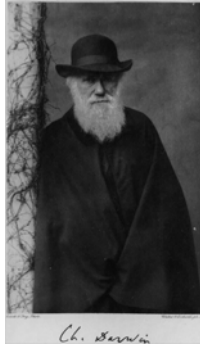


Georges Cuvier (1769-1832) suggested that many species of animals had existed and had gone extinct

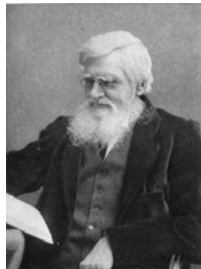
Charles Lyell (1797-1875) coined uniformitarianism- geological time is immense

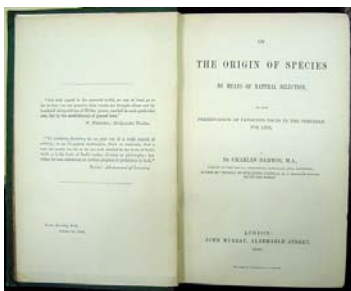


Charles Darwin (1809-1882)

Darwin and Wallace (1823-1913)

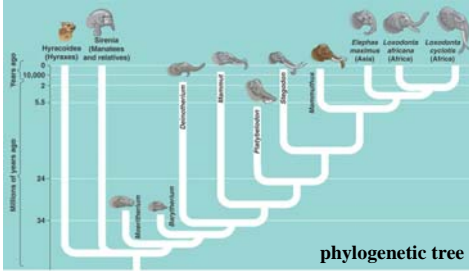
- Darwin developed ideas on natural selection in early 1840s (1844 essay), but did not publish
- Received a letter from Wallace in 1858 outlining natural selection
- 1858 presentation in London at a meeting of the Linnaean Society
- 1859 publication of *Origin of Species*





1859

EVOLUTION: Descent with Modification



Evolution: forms of heritable traits changing over time w/in a population.

EVOLUTION: Variation & Selection

Natural selection

- Based on three important observations.....



Heritable Variation



Rule #1- Individual members of any species vary somewhat from one another. (The Beagle)

Rule #2- This individual variation is heritable.
"Pangenesis"

Use and Disuse

aka - Evolution of Acquired Characteristics



Darwin accepted this because he had not read his copy of Mendel's paper

Evolution of Acquired Characteristics



Jean-Baptiste Lamarck (1744-1829)

Overproduction of Offspring



Rule #3- Organisms can multiply at a rate that exceeds the capacity of the environment to support them.

Thomas Malthus (1766-1834) suggests that human populations are growing exponentially

Natural Selection

- Differences in survival and reproduction rates among the members of a population based on their relative “fitness” for the environment. p. 243
- i.e. an increased adaptation to the environment

ADAPTATION

a heritable aspect of form, function or behavior that contributes to an organisms “fitness” for it’s environment. (p. 244)



The result of the process of natural selection is adaptation.



(a) **Cactus eater.** The long, sharp beak of the cactus ground finch (*Geospiza scandens*) helps it tear and eat cactus flowers and pulp.

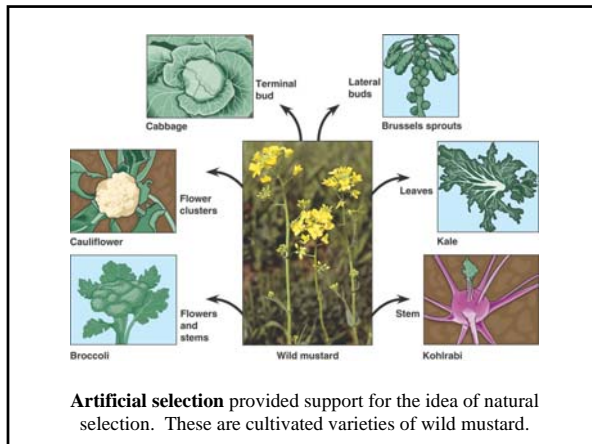


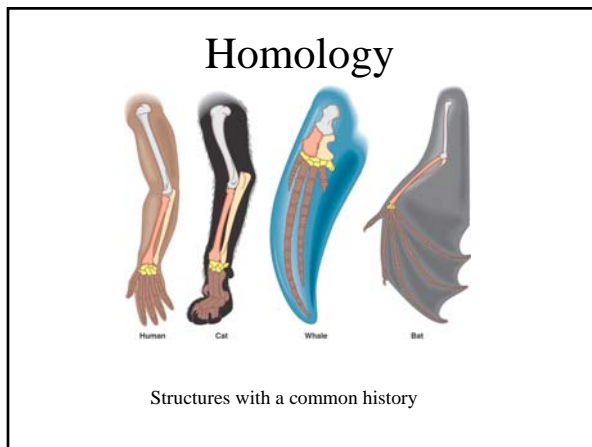
(c) **Seed eater.** The large ground finch (*Geospiza magnirostris*) has a large beak adapted for cracking seeds that fall from plants to the ground.

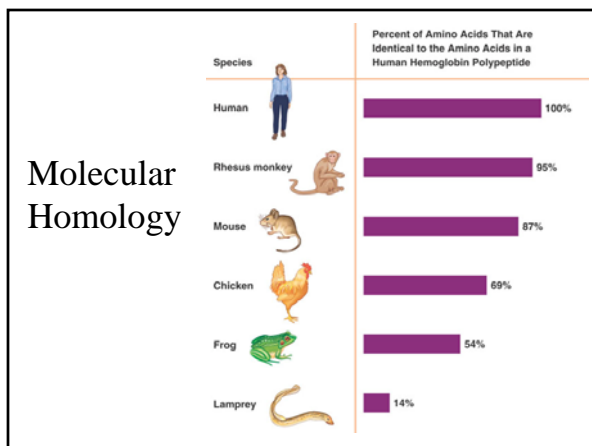


(b) **Insect eater.** The green warbler finch (*Certhidea olivacea*) uses its narrow, pointed beak to grasp insects.

Adaptations to different diets in “Darwin’s finches”







Microevolution

- **Population**- a group of individuals of the same species living in a given area
- **Gene Pool**- all the genes (alleles) present on a population





The Gene Pool

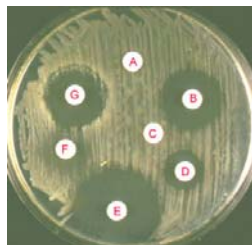
Allele Frequencies- abundance of certain alleles in a population



Changes in allele frequencies within the gene pool are microevolution

Types of Microevolution

- **Mutation**
- **Natural Selection**
- **Gene Flow**
- **Genetic Drift**



Source of new alleles is mutation!!!

Rate per gene during replication is fairly consistent

10^{-5} to 10^{-6}



Remember:

The distribution of alleles among individuals is dependant on:

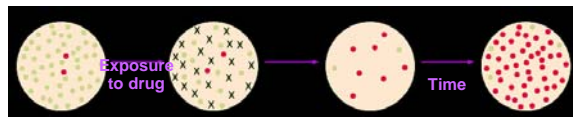
- crossing over
- independent assortment
- Random fertilization
- changes in chromosome number or structure/non-disjunction



Natural Selection

- Directional Selection- antibiotic resistance
- Stabilizing Selection- human birth weight
- Disruptive Selection- Darwin's finches
- Balancing Selection- Malaria & Sickle cell
- Sexual Selection- expensive and flashy

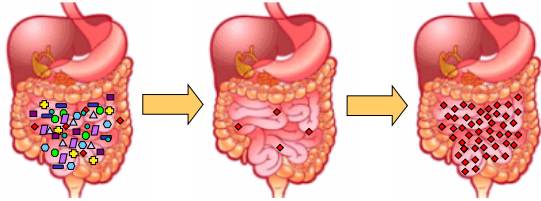
Directional Selection



Antibiotic resistance

- Drug-sensitive
- Drug-resistant mutant

Superinfection



Stabilizing Selection



Other ways the gene pool can change...

- Genetic Drift (random)
- bottlenecks (meat-eating deer!!)
 - founder effect
 - inbreeding

- Gene flow
- immigration
 - emigration



Speciation

Disruptive Selection- Darwin's finches



(a) **Cactus eater.** The long, sharp beak of the cactus ground finch (*Geospiza scandens*) helps it tear and eat cactus flowers and pulp.



(c) **Seed eater.** The large ground finch (*Geospiza magnirostris*) has a large beak adapted for cracking seeds that fall from plants to the ground.



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