

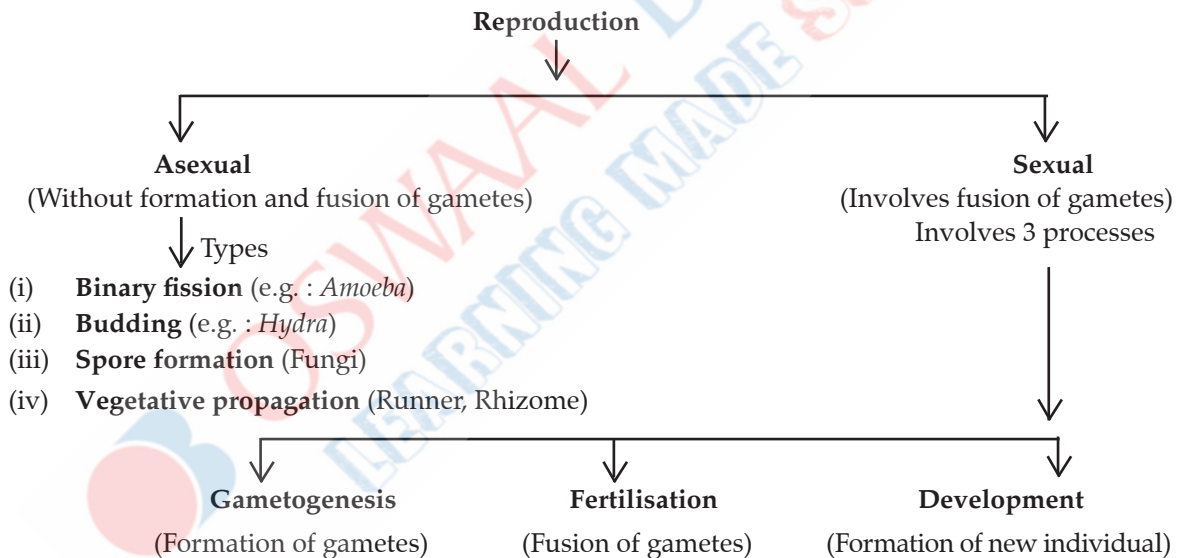


ON TIPS NOTES

Note making is a skill that we use in many walks of life : at school, university and in the world of work. However, accurate note making requires a thorough understanding of concepts. We, at Oswaal, have tried to encapsulate all the chapters from the given syllabus into the following **ON TIPS NOTES**. These notes will not only facilitate better understanding of concepts, but will also ensure that each and every concept is taken up and every chapter is covered in totality. So go ahead and use these to your advantage... go get the **OSWAAL ADVANTAGE !!**

CHAPTER 1 : Reproduction in Organisms

1. Reproduction is the ability of an organism to produce young ones of its own kind.
2. Reproduction may be asexual or sexual.

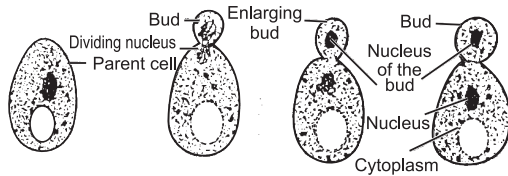


3. **Clones** is a group of genetically and morphologically identical organisms reproduced asexually from a common parent.
4. Fusion of gametes in sexual reproduction is known as **syngamy**.
5. Fusion of similar gametes is **isogamy**, while fusion of dissimilar gametes is **anisogamy**.
6. When male and female gametes are separated, they are called **unisexual, heterothallic** or **dioecious**.
7. The individual which possess both reproductive organs are called **bisexual, homothallic** or **monoecious**.
8. **Pollination** ensures the transfer of pollen grains from anther to stigma.
9. Process of development of embryo is called **embryogenesis**.
10. Animals may be **oviparous, viviparous** or **ovoviviparous**.
11. In plants, after fertilisation **ovary** develops into **fruits** and **ovule** into **seeds**.

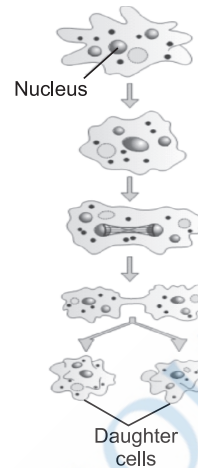
12. Formation of new individual without fertilisation is called **parthenogenesis**.

IMPORTANT DIAGRAMS

1. Budding in Yeast



2. Binary Fission in Amoeba

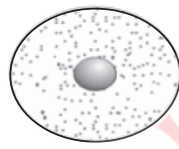


3. Types of gametes



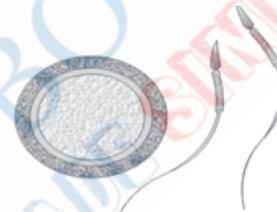
(a)

Isogametes
(*Cladophora*)



(b)

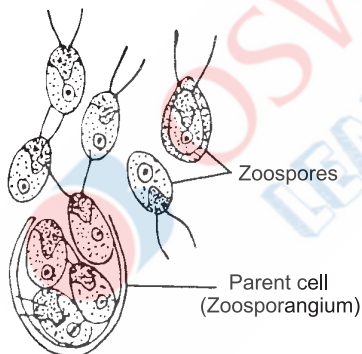
Heterogametes
(*Fucus*)



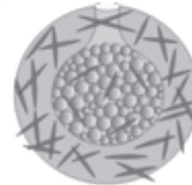
(c)

Human beings

4. Zoospores of *Chlamydomonas*



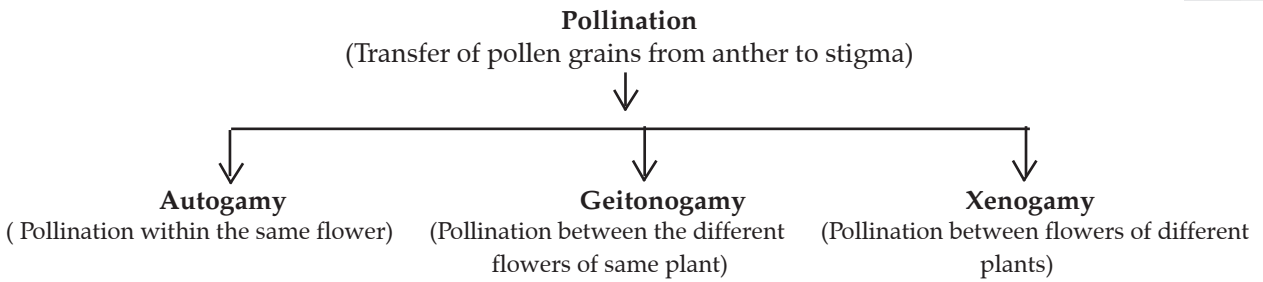
5. Gemmules in Sponges



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CHAPTER 2 : Sexual Reproduction in Flowering Plants

1. A flower shows four kinds of floral parts : sepals, petals, stamens and carpels.
2. Stamens are male reproductive organs of flower while carpels are female reproductive organs.
3. **Microsporogenesis** is process of formation of haploid microspore (pollen grain) from a pollen mother cell through meiosis.
4. **Sporoderm** is a covering of pollen grain, which has two layers – outer exine and inner intine.
5. A matured pollen grain contains two cells : Vegetables cell and Generative cell.
6. **Megasporogenesis** is process of formation of megaspores from the megaspore mother cell. It takes place in the region of nucellus through meiosis.
7. An ovule is a female megasporangium where the formation of megaspores takes place.



8. **Anemophily** : Pollination by wind. eg., : Maize
9. **Entomophily** : Pollination by insects. eg., : Dahlia
10. **Hydrophily** : Pollination by water. eg., : *Vallisneria*
11. **Zoophily** : Pollination by animals. eg., : Rafflesia (Pollination by elephants : Elephophily)
12. Herkogamy, unisexuality, heterostyly are some devices to prevent self-pollination and promote cross-pollination.
13. The mature embryo sac is 7-celled (3 antipodal, one egg, 2 synergids and one central) and 8- nucleate.
14. Angiosperm exhibits **double fertilisation**— It comprises 2 events : syngamy and triple fusion.
15. Apomixis, polyembryony and plant tissue culture are some methods for multiplication.
16. Seed is the final (last) product of sexual reproduction in angiosperms. It is the fertilised ovule that is developed inside a fruit.
17. **Apomixis** is the production of seeds without involving the process of meiosis and syngamy. e.g., Some species of Asteraceae and grasses.
18. Occurrence of more than one embryo in a seed is called polyembryony.
19. **Albuminous and non-albuminous seed :**

Albuminous Seed	Non-albuminous Seed
They retain a part of endosperm and is not completely used up during embryogenesis. e.g., : Wheat, maize.	They have no residual endosperm as it is completely used up during embryogenesis. e.g., : Pea, groundnut.

20. **Perisperm and Pericarp :**

Perisperm	Pericarp
Remnants of nucellus in matured seeds are known as perisperm.	The wall of the ovary develops into the wall of fruits called pericarp.

21. **Parthenogenesis and Parthenocarpy :**

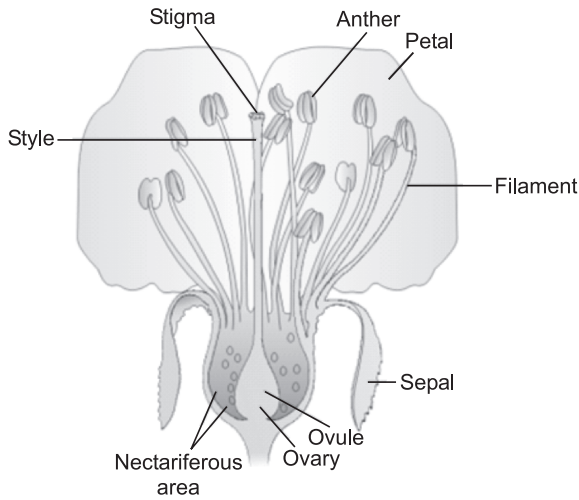
Parthenogenesis	Parthenocarpy
It is the phenomenon where reproduction takes place by egg formation without fertilisation. e.g., Rotifers, honey bees, etc.	Fruits that develop without fertilisation is called parthenocarpic fruits and the process is called parthenocarpy. e.g., Banana.

22. **Integument and Testa :**

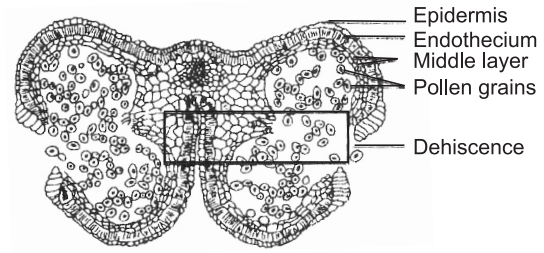
	Integument	Testa
(i)	Outer covering of ovule.	Outer covering of seed.
(ii)	Thin walled.	Thick walled.
(iii)	Its cells are living.	Its cells are dead.

IMPORTANT DIAGRAMS

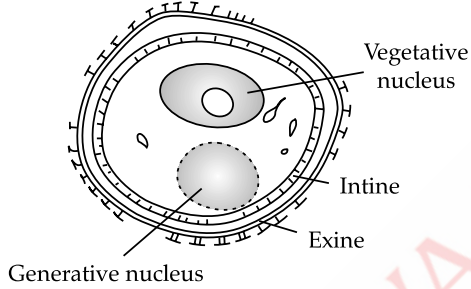
23. L.S of Flower



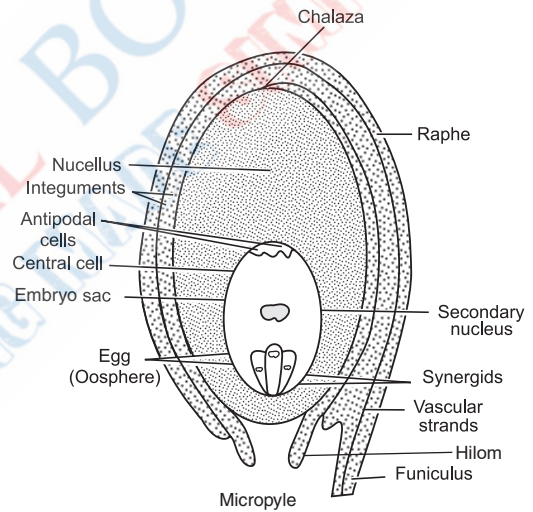
24. Mature Anther



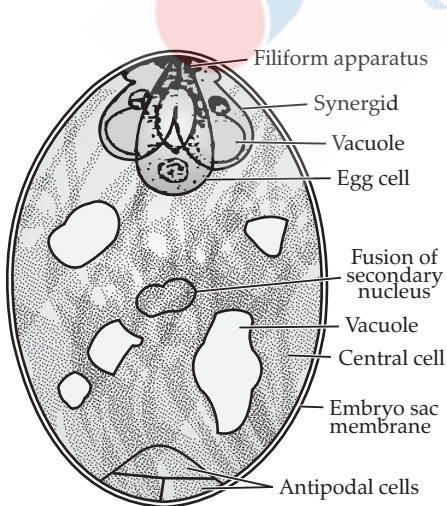
25. Male gametophyte



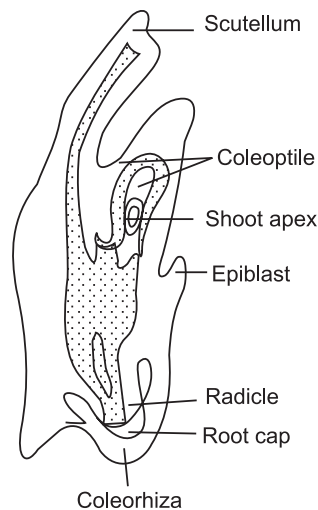
26. Ovule (Anatropus)



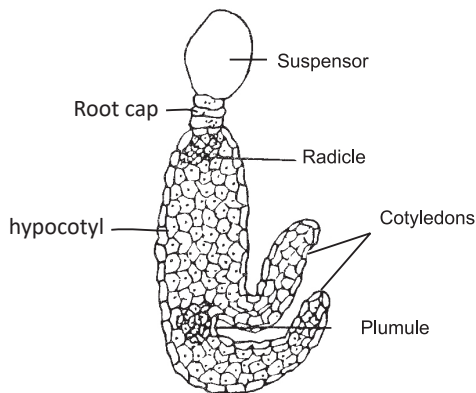
27. Mature embryo



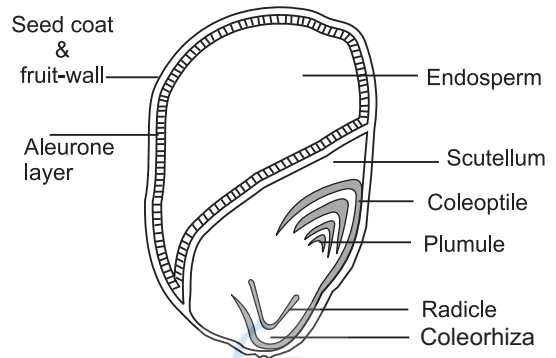
28. L.S. of embryo of grass



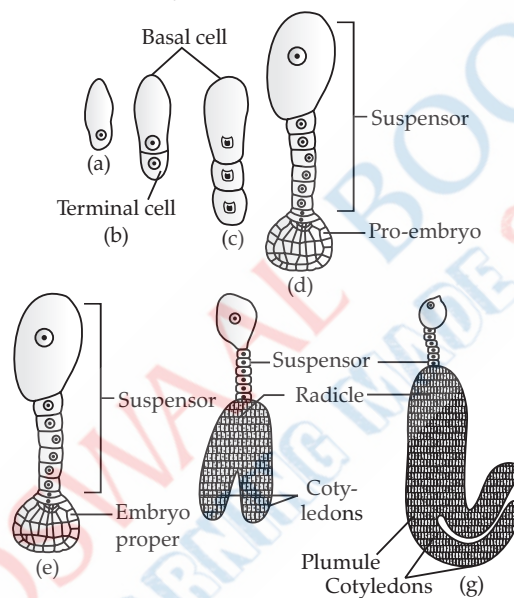
29. Dicot embryo



30. V.S. of maize grain



31. Stages of development of dicot embryo



CHAPTER 3 : Human Reproduction

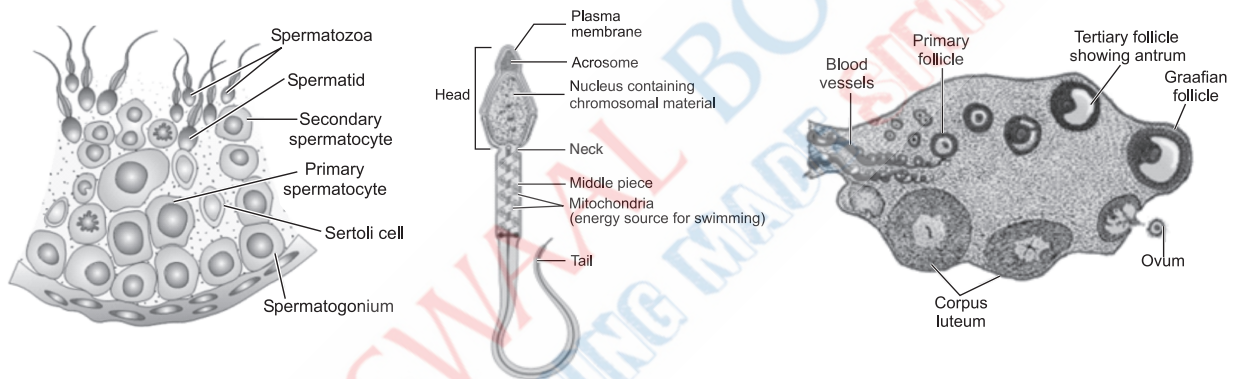
- Sexual reproduction involves formation and fusion of gametes.
- Puberty** is the period of sexual maturity.
- Sertoli cells** provide nutrition to the germ cells while **leydig cells** synthesise and secrete androgens in man.
- Bulbourethral** are the glands (in male) which help in lubrication of penis.
- Secretion of seminal vesicles, prostate gland, Cowper's gland and sperms from testis is called **semen**.
- Gametogenesis** is the process of formation of gametes.
- Spermatogenesis** is formation of sperms while **oogenesis** is formation of ovum.
- Menarche** is the beginning of menstruation, occurs between 12-15 years.
- Menopause** is the phase when menstruation end. It occurs between 40-50 years.
- Menstrual cycle** consists of four phases : Proliferatory, ovulatory, luteal and menstrual.
- Fertilization** is the fusion of gametes. The fertilized egg gets implanted in the wall of uterus.
- Cleavage** : Single celled zygote $\xrightarrow{\text{Mitotic divisions}}$ Multicellular blastula.
- The **extra embryonic membranes** are amnion, chorion, allantois and yolk sac.
- Placenta** acts as barrier between foetus and mother.
- Progesterone** is a pregnancy hormone.
- Gestation** is the time from conception to birth. Gestation period in human is 9 months.

17. Onset of labour is termed **parturition** which leads to child birth.
18. **Colostrum** is the first milk which comes out of the mammary gland of mother just after the birth. It contains several antibodies essential to develop resistance for new born babies.
19. **Differences between spermatogenesis and oogenesis :**

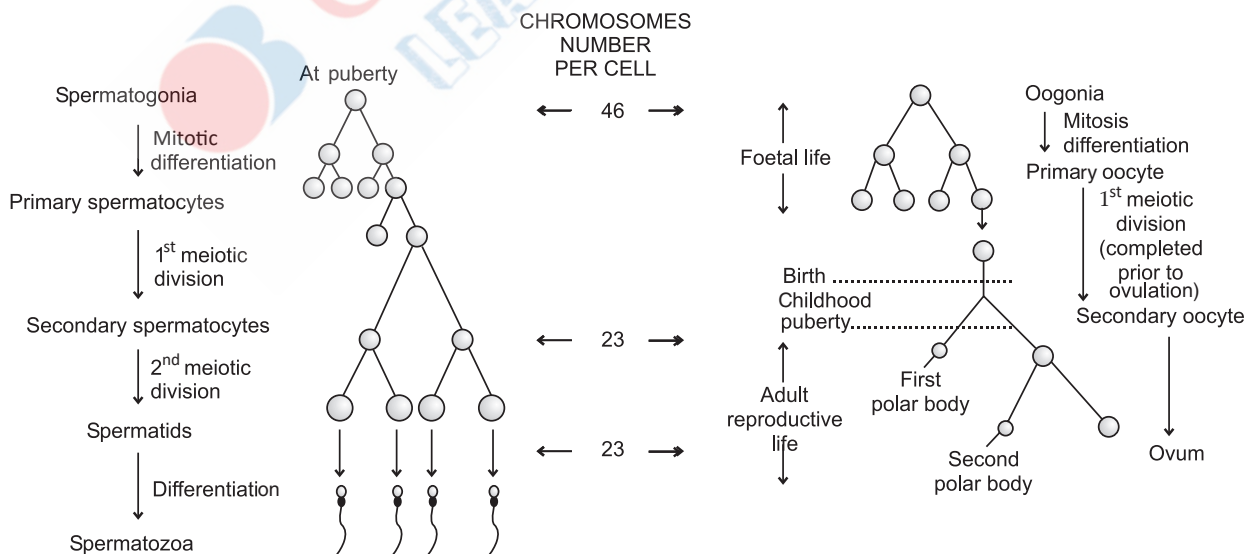
S.No.	Spermatogenesis	Oogenesis
(i)	Formation of sperm.	Formation of ovum.
(ii)	Occurs in testis.	Occurs in ovaries.
(iii)	One spermatogonium produces four haploid sperms.	One oogonium produces only one haploid ovum.
(iv)	No polar bodies are formed.	Two or three polar bodies are formed.
(v)	It is started and completed in the testis.	It is started in the ovary and completed in the oviduct.
(vi)	Sperms formed are smaller in size.	Ovum is larger in size.

IMPORTANT DIAGRAMS

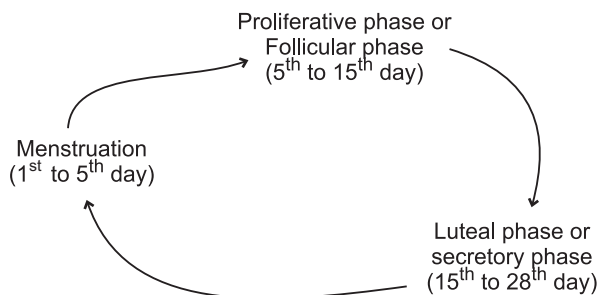
1. Sectional view of Seminiferous tubules 2. Structure of sperm 3. Sectional view of Ovary



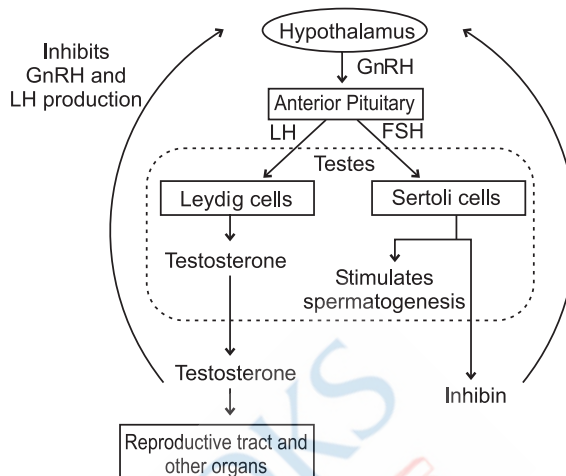
4. Spermatogenesis and oogenesis



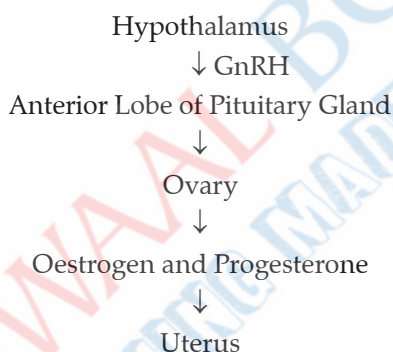
5. Menstrual cycle



6. Hormonal control of Male reproductive system



7. Hormonal control of Female reproductive system



CHAPTER 4 : Reproductive Health

- Reproductive health** means the total well being in all aspects of reproduction.
- Amniocentesis** is a foetal sex determination test based on the chromosomal pattern in the amniotic fluid.
- Population explosion** is the high rate of growth of population.
- Methods of Contraception :**
 - Natural/Traditional methods :** It works on the principle of avoiding chances of ovum and sperms meeting. It includes periodic abstinence, coitus interruptus, and lactational amenorrhoea.
 - Artificial methods :** It includes :
 - Barrier method :** In this method, a device is used to prevent the entry of sperms in the female's genital tract during sexual intercourse.
Example : Condom, diaphragm and cervical cap.
 - Chemical method :** It involves the use of specific drugs by females.
Example : Oral pills, vaginal pills, OC (Oral Contraceptive) pills.
 - Surgical method :** Surgical removal or ligation of vas deferens in males and the fallopian tube in females, thereby preventing production of male and female gametes.
- Medical Termination of Pregnancy (MTP)** – Intentional termination of pregnancy before full term.
- Sexually Transmitted Diseases (STDs)** – Infection transmitted through sexual intercourse.

Example : Gonorrhoea, syphilis, genital herpes, AIDS, etc.

7. **HIV :** Human Immuno Deficiency Virus, which causes AIDS in human beings.
8. **ELISA :** Enzyme-Linked Immunosorbent Assay. It is a test that detect and measures antibodies in blood.
9. Avoiding sexual intercourse with unknown/multiple partners, use of condoms during intercourse are some of the tips to avoid contracting STDs.
10. **Infertility :** It is the inability of a couple to produce baby even after unprotected intercourse.
11. **Assisted Reproductive Technologies (ART):**
 - (i) **IVF :** *In Vitro* Fertilisation
 - (ii) **ZIFT :** Zygote Intra Fallopian Transfer.
 - (iii) **IUT :** Intra Uterine Transfer.
 - (iv) **GIFT :** Gamete Intra Fallopian Transfer.
 - (v) **IUI :** Intra Uterine Insemination.
 - (vi) **AI technique :** Artificial Insemination technique
12. *In Vitro* Fertilisation (IVF) followed by Embryo Transfer (ET) in the female genital tract is known as **test-tube baby programme**.

□□□

CHAPTER 5 : Heredity and Variation

1. **Heredity** is the transfer of characters from one generation to the next with the help of genes.
2. **Acquired traits and Inherited traits :**

S. No.	Acquired Traits	Inherited Traits
1.	The traits that develop during lifetime of an individual.	The traits that are received from the parents.
2.	They are somatic variations and die with the death of the individual.	They are genetic variations which passes on to the next generation.
3.	Example : Muscular body of wrestler.	Example : Fused and free ear lobes.

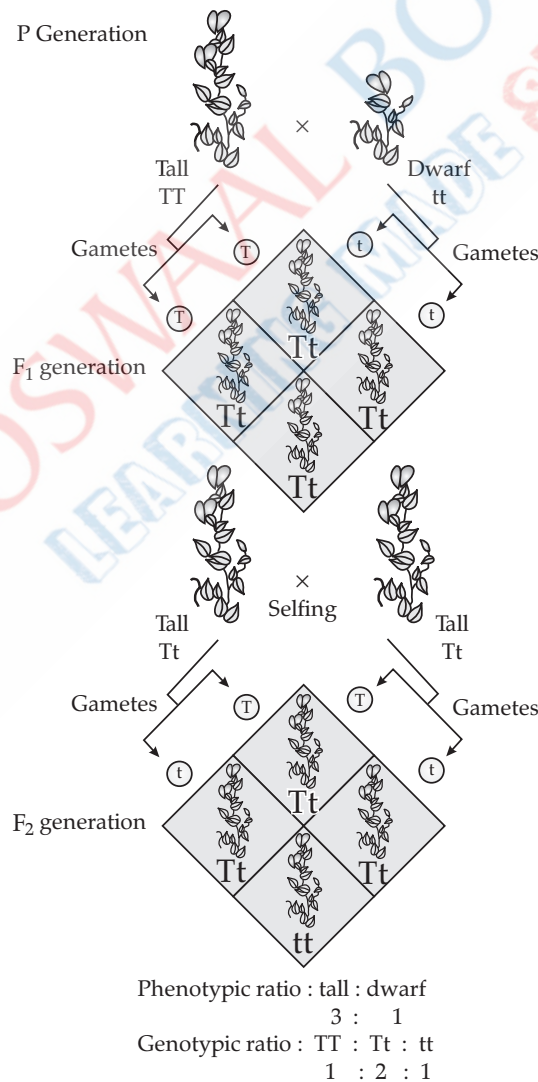
3. Gene determines the biological character of an organism.
4. **Homozygous :** Both the genes of a character are identical. e.g. : TT (homozygous dominant) and tt (homozygous recessive).
5. **Heterozygous :** Both the genes of a character are unlike. e.g. : Tt
6. **Variations** means differences in individuals of the same species.
7. **Dominant factor** is the pair of allele which can express itself, whereas **recessive factor** is unable to express itself in the presence of contrasting factor in heterozygous. It can only express in homozygous condition.
8. In case of *monohybrid cross* with pure variety of plants , the phenotypic ratio obtained in F₂ generation is 3 : 1.
9. In case of *dihybrid cross* involving two pairs of contrasting characters, the phenotypic ratio obtained in F₂ generation is 9 : 3 : 3 : 1.
10. **Incomplete dominance :** In it none of the two contrasting factor is dominant. The expression of a character in a hybrid is intermediate of the two factors.
11. **Co-dominant alleles :** The alleles which are able to express themselves independently, when present together.
12. **Test cross :** Individual of unknown genotype is crossed with homozygous recessive genotype.
13. **Back cross :** Cross between hybrid and one of its parents in the presence of dominant gene.
14. **Mutation :** It is defined as the sudden, abrupt and inheritable change in the progeny.
15. **Chromosomal theory of inheritance :** It states that genes are located on the chromosomes and they later segregate and assort independently during meiosis.
16. **Linkage :** It is defined as the co-existence of two or more genes in the same chromosome. If the genes are situated on the same chromosome and lie close to each other, then they are inherited together and are said to be linked genes.
17. Linked genes can exhibit recombination by crossing over.

18. **Sex linkage** is the transmission of characters and their determining genes which are borne on sex chromosomes and are inherited to the next generation.
19. Humans have 22 pairs of autosomes and one pair of sex chromosome.
20. Female have similar sex chromosomes XX, whereas male have a dissimilar pair *i.e.*, XY.
21. All eggs carry X chromosome.
22. The sex of the child depends on whether the egg fuses with the sperm carrying X chromosome (resulting in a girl) or with the sperm carrying Y chromosome (resulting in a boy).
23. **Mendelian Disorders** :
 - (i) **Haemophilia** (sex linked recessive disease).
 - (ii) **Sickle cell anaemia** (autosomal recessive trait).
 - (iii) **Phenylketonuria** (autosomal recessive trait).
24. **Chromosomal Disorders** : **Polyploidy** is having more than 2 sets of chromosomes and **aneuploidy** is having fewer or extra chromosomes than the normal.
 - (i) **Down's syndrome** – Trisomy of chromosome number 21.
 - (ii) **Klinefelter's syndrome** – Presence of an additional copy of X chromosomes.
 - (iii) **Turner's syndrome** – Absence of one of the X chromosome.

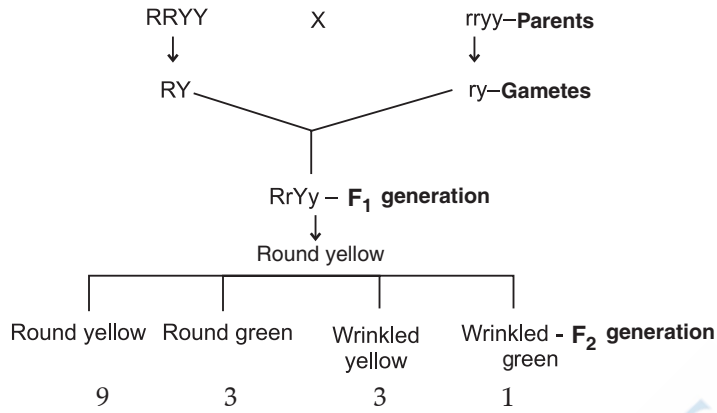
IMPORTANT GRAPHS AND DIAGRAMS

1. Experiments conducted by Mendel

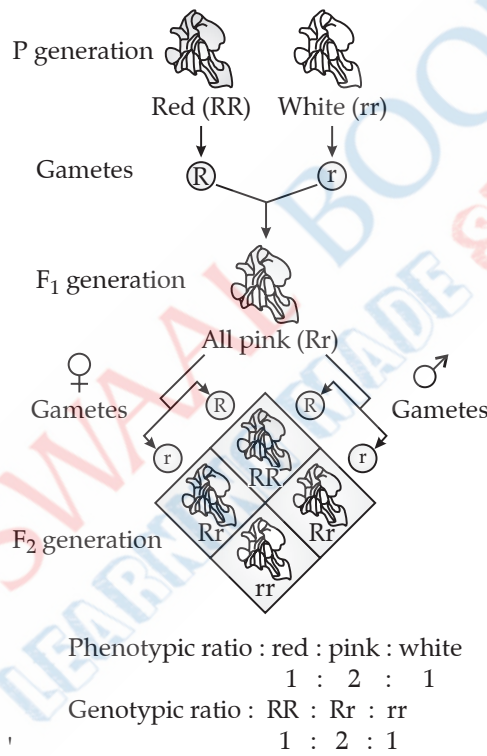
(a) **Monohybrid cross** : The cross between tall and dwarf pea plants.



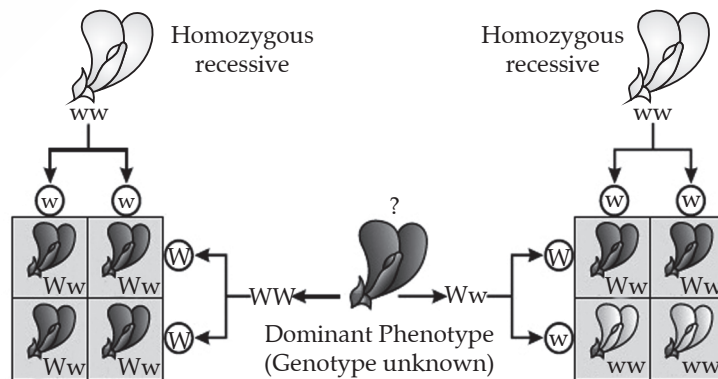
(b) **Dihybrid Cross** : Inheritance of two characters over two generations by making a cross between round and yellow seeded plant (RRYY) with wrinkled and green seeded plant, (rryy).



2. Incomplete dominance



3. Test Cross



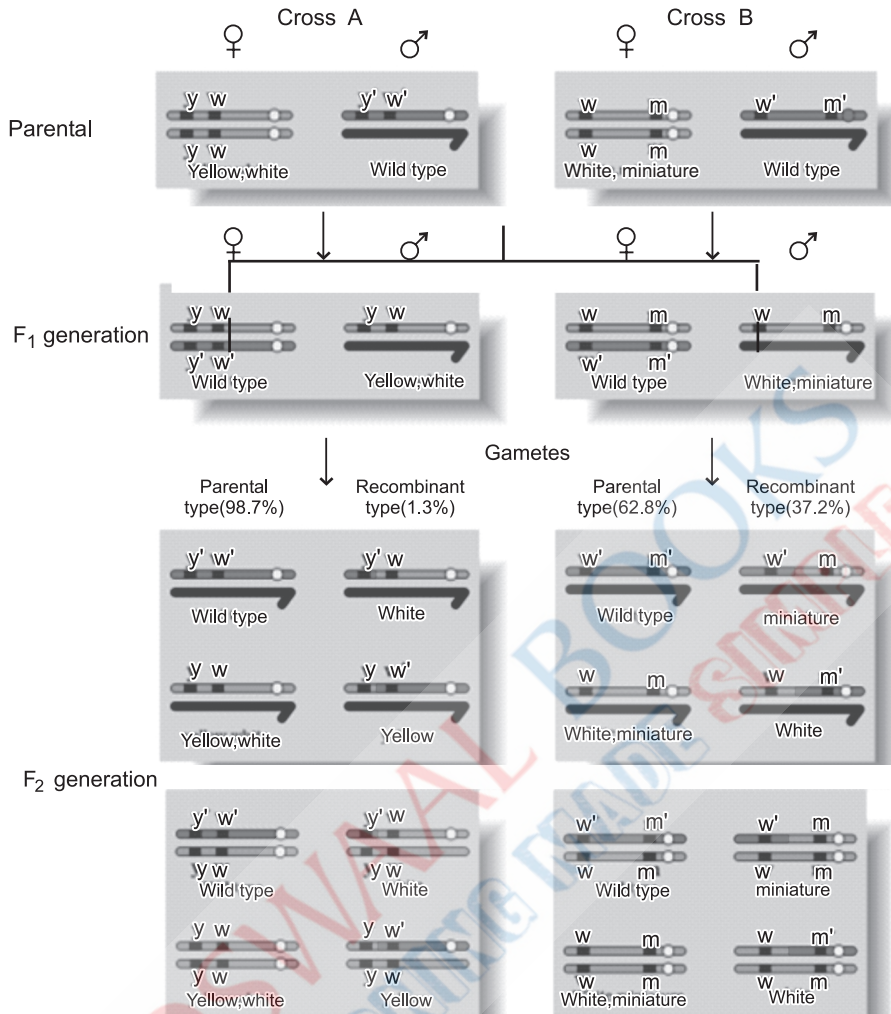
Result All flowers are violet

Interpretation Unknown flower is homozygous dominant

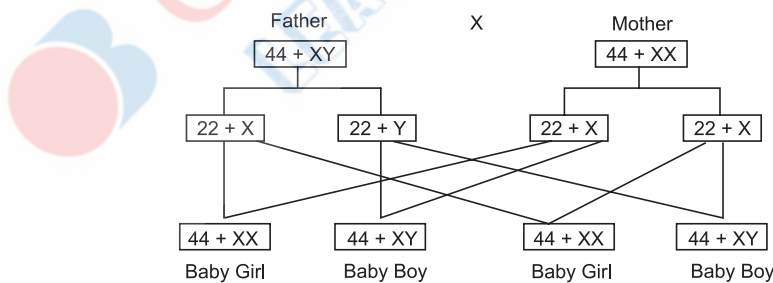
Half of the flowers are violet and half of the flowers are white.

Unknown flower is heterozygous

4. Linkage

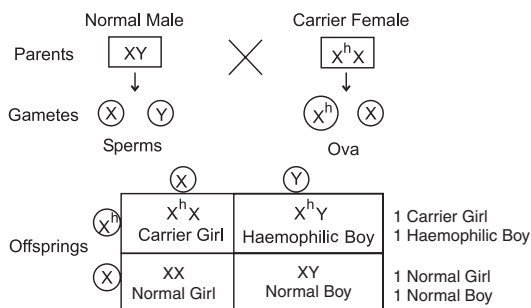


5. Determination of sex of a child

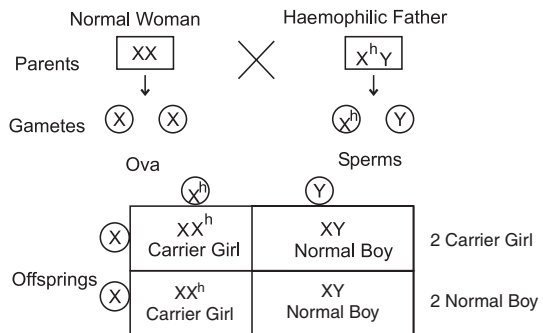


6. Haemophilia

(a)

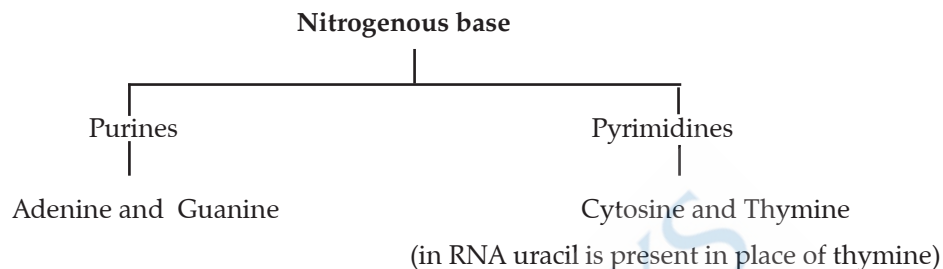


(b)

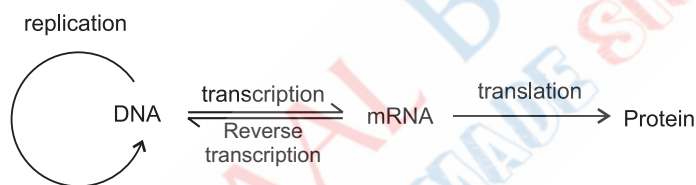


CHAPTER 6 : Molecular Basis of Inheritance

- The polynucleotide chains of very high molecular weight are called **nucleic acid**.
- DNA (deoxyribonucleic acid) and RNA (ribonucleic acid) are two types of nucleic acids.
- Nucleotides** : Pentose sugar + phosphate group + nitrogenous base.
-



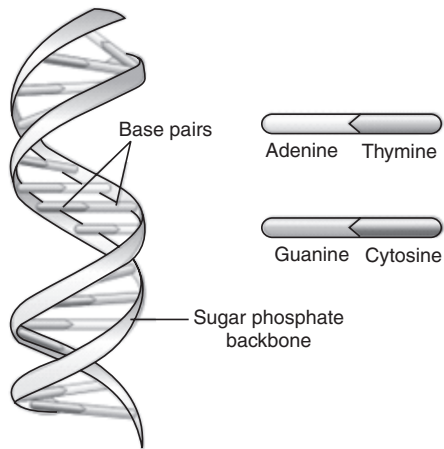
- Structure of DNA : **Double helix model**, proposed by **Watson and Crick** in 1953.
- The DNA molecule consists of two polynucleotide chains of deoxyribose series twisted around a common axis in the form of a double helix.
- Central dogma** :



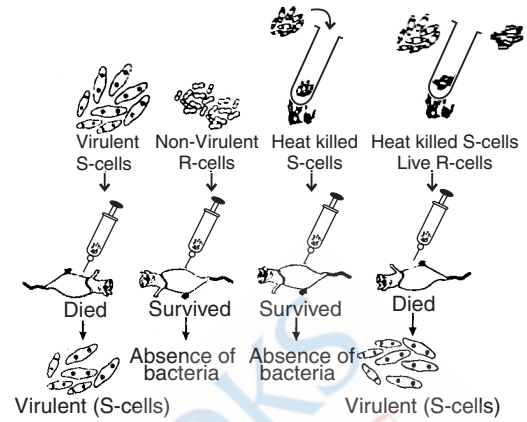
- Transformation** is the genetic alteration of a cell resulting from the direct uptake and incorporation of exogenous genetic material from its surrounding through cell membrane. It was 1st studied by **Frederick Griffith** in *Streptococcus pneumoniae*.
- Replication** is the process of formation of copies of DNA.
- Semi-conservative replication** : In it, one DNA strand of the daughter duplex is derived from the parent while the other strand is new. It was proved by **Meselson and Stahl**.
- Formation of RNA over DNA template is called **transcription** and formation of DNA over RNA template is called **reverse transcription**.
- A promotor, structural gene and a terminator are three regions of a **transcription unit**.
- Chemically a gene is linear segment of DNA called **cistron**.
- Exons** are **coding** sequences while **introns** are **non-coding** sequences.
- Splicing** is the phenomenon of removal of non-coding regions and fusion of coding parts of RNA.
- Genetic code** is the nitrogenous base in mRNA which contain information for protein synthesis.
- During **translation**, proteins are made by the ribosomes on mRNA strand.
- Operons** are segments of genetic material which function as regulated unit.
- Human genome project** was aimed to sequence every nitrogenous base in human genome.
- DNA fingerprinting** is a technique to find out variations in individuals of a population at DNA level.

IMPORTANT DIAGRAMS :

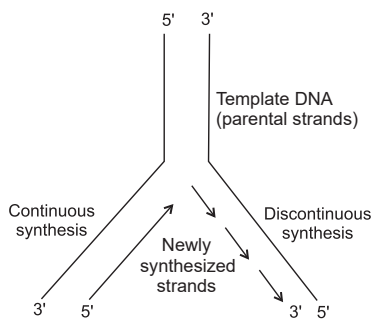
1. DNA double helix



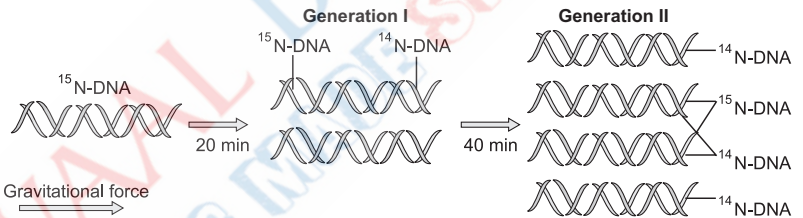
2. Griffith's experiment



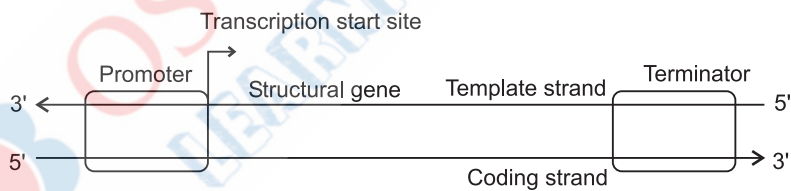
3. Replicating fork of DNA



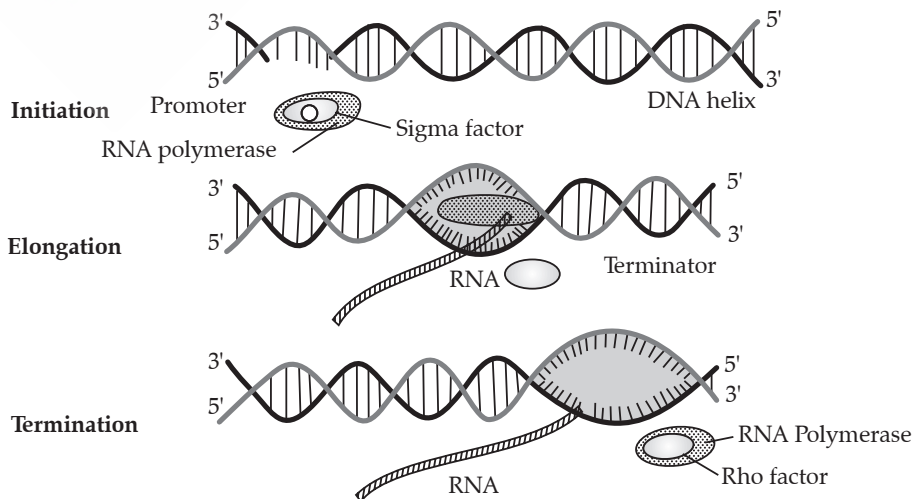
4. Meselson and Stahl's Experiment



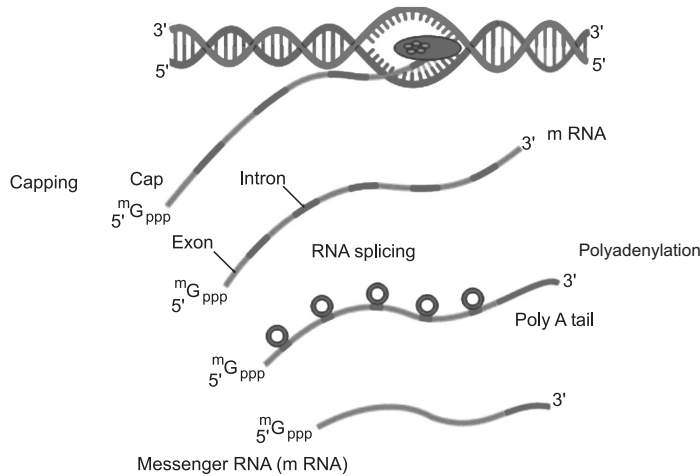
5. Transcription unit



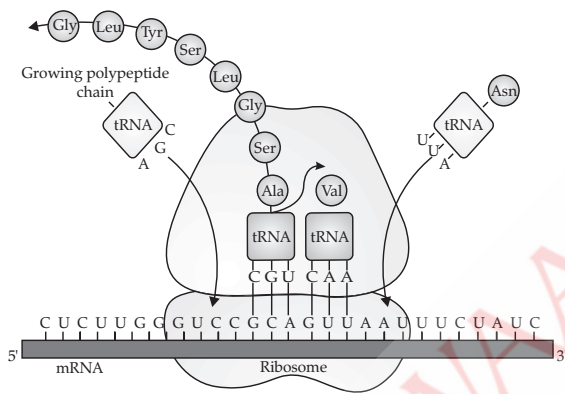
6. Transcription in Bacteria :



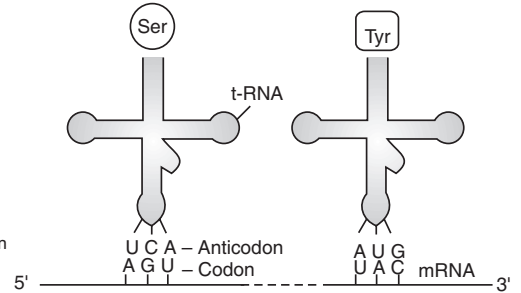
7. Transcription in eukaryotes



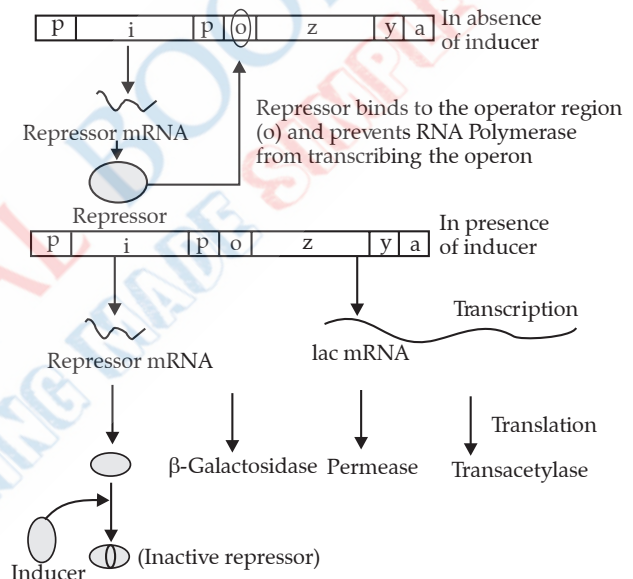
9. Translation



8. t-RNA – the adaptor molecule



10. Lac Operon



CHAPTER 7 : Evolution

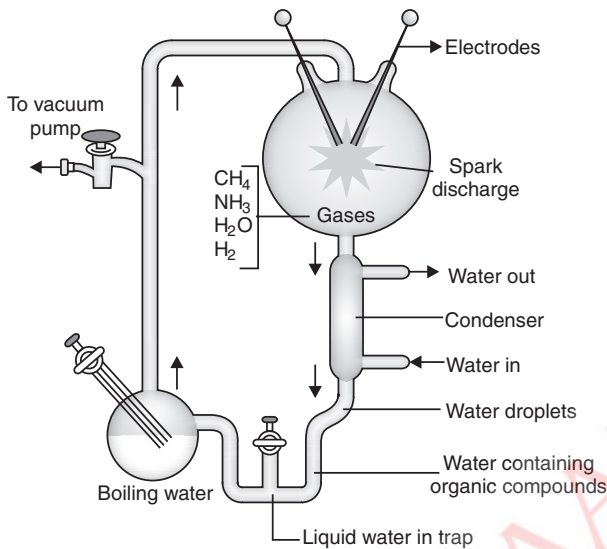
1. **Evolution** is the gradual change in the characteristics of organisms over successive generations.
2. Life is always formed from pre-existing life termed as **biogenesis**.
3. **Louis Pasteur** disapproved spontaneous generation theory.
4. The accepted theory of origin of life was put forward by **Oparin** and **Haldane**.
5. **Homologous organs** have same structure and origin but perform different function. *e.g.* thorns and tendrils of cucurbita.
6. **Analogous organs** perform same function but are different in structure and origin. *e.g.* eye of octopus and mammals.
7. **Vestigial organs** are non-functional organs.
8. **Biogenetic law**—*Ontogeny repeats phylogeny*.
9. **Atavism** is the reappearance of characters which were reduced.
10. **Charles Darwin** introduced the Theory of Natural Selection.
11. **Hardy Weinberg principle** – Allele frequencies in a population are stable and is constant from generation to generation.
12. $(p + q)^2 = p^2 + 2pq + q^2 = 1$
13. **Evolution of man :**
Dryopithecus (ape like) → Ramapithecus (man like) → **Australopithecus** → *Homo habilis* → *Homo erectus* → Neanderthals → *Homo sapiens*

14. Difference between divergent and convergent evolution :

Divergent Evolution	Convergent Evolution
1. They differ morphologically. 2. They have similar internal structure. 3. They develop in related organisms. 4. They perform different functions. 5. They have similar developmental pattern.	They show superficial resemblance. Their internal structure is quite different. They develop in unrelated organisms. They have similar functions. They have dissimilar developmental pattern.

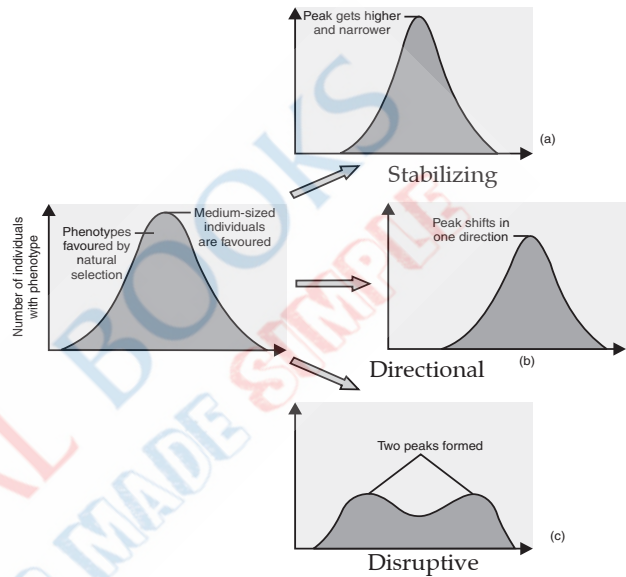
IMPORTANT DIAGRAMS AND GRAPHS :

(i) Miller's experiment



(ii) Operation of natural selection on different traits

a) stabilizing b) directional c) disruptive



CHAPTER 8 : Health and Disease

1. **Health** is a state of complete, social and physiological well being.
2. **Disease** is condition of a body, when its functions are disturbed.
3. **Congenital** and **acquired** are two types of diseases. Congenital diseases are present from birth whereas acquired diseases develops after birth.
4. Infectious and non-infectious are two types of acquired diseases.
5. **Immunity** is the ability of the body to protect or prevent the growth of pathogens.
6. Innate (inborn) and acquired are two types of immunities.
7. Innate immunity consists of four barriers: physical, physiological, cellular and cytokine barrier.
8. **Antigens** are substances, which when introduced in the body stimulate the production of antibodies.
9. **Antibodies** are immunoglobulins, proteinaceous in nature and are specific for each antigen.
10. Five classes of antibodies are – IgA , IgD , IgE , IgM and IgG.
11. The immune system has two components: the Humoral and the Cell-mediated. The former defends against pathogens and later defends the host cells.
12. **Active immunity** develops when body produces its own antibodies against disease causing antigens whereas **passive immunity** results when ready-made antibodies are given to the body to protect against foreign agents.
13. **Vaccination** is a process of introduction of vaccine into an individual to provide protection against a disease.

14. The primary and secondary immune responses are carried out by B-lymphocytes and T-lymphocytes.
15. **B-lymphocytes:** They produce a group of proteins in response to pathogen into the blood to fight with them, called antibody.
16. **T-lymphocytes:** They help B-cells to produce antibodies.
17. **Auto immunity:** It is the memory based acquired immunity, which is able to distinguish foreign molecules or cells (pathogen) from self-cells. Sometimes, due to genetic and other unknown reasons the body attacks self-cells. This results in damage to the body cells and is called auto-immune disease. e.g., Rheumatoid arthritis, multiple sclerosis.
18. **Lymphoid organs:** Organs where maturation and proliferation of lymphocytes takes place.
 (i) **Primary lymphoid organs:** Bone marrow and thymus.
 (ii) **Secondary lymphoid organs:** Spleen, lymph nodes, tonsils, appendix, MALT (mucosa-associated lymphoid tissue).
19. **AIDS** stands for Acquired Immunodeficiency Syndrome. It is caused by HIV (Human Immunodeficiency Virus), a retrovirus having RNA genome. **AIDS** can be diagnosed by **ELISA** and **Western blot test**.
20. **Cancer:** It is an abnormal and uncontrolled multiplication of cells resulting in the formation of tumour.
21. **Contact inhibition** is a property of normal cells; contact with other cell inhibit their uncontrolled growth.
22. Commonly abused drugs are opioids, cannabinoids and coca alkaloids.
23. **Benign and Malignant tumour:**

S. No.	Benign tumours	Malignant tumours
(i)	They remain confined to their original location and do not spread to other parts. Hence, they cause lesser damage.	They are the mass of proliferating cells called neoplastic or tumour cells. These cells grow very rapidly and invade and damage surrounding tissues.
(ii)	It may grow in size and thus may be dangerous when it spreads into some vital organ or tissue.	These cells compete with the normal cells for vital nutrients and disrupt the normal metabolism. These cells show the property of metastasis.

24. **B and T-lymphocytes:**

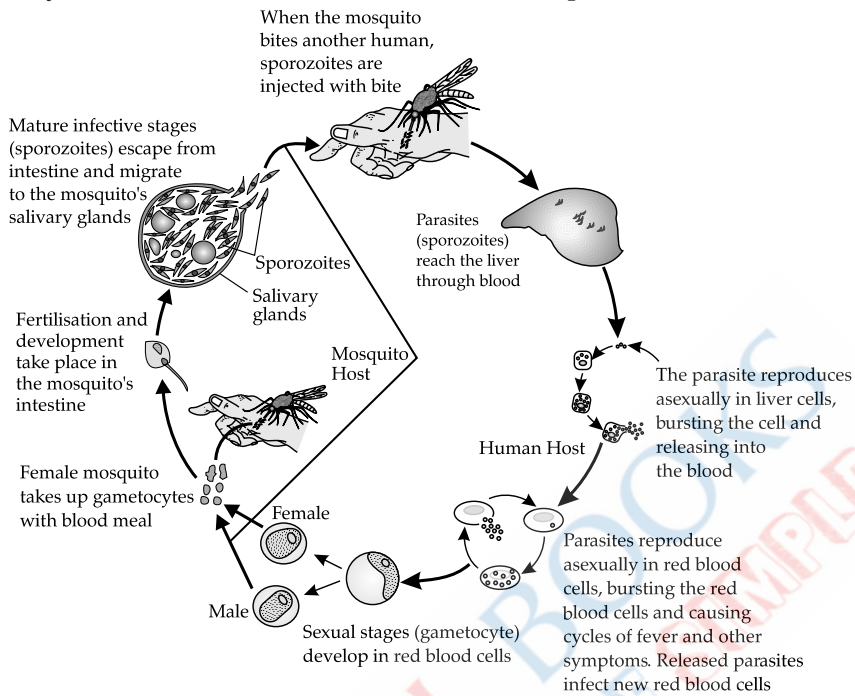
S. No.	T-lymphocytes	B-lymphocytes
(i)	They defend against pathogens including protists and fungi that enter the cells.	They defend against viruses and bacteria that enter the blood and lymph.
(ii)	T-cells form Cell-Mediated Immunity (CMI).	B-cells form Humoral or Antibody Mediated Immunity (AMI).

25. **Antigens and antibodies:**

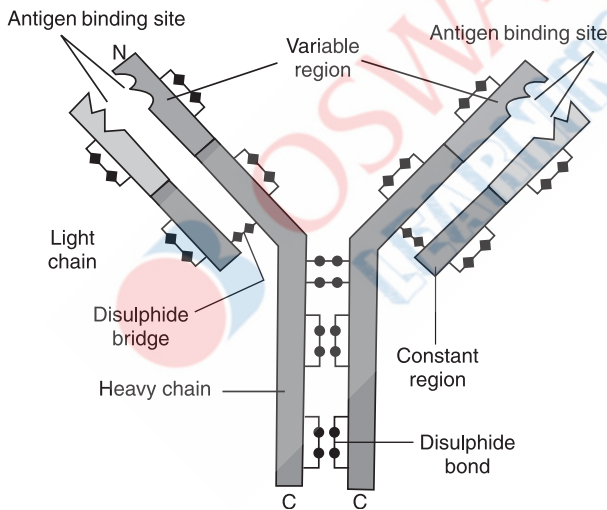
S. No.	Antigens	Antibodies (Immunoglobulins)
(i)	Antigen is a protein or polysaccharide molecule.	Antibody is a protein molecule.
(ii)	It is usually a foreign material that stimulates antibody formation.	It is synthesized by an animal to combat foreign material.
(iii)	Antigen may occur on the surface of a microbe or as a free molecule.	Antibody occurs on the surface of a plasma cell and also in body fluids.
(iv)	Antigen binds to a macrophage to reach a helper T-cell to initiate immune response.	Antibody directly joins with antigen to destroy the latter.

IMPORTANT DIAGRAMS

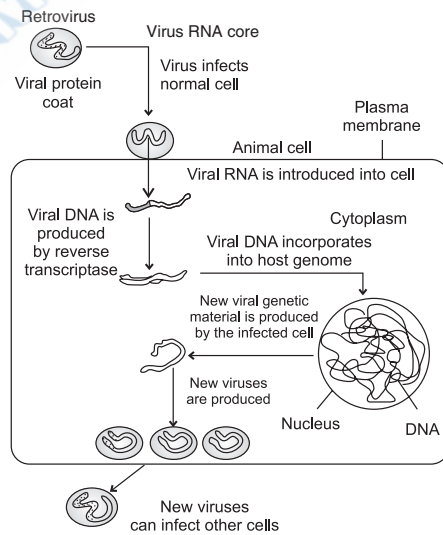
1. The life cycle of *Plasmodium vivax* in man and mosquito



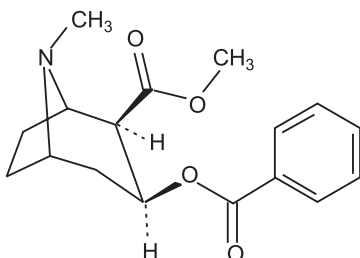
2. Structure of an antibody molecule



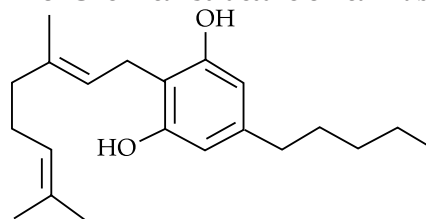
3. Replication of retrovirus



4. Chemical structure of morphine



5. Chemical structure of cannabinoid



CHAPTER 9 : Improvement in Food Production

- Animal husbandry** is the agricultural practice of breeding and raising livestock like buffaloes , cows , pigs etc.
- Dairying** is the management of animals for milk.
- Animal breeding** is producing improved breeds of domesticated animals.
- Inbreeding** is breeding between animals of same breed, while crosses between different breeds is called **outbreeding**.
- Cross breeding** is mating between superior males of one breed and superior females of another breed.
- Hybridisation** is crossing of two or more types of plants for bringing their traits together in the progeny.
- Controlled breeding experiments are carried out using Artificial insemination (AI) and **Multiple Ovulation Embryo Transfer Techniques (MOET)**.
- Poultry** is the class of domesticated fowl (birds) for food.
- Apiculture** is the maintenance of honey bees for honey.
- Plant breeding** may be used to create varieties; which are resistance to pathogens.
- Heterosis** is the phenotypic superiority of the hybrids over either of its parents in one or more traits.
- Callus** is the undifferentiated mass of cell.
- Single cell protein** is the cell protein from micro-organisms such as bacteria, which is used as food.
- Techniques of **tissue culture** and **somatic hybridisation** offer vast potential for manipulation of plants *in vitro* to produce new varieties.
- Totipotency** is the ability to generate whole plant from any cell.
- Biofortification** is breeding of crops with higher levels of vitamins and minerals.

Crop	Variety	Resistance to diseases
Wheat	<i>Himgiri</i>	Leaf and stripe rust, hill bunt
<i>Brassica</i>	<i>Pusa swarnim</i> (Karan rai)	White rust
Cauliflower	<i>Pusa Shubhra</i>	Black rot and curl
	<i>Pusa Snoball K-1</i>	Blight black rot bacterial blight
Cowpea	<i>Pusa Komal</i>	Chilly mosaic virus, Tobacco
Chilli	<i>Pusa Sadabahar</i>	mosaic virus and Leaf curl

Crop	Variety	Insect Pests
<i>Brassica</i> (rapeseed mustard)	<i>Pusa Gaurav</i>	Aphids
Flat bean	<i>Pusa Sem 2</i>	Jassids, aphids and fruit borer
	<i>Pusa Sem 3</i>	
Okra (Bhindi)	<i>Pusa Sawani</i>	Shoot and Fruit borer
	<i>Pusa A-4</i>	

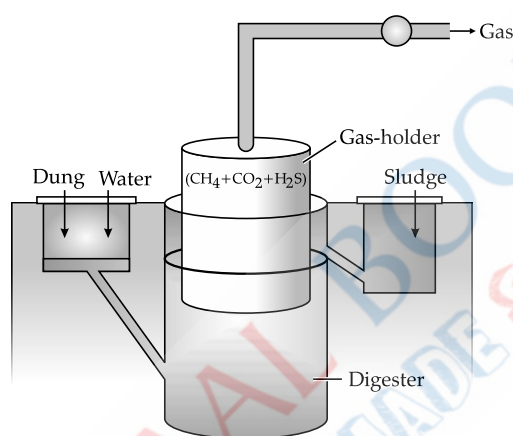
CHAPTER 10 : Microbes in Human Welfare

- Microorganisms** are the microscopic organisms that cannot be seen with the naked eyes.
- Microbes helps in making **curd** (*Lactobacillus* bacteria) and **bread** (*Saccharomyces cerevisiae*-Yeast).
- Large holes in swiss cheese are due to the production of large amount of CO₂ by a bacterium namely *Propionibacterium shermanii*.
- The yeast *Saccharomyces cerevisiae* (Brewer's yeast) is used in the production of wine, beer, whisky, etc.
- The antibiotic Penicillin is obtained from *Penicillium notatum*.
- Acetic acid** is prepared from *Acetobacter aceti*.
- Citric acid** is prepared by *Aspergillus niger* (fungus).
- Clostridium butylicum* and *Lactobacillus* is used to produce butyric acid and lactic acid, respectively.
- Streptokinase is prepared by *Streptococcus* and is used as clot buster.
- Cyclosporin A is produced by *Trichoderma polysporum* and is used as **immunosuppressive agent**.
- Statins produced by *Monascus purpureus* is used as **blood cholesterol lowering agents**.
- Biogas is a mixture of gases CH₄ + CO₂ + H₂S (mainly CH₄) produced by the microbial activity.

13. **Methanogens** are anaerobes and **autotrophic** archaeobacteria. They produce methane which is used as a source of energy.
14. **Baculoviruses** (especially genus *Nucleopolyhedrovirus*) attack insects and other arthropods. These are suitable for species-specific, narrow spectrum insecticidal applications.
15. **Biofertilisers** are the organisms which enrich the soil with nutrients due to their biological activity.
16. **Mycorrhiza** is the symbiotic association of roots of higher plants with fungi. The fungus gets food from the plant, while the fungal symbionts absorb phosphorus from soil and passes it to the plant.
17. **Biological Oxygen Demand (BOD)** is the measure of organic matter present in the water.

IMPORTANT DIAGRAM

1. A typical biogas plant



A Biogas Plant



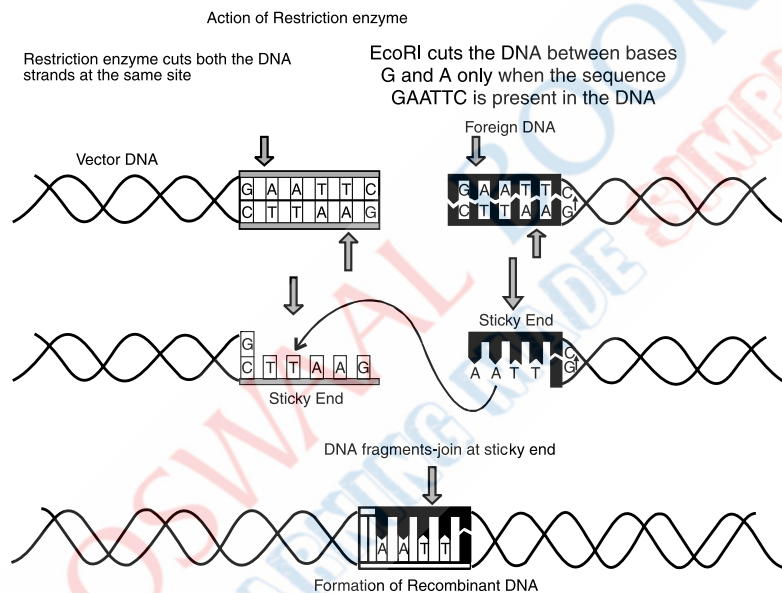
CHAPTER 11 : Principles and Processes of Biotechnology

1. **Biotechnology** deals with the techniques of using biological living organisms or enzymes to produce useful products.
2. **Restriction enzymes** cut DNA at specific locations and are also known as Biological or molecular scissors.
3. **Exonucleases** remove the nucleotides from either 5' or 3' ends of the DNA molecules while **endonucleases** make a cut within the DNA at a specific site.
4. **Genetic engineering** is the technique in which the genetic material (DNA and RNA) is chemically altered and introduced into host organisms to change their phenotype. It is also known as recombinant DNA technology.
5. **Palindromic nucleotide** sequences are the same when read from forward and backward direction.
e.g.,
5' — GAATTC — 3'
3' — CTTAAG — 5'
6. **Gene cloning** refers to production of large copies of a DNA fragment.
7. The fragments of DNA are separated by a technique known as **Gel electrophoresis**.
8. **Cloning vectors** are DNA molecules that carry a foreign DNA segment and replicate inside the host cell. e.g., : Bacteriophage and plasmids.
9. *Agrobacterium tumefaciens* is natural genetic engineer, a pathogen for several dicot plants.
10. **Origin of replication (Ori)** is a specific DNA sequence which is responsible for initiating DNA replication.

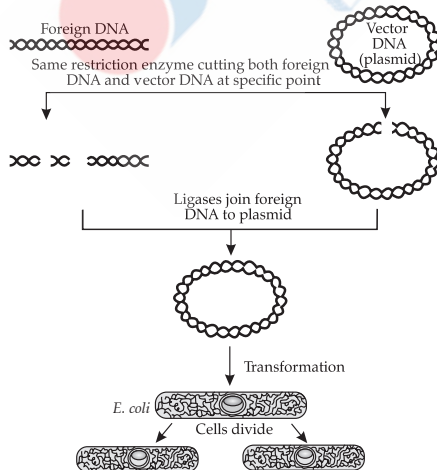
11. **Microinjection** is a process in which recombinant DNA is directly injected into the nucleus of an animal.
12. In **gene gun**, cells are bombarded with high velocity micro-particles of gold or tungsten coated with DNA, known as Biolistic method.
13. **PCR (Polymerase Chain Reaction)** is a technique in molecular biology to amplify a gene or a piece of DNA to obtain several copies. It was developed by **Kary Mullis**.
14. If any protein encoding gene is expressed in a heterologous host, it is known as **recombinant protein**.
15. **Bioreactors** are large vessels used for large scale production of biotechnology products from the raw materials.
16. The most commonly used bioreactors are of stirring type (stirred-tank reactor).
17. **Down streaming processing:** It is the method of separation and purification of foreign gene products after the completion of biosynthetic stage.

IMPORTANT DIAGRAMS

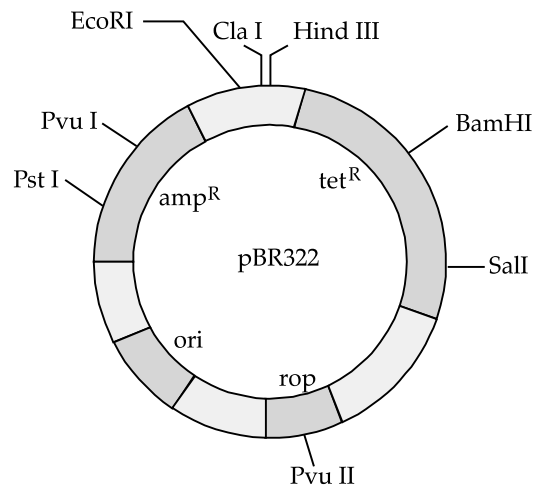
1. Action of restriction endonucleases in forming rDNA



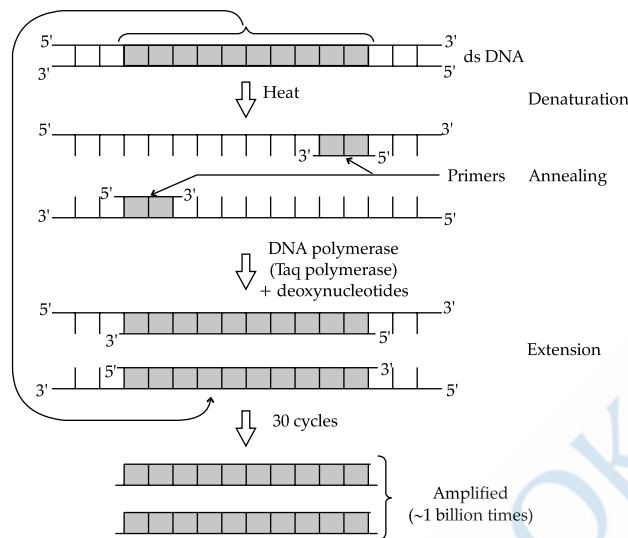
2. Recombinant DNA technology



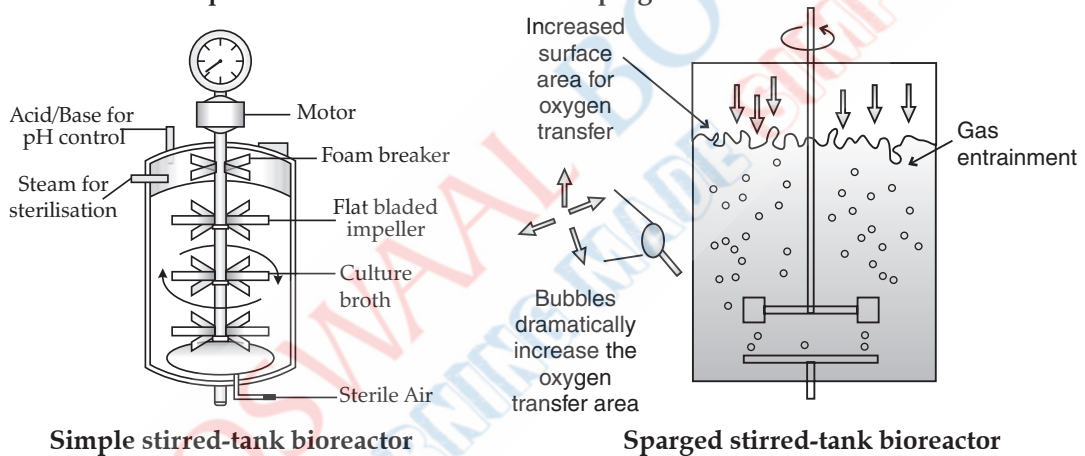
3. Cloning vector pBR322



4. Polymerase Chain Reaction (PCR)



5. Bioreactors: Simple stirred-tank bioreactor and sparged stirred-tank bioreactor



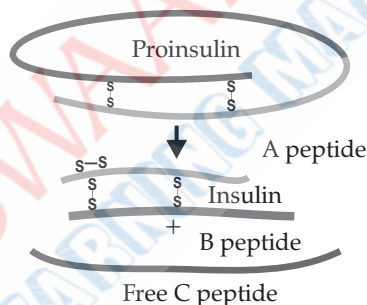
CHAPTER 12 : Applications of Biotechnology in health and agriculture

- The applications of biotechnology include therapeutics, diagnostics, genetically modified crops for agriculture, energy production, processed food, etc.
- Genetically modified organisms:** Organisms whose genes can be altered by manipulations are genetically modified organisms.
- Role of Biotechnology in agriculture:**
 - Insect resistant plants:** In these plants, genes encoding for insecticidal proteins are incorporated. e.g., *Bacillus thuringiensis* has cry protein which kill certain insects.
 - Pest resistant plants** act as biopesticide. It reduces the need for insecticides. e.g., Bt cotton, Bt corn, rice, tomato, potato, soyabean, etc.
- The process of RNA interference (RNAi) help to control the nematode from infecting the roots of tobacco plants.
- The rDNA technology helps for the mass production of safe and more effective therapeutic drugs.

6. In 1983, Eli Lilly an American company prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them in plasmids of *E. coli* to produce insulin chains. Chains A and B were produced separately, extracted and combined by creating disulphide bonds to form first biosynthetic human insulin.
7. **Gene therapy** is the replacement of faulty gene by a normal gene. First clinical gene therapy was given in 1990 to a 4-year old girl with Adenosine Deaminase (ADA) Deficiency.
8. **ADA:** Adenosine Deaminase. This enzyme is crucial for the immune system to function.
9. **SCID:** Severe Combined Immuno-deficiency Disease, is caused by a defect in the gene for the enzyme ADA.
10. Recombinant DNA technology, Polymerase Chain Reaction and Enzyme Linked Immuno-sorbent Assay (ELISA) are some techniques for early molecular diagnosis.
11. PCR is used to detect HIV in suspected AIDS patients. It is also used to detect mutations in genes in suspected cancer patients. It is a powerful technique to identify many other genetic disorders.
12. **Transgenic animals:** Animals that have their DNA manipulated to possess or express an extra gene are called transgenic animals.
13. A **patent** is a right granted by government to an inventor, to prevent other commercial use of his invention. When patents are granted for biological entities, they are called **biopatents**.
14. **Biopiracy** is the use of resources by multinational companies without proper authorisation and payment to countries.

IMPORTANT DIAGRAM

1. Maturation of Proinsulin into insulin



CHAPTER 13 : Organisms and Environment

1. **Ecology** is the study of interaction between organisms and environment.
2. **Community** is the assemblage of population of different species.
3. A number of ecosystems are associated to form a bigger organization specific for a geographical area known as **biome**.
4. **Abiotic** is non-living components of biosphere such as temperature, light, water and soil.
5. **Biotic** is living components of biosphere such as plants, animals, humans, etc.
6. **Homeostasis:** It is the process by which an organism maintains a constant internal environment in respect to changing external environment.
7. **Hibernation** is the winter sleep while **aestivation** is the summer sleep and **diapause** is the dormant stage during development which occurs in both winter and summer.
8. **Adaptations:** There are certain characteristics that organism develop in order to survive and reproduce better in their habitat. These adaptations may be morphological, physiological and behavioural attribute that enables an organism to survive and reproduce in its habitat.

9. **Allen's rule:** Mammals from colder climates have shorter ears and limbs to reduce heat loss. This is called Allen's rule.
10. **Population:** It is defined as a group of individuals of the same species that live in a particular geographical area at a particular time and functioning as a unit.
11. **Natality:** Number of births in a given population during a given period.
12. **Mortality:** Number of deaths in a given population during a given period.
13. **Immigration:** It is the permanent inward movement of a segment of population.
14. **Emigration:** It is the permanent outward movement of a segment of population.
15. **Age pyramid:** If the age distribution (% individuals of a given age or age group) is plotted for the population, the resulting structure is called an age pyramid.
16. The shape of the pyramids reflects the growth status of the population like expanding, stable or declining.
17. **Population density:** Number of individuals per unit area/space at a given time.
18. **Population growth:** Number of individuals added per unit population per unit time.
19. There are two types of population growth models: Exponential and logistic growth model.
20. In exponential growth, "J" shaped curve is obtained.
21. In logistic growth, sigmoid curve is obtained.
22. **Population interactions:**

Species A	Species B	Name of interaction
+	+	Mutualism
-	-	Competition
+	-	Predation
+	-	Parasitism
+	0	Commensalism
-	0	Amensalism

23. **Mutualism and Competition**

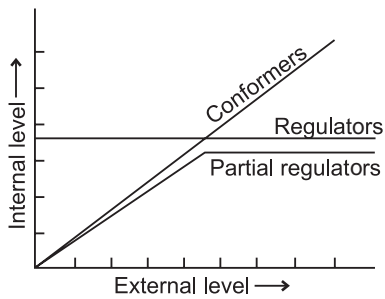
Mutualism	Competition
It is an interaction that confers benefits to both the interacting species. e.g., Lichen represent an intimate mutualistic relationship between a fungus and photosynthetic algae.	It is a relation (struggle) among organisms for water, nutrients, space, sunlight or organic food. e.g., Shallow South American lakes fishes compete for their common food with the zooplankton.

24. **Commensalism and Amensalism**

Commensalism	Amensalism
This is an interaction in which one species is benefited and the other is neither harmed nor benefited. e.g., An orchid growing as an epiphyte on a mango branch and barnacles growing on the back of a whale gets benefited while neither the mango tree nor the whale derives any apparent benefit.	Amensalism is the association between organisms of two different species in which one is inhibited or destroyed and the other is unaffected. e.g., <i>Penicillium</i> produces penicillin to check the growth of the bacteria. Ink is produced by the octopus to confuse the predator.

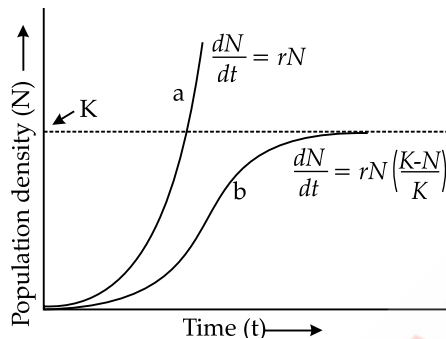
IMPORTANT DIAGRAMS AND GRAPHS

1. Organismic response



2. Population growth curve

- (a) when responses are not limiting the growth, plot is exponential.
 (b) when responses are limiting the growth, plot is logistic, K is carrying capacity.

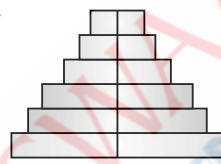


3. Age pyramids

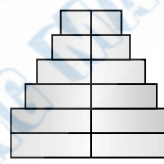
Post reproductive

Reproductive

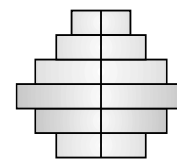
Pre-reproductive



Expanding



Stable



Declining



CHAPTER 14 : Ecosystem

- Ecosystem** is a functional unit of nature where living organism interact among themselves and also with the environment.
- Stratification**— Various plants in a forest plants get arranged in various strata according to their shade tolerance, this phenomenon is called stratification.
- Producers**— Autotrophic plants which are able to synthesise food.
- Consumers**—They depend upon producers for food.
- Decomposers**—They are saprotrophs which feed on dead bodies and organic wastes.
- Productivity**— The rate of synthesis of energy per unit area in a unit time.
- Net productivity** = Gross productivity rate – respiration rate.
- Secondary productivity** = Rate of formation of new organic matter by consumers.
- The important steps of **decomposition** are : fragmentation, leaching, catabolism, humification and mineralisation.
- Plants capture only 2-10% of the photosynthetically active radiation and this energy sustains the entire living world.
- The transfer of energy from one trophic level to the next is called **food chain**.
 e.g., : grass \longrightarrow goat \longrightarrow man (**grazing food chain**).

12. The other type is **detritus food chain**, which begins from dead organic matter.
13. Interconnected matrix of food chain is called **food web**.
14. **Ecological pyramids** : Graphical representation of ecological parameters like number (**pyramid of number**), mass (**pyramid of biomass**) and energy (**pyramid of energy**) of different trophic level in food chain.
15. Pyramid of energy is always upright.
16. **Standing state** is the amount of biogenetic or inorganic materials present in the abiotic environment per unit area at any time.
17. **Standing crop** is the amount of living material present in an ecosystem at any time.
18. Cycle of matter occurs as gaseous and sedimentary cycle.
19. **Gaseous cycle** involves cycling of matter such as carbon, oxygen or hydrogen while **sedimentary cycle** involves phosphorus and calcium.
20. The transitional zone between two vegetations is called **ecotone**.
21. **Edge effect** : Tendency of ecotone to have greater number of species and higher population density as compared to adjacent communities.
22. **Primary succession** is series of changes in totally barren area while in **secondary succession** plants and animals recolonise a habitat after a major disturbance such as wildfire, lava flow, etc.
23. **Xerarch** is succession on bare rock.
24. **Hydrarch** is succession in aquatic environment.
25. **Ectoparasite and endoparasite** :

Ectoparasite	Endoparasite
Ectoparasites remain outside the host. Ectoparasite do not cause any damage to their hosts.	Endoparasites remain inside the host. Endoparasite normally cause severe damages to their hosts.

26. **Primary and secondary succession** :

Primary succession	Secondary succession
Succession occurring on previously unoccupied sites such as a rocks, outcrops or a glacial moraine.	The reappearance and establishment of communities in an area where natural vegetation has been destroyed or removed.
It occurs in a lifeless/barren area. As soil is absent, humus is absent in the beginning.	It occurs in an area which is renuded recently but previously inhabited. Humus is present from the beginning.

27. **Gaseous and sedimentary cycle** :

Gaseous nutrient cycle	Sedimentary nutrient cycle
The reservoir of gaseous type of nutrient cycle is generally located in the atmosphere or the hydrosphere. e.g., O ₂ cycle, N ₂ cycle.	The reservoir that exists in the earth's crust. e.g., Phosphorus cycle, sulphur cycle.

28. **Net primary and gross primary productivity** :

Net primary productivity	Gross primary productivity
It is balance energy or biomass remaining after meeting the cost of respiration of the producers.	It is the rate of total capture of energy or the rate of total production of organic material or biomass.

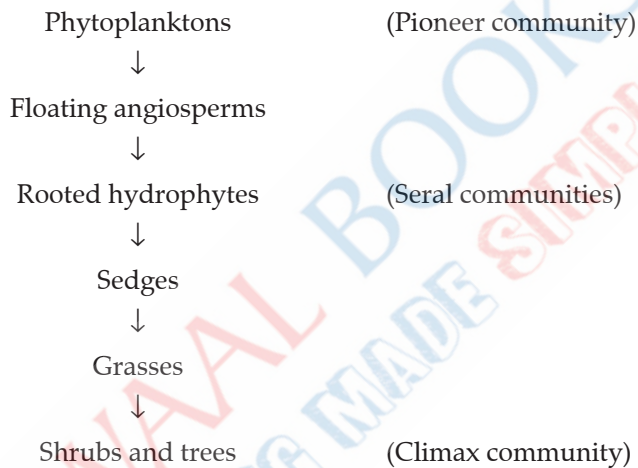
It does not depend on chlorophyll content. It directly influences consumers.	It depends on chlorophyll content. It directly influences producers.
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29. Carbon and phosphorus cycle :

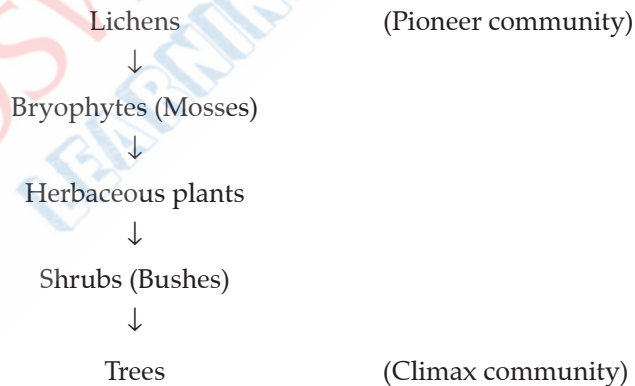
Characters	Carbon cycle	Phosphorus cycle
1. Amount of atmospheric input :	More in amount	Less in amount
2. Degree of exchange between organism and environment :	High	Negligible
3. Nature of cycle :	Perfect cycle	Imperfect cycle

30. IMPORTANT GRAPHS & DIAGRAMS

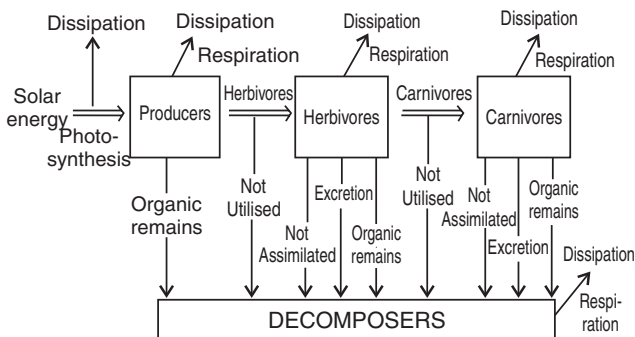
(i) Hydrarch succession



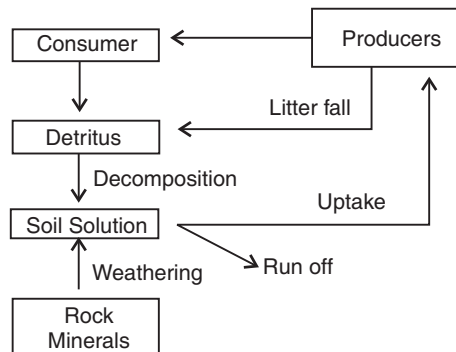
(ii) Xerarch succession



(iii) Flow of energy in an ecosystem



(iv) Phosphorus cycle



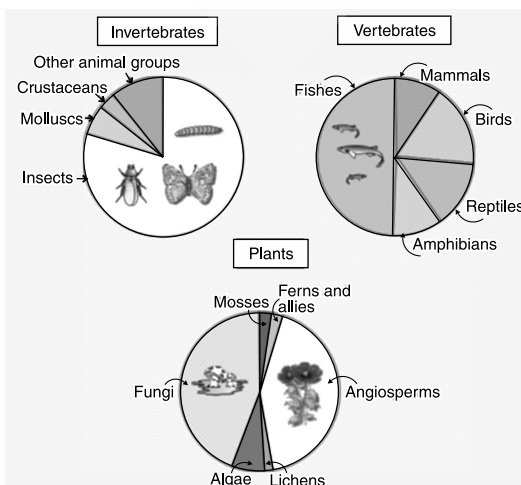
CHAPTER 15 : Biodiversity and its Conservation

- Biodiversity:** Variety of living beings on earth.
- Genetic diversity:** Variations of genes within species. e.g., India has more than 50,000 varieties of rice and 1000 varieties of mango.
- Species diversity:** Diversity at species level. e.g., Western ghats have greater amphibian diversity than Eastern ghats.
- Ecological diversity:** Diversity at ecosystem level. e.g., In India, deserts, coral reefs, wetlands have greater ecosystem diversity than a country like Norway.
- Species-Area relationship:** Alexander Von Humboldt observed that within a region, species richness gets increased when explored area is increased, but only up to a limit.
- Relation between species richness and area for a wide variety of taxa gives a rectangular hyperbola.
- Biodiversity is essential for the maintenance and utilisation of goods from ecological system and the individual species.
- Loss of habitat, introduction of exotic species, pollution, over exploitation of resources, etc. are threats to biodiversity.
- Exotic species** are non-native or alien species often introduced for economic and other uses and become invasive and drive away local species.
- IUCN:** International Union of Conservation of Nature and Natural Resources.
- Conservation** is the protection, uplift and scientific management of the biodiversity.
- There are two basic strategies of conservation of biodiversity *i.e.*, **in-situ (on site)** and **ex-situ (off site)** conservation.
- Protected area network includes national parks, wildlife sanctuaries and biosphere reserve.
- Sacred grooves** and **forests** are traditional protected areas which serve as refugia for a number of rare taxa.
- Hotspots** are the areas with high density of biodiversity which are also the most threatened ones.
- Chipko movement** was started by Sunderlal Bahuguna which resisted deforestation.
- Red data book** contains a record of animals and plants known to be in danger.
- In-situ and ex-situ conservation:**

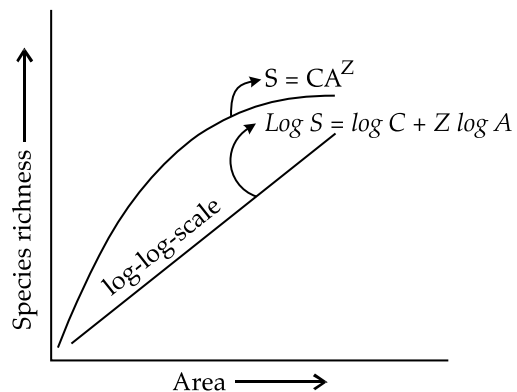
<i>In-situ</i> conservation	<i>Ex-situ</i> conservation
It is the process of protecting the endangered species of plants or animals in their natural habitat, either by protecting or cleaning up the habitat itself or by defending the species from predators.	It is the process of protecting the endangered species of plant or animal by removing them from the unsafe or threatened habitat and placing under the care of humans.
It helps in recovering population in the surroundings where they have developed their distinctive features. <i>e.g.</i> , national parks, biosphere reserve, wildlife sanctuaries.	It helps in recovering population or preventing their extinction under simulated conditions that closely resemble their natural habitats. <i>e.g.</i> , Botanical gardens, zoos, arboreta, seed and pollen banks, gene banks etc.

17. IMPORTANT DIAGRAMS & GRAPHS:

1. Global diversity



2. Species-area relationship



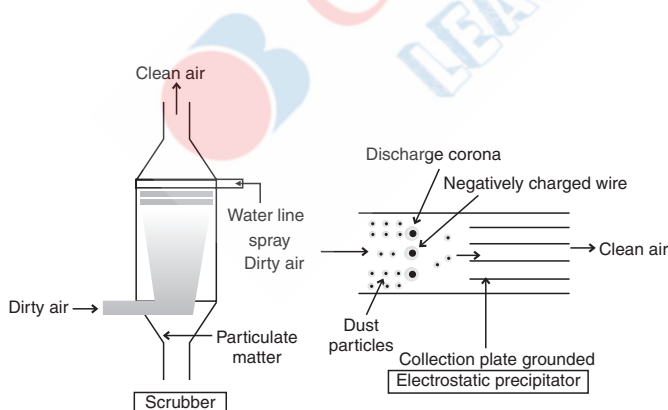
CHAPTER 16 : Environmental Issues

- Pollution** is an undesirable change in the environment. **Pollutants** are the agents which causes pollution.
- Pollution may be natural or anthropogenic (by human activities). Air, water and soil pollution are the three main types.
- Electrostatic precipitator** is used to remove the particulate matter.
- Carbon monoxide, SO_2 , NO_2 and hydrocarbons are **primary air pollutants**.
- Photochemical smog, ozone, peroxyacetyl nitrate (PAN) are **secondary pollutants**.
- Smog** is produced as a result of reactions of products of incomplete combustion with oxides of nitrogen.
- Acid rain** is the rain polluted by acid that has been released into the atmosphere from factories and other industrial processes.
- Sewage** is the waste water having food residues , human and animal excreta , detergents and industrial discharge.
- Biological magnification** is the phenomenon through which certain pollutants get accumulated in tissues in increasing concentration along food chain.
- Eutrophication** is the enrichment of water and consequent loss of species diversity.
- Two major environmental issues of global nature are increasing **green house effect (warming of earth)** and **depletion of ozone in the stratosphere**.
- Ozone hole refers to the thinning of stratospheric ozone layer.
- The thickness of ozone is measured in terms of **Dobson Units (DU)**.
- Deforestation** is the conversion of forested area into non-forested area.
- Reforestation** is the restoring of a forest that once existed.
- Primary and secondary air pollutants :**

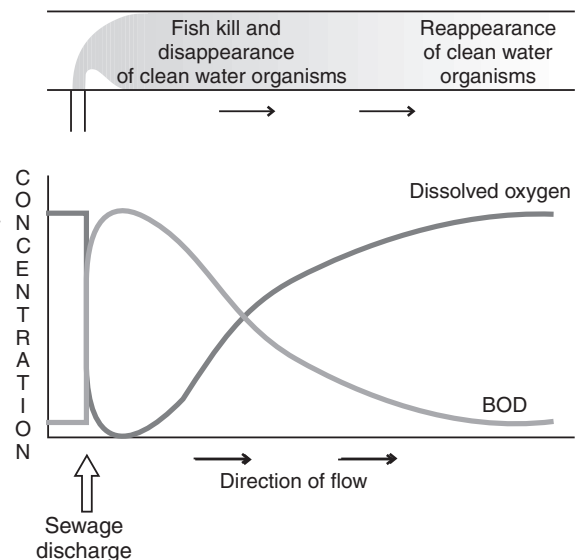
Primary Air Pollutants	Secondary Air Pollutants
They enter the atmosphere directly from various sources. e.g., CO , CH_4 , SO_x , NO_x etc.	They are formed during chemical reactions between primary air pollutants and other atmospheric constituents such as H_2O . e.g., Photochemical smog, acid rain.

IMPORTANT DIAGRAMS

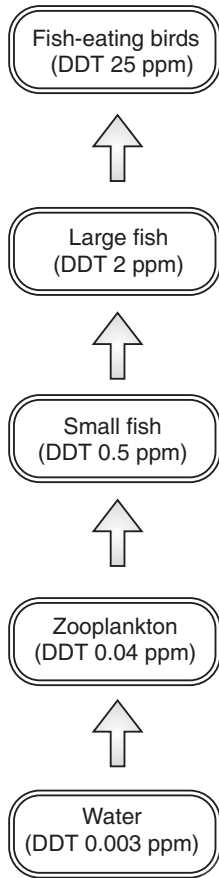
(i) Electrostatic precipitator :



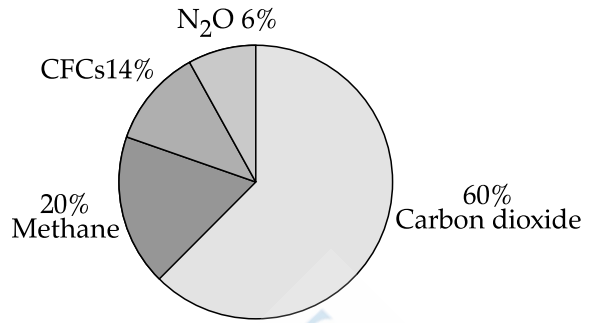
(ii) Effect of sewage discharge on some important characters of river



(iii) Biomagnification



(iv) Green house gases



OSWAAL BOOKS
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