

EVOLUTION- introduction





What is evolution?

Evolution is a process that results in changes in the genetic material of a population over time. Evolution reflects the adaptations of organisms to their changing environments and can result in altered genes, novel traits, and new species.

1. The development of plants, animals, etc. over many thousands of years from simple early forms to more advanced ones.
2. The gradual process of change and development of something.

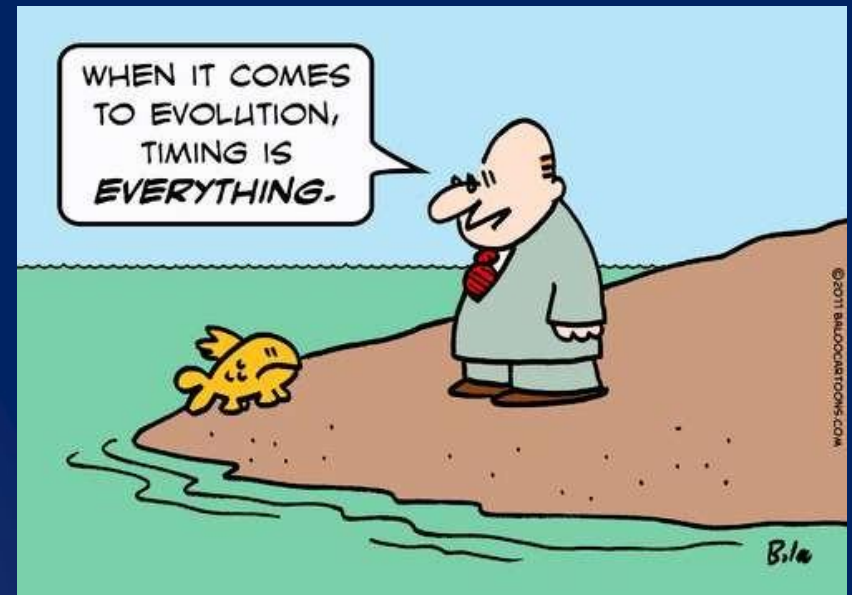
Species on the earth

There are around 8.7 million species of plants and animals in existence on the earth. However, only around 1.2-1.5 million species have been identified so far and described or reported so far, most of which are insects.

Evolution is a process witnessed in living entities wherein gradual changes are observed in the characteristics of species over generations attributed to the process of natural selection. Charles Darwin was the first person who observed the process and formulated the scientific theory of evolution.

What is evolution?

- Explains how modern organisms arose from ancient organisms
- Evolution involves changes in **gene pool** over time
- 5 fingers of evolution:
<https://www.youtube.com/watch?v=5NdMnlt2keE>



Five Fingers of Evolution

There is a five finger option or understanding of the five processes of evolution — small population, non-random mating, mutations, gene flow, adaptation .

This has impacted the evolution (ie. the changes in the gene pool of a population from generation to generation).

Human have 5 fingers

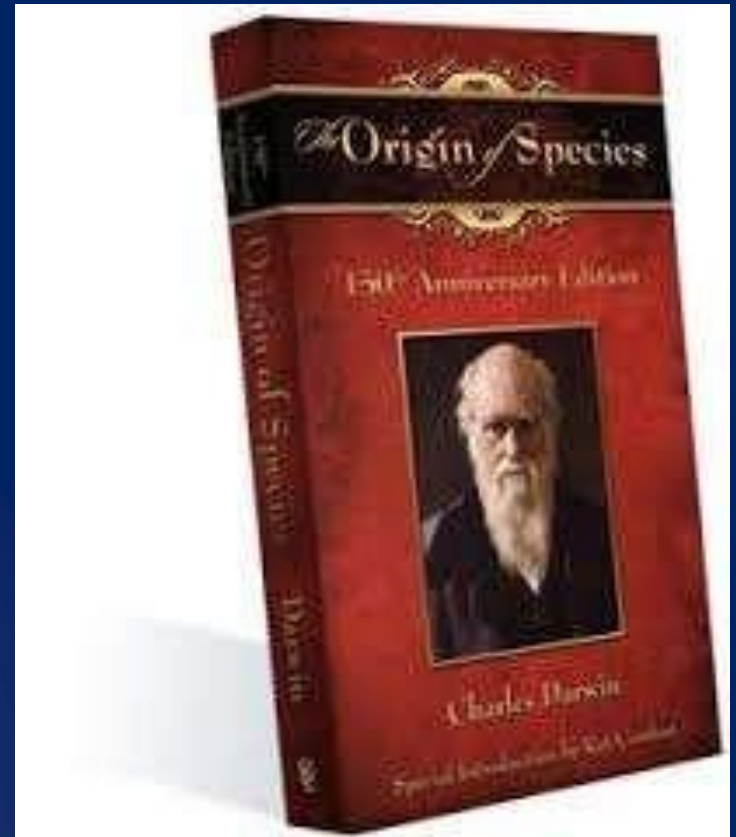
Why did humans evolve with 5 fingers?

About 380 million years ago, quadrupedalism (four limbs) can have six, seven even eight fingers depending on different species. Due to evolution, it has been simplified into a five-finger structure which ensure both the flexibility and the grasping ability. This is the reason why we all have five fingers not six or four.

Quadrupedalism is a form of locomotion where four limbs are used to bear weight and move around. An animal or machine that usually maintains a four-legged posture.

Charles Darwin (and Alfred Wallace)

- Darwin published “The Origin of Species” in 1859.
- His writings helped explain the origins of biodiversity observed on earth
- He coined the term “natural selection” to explain **adaptation**
- https://www.youtube.com/watch?v=6GNUlZhE_jE



ALFRED wallace

Alfred Russel Wallace noted the similarities and differences between nearby species and those separated by natural boundaries in the Amazon and Indonesia. Independently they came to the same conclusion: over generations, natural selection of inherited traits could give rise to new species.

Common Descent

- Darwin proposed that species he observed on the **Galapagos island** had descended from species from the **mainland**



Ecuador - one of the most biodiverse countries in the world

The Galapagos Islands are part of the country of Ecuador, a UNESCO World Heritage site and a renowned National Park. They are situated in the Pacific Ocean about 605 miles (1,000 kilometers) west of northern South America. The islands emerged from the bottom of the sea in the form of **astonishing volcanic upheavals**.

Ecuador is considered **one of the most biodiverse countries** in the world (one of the 17th most diverse), due to the high diversity of their natural species. The country has around 23.056 **taxonomic** species of animals and plants reported, which constitutes the 6.1% of all species reported worldwide.

Descent with modification

The crucial **break** from the concept of constant typological classes or types in biology came with the **theory of evolution through natural selection**, which was formulated by Charles Darwin and Alfred Wallace in terms of **variable populations**. Darwin used the expression "**descent with modification**" rather than "evolution".

Partly influenced by An Essay on the Principle of Population (1798) by Thomas Robert Malthus, Darwin noted that population growth would lead to a "**struggle for existence**" in which favourable variations prevailed as others perished.

In each generation, many offsprings fail to survive to an age of reproduction because of **limited resources**. This could explain the **diversity of plants and animals** from a common ancestry through the working of natural laws in the same way for **all types of organisms**.

What is Selection?

- In **artificial selection**, farmers breed for desirable traits that ensure marketability
- In **natural selection**, environmental factors select for desirable traits that ensure survival



Natural Selection Example

- Before the Industrial Revolution, light-winged **peppered moths** were more common.
- Due to increased pollution, **dark winged** peppered moths became more common



<https://www.youtube.com/watch?v=etsjB-6u-6w>



Artificial Selection

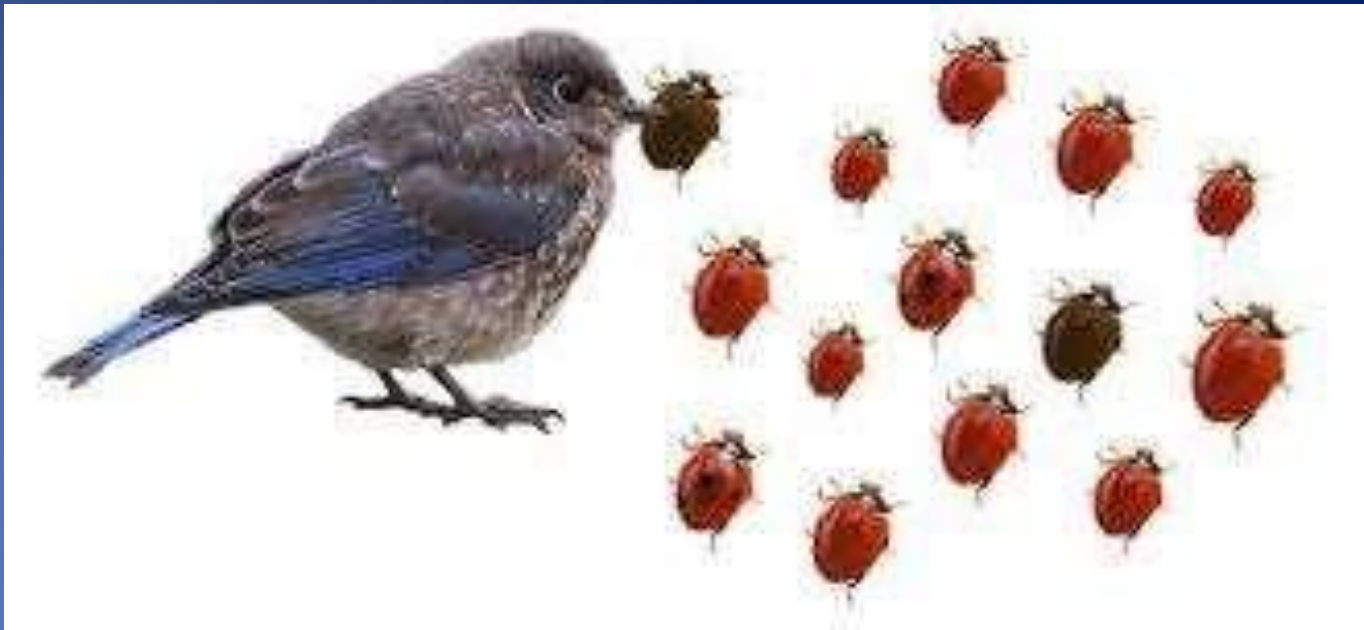
Artificial selection is the identification by humans of desirable traits in plants and animals, and the steps taken to enhance and perpetuate those traits in future generations- Crop plants, Pets , live stocks – increased milk, meat, seeds , fruits etc.

Dogs are domesticated from wolves.

All dogs descended from wolves.

Selective Pressure

- Factors in the environment select FOR or AGAINST a genetic trait
- The greater the selective pressure, the faster evolutionary change occurs



Sexual selection

- For many species, sexual selection is an important selective pressure
- Intra-sexual: males compete against each other to win a mate
- Inter-sexual: females choose a mate based on specific male traits – Weaver Bird, Peacock .



<https://www.youtube.com/watch>

What is Adaptation?

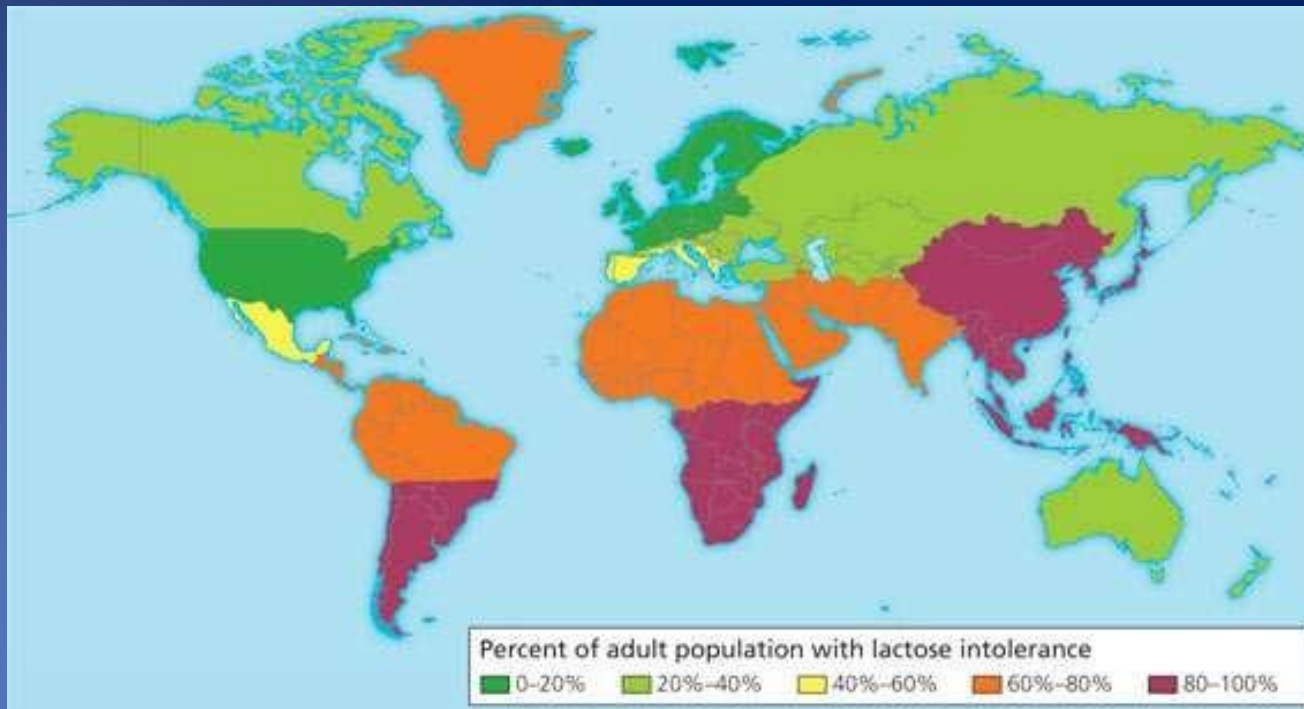
- Adaptation is a process that allows organisms to be better suited to survive in their niche
- Eg. Darwin's finches:

<https://www.youtube.com/watch?v=l25MBq8T77w>



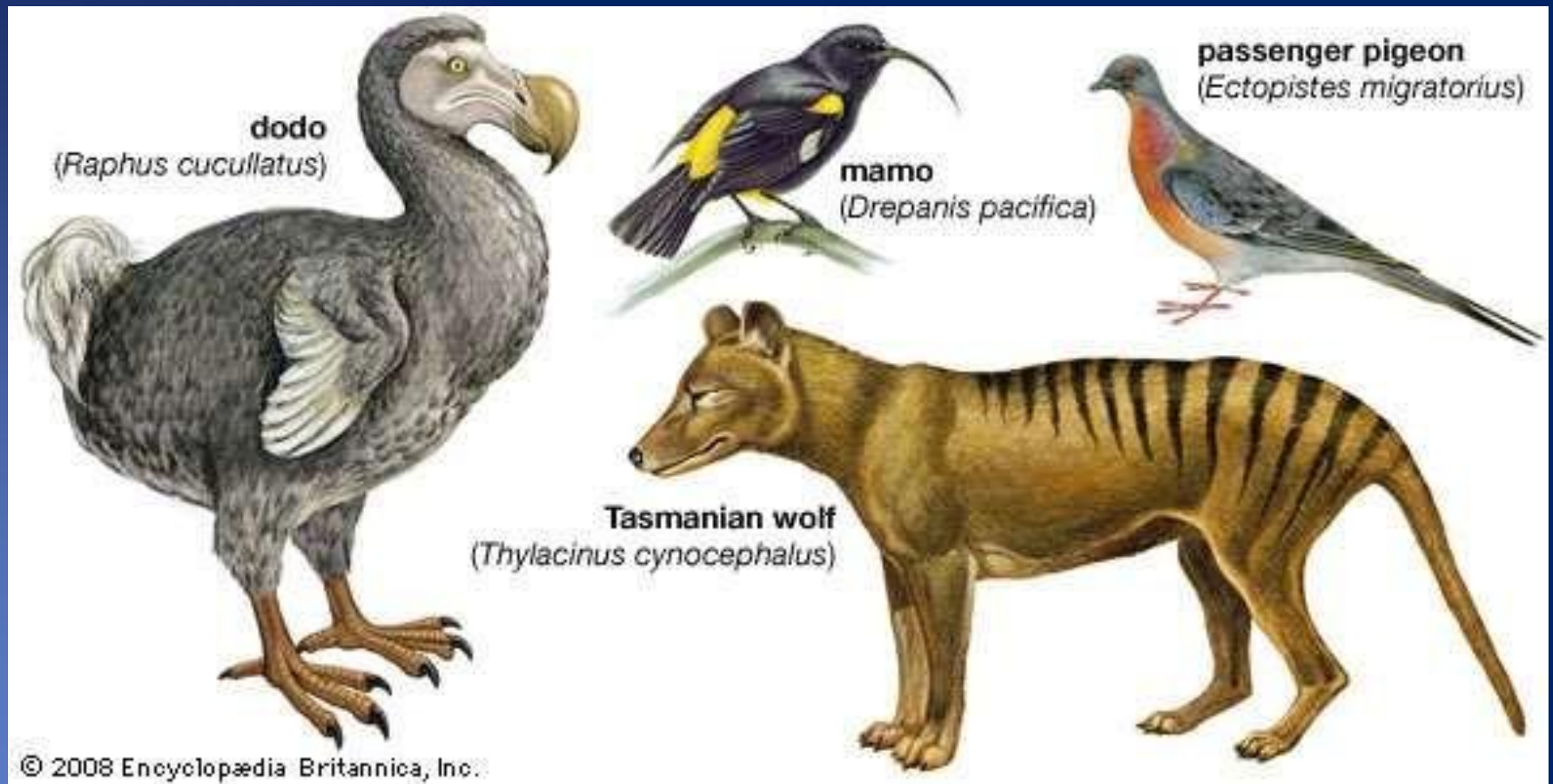
Human lactose

- In general, in regions where dairy farming is prevalent, a greater percentage of the adult population possesses the enzyme, lactase, to break down milk sugars



- The consequence of not adapting in the face of environmental change is EXTINCTION

<https://www.youtube.com/watch?v=jbmvwieuKrU>



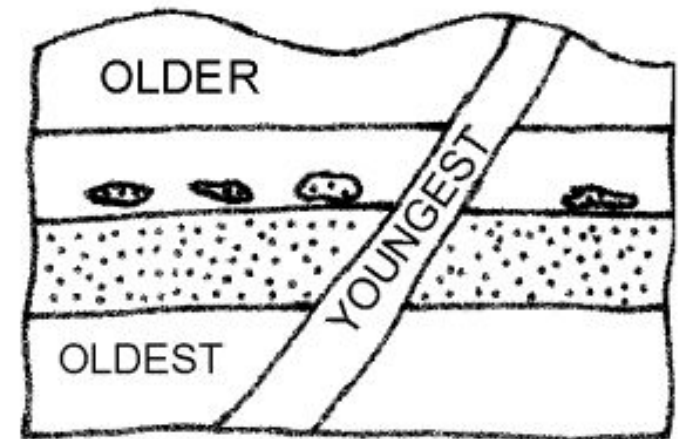
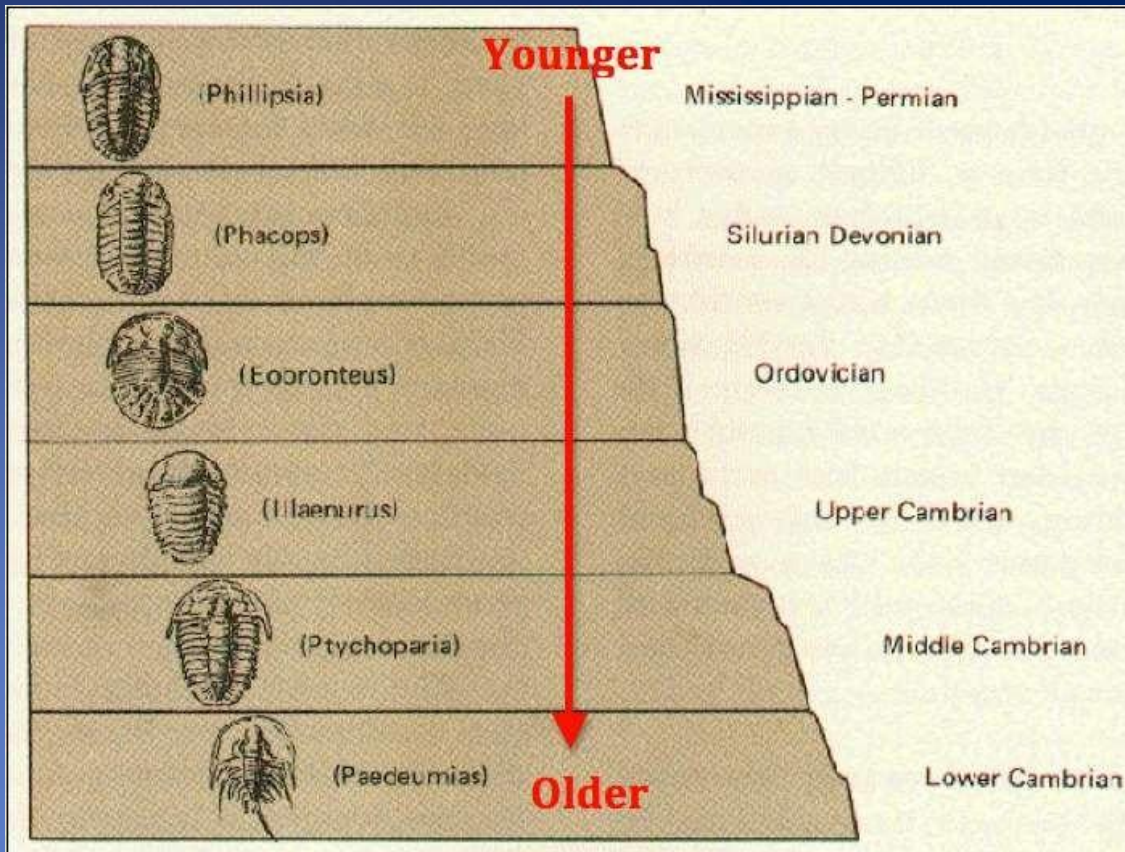
Geologic Time Scale

- **Charles Lyell's** *Principles of Geology* showed that the earth is very old and that geological events have changed the earth's surface
- https://www.youtube.com/watch?v=o_wmulBtWlk



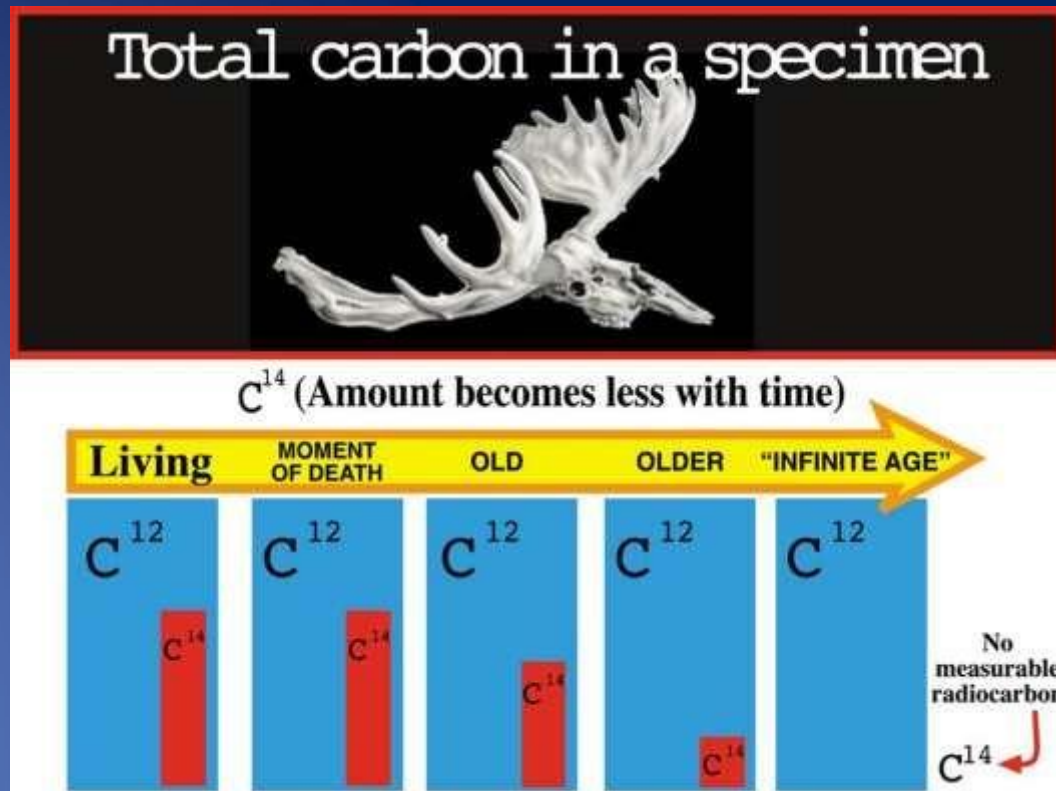
Relative Dating

- Relative dating allows scientists to estimate the age of a fossil based on its position in the rock layers



Radioactive Dating

- By knowing the rate of radioactive decay (half life) of certain elements, scientists can determine the age of fossils



How are fossils formed?

- Dead organisms are embedded in layers of sedimentary rock.
- After a long time of heat and pressure, the sediment hardens and preserves the organisms through petrification- fossils.



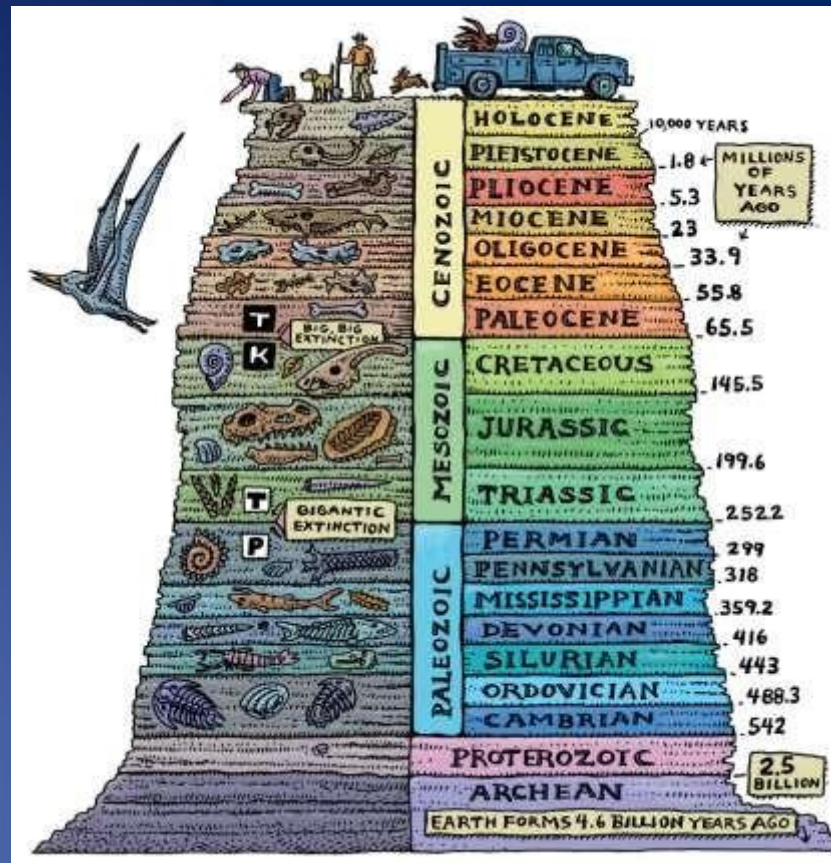
Fossil evidence

- Can be used to construct probable evolutionary histories



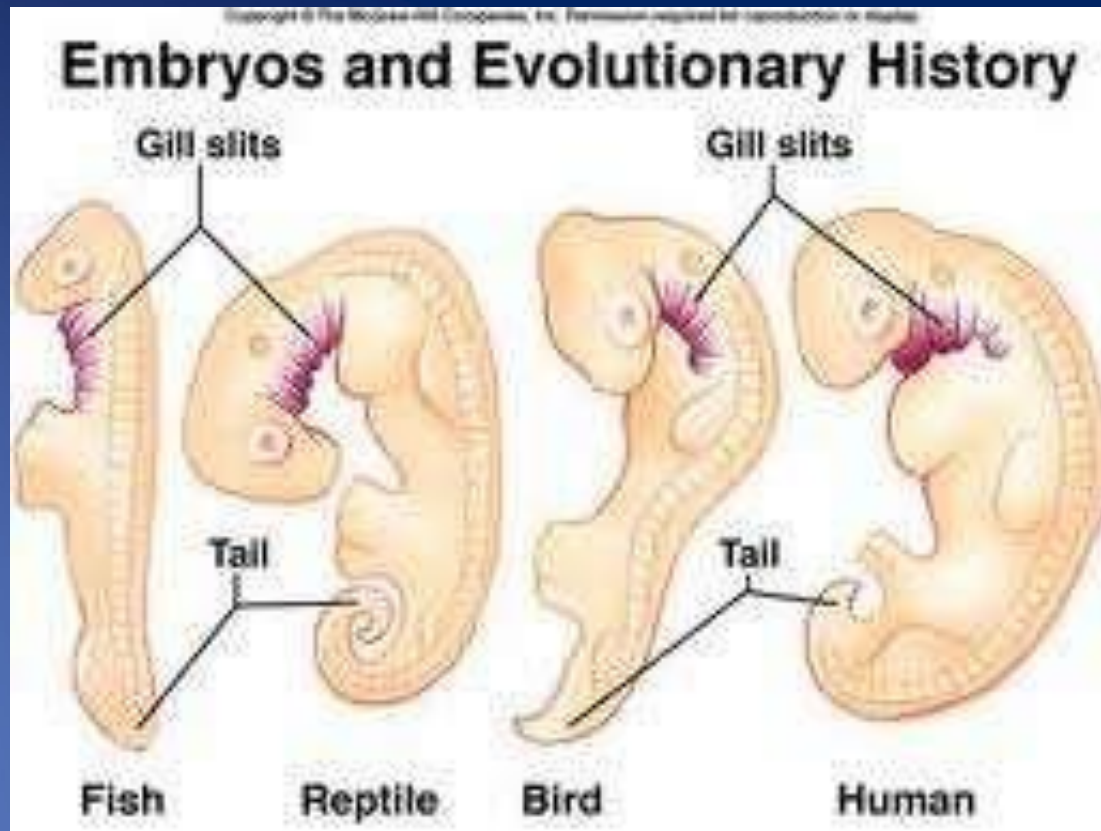
Fossil evidence

- Shows major climatic and geological changes in Earth's history
- <https://www.youtube.com/watch?v=wisslOikrgc>



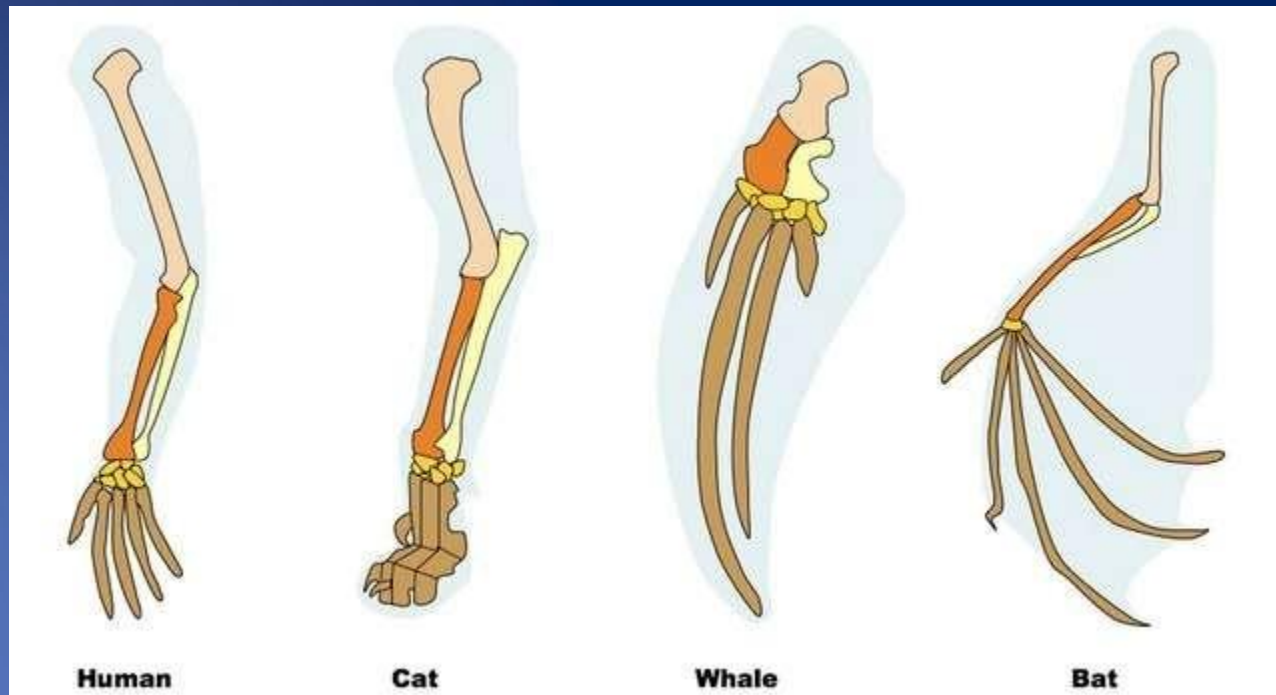
Embryological Evidence

- Many embryos are similar in appearance during the early stages of development, suggesting that similar genes are at work



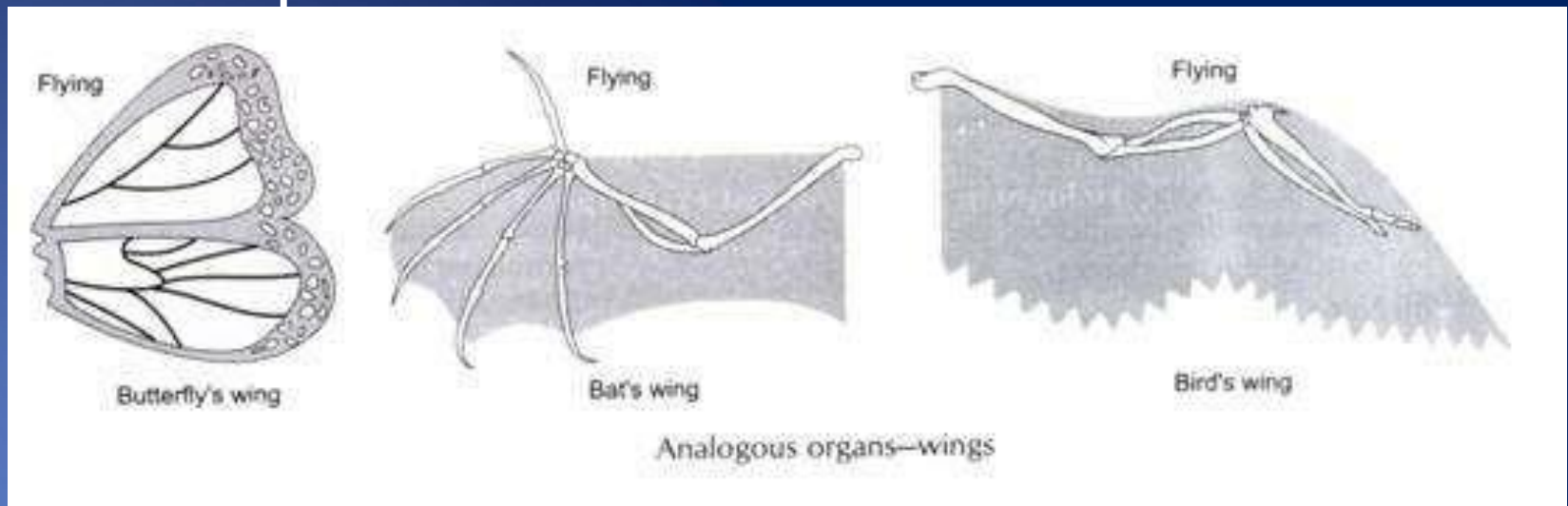
Homologous Structures

- Body parts with **similar internal structure** that **perform different functions** suggest that adaptations have occurred

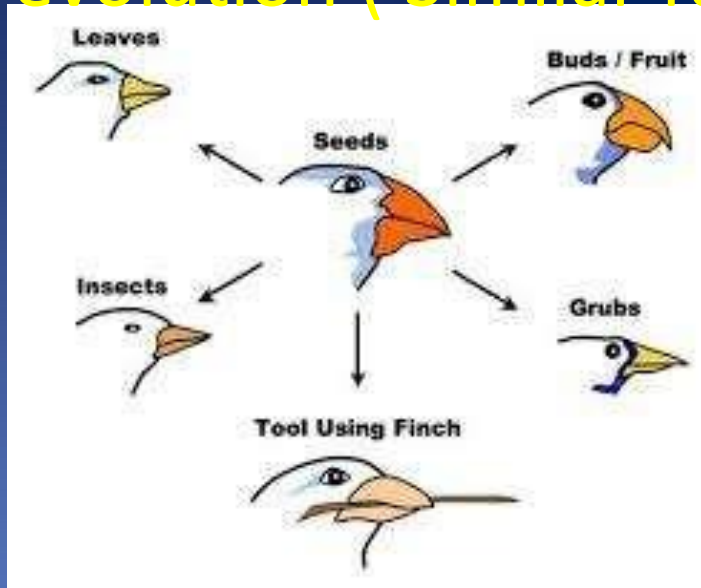


Analogous Structures

- Body parts with **different internal anatomy** that perform the **same function** suggest that the same selective pressure may have been

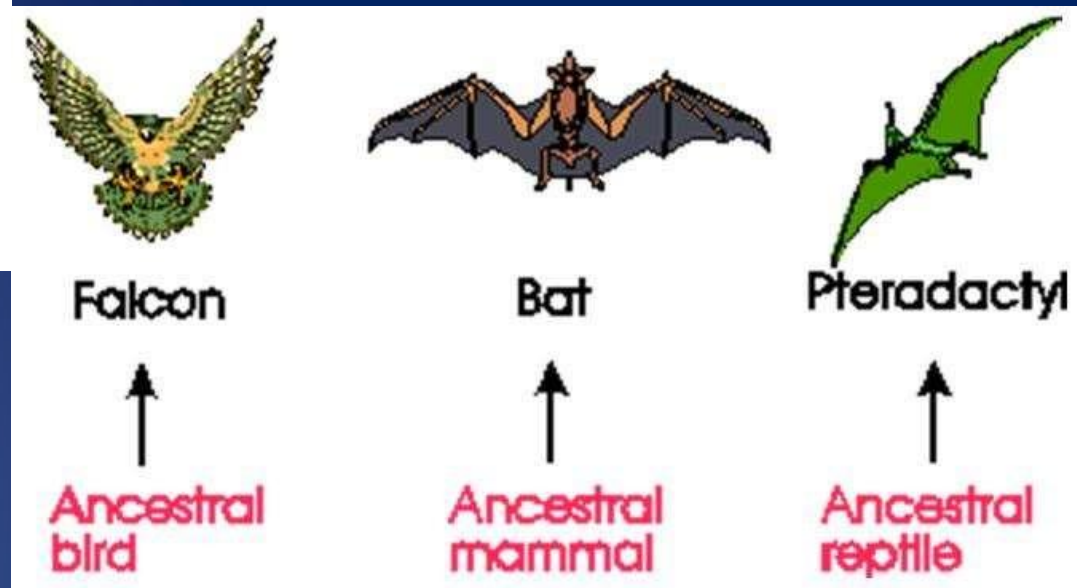


- Homologous structures imply **divergent evolution** (Similar origin but different function).
- Analogous structures imply **convergent evolution** (Similar function but different origin.



Divergent Evolution

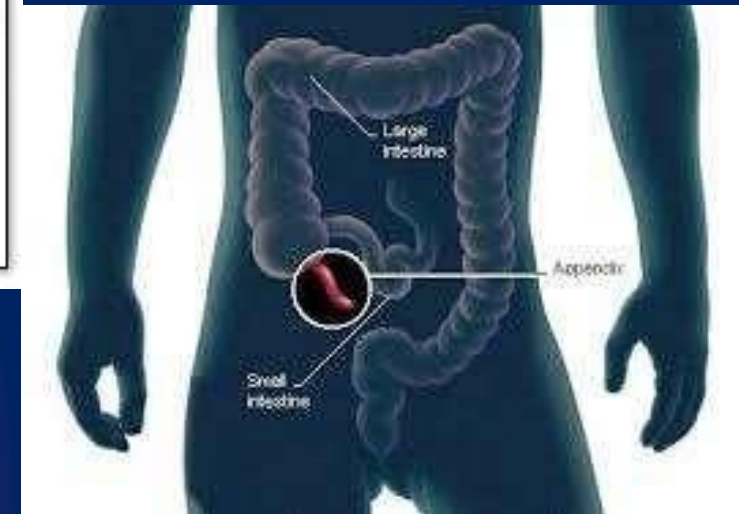
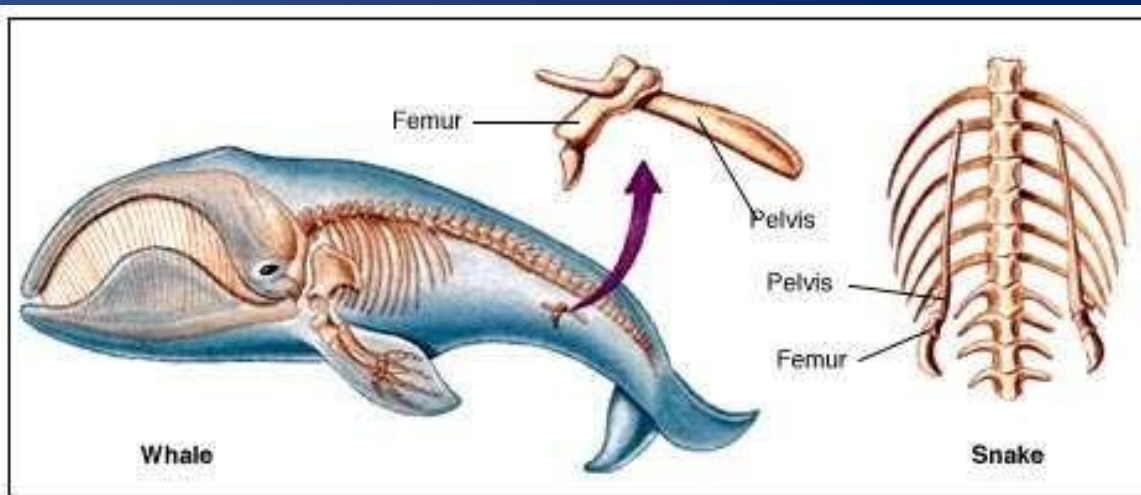
Convergent Evolution



Vestigial (Functionless) Structures

- Structures that are reduced in size or function serve as clues to the organisms' evolutionary history

<https://www.youtube.com/watch?v=OAw3akpRe8>



Human Ancestors

Ardipithicines :

Ardipithecus ramidus is the earliest known genus of the human lineage and the likely ancestor of **Australopithecus**, a group closely related to and often considered ancestral to modern human beings.

Ardipithecus lived between 5.8 million and 4.4 million years ago.



Why and when did human lose their tails

The loss of the tail is inferred to have occurred around 25 million years ago when the hominoid lineage diverged from the ancient Old World monkeys, leaving only 3–5 caudal vertebrae to form the coccyx or tailbone, in modern humans.

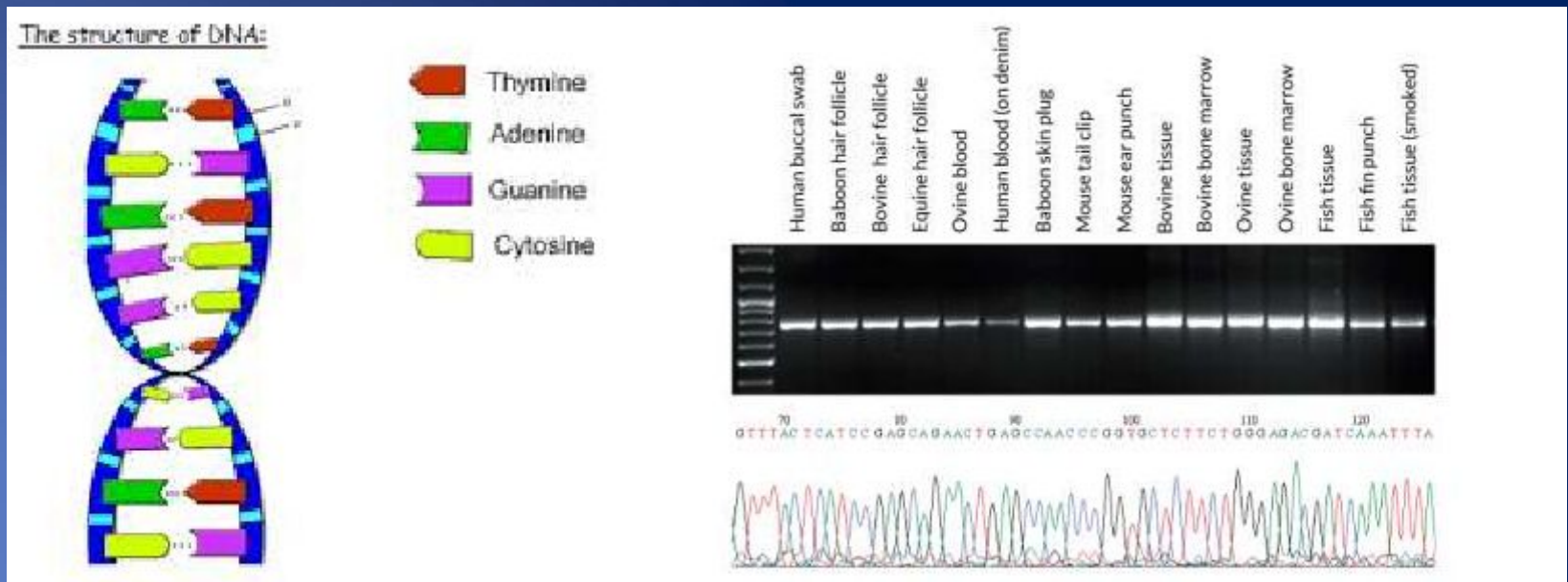
Deoxyribonucleic acid and Ribonucleic acid

DNA is the molecule that carries genetic information for the development and functioning of an organism. DNA is made of two linked strands that wind around each other to resemble a twisted ladder — a shape known as a double helix.

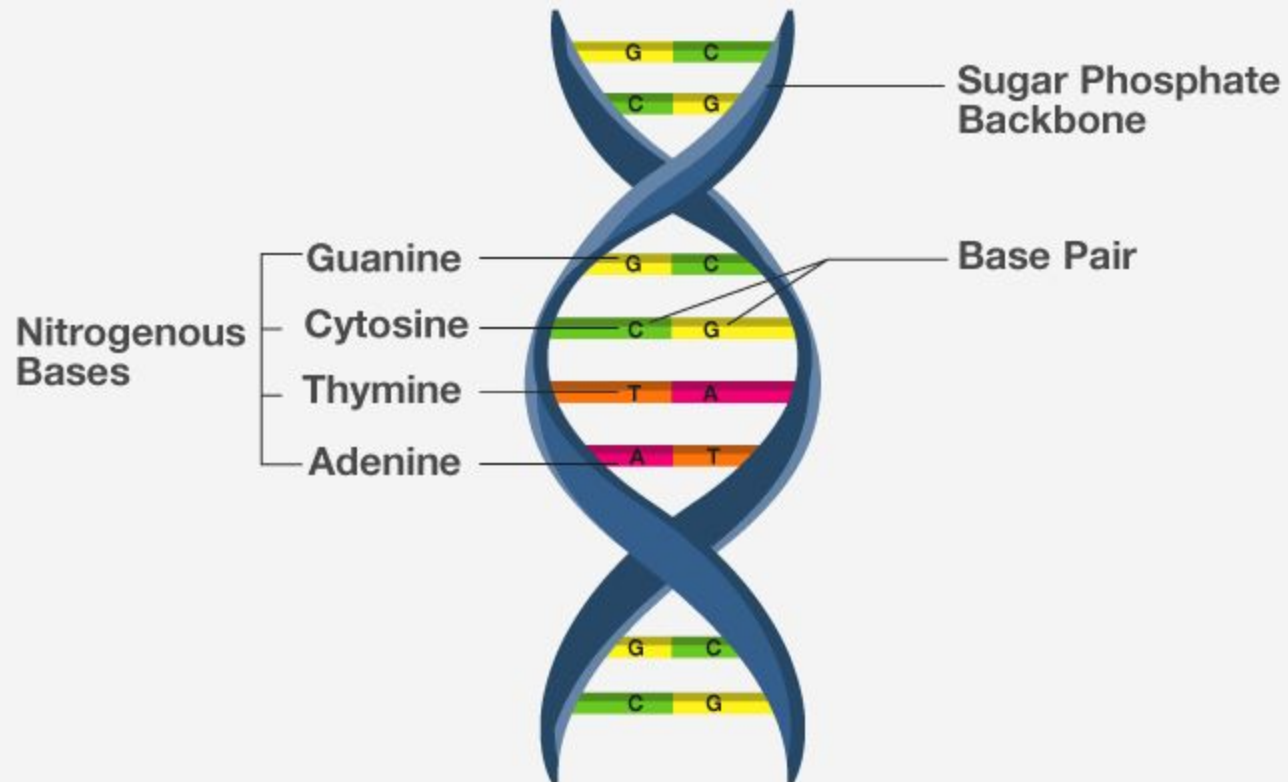
RNA is the molecule that carries genetic information for the development and functioning of an organism. RNA is made of one linked strand that winds around itself to resemble a twisted ladder — a shape known as a double helix.

Biochemical Compounds

- DNA and RNA is the genetic material in all organisms
- Proteins such as Cytochrome c are present in most organisms



DNA STRUCTURE



DNA Mutations and Recombinations led to Evolutionary changes , Natural Selections and Environment also led to the Evolution

https://www.google.com/search?q=video+on+evolution+&sca_esv=bd997e1f421b6b7e&rlz=1C1YUUh_enIN1045IN1045&sxsrf=ADLYWII1Oox6o63f7xs-oDGsToJT6uK2Yw%3A1736663272029&ei=6GCDZ6nAAee64-EPpqypqAw&ved=0ahUKEwip1LHrxu-KAxVn3TgGHSZWCsUQ4dUDCBA&uact=5&oq=video+on+evolution+&gs_lp=Egxnd3Mtd2l6LXNlcjE3ZGVvIG9uIGV2b2x1dGlubiAyBRAAGIAEMgUQABiABDIGEAAAYFhgeMgYQABgWGB4yBhAAGBYHjIGEAAAYFhgeMgYQABgWGB4yBhAAGBYHjIGEAAAYFhgeMgYQABgWGB5ImlhQAFiFU3ABeACQAQCYAawBoAHiFaoBBDAuMTm4AQPIAQD4AQGYAhSgArUWqAIKwglHECMYJxjqAsICBBAjGCFCAgsQABiABBiRAhiKBcICCAAGIAEGLEDGIMBwglIEAAYgAQYsQPCAggQLhiABBixA8ICCAuGIAEGJECGIoFwglKEAAYgAQYQxiKBcICDRAAGIAEGLEDGEMyigXCAGoQABiABBgCGMsBwglIEC4YgAQYxwEYrwHCAgoQABiABBgUGlCmAMH8QVNtqrdd5e6tJIHBDEuMTmgB4i4AQ&sclnt=gws-wiz-serp#fpstate=ive&vld=cid:f44b6587,vid:aMQxfUO1eN0,st:0

Why didn't the dinosaurs evolve into intelligent beings like humans did?

All creatures today are just as “evolved” as each other. Humans and dinosaurs had a common ancestor. Humans and all life has been evolving since the first single celled creature. Some have different adaptations though. Necessity is the mother pf inventions.

Dinosaurs could not develop technologies probably the environment did not exist for the requirement of the same. Their genes were not as evolved as those of human beings today?

However there is little evidence about the lives of dinosaurs today?

You may answer this as an Assignment – Little discussion but no submission of Assignment.