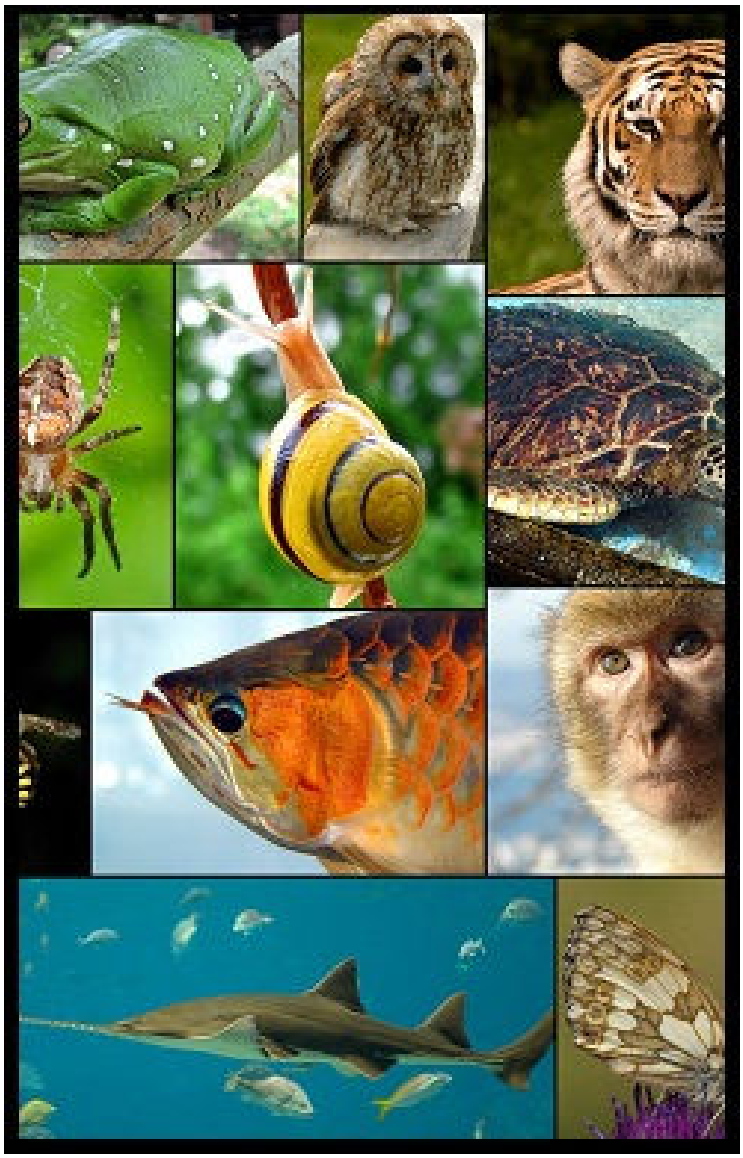
Chapter (5) Biological Evolution

Lesson (1)
Origin of living organisms and mechanisms of their evolution



The origin of life on earth is still unknown till now, scientists have two opinions about the origin of life

1st opinion: *Organic compounds from which life originated came to the earth from space*

2nd opinion: *Life originated on the earth, the first organisms to appear were bacteria, and the last to appear were humans*

Life Origin Theories

Special creation theory

→ *It states that all different living organisms were created in their present forms and no changes occurred to them over time.*

Spontaneous generation theory

→ *It states that living organisms may be created spontaneously from non living matter, such as the erroneous belief that mice originated from dirty hay*

The theory of universal origin of life

→ *It states that life reached to the earth in the form of bacteria from celestial bodies (meteors, meteorites….etc). Which means that life began from space*

The theory of earth origin of life *(the most scientific theory)*

→ *It states that life originated from earth due to the chemical reactions between some substances which were common on earth (Methane, Hydrogen, Water, Ammonia, Carbon monoxide), these reactions were very slow and complex*

→ *In 1953, Scientists Urey and Miller succeeded in changing Methane (CH_4), Hydrogen (H_2), Ammonia (NH_3), Water (H_2O) and carbon monoxide (CO) into amino acids, the building units of proteins, with the help of high electric charges for long time periods. They received Nobel Prize for this*

Evolution

Evolution: *The gradual and slow change in the characteristics of living organisms over long time periods*

→ *The supporters of evolution theory see that the idea of biological evolution depends on the following points:-*

1- Each kind of living organisms originated from more primitive and less structured organism which existed before it

2- Permanent changes occur to the shape, structures and functions of organisms

3- The changes occurring to living organisms are very small, but over centuries they accumulate causing big differences which result in the creation of different Living organisms

4- The number of living organisms is variant, as all living organisms didn't appear at the same time. But they appeared gradually and evolved till they became in their present forms

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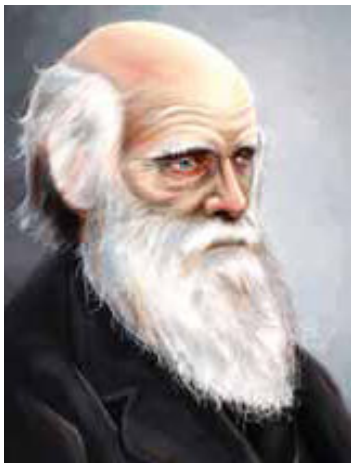
Philosophers and the origin of life

Thales: *Living organisms originated from water*
Alexander: *Living organisms originated from mixture of sun and water*
Aristotle: *He believed in the idea of the gradual change from the simple to the complex (from the incomplete to the complete)*

Mechanisms of evolution

1- Natural selection



→ *British scientist* ***Charles Darwin*** *(1809 – 1882) began his historical trip around the world in 1831, which ended in 1836 (after five years). He noticed the differences between the living organisms he found on some islands, especially those on* ***Galapagos Island.***

→ *Darwin noticed that birds have different shapes of beaks due to the adaptation of every species with the kind of food it eats and the evolution of beaks by natural selection*

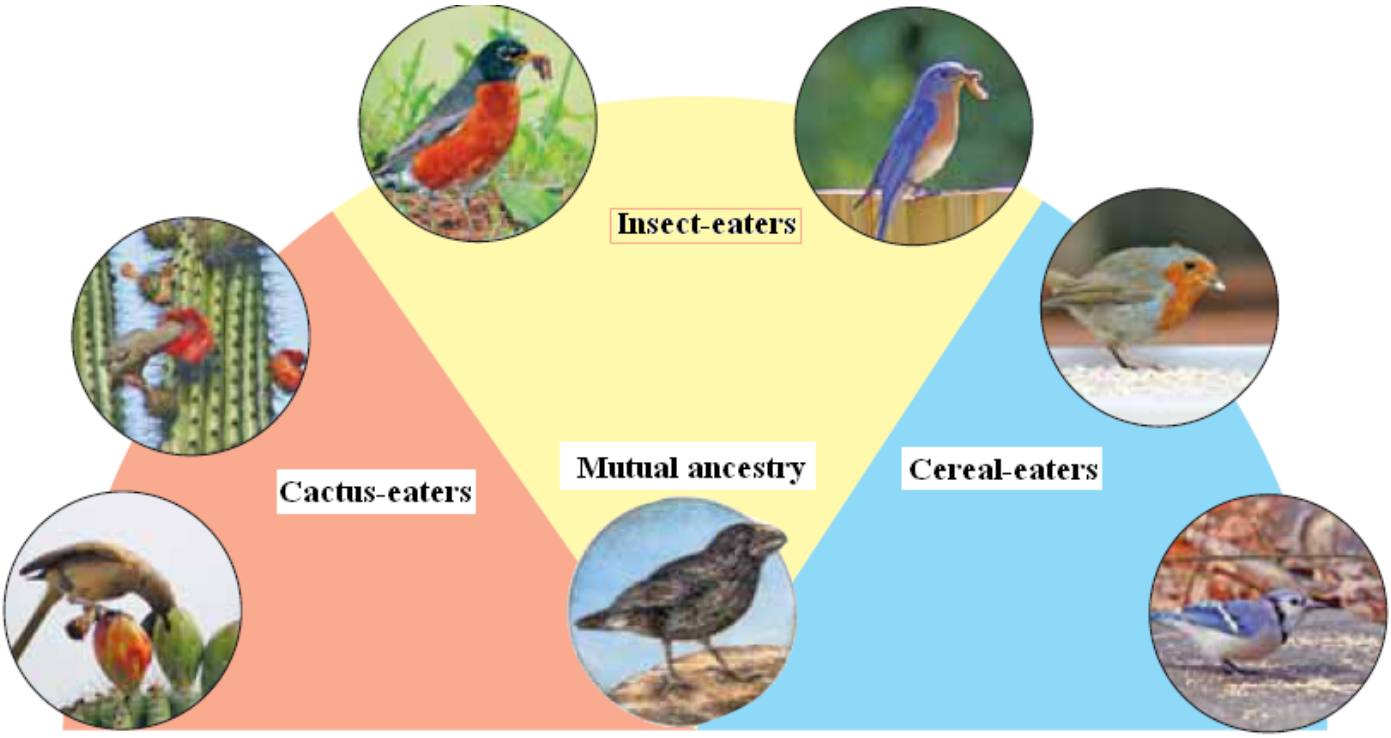


Fig. (1) Natural selection and beaks of birds, each kind has different shape

Bird	***Beak shape***	***Kind of suitable food***
Vulture	*Hooked*	*Meat*
Duck	*Broad and flat*	*Grass - vegetables*
Pigeons	*Short and pointed forward*	*Seeds*
Cattle egret	*Long*	*Insects*

Fig. (2) Cattle egret

Fig. (3) Pigeon

Fig. (4) Duck

Fig. (5) Vulture

Explanation of natural selection

→ *Living organisms face extreme conditions which lead to their death. So, weak organisms which cannot face these conditions die. When weak organisms die, their characteristics cannot be inherited at all. On the other hand, strong organisms which could overcome the extreme conditions by their characteristics go on living and give these characteristics to their offspring. Over the time, strong characteristics accumulate forming new organisms.*

→ ***Sexual selection*** *works on increasing the occurrence of natural selection, where the stronger and more suitable males and females mate. So, good characteristics are inherited to the offspring. Weak characteristics disappear because living organisms do not tend to mate with weak individuals*

Artificial selection

→ *Darwin carried out an experiment on pigeons, he concluded that we can increase or limit a certain characteristic in living organisms. We can do so by determining the mating couples*

→ *Darwin observed that artificial selection gives the same results of natural election, but it needs more time*

Fig. (6) Frisian cow race

→ *Artificial selection caused the appearance of new animal races such as* ***Frisian cow***

A shepherd cross different races of animals in order to accumulate the good characteristics of different races together, which produces a new race causing the evolution of living organisms by artificial selection

→ *Artificial selection is directed, while natural selection is directed by nothing but nature factors*

Natural selection: *Selecting organisms which are most adapted to environmental conditions due to the accumulation of inherited traits, which help them survive and go on living*

2- Struggle between living organisms

→ *Struggle between the individuals of the same or different species works on increasing the chances of natural selection occurrence*

→ *Struggle between living organisms for of food and shelter is called environmental selection, while the struggle for mating is called sexual selection*

3- Mutation

Mutation: *Sudden change in the hereditary material of a living organism which causes the change of hereditary trait*

→ *Most evolution scientists see that natural selection is not enough for the occurrence of evolution, sometimes mutations work on changing the hereditary traits, which causes the appearance of new traits.*

→ *Mutation may be positive or negative. Mutations cause the occurrence of genetic variation required for the occurrence of evolution*

→ *Mutations which occur to some kinds of microbes, which increase their resistance to antibiotics, is an example on mutations causing evolutionary change*

→ *Mutations cause the creation of new genetically modified organisms. Natural Selection selects the best of these mutations and works on its survival and continuity and eliminates harmful mutations. In other words, natural selection 'sieves' living organisms which carry these mutations*

4- Population genetics

→ *Population is a group of living organisms of a certain species living in a certain place which inbreed randomly*

→ *The genes of a population individuals represent the genetic content of the population.*

→ *We can calculate the rate of genes distribution in the genetic content of the population by counting the number of phenotypes of a certain trait, and determining the kind of gene (recessive – dominant)*

→ *Scientists **Hardy** and **Weinberg** stated that there is a tendency for the rate of gene distribution to remain constant in a population from one generation to another. The same tendency applies to the phenotypes and genotypes of this genes. In other words, there is a tendency towards a state of genetic equilibrium in the population, that keeps its existence and keeps it genetic characteristics constant*

***Hardy- Weinberg law:** The rate of gene distribution remains constant in a population from one generation to another and the same applies to the genotypes and phenotypes of this gene*

Conditions that keep the genetic equilibrium in the population:-

1- The population must be large in size so that all genetic characteristics are represented
2- All the population individuals should be of the same species
3- Mating between individuals should be random, so that mating won't be in favour of a certain characteristic
4- Genetic characteristics should not be subjected to natural selection, which increases or decreases its spread in population according to the environment
5- Individuals of other populations should not migrate to the population and vice versa
6- Mutations should not occur
7- Parents of each species should produce equal number of offspring

*If one of the previous conditions is not fulfilled, the genetic equilibrium will be disturbed and go in a new direction called **genetic drift.** Which leads to the evolution of population*

***Genetic drift:** Evolution which occurs to the population due to the occurrence of disorder in one or more conditions of genetic equilibrium*

5- Variation

Variation of genetic characteristics helps in the adaptation with different environmental conditions, and its continuity.

Causes of variation

*1- **Sexual reproduction:** It occurs by genetically-different gametes*
2- The abundance of genetic characteristics of the individuals of same species
*3- **Genes interaction:** Which makes genes affect each other*

4- The occurrence of crossing over during Meiotic cell division which works on the variation of gametes

5- The influence of different environmental conditions on the appearance of some genetic characteristics

6- The occurrence of chromosomal or genetic mutations

7- Adaptation

Adaptation: *The compatibility of any structure inside an organism's body to its function*

Living organisms have genetic characteristics which make able to be adapted to the environment they live in and helps in continuity and reproduction

Examples: *Gills in fish – Wings in birds*

8- Isolation and the creation of new living organisms species

→ *Scientists see that the formation of new species of living organisms depends on isolating them from their group, and preventing them from mating with individuals of the population. Which is known as* ***Reproductive Isolation***

→ *Reproductive isolation causes disorder in genetic equilibrium and the occurrence of genetic drift; which leads to the appearance of new species*

Causes of reproductive isolation

Geographical isolation which occurs due to the existence of geographical barriers (Mountains, seas…etc), which prevents the mating of individuals of the same species

9- Extinction of small groups

Extinction: *The gradual decrease of the individuals of a certain species, which leads to its disappearance*

Causes of extinction

1- The struggle of species for limited resources , which is called ***competitive exclusion,*** *which makes a certain species surpass another one causing the extinction of that weak species*

2- The occurrence of climate changes which are harmful to living organisms, such as drought which causes the extinction of many plants. So, animals which feed on these plants becomes extinct or endangered

3- The struggle of new species with original species

4- The collision of celestial bodies with earth (it is one of the assumptions which explained the extinction of huge reptiles like dinosaurs 62 million years ago)

5- Human activities such as overcutting of trees, overhunting of animals, dehydration of water surfaces and environmental pollution

The effect of extinction of biological equilibrium

Extinction causes disorder in ecosystem, as the constancy of biological equilibrium of any ecosystem is linked to the diversity of the species living in it. When the number of species decreases, the equilibrium decreases and vice versa

Definitions of lesson (1)

Evolution: *The gradual and slow change in the characteristics of living organisms over long time periods*

Natural selection: *Selecting organisms which are most adapted to environmental conditions due to the accumulation of inherited traits, which help them survive and go on living.*

Mutation: *Sudden change in the hereditary material which causes the change of hereditary trait*

Hardy- Weinberg law: *The rate of gene distribution remains constant in a population from one generation to another and the same is applied to the genotypes and phenotypes of this gene*

Genetic drift: *Evolution which occurs to the population due to the occurrence of disorder in one or more conditions of genetic equilibrium*

Adaptation: *The compatibility of any structure inside an organism's body to its function*

Extinction: *The gradual decrease of the individuals of a certain species, which leads to its disappearance*

Give reasons for

1- Urey and Miller experiment made scientists support the theory of earth origin of life

Because Urey and Miller could change ammonia, carbon monoxide, water and hydrogen into amino acids (the building units of proteins) with help of high electric charges. This experiment supported earth origin of life theory (which states that life originated from the reaction of substances on earth with each other over long time)

2- Birds have different beak shapes

Due to the adaptation of every species with the kind of food it eats, and the evolution of beaks by natural selection

3- Artificial selection is different from natural selection

Because artificial selection is directed, while natural selection is directed by nothing but nature factor

4- Sexual selection is different from environmental selection

Because sexual selection is the struggle of species for mating, while environmental selection is the struggle of species for food and shelter

5- Mutations play an important role in biological evolution

Because they cause changes in hereditary material, which causes the appearance of new hereditary traits and hence evolution

6- The type of antibiotics used for treatment should be changed every certain period of time

Because mutations occur to microbes which increases their resistance to antibiotics, so we should change the type of antibiotic so that the microbes could not resist it.

6- The occurrence of genetic drift

Due to the occurrence of disorder in one or more conditions of genetic equilibrium

7- The variation of living organisms

Due to:-

1- Sexual reproduction: It occurs by genetically-different gametes

2- The abundance of genetic characteristics of the individuals of same species

3- Genes interaction: Which makes genes affect each other

4- The occurrence of crossing over during Meiotic cell division which works on the variation of gametes

5- The influence of different environmental conditions on the appearance of some genetic characteristics

6- The occurrence of chromosomal or genetic mutations

8- The extinction of some living organisms

- The struggle of species for limited resources

2- The occurrence of climate changes which are harmful to living organisms

3- The struggle of new species with original species

4- The collision of celestial bodies with earth (it is one of the assumptions which explained the extinction of huge reptiles like dinosaurs 62 million years ago)

5- Human activities such as overcutting of trees, overhunting of animals, dehydration of water surfaces and environmental pollution

9- The sudden disappearance of dinosaurs

Because a celestial body hit the earth 62 million years ago, which lead to the change of climate conditions and hence the extinction of dinosaurs

10- Competitive exclusion is from the major causes of extinction

Because the struggle between species for survival makes a certain species surpass another one, causing the extinction of that weak species

What happens when

1- The immigration of living organisms carrying certain characteristics to another population

This causes disorder in the genetic equilibrium of the population, which causes the occurrence of genetic drift and hence evolution

2- The occurrence of climate changes which are harmful to living organisms

This will cause the extinction of these organisms, or make them endangered

3- The occurrence of geographical isolation between the individuals of the same species

This will prevent individuals of the same species from mating. So, they tend to mate with other animals causing the formation of new organisms with different traits (evolution)

Questions

<u>1- Choose the correct answer</u>

1- The theory which states that life originated due to the occurrence of chemical reactions between some substances is

A- Special creation theory B- Spontaneous generation theory
C- The universal origin of life D- Earth origin of life

2- Urey and Miller changed hydrogen, water, methane and ammonia into……

A- Monosaccharides B- Disaccharides C- Amino acids D- Lipids

3- Microbe acquire the ability to resist antibiotics due to the occurrence of ……

A- Isolation B- Mutation C- Evolution D- Adaptation

4- Beaks of Galapagos birds evolved due to …..

A- Mutations B- sexual selection C- Environmental selection D- isolation

5- Which one of the following conditions aren't from genetic equilibrium conditions?

A- Individuals of population should not migrate
B- Mating should be random
C- The occurrence of mutations
D- The size of population should be large

2- Write short notes about

1- Spontaneous generation theory
2- Mutation
3- Hardy- Weinberg law

3- Compare between

1- Universal origin of life and earth origin of life theories
2- Sexual and environmental selections

Answers

1- Choose the correct answer

1- Earth origin of life
2- Amino acids
3- Mutations
4- Natural selection
5- The occurrence of mutations

2- Write short notes about

1- This theory states that living organisms may be created spontaneously from non living matter, such as the erroneous belief that mice originated from dirty hay

2- Mutation is the sudden change in the hereditary material which causes the change of hereditary traits of living organisms. It sometimes causes evolution

3- This law states that rate of gene distribution remains constant in a population from one generation to another and the same is applied to the genotypes and phenotypes of this gene.

3- Compare between

Universal origin of life theory	***Earth origin of life theory***
- Life reached to the earth in the form of bacteria from celestial bodies (meteors, meteorites….etc). Which means that life began from space	*Life originated from earth due to vey slow and complex chemical reactions between some substances which were common on earth*

Sexual selection	***Environmental election***
- It is the struggle of living organisms for food and shelter	*- It is the struggle of living organisms for mating*

Lesson (2)
Evidences of the occurrence of evolution

Evidences of evolution occurrence: *Fossils – Taxonomy – Comparative anatomy – Vestigial structures – Physiological resemblance – Stages of fetal growth – Molecular biology*

1- Fossils

Fossils: *The remains or traces of living organisms which lived in old ages and were buried after their death in sedimentary rocks*

Conditions for fossil formation

1- The presence of hard skeletons for living organisms
2- Burial of living organisms in sedimentary rocks right after their death
3- The presence of suitable mineral medium which replaces the organic parts of living organisms

Fig. (7) Fossils

Fossils prove the existence of its living organisms in the past, but fossils of some organisms were not formed because of factors which prevented the occurrence of petrifaction process which are:-
- Lack of water in porous layers of sedimentary rocks, which causes the decay of living organism
- The occurrence of volcanoes and earthquakes, which causes the deformation and breakage of fossils

Index fossil

Index fossil: *Fossil of living organisms on which we depend in the comparison between the layers of sedimentary rocks in order to determine their relative ages*

Index fossil is fossil of living organisms species which lived for a short period of time of geological history of earth and disappeared, this species had a wide geographical spread and lived in many environment.

Importance of fossil study

1- Determination of the geological age of rocks by determining the age of fossils in them
2- Recognizing the landmarks of old environment
3- Proving the evolution of living organisms
4- Comparing between rocks layers by index fossils
5- Drawing old geographical maps: as fossils gave us information about the distribution of water and land in the past

Examples of fossils:-

Original remains of living organisms

→ Fossils may be of a whole organism such as Mammoth fossil. Mammoth is a species of elephants which lived 20,000 years ago in south Europe.

→ Fossils may be of bones or teeth of an organism which died and buried, their soft tissues decayed and their hard parts remained (Ex. Teeth and bones of dinosaurs)

Fig. (8) Fossil of dinosaur bones

Fig. (9) Fossil of mammoth

Petrified remains

→ Such as the petrified forests in Mokattam hills, where silica (silicon dioxide SiO_2) replaced the fibres of trees keeping their original shapes.

Fig. (10) Petrified tree

Moulds, casts and printings

Mould: *Fossil which carries the internal details of the solid skeleton of living organism after its death. (Ex. Ammonite fossil in sedimentary rocks)*

Cast: *Fossil which an organism leaves after its death, which decays in soft rocks (Ex. Cast of tree leaves – Fish bones on rocks)*

Printing: *The shape which an organism leaves on soft rocks in its life. (Ex. Printings of dinosaurs feet on rocks)*

Fig. (11) Ammonite fossil
Mould

Fig. (12) Dinosaur feet
Printing

Fig. (13) Fish fossil
Cast

Fossil Record

Fossil record: *Complete set of fossils which records the evolution of some living organisms during geological ages, such as fossil records of horses and elephants*

Fossil record of horse

→ *Fossil record of horse illustrates that the first ancestries of horse were small-sized and their forelimbs ended with four fingers and a printing of fifth finger, and their hind-limbs ended with three fingers and printing of fourth finger*

→ *They evolved over time and their size increased, their limbs had three fingers, the middle finger is the longest of them*

→ *Evolution went on and limbs ended with one finger with two small fingers (which do not touch the ground) on both of its sides*

Fig. (14) Evolution of horse

Intermediate fossil

Intermediate fossil: *Fossil which has the characteristics of two consecutive classes*

Example: *Archaeopteryx fossil (intermediate link between birds and reptiles)*

→ *Archaeopteryx fossil has many characteristics of birds, such as the existence of feather, wings and beaks*

→ *Archaeopteryx fossil has also some characteristics of reptiles, such as the existence of teeth in the beak, bony vertebrae in tail and claws in wings*

Fig. (15) Archaeopteryx

2- Taxonomy

→ *We studied in last chapter that living organisms are ordered in phyla from the simple to complex organisms. Development is graduated from one phylum to another. We can say that the arrangement of living organisms is like a tree, which begins from the simple to complex. This lead to the discovery of gaps in living organisms arrangement*

→ *Scientists closed these gaps by putting some extinct organisms (intermediate fossils) and modern organisms in the living organisms arrangement, such as:-*

Archaeopteryx: *Closed the gap between reptiles and birds*

Lung fish: *Closed the gap between fish and Amphibia, as lung fish breathe in water by gills, and breath in case of drought by a structure resembling simple lungs*

Cladogram (Evolution tree)

→ *It describes the relation between different species and groups of living organisms*

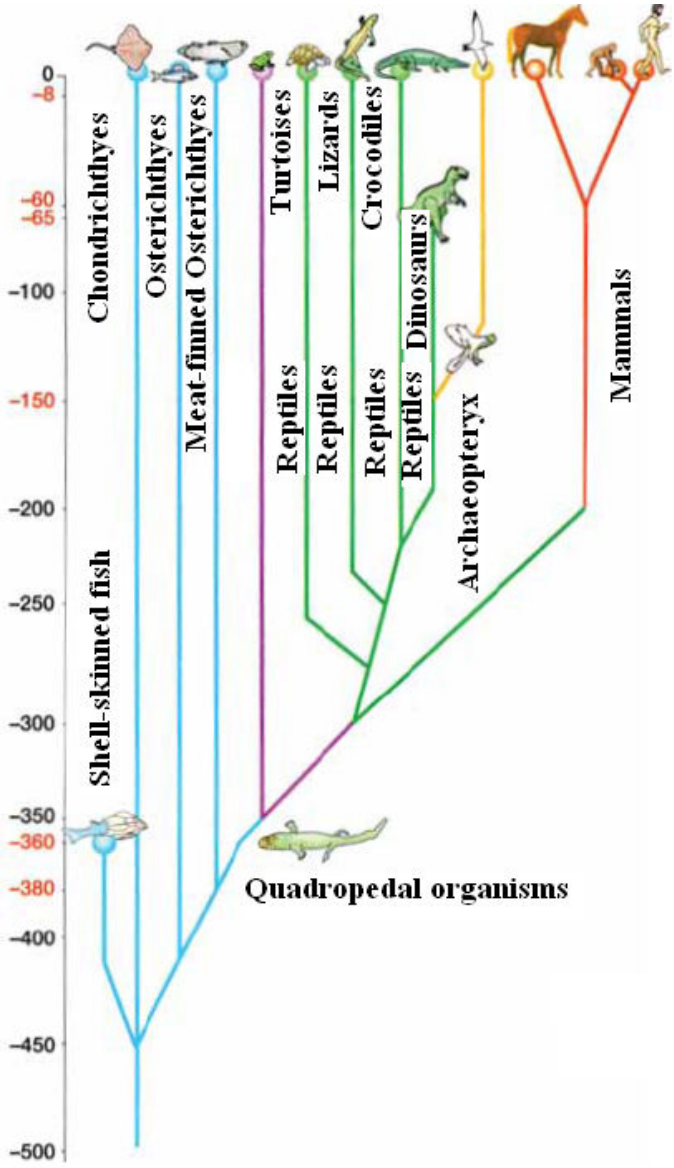


Fig. (16) Evolution tree of vertebrates

From the previous Cladogram we conclude that:-
- The ancestry of living organisms (Quadropedal organisms) appeared 360 million years ago
- All the groups of the Cladogram have vertebral column

→ Cladogram summarizes the relation between species and consecutive groups, beginning from mutual ancestries. It allows us determine the degree of similarity between different species

3- Comparative anatomy

There are similarities and differences between living organisms, which are used in classification. Animals are classified into vertebrates and invertebrates according to the presence of vertebral column

→ Vertebrates are similar in the existence of skull containing the brain, and the existence of blood cells carrying hemoglobin

→ Limbs of vertebrates are similar in structure, but they have different shapes to suit the function

The similarity in vertebrates structure proved that they are descended from common origin

4- Vestigial structures

The proof on the evolution of vertebrates from common origin is that there are organs which used to perform necessary functions in old ancestries. When they became useless, they disappeared or diminished.

Examples of vestigial structures:-

1- Appendix: *A part of large intestine which secretes enzymes to digest cellulose in plants. So, it doesn't exist in carnivorous animals (lions), it is large in herbivorous (rabbits)and diminished in human, it is thought that it was large in old human who used to eat plants*

2- Muscles that move ears: *large in most mammals (Ex. dogs – horses) and diminished in human*

3- Coccyx vertebrae: *They are vertebrae with which vertebral column ends, they form the tails of lot of animals. They are diminished in human*

4- Third eyelid (nictitating membrane): *A transparent membrane which appears obviously in the eyes of birds and reptiles to protect them from sands carried by the wind. This eyelid is diminished in mammals and doesn't exist in humans*

5- Physiological Resemblence

Living organisms are similar in many vital functions, such as:-

1- Cytoplasm: *All living organisms cells have protoplasm in which anabolism and catabolism processes takes place in an identical manner*

2- Cell division: *Cell division occurs in the same steps in all living organisms under the control of nucleus (which carries hereditary material identically in the form of chromosomes)*

3- Wastes: *Living organisms are similar in excreting wastes in the form of nitrogenous compounds, but the kind of compound differs according to the kind of animal:-*

- Fish get rid of nitrogenous wastes in the form of ammonia through gills, because it dissolves in water quickly

- Amphibians and mammals get rid of nitrogenous wastes in the form of urea through kidneys, as urea dissolves quickly in urine water

- Reptiles and birds get rid of nitrogenous waster in the form of uric acid with faeces, because uric acid is insoluble in water

4- Hormones: *Vertebrates are similar in the existence of glands responsible for regulating vital processes in body (Digestion, growth, reproduction…etc)*

6- Stages of fetal growth

→ *All organisms which reproduce sexually begin their life as a single cell called zygote*

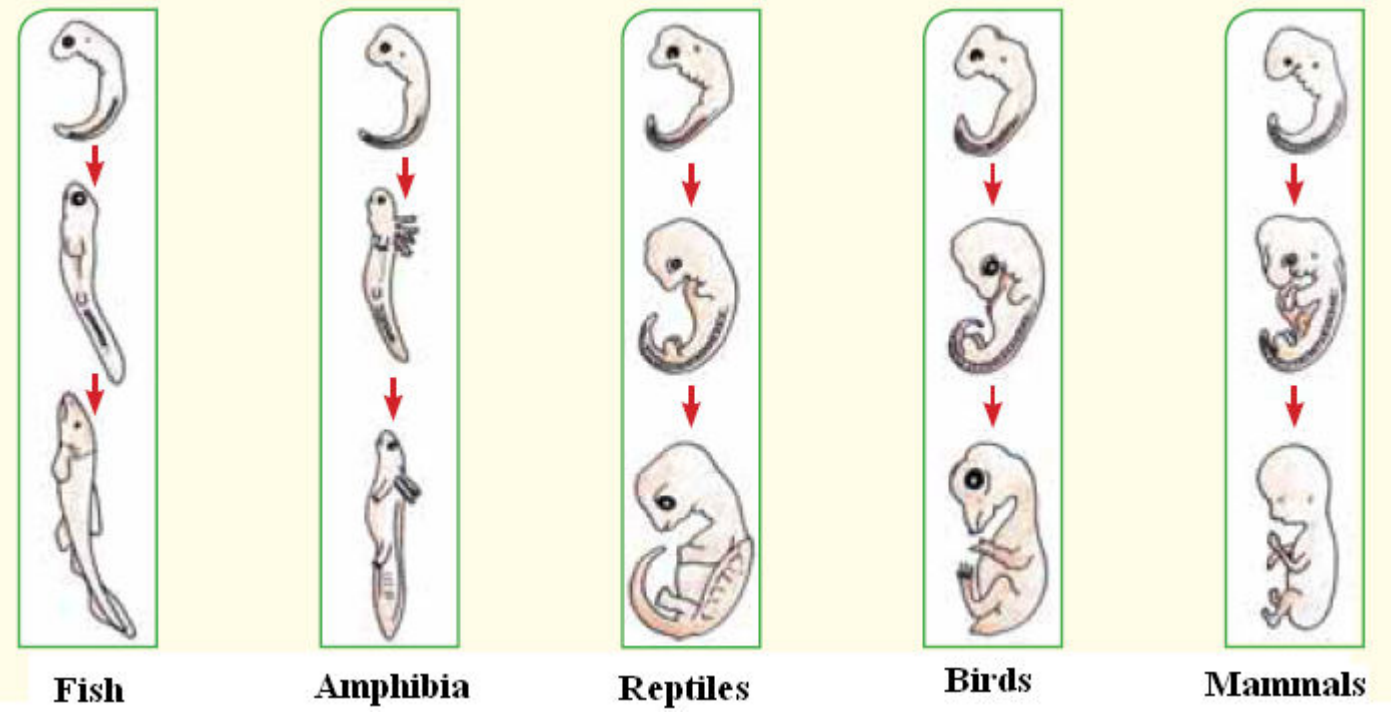


Fig. (17) Stages of fetal growth in vertebrates

→ *The fetuses of the previous vertebrates pass through the same stage, where gill slits are formed, and heart is formed from two chambers (one auricle and one ventricle). As growth goes on, changes begin to appear*

→ *Fetal similarity in mammals proved that they are descended from common origin*

→ *Bird fetus gets rid of nitrogenous wastes in the 1st stage (inside the egg) in the form of ammonia (like fish). Then, it begins getting rid of these wastes in the form of urea (like Amphibia). When growth is over, it gets rid of these wastes in the form of uric acid*

7- Molecular Biology

Molecular biology science is from the modern evidences of evolution theory, as hereditary material in all living organisms is composed of the same building units (nucleotides). Which proved that all organisms are descended from a common ancestry.

Science, technology and society

A- Natural reserves (protectorates)

Natural reserve: *An area of nature preserving particular types of plants and animals which is surrounded by a barrier to be protected from environmental conditions and human activities*

Importance of natural reserves:-

1- They protect the endangered species from extinction
2- They protect natural resources and biological diversity
3- They keep the environmental balance constant
4- They can be used in touristic purposes

Natural reserves in the Arabic Republic of Egypt

→ *There are 30 natural reserves in Egypt*

In South Sinai:-

- Ras Muhammad protectorate
- Tiran and Sanafir Islands
- Saint Catherine protectorate
- Abu Galum protectorate
- Napq protectorate

In North Sinai:-

- Zaranik protectorate

In Red Sea governorate:-

- Gebel Elba

In Matrouh governorate:-

- Alameed protectorate

In Portsaid governorate:-

- Ashtoum El Gamil protectorate

- Tennis island

In Aswan governorate:-

- Wadi Al-Alaqi protectorate

In fayoum governorate:-

- Wadi Elrayan protectorate

- Lake Moeris

B- Determination of fossils age

→ Age of fossil are determined by measuring the ratio of radioactive carbon in it. The first to use this technique was the American chemist Willard Libby in 1949. He calculated the age of organic substances (Hair, bones, plants, wood, natural textiles…etc) approximately

How to determine the age using radioactive carbon

→ Radioactive carbon is the radioactive isotope of carbon (carbon-12)

→ When cosmic radiation reaches the atmosphere everyday, it causes the reaction of carbon-12 and carbon-14 with oxygen forming carbon dioxide gas.

→ Plants absorb both carbon-12 and carbon-14 during photosynthesis process

→ The ratios of carbon-12 and carbon-14 are equal to those in the atmosphere in this time.

→ When living organisms die, the ratio of carbon-12 doesn't change, while the ratio of carbon-14 changes (due to its decay) without being replaced

→ Half time of carbon-14 equals 5730 years. In other words, half the amount of carbon-14 decays to its half after 5730 years

→ So, we can measure the amount of carbon-14 in a petrified tree and that in an alive tree, which gives us its age approximately

Definitions of lesson (2)

Fossils: *The remains or traces of living organisms which lived in old ages and were buried after their death in sedimentary rock*

Index fossil: *Fossil of living organisms on which we depend in the comparison between the layers of sedimentary rocks in order to determine their relative ages*

Mould: *Fossil which carries the internal details of the solid skeleton of living organism after its death.*

Cast: *Fossil which an organism leaves after its death, which decays in soft rocks.*

Printings: *The shape which an organism leaves on soft rocks in its life.*

Fossil record: *Complete set of fossils which records the evolution of some living organisms during geological ages, such as fossil records of horses and elephants*

Intermediate fossil: *Fossil which has the characteristics of two consecutive classes*

Protectorate: *An area of nature preserving particular types of plants and animals which is surrounded by a barrier to be protected from environmental conditions and human activities*

Give reasons for

1- The importance of fossils
Because:-
1- Determination of the geological age of rocks by determining the age of fossils in them
2- Recognizing the landmarks of old environment
3- Proving the evolution of living organisms
4- Comparing between rocks layers by index fossils
5- Drawing old geographical maps

2- The fossils of some animals weren't formed
Because of factors which prevented the occurrence of petrifaction process which are:-
- Lack of water in porous layers of sedimentary rocks, which causes the decay of living organism
- The occurrence of volcanoes and earthquakes, which causes the deformation and breakage of fossils

3- Archaeopteryx fossils in the intermediate link between birds and reptiles

Because Archaeopteryx fossil has many characteristics of birds, such as the existence of feather, wings and beaks. It has also some characteristics of reptiles, such as the existence of teeth in the beak, bony vertebrae in tail and claws in wings

4- The importance of Cladogram (Evolution tree)

Because it describes the relation between species and consecutive groups, beginning from mutual ancestries. It also allows us determine the degree of similarity between different species

5- The existence of fully-grown appendix in rabbits and such herbivorous animals

Because rabbits feed on plants basically. So, appendix is fully grown in order to secrete enzymes which digest cellulose in these plants

6- Appendix in humans is diminished (from vestigial organs)

Because it was fully-grown in old man who used to feed on plants, but now it became useless in human, so it diminished

7- Birds and reptiles have nictitating membrane (third eyelid) in their eyes

To protect their eyes from the sand carried by the wind

8- Mammals forelimbs are modified

In order to be adapted to their environment and functions

9- Molecular biology give an evidence on the validity of evolution theory

Because molecular biology states that hereditary material in all living organisms is composed of the same building units (nucleotides). Which proved that all organisms are descended from a common origin.

10- The importance of protectorates

Because:-

1- They protect the endangered species from extinction
2- They protect natural resources and biological diversity
3- They keep the environmental balance constant
4- They can be used in touristic purposes

Questions

1- Choose the correct answer

1-…….. is an example on fossils of entire organisms

A- Ammonite fossil B- Amber C- Mammoth fossil D- Dinosaur bones

2- …… is an example of moulds

A- Petrified forest B- Fish fossil C- Ammonite fossil D- Mammoth fossil

3- …… is an example on casts

A- Petrified forest B- Fish fossil C- Ammonite fossil D- Mammoth fossil

4- …….. is the intermediate link between birds and reptiles

A- Lung fish B- Archaeopteryx C- Dinosaurs D- Shield fish

5- ……. is the intermediate link between fish and amphibians

A- Lung fish B- Archaeopteryx C- Dinosaurs D- Shield fish

6- ……. is an example of vestigial organs in human

A- Appendix B- Duodenum C- Cerebrum D- Uterus

2- Write the scientific term

1- The remains or traces of living organisms which lived in old ages and were buried after their death in sedimentary rock

2- Fossil of living organisms on which we depend in the comparison between the layers of sedimentary rocks in order to determine their relative ages

3- Fossil which carries the internal details of the solid skeleton of living organism after its death.

4- Fossil which an organism leaves after its death, which decays in soft rocks.

5- The shape which an organism leaves on soft rocks in its life.

6- Complete set of fossils which records the evolution of some living organisms during geological ages, such as fossil records of horses and elephants

7- Fossil which has the characteristics of two consecutive classes

8- Area of nature preserving particular types of plants and animals which is surrounded by a barrier to be protected from environmental conditions and human activities

The Answers

1- Choose the correct answer

1- Mammoth fossil 2- Ammonite fish 3- Fish fossil 4- Archaeopteryx
5- Lung fish 6- Appendix

2- Write the scientific term

1- Fossils 2- Index fossil 3- Mould 4- Cast 5- Printing 6- Fossil record
7- Intermediate fossil 8- Protectorate