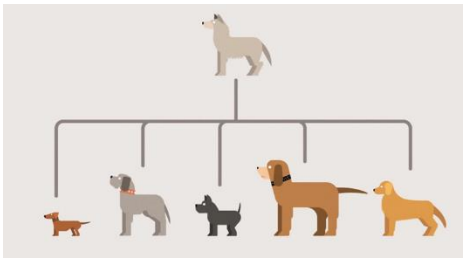
Name:_____ Hemingway

Evolution

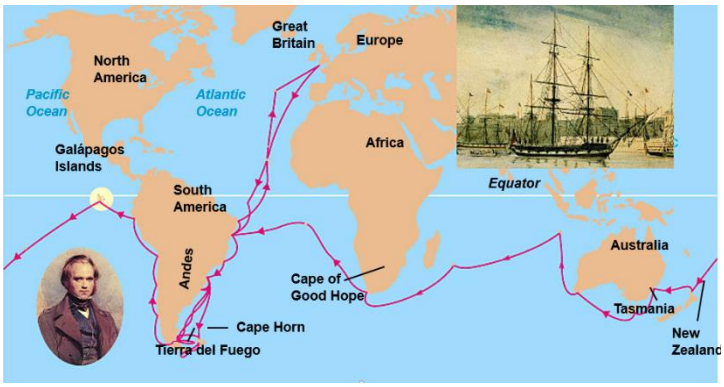
What is evolution?



- _____
- Specifically, a change in the frequency of a _____or _____ in a population over time
- Process by which modern organisms have descended from ancient organisms
- Scientific Theory
- Well tested

Charles Darwin

- "Father of Evolution"
- Proposed a mechanism for _____
- _____
- Darwin went on a 5-year trip around the world on the ship, the HMS Beagle
- As the ship's naturalist, he made observations of organisms in South America and the _____Islands
- Made important observations and collected evidence supporting how life _____
- Wrote a book, "Origin of the Species"



Ideas around Darwin's Time

- Most Europeans believed that the earth and all of its life forms were created only a few _____ years ago
- Since creation, _____ has occurred

James Hutton and Charles Lyell

- recognized that the earth is _____ of years old
- Processes that change the earth in the past are still happening
- Learn that layers of rock form _____ and are moved by _____beneath the Earth's surface
- Rock is then shaped by natural forces _____
- These processes are very slow and have shaped the Earth's geologic features over _____

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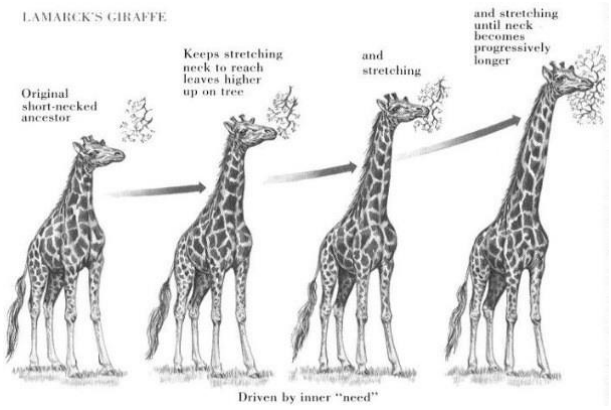
Darwin Witnesses Geology at work

- Volcanic Eruption
- New rock forming
- Earthquake lifting rocky shoreline _____above its previous position
- All helped him recognize that Earth changes over time…..then why not life?

Lamarck

- French Naturalist
- One of the first to propose a mechanism explaining how organisms _____
- Also realized that organisms were somehow _____ to their environments
- His hypothesis:
    - By selective use or disuse of organs, organisms acquired or lost certain traits during their lifetime. These traits are then passed on and over time it leads to change.
- Though flawed ideas about inheritance about acquired traits Lamarck was a pioneer for evolution



Lamarck's Main Ideas

- Organisms have an innate tendency towards _____
    - Inner _____ to change
- _____
- Organisms could alter the size/shape of organs by using their body in a new way
- Disused organs would eventually _____
- Acquired characteristics could then be _____

Thomas Malthus

- _____
- If human population continued to grow sooner or later there would be insufficient living space and food
- Forces against: War, famine, disease

Darwin observed plants and animals

- Noticed
    - The majority of a species offspring _____
    - Only a few that survive produce _____

- Lead to questions
  - "What causes the death of so many individuals?"
  - "What factors determine which one survives and which ones do not?"

Darwin makes a case for Evolution

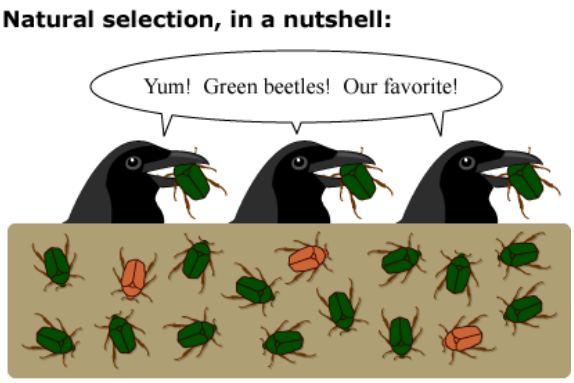
- 1859- Published Origin of Species
- Based on his ideas of Natural Selection

Natural Selection

- Natural Selection:
  _____

Darwin's Ideas

- Members of each species _____from each other in important ways
  - I.e. some plants bear larger fruit
  - Some cows produce more milk
- Some of this variation is_____
- Observed that plant and animal breeders would use heritable variation
- Selected variations that were useful
  - Called _____



Darwin's Theory of Natural Selection occurs in four steps:

- Overproduction
- Variation
- Competition
- Selection

1. Overproduction

- Each species produces more offspring that can _____
- Why are the population sizes not bursting?

2. Variation

- Each individual has a _____ combination of inherited traits.

Why is Variation Important?

- Because the environment _____
- The more variation within a species, the more likely it will _____
    - EX: If everyone is the same, they are all vulnerable to the same environmental changes or diseases
- The more variation of types of species in an habitat, the more likely at least some will survive

The Role of Genetics in Evolution

- Darwin knew that traits were inherited, but not _____they were inherited
- _____ provide the variation necessary for evolution.
- Meiosis:
    - Reshuffles genes creating new _____ of genes
- Mutation
    - Provides new _____
- Both result in the _____ necessary for evolution to occur
- Variation is _____
- Combination of genes are determined by _____
    - As are resulting variations
- Variation provides the raw material for natural selection

3. Competition

- Process like Artificial Selection working in nature
- _____
    - Organisms compete for _____, habitat and other of life's necessities

Fitness

- Fitness: The ability of an individual to _____ in its environment
    - The result of _____
        - Inherited characteristics that _____ an organisms chance of survival

- Structural, Physiological & Behavioral
- Successful adaptations
  - Enable organisms to survive/reproduce and pass traits to _____
- Individuals with _____characteristics enable fitness and survive/reproduce more successfully
- Individuals with _____characteristics die or have fewer offspring

4. Natural Selection

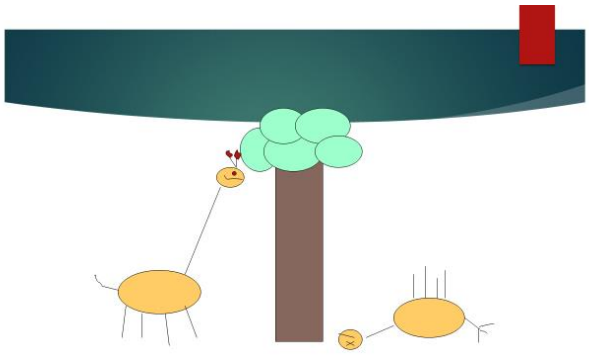
- The individuals with the best traits / adaptations will survive and have the opportunity to _____ to offspring.
- Natural selection acts on the _____ (physical appearance), not the genotype (genetic makeup)
  - Ex: When a predator finds its prey, it is due to the prey's _____ like color or slow speed, not the alleles (BB, Bb)

Survival of the Fittest

- Takes place without human control or direction
- Therefore _____
- Over time natural selection results in changes in the _____ of a population
- These changes increase a species _____in its environment
- Changes cannot be seen directly but it can be observed as changes in a population over _____

What does "more fit" mean?

Descent with Modification



- Each living species has descended with changes from_____over time
- Over long periods of time Natural Selection produces organism with
  - different _____
  - Different niches
  - Different _____
- Results in species looking very _____from ancestors
- _____ – all living organisms are related to one another
- A single tree of life links_____ living things

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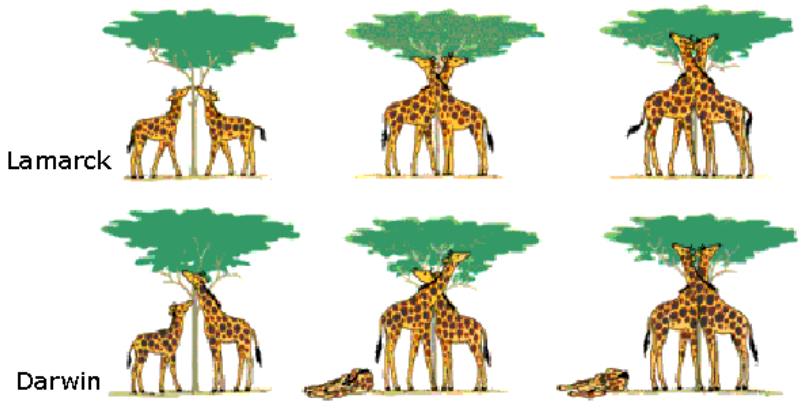


Evidence for Evolution:

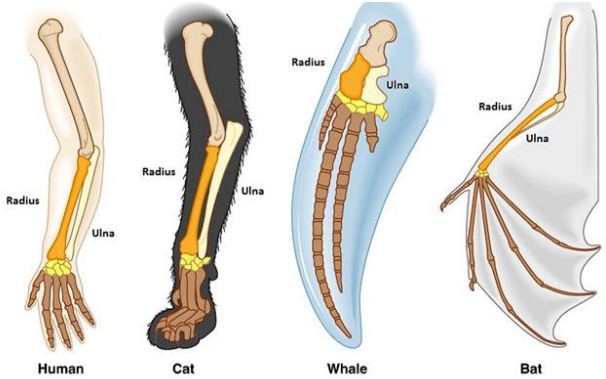
- Living things have been evolving on Earth _____
- Evidence of this has come from:
  - Fossil Record
  - Distribution of Living species
  - Homologous Body Structures
  - Vestigial Organs
  - Embryology

The Fossil Record

- Fossils: a record of the history of life on Earth
- Remains of _____
- Comparing fossils in older rock to younger rock we can document that life on earth has _____Includes a variety of extinct organisms that are related to one another and living species
- The number of fossils has grown enormously
  - Documented intermediate stages in _____of modern species

Homologous Body Structures:

- Similar anatomy in different types of animals because of _____
- Striking anatomical similarities among the_____of animals with backbones
- _____ of reptiles, birds and mammals vary greatly in form and function yet all constructed from the same _____
- Each limb has adapted to enable organisms to _____in different Environments



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Vestigial Organs:

- "leftover" traces of evolution that serve _____
- Why do they still exist?
    - Does not affect the organisms ability to _____

Embryology

- embryos of all vertebrates are very similar early on