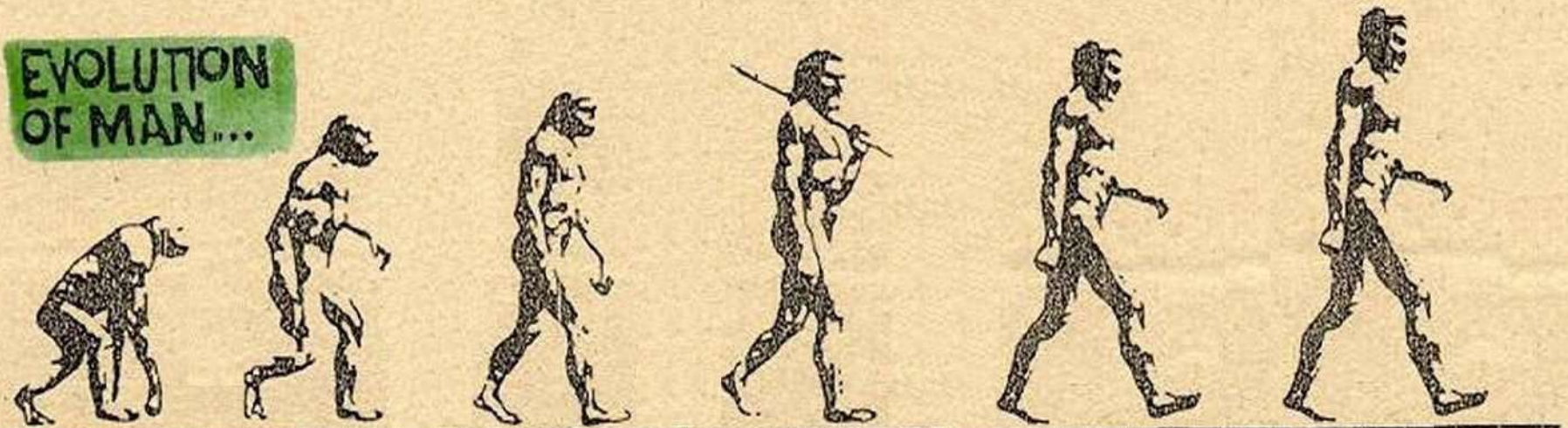


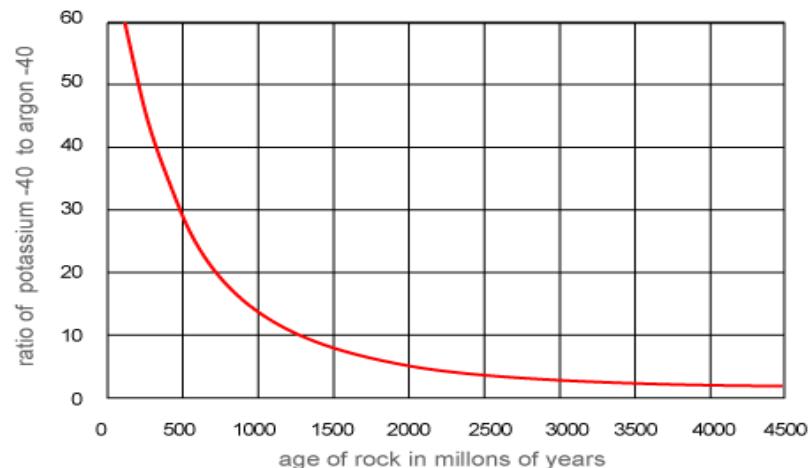
Chapter 12 & 13

Evolution



The Beginning...

- The earth is thought to have been formed about 4.5 billion years ago.
- Radioactive dating have been used to determine the age of the oldest rocks found on earth



Origins of Life

- **The “Primordial Soup” Model-** the early atmosphere and oceans contained many organic molecules which may have been combined through chemical reactions to form the earliest forms of life on earth



Origins of Life

The Bubble Model-

- Gases from underwater volcanoes were trapped in bubbles in the water
- Gases within the bubbles could undergo chemical reactions to form amino-acids
- Bubbles rose to the surface and burst, releasing organic molecules into the air
- Organic molecules in the air underwent more chemical reactions
- More complex organic substances were then formed leading to the formation of the first living things

Evolution

- Evolution is the process by which organisms slowly change over time and adapt to their environment

Variations- differences between organisms

Fossil Evidence- fossils are preserved remains of organisms that show changes in organisms over millions of years

Theories of Evolution

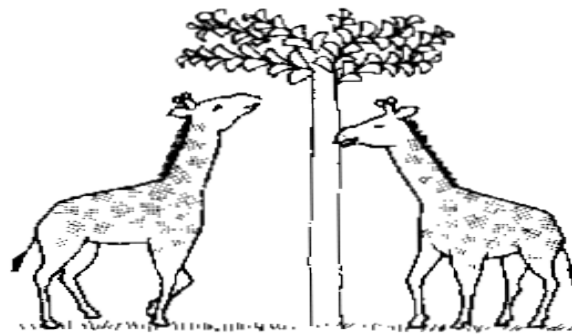
Lamarck's Theory:

- Organisms develop traits or characteristics by using or not using a particular body part

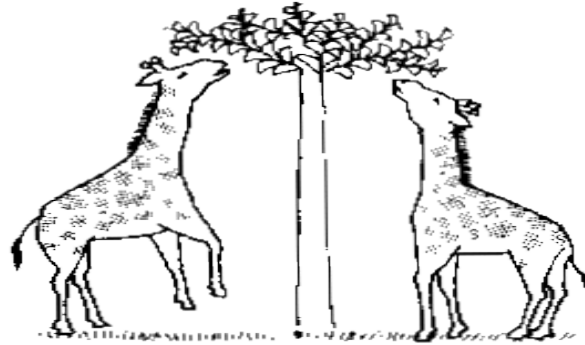
Ex: when body part are used they get bigger and stronger

- Traits that an organism develops during their lifetime are passed on to their offspring

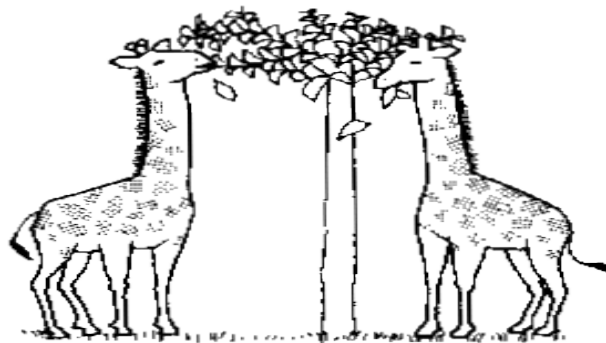
Ex: Giraffes stretched their necks to reach leaves in tall trees and then their offspring were born with long necks



The ancestors of giraffes had a short neck, but they had the habit of eating leaves up on the trees



As they reached for high leaves their necks became longer.

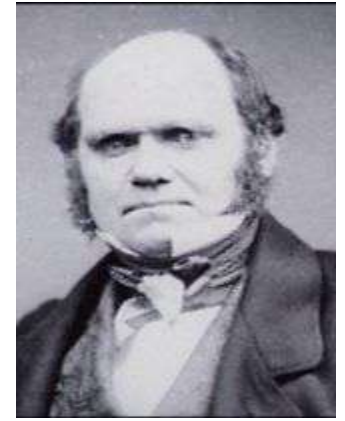


The character of longer neck was passed on to their descendants, making a long-necked giraffe

Darwin's Theory

- **Overproduction-** each species produces many more offspring than can survive and reproduce
- **Competition-** organisms must compete for limited resources
- **Variations-** differences in traits occur among members of the same species
- **Survival of the Fittest-** Organisms with traits that make them well adapted to their environment have a better chance of surviving and reproducing

Charles Darwin



- Voyage through the Galapagos islands



Adaptations

- Adaptations are changes in an organisms traits that help an organism to survive



Photo by: Jürgen Menzel
© 2009, USA



Population Genetics

Population- all members of the same species living in the same area

Gene Pool- all the possible genes/traits in a population

Hardy-Weinberg Principle-

Changes in the gene pool are caused by:

- **Natural selection:** survival of the fittest
- **Mutations:** changes in the genetic code
- **Migration:** organisms move to a new area
- **Isolation:** organisms become separated from the population

Causes of Divergent Evolution

Geographic Isolation- a physical barrier separates members of a population

Ex: mountains, river, ocean, roadways

Speciation- development of a new species

- evolution in separated populations may be different based on their environments
- over time both populations develop new traits for their environments

Reproductive Isolation- when organisms become separated and evolve differently they may no longer be able to reproduce with one another

- 2 new species have then evolved

Rate of Evolution

Gradualism- process of evolution through slow change over time

- supported by fossil evidence

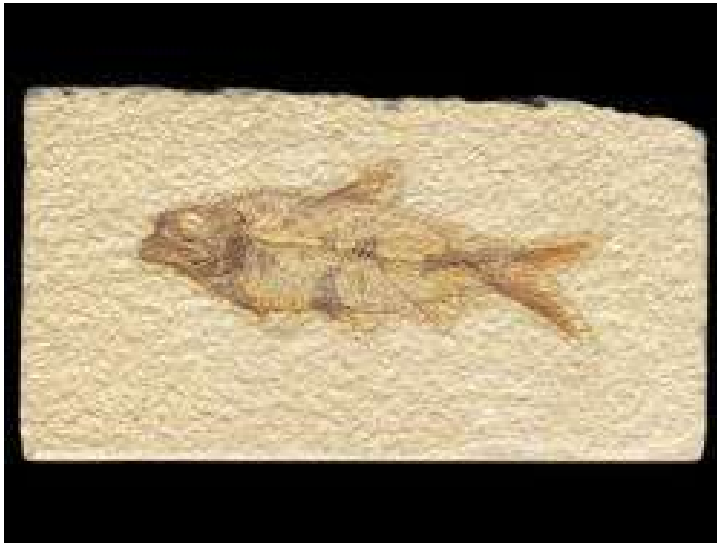
Punctuated Equilibrium- process of evolution that occurs in a series of rapid changes

- supported by the rapid extinction of dinosaurs and the rapid rise of mammals

Evidence of Evolution

Fossil Evidence- remains or traces of organisms that lived in the past

- most fossils are found in sedimentary rock



Types of Fossils

- **Molds & Casts-** an imprint of an organism filled with hardened sediment
- **Imprints-** an impression of an organism into a rock
- **Amber-** insects can be preserved in hardened tree sap
- **Ice-** some organisms can be trapped and preserved in ice
- **Tar Pits-** animals trapped in tar pits remain preserved for over 15,000 years
- **Petrifaction-** hardening of dead organic matter into mineral

Types of Fossils



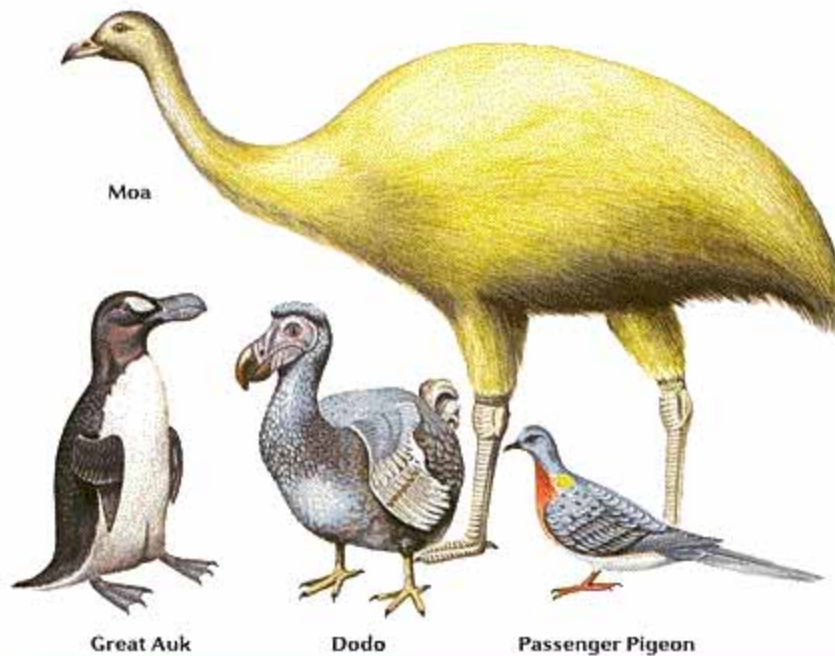
Interpreting Fossils

- **Index Fossils**- fossils that are always found in specific rock layers
- **Radioactive Dating**- used to determine the age of the fossil

Rock Layers:

Extinction

- Extinct organisms have no living members left on earth



World Book illustrations by Verner Artists, Ltd.



Laughing owl, extinct 1914



Bourbon crested starling, extinct 1850-60



Tasmanian Wolf, extinct 1936. AMNH transparency #5522

Geologic Time

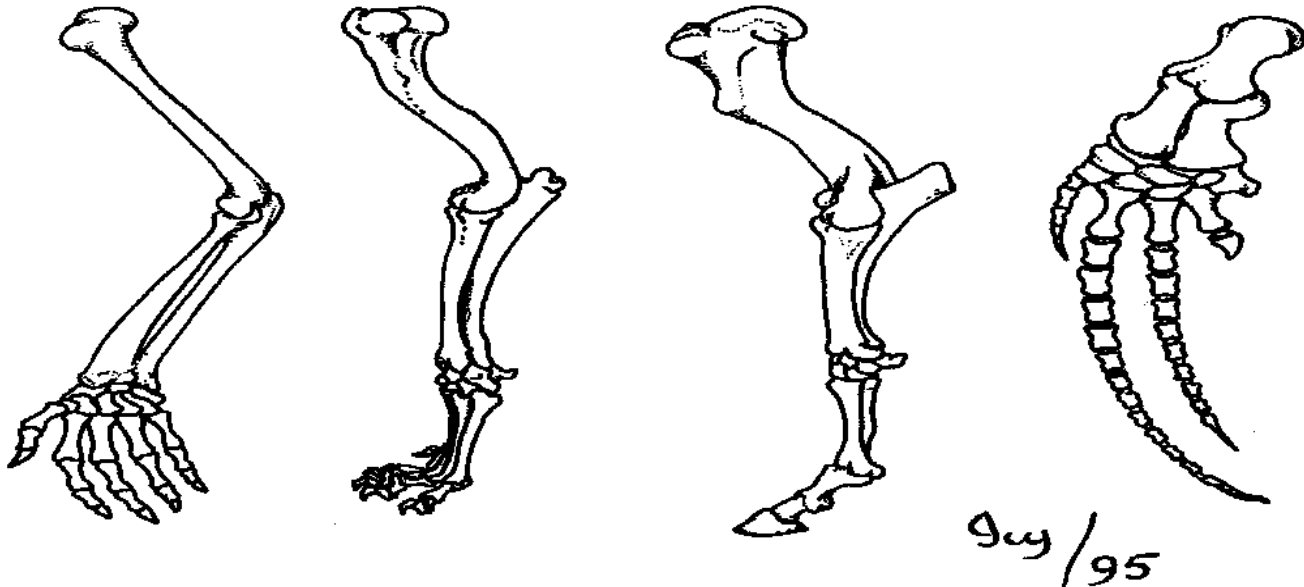
Era	Period(s)	Date	Organisms
Cenozoic	Quaternary Tertiary	Current to 65 million years ago	Mammals Primates
Mesozoic	Cretaceous Jurassic Triassic	130 – 225 million years ago	Flowers Birds Dinosaurs
Paleozoic	Permian Devonian Cambrian	275 – 600 million years ago	Reptiles Fish Insects
Precambrian	Precambrian	4.5 billion years ago	Bacteria Algae

Evidence of Evolution

Anatomy- the structure of organisms

Homologous Structures- body parts that have the same basic structure

Ex:



Homologous Structures

- Homologous structures may have similar shapes and parts, but usually have different functions
- Ex: **Human Arm**- grasping
Bird Wing- flying
Whale Flipper- swimming
Horse Leg- running

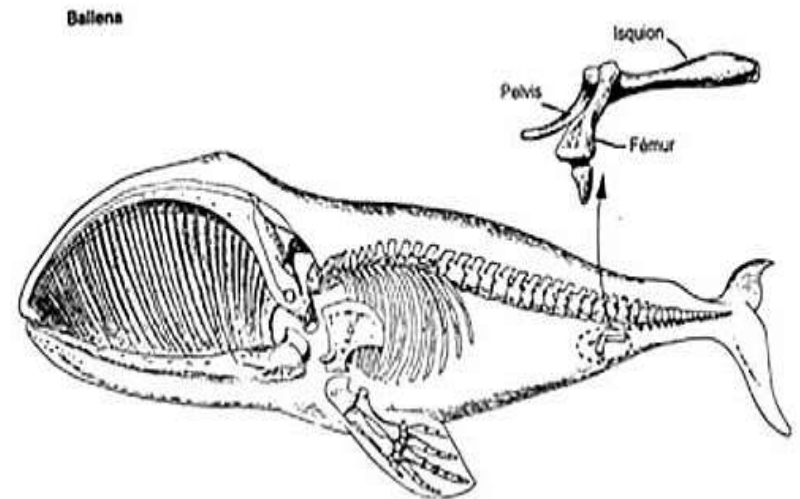
Vestigial Structures

- Vestigial structures have no current function in an organism
- These structures have lost their function over time through evolution
- **Ex: Human Appendix**

Snake Hips

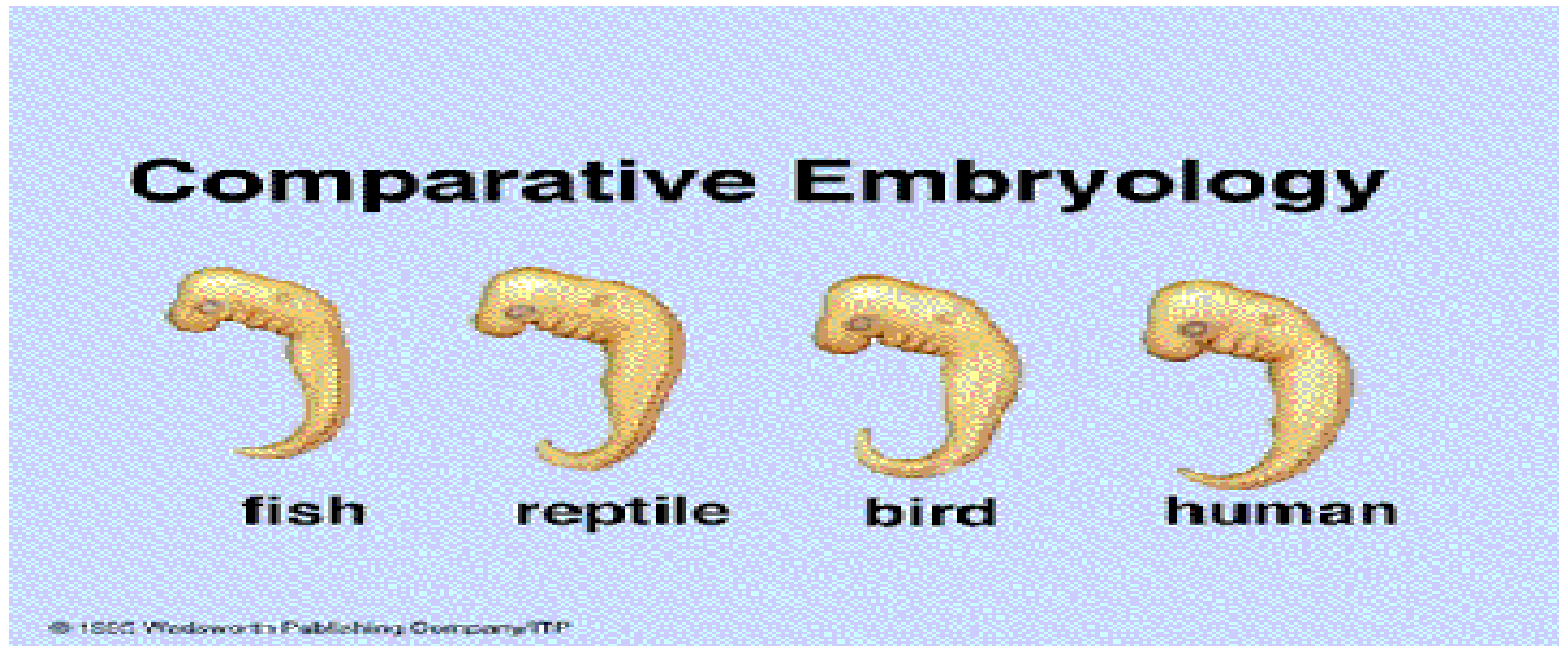
Human Tailbone

Whale Leg Bones



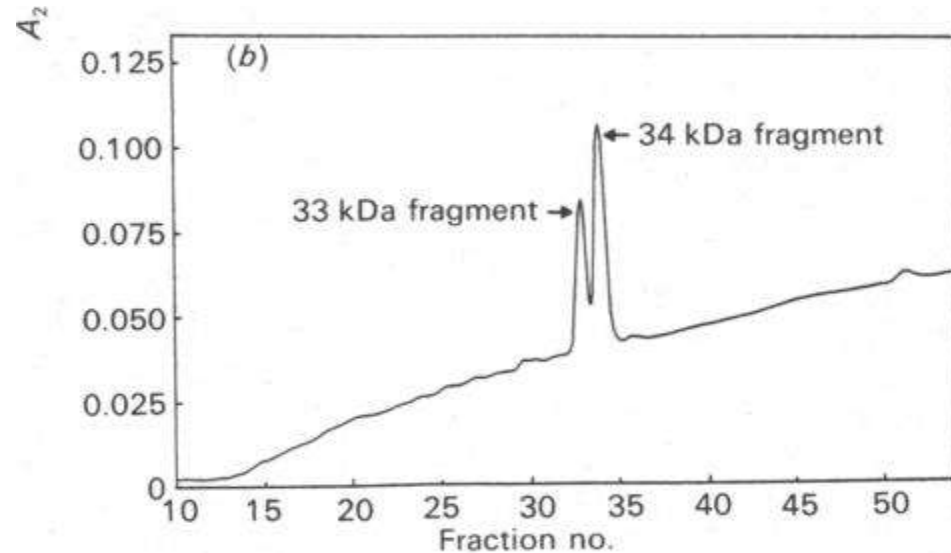
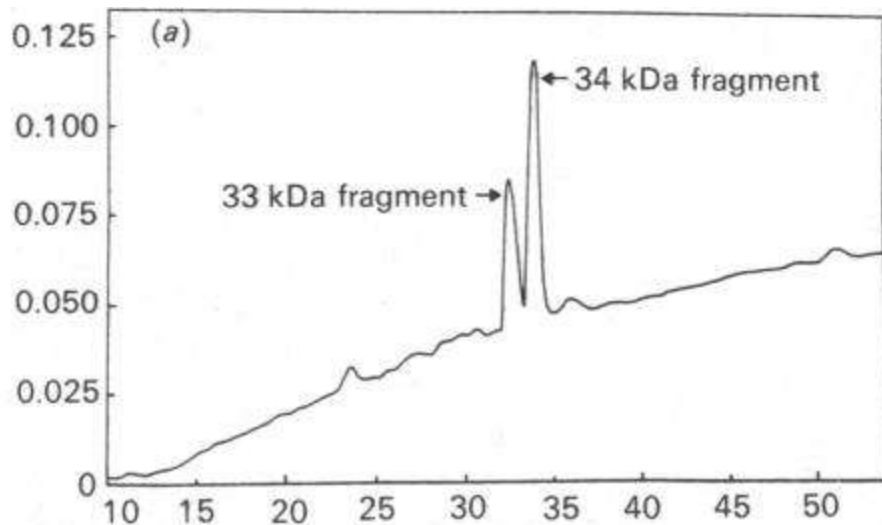
Embryology

- Embryology is the study of organisms in early stages of their development
 - Many different organisms appear very similar in early stages of development



Biochemistry

- Biochemistry is the study of the molecules that make up living things
 - The relationship between organisms can be determined using biochemistry analysis



Human Evolution

Classification of Humans: *Homo sapiens*

Primates- a group of organisms with backbones, opposable thumbs, and frontal vision

Opposable Thumb- a thumb that is movable in several directions used for grasping objects and using tools

Frontal Vision- eyes at the front of the head, looking forward

Stereoscopic Vision- having depth perception

Human Characteristics

Bipedal- stand upright and walk on 2 legs

Rounded Jaw- humans have a round jaw in comparison to apes which have an elongated jaw

Brain Capacity- humans have large, highly developed brains for their body size

Spoken Language- communication through spoken words

Early Humans

Australopithecus afarensis- earliest human ancestor

Australopithecus africanus- South-African ancestor

Homo habilis- used tools

Homo erectus- walked upright

Homo sapiens- modern humans

Neanderthals- European ancestors “cave men”

Cro-Magnon- most recent human ancestor

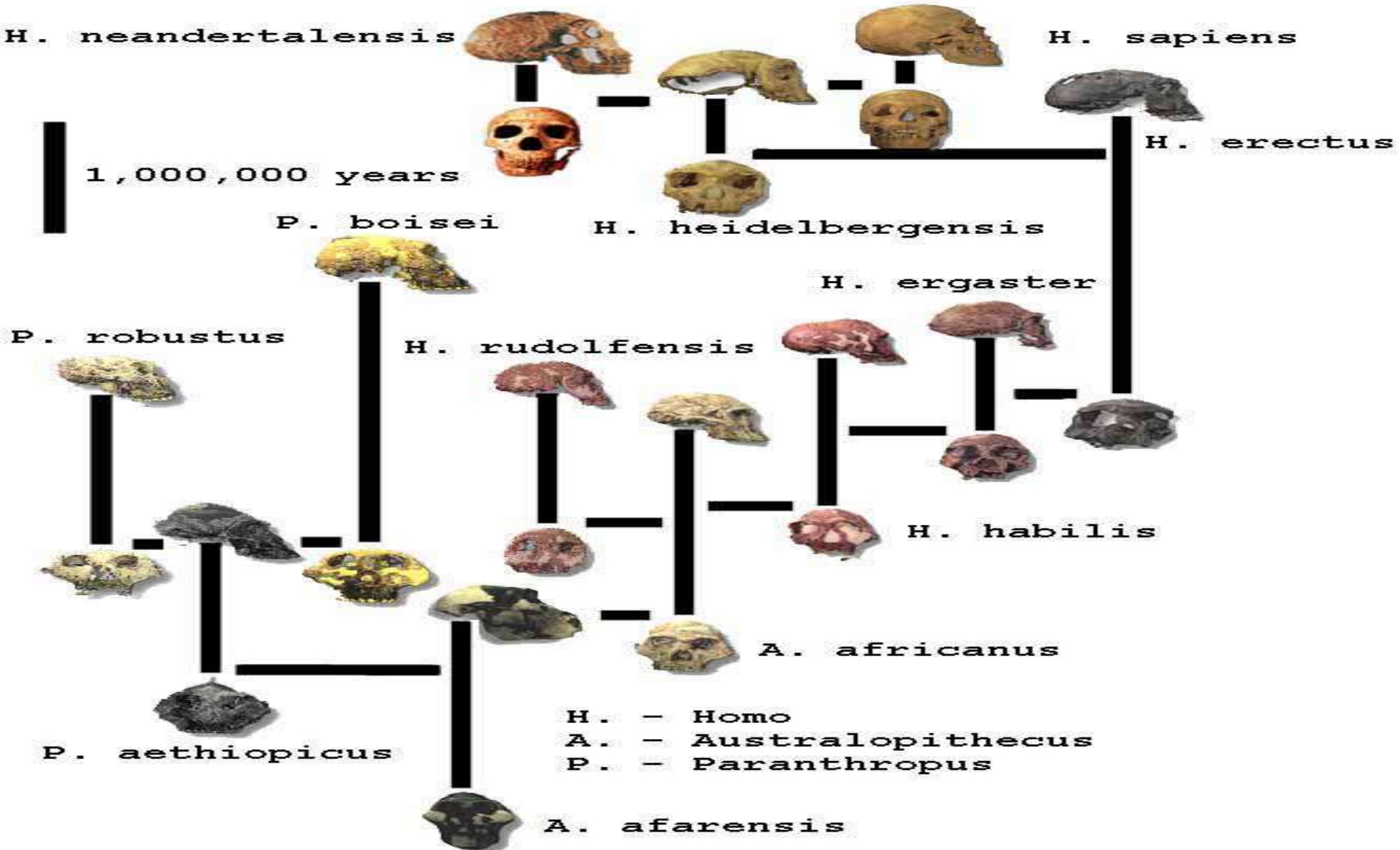
Lucy



- **Early hominid ancestor**
- **Incomplete female skeleton**

Australopithecus afarensis

Human Evolution



Human Evolution

Evolution



(OR IS IT?)