

B4 Human Evolution - Fact Sheet

HUMAN EVOLUTION

- 1) The evidence for human evolution is based on **FOSSILS**, including:
 - a) Ardi from 4.4 million years ago
 - b) b Lucy from 3.2 million years ago
 - c) c Leakey's discovery of fossils from 1.6 million years ago
- 2) The change in human brain size is suggested by the **development of stone tools over time**. A larger brain size is needed to make and use tools that are more sophisticated.
- 3) Stone tools were used for skinning animals, butchering meat, making fire, making shelters, farming.

CLASSIFICATION

4) Life on earth used to be classified into five kingdoms: animals, plants, fungi, protists (single-celled organisms **with** nuclei) and prokaryotes (single-celled organisms with cell walls but **without** nuclei e.g. bacteria).

However, **genetic analysis** of life on earth has led to the suggestion of **three domains** rather than the five kingdoms.

5) The three domains are:

- **Bacteria:** cells with no nucleus and no unused sections of genes in their DNA.
- **Archea:** cells with NO nucleus but also some unused sections of genes in their DNA.
- **Eukarya:** cells **with** a nucleus and some unused sections of genes.

SELECTIVE BREEDING is done by humans to breed animals and plants with traits desirable *to us*.

6) Examples of desirable traits in **ANIMALS**:

- More meat (for animals bred for food)
- Higher quality milk (for cows)
- Disease resistant

7) Examples of desirable traits in **PLANTS**:

- Higher yield (amount of useful product)
- Faster growth
- Able to grow in certain climates
- Disease resistant
- Flavour

8) Issues with Selective Breeding

- Loss of genes (alleles) from the gene pool. Only desirable traits are selected, meaning some genes become rare or are lost altogether from a species. Those genes may be useful in the future.
- Animal welfare – Some selectively bred traits cause suffering e.g. some selectively bred chickens produce so much breast meat that they cannot stand up.

GENETIC ENGINEERING

9) Genetic engineering involves **CHANGING THE DNA (or genome)** of an organism to introduce desirable characteristics.

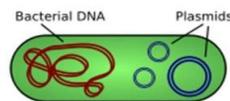
10) Example of a **GMO (genetically modified organism)** – GOLDEN RICE.

Two genes inserted into the DNA of Golden Rice, increase the levels of beta carotene in the rice. This can prevent blindness in poorer countries, where vitamin A can be lacking in the diet. Humans use the beta carotene to make vitamin A, which prevents blindness.

11) GENETIC ENGINEERING STEP-BY-STEP:

- 1) Identify the **desired gene**
- 2) Remove that gene from the first organism's DNA using a **RESTRICTION ENZYME** to create 'sticky ends' or unpaired bases at the ends of the DNA strands.
- 3) Cut open the DNA in another organism using the **same RESTRICTION ENZYME**, to create matching sticky ends.
- 4) Insert the new gene into the second organism's DNA using **LIGASE ENZYMES**.
- 5) The new 'transgenic organism' can be cloned to produce many copies.

12) WHAT ARE PLASMIDS: PLASMIDS are rings of spare DNA inside bacteria. They are useful **VECTORS (carriers)** for inserting the genes into bacteria from other organisms, to make them produce useful substances, such as human insulin.



13) GENETIC ENGINEERING BACTERIA TO MAKE HUMAN INSULIN:

- Identify the gene for human insulin in human DNA.
- Remove that gene from the human DNA using a **RESTRICTION ENZYME** to create 'sticky ends' or unpaired bases at the ends of the DNA strand.
- Cut open a space in the bacterial PLASMID using the **same RESTRICTION ENZYME** again, to create matching sticky ends.
- Insert the insulin gene into the PLASMID DNA using **LIGASE ENZYMES**.
- Allow the bacteria to reproduce rapidly, producing human insulin.

NATURAL SELECTION

Charles Darwin's theory of evolution states that evolution of any species happens by natural selection. Here are the key points:

- Individuals in a species show a **wide range of VARIATION (differences)**
- This variation is because of **differences in genes**.
- Individuals with characteristics most **suited to the environment** are more likely to survive **and reproduce**.
- The successful genes are **passed to the offspring**.
- Given enough time, a species will gradually evolve as all members have the successful genes.