Kerala **Class 10**

Part 2

Simplified Notes

English Medium

Volume : 2

Units :

5. Soldiers of Defense
6. Unravelling Genetic Mysteries
7. Genetics of the Future
8. The Paths Traversed by Life

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5. SOLDIERS OF DEFENSE

CONTENT

* Defense by body coverings, body secretions and body fluids.
  WBCs in non-specific defense.
  Defense mechanisms (Inflammatory response, Phagocytosis, Blood clotting, Healing, Fever)
* Specific defense - Actions of B and T-lymphocytes.
* Vaccines for induced immunity.
* Popular systems of treatment – Allopathy, Ayurveda, Homeopathy, Unani, Sidha etc.
* Techniques for the diagnosis of diseases – Equipments, Lab test etc.
* Antibiotics.
* Blood groups and blood transfusion.
* Defense mechanisms in plants (-structural & biochemical)

QUESTIONS & ANSWERS

1. Defense ?
   Defense is the ability of the body to prevent the entry of pathogens and to destroy those that have already entered the body.
2. Defense mechanisms in our body ?
   - Body coverings (Skin and mucous membrane)
   - Body secretions (Mucus, lysozyme in saliva, tears and urine, sweat, sebum, ear wax, HCl …)
   - Body fluids (Blood and lymph)
3. 'Our skin is referred as a fort of defense'. How?
   The outer epidermis of the skin have a protein called **keratin**, prevents germs from entering it.
   Sebum, produced by the sebaceous glands makes skin oily and water proof.
   Sweat, produced by the sweat glands have disinfectants to destroy germs.
   Skin also contain useful bacteria, which indirectly prevent germs.
4. How mucous membrane protects our body ?
   Mucous membrane secretes **mucus** where germs trapped and get destroyed. The destroyed germs are expelled out by the cilia cells of the mucous membrane. It also contain useful bacteria.
5. Many useful bacteria seen in our body also prevent germs. How ?
   The germs that enter the body get destroyed during the competition with the useful bacteria.
6. Table showing various secretions to defend pathogens in different body parts.

Body part	Secretion
Eye	- Lysozyme in tears
Ear	- Ear wax
Nose, Trachea	- Mucus
Mouth	- Lysozyme in saliva
Stomach	- HCl in gastric juice
Intestines	- Mucus
Urinary bladder	- Lysozyme in urine

7. The main warriors of the body ?
   White blood cells (Monocytes, Basophils, Neutrophils, Eosinophils and Lymphocytes)
8. The real warriors among white blood cells ?
   Lymphocytes (B-lymphocytes and T-lymphocytes)

9. Examples for certain natural defense mechanisms of our body, to prevent or destroy germs ?
   Inflammatory response, Phagocytosis, Blood clotting, Healing of wounds, Fever..

10. The role of white blood cells ?

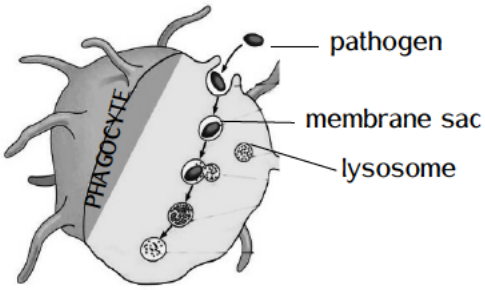
	Neutrophil	Engulfs bacteria, Synthesizes chemicals to destroy bacteria
	Basophil	Stimulates the other white blood cells, Dilates the blood vessels.
	Eosinophil	Synthesizes chemicals to destroy foreign bodies. Synthesizes chemicals for inflammatory response.
	Monocyte	Engulfs and destroys germs.
	Lymphocytes (B & T)	Identifies and destroys germs specifically

11. Inflammatory response is a kind of defense mechanism. What is inflammatory response ?
The dilation of the blood vessels by certain chemicals, when germs enter through wound, is termed as inflammatory response.

12. What is the advantage of dilation of blood vessels (inflammation) at the wound site ?
When inflammation occur, blood flow increases to the wound site and more plasma and white blood cells can reach easily there. WBC can come out from blood vessels. Germs can be engulfed and destroyed there.

13. What is phagocytosis ?
Phagocytosis is the process of engulfing and destroying germs by certain white blood cells (phagocytes).

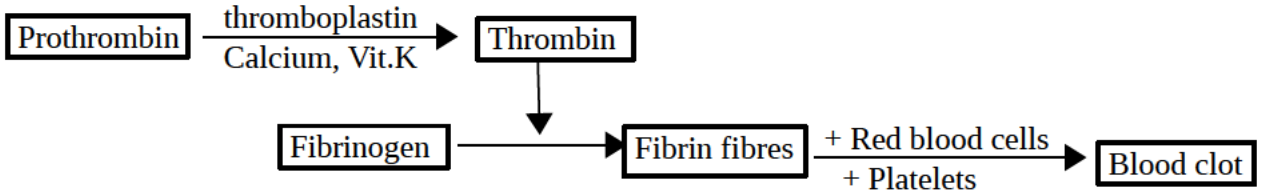
- Phagocyte reach near the pathogen.
- Engulfs the pathogen in the membrane sac.
- Membrane sac combines with lysosome.
- The enzyme in the lysosome destroys the pathogen.
- Phagocyte expels the remnants.



14. Give examples for phagocytes.
Monocytes and neutrophils.

15. The factors needed for blood clotting ?
The proteins prothrombin and fibrinogen in plasma, calcium ions, vitamin K, RBC and platelets.

16. Different stages in the process of blood clotting.
- Tissues of the wounded part degenerate to form an enzyme, **thromboplastin**.
- With calcium ions and vitamin K, thromboplastin converts prothrombin to **thrombin**.
- Thrombin converts fibrinogen to **fibrin**.
- In the fibrin net, RBCs and plateletes entangled to form the blood clot.



17. In certain situations, wound scar remains there. Why ?
Instead of forming same new tissues, connective tissues form which heal the wound. In such situations the wound scar remains there.

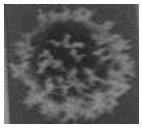
18. Bacterial diseases are common in man. Give reason.
Our body temperature, 37^0 C (98.6^0 F), is favourable for the rapid multiplication of bacteria.

19. 'Fever is not a disease, it is mere a defense mechanism.' - Analyse the statement.
True. Our body raises temperature (fever) when chemical substances are produced by the white blood cells, which are stimulated by the toxin of pathogens.

20. What is specific defense ?
The defense mechanism that identifies the structure of each antigen and destroys it specifically is called specific defense.

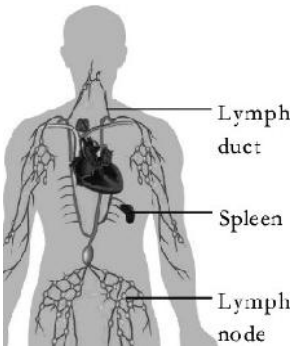
21. What are antigens ?
Antigens are foreign bodies or pathogens that enter the body and stimulate the defense mechanism.

22. B-lymphocytes : Mature in the bone marrow;
T-lymphocytes : ---------- ? [Mature in the thymus gland]

23. Name the chemical substances, produced by B-lymphocytes against foreign bodies/antigens.
How these substances destroy germs ?

Antibodies.
They destroy germs by disintegrating tbacterial cell membrane, neutralise their toxins and stimulate the other white blood cells.

24. How is T-lymphocyte destroy germs ?

T-lymphocytes stimulate the other white blood cells and destroy cancer cells as well as virus affected cells.



25. How lymph helps in defense mechanisms ?
Lymphocytes in the lymph destroy bacteria with in the **lymph nodes** and **spleen**.

26. What are vaccines ?
Vaccines are substances used for artificial immunization.
Vaccines are used to prevent certain diseases in advance. A vaccinated person gets induced immunity by the formation of antibodies in his body in advance.

27. Who started **immunization** ?

Doctor Edward Jenner.
[Smallpox vaccine , the first vaccine, was invented by him]

[The immunization programmes got the name vaccination from the Latin word '*vacca*' meaning cow, in memory of the cowpox experiments of Jenner.]

Vaccine	Disease
BCG	Tuberculosis
OPV	Polio
Pentavalent	Diphtheria, Pertussis, Tetanus Hepatitis-b, Hib
MMR	Mumps, Measles, Rubella
TT	Tetanus

BCG= Bacillus Calmette-Guerin
OPV= Oral polio vaccine
Hib= Haemophilus influenza -type b
TT= Tetanus toxoid

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28. How do vaccines induce immunity ?
Dead, inactive, alive but neutralized germs or toxins are used as vaccines.
By the presence of these antigens, lymphocytes become activated and produce antibodies.
These antibodies remain in the body for long time to provide immunity against such antigens.

29. Give examples for a few popular systems of treatment in the world.
Allopathy, Ayurveda, Homeopathy, Unani, Naturopathy, Siddavaidya, Panchakarma …..

System	Founding fathers	Special features
Ayurveda	Charaka, Susrutha, Vagbhada … (Indian)	A life style to maintain the body fit. Medicines are herbal, but a few are animal products.
Homeopathy	Samuel Hahniman (German)	Great concern for symptoms. Homeopathy considers the causative factor can itself effect the cure and when medicine is more diluted the more is its potency.
Allopathy- Modern medicine	Hippocrates (Greek)	Gives much importance to diagnosis, treatment, medicines etc. Different areas of specialisation, Modern equipments or instruments for treatment....
Unani	Hippocrates, Galan, Razi, Ebnuseena (Greek, Arabian)	When the stability of the four body fluids (namely blood, sputum, dark and yellow bile) alters, disease occur in that body. Herbal medicines are used.

30. Give examples for equipments or means used for diagnosis.
Lab test and equipments like stethoscope, thermometer, sphygmomanometer , ECG, EEG and scanners.

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A. Stethoscope B. Thermometer C. Sphygmomanometer (to measure BP).

31. Electrocardiogram (ECG) : to record electric waves in the heart muscles;
--------- ? ---------- : to record electric waves in the brain.
Electroencephalogram (EEG).

32. Different types of scanners and their uses in the diagnosis of disease.
Ultra sound scanner - to understand the structure of internal organs using ultrasonic sound waves.
CT (Computerised Tomography) scanner - to get 3D visuals of internal organs with the help of computer, using X-rays.
MRI (Magnetic Resonance Imaging) scanner - to get 3D visuals of internal organs using radio waves and magnetic field.

33. Normal value of blood cells and haemoglobin in our blood.
Haemoglobin – 12-17gm/100ml of blood.
RBCs count - 45-60 lakhs/ml of blood.
WBCs count – 5000-10000/ml of blood.
Platelets count – 2.5-3.5 lakhs/ml of blood.

CBC= Complete Blood Test

34. A doctor suggested one of his patients to test his blood for platelet count. What might be the reason ?
To know whether the patient is affected by dengue virus, which prevent the formation of platelets from the bone marrow. There will be considerable decrease in the number of platelets in dengue fever patients.

35. Examples for specialisations in modern medicines.
Cardiology – (treatment of heart)
Ophthalmology - (treatment of eye)
Neurology - (treatment of brain or nerves)
Oncology - (treatment of cancer)
E.N.T - (treatment of ear, nose and throat)

36. Define: * Antigen * Antibody * Antibiotics
Any foreign body that stimulates the defense system is called as an antigen.
Antibodies are chemical substances, produced by the B lymphocytes against antigens.
Antibiotics are medicines that are extracted from microorganisms like bacteria, fungi, etc. and used to destroy bacteria.

37. Different kinds of medicines against microorganisms ?
Antibiotics against bacteria.
Antifungal medicines against fungi.
Antiviral medicines against viruses.

38. The first antibiotics (penicillin)was synthesized by ---------- ?
Alexander Fleming (in 1928 from a fungus, *penicillium notatum.*)

39. Though antibiotics are useful medicine, its use should be with great care. Why ?
- Regular use develops immunity in pathogens against antibiotics.
- Destroy useful bacteria in the body.
- Reduces the quantity of certain vitamins in the body.

40. What is **blood transfusion** ? Give example for instances that need blood transfusion.
Blood transfusion is the transfer of blood from one person to other. It can be done in the situations like heavy loss of blood in accidents, surgical operations and in the treatment of blood cancer.

41. What all things should be taken care of while transfusing blood?
Healthy people in the age 18-60 can donate blood, once in 3 months.
Pregnant and breast feeding women as well as person with communicable disease should not donate blood.
Prior to blood transfusion, blood group testing is necessary.

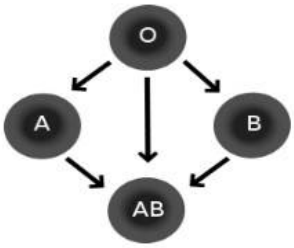
42. Name the major blood groups.
A, B, AB, O
[Carl Landsteiner proposed blood grouping on the basis of A, B antigens seen on the surface of RBC]

43. On what basis, blood groups are called as positive or negative ?
Those blood with Rh factor (antigen D) on the surface of RBC are termed as positive group blood and those with out Rh are termed as negative group blood.

44. Why is that not possible to receive blood from all persons ?
If blood is not compatible, the antigen in the received blood will react with the antibody in the recipient's blood of so as to clot RBC (agglutination).

45. Table showing different blood groups, antigen, possible antibody and group that can receive the blood.

Blood gr	Antigen present	Antibody	Whom can receive each
A	A	Anti-b	A, AB
B	B	Anti-a	B, AB
AB	A, B	--	AB
O	--	Anti-a, Anti-b	A, B, AB, O



46. Prepare apt slogans to encourage blood donation.
Blood donation is life donation.
You can save a valuable life, through donating your blood.
Donating blood is not harmful to our health, instead it is a noble deed.

47. Defense mechanisms in plants ?
Structural:- - Wax covering and Cuticle on leaves (prevents entry of germs through leaves).
- Bark (protects the inner cells from direct contact of pathogens)
- Cell wall (serve as a well equipped resistant coat).
Biochemical:- - Lignin, cutin, suberin etc. strengthen the cell wall.
- **Callose**, a poly saccharide formed in cell wall prevents the germs which have crossed the cell wall.

48. Examples for a few chemical substances that strengthen the cell wall ?
Lignin, cutin or suberin.

Video class links of chapter 5 : **Part 1** - https://youtu.be/bgvdOC8yB48
Part 2 - https://youtu.be/Rc3Tw2YGakY **Part 3** - https://youtu.be/a0Uq1zstbXA

6. UNRAVELLING GENETIC MYSTERIES

CONTENT

* Genetics -Heredity and Variations
* Experiments and inferences of Gregor Johann Mendel
* Nucleic acids - DNA, RNA -structure
* Nucleotides, Genes and Alleles
* Gene action (protein synthesis)
* Autosomes & Sex chromosomes
* Sex determination
* Variations – Crossing over, fertilization & Mutation.

1. What is genetics (Hereditary science) ?

Genetics is the branch of science which deals with heredity and variations.

2. What do you mean by Heredity and Variations ?

Heredity is the transmission of characters from parents to their offsprings.

Variations are the features seen in offsprings that are different from their parents.

3. Who is known as 'the Father of Genetics' ? Why is he known as so ?

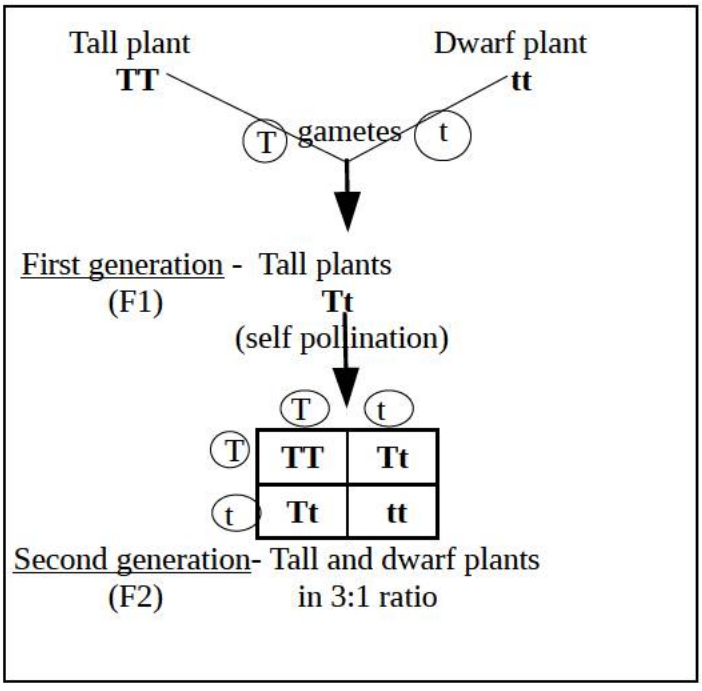
Gregor Johann Mendel.

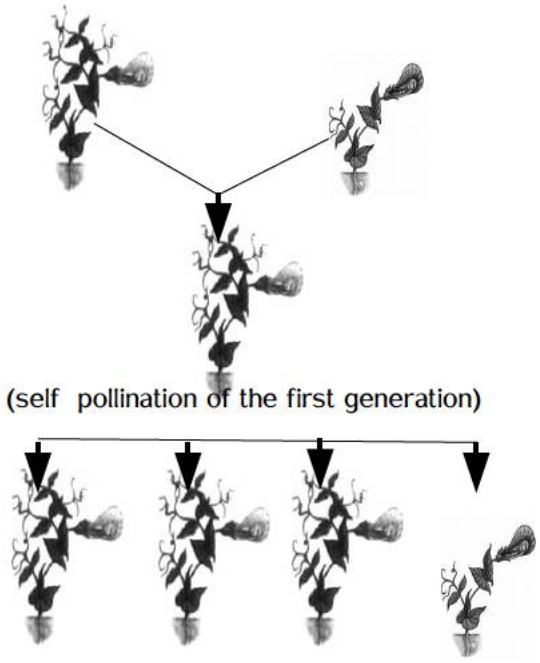
The inferences from his hybridization experiments in pea plants (*Pisum sativum*) from 1856 to 1863 led to the foundation of Hereditary science or Genetics.

4. What were the traits considered by Gregor Mendel for his hybridization experiments in pea plants ?

- Height of the plant (tall/dwarf)
- Position of the flower (axial/terminal)
- Shape of the seed (round/wrinkled)
- Colour of seed coat
- Colour of cotyledon
- Colour of fruit
- Shape of fruit.

5. Mendel's experiment on pea plants considering one pair of contrasting traits: (tallness-dwarfness)





6. What, according to Mendel, the terms dominant trait and recessive trait are referred to ?

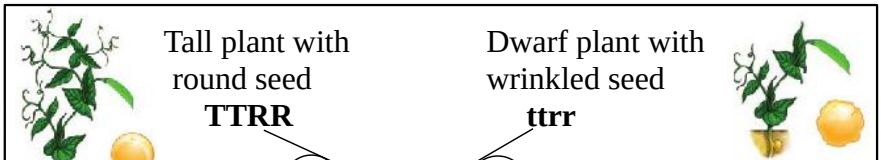
The expressed character, out of the two factors of a particular trait, is known as **dominant trait** and the other factor which remains hidden, is known as **recessive trait**.

For example, if 'Tt' are the two factors of the trait 'height', the "T" is dominant trait and 't' is recessive trait.

7. When Gregor Mendel conducted experiments considering one pair of contrasting traits, the plants obtained in the second generation were always in ---------- ratio.
3:1 [Out of 1064 plants got in F2, 787 were tall and 277 were dwarf. Approximate ratio is 3:1]

8. The main <u>inferences of Gregor Mendel</u> that paved the way for the emergence of Genetics ?
- A trait is controlled by the combination of two factors.
- One trait is expressed (dominant trait) and the other remains hidden (recessive trait) in F1 generation.
- The trait which remains hidden in the first generation appears in the second generation.
- The ratio of the dominant and recessive traits in the second generation is 3:1 .

9. Illustration of Mendel's experiment considering two pair of contrasting traits:
(tallness-dwarfness and round-wrinkled seeds)



Tall plant with round seed **TTRR**

Dwarf plant with wrinkled seed **ttrr**

TR tr

<u>First generation</u> - (F1) Tall plants with round seed **TtRr** (self pollination)

	TR	Tr	tR	tr
TR	**TTRR**	**TTRr**	**TtRR**	**TtRr**
Tr	**TTRr**	**TTrr**	**TtRr**	**Ttrr**
tR	**TtRR**	**TtRr**	**ttRR**	**ttRr**
tr	**TtRr**	**Ttrr**	**ttRr**	**ttrr**

<u>Second generation</u> (F2)
- tall with round seed : **9**
- tall with wrinkled seed : **3**
- dwarf with round seed : **3**
- dwarf with wrinkled seed : **1**

When considering two pair of contrasting traits, the ratio in the F2 will be 9:3:3:1

10. The hereditary factors, first described by Gregor Mendel, are now known as ------ ?
Genes.

11. Define the term 'genes'.
Genes are the specific parts of DNA that control metabolic activities and responsible for specific characteristic feature of any organism.

12. What is the meaning of term 'allele' ?
Alleles are the different forms of a gene that controls a trait.
Eg:- Suppose 'Tt' is the factors responsible for the trait, 'height', the allele 'T' determines tallness and the allele 't' determines dwarfness.

13. Offsprings of the same parents may show differences among themselves. Why ?
Fertilization causes change in the allele combination in the chromosomes and it causes slight difference among the offsprings.
(According to Mendel, the difference is due to the <u>independent assortment</u> of each character or trait)

14. Name the 2 types of nucleic acids.
DNA (deoxyribo nucleic acid) and **RNA** (ribo nucleic acid)

15. Who proposed the double helical model of DNA ?
James Watson and Francis Crick (in 1953)

16. Comparison between the two types of nucleic acids, DNA and RNA.

	DNA	**RNA**
Number of strand	2	1
Type of sugar	deoxyribose	ribose
Nitrogen bases	Adenine, **thymine**, cytosine, guanine	Adenine, **uracil**, cytosine, guanine

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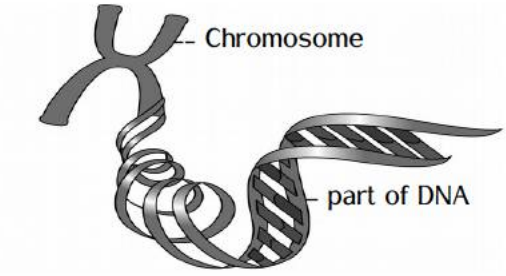
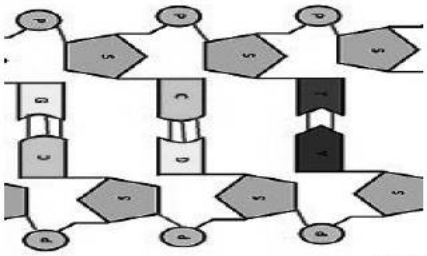


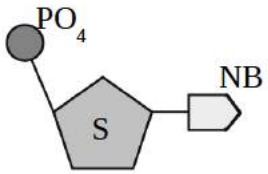
17. Explain the Watson-Crick model of DNA.
Each chromosome contains a DNA , which is made up of several **nucleotides**. DNA is a double helical structured molecule. The two long strands of DNA contain deoxyribose sugar and phosphate groups and its steps are made of pairs of **nitrogen bases**. The nitrogen base, adenine pairs with thymine and the nitrogen base, cytosine pairs with guanine.

In other words, DNA molecule is made up of four kinds of nucleotides, namely adenine nucleotide, thymine nucleotide, cytosine nucleotide and guanine nucleotide.



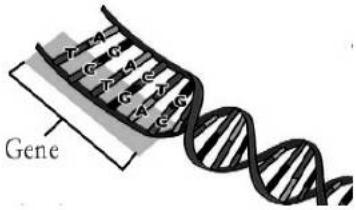
Nucleotides

18. Define a nucleotide.
Nucleotides are the basic units of nucleic acids, (DNA, RNA).
A nucleotide is made up of a nitrogen base, a sugar molecule and a phosphate group.



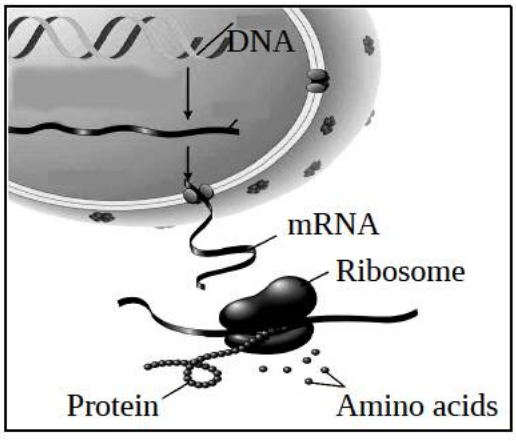
19. Molecules seen in the nucleic acids that contain nitrogen and are alkaline in nature ?
Nitrogen bases.

20. Adenine : Thymine;
Guanine : ---------- ?
Cytosine.



21. How do genes act ?
Genes, which are the specific parts of DNA, act through synthesizing proteins.
Proteins are formed in the ribosomes. Different types of RNA involve in this process.

22. DNA unwinds and ---------- is synthesized which carries the information from DNA to the ribosomes.
mRNA.



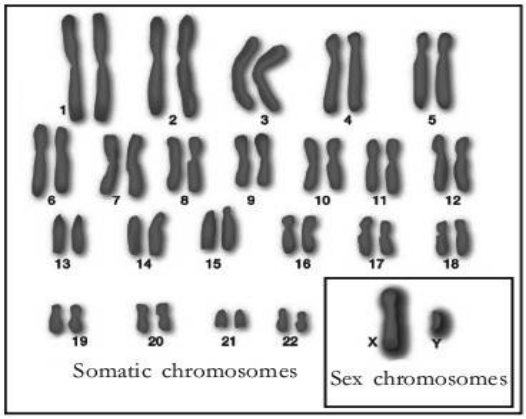
23. The stages of protein synthesis of DNA (The action of genes) ?
- DNA unwinds and mRNA forms.
- mRNA reaches outside the nucleus.
- mRNA reaches ribosomes.
- Based on the information in mRN, amino acids are transferred to ribosomes by tRNA.
- Ribosomes bind amino acids to form protein molecule.

24. Name different types of RNA.
mRNA (messenger RNA), **tRNA** (transfer RNA), **rRNA** (ribosomal RNA).

25. The cell organelles where protein synthesis occur ?
Ribosomes.

26. How many chromosomes are seen in each cell of human being ?
46 (23 pairs) chromosomes.
Out of which, 44 (22 pairs) are **somatic chromosomes** and 2 (one pair) are **sex chromosomes**.

44+XX is female and **44+XY** is male



27. The two types of sex chromosomes ?
X and Y chromosomes.
[XY in males and XX in females]

28. Y chromosome of male gamete : Male child ;
X chromosome of male gamete : ---------- ?
Female child

29. What are the reasons for variations in organisms ?
Crossing over, combination of allele during fertilization and mutation occur in chromosomes.

30. Define the term 'crossing over'. How does crossing over cause variations ?
The process of pairing of chromosome and exchanging their parts, during the initial phase of meiosis, is called **crossing over**. As a result of this, part of one DNA becomes the part of another DNA, causing a difference in the normal distribution of genes. This may causes expression of new characters (variations) in the offsprings.

31.How fertilization causes variation in offsprings ?
When gametes undergo fusion (fertilization), the combination of allele changes. This causes the expression of characteristics in offsprings that are different from parents.

32. Define mutation.
Mutation is a sudden inheritable change in the genetic constitution of an organism. It may occur due to the defects in the duplication of DNA, certain chemicals, radiations etc.
Mutation causes changes in genes, that lead to variations in characters.

33. The protein which gives colour to our skin ?
Melanin.

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34. What may be the reason in the colour difference of skin in people living in various parts of the world ?
Melanin, a pigment protein, imparts colour to the skin . The difference in gene function is the reason for colour differences of skin. The differences in skin colour is mere an adaptation to live under sun.

Youtube video links for this chapter:

Part 1 : https://youtu.be/Tu8Ztn9vQWk
Part 2 : https://youtu.be/qivKb8Oc6Aw
Part 3 : https://youtu.be/yCWoqzsFTo4

7. GENETICS OF THE FUTURE

CONTENT

* Genetic engineering and Biotechnology
  - What ? How ?
  - Genome Project, Genome mapping
* The scope of Genetic engineering
  - Genetically modified organisms for medicine, food etc.
  - .Gene therapy
  - DNA finger printing
* The possibility to misuse genetic engineering.

1. What is biotechnology ?
Biotechnology is the use of microrganisms and biological processes for various human requisites.

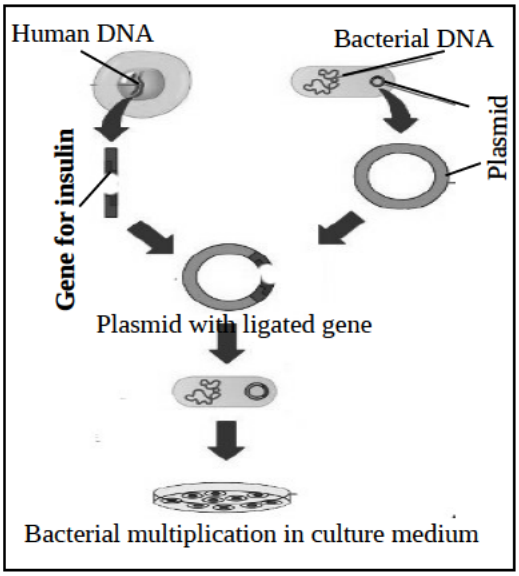
2. What is modern biotechnology ?
Modern biotechnology includes the production of organisms with desirable qualities by changing their genetic material. Genetic engineering is the modern form of biotechnology.

3. What is genetic engineering ?
Genetic engineering is a technology that controls traits of organisms by bringing about desirable changes in their genetic constitution.

4. Methods of biotechnology that man adopted and practised traditionally,
- Yeast (a fungus) was used to prepare food items like bread.
- Bacteria and fungi were utilized to convert sugar in to alcohol to make wine, appam or cake.

5. Give example for modern biotechnological practices.
- Development of human insulin producing bacteria.
- Production of 'pharm animals', that yielding medicines or vaccines
- Production of high yield variety of food crops and animals.

6. How is it possible to bring about desirable changes in an organism ?
Genetic modification in organism is done by cutting or joining specific genes, using certain enzymes. This process is known as genetic engineering.



7. Describe the stages in the production of human insulin bacteria through the process of genetic engineering.

a- From human DNA, cut the gene responsible for the production of insulin.
b- Plasmid (circular DNA) is isolated from a bacterium.
c- Human insulin gene is ligated with the isolated plasmid, which is used as the 'vector'
d- Insert this ligated plasmid in to another bacterial cell.
e- This bacterium is allowed to multiply in a culture medium to produce inactive insulin.
f- Active insulin is produced from this.

8. Define 'vectors' in genetic engineering.
Vectors are other DNA (usually bacterial DNA / plasmid), by which genes can be transferred from one cell to another.

9. What do you mean by genetic scissors and genetic glue that are used in the process of genetic engineering ?

The enzymes like *Restriction endonuclease*, used to cut DNA at specific sites, are generally called as '**genetic scissors**'. The enzymes like *Ligase*, used for joining DNA at specific sites, are generally called as '**genetic glue**'.

10. Genetic scissor : Restriction endonuclease,
Genetic glue : ---------- ?
Ligase

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11. What is gene therapy ? How is it beneficial to mankind ?

Gene therapy is a method of treatment in which the genes that are responsible for diseases are removed and normal functional genes are inserted in their place.
Gene therapy has triggered great hope in the control of genetic diseases.

12. What is ' Human Genome Project'.

The human genome has 2400 functional genes present in the 46 chromosomes.
To find out the exact gene for a specific trait and its location in our genome, a project called **Human Genome Project**, started in 1990 and ended in 2003 in various laboratories of the world.
The Gene mapping is the technology helped us to identify the location of a gene in the DNA.

13. What is gene mapping ?

Gene mapping is a technology by which we can locate a specific gene in the DNA responsible for a particular trait.

14. The sum of genetic material present in an organism is called its --------- ?

Genome
[The human genome includes about 24,000 functional genes present in his 46 chromosomes.
About 200 genes in human genome are identical to those in bacteria.]

15. Define the term 'junk genes'.

Majority of our genes seen in the chromosomes are non functional and is known as '**junk genes**'.

16. What do you mean by pharm animals ?

Genes responsible for the production of human insulin and growth hormones etc. are identified and inserted in animals like cow or pig to transform them in to '**pharm animals**' (animals providing pharmaceuticals or medicines).
Medicines thus produced can be extracted from the blood or milk of such genetically modified animals.

17. Examples for proteins, used as medicines that can be produced from genetically modified animals.

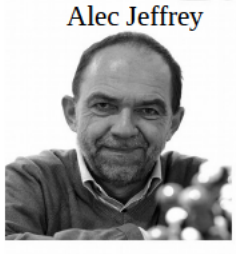
Interferons (for viral disease),
Endorphin (for pain relief),
Somatotropin (for growth disorders),
Insulin (for diabetes mellitus).

18. What is DNA profiling ?

The technology of testing the arrangement of nucleotides in the DNA of persons is called **DNA profiling** or **DNA finger printing** (**DNA testing**).

19. The developer of DNA finger printing ?

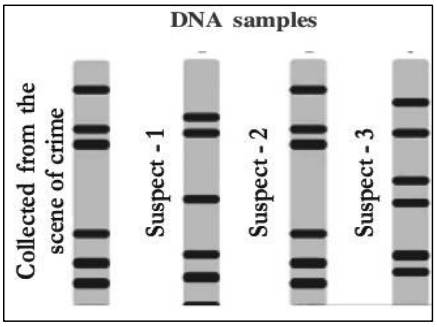
Alec Jeffrey



20. What is the basic principle behind this technology ?

The arrangement of nucleotides in the DNA of each person differs. In DNA profiling, we test the arrangement of nucleotides in the particular person with that of others.

21. Mention the scope of DNA testing.
- To find out hereditary characteristics,
- To identify real parents in the case of parental dispute
- To identify persons found after a long periods of missing due to war or natural calamities.
- To prove murder, robbery etc.



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22. DNA profiling : For identifying person or other organisms,
---------- : For the treatment of genetic diseases (gene therapy)
Gene mapping.

23. Mention how gene technology becomes beneficial ?
- Genetically modified organisms producing medicines, food items and other products.
- High productive and disease resistant varieties
- Remedy of genetic diseases through Gene therapy
- DNA finger printing/profiling to identify real person.

24. Examples for pest resistant verieties ?
B.t. Brinjal, B.t. Soyabean, B.t. Cotton.

25. What are the possibilities to misuse genetic engineering ?
It is criticized that genetically modified varieties are threat to indigenous varieties and may cause health issues to human. There are possibilities to use the genetically modified organisms as 'bioweapons'.

26. What are bioweapons ? Which is the technology behind biowar ?
Bioweapons are genetically modified pathogens that might be applied any country to their enemies. Genetic engineering is the technology behind this kind of biowar.

27. 'Since genetic engineering has many harmful effects, it shouldn't be promoted'. Do you agree with this ?
Genetic engineering or gene technology becomes beneficial to mankind. (see Qns 23, 24). Science and technologies are meant for protection, not for destruction. So, it should be promoted.

28. Make a few logo sentences that can be used for the awareness programme against the misuse of science and technology.
- Genetic modification can be allowed only for the benefit of mankind.
- Avoid all weapons including bioweapons, save life.
- Science and technologies are meant for protection, not for destruction.

YouTube video link of the
focus area covered portion of this chapter : https://youtu.be/M6DZjKdkcg4

8. THE PATHS TRAVERSED BY LIFE

CONTENT

* Origin of first life form on earth
  - Theory of chemical evolution - Urey-Miller experimental support
* Evolution of primitive cell (Geological time scale)
* Theories of evolution
  - Theory of Lamarck
  - Darwin's theory of Natural selection
  - Neo Darwinism – Mutation theory of Hugo deVries
* Evidences of evolution -Fossils, Comparative morphology, Biochemistry-Physiology, Modern molecular biology.
* Stages in the history of human evolution.

1. The hypotheses or theories that are related to the origin of life in earth ?
Theory of Chemical evolution and the Panspermia theory.

2. What is the argument of Panspermia theory ?
The **Panspermia theory** argues that life has originated in some other planet in the universe and accidentally reached the earth.
The organic substances obtained from the meteors that fell on earth, support this hypotheses.

3. What were the ideas proposed by Oparin and Haldane on the origin of life on the earth ?
[Describe the **theory of chemical evolution** on the origin of life]

A.I. Oparin (Russia) and J.B.S Haldane (Britain) proposed the theory of chemical evolution. The theory states that life originated as a result of the changes that occurred in the chemical substances in seawater, under specific conditions in primitive earth.


According to their theory, simple organic molecule are formed first in the primitive ocean by a series of chemical reactions of certain molecules of the primitive atmosphere, where oxygen was absent. By further reactions,complex molecules were formed including genetic material to evolve the first primitive cell, capable of division.

4. Show the process of formation of primitive cell in primitive ocean. (flow chart):

Earth forms,
→ formation of primitive gases,
→ condensation of water vapour to form rain --- primitive ocean forms,
→ formation of simple organic molecules
→ formation of complex organic molecules
→ formation of **primitive cell** from nucleic acids and lipids.

5. On the basis of chemical evolution, find out examples for A,B and C category shown below.
A. Gases in the primitive atmosphere B. Simple organic molecules C. Complex organic molecules

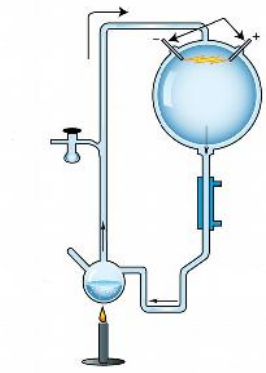
A. methane, ammonia, hydrogen, nitrogen, CO_2, H_2S, water vapour.
B. monosaccharides, amino acids, fatty acids, nitrogen bases.
C. polysaccharides, proteins, nucleotides, lipids...

6. What were the possible sources of energy for chemical evolution in the primitive earth ?
Thunder and lightning, Ultra violet radiations and volcanic eruptions.

7. According to Oparin and Haldane hypotheses, life evolved in---------- as a result of chemical reactions of inorganic molecules, for millions of years, after the origin of earth.
Oceans

8. The scientists who gave support to the theory of chemical evolution ?
Stanley Miller and Harold Urey.

9. Which were the conditions of the primitive earth, recreated by Stanley Miller and Harold Urey ?
Stanley Miller and Harold Urey re-created an experimental set up, in which the glass flask considered as the primitive atmosphere that contained methane, ammonia H_2 and water vapour. Instead of lightning or other energy sources, they passed high voltage electricity through the gaseous mixture. The condensed water from this gaseous mixture was considered as the primitive ocean. Organic molecules like <u>amino acids</u> were found in this.



10. Oparin : Haldane, Stanley Miller : --------- ?
Harold Urey.

11. The organic substances synthesized through Urey-Miller experiment ?
Amino acids.

12. The evolutionary stages after the origin of earth.
Origin of earth ⟶ Chemical evolution begins ⟶ **Primitive cell** (first form of life) ⟶ **Prokaryotes** ⟶ **Eukaryotes** ⟶ **Colony of eukaryotes** ⟶ **Multicellular organisms**.

3800 million years back – origin of life on earth (origin of primitive cell)
3500 million years back – origin of prokaryotes
1500 million years back – origin of eukaryotes
1000 million years back – origin of multicellular organisms

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13. Organisms without definite nucleus : Prokaryotes,
Organism with nucleus and membranous bound cell organelles : ---------- ?
Eukaryotes.

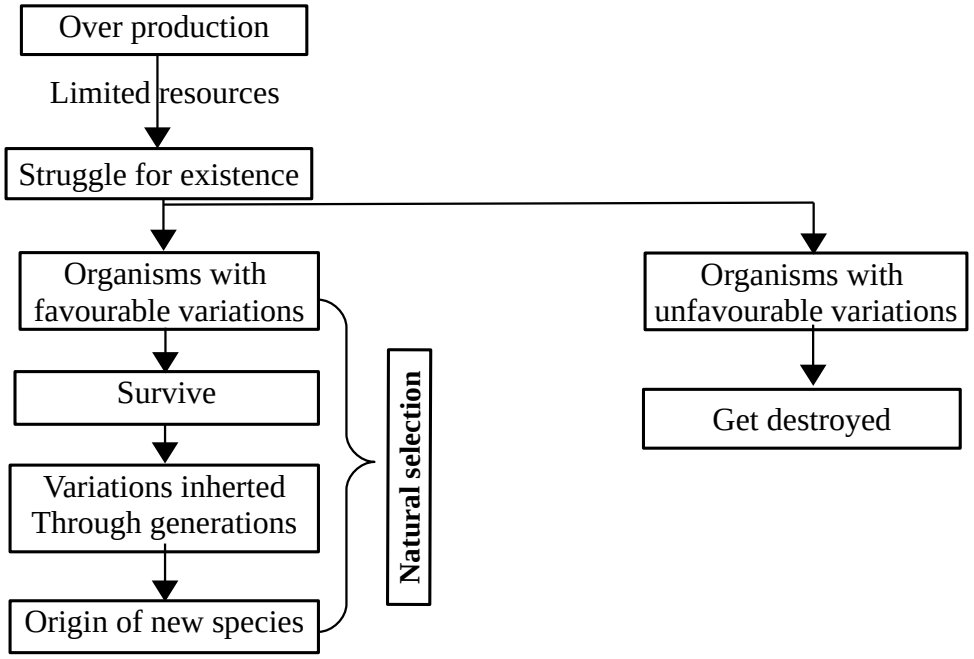
14. The important theories related to organic evolution. Name the proponent of each theory.
* Theory of inheritance of acquired characters by Jean Baptist Lamarck (Lamarckism)
* Theory of natural selection by Charles Robert Darwin (Darwinism)
* Neodarwinism - Theory of mutation by Hugo deVries.

15. The first person who tried to explain organic evolution but did not get acceptance by the scientific world ?
J.B. Lamarck.

16. Explain the ideas of J.B. Lamarck about organic evolution.(Inheritance of Acquired characters.)
<u>The characters developed during the life time of organisms (acquired characters) accumulate through generations and lead to the formation of new species.</u>
According to Lamarck, giraffes had short necks in the beginning. When they faced food scarcity, they stretched their necks to reach out to tall trees. Thus giraffes with long necks emerged through generations .

17. Why did scientists criticize Lamarck's view ?
They did not accept his theory because, the acquired characters are not inheritable.

18. Describe the theory of Natural Selection proposed by Charles Darwin.
<u>Variations develops in each species. Only organisms with favourable variations to that nature, survive and those which are unfavourable get eliminated</u>.
According to Darwin, organisms of one kind, when produced in large numbers (<u>Over Production</u>), compete for food, space, mate, and other limited resources (<u>Struggle for Existence</u>). In this struggle, only organisms with favourable variations survive in that nature. Over a long period, the favourable variations accumulate, resulting the formation of new species.



19. What were the things that influenced Charles Darwin to thought about the importance of nature in the survival or elimination of organisms ?
His studies in Galapagos Islands and the population theory of Robert Malthus.

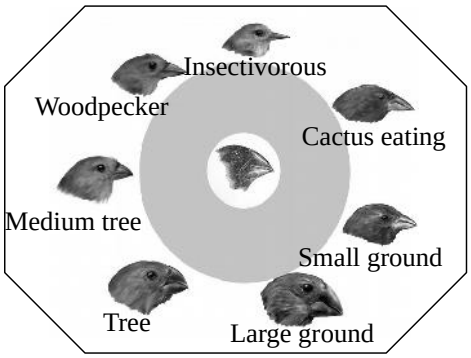
20. The ship by which Charles Darwin reached Galapogos Islands ?
HMS Beagle.

21. Book published by Charles Darwin with his theory, Natural Selection ?
Origin Of Species by means of Natural Selection.

22. Acquired variations : Lamarck, Favourable variations : ---------- ?
Darwin.

23. 'Giraffes with short necks when faced scarcity of food eventually developed in to those with long necks'. How can you described the above view of Lamarck in the light of the view of Darwin ?
When faced scarcity of food, only giraffes with favourable neck (long neck to reach out to tall trees) could survive and others get eliminated.

24. How Darwin could understand that the 13 different finches found in Galapogos Islands came from a common ancestor ?
Though the finches were similar in sound and nesting habits, only they showed differences in food and food habits. [Insectivorous finches have small beaks, cactus feeding finches have long and sharp beaks, woodpecker finches feed on worms in tree trunks have sharp beaks and ground finches feed on seeds have large beaks etc.] So, Darwin thought that they were evolved from a common ancestor.



25. According to Darwin, what might be the reasons for the peculiarities of the beaks of finches ?
The finches of Darwin's had beaks adapted to their feeding habits. When scarcity of food occurred in each island, only beaks with favourable variations (adaptations) to that nature might have survived there.

26. The theory of Robert Malthus was also influenced Charles Darwin to thought about the importance of nature in the survival or elimination of organisms. What was Malthus' theory ?
In his theory of population, Robert Malthus pointed out that rate of food production is not proportionate to the growth rate of human population, and when scarcity of food occur, it will lead to diseases, starvation and struggle for existence.

27. What, according to Darwin, is the cause of the struggle for existence ?
Over Production and hence, limited resources.

28. What was the limitation in Darwin's theory ? Who gave sufficient explanations to this ?
Darwin could not explain the reasons for variations in organisms. However, Hugo deVries explained that one of the reasons for variations in organisms is **mutation** (sudden changes that occur in genes).

29. What do you mean by Neo Darwinism ?
Neo Darwinism is the modified version of Darwin's theory in the light of new information from the branches of genetics, cytology, geology and palaeontology about the reasons of variations occurred in organisms. Hugo deVries first supported Darwin by his theory of mutation.

30. Charles Darwin : Theory of natural selection, Hugo deVries : ---------- ?
Mutation theory.

31.In what ways Hugo de Vries described evolution ?
Hugo de Vries described <u>that sudden and heritable changes (mutation) lead to evolution</u>.

32. The branches of science which provide evidences to organic evolution.
- Palaeontology (fossil study),
- Comparative morphology,
- Biochemistry and Physiology,
- Modern molecular biology.

33. Define fossils.
Fossils are remnants of primitive organisms , preserved in earth crust.
(Fossils may be the body, body parts or imprints of organisms.)

34. What evidences of organic evolution do the study of fossils (Palaeontology) reveal ?
- Primitive fossils have simple structure.
- Recently formed fossils have complex structure.
  (The study of fossils from different layers of rocks indicate that complex structured organisms are evolved from primitive simple organisms.)
- Certain linking fossils reveal the evolution of one form of organisms from another form.

35. 'Comparative study of structure gives evidences to evolution'. Evaluate this statement.
Though there are differences in the external structure (morphology) among different organisms , there are certain similarities in their internal structure (anatomy). The evidences from the comparative morphological studies justify the inferences that all organisms were evolved from a common ancestor.
For example,
The forelimbs in lizard, bat and whale are internally similar (in blood vessels, nerves, muscles and bones) but morphologically different (homologous organs). Reason for these differences are their adaptations to live their own habitats.

Homologous organs

36. What do you mean by **homologous organs** ?
Organs that are similar in structure but perform different functions are called homologous organs.

37. How do biochemistry and physiology justify evolution ?
All organisms are made up of cells with protoplasm. There are similarities among the cell organelles and cellular activities. Enzymes control chemical reactions and energy is stored in ATP molecules in all organisms. Hereditary factors are gene , seen in DNA and the structure of DNA is alike in all. Carbohydrates, proteins and fats are the basic substances. There are similarities in growth, excretion etc.

38. What evolutionary interference can be arrived from the evidences from the comparative morphological , biochemical and physiological studies ?
All organisms were evolved <u>from a common ancestor</u>.

39. What evidences of organic evolution do the study of modern molecular biology provide us ?

a). Through a comparative study of protein molecules in different species, the evolutionary relationship (similarity / difference) among organisms can be identified.
For instance, we can analyse the similarities or differences in the sequence of amino acids in the beta chain of haemoglobin molecules of different mammals and there by we can understand about the evolutionary relationship among them.

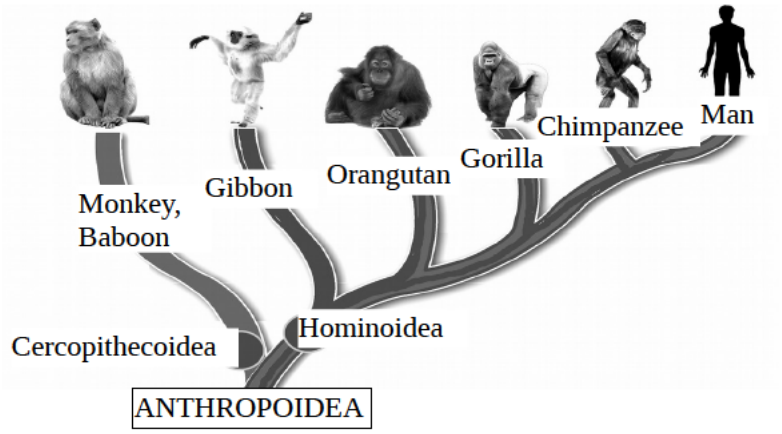
b). Mutations are the main reason for evolutionary changes. Through the molecular studies, we can find out how mutation occur in the genes that determine amino acid sequence in protein molecules. From this we can infer the period of separation of different group of organisms from their ancestor.

40. The differences of the sequential arrangement of amino acids in the beta chain of haemoglobin of man with other animals are given below. Which one is so close to human being ?

Chimpanzee	No difference
Gorilla	Difference of 1 amino acid
Rat	Difference of 31 amino acids

Chimpanzee is so close to human being.

41. Evolutionary tree of certain organisms related to man.



Anthropoidea

Cercopithecoidea	**Hominoidea**
Feature * Small brain * Long tail	Feature * Developed brain * Freely movable hands
Eg:-Monkey, Baboon	**Eg**:- Gibbon, Orangutan, Gorilla, Chimpanzee, Man

42. Find out the missing links in the following evolutionary series of hominoidea.
Gibbon → ------A------ → Gorilla → --------B------ → Man.

A- Orangutan B- Chimpanzee.

43. Do you agree with the statement that man is evolved from monkeys ? What is your opinion ?
This statement is wrong. Man come under the group Hominoidea while monkeys are included in Cercopithecoidea. It is believed that both the ancestors of man and monkeys are evolved from a common ancestor.

44. The oldest fossil of the genus ,Homo ?
Homo habilis

45. How do modern man differ from the other groups of human beings ?
Modern man have developed brain and equipped with advanced technologies.

46. Table showing the organisms that are included in the evolutionary history of modern man.

A (Human beings)	B (Features)	C. (First fossil discovered from)	Development of brain ⟶
a. Ardipithecus ramidus	Most primitive human race	Africa	
b. Australopithecus afarensis	Slender body.	Africa	
c. Homo habilis	Made weapons from stones and bones	Africa	
d. Homo erectus	Thick chin and large teeth, ability to stand erect	Africa and Asia	
e. Homo neanderthalensis	Contemporary to modern man	Europe and Asia	
f. Homo sapiens	Modern man	First fossils from France	

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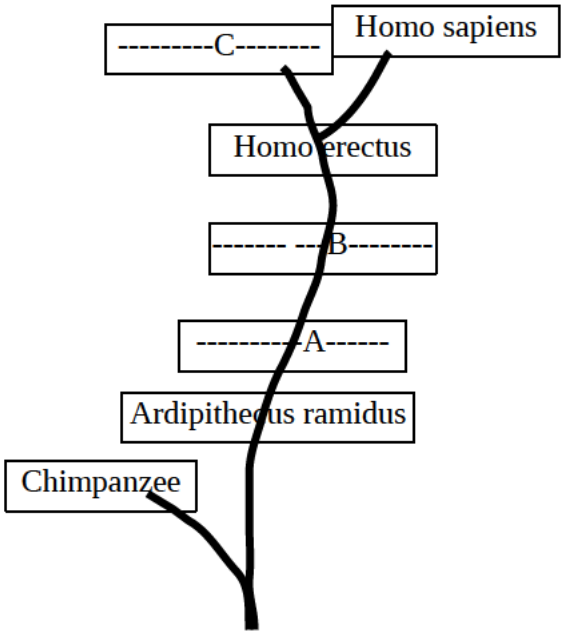
47. Here is an incomplete illustration of human evolutionary tree. Find out the missing links.



A- Australopithecus afarensis.
B- Homo habilis.
C- Homo neanderthalensis.

48. Do the interventions of modern man cause any change to natural evolutionary process ? How ?
Yes. Biodiversity is on a dangerous decline due to the interference of human beings in nature and natural resources. By human interventions climatic changes brought in as well as the extinction of many organisms.(there occurred five mass extinctions in the world history till now)
Human life is possible on earth only with the preservation of other diverse ecosystems.

Youtube video link of Focus area covered portion of this unit : https://youtu.be/p_ND6dAsi8Y

Vist: *odakkal blog*