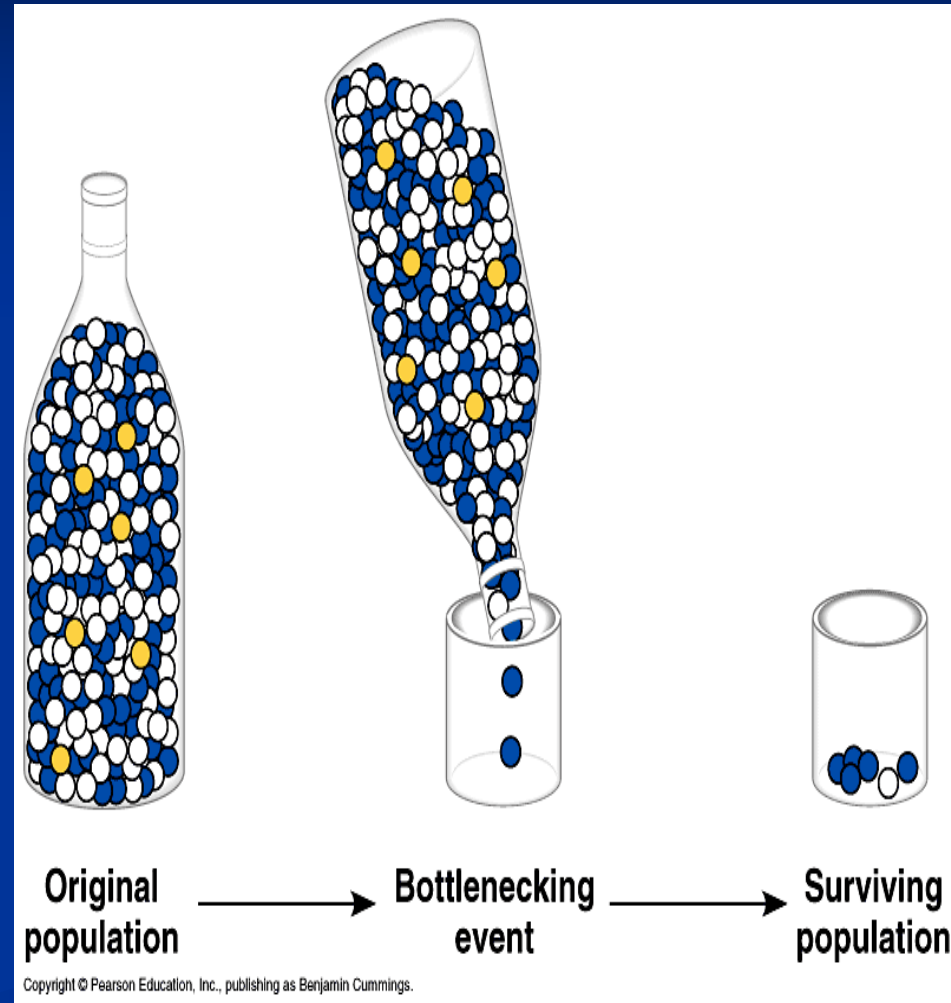
# Microevolution

- A change in the gene pool of a population over a succession of generations
- 1- Genetic drift: changes in the gene pool of a small population due to chance (usually reduces genetic variability)



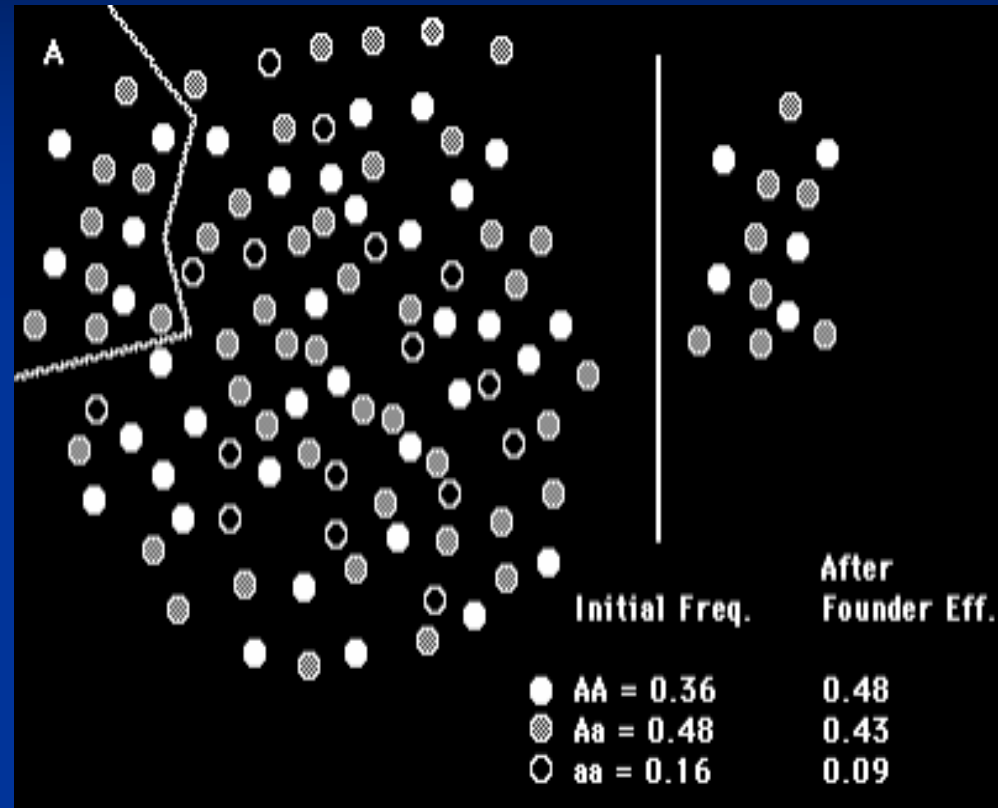
# Microevolution

- The Bottleneck Effect: type of genetic drift resulting from a reduction in population (natural disaster) such that the surviving population is no longer genetically representative of the original population



# Microevolution

- Founder Effect:  
a cause of genetic drift attributable to colonization by a limited number of individuals from a parent population



# Microevolution

- 2- Gene Flow:  
genetic exchange due to the migration of fertile individuals or gametes between populations (reduces differences between populations)



# Microevolution

- 3- Mutations:  
a change in an organism's DNA (gametes; many generations); original source of genetic variation (raw material for natural selection)



# Microevolution

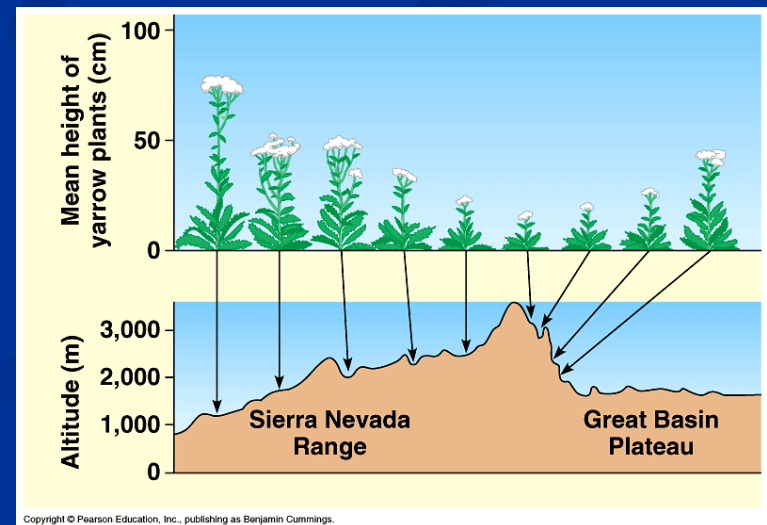
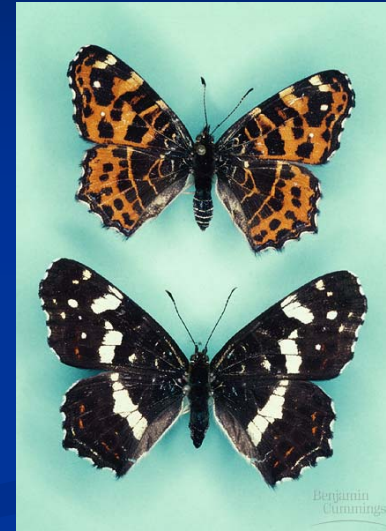
- 4- Nonrandom mating:  
inbreeding and assortive  
mating (both shift  
frequencies of different  
genotypes)

# Microevolution

- 5- Natural Selection:  
differential success in  
reproduction; only  
form of  
microevolution that  
adapts a population  
to its environment

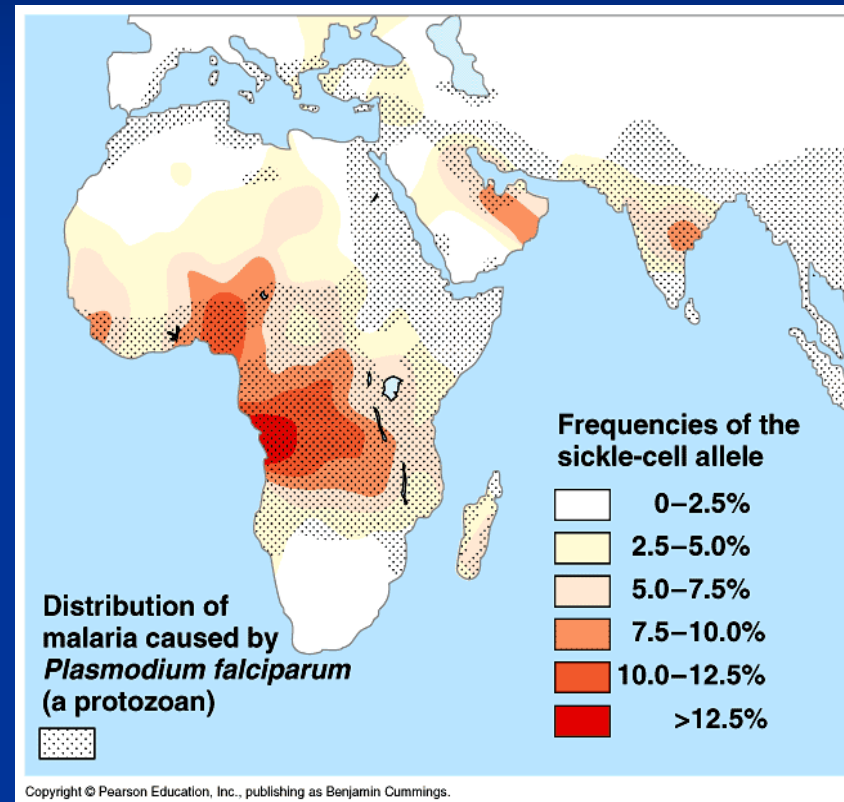
# Population variation

- Polymorphism:  
coexistence of 2 or more  
distinct forms of  
individuals (morphs)  
within the same  
population
- Geographical variation:  
differences in genetic  
structure between  
populations (cline)



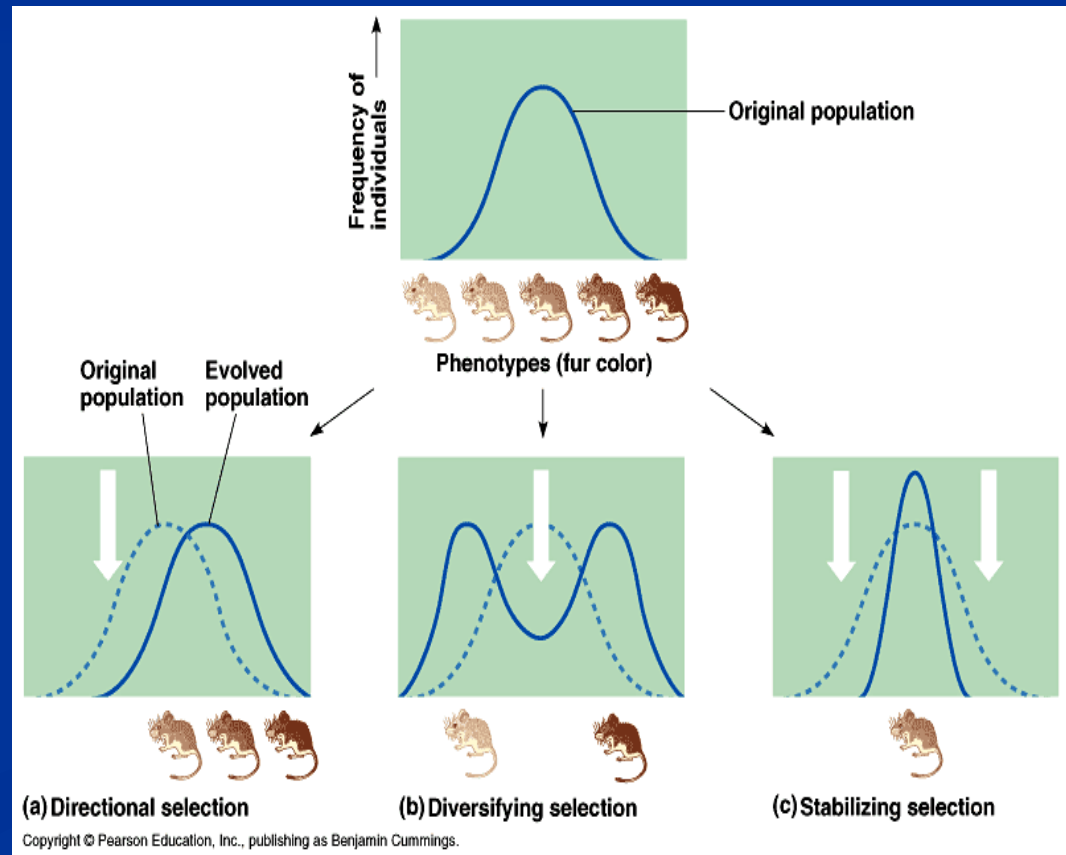
# Variation preservation

- Prevention of natural selection's reduction of variation
- Diploidy  
2nd set of chromosomes hides variation in the heterozygote
- Balanced polymorphism  
1- heterozygote advantage (hybrid vigor; i.e., malaria/sickle-cell anemia);  
2- frequency dependent selection (survival & reproduction of any 1 morph declines if it becomes too common; i.e., parasite/host)



# Natural selection

- Fitness: contribution an individual makes to the gene pool of the next generation
- 3 types:
- A. Directional
- B. Diversifying
- C. Stabilizing



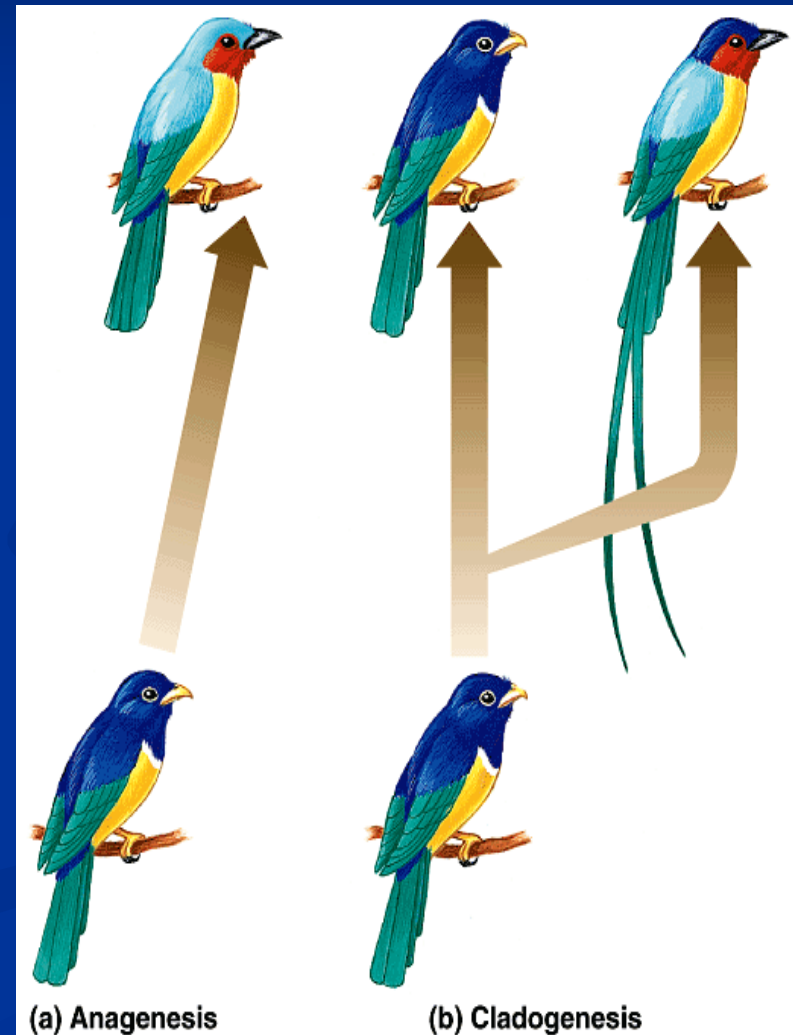
# Sexual selection

- Sexual dimorphism:  
secondary sex  
characteristic distinction
- Sexual selection:  
selection towards  
secondary sex  
characteristics that leads  
to sexual dimorphism



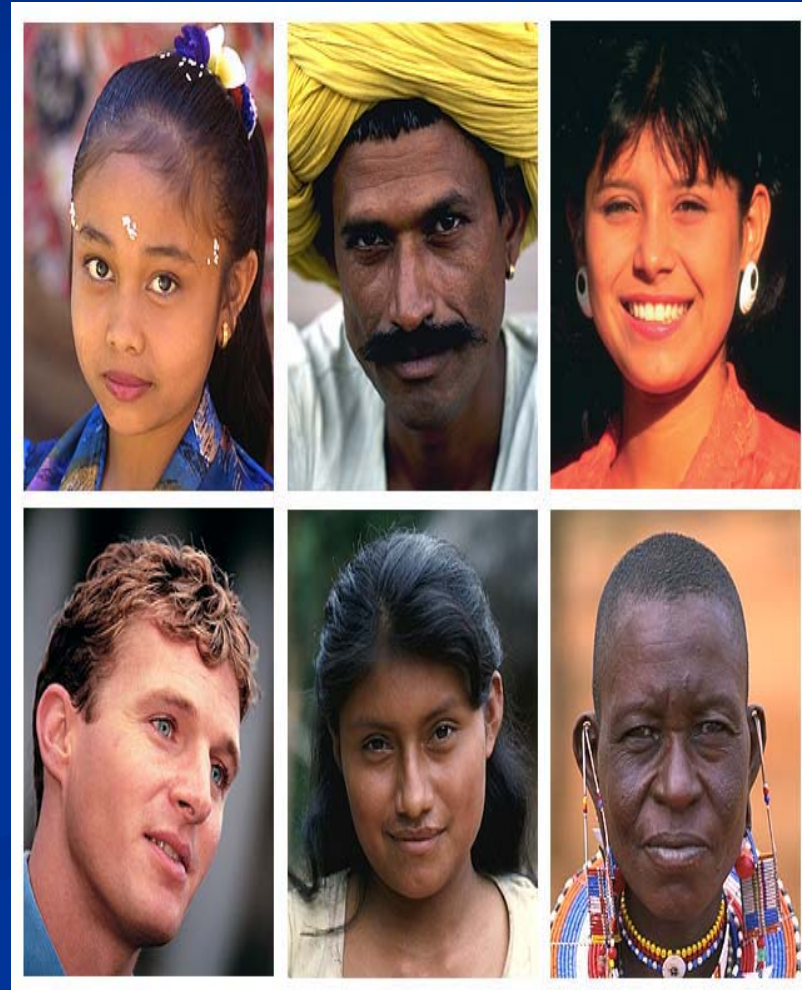
# Macroevolution: *the origin of new taxonomic groups*

- 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)



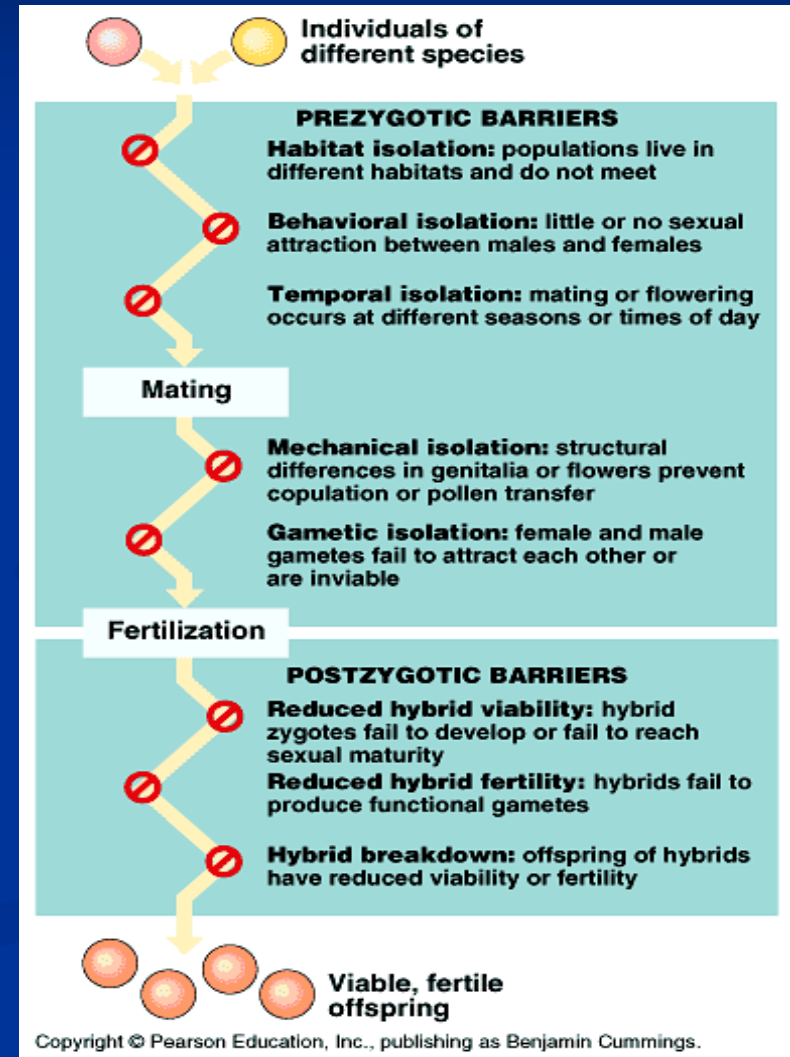
# What is a species?

- 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)



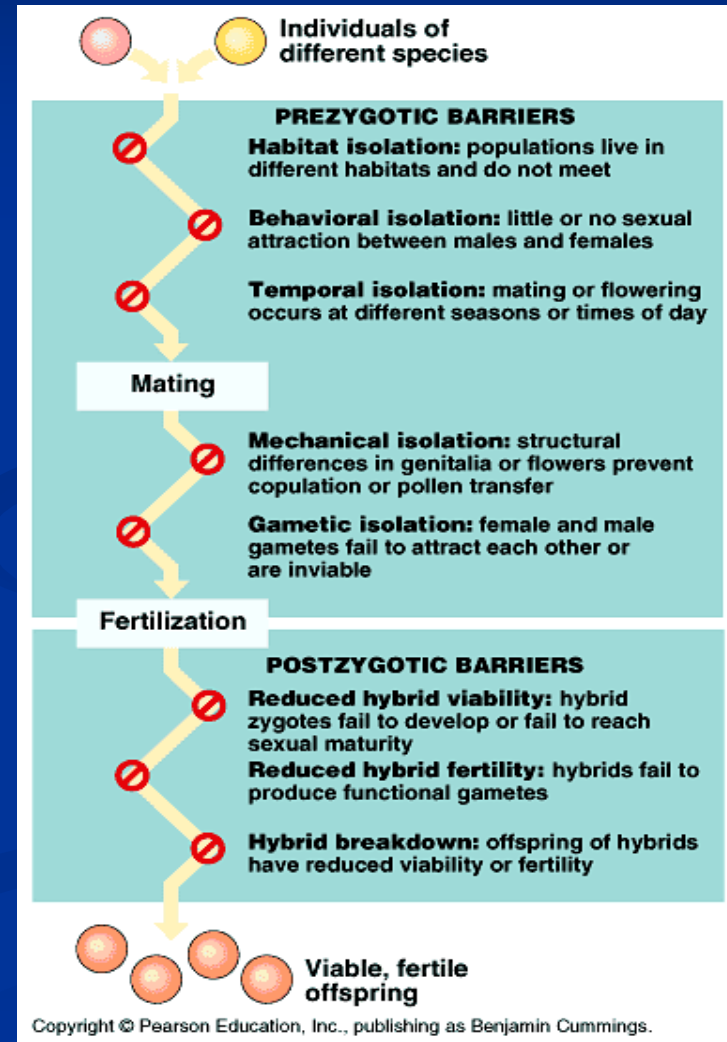
# Reproductive Isolation (isolation of gene pools)

- 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)



# Reproductive Isolation

- 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)



# 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

