

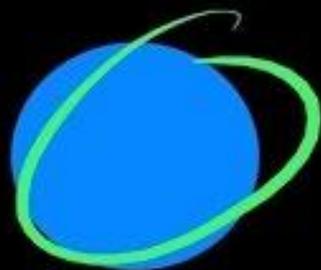
Unit 5 Evolution

Ch. 17 Darwin's Theory of Evolution



NOSWEARING

history of the
entire world,
i guess



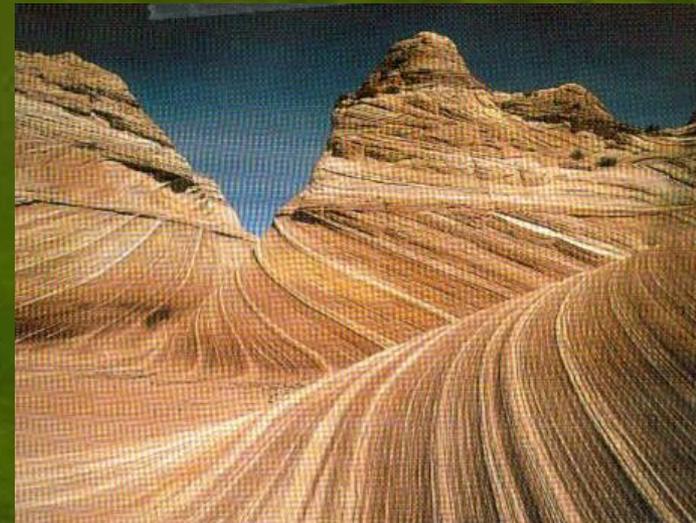
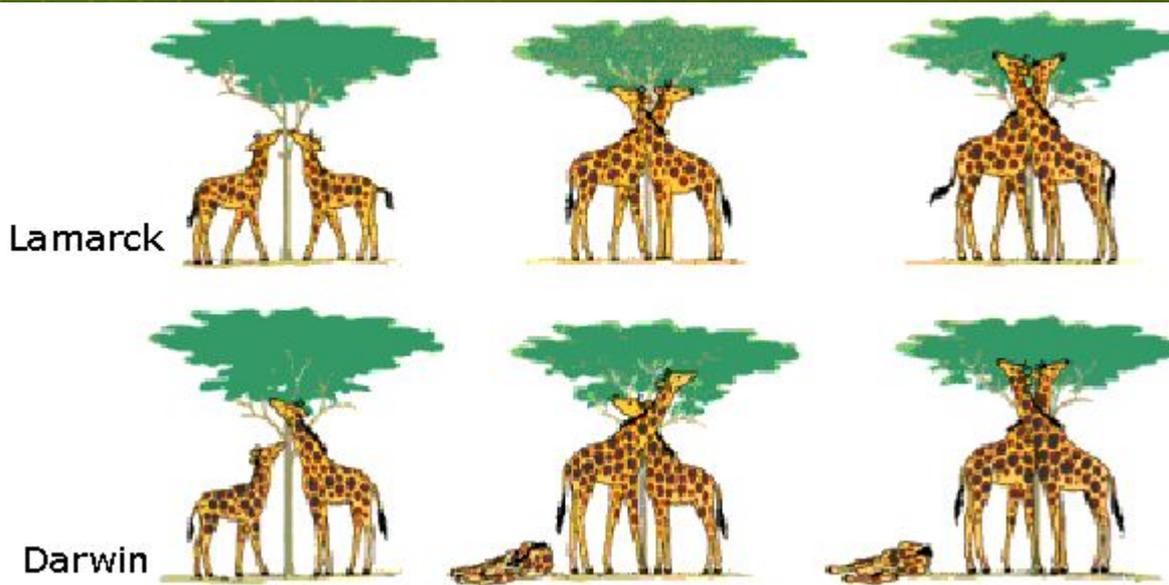
FOR SCHOOLS!

The Puzzle of Life's Diversity

- Evolution - modern organisms have descended from ancient organisms (change over time) through macro evolution, evolving from 1 simple life form to the diversity we see today.
- Theory - a well-supported, testable explanation of phenomena that have occurred in the natural world

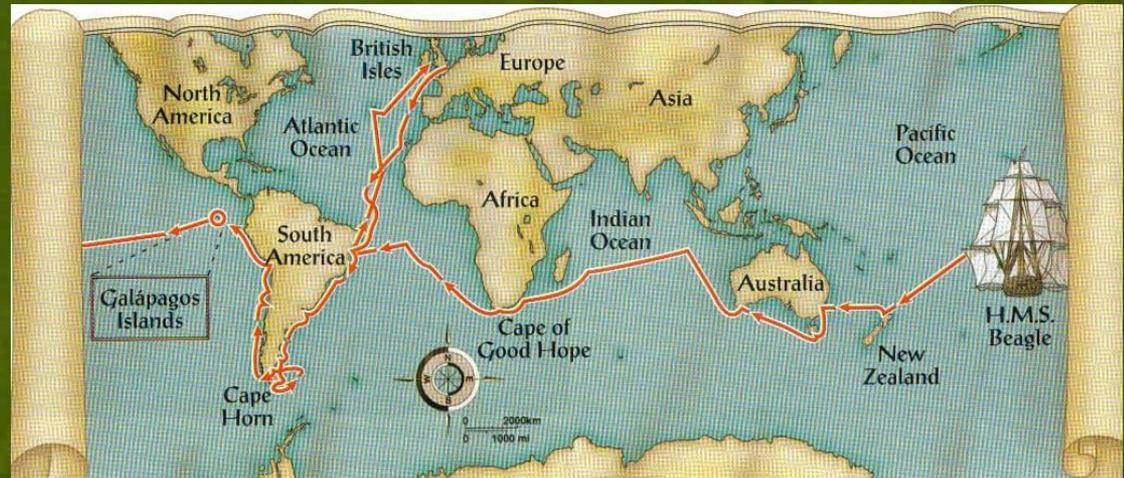
An Ancient, Changing Earth

- **Hutton & Lyell**- geologists who helped to shape evolutionary theory.
- Another key individual at the time of Darwin was Lamarck- He proposed that by selective use or disuse of organs, organisms acquired or lost certain traits during their lifetime
- Over time, this process led to change in a species



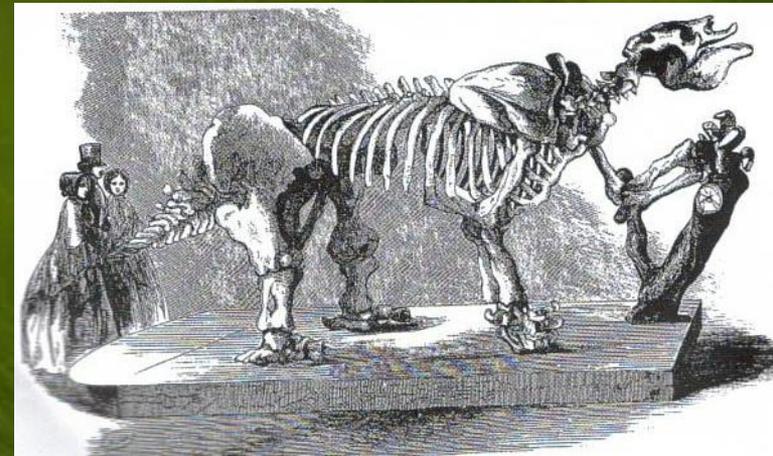
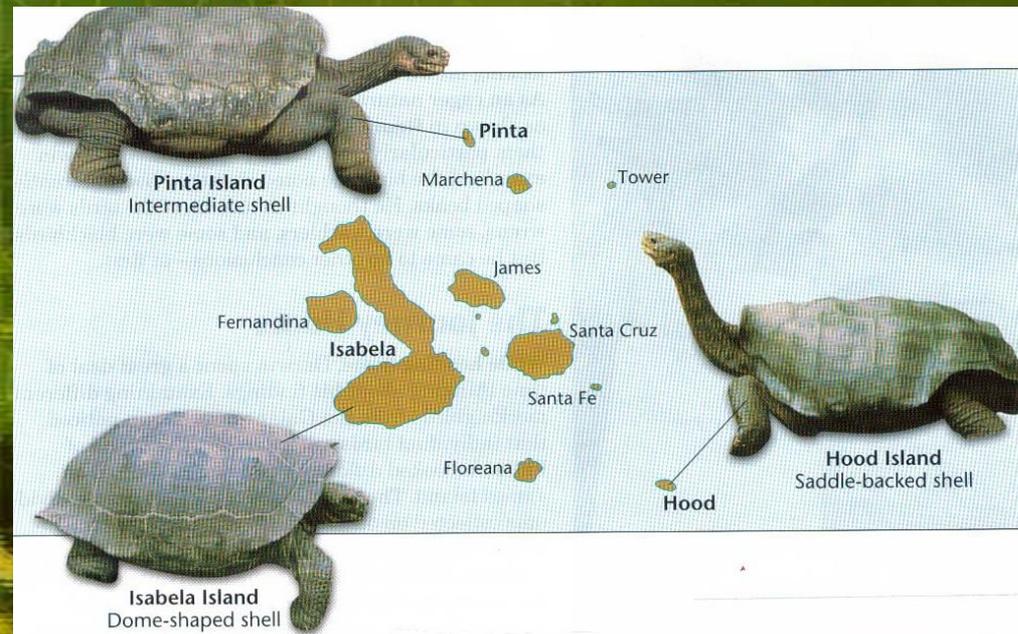
Voyage of the HMS *Beagle*

- 1831
- Charles Darwin is the father of the evolutionary theory- but not the creator.
- He made observations & collected evidence that led him to propose a hypothesis about the way life changes over time.



Darwin's Observations

- Darwin collected the preserved remains of ancient organisms - Fossils
- Traveled around the world- biggest impact was at the Galapagos Islands- where he noticed the similarities and differences of organisms on the different islands.



Darwin Presents His Case

- In 1859, Darwin published the results of his work in a book, “**On the Origin of Species by Means of Natural Selection or the Preservation of Favoured Races in the Struggle for Life.**”
- In his book, he proposed a mechanism for evolution called **natural selection.**
- He stated that evolution has been taking place for millions of years, & continues in all living things



Evolution by Natural Selection

- Fitness - the ability of the organism to survive & reproduce in its specific environ.
 - Fitness is the result of adaptations
- Struggle for existence - the members of each species compete regularly to obtain food, living space, & other necessities of life
 - Predators that are faster & better at catching prey are more likely to survive



Evolution by Natural Selection

- Adaptation - any inherited characteristic that increases an organism's' chance of survival
 - Successful adaptations allow organisms to become better suited to their environ. & thus better able to survive



- Individuals that are better suited to their environ., with adaptations that enable fitness, survive & reproduce most successfully - Survival of the Fittest- or Natural Selection.

Evolution by Natural Selection

- NS results in changes in the inherited characteristics of a population, that increase a species' fitness in its environ.
- Over time, NS produces organisms that have different structures, & occupy different habitats
- As a result organisms today look different from their ancestors



Evidence of Evolution

- Darwin argued that living things have been evolving on Earth for millions of years
- Evidence of this could be found: in the fossil record, the geographical distribution of living species, homologous structures of living organisms, & similarities in early development



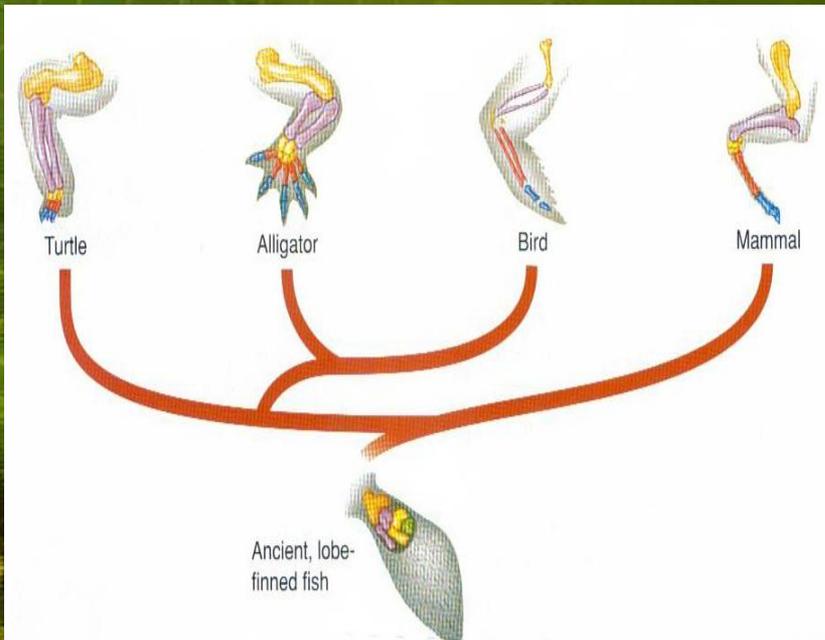
Evidence of Evolution

- Geographic Distribution of Living Species:
 - Darwin realized that similar animals in different locations were the product of different lines of evolutionary descent
- The Fossil Record:
 - Darwin noticed that the sizes, shapes, & varieties of related organisms preserved in the fossil record, changed over time



Evidence of Evolution

- Homologous Body Structures:
 - Homologous structures - structures that have different mature forms but develop from the same embryonic tissues
 - Not all homologous structures serve important functions
 - Organs of many animals are so reduced in size that they are just vestiges, or traces, of homologous organs



Evidence of Evolution

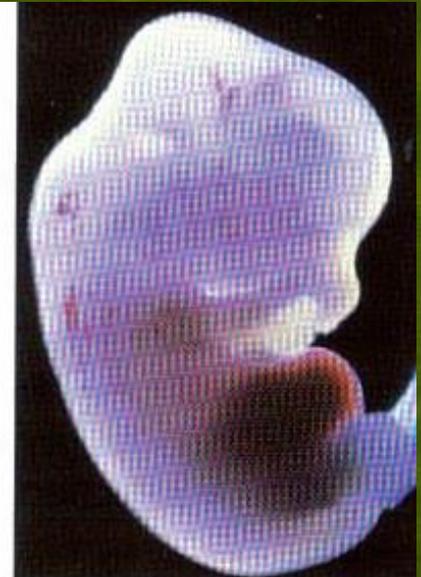
- Similarities in Early Development:
 - The early stages or embryos, of many animals with backbones are very similar



Chicken



Turtle



Rat

Ch. 18 Evolution of Populations

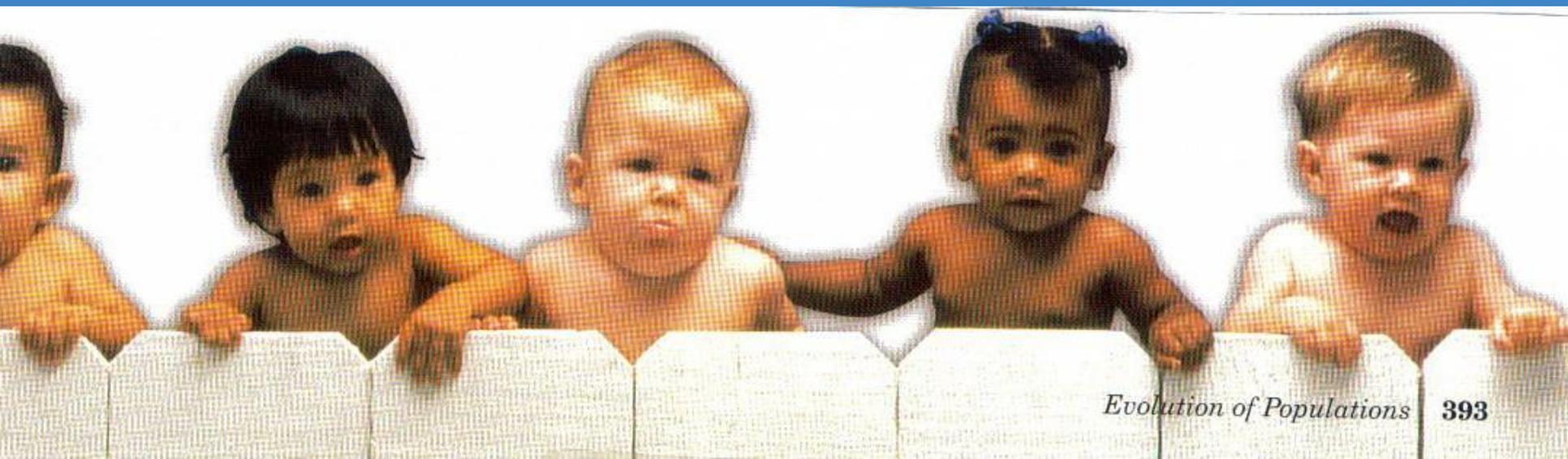


Variations and Gene Pools

- **Gene pool** – consists of all genes, including all the different alleles, that are present in a population.
- **Relative frequency** – the number of times that the allele occurs in a gene pool, compared with the number of times other alleles for the same gene occur.

Sources of Genetic Variation

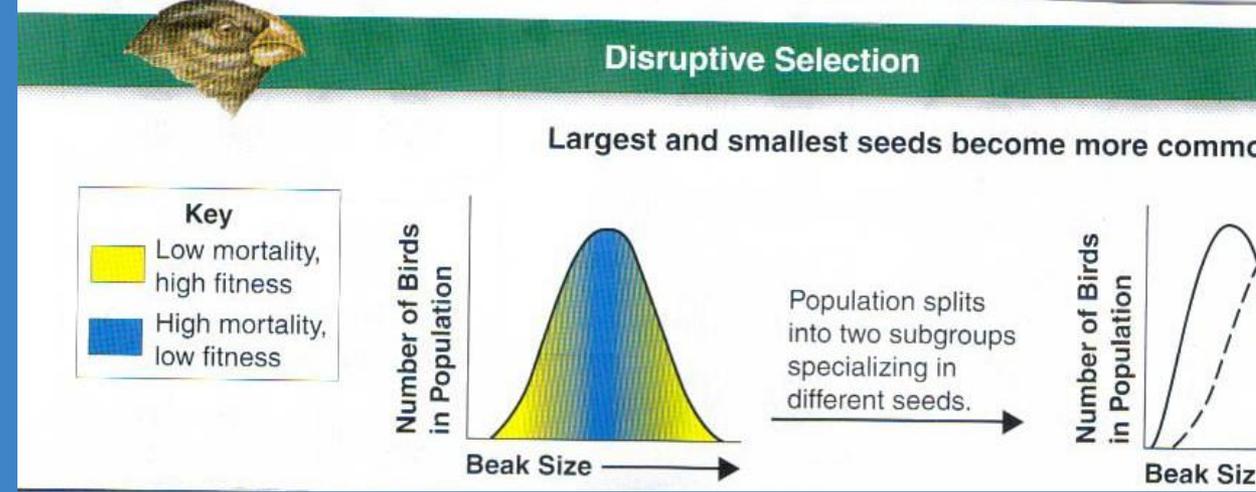
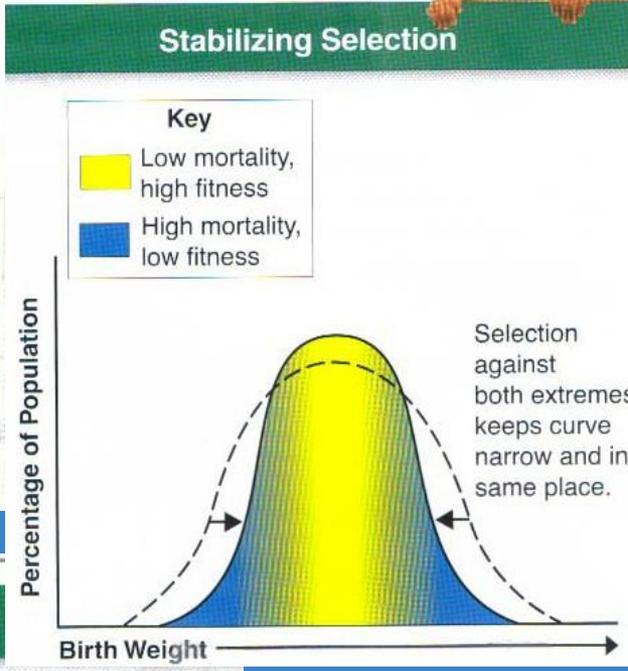
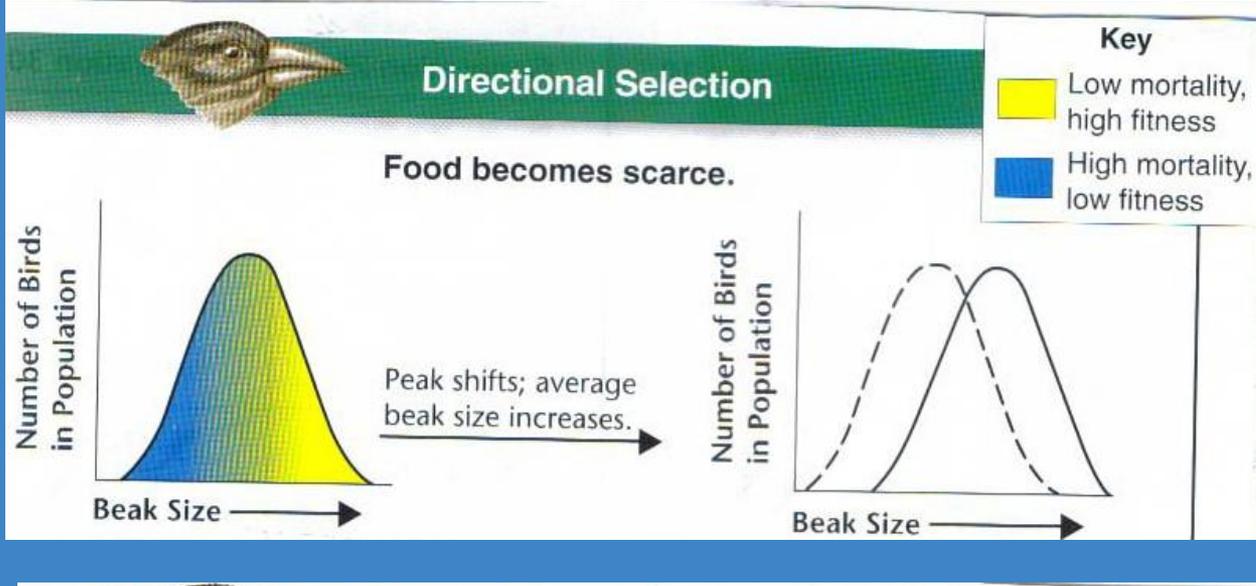
- The 2 main sources of genetic variation are **mutations** & the **genetic shuffling** that results from sexual reproduction.



NS on Polygenic Traits

- NS can affect the distributions of phenotypes in any of 3 ways:
 - directional selection**
 - stabilizing selection**
 - disruptive selection**

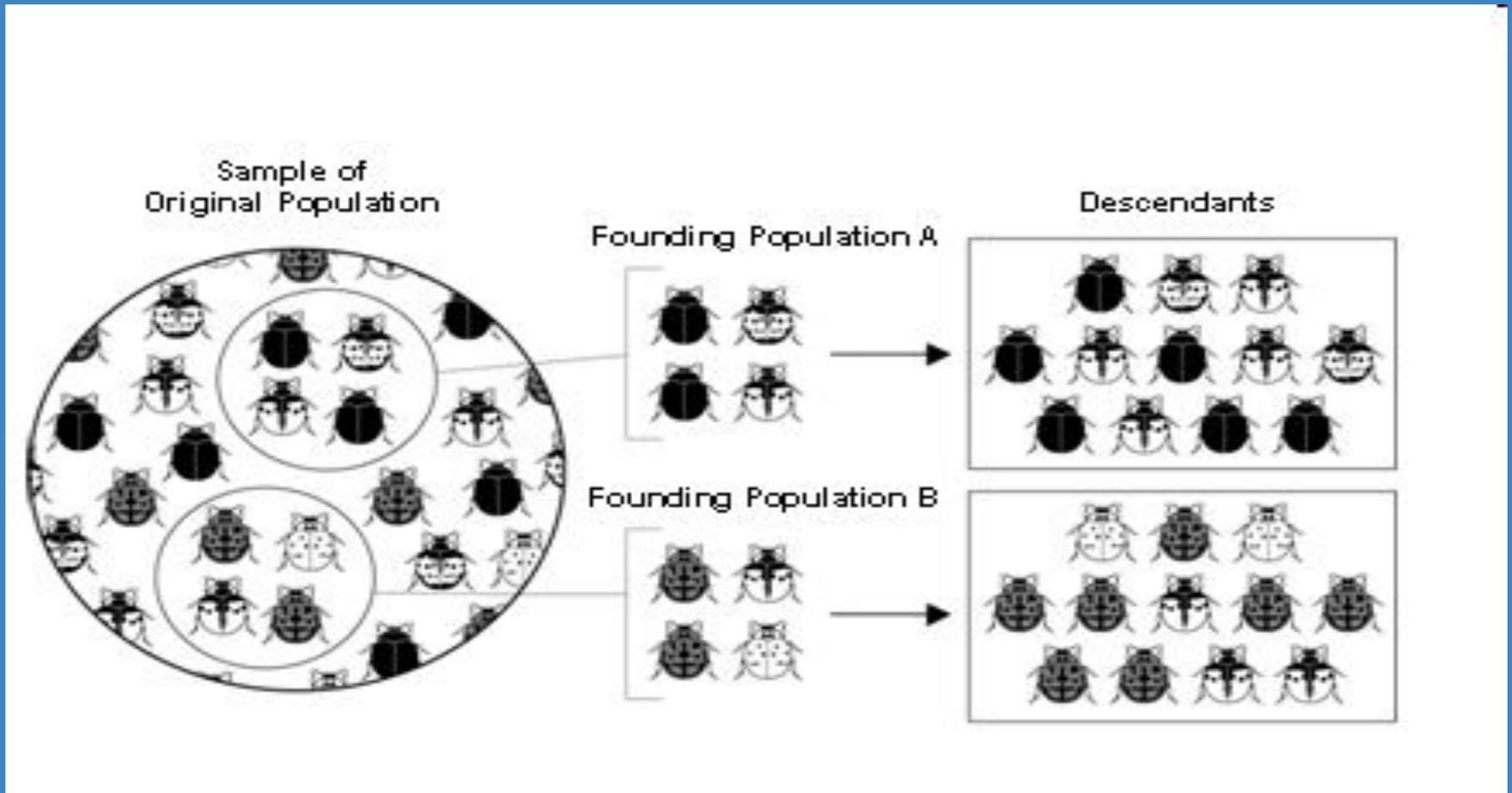
NS on Divergence



Genetic Drift

- **Genetic drift** – random change in allele frequencies that occurs in small populations.
- **Founder effect** - situation in which allele frequencies change as a result of the migration of a small subgroup of a population.

Genetic Drift



Evolution vs. Genetic Equilibrium

- Hardy-Weinberg Principle-allele frequencies in a population will remain constant unless one or more factors cause those frequencies to change.
- Genetic equilibrium - when allele frequencies remain constant, the population will not evolve.

Evolution vs. Genetic Equilibrium

- 5 conditions are required to maintain genetic equilibrium:
 - random mating
 - large population
 - no movement into/out of pop.
 - no mutations
 - no NS

The Process of Speciation

- **Speciation** - formation of a new species (Also called micro-evolution)
- The gene pools of 2 populations must become separated for them to become new species.

Testing NS in Nature

Bird Survival Based on Beak Size



Galápagos Islands Finches

Shape of Head and Beak						
Common Name of Finch Species	Vegetarian tree finch	Large insectivorous tree finch	Woodpecker finch	Cactus ground finch	Sharp-beaked ground finch	Large ground finch
Main Food	Fruits	Insects	Insects	Cacti	Seeds	Seeds
Feeding Adaptation	Parrotlike beak	Grasping beak	Uses cactus spines	Large crushing beak	Pointed crushing beak	Large crushing beak
Habitat	Trees	Trees	Trees	Ground	Ground	Ground

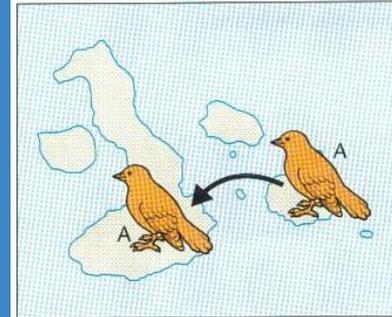
Speciation in Darwin's Finches

- Speciation in the Galapagos finches occurred by:
 - founding a new population
 - geographic isolation
 - changes in the new population's pool
 - reproductive isolation
 - ecological competition



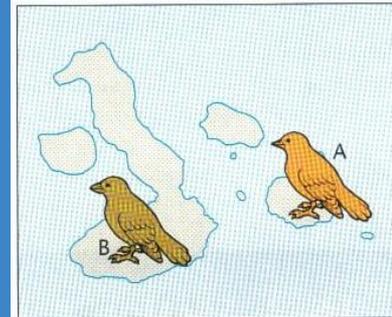
Founders Arrive

A few finches travel from South America to one of the islands. There, they survive and reproduce.



Separation of Populations

Some birds from species A cross to a second island. The two populations no longer share a gene pool.



Changes in the Gene Pool

Seed sizes on the second island favor birds with larger beaks. The population on the second island evolves into a population, B, with larger beaks. Eventually, populations A and B evolve into separate species.

Chapter 20: History of Life

The fossil record

Evolutionary processes

Earth's early history

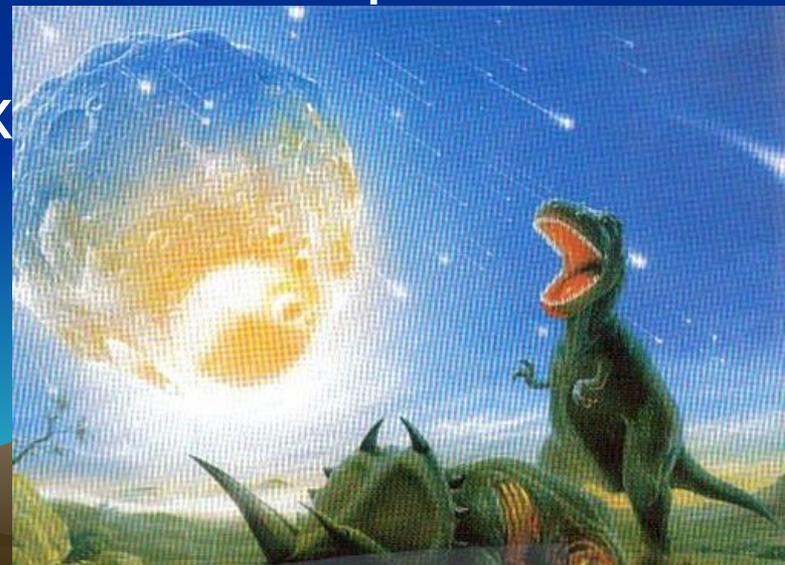
Patterns of Evolution

- Macroevolution - large-scale evolutionary patterns & processes that occur over long periods of time
- 6 important topics in macroevolution are:
 - extinction
 - adaptive radiation
 - convergent evolution
 - coevolution
 - punctuated equilibrium
 - changes in developmental genes



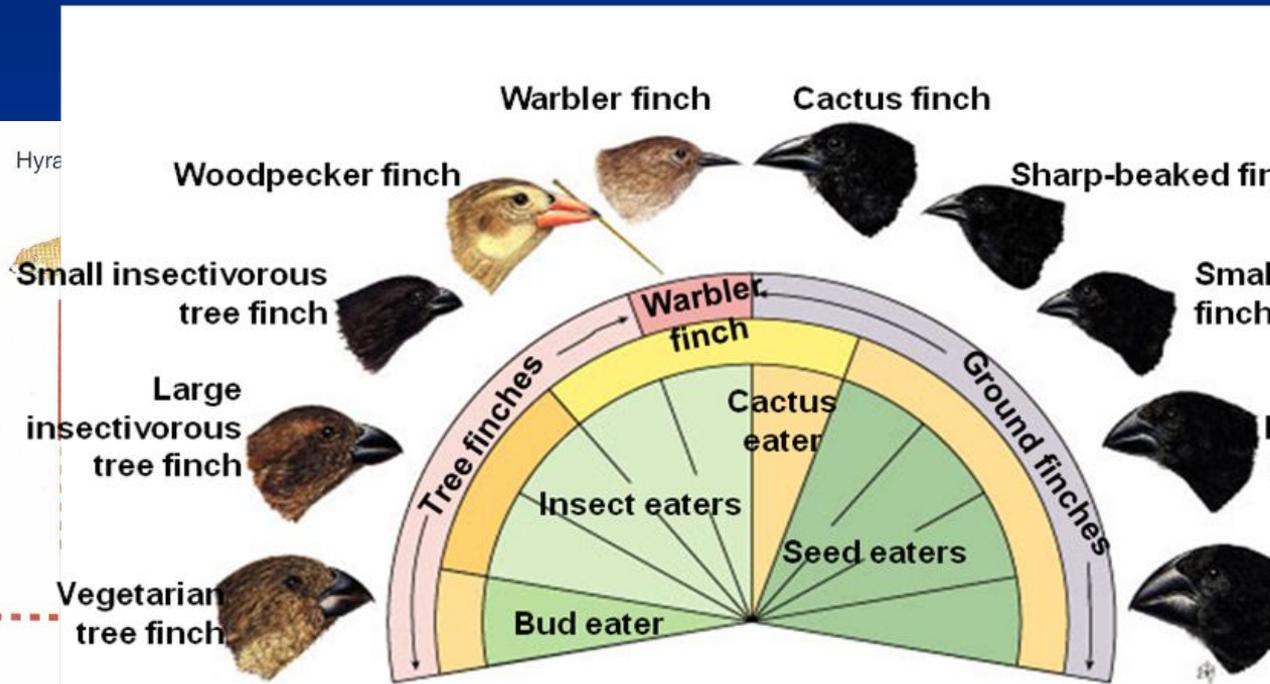
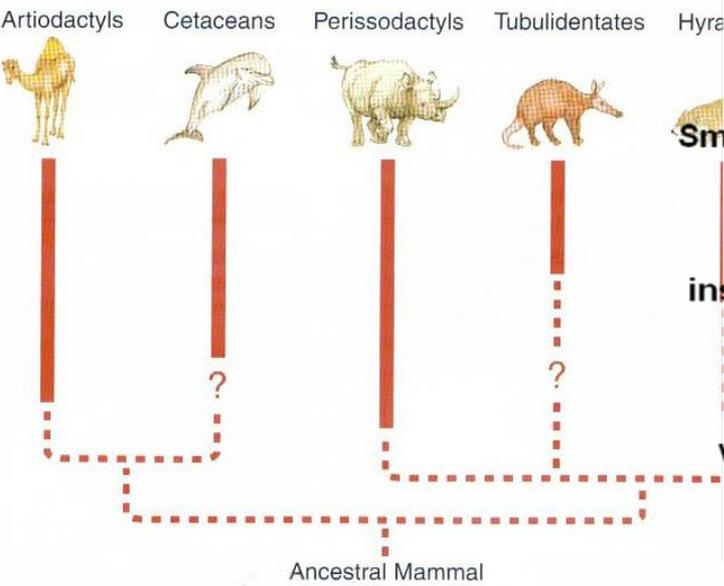
Patterns of Evolution

- Extinction:
 - More than 99% of all species are now extinct
 - It usually happens for a reason; species compete for resources, & environments change
 - Some species adapt & others become extinct



Patterns of Evolution

- Adaptive radiation - when a single species has evolved, through natural selection, into diverse forms that live in different ways (divergent evolution)
- Ex.) Darwin's Finches



Patterns of Evolution

- Convergent evolution - when unrelated organisms begin to resemble one another
- Ex.) Swimming animals



Dolphin



Penguins



Shark

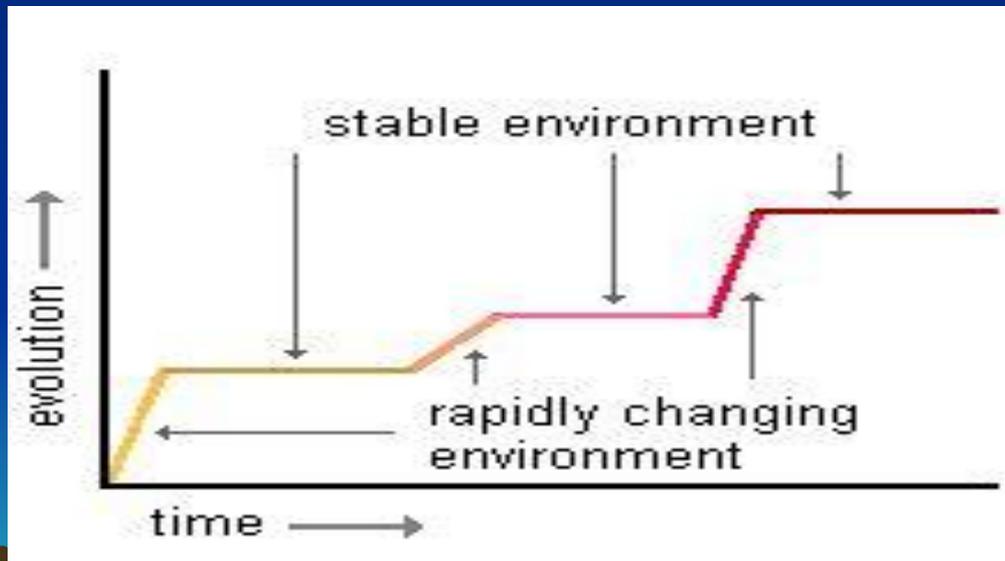
Patterns of Evolution

- Coevolution - when 2 species evolve in response to changes in each other over time
 - Ex.) Orchid has long spur with nectar in its tip, a Hawk moth has equally long feeding tube that allows it to feed on the nectar



Patterns of Evolution

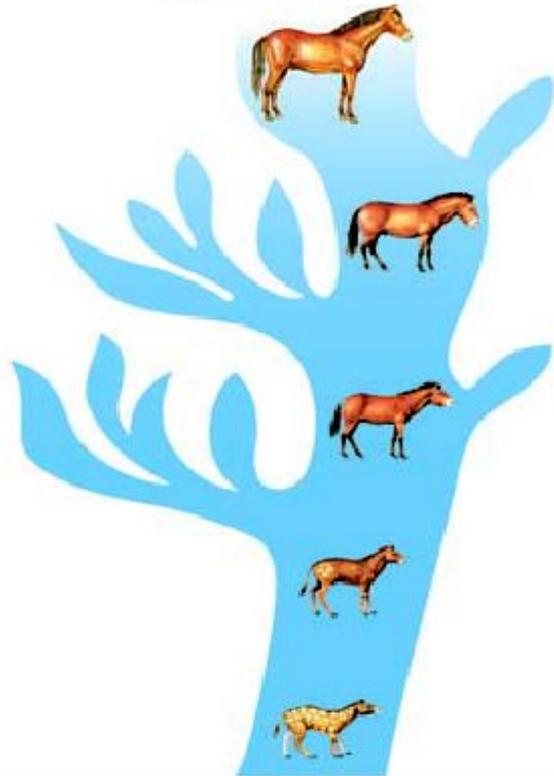
- Punctuated equilibrium - a pattern of long, stable periods interrupted by brief periods of more rapid change



Gradualism vs. Punctuated Equilibrium

Biologists generally agree that both gradualism and punctuated equilibrium can result in speciation, depending on the circumstances.

Model of Gradualism



Gradualism involves a slow, steady change in a particular line of descent. Punctuated equilibrium involves stable periods interrupted by rapid changes involving many different lines of descent.

Model of Punctuated Equilibrium

