UNIT

19

Origin and Evolution of Life

POINTS TO REMEMBER

Evolution	:	It is the gradual change occuring in living organisms over a period of time.
Fossils	:	Preserved part of a plant / animal that has died long back.
Homologous organs	:	Organs with similar developmental pattern but look dissimilar and adapted for different functions.
Analogous organs	:	Organs of different animals which have different origin and different structure but perform same function.
Vestigial organs	:	Degenerated and non-functional organs of animals.
Atavism	:	Reappearance of ancestral characters in some individuals.
Acquired characters	:	The characters developed by the animals during their life time in response to the environmental changes.
Biogenesis	:	Life originates from pre-exis ting life.
Biogenetic law / Recapitulation theory	:	Ontogeny recapitulates Phylogeny.
Archaeopteryx	:	Connecting link between reptiles and birds
Origin of species	:	It is the book of Darwin demonstrates the fact of evolution.
Paleobotany	:	Recovery and identification of plant remains of geological past.
Paleontology	:	It deals with the study of fossils.
Ethnobotany	:	Study of a region's plants and their practical uses.
Ontogeny	:	Stages of development of the individual animal.
Phylogeny	:	Evolutionary history of the entire race of the animal.
Astrobiology	:	It deals with the origin, evolution and dis tribution of life in the Universe.

MIND MAP

Scienctists and Inventions:

Louis Pasteur(1862)	- Life orginates from pre exixting life.
Oparin(1922) and Haldane(1929)	- Chemical evolution of life
Ernst Haeckel	- Biogenetic Law
Leonardo da Vinci	- Father of Palaeontology
Jean Baptiste Lamarck (1744 - 1829)	- Philosophic Zoologique
Charles Darwin(1809 - 1882)	- Origin of Species
De Vries	- Mutation theory
Kaspur Maria von Sternberg	- Father of Paleobotany
Birbal Sahani	- Father of Indian paleobotany
W.F.Libby(1956)	- Radio active carbon dating method
J.W.Harshberger(1895)	- Ethnobotany

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Biogenetic law states that _____**
   a) Ontogeny and phylogeny go together
   b) Ontogeny recapitulates phylogeny
   c) Phylogeny recapitulates ontogeny
   d) There is no relationship between phylogeny and ontogeny

2. **The 'use and disuse theory' was proposed by _____.** ★★
   a) Charles Darwin
   b) Ernst Haeckel
   c) Jean Baptiste Lamarck
   d) Gregor Mendel

3. **Paleontologists deal with**
   a) Embryological evidences
   b) Fossil evidences
   c) Vestigial organ evidences
   d) All the above

4. **The best way of direct dating fossils of recent origin is by** ★★
   a) Radio-carbon method
   b) Uranium lead method
   c) Potassium-argon method
   d) Both a) and c)

5. **The term Ethnobotany was coined by**
   a) Khorana
   b) J.W. Harsbberger
   c) Ronald Ross
   d) Hugo de Vries

Ans:

1.	b)	Ontogeny recapitulates phylogeny	2.	c)	Jean Baptiste Lamarck
3.	d)	All the above	4.	d)	Both a) and c)
5.	b)	J.W. Harsbberger			

II. Fill in the blanks

1. **The characters developed by the animals during their life time, in response to the environmental changes are called _____.**
2. **The degenerated and non-functional organs found in an organism are called _____.**
3. **The forelimbs of bat and human are examples of _____ organs.** ★★
4. **The theory of natural selection for evolution was proposed by _____.** ★★

Ans:

1.	acquired character	2.	Vestigial organs
3.	Homologous	4.	Darwin

III. State true or false. Correct the false statements

1. **The use and disuse theory of organs' was postulated by Charles Darwin.** **False**
   The use and disuse theory of organs' was postulated by Lamarck. ★★
2. **The homologous organs look similar and perform similar functions but they have different origin and developmental pattern.** **False**
   The analogous organs look similar and perform similar functions but they have different origin and developmental pattern.
3. **Birds have evolved from reptiles.** ★★ **True**

IV. Match the following

1.

Column A		Column B	
1) Atavism	-	a) Caudal vertebrae and vermiform appendix	(c)
2) Vestigial organs	-	b) A forelimb of a cat and a bat's wing	(a)
3) Analogous organs	-	c) Rudimentary tail and thick hair on the body	(d)
4) Homologous organs	-	d) A wing of a bat and a wing of an insect	(b)
5) Wood park	-	e) Radio carbondating	(f)
6) W.F. Libby	-	f) Thiruvakkarai	(e)

V. Answer in a word or sentence

1. **A human hand, a front leg of a cat, a front flipper of a whale and a bat's wing look dissimilar and are adapted for different functions. What is the name given to these organs?**
   Homologous organs
2. **Which organism is considered to be the fossil bird?** ✶ ✶ ✶
   Archaeopteryx
3. **What is the study of fossils called?**
   Paleontology

VI. Short answers questions

1. **The degenerated wing of a kiwi is an acquired character. Why is it an acquired character?**
   - Kiwi is a flightless bird. The degenerated wing in Kiwi is an example for organ of disuse.
   - When there is a change in the environment, the animals respond to the change.
   - They develop adaptive structures (acquired characters).
2. **Why is Archaeopteryx considered to be a connecting link?** ✶ ✶ ✶
   - Archaeopteryx is considered to be a connecting link because it links between **reptiles** and **birds**.
   - It had wings with feathers like a bird. It has long tail, clawed digits and conical teeth **like a reptile.**
3. **Define Ethnobotany and write its importance.**
   Ethnobotany is the study of a **region's plants** and their practical uses through the **traditional knowledge** of local culture of people.

   Importance
   - It provides **traditional uses** of plant.
   - It gives information about certain **unknown** and **known** useful plants.
   - The ethnomedicinal data will serve as a useful source of information for the chemists, pharmacologists.
   - Tribal communities utilise ethnomedicinal plant and prepare medicine to cure many diseases.
4. **How can you determine the age of the fossils?** ✶ ✶
   - The age of fossils is determined by **radioactive elements** present in it.
   - They may be carbon, Uranium, lead or pottasium.
   - It is used in paleobotany and anthropology for determining the age of human fossils and manuscripts.

VII. Long answer questions

1. **Natural selection is a driving force for evolution-How?** ✶ ✶
   Natural selection is a driving force for evolution.

   Overproduction:
   - Living beings have the ability to reproduce more individuals and form their **own progeny**.
   - This will increase **reproductive potential** leading to over production

Struggle for existence:

- Due to over production, a geometric ratio of **increase** of **population** occurs.
- This creates an intense **competition** among the organisms for food and space leading to **struggle**.
- The struggle for existence are of three types:

a. Intraspecific struggle:
Competition among the individuals of **same species.**

b. Interspecific struggle:
Competition between the organisms of **different species** living together.

c. Environmental struggle:
Natural conditions like extream heat or cold, drought and floods can affect the existence of organisms.

Variations

- The occurrence of variation is a characteristic feature of all plants and animals.
- **Small variations** are important for evolution.
- According to Darwin, **favourable variations** are useful to the organism.
- **Unfavourable variations** are harmful or useless to the organism.

Survival of the fittest or Natural selection

- During the struggle for existence, the organisms which can overcome the challenging situation, **survive** and **adapt** to the surrounding environment.
- Organisms which are **unable** to **face** the challenges, are **unfit** to survive and disappear.
- The process of selection of organisms with **favourable variation** is called as natural selection.

Origin of species:

According to Darwin, **new species** originates by the gradual accumulation of **favourable variations** for a number of generations.

2. How do you differentiate homologous organs from analogous organs? ✶✶

S.No	Homologous organs	Analogous organs
1.	The homologous organs are those which have been inherited from common ancestors with similar developmental pattern in embryos.	The analogous organs look similar and perform similar function but they have different origin and developmental pattern.
2.	The fore limbs of mammals are homologous structures.	The wings of a bird, wings of an insect are similar.
3.	The mode of development and basic structure of bone is similar.	The development is similar, but their bone structures are different.

3. How does fossilization occur in plants?

- 2 million years ago tree trunks that got buried along the river, incourse of time the organic matter was replaced by silica and was fossilized.
- They retained their colour, shape and texture and was converted into solid rocks.
- The annular rings, the texture, colours of the layers, nodes and every properties of plants are still visible.

VIII. Higher Order Thinking Skills (HOTS)

1. **Arun was playing in the garden. Suddenly he saw a dragon fly sitting on a plant. He observed the wings of it. He thought it looked similar to a wing of a crow. Is he correct? Give reason for your answer.**

   Yes, he is correct.

   Reason: The function of the wings of a crow (the wings of a bird) and wings of an insect are similar, but the basic structure is different.

2. **Imprints of fossils tell us about evolution How?**
   - Fossils are remains or impressions of organisms that lived in the remote past.
   - Fossil provide the evidence that the present animal have originated from previously existing ones through the process of continuous evolution.

3. **Octopus, cockroach and frog all have eyes. Can we group these animals together to establish a common evolutionary origin. Justify your answer**
   - Octopus, cockroach and frog all have eyes.
   - Octopus-belongs to mollusc which have simple eye without lens.
   - Cockroach are invertebrate have compound eyes.
   - Frog which is vertebrate, have highly specialised lens.
   - However, all of them perform the same function that is vision.
   - Thus a common evolutionary origin can be established on the basis of eye.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Biogenesis was speculated by**

   a) Oparin b) Louis Pasteur
   c) Haldane d) All the above

2. **Example for Analogous organ**

   a) Wings of a bird b) Human hand
   c) Flipper of a whale d) Front leg of a cat

3. **Darwin worked for a period of _____ to develop the theory of natural selection.** ✶

   a) 10 years b) 20 years c) 30 years d) 40 years

4. **Competition among the individuals of same species called _____**

   a) struggle for existence
   b) environmental struggle
   c) interspecific struggle
   d) intraspecific struggle

5. **The study of a regions plants and their practical uses is called _____**
   a) Astrobiology b) Exobiology
   c) Ethnobotany d) Biobotany

6. **The first form of life could have come from pre.existing inorganic molecules. This theory is called as _____** ★
   a) Spontaneous generation (Abiogenesis)
   b) Biogenesis
   c) Chemical Evolution of life
   d) Special creation.

7. **Presence of rudimentary tail in new born babies is an example of _____**
   a) Homologous organs
   b) Analogous organs
   c) Vestigial Organ
   d) Atavism or reappearance of ancestral characters.

8. **_____ is called the Father of palaeontology.** ★
   a) Oparin b) Leonardo da Vinci
   c) Lamarck d) Haldane

9. **_____ published the book Origin of species**
   a) Lamarck b) Oparin
   c) Darwin d) Haldane

10. **_____ variations are not heritable**
    a) Somatic variation
    b) Germinal Variation
    c) Continuous variation.
    d) Discontinuous Variation

11. **Father of paleobotany is _____**
    a) Birbal Sahani
    b) Kaspar Maria Von Sternberg
    c) Darwin
    d) Lamarck

12. **Most bones and wood fossils are _____** ★
    a) petrified b) Mold and cost
    c) Carbonization d) preservation

13. **_____ is the only planet is the Goldilock Zone for life.**
    a) Mercury b) Earth c) Mars d) Venus.

14. **In Tamil Nadu Fossil Wood Park is situated in _____ District**
    a) Madurai b) Chennai
    c) Nellai d) Villupuram

15. **_____ is the raw material which plays an important role in evolution.**
    a) variations. b) Sudden Changes
    c) Homologous organs d) None of the above

Ans:

1.	b)	Louis pasteur	2.	a)	wings of a bird
3.	b)	20 years	4.	d)	Intraspecific struggle
5.	c)	Ethnobotany	6.	c)	Chemical Evolution of life
7.	d)	Atavism	8.	b)	Leonardo da Vinci
9.	c)	Darwin	10.	a)	Somatic Variation
11.	b)	Kaspar Maria Von Sternberg	12.	a)	petrified
13.	b)	Earth	14.	d)	Villupuram
15.	a)	Variations			

II. Fill in the blanks

1. **The Big Bang Theory explains the _____.** ★
2. **The_____ of their special characters appear in the later stage of development.**
3. **Fossil bird was an early bird like form found in the _____ period.**
4. **Lamarcks theory of evolution was published in _____ in the year 1809.** ★
5. **_____ is the father of Indian Paleobotany.**

Ans:

1.	Origin of universal	2.	differentiate
3.	Jurassic	4.	Philosophic Zoology
5.	Birbal Sahani		

III. State true or false. Correct the false statements

1. **The reappearance of ancestral characters in some individuals is called Atavism** **True**
2. **The acquired characters are not transmitted to the offspring by the process of inheritance** **False**

   The acquired characters are transmitted to the offspring by the the process of inheritance.
3. **Kaspar Maria Von Sternbery is the Father of Indian Paleobotany.** ★ **False**

   Birbal Sahani is the father of Indian Paleobotany (or) Kaspar Maria Von Sternbery is the father of Paleobotany.

IV. Match the following

1. 1) Special creation - a) Lifeless matter (b)
   2) Spontaneous creation - b) Study of a region's plants (d)
   3) Palaeontology - c) Divine creation (a)
   4) Ethnobotany - d) Study of fossils (c)

V. Assertion and Reason

a) Both assertion and reason are true a reason is correct explanation of assertion

b) Both assertion and reason are true but reason is not the correct explanation of assertion.

c) Assertion is true but reason is false.

d) Both assertion and reason are false.

1. **Assertion:** During their life time, in response, the environmental changes are called acquired character.
   Reason: The acquired characters are transmitted to the offspring by the process of inheritance.
   Ans: a) Both assertion and reason are true a reason is correct explanation of assertion

2. **Assertion:** Living beings have the ability to reproduce more individuals and their own progeny. ✱
   Reason: Due to over production, a geometric ratio of increase in population occurs
   Ans: a) Both assertion and reason are true a reason is correct explanation of assertion

VI. Answer in a word or sentence

1. **Give an example for living fossils.**
   Ginko biloba.

2. **What are the events involved in the process of evolution?**
   Mutation and variation.

3. **Which is the study of science that deals with recovery and identification of plant remains of geological past?** ✱
   Paleobotany

VII. Short answers questions

1. **What is vestigial organ?**
   The **degenerated** and **non – functional organs** of animals are called vestigial organ.

2. **State use and disuse theory.** ✱
   - If an **organ is used** constantly, the organ develops well and gets strengthened.
   - When an **organ** is **not used** for a long time it gradually degenerates.

3. **Write the types of struggle for existence.**
   - Intraspecific struggle
   - Inter specific struggle
   - Environmental struggle.

4. **What is the geologic time scale?** ✱
   The geological time scale is a **system** of **chronological dating** that relates geological rock strata of time and in used by geologists, palaeontologists and other earth scientists to describe the timing and relationships of events that have occurred during Earth's history.

5. What is Astrobiology?

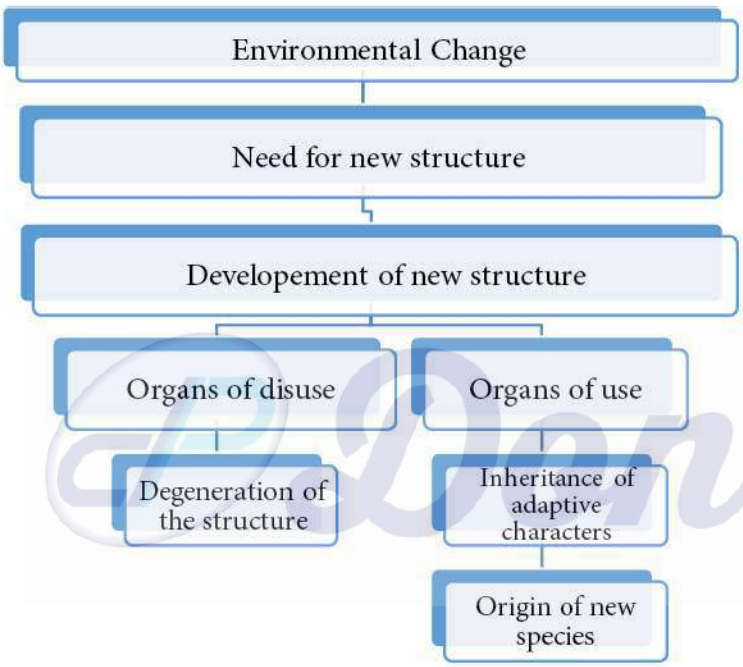
Astrobiology is the science which looks for the **presence** of **extra-terrestrial** life in the universe.

6. What are extremophiles?

The organisms which live in **extreme environmental conditions** on earth are called extremophiles.

VIII. Long answer questions

1. Write flow chart showing the postulates of Lamarckism.



2. What is called variation and explain its types? ✶

- Sexual reproduction, which involves meiois helps in **recombination of genes** during gametic fusion.
- This leads to differences in the phenotype of the off spring from its parents.
- These differences are called variation.

Types of variation:

- Somatic variation
- Germinal variation

Somatic variation:

These are the variation which **affect the body cells** of the organisms, which are non -heritable.

Germinal variation:

These variation are produced in **germ cells of an organisms** which are inherited. They are classified into two type

- Continuous variation.
- Discontinuous variation.

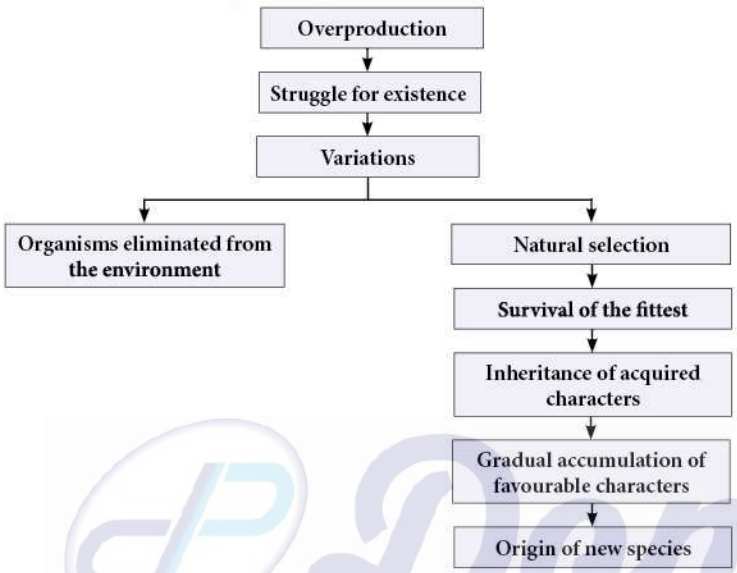
Continuous variation:

These are **small variation** which **occur** among **individuals of a population** they are called fluctuating variation. (eg) skin colour, height, weight of an individual

Discontinuous variation:

These are **sudden changes** which **occur in an organism** due to mutations (eg) Short Legged Ancon sheep. Six or more digits in human etc.

3. Draw the flow chart showing the postulates of Darwinsm.



Flow chart showing the postulates of Darwinism

4. What is known as fossilization? Give the methods of fossilization and explain . ★

Fossilization:

- The process of formation of fossil in the rocks is called fossilization.
- Common methods of fossilization includes petrifaction, moulds and cast, carbonization, preservation, compression and infiltration.

Petrifaction:

- Minerals like silica slowly penetrate in and replace the original organic tissue and forms a rock like fossil.
- This method of fossilization can preserve hard and soft parts.
- Most bones and wood fossils are petrified.

Mould and Cast:

- A replica of a plant or animal is preserved in sedimentary rocks.
- When the organism gets buried in sediment it is dissolved by underground water leaving a hollow depression called a mould.
- It shows the original shape but does not reveal the internal structure.
- Minerals or sediment fill the hollow depression and forms a cast.

Preservation:

- Original remains can be preserved in ice or amber (tree sap).
- They protect the organisms from decay. The entire plant or animal is preserved.

Compression:

- When an organism dies, the hard parts of their bodies settle at the bottom of the sea bed and are covered by sediment.
- The process of sedimentation goes on continuously and fossils are formed.

Infiltration or Replacement:

- The precipitation of minerals takes place which later on infiltrate the cell wall.
- The process is brought about by several mineral elements such as silica, calcium carbonate and magnesium carbonate.
- Hard parts are dissolved and replaced by these minerals.

IX. Higher Order Thinking Skills (HOTS)

1. How does the creation of variations in a species promote survival?

- Sometimes for a species, the environmental conditions change so drastically that their survival becomes difficult.
- e.g: if the temperature of water increases suddenly, most of the bacteria living in that water would die, only few variants resistants to heat would be able to survive.
- However not all variation are useful. Therefore these are not necessarily beneficial for the individual organisms

2. Only variations confer an advantage to an individual organism's population. Do you agree with this statement? Why or why not?

- No, depending on the nature of variations different individuals have different kind of advantages.
- However, when a drastic change occurs in environment only those organism in the population will survive which have an advantageous variation in that population to survive in changed environments.

Unit Test - 19

Origin and Evolution of Life

Time : 1 hr | Marks : 30

I. Choose the most suitable answer and write the code with the corresponding answer. 5 × 1 = 5

1. The 'use and disuse theory' was proposed by _____.
   a) Charles Darwin b) Ernst Haeckel
   c) Jean Baptiste Lamarck d) Gregor Mendel
2. Paleontologists deal with
   a) Embryological evidences b) Fossil evidences
   c) Vestigial organ evidences d) All the above
3. The best way of direct dating fossils of recent origin is by
   a) Radio-carbon method b) Uranium lead method
   c) Potassium-argon method d) Both a and c
4. Example for Analogous organ
   a) Wings of a bird b) Human hand
   c) Flipper of a whale d) Front leg of a cat
5. Darwin worked for a period of.....to develop the theory of natural selection.
   a) 10 years b) 20 years
   c) 30 years d) 40 years

II. Answer the following questions in one or two lines. 5 × 2 = 10

1. How can you determine the age of the fossils?
2. State use and disuse theory.
3. Write the types of struggle for existence.
4. What is Astrobiology?
5. What are extremophiles?

III. Answer the following questions in brief. 2 × 4 = 8

1. Define Abiogenesis.
2. Draw the embryonic development stages of vertebrates.

IV. Answer the following questions in detail. 1 × 7 = 7

1. i) What is fossilization? and explain its methods.
   ii) How does fossilization occur in plants?