

REVISION: EVOLUTION

12 JUNE 2013

Lesson Description

In this lesson, we revise:

- Natural selection as an explanation for evolution
- The concept of speciation
- Theories of Human Evolution

Key Concepts

Important Terminology

- Hypothesis:** A temporary explanation of physical phenomena, which can be tested by observation or experiment.
- Theory:** An explanation of a group of physical phenomena, firmly founded on observation and experiment, which continues on to be investigated.
- Evolution:** Evolve, to unroll, to disclose, to develop, to unravel.
The theory of evolution states that all species of living things that exist today (and many more which are now extinct) have evolved from simple life forms, which first developed more than 3 billion years ago.
- Gene pool:** The communal genes of all the organisms in a population at a particular time.



Gene Pool

- Species:** A group of organisms that share similar characteristics and can interbreed and produce fertile offspring.
- Population:** A group of organisms of the same species that can interbreed in a specific habitat at a specific time

Early Theories

Erasmus Darwin
(1731 – 1802)



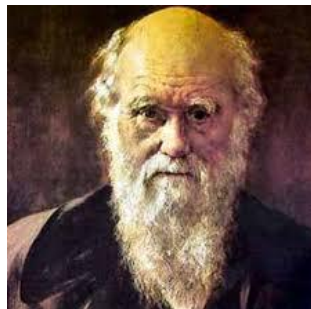
Ideas on evolution that were proposed by Erasmus Darwin in his book called *Zoonomia*: All life developed from simple forms. There are similarities amongst various organisms. Artificial selection and metamorphosis showed how changes may have occurred.

Jean Baptiste de Lamarck
(1744 – 1829)



Two ideas of Lamarck in explaining evolution: Law of use and disuse as well as inheritance of modified characteristics.

Charles Darwin
(1809 – 1882)



Theory of evolution by natural Selection.

Alfred Wallace
(1823 – 1913)



Natural selection as an explanation for evolution.

What is Natural Selection?

The main concepts of natural selection are:

- In a population, more offspring are produced than the environment can support, so there is a struggle for life and many organisms die.
- The organisms best suited to the environment survive, reproduce and pass on their inherited adaptations to the next generation.
- In this way, the composition of the population changes, i.e. the population evolves.
- Because the best-suited individuals survive, the population remains suited to its environment.

Human Evolution

Where exactly do scientists place us?

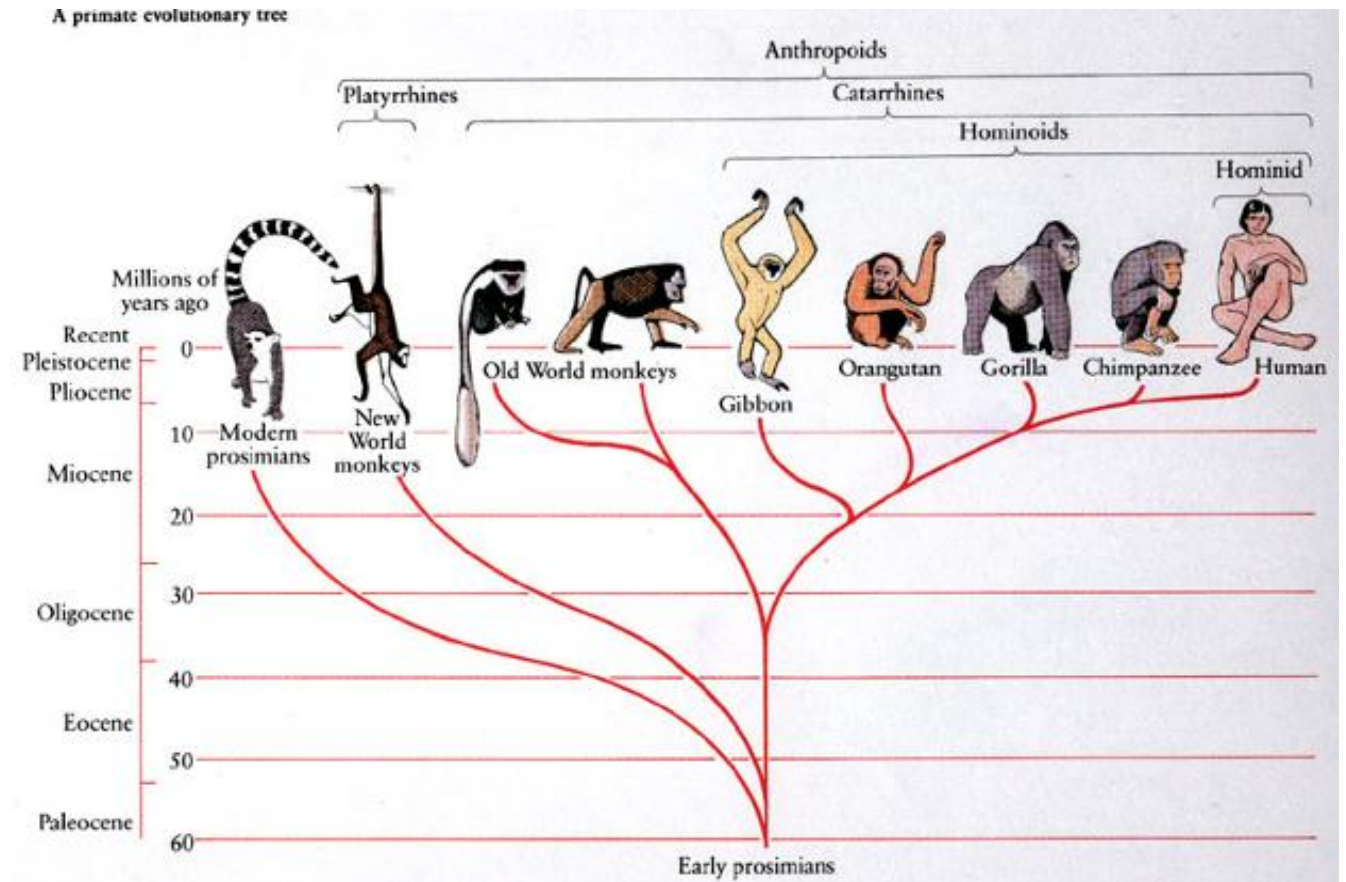


Fig. 1 Evolutionary path of humans and other primates

- First species - *Australopithecus afarensis* - 4.2 to 2.5 million years ago.
"Lucy" - Ethiopia.



- Next - *Australopithecus africanus* - 3.5 to 2.5 million years ago.
Famous fossils discovered in South Africa:

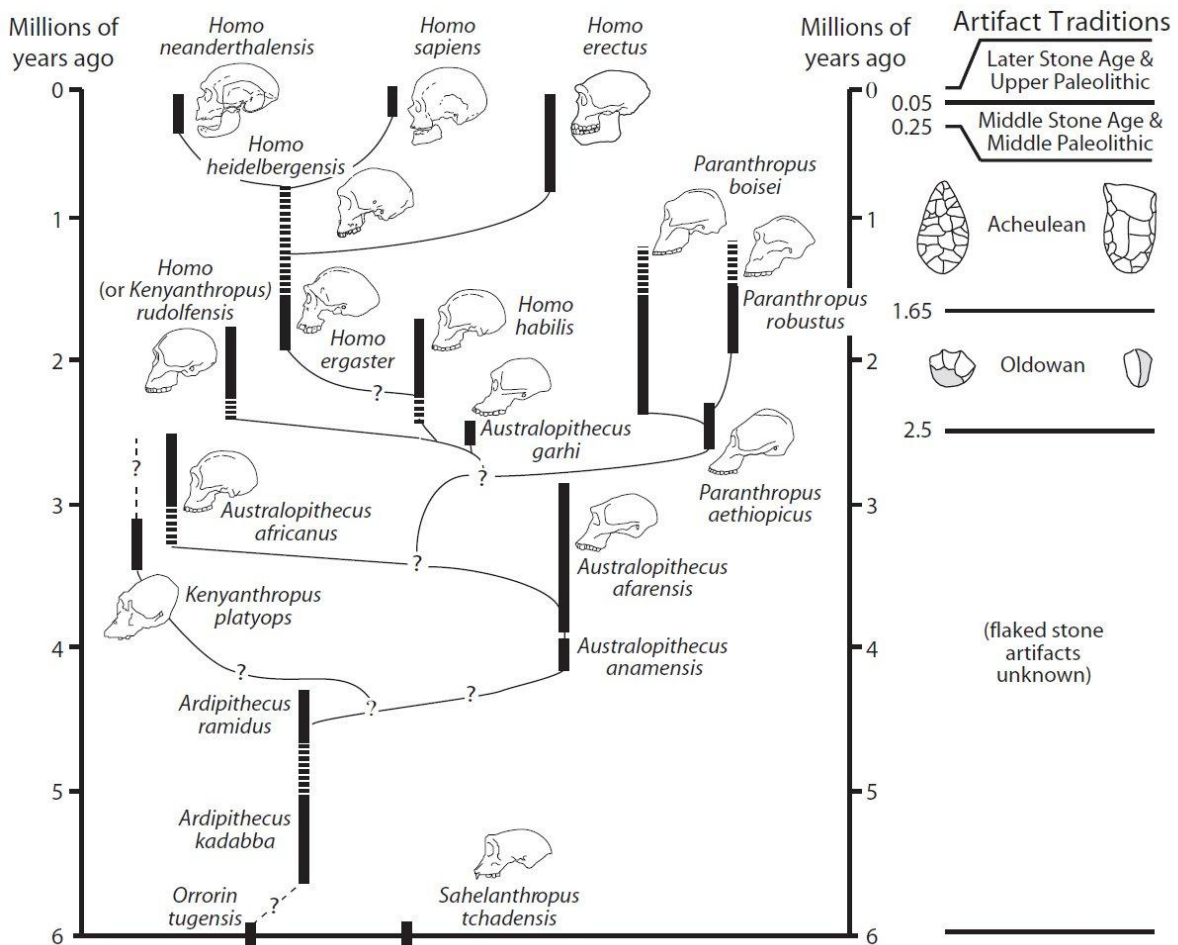
“Taung child” - Taung near Kimberley.

“Mrs Ples” - Sterkfontein caves.

“Little Foot” - Sterkfontein caves.

“Karabo” – Sterkfontein caves

- Next - **Homo habilis**, - 2 to 1.6 million years ago.
- Next - **Homo erectus** - 1.9 to 0.3 million years ago.
- Next - **Homo neanderthalensis**
- Last - **Homo sapiens** species which are considered to be our direct ancestors.



Questions

Question 1

(Adapted from November 2012, NSC, Paper 1, Question 1.3)

Indicate whether each of the statements in COLUMN I applies to A ONLY, B ONLY, BOTH A AND B or NONE of the items in COLUMN II.

COLUMN I	COLUMN II
1.1 Examples of reproductive isolation mechanisms	A: Adaptation to different pollinators B: Breeding at different times
1.2 Fossils found in the Great Rift Valley	A: Nutcracker man B: Taung child
1.3 Supports the 'Out of Africa' hypothesis	A: Y-chromosome mutations B: Migration of <i>Homo erectus</i>
1.4 Characteristics that may be used by scientists to build a phylogenetic tree	A: Similarity of DNA sequencing B: Fossil evidence
1.5 Foramen magnum is towards the back of the skull	A: Human B: Chimpanzee
1.6 Natural Selection	A: Erasmus Darwin B: Lamarck
1.7 Law of Inheritance of modified characteristics	A: Lamarck B: Alfred Wallace
1.8 The epoch in which we are currently living	A: Holocene B: Pleistocene

Question 2

(Adapted from November 2012, NSC, Paper 2, Question 3)

Read the following passage and answer the questions that follow.

Thousands of wildebeest were migrating across the great plains of the Serengeti in Africa. Some of them were large, some small, some strong and some weak. Lions followed the wildebeest, catching and eating the slowest ones. Water was scarce and only the strongest were brave enough to stop to drink from the waterholes.

- a.) Identify ONE phrase in this passage which describes variation among the wildebeest. (1)
- b.) Explain how Darwin's idea of evolution by natural selection can be applied to this passage. (5)

Question 3

(Adapted from November 2012, NSC, Paper 1, Question 4.3)

One of the observations Darwin made during his study of pigeons was about artificial selection. In 1859 Darwin and Wallace jointly proposed that new species could develop by a process of natural selection.

Using examples describe natural and artificial selection and also highlight the differences between these two processes.

Question 4

(Adapted from NSC Mar 2009 Paper 2, Question 2.3)

Describe how speciation occurs when a population becomes separated by a geographical barrier. (8)

Question 5

(Adapted from NSC Nov 2011 Paper 2, Question 3.4)

Describe how sympatric speciation occurs. (5)

Question 6

a.) List features that humans share with primates. (5)

b.) Tabulate five differences between humans and other primates. (11)

Question 7

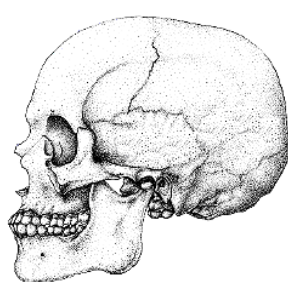
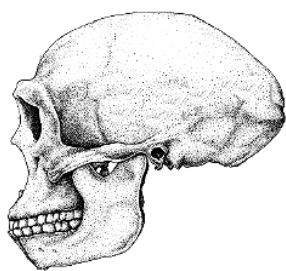
(Adapted from NSC Nov 2011 Paper 2, Question 3.4)

DIAGRAMS A, B and C below illustrate the skulls of *Homo sapiens*, *Homo erectus* and *Pan troglodytes* (chimpanzee). The diagrams are drawn to scale.

A

B

C



a.) Which diagram A,B or C appeared last on earth according to scientists. (1)

b.) Tabulate THREE visible structural differences between DIAGRAM A and DIAGRAM B that illustrate evolutionary trends in human development. (7)

c.) Describe TWO lines of evidence which support the idea that the human population had its origins on the African continent. (4)