CHAPTER – 1

# HUMAN REPRODUCTION

Points to remember

Gametogenesis – Formation of gametes within reproductive organs (ovaries in female and testes in male).

Insemination – Transfer of sperm into the female genital tract.

Fertilisation – Fusion of mala and female gametes.

Implantation – Embedding of blastocyst in the endometrium of uterus.

Gestation – Embryonic development.

Parturition – Delivery of the baby.

Human male reproductive system

A pair of testes.

Accessory sex organs.

External genitalia.

Testes

Located in pelvic region outside the abdominal cavity within a pouch – **scrotum.**

Testis is divided into 250 compartments called testicular lobules.

Each lobule contains 1 – 3 highly coiled seminiferous tubules in which sperms are produced.

It contain 2 types of cells:

1. Spermatogonia (male germ cell) which produce sperms.
2. Sertoli cells – gives nourishment to the germ cells.

Region outside the seminiferous tubules:

a) Contain small blood vessels.

b) Leydig cells – produce androgens (testosterone).

Accessory ducts

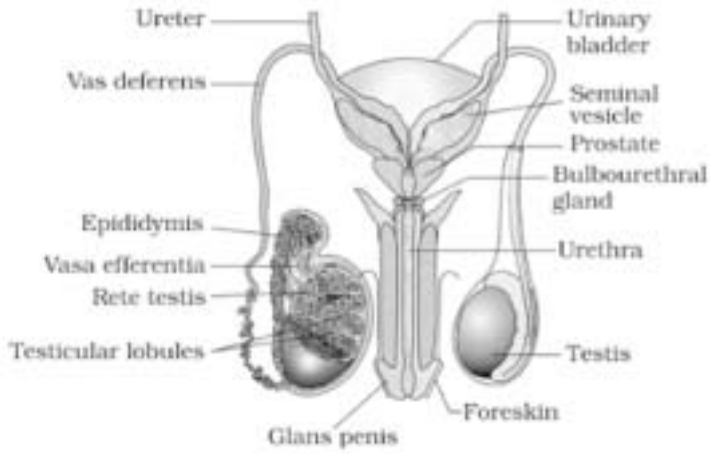
1. Rete testes
2. Vasa efferentia
3. Epididymis
4. Vas deferens

Accessory glands

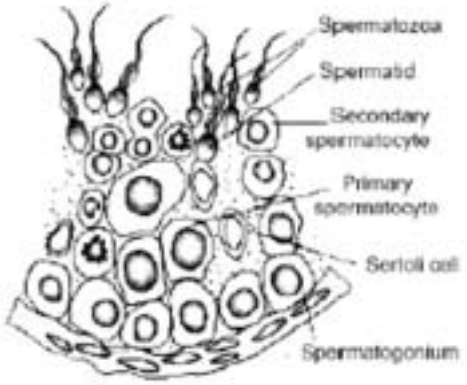
1. Seminal vesicle
2. Prostate gland
3. Bulbo-urethral gland ( Cowper's gland)

1. Seminal plasma( Semen ).
2. Rich in fructose, Ca and certain enzymes.
3. Secretions also help in lubrication of penis.
4. External genitalia – Penis.

**Human male reproductive system**




**Seminiferous tubule**




**Female reproductive system**

1. A pair of ovaries.
2. A pair of fallopian tubes, a uterus, cervix and vagina.
3. External genitalia.
4. Mammary glands.

Ovaries

Located in the abdominal cavity one on each side near the kidney.

It is an almond shaped body attached to the pelvic body wall and uterus by ligaments.

Fallopian tube

It extends from the periphery of each ovary to the uterus.

The part of fallopian tube closer to the ovary is funnel shaped and is called infundibulum.

The edges of the infundibulum possess finger like projections called fimbriae, helps in collecting the ovum during ovulation.

The wider part of fallopian tube is called ampulla.

The last part of fallopian tube that joins the uterus is called isthmus.

Uterus

Pear shaped muscular structure attached to pelvic wall and supported by ligaments.

3 layered wall

1. Outermost perimetrium.
2. Middle myometrium ( The contractions of myometrium are responsible for the expulsion of the baby during parturition).
3. Innermost endometrium undergoes cyclic changes during menstrual cycle.

Uterus opens into vagina through a narrow cervix.

Vagina

Is a muscular tube like structure that opens to outside.

It is partially covered by a membrane called hymen.

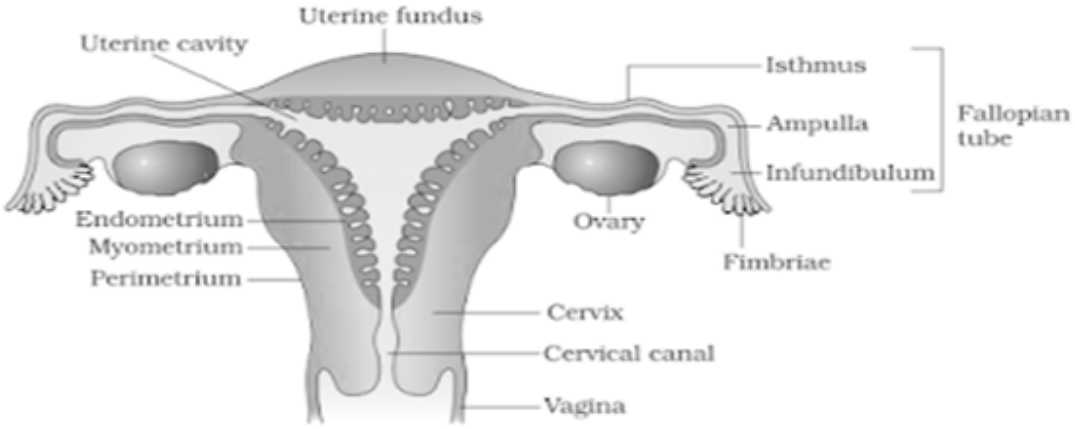
The cervix and the vagina together constitute the birth canal.

The functions of vagina are to:

Receive the male gametes during insemination

Serve as the birth canal during parturition

**Human female reproductive system**




**External genitalia**

It includes Mons pubis, labia majora, labia minora, clitoris and hymen.

Hymen is the membrane that partially covers the vaginal opening.

It is torn during first intercourse.

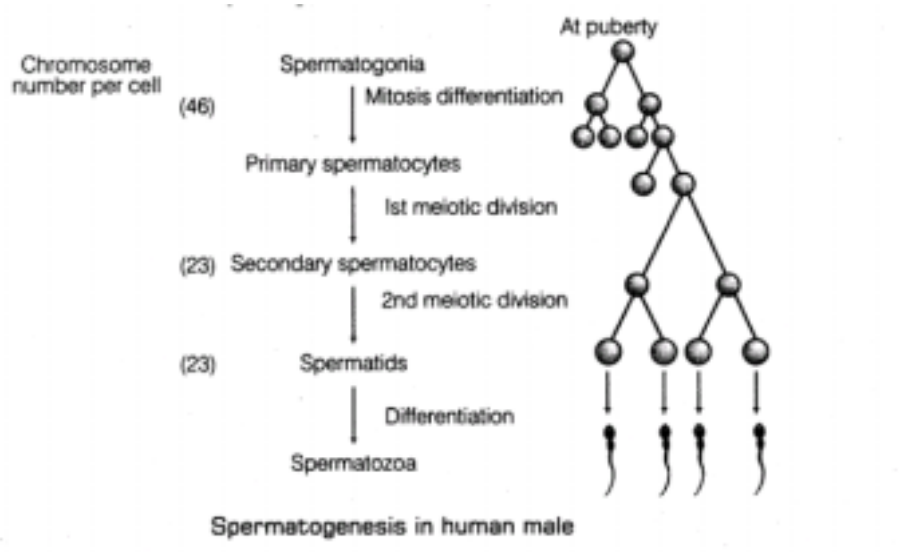
It is not an indicator of virginity.

It can also be broken by sudden fall or active participation in some sports like horse riding, cycling etc.

Mammary glands

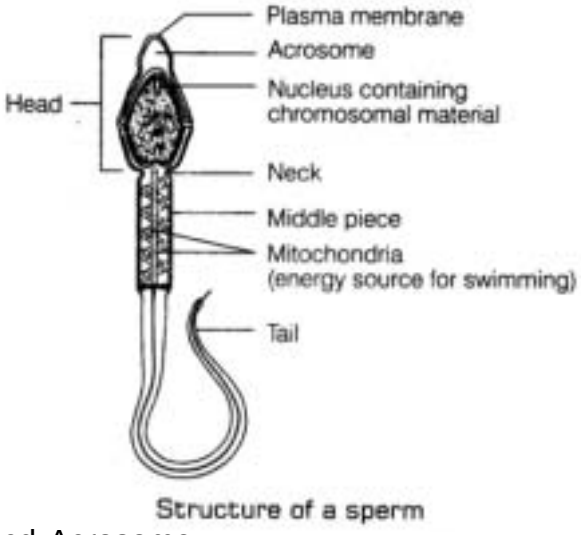
Mammary lobe → Alveoli → Mammary tubule → Mammary duct → Mammary ampulla → Lactiferous duct → Milk is ejected out

**SPERMATOGENESIS**




Spermatogenesis in human male

**STRUCTURE OF SPERM**




Structure of a sperm

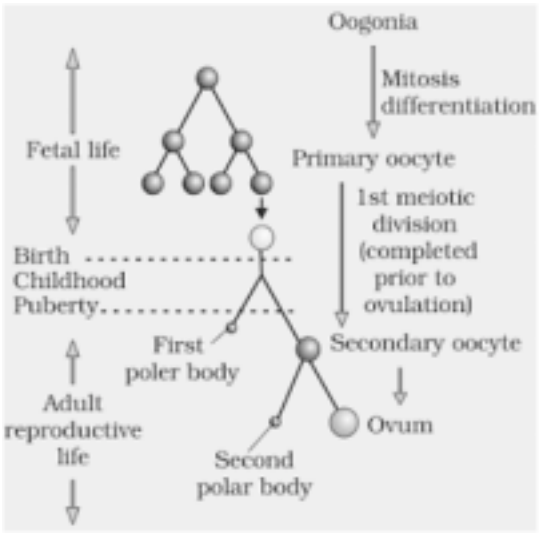
Head consists of nucleus and Acrosome

Neck contain 2 centrioles

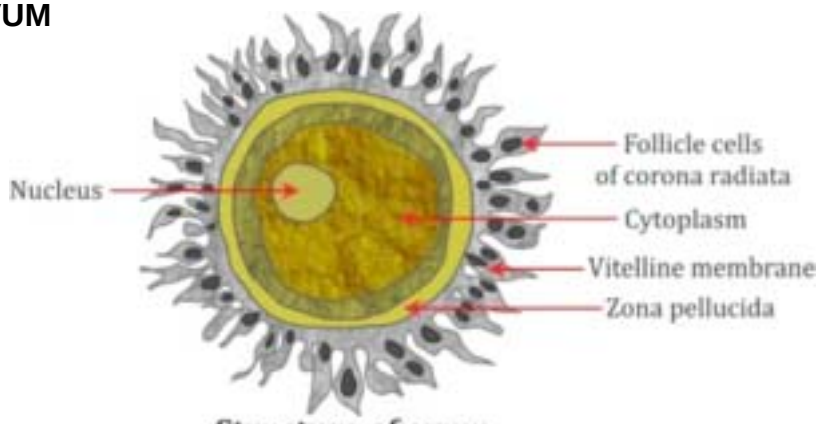
Middle piece with mitochondria

Tail helps in motility

Oogenesis

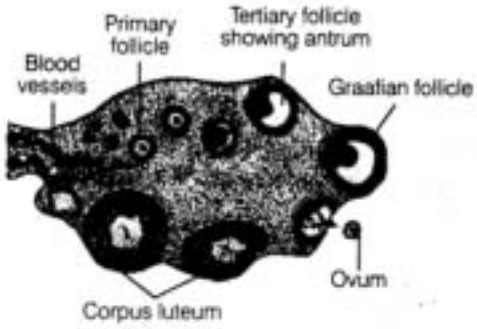


## STRUCTURE OF OVUM



Structure of ovum

## C.S of ovary



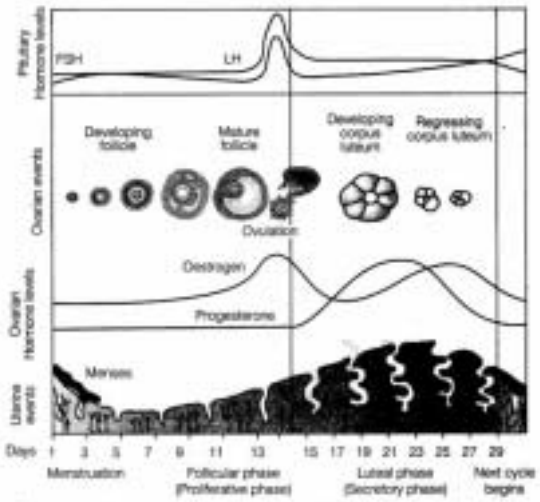
Sectional view of a ovary

## MENSTRUAL CYCLE

4 phases

1. Menstrual phase – It lasts for 3-5 days. Breakdown of endometrium, blood vessels etc. (Menstruation is absent during pregnancy).
2. Follicular phase – 4-13 days. Formation of mature Graffian follicle, endometrium regenerates.
3. Ovulatory phase – 14$^{th}$ day. Peak level of LH ( Luteinising hormone ) induces the rupture of Graffian follicle and release of ovum.
4. Luteal phase – Formation of Corpus luteum.

Corpus luteum secrete large amount of progesterone for the maintenance of endometrium during pregnancy.



Diagrammatic representation of various events during a menstrual cycle

## FERTILISATION

Fertilisation takes place in ampullary – isthmic junction of fallopian tube.

Only one sperm fertilises with one ovum. When a sperm comes in contact with zona pellucida of the ovum, it induces changes in the membrane that blocks the entry of other sperms

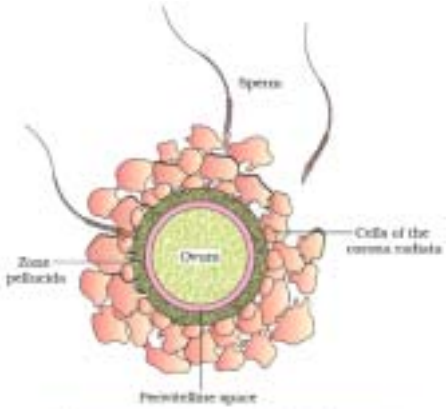
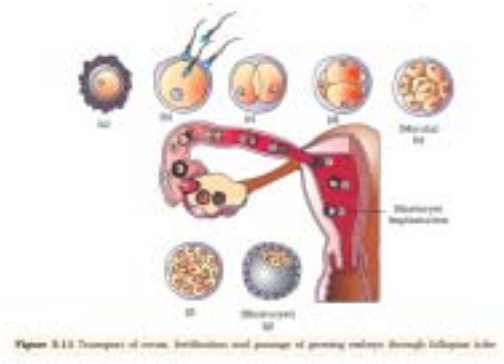



**Figure 3.10** Ovum surrounded by few sperms

## STAGES OF EMBRYOGENESIS

Gametes → Fertilisation → Zygote → Morula → Blastula → Gastrula → Organogenesis



## CLEAVAGE

The zygote undergoes successive mitotic divisions called cleavage, as it moves through the fallopian tube towards the uterus.

The daughter cells are called blastomeres.

Morula – At the 8 – 16 celled stage, the embryo is a solid sphere called a morula.

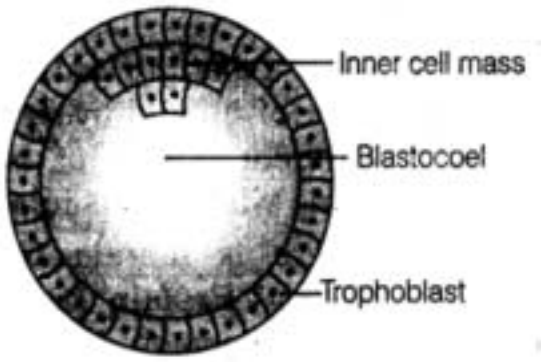
Blastocyst

Cell divisions continue in the morula and the blastomeres become arranged along the periphery leaving the central cavity called blastocoel.

The embryo at this stage is called a blastocyst.

Functions:

Trophoblast – Helps in implantation




Inner cell mass – Formation of embryo

Implantation

The blastocyst gets embedded in the endometrium. The process is called implantation.

Umbilical cord – The structure that connects the placenta with the foetus.

**PLACENTA**

The chorionic villi and the uterine tissue become interdigitated to form the structural and functional unit called placenta.

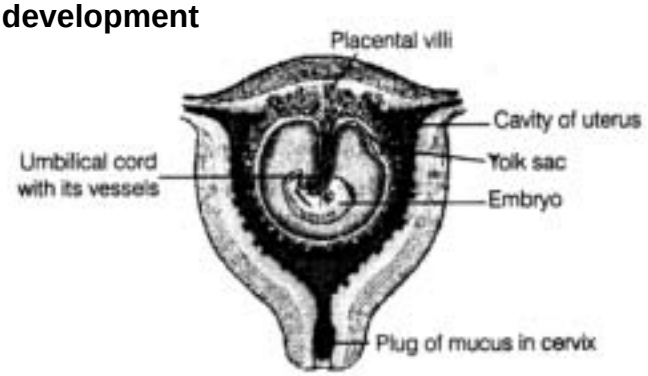
It secretes hormones like hCG, hPL, estrogens and progesterone.

It supplies oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory products produced by the embryo.

hCG – human chorionic gonadotropin

hPL – human placental lactogen.

**Pregnancy and embryonic development**



Human foetus within the uterus

| Embryonic Development | Changes |
|---|---|
| 1 st month | Formation of Heart |
| 2 nd month | Limbs and Digits |
| 3 rd month ( First trimester ) | Most of organ systems |
| 5 th month | Hair on head, foetus shows movement |
| 6 th month ( Second trimester ) | Body covers with fine hair, eyelids separate, eye lashes |
| End of 9 th month | Fully developed foetus |

Parturition

Vigorous contractions of the uterus at the end of pregnancy causes delivery of the foetus.

Hormones – Relaxin , Oxytocin

Foetal ejection reflex ( Neuro endocrine mechanism ) starts from fully developed foetus and the placenta induce mild contractions.

Oxytocin induces stronger contractions of the uterine muscles which leads to expulsion of the baby from the uterus through the birth canal.

Lactation

The mammary glands start producing milk towards the end of pregnancy.

Hormone – Prolactin

Colostrum ( Yellow milk )

The milk that comes out of the mammary glands of the mother just after child birth. It is rich in nutrients and antibodies ( lg A ) to develop resistance to the new born babies.

Important Functions

Sertoli cells – Provide nutrition and shape to the developing spermatozoa.

Leygid cells – Synthesis and secrete androgens ( Testosterone )

Scrotum - Provide a temperature 2 – 2.5$^{o}$C lower than body temperature.

Fimbriae – Helps in collecting ovum during ovulation.

Colostrum – Milk comes out of mammary glands during initial few days of lactation. It contains several antibodies ( lg A ) to develop resistance in the new born babies.

Acrosome – Contains enzymes help in dissolving membranes of ovum for fertilisation.

CHAPTER – 2

# REPRODUCTIVE HEALTH

RCH ( Reproductive and Child Health Care Programmes )

1. Creating awareness among the people about various reproduction – related aspects.
2. Providing facilities and support for building up a reproductively healthy society.

Reasons for population explosion

1. Decline in death rate
2. Decline in Maternal Mortality Rate ( MMR )
3. Decline in Infant Mortality Rate ( IMR )
4. Increase in the number of people in the reproductive age

Consequences of population explosion

Absolute scarcity of basic requirements like food, shelter, clothing etc.

Steps for birth control

The most important step to control population is to motivate smaller families by using contraceptive methods.

Other steps include:

1. Raising of marriageable age to 18 for females and 21 for males.
2. Incentives given to couples with small families.

Programmes launched by Govt of India in order to attain reproductive health

1. Family Planning Programme in 1951
2. Reproductive And Child Health Care Programme in 1997

Features of an ideal contraceptive

1. User friendly
2. Easily available
3. Effective
4. With no side effects
5. Non interfering with the sexual desire

ILL EFFECTS

1. Nausea
2. Abdominal pain
3. Irregular menstrual bleeding

4 .Breast cancer

Birth control methods

| NATURAL | BARRIER | IUD | ORAL | SURGICAL | IMPLANTS |
|---|---|---|---|---|---|
| 1.Periodic Abstinence<br>2.Coitus Interruptus<br>3.Lactational amenorrhoea | 1.Condoms<br>2.Diaphragms<br>3.Cervical caps<br>4.Vaults | 1.Lippe's loop<br>2.Cu – T<br>3.Cu – 7<br>4.Multiload 375<br>5.Progestasert<br>6.LNG - 20 | Pills(Saheli) | 1.Vasectomy<br>2.Tubectomy | 1.Progesterone<br>2.Oestrogen Combination beneath the skin |

Copper releasing IUD's - Cu – T, Cu – 7 , Multiload 375

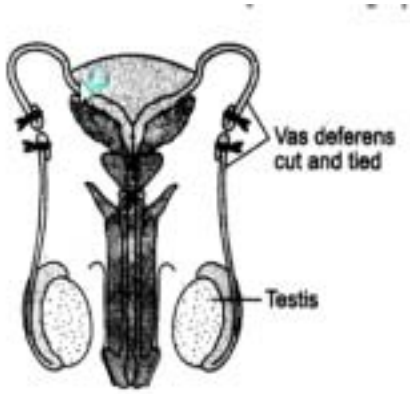
Hormone releasing IUD's - Progestasert, LNG – 20

Figure 4.3 Implants

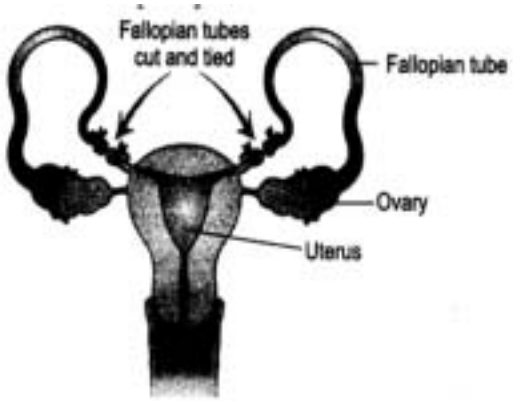

Sterilisation Methods:

Vasectomy

Tubectomy




Vasectomy in male




Tubectomy in female

STD's

| Diseases | Causative agent | Type of microbe |
|---|---|---|
| 1.AIDS | Human immuno deficiency virus | Virus |
| 2.Hepatitis B | Hepatitis virus | Virus |
| 3.Genital Herpes | Herpex simplex virus | Virus |
| 4.Syphilis | Treponema pallidum | Bacteria |
| 5.Gonorrhoea | Neisseria gonorrhoeae | Bacteria |
| 6.Chlamydiasis | Chlamydia trachomatis | Bacteria |
| 7.Trichomoniasis | Trichomonas vaginalis | Protozoan |

**PREVENTIVE MEASURES OF STD:**

1. Avoid sex with multiple partners
2. Using condoms during intercourse
3. Seeking medical help

**MEDICAL TERMINATION OF PREGNANCY ( MTP )**

MTP has been legalised by government in 1971, with strict conditions to avoid its misuse of illegal female foeticides. It is essential where pregnancy could be harmful to mother or foetus or both. MTP are safe during first 12 weeks of pregnancy.

Infertility

Assisted Reproductive Technologies ( ART )

1. Test Tube Baby Programme
   In this method, ova from donor female and sperms from the husband are allowed to fuse under simulated conditions in the lab called IVF (In Vitro Fertilisation)

Embryo Transfer ( ET )

1. a) ZIFT ( Zygote Intra Fallopian Transfer ) – Zygote or embryo upto 8 blastomeres is transferred into the fallopian tube
   b) IUT ( Intra Uterine Transfer ) – Embryos with more than 8 blastmeres are transferred into the uterus.
2. Gamete Intra Fallopian Transfer (GIFT )
   Transfer of an ovum collected from a donor female into another female, who cannot produce ova, but can provide suitable conditions for fertilisation and further development of the foetus upto parturition.
3. Intra Cytoplasmic Sperm Injection ( ICSI )
   The sperm is directly injected into the ovum to form an embryo in the lab and then ET is carried out.
4. Artificial Insemination ( AI ) – This method is used when the male partner fail to inseminate the female or due to very low sperm count.
   Intra Uterine Insemination ( IUI ) – Semen collected from the husband is artificially introduced into the vagina or into the uterus

AMNIOCENTESIS

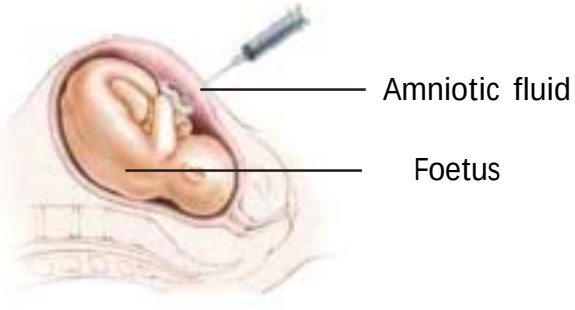
It is a prenatal diagonostic technique in which a sample of amniotic fluid from the womb of a pregnant women is taken during the early stages of development and the cells are cultured and analysed.

Uses:

Chromosomal abnormalities, sex of the foetus and developmental disorders could be detected.

Misuse:

Destroying the normal female foet



CHAPTER – 3

# PRINCIPLES OF INHERITANCE AND VARIATION

**Mendel's Laws of Inheritance:**

**1. Genetics** is the branch of biology, which deals with inheritance and variation.

**2. Inheritance** -characters or traits are transferred from one generation to the next.

**3. Variation** is the degree by which progeny differs from each other and with their parents.

**4. Gregor Johann Mendel- father of genetics**

**5. Mendel's Experimental Material**

garden pea( Pisum sativum).

Reason for selecting Garden pea

(a) Easy availability

(b) Many varieties are available

(c)Can be cross-pollinated easily

Mendels law

**Monohybrid cross**

In this cross only one trait is considered

Phenotypic ratio-3:1

Genotypic ratio – 1:2:1

**Phenotype – physical appearance of an organism**

**Genotype – allelic combination of an organism**

**Punnett square**

(*i*) The production of gametes by the parents, the formation of the zygotes, the $F_1$ and $F_2$- generations can be understood by a diagram called Punnett square developed by a British geneticist RC Punnett.

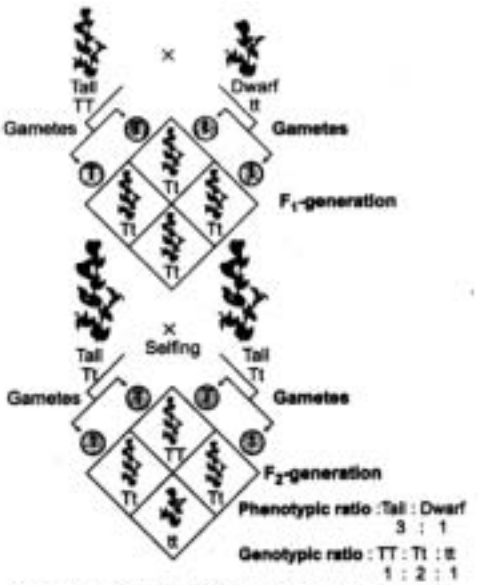
(*ii*) The Punnett square is a graphical representation to calculate the probability of all possible genotypes of offsprings in a genetic cross.

(*iii*) The 1/4 : 1/2 : 1/4 genotypic ratio of TT : Tt : tt is mathematically condensable to the form of binomial expression $(ax + by)^2$, that has the gametes bearing genes T or t in equal frequency of 1/2.

(*iv*) The expression is expanded as

$$(1/2\ T + 1/2t)^2 = (1/2\ T + 1/2\ t) \times (1/2\ T + 1/2\ t)$$

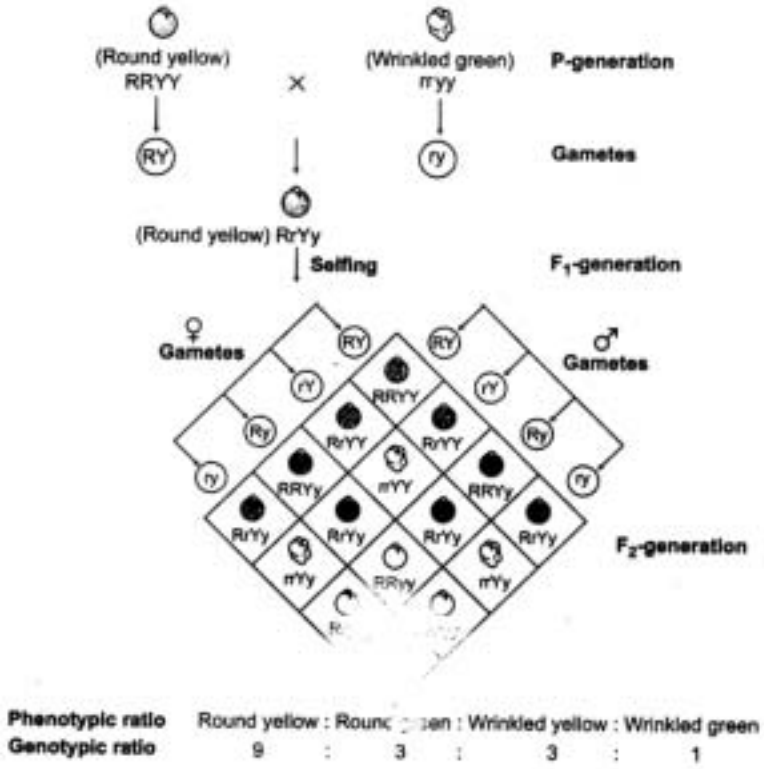
$$= \frac{1}{4}TT + \frac{1}{2}Tt + \frac{1}{4}tt$$




A punnett square used to understand a typical monohybrid cross conducted by Mendel between true-breeding tall plants and true-breeding

**Dihybrid cross**

In this cross two traits are considered




Eg 1:2:1:2:4:2:1:2:1

**Menedels law**

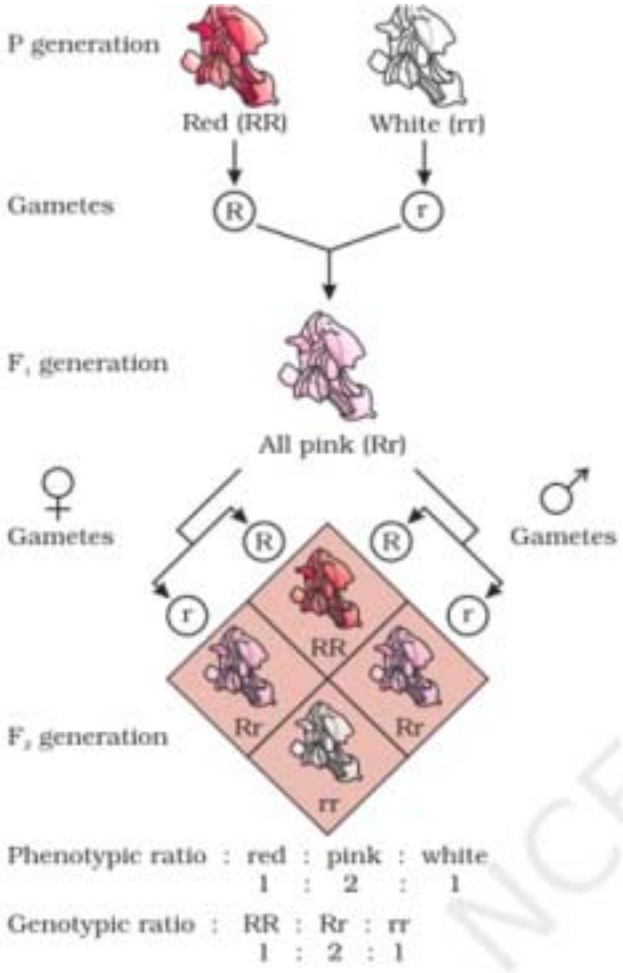
(i) **Law of dominance (first law)** when two alternate forms of a tra are present in an organism, only one factor expresses itself in F1-generation. While, the other factor (recessive) remains hidden.The expressed trait is called dominant and the hidden character is recessive

(ii) **Law of segregation (second law)** States that alleles of a pair segregate from each other during gamete formation.

(iii) **Law of independent assortment (third law)** It is base on dihybrid cross ,which states that when two pairs of contrasting traits are combined in a hybrid, segregation of one pair of characters is independent of the other pair of characters

**Incomplete dominance** is a phenomenon in which the F1: – hybrid shows characters intermediate of the parental genes.

Example, inheritance of flower colour in the dog flower




**Codominance** is a phenomenon in which two alleles are able to express themselves independently when present toget

example ABO blood groups in human. In AB group both A and B alleles expressed

Multiple allelism It can also be explained by ABO blood grouping. In this case, more than two, i.e. three alleles are governing the same character. Multiple alleles can be found only when population studies are made since, an individual can have only two allele Multiple allelism It can also be explained by ABO blood grouping. In this case, more than two, i.e. three alleles are governing the same character. Multiple alleles can be found only when population studies are made since, an individual can have only two aen in in AB

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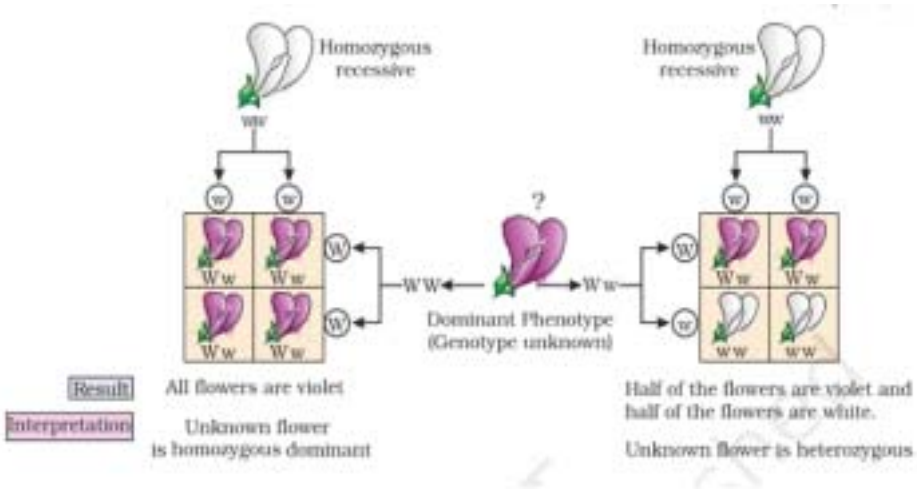
| Allele from Parent 1 | Allele from Parent 2 | Genotype of offspring | Blood types of offspring |
|---|---|---|---|
| $I^A$ | $I^A$ | $I^AI^A$ | A |
| $I^A$ | $I^B$ | $I^AI^B$ | AB |
| $I^A$ | $i$ | $I^Ai$ | A |
| $I^B$ | $I^A$ | $I^AI^B$ | AB |
| $I^B$ | $I^B$ | $I^BI^B$ | B |
| $I^B$ | $i$ | $I^Bi$ | B |
| $i$ | $i$ | $ii$ | O |

**Test cross-**

**A cross is made of unknown dominant genotype with the recessive parent.**




**Pleiotropy**

It is the phenomenon in which a single gene exhibits multiple phenotypic expressions.

For example seed shape and size of starch grains controlled by same gene

**Polygenic inheritance**

In this, traits are controlled by three or more genes

For example, human skin colour

**Rediscovery of Mendel's Laws**

**Hugo de Vries,Carl Correns and Eric Von Tschermak**

**Chromosomal theory of inheritance- (Walter Sutton and Theodore Boveri in 1902.)**

**The main points are as follow:**

**(i) Chromosomes as well as genes are found in pairs.**

**(ii) The two alleles of a gene pair are located on homologous sites on the homologous chromosomes.**

**(vi) Homologous chromosomes synapse during meiosis and get separated to pass into different cells and is the basis of segregation and independent assortment during meiosis.**

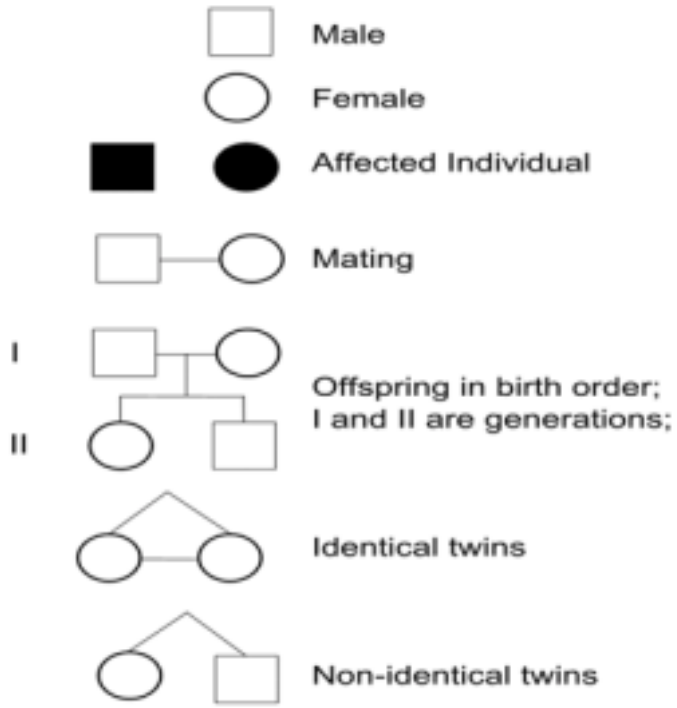
**Linkage and Recombination**

The physical association of two genes on a chromosome is called linkage.

Reciprcal exchange of chromosomal segment between non homologous is called recombination

Pedigree analysis

Pedigree Analysis is a tabular representation of a family history by taking a particular disease or character




**Sex Determination in Different Organisms**

**1) XX – XY type**

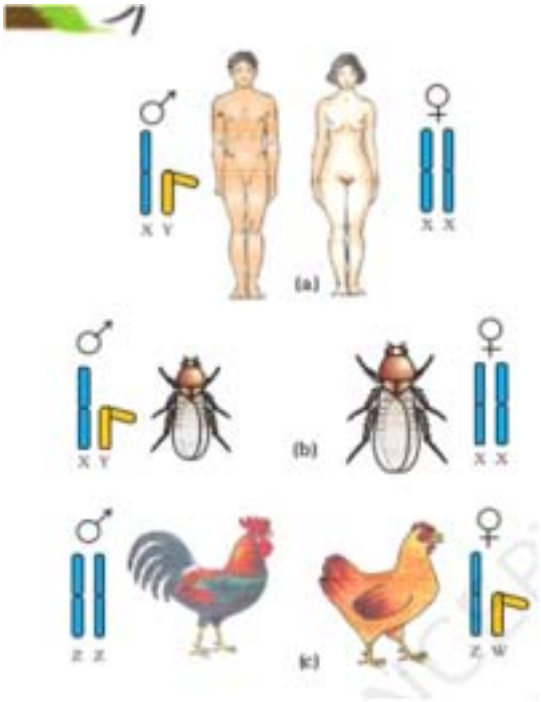
In this type females have 2 X chromosomes.The males have one X and one Y chromosomes. Thus the presence or absence of Y chromosome decide whether the child will be male or female.eg-Drosophila and man

**2) ZZ – ZW type**

The males are represented as ZZ (homomorphic) and females are heteromorphic, that is ZW.eg- Birds and Reptiles

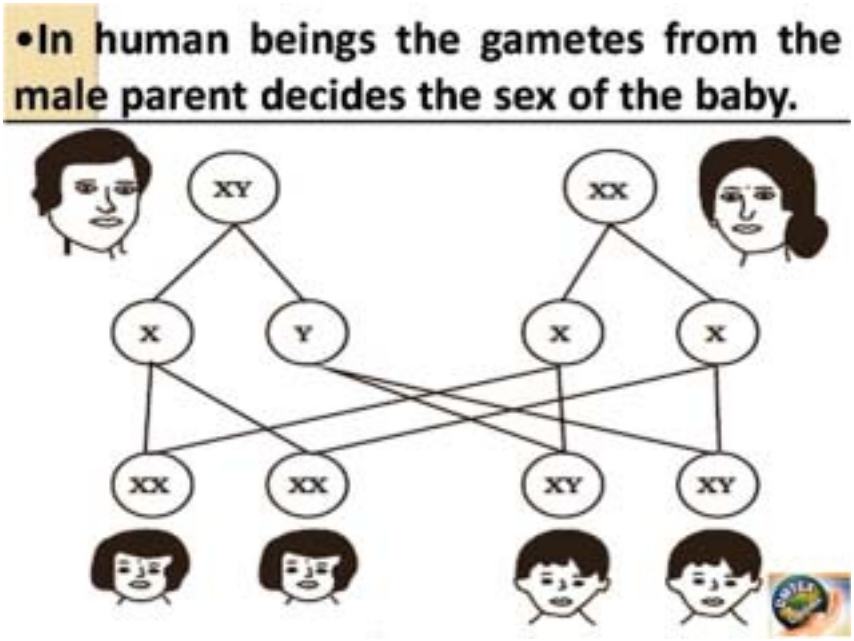
**3) XX – XO type**

The females have two sex chromosomes, XX, while the males have only one sex chromosomes X. Therefore, the males are labelled as XO. eg: roundworms and insects.




**Sex Determination in Humans**

Humans have 22 pairs of autosomes and one pair of sex chromosomes. All the eggs possess only X chromosomes. The male gametes produced by human males are of two types, that is, they either contain X chromosome or Y chromosome.



## Genetic Disorders

Disorders that arises due to abnormality in individuals DNA. Below are some examples of genetic disorders

### Hemophilia

It is a **sex linked recessive disease**. It is a disorder in which person ability of blood clotting is lost.

### Sickle Cell Anemia

It is an **autosome recessive disease.** In this amino acid glutamine (GAG) is replaced by valine (GUG) at the sixth position of â-chain of hemoglobin. The patient RBCs becomes sickle shaped and thus reduces the oxygen supply to different parts of the body.

### Phenylketonuria

It is an **autosomal recessive** disease. The individuals suffering from the disease lack an enzyme known as **phenylalanine hydroxylase** that converts the amino acid phenylalanine into amino acid tyrosine. Due to this, phenylalanine accumulates in the cerebrospinal fluid (CSF) causing brain problems.

## Chromosomal Disorders

Disorders that arises due to abnormal arrangement of chromosomes. This leads to change in chromosome number.

### Aneuploidy

This occurs when there is loss or gain of one or more chromosomes at the time of gamete formation.eg Turner's syndrome (45).

### Polyploidy

Polyploidy is a condition in which nucleus contain more than two sets of homologous chromosomes. : Down syndrome.

### Down's Syndrome

The trisomy at 21$^{st}$ chromosome ie addition of 1chromosome in 21$^{st}$ pair.

**Symptoms***:* Short stature, mentally retarded, low muscle tone etc.

### Klinefelter's Syndrome

When an ovum containing 2 X chromosomes is fertilized with the sperm containing single Y chromosome. The individual will have 47 chromosomes instead of 46 chromosomes.

**Symptoms***:* The child is male genotypically but possess features of female child. The child will have low testosterone level in the body, weaker muscles, fatter around the belly etc.

- **Turner's Syndrome**
- When an ovum without X-chromosome is fertilized by a sperm carrying X-chromosome, a zygote with XO, that is, with single X chromosome is formed. **See Fig. 5**

**Symptoms**: low set ears, females with rudimentary ovaries, short fingers and toes, delayed growth, swelling of hands and feet.

**Pleiotropy** It is the phenomenon in which a single gene exhibits multiple phenotypic expressions.

For example seed shape and size of starch grains controlled by same gene

**Polygenic inheritance** In this, traits are controlled by three or more genes

For example, human skin colour

**Rediscovery of Mendel's Laws**

Hugo de Vries,Carl Correns and Eric Von Tschermak

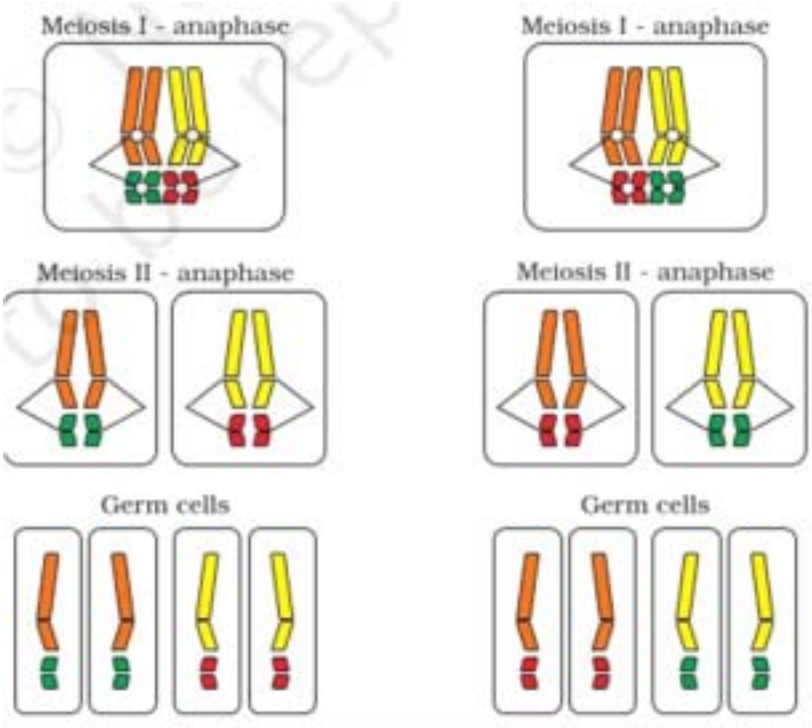
**Chromosomal theory of inheritance**- (Walter Sutton and Theodore Boveri in 1902.)

The main points are as follow:

(i) Chromosomes as well as genes are found in pairs.

(ii) The two alleles of a gene pair are located on homologous sites on the homologous chromosomes.

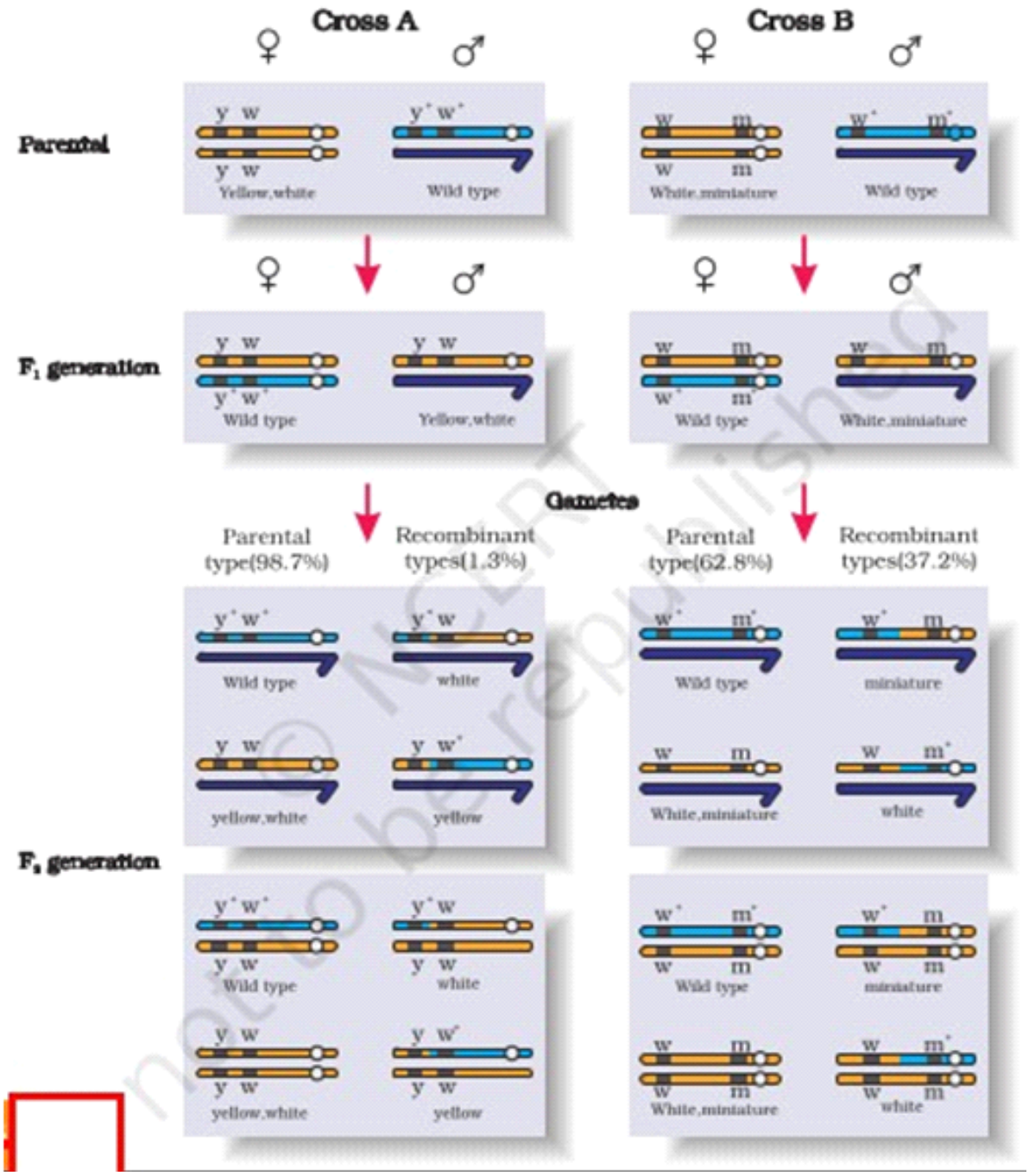
(vi) Homologous chromosomes synapse during meiosis and get separated to pass into different cells and is the basis of segregation and independent assortment during meiosis.



## Linkage and Recombination

The physical association of two genes on a chromosome is called linkage.

Reciprcal exchange of chromosomal segment between non homologous is called recombination



CHAPTER – 4

# MOLECULAR BASIS OF INHERITANCE

**1.** DNA is the genetic material in majority of organisms.

**2. Deoxyribonucleic acid (DNA)** and **Ribonucleic acid (RNA)** are the two types of nucleic acid found in living systems. Nucleic acids are polymers of nucleotides.

**3. DNA acts as a genetic material** in most organisms, whereas RNA acts as a genetic material in some viruses.

**4. RNA** mostly functions as **messenger, adapter**, or as a **catalytic molecule.**

| DNA | RNA |
|---|---|
| (a) The sugarpresent in DNA is 2-deoxy-D – (-) -ribose. | (a) Thesugar present in RNAis D- (-)-ribose. |
| (b) DNA contains cytosine and thymine as pyrimidine bases and guanine and adenine is purine bases. | (b) RNA contains cytosine and uracilpyrimidine bones and guanine and adenine as purine bases. |
| (c) DNA has double strand á-helix structure. | (c) RNA has a single stranded á-helix structure. |

**5. STRUCTURE OF DNA**

DNA is a polymer nucleotides

A nucleotide has three parts, i.e. **a nitrogenous base**, a **pentose sugar** and **phosphate group.**

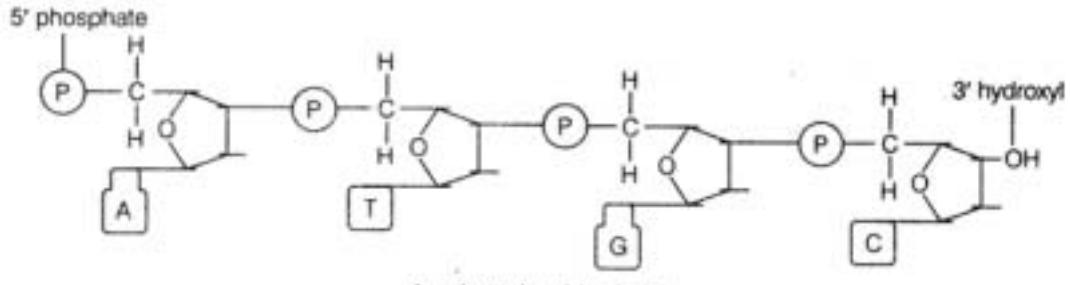
(ii) Nitrogenous bases are **purines(A and G)** and **pyrimidines(C,U,T)**.

(iv) A nitrogenous base is linked to the pentose sugar through a **N-glycosidic linkage** .

(v) Phosphate group linked to nucleoside through **phosphodiester linkage**, a corresponding nucleotide is formed.

Sugar+nitrogen base=Nucleoside

Nucleoside+phosphate =Nucleotide




A polynucleotide chain

8. Salient Features of Double-helix Structure of DNA

(i) DNA is a long polymer of deoxyribonucleotides.

ii) The two chains have **anti-parallel**

ii) Adenine bond with thymine by 2 H- bond (A=T) Guanine bonds with cytosine by three H—bonds(G C).

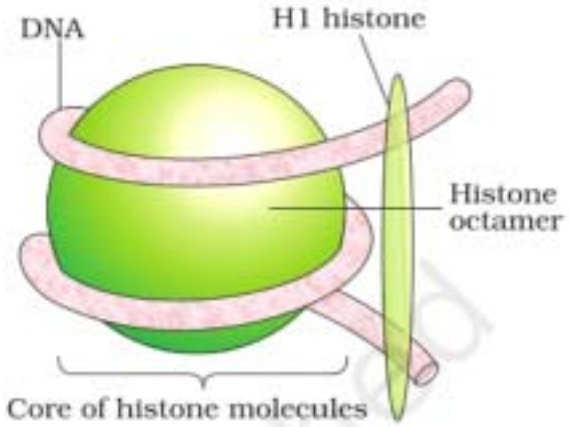
each turn consist of 10 bp

iv) the distance between a base pair in a helix is about 0.34 nm.

**PAKAGING OF DNA**

(i) In prokaryotic cells DNA is held with some proteins in a region called as nucleoid.

(ii) In eukaryotes, there is a set of positively charged proteins called **histone** which is organized to form 8 molecules unit called **histone octomer**. Negatively charged DNA is wrapped around the histone octomer to form **nucleosome**. Histones are rich in the basic amino acids lysines and arginines. Single nucleosome contains about 200 base pairs. Chromatin is the repeating unit of nucleosome.The nucleosomes in chromatin can be seen as beads-on-string. This structure in chromatin is packaged to form chromatin fibres that further coils and condense to form chromosomes at metaphase stage.




TRANSFORMATION EXPERIMENT-GRIFFITH

S-strain $\xrightarrow{\text{Injection}}$ Mice $\longrightarrow$ Mice die

R-strain $\xrightarrow{\text{Injection}}$ Mice $\longrightarrow$ Mice live

S-strain (Heat-killed) $\xrightarrow{\text{Injection}}$ Mice $\longrightarrow$ Mice live

S-strain (Heat-killed) + R-strain (live) $\xrightarrow{\text{Injection}}$ Mice $\longrightarrow$ Mice die

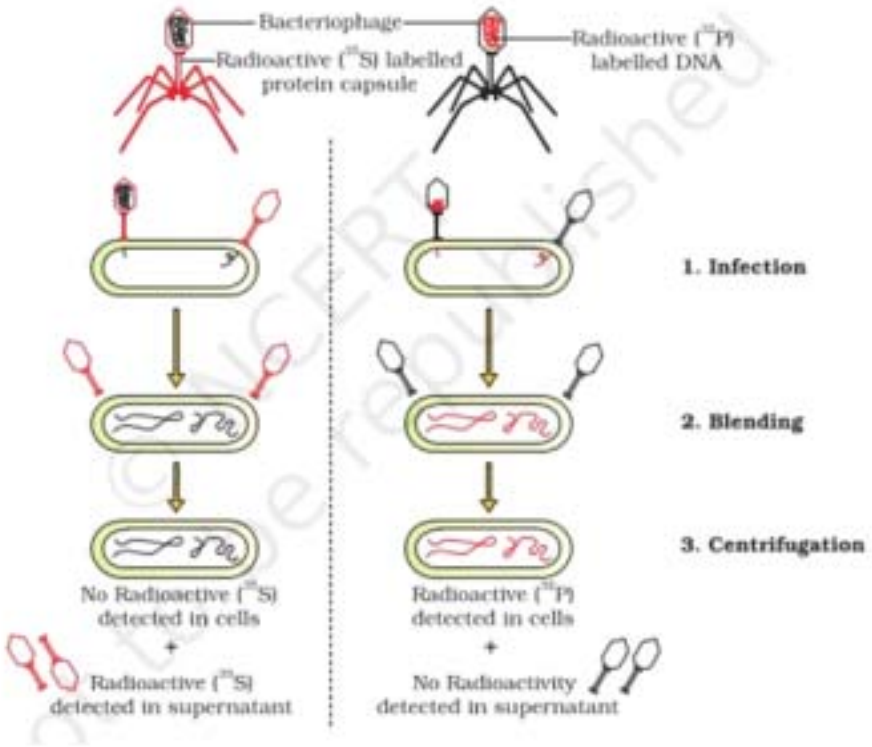
(i) There are 2 strais of streptococcus bacteria S and R.The S-strain virulent(with smooth polysaccharide coat) while R-strain non virulent.

(iii) Mice infected with S-strain (virulent) die from pneumonia but mice infected with R-strain do not develop pneumonia.

(iv) Heat-killed S-strain bacteria injected into mice did not kill them. On injecting mixture of heat-killed S and live R bacteria, the mice died. He recovered living S-bacteria from dead mice.

(vi) From this experiment, he concluded that **Some transforming principle transferred from heat-killed S-strain to r strain and transformed the R-strain toS strain.** Oswald Avery, Colin MacLeod and Maclyn McCarty, determine the biochemical nature of transforming principle.

**12.** HERSHEY AND CHASE EXPERIMENT




(i) Radioactive phages were allowed to attach to E. coli bacteria. (ii)Agitating them in a blender (iii) Detect radioactivity in cell and supernatant

**CONCLUSION**

Bacteria which were infected with viruses that had radioactive DNA were radioactive, indicating that DNA was the material that passed from the virus to the bacteria. Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This indicated that the proteins did not enter the bacteria from viruses. It proved that DNA is a genetic material that is passed from virus to bacteria.

Characteristics of a Genetic Material

(a) It should be able to replicate.

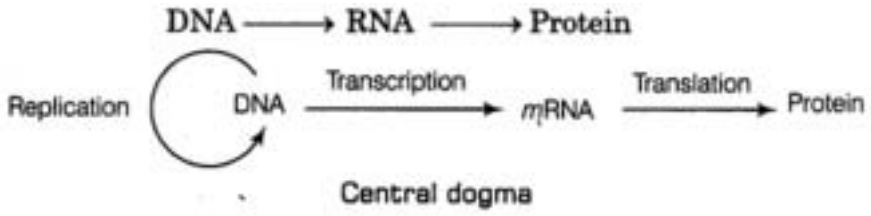
(b) It should be chemically and structurally stable.

(c) It should provide scope mutation that are required for evolution.

(d) It should be able to express itself in the form of 'Mendelian characters'.

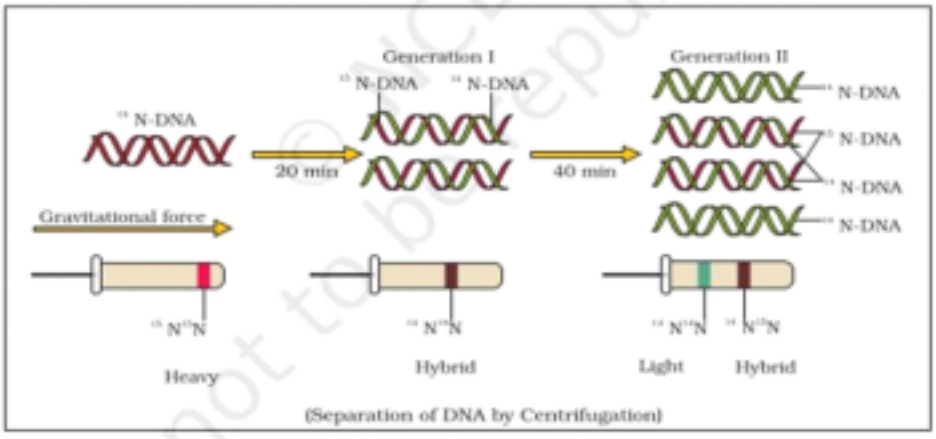
**14. CENTRAL DOGMA OF MOLECULAR BIOLOGY**

**Francis Crick proposed** the central dogma in molecular biology, which states that the genetic information flows from




**16. Experimental proof that DNA replicates semiconservatively**,

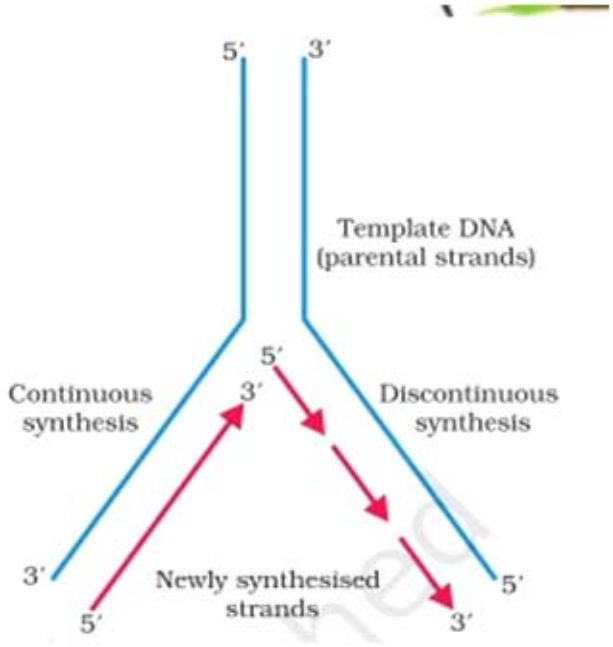
Matthew Meselson and Franklin Stahl performed the following experiments to prove this in 1958.




(i) E. coli was grown in a medium containing $15NH_4C1$. 15N got incorporated into newly synthesised DNA.

(ii) They then transferred the cells into a medium with normal $14NH_4Cl$.(iii)After one generation the DNA extracted had a hybrid or intermediate density. (iv)DNA extracted from the culture after another generation (after 40 min) was composed of equal amounts of this hybrid DNA and of light DNA..

**17. DNA replication**




**STEPS**

1. **Unwinding** of double stranded DNA into single strants by the enzyme **helicasera**
2. **RNA Primase** synthesise **primer** at the 3' end of both template
3. **DNA Polymerase** polymerise the primer in 5' to 3' direction .In 3' – 5' template DNA synthesis is continuous (Leading strand)and in 5' – 3'Itemplate DNA synthesis is discontinuos.(Laging strand)
4. Discontinuosly synthesized DNA segments are called **Okazaki fragments**
5. Okazaki fragments are later joined by **ligase**

**19. RNA world**

**RNA** was the first genetic material.

(ii) DNA has evolved from RNA

**20. There are following three types of RNAs:**

(i) mRNA (messenger RNA) provides the template for transcription.

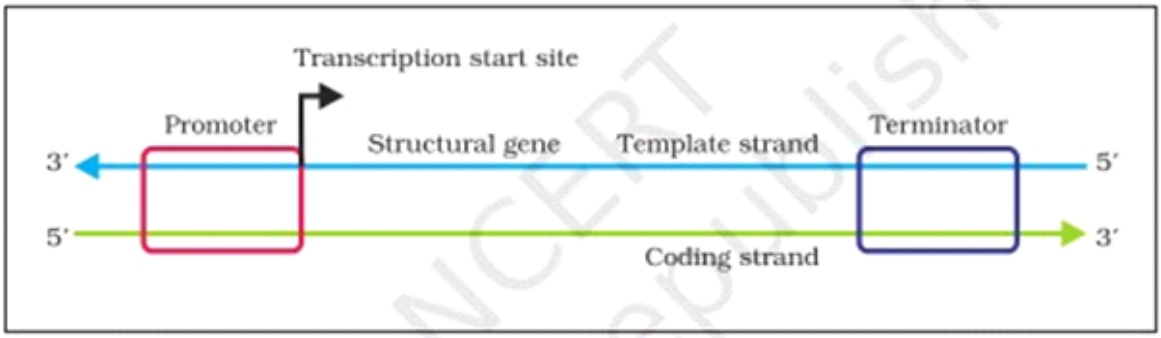
(ii) tRNA (transfer RNA) brings amino acids and reads the genetic code.

(iii) rRNA (ribosomal RNA) plays structural and catalytic role during translation.

## TRANSCRIPTION

**Traription is the process** of copying genetic information from one strand of the DNA. into RNA

A TRANSCRIPTION UNIT




(i) A transcription unit in DNAhas three regions (a) **A promoter** (b) The **structural gene** (c) A **terminator**

(ii) The **32 -» 52 strand acts as a template**.The other strand which has the polarity 52 -> 32 is **coding strand.**

(iii) The **promoter is located towards 52 end** (upstream) of the structural gene.

it is the binding site for RNA polymerase (iv) The terminator is located towards 3'-end (downstream) of the coding strand and it usually defines the end of the process of transcription..

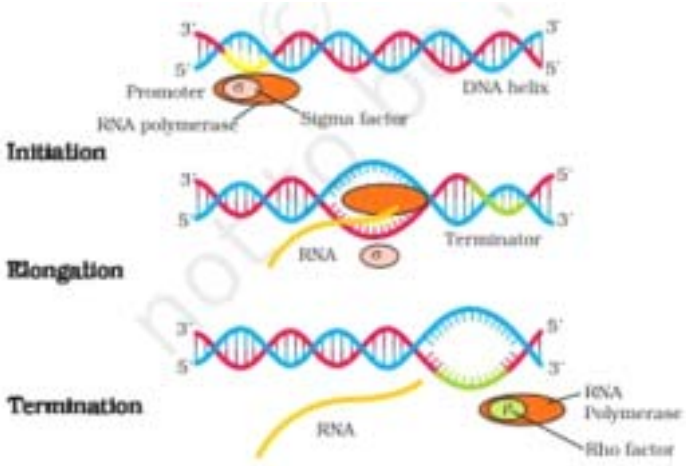
**22. Transcription in prokaryotes occur in the following steps:**

(ii) RNA polymerase binds to promotor and initiates transcription **(initiation).**

(iii) The enzyme polymerises RNA nucleotides on template strand(**Elongation**)

(v) Once the polymerase reaches the terminator region, the nascent RNA and RNA polymerase. falls off. This results in **termination** of transcription.

transcription and translation take place in the same compartment, ,



## TRANSCRIPTION IN EUKARYOTES

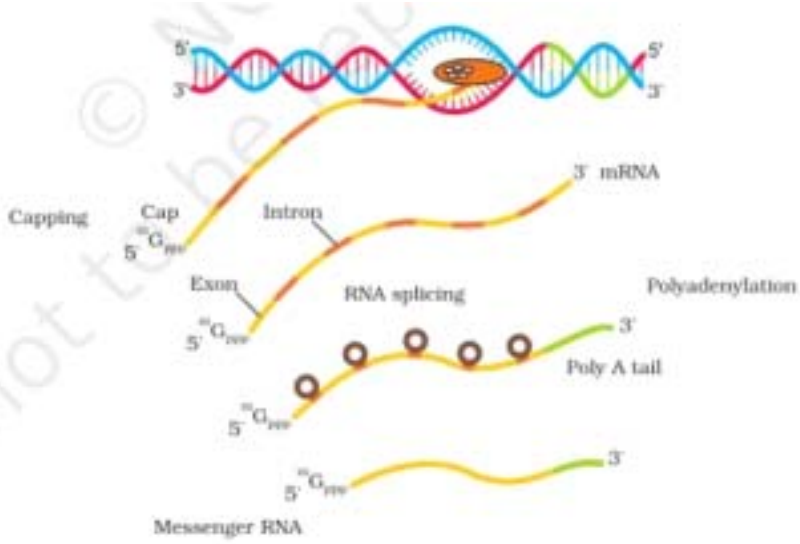
(i) There are at least three RNA polymerases in the nucleus (ii) Primary transcripts contain both the exons and the introns (iii) /mRNA undergoes additional processing called as capping and tailing.

## CAPPING

an unusual nucleotide methylguanine is added to the 52 -end of /mRNA.

## TAILING

Many adenylate residues are added at 3' end




## SALIENT FEATURES OF GENETIC CODE

i The code is triplet..

ii. Codon is unambiguous and specific, code for one amino acid.

iii. The code is degenerate. Some amino acids are coded by more than one codon.

iv. The codon is read in mRNA in a contiguous fashion without any punctuation.

## TRANSLATION

Translation is the process of polymerisation of amino acids to form a polypeptide. The order and sequence of amino acids are defined by the sequence of bases in the mRNA. Amino acids are joined by peptide bonds.

steps-

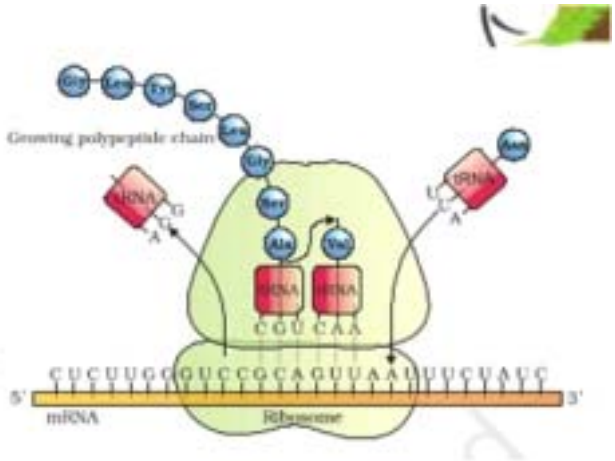
a) Charging of t-RNA.(Binding of aminoacid with tRNA )

b) Binding of charged tRNA in the 1st and 2nd (P and A)site on ribosome

c) Formation of peptide bonds between two charged tRNA.

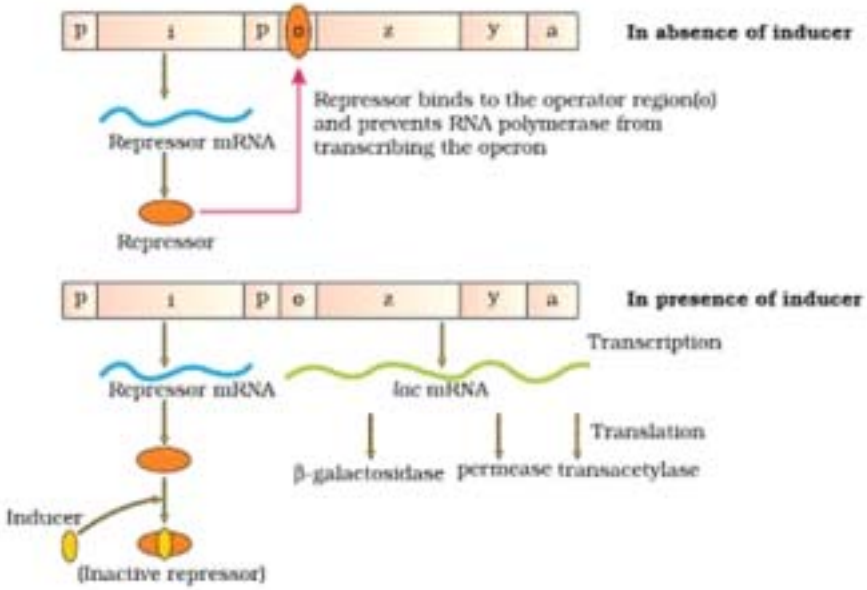
d) Translocation of ribosome result in expulsion of 1st aminoacid from ribosome and addition of subsequent aminoacids

• The start codon is AUG.




**The Lac Operon**

Lac operon consists of one regulatory gene (i ) and three structural genes (y,z and a). Gene i code for the repressor of the lac operon. The z gene code for beta-galactosidase, that is responsible for hydrolysis of disaccharide, lactose into monomeric units, galactose and glucose. Gene y code for permease, which increases permeability of the cell. Gene a encode for transacetylase.




Lactose is the substrate for enzyme beta-galactosidase and it regulates switching on and off of the operon, so it is called inducer.

**.HUMAN GENOME PROJECT**

**Goal of HGP-**

a) Identify all the genes (20,000 to 25,000) in human DNA.

b) Determine the sequence of the 3 billion chemical base pairs that make up human DNA.

c) Store this information in data base.

d) Improve tools for data analysis.

e) Transfer related information to other sectors.

f) To address the legal, ethical and social issues that may arise due to project.

**METHODOL**

(i) Identifying all the genes that express as RNA called **Express sequence tags(EST).**

(ii) second is the sequencing the all set of genome that contained the all the coding and non-coding sequence called **sequence Annotation.**

**Salient features of Human Genome:**

a) The human genome contains 3164.7 million nucleotide bases.

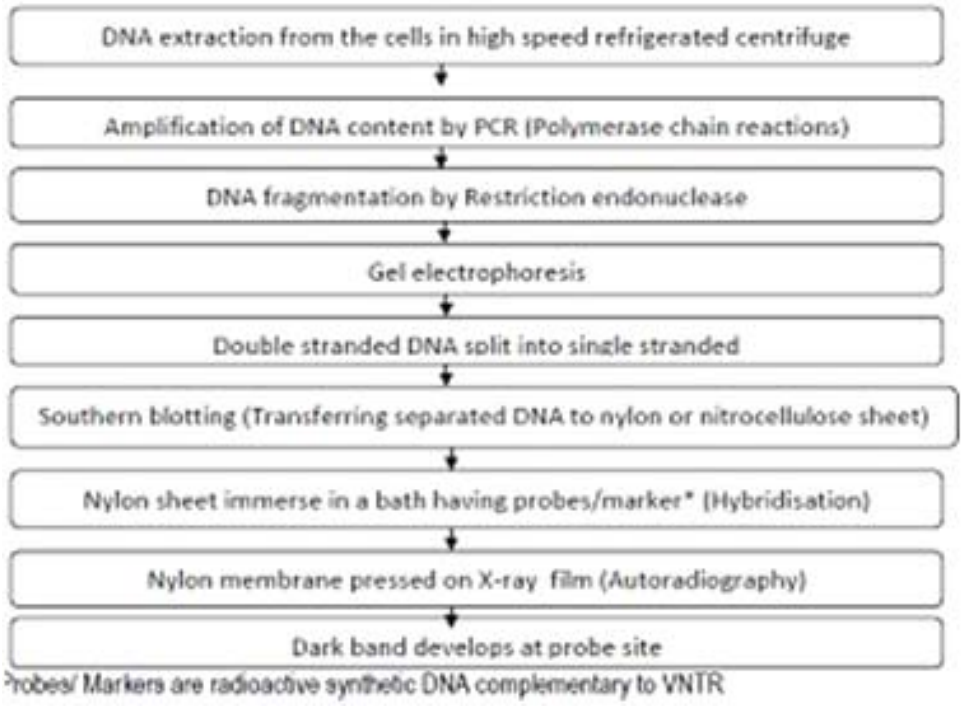
b) The average gene consists of 3000 bases,largest known human gene being dystrophin at 2.4 million bases.

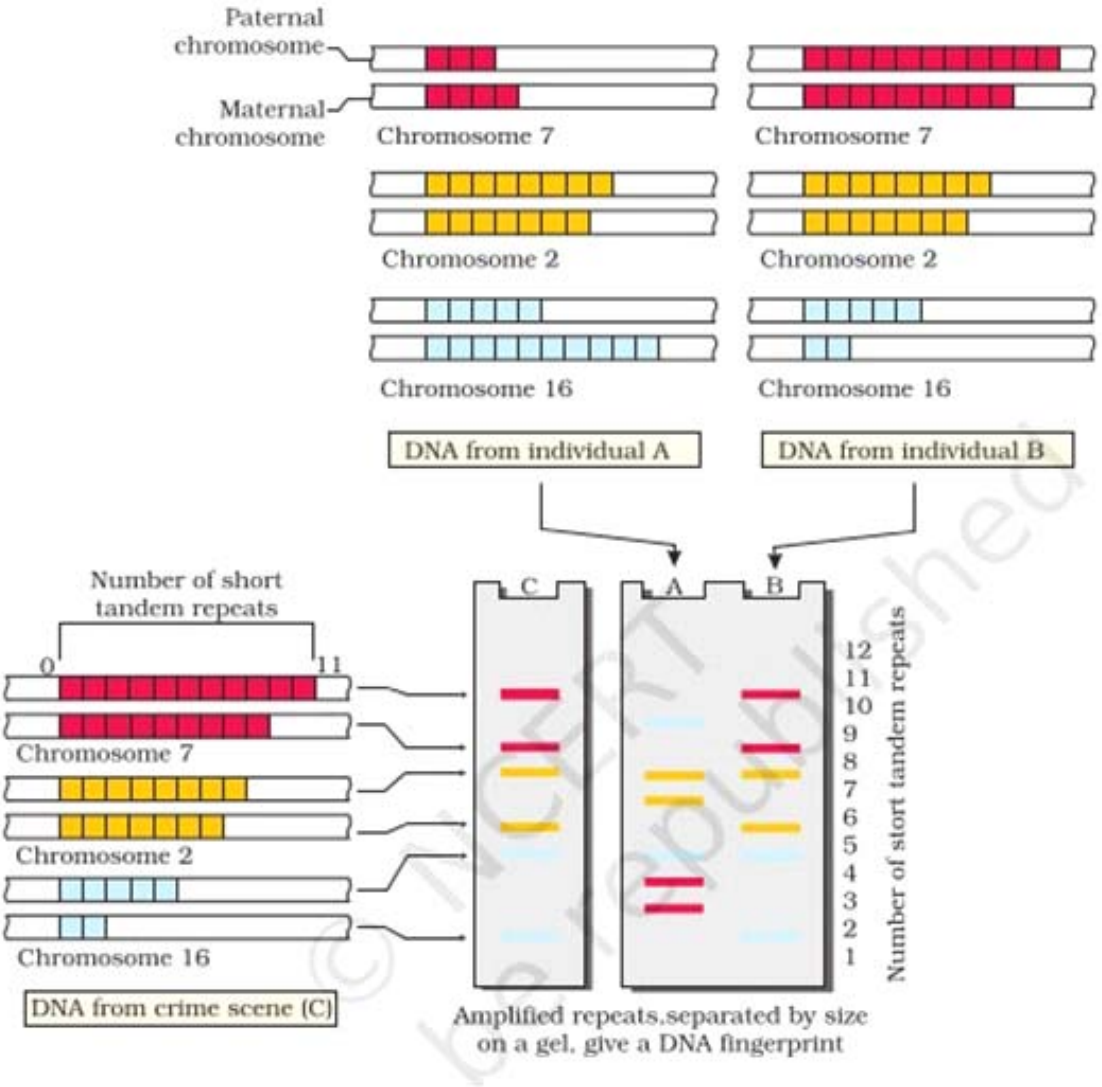
c) Less than 2 per cent of the genome codes for proteins.

d) Repeated sequences make up very large portion of the human genome.

e) Chromosome 1 has most genes (2968), and the Y has the fewest (231).

DNA FINGER PRINTING





# EVOLUTION - CHAPTER 5

## THEORIES OF ORIGIN OF LIFE

1. Theory of Panspermia
   Cosmozoic Theory - Early greekthinkers thought units of life called spores (Cosmozoa) were transferred to different planets including earth.
2. Theory of Spontaneous generation / Theory of abiogenesis - Life came out of decaying and rotting matter like straw, mud etc. Louis pasteur disproved this theory with the swan necked flask experiment and put forwarded Biogenesis
3. Theory of Biogenesis - Living organisms are formed from pre existing life only
4. Chemical Evolution / Organic evolution - Oparin & Haldane Proposed chemical evolution. First life form appeared from pre-existing non- living organic molecules (Eg: RNA, Protein etc) ie, Formation of organic molecules from inorganic constituents

**Experimental Proof of Chemical Evolution**

In 1953, S.L Miller created a similar conditions in a laboratory scale. Similar to the primitive earth. He created electric discharge in a closed flask containing $CH_4$, $H_2$, $NH_3$ and water vapour at $800^0$C. He observed formation of amino acids.

Diagramatic represention of Miller's Experiment

**Evolution of Life forms - A Theory**

Charles Darwin strongly challenged the ideas of special creation theory and made a sea voyage in a ship called HMS Beagle round the world. He made most of the observations in Galapagos islands and arrived at the theory of National Selection, as a mechanism of evolution. Alfred Wallace, a naturalist who worked in Malay archipelago had also come to similar conclusion around the same time.

**Evidences for Evolution**

1. Paleontological evidence

   Study of fossils is called paleontology

   Fossils are the remains of hard parts of life - forms found in rocks

**Importance of Fossil study**

- ❖ It helps to study about extinct animals.
- ❖ It helps to study the evolutionary history of animals (phylogeny)
- ❖ It helps to study about geological time periods.
- ❖ It helps to study about connecting links

**Archaeoptery x shows the feature of both reptiles and Birds Otherwise called Reptile Bird.**

| Reptilian Characters | Avian Characters |
|---|---|
| 1. Presence of Teeth | 1. Presence of Beak |
| 2. Presence of Claws | 2. Presence of wings |
| 3. Presence of Scales | 3. Presence of feathers |
| 4. Presence of tail vertebra | 4. Presence of feathery tail |

2. Comparative anatomy and morphology

It discusses similarities and differences among organisms of today and those that existed years. ago, to check the presence of common ancestry.

**a) Homologus organ** - All mammals share the same pattern of forelimbs. Though they perform different functions, they are anatomically similar. The structures are called Homologus organ and leads to divergent evolution.

**Analogous organ** - The pair of Organs is not anatomically similar, but performs the same function. It leads to convergent evolution.

Examples for Homologies organs & Analogous

| Homologous Organs | Analogous Organs |
|---|---|
| 1. Bones of Forelimbs of Whales, bats, Cheetah and human (all mammal) | 1. Eye of octopus and mammals |
| 2. Vertebrate hearts | 2. Flippers of penguins and Dolphins |
| 3. Vertebrate brains | 3. Sweet potato and potato |
| 4. Thorn & Tendrils of Bougainvillea and Cucurbita | |

**Industrial Melanism :**

In England it was noted that before industrial revolution, the number of white winged moths was more than that of dark melanised moth.

After Industrialisation, there increased the number of dark melanised moths.

After industrialization, the tree trunks became darker with deposits of soot and smoke and hence the number of dark moths increased in order to protect themselves from predators while the white winged ones were easily picked up by the predators.

**Adaptive Radiation in Darwin Finches**

- ❖ Darwin noticed that there were many varities of small black bird finches in Galapagos Islands
- ❖ From the original seed eating varieties to become insect eaters and vegetarian finches.
- ❖ They differ in their beak shape, size and food habit.
- ❖ This process of evolution starting from a single point and radiating in different directions is called Adaptive radiation.

**Examples for Adaptive Radiatiion**

- ❖ Darwin Finches, Evolution of Australian marsupials and placent mammals.

**Biological Evolution**

According to Charles Darwin, Evolution took place by Natural selection.

The main points of Natural Selection (Survival of the fittest)

- ❖ Over production / Rapid multiplication .....
- ❖ Struggle for existance
- ❖ Variation
- ❖ Natural selection
- ❖ Inheritance of useful variation
- ❖ Speciation
- ❖ Two important concepts of Darwin theory of evolution are

1. Branching descent

2. Natural selection

Use & Disuse Theory / Theory of aquired characters

- ❖ This theory was put forwarding by Lamarck
- ❖ He observed that evolution occurs due to the use and disuse of particular organs or body parts.

Eg : - Giraffe have developed long necks as a result of attempts to eat leaves high up on trees.

**Mechanism of Evolution**

- ❖ Drawin did not quite explain how evolution gave rise to different species of the same organism.
- ❖ Mendel explained about inheritable factors, which influenced the phenoty pe of an organism.
- ❖ Hugo Devries based on his work on Evening primerose suggested that variations occured due to mutations.

**Mutations :** Sudden heritable changes in the genotype of an organism

**Sattation** : Single step large mutation that causes speciation

**Difference between Mutation & Variation**

| Mutation | Variation |
|---|---|
| ● Random & Directionless | ● Small & Directional |
| ● Single step large mutations are called saltation | ● May be useful (or) useless in function |
| ● Inherited | ● Useful variations are inherited |
| ● Causes speciation & evolution | ● Causes speciation & evolution |

## Hardy Wein berg Principle

The frequency of occurance of alleles of a gene in a population remains constant through generation unless distarbances such as mutations, non-random mating etc. are introduced. Sum total of all allelic frequencies is ?

Individual frequencies are represented as P and q such as in a diploid, where P and q represent the frequency of allele A and a. The frequency of AA is $P^2$, that of aa is $q^2$ and that of Aa is a 2pq.

Hence, $P^2+2pq+q^2 = 1$, which is the explanation of $(p+q)^2$

Factors Affecting Hardy Wemberg Equillibrium

- Gene flow (or) gene migration
- Genetic drift (changes occuring by chance)
- Mutation
- Natural selection
- Genetic recombination

### Founder Effect

The change in allele frequency is so prominent in the new sample of population that they become a different species and the original drifted population becomes the founder.

### Evolution of Animals

Animals evolved about 500 million years ago.

↓

Invertebrates (500 million years ago)

↓

Jawless fisher (350 million years ago)

↓

First Amphitions

↓

Reptiles (250 million years ago)

↓

Dinosaurs disappeared (65 million years ago)

↓

First shrew - like Mammals Appeared

**Flow chart of Origin & Evolution of Man**

| | | |
|---|---|---|
| | Dryopithecus (Ape - like) | |
| | ↓ | → 15 Million years ago |
| | Ramapithecus (Man - like) | |
| | ↓ | |
| | Man - Like primates | → 3- 4 million years ago |
| | ↓ | |
| (650- 800 cc) | Australopithecines (Homo-habitis) | → 2 million years ago |
| | ↓ | |
| (900 cc) | Homo erectus | → 1.5 million years ago |
| | ↓ | |
| (1400 cc) | Neanderthalman | → 1000,40,000 years ago |
| | ↓ | |
| | Homo sapiens | → 75,000 - 10,000 yers |

CHAPTER – 6

# HUMAN HEALTH AND DISEASES

## PATHOGENS

The disease causing Organisms are called pathogens and they enter the human body through various means, then multiply and interfere with normal vital activities.

Classification of Diseases based on the Pathogens, their mode of transmission preventure and control measures are diseased briefly.

### BACTERIAL DISEASES

| Pathogen | Way of spreading |
|---|---|
| Typhoid - Salmonella typhi | (Mode of Tramission) |
| Site of infection | Contaminated food and water |
| Small intestine | Symptoms |
| | High fever weakness stomach fever Headache, loss of appetite constipation and intestinal perforation and death may occur in severe cases. |

**Confirmatory Test** - Widal Test

**PNEUMONIA**

**Pathogens** - Strep to coccus pneumonia and Haemophilus influenzae

**Spreads through** - Droplets / aerosolscted person, sharing of glasses or utensils

**Site of infection** - Alveofi (gets filled with fluid, difficulty in breathing)

**Symptoms** - Fever, chills caugh and Headache. In severe... lips and finger nails may turn gray to bluish in colour

**Examples of Bacterial Diseases**

Dysentery, Plague, Diphtheria

**VIRAL DISEASES**

**Common Cold**

**Pathogen** - Rhino Viruses

**Site of inflection** - Nose and Respiratory passage

**Spreads through** - Droplets released from coughing of sneezing or contaminated objects

**Symptoms** - Nasal congestion and discharge, Sore throat, Cough, headache, tiredness

## PROTOZOAN DISEASES

### MALARIA

**Pathogen** - Different species of plasmodium P.vivax, P. malaria and falciparum, P. vivax

**Vector** - Female amopheles mosquito

**Symptoms** - High fever, recurring every 3 to 4 days with chill

**Life cycle of plasmodium**

Figure 8 1

- ❖ Plasmodium requires two hosts to complete its life cycle (digenetic parasite)
- ❖ When a female Anopheles mosquito bites a healthy human being, it releases plasmodium, which lives in its body as sporozoite (inflactious stage)
- ❖ Multiplication of parasites (Asexual reproduction) occurs in the liver cells, finally burst out and releases sporozoites into the blood.
- ❖ Parasites enter RBCs and further multiply (asexual reproduction) and finally burst RBCs too
- ❖ Bursting of RBCs is followed by release of haemozoin, a toxic substance causes the fever and chills
- ❖ In the RBCs, only sporozoites change into gametocytes (sexual stage) game to cytes multiply
- ❖ When the diseased person is bitten by a female Anopheles mosquito, gametocytes are introduced into he mosquito
- ❖ Game to cytes fertilise and develop inside the intestine of mosquito to form sponozoite.
- ❖ Sponozoites are stored in the salivary glands of mosquito and are relased into the healthy person who is bitten by this mosquito

### AMOEBIASIS

**Pathogen** - Entamoeba histolyica

**Vector** - House Fly

**Symptoms** - Constipation, abdominal pain, cramps, stools with mucus and blood clots

## FUNGAL DISEASES

### RING WORNS

**Pathogens** - General-Microsporum, Trichophyton and Epidermophyton

**Spreads Through** - Towels, clothes, comb

**Symtoms** - Appearance of dry scaly lesions on various body parts with intense itching

**Diseases caused by Nematodes**

**ASCARIASIS**

**Pathogen** - Round worm, Ascaris

**Spreads through-** Water, vegetables fruits contaminated by feaces of infected person

**Symptoms** - Internal bleeding muscular pain, fever anaemia, blockage of inestinal passage

**ELEPHANTIASIS (FILARIASIS)**

**Pathogen** - Wuchereria (W. Malayi & W. Bancrofi)

**Spreads through-** Bite of female culex mosquito, vector

**Symptoms** - Chronic inflammation of the organs, usually the lymphatic vessels of lower limb, defermities of genital organs

**Practices for personal and public Hygiene**

- ❖ Keeping the body clean
- ❖ Consumption of clean drinking water, food, vegetables and fruits
- ❖ Proper disposal of waste
- ❖ Periodic cleaning and disinfection of water reservoirs, pools etc.
- ❖ Keeping hygience in public catering
- ❖ Keeping contast with diseases persons should be avoid
- ❖ Mosquito eradication program
- ❖ Vaccination

**IMMUNIM**

The ability of body is to fight against the disease carrying organisums

**Type of Immunity**

- ❖ Innate (inborn)
- ❖ Acquired

**Innate Immunity:**

It is present from birth onwards. It is non-specific . It consists of 4 kinds of barriers.

**1. Physical barriers**

Skin, mucus coating of respiratory, gastro intestrial and urinogenital treat prevent entry of microbes in to the body.

**2. Physiological barriers**

Acid in stomach, saliva and tears antibacterial effect.

**3. Cellular barriers**

Leukocytes such as PMNL, Monocytes and macrophages phogocytic activity

**4. Cytokine barriers**

Spenal proterns called interferons are secreted by virus infeted cells that prevent the further spread of viral infection

**ACQUIRED IMMUNITY**

It is produced in response to an encounter with a pathogen based on memory. It is pathogen specific

**Primary Response**

When a pathogen inferts a person for the first time, low intesit immune response is produced

**Secondary Response**

When a pathogen attacks the person for the second time, intensified immune response will be product and that prevents the disease

**Acquired immunity is alone by B-lymphocytes and T-lymphocytes**

| B-lymphocytes | T-lymphocytes |
|---|---|
| ● Formed differential in bone marrow | ● Help B-lymphocytes to produce antibodies |
| ● Secretes, antibodies | ● Involved graft rejection |
| ● Humeral immune response | ● Cell mediated immune response |

**Antibody**

Structure of antibody diagram

**ANTIBODY**

They are specialised protiens with 4 peptide chains (2 light and 2 heavy), hece denoted as $H_2L_2$

*Eg:- IgA, IgM, IgE etc.*

They generate humoral immune response

| Active Immunity | Passive Immunity |
|---|---|
| ● Naturally acquired immunity | ● Using ready made antibodies |
| ● Produced in response to an antigen | ● Colostrum provied IgA |
| *Eg:- Immunization* | |

**HOW DOES A VACCINATION HELP**

❖ Vaccines are nothing but inactivated or killed pathogens

❖ These inactivated pathogens when intoduced into the body produce a primary response

- ❖ Memory B & T cells are produce.
- ❖ Now when the pathogen again attacks the person, momory B and T cells gener ate a massine immune response and the pathogen is killed.

**Allergy**

Exaggerated immune response to certain antigens

Allegens - Allergy causing substances

*Eg:- Dust, pollengrains etc*

- ❖ Antibodies produced in allergic reaction is IgE.
- ❖ Chemicals released during allergic reactions are histamineo and serotonins.
- ❖ Sneezing, Watery eyes and difficulty in breathing are the symptoms.
- ❖ Treatment with Antihistamins adrenalins and sterodis recommended.

**Autoimmunity**

Body generates immune response against its own cells.

Reasons - Genetic and other unkown reasons.

*Eg:- Rheumatoid arthritis*

## LYMPHOID ORGANS

**Primary Lymphoid organ (Bone Marrow, Thymus)**

Immature Lymphocytes differentiated
to form antigen sensitive lymphocytes

→ Bone Marrow

Lymphocytes are produced

→ Thymus

Maturation of T-lymphocytes

**Secondary Lymphoid organs**

Lymphocytomigratezene and attains majority

→ Spleen, lymphnodes, tonsils, peyerspatches and etc..

**Spleen** - Large, bean shaped organ known as reservoir of blood and phagocytic in function

**Lymphnodes** - Generation immune response with hymphocytes and destroy antigons

Largest lymphoid tissue in the body-MALT

(Mucosal associated lymphoid tissue)

**AIDS (Acquired Immuno Deficiency Syndrome)**

Pathogen - HIV (Human Immune deficiency Virus-RNA Virus)

**Transmission of HIV occurs through (പകർച്ച രീതികൾ)**

- ❖ Sexual contact with infected person
- ❖ Sharing of infected needles
- ❖ Transfusion of contaminated blood
- ❖ Infected mother to child through placenta

Symptoms may appear from few months to many years (5-10 yrs)

**REPLICATION OF HIV VIRUS**

Virus infects normal cell

↓

Viral RNA is introduced into the cell cytoplasm

↓

Viral DNA is produced (By reverse transcription)

↓

Viral DNA gets attached with host DNA

↓

New Viral RNA is produced by the infected cell

↓

New Viruses are produced

↓

They can infect other cells

Diagnosis of AIDS- ELISA test (Enzyme Linked Immuno Sorbent Assay)

Treatment - No permanent cure sofar, Anti-retroviral therapy is recommended

**Preventive Measures**

- ❖ Ensuring use of disposable syringes
- ❖ Advocating safe sex
- ❖ Screening of blood before transfusion from blood bank
- ❖ Sex education & awareness programmes

**CANCER**

The cells which lane test their contact inhibition will show uncontrolled cell division, leads to tumers.

| Benign tumors | Malignant tumors |
|---|---|
| ● Tumors remains at its origin site only | ● Exhibits Metastasis |
| ● Donot spread | ● Spreads to other tissue |
| ● May be changes to cancerons | ● All become cancer cells |

**Metastasis**

The property of cancerous cells to spread to other cells

**Causes of cancer**

- ❖ Carcninogens
- ❖ Oncogenic viruses
- ❖ Proto oncogenes

**Diagnosis of cancer**

Biopsy, Histopathological study, Radiography CT scan, MRI, Immunological and molecular biological techniques

**Treatment of cancer**

Radiotherapy, Chemotherapy and Immunotherapy

## DRUG ABUSE / ALCOHOL ABUSE

**Commonly abused drugs Opioids (Heroin)**

**Source:**

From the latex of poppyplants (Papaver Somniferum)

**Censumed by** : Snorting (or) injection

**Properties** : White, bitter and odourless

**Mode of Action** : Binds to opioid receptors present in the CNS and gastro intestinal tract

**Effect** : Slows down body functions (depressant)

**Cannabinoids**

**Source** : Inflorescence of the plant cannabis sativa

**Consumed by** : Inhalation (or) Oral Ingestion

**Mode of action** : Binds to cannabinoid receptors in the brain

**Effect** : Affects the cardio Vast system.

**Coccaine**

**Source** : Cocoplant erythroxylic coca

**Consumed by** : snorting

**Mode of action** : Interference with transfer of neurotransmitter, dopamine

**Effect** : Stimulates the CNS, produces euphoria and increased energy

Drugs like barbiturates, amphetamines benzodiazepines, LSD (lysergic acid diethyl amides) are used as medicines for mental illness and insomnia

Nicotine is present in tobacco, which is smoked, chewed or snuffed

**Mode of action :** stimulates the adrenal gland to release adrenalin and non-adrenaline

**Effects of smoking**

- ❖ Increased carbon monoxide levels in blood, leading to oxygen deficiency
- ❖ Increased risk of diseases like bronchitis, emphysema coronary heart disease, gastric ulcer and cancer

**Causes of drug / Alcohol abuse**

- ❖ It normally starts in adolescence phase
- ❖ Many adolescents are motivated towards drugs due to curiosity experimentation.
- ❖ Peer pressure, academic stress, unstable family structure.
- ❖ Perception of consuming alcohol

**Alchol / Drug addiction**

- ❖ Repeated use leads to addiction
- ❖ Addiction refers to psychological attachment
- ❖ Due to addiction the tolerance level of receptors in our body increases
- ❖ Dependence leads to manifestation of with drawl syndrome

**Effects of alchol / Drug abuse**

- ❖ Immediate effect - Vandalism violence and reckless behavior
- ❖ Drop in academic performance
- ❖ Lack of interest in personal hygiene
- ❖ Mental psychological and financial loss not only to the user but also to his family
- ❖ Damage to nervous system and liver cirrhosis

Use of anabolic steroids in Female person - Increases masculinity aggressivness, depression and deepening of voice

**In Males -** Aggressiveness, depression, decreased sperm production, enlargement of breast premature baldness.

**Some of the ways to Prevent Alcohol / Drug abuse**

1. Avoid peer pressure
2. Education and counseling
3. Help from parents and peers
4. identifying danger signets
5. Seeking medical help - psychologists and rehabilitation programms

CHAPTER – 7

# MICROBES IN HUMAN WELFARE

1.Microbes in household products :

Lactobacillus convert milk into curd.

Lactic Acid Bacteria ( LAB ) :-

It improves the nutritional quality by increasing vitamin $B_{12}$.

Saccharomyces cerevisiae ( Baker's Yeast ) is used for making bread.

Propionibacterium sharmanii produce large amount of $CO_2$ in Swiss cheese.

2.Microbes in industrial products

| | | |
|---|---|---|
| a) Beverage | | |
| Yeast | Saccharomyces cerevisiae | |
| b) Antibiotic | | |
| Penicillin | Penicillium notatum | |
| c) Organic acids | | |
| Citric acid<br>Acetic acid<br>Butyric acid<br>Lactic acid<br>Ethanol | Aspergillus niger<br>Acetobacter aceti<br>Clostridium butylicum<br>Lactobacillus delbrueckii<br>Saccharomyces cerevisiae | Fungus<br>Bacterium<br>Bacterium<br>Bacterium<br>Fungus |
| d) Enzymes | | |
| Pectinase and Protease | Clear fruit juices | |
| Lipase | Removing oily stains | |
| Streptokinase | Clot bluster ( To remove blood clots from blood vessels ) | |
| E) Bioactive molecules | | |
| Cyclosporin A | Trichoderma polysporum | Immuno suppressive agent |
| Statin | Monascus purpureus | Lowering blood cholesterol |

3. Microbes in Sewage Treatment

It has two steps :-

a) Primary treatment :- Physical removal of particles through filteration and sedimentation.

b) Secondary treatment :- Biological treatment, reduces BOD of the effluent

4. Microbes in the production of Biogas

Methanobacterium (Methanogens) — found in anaerobic sludge, rumen of cattle, marshy places etc.

Cattle dung is used for biogas production.

5. Microbes as Biocontrol agents

1) Lady bird beetle – Control aphids
2) Dragon flies – Control mosquitoes
3) Bacillus thuringiensis
4) Trichoderma
5) Nucleopolyhedrovirus

6.Microbes as biofertilizers

1) Bacteria - Symbiotic bacterium Eg : Rhizobium
   Free living Eg : Azospirillum, Azotobacter
2) Cyanobacteria - Fix atmospheric nitrogen
   Eg : Nostoc, Anabaena, Oscillatoria
3) Fungi / Mycorrhiza

**ABSORBS PHOSPHORUS**

Resistant to root borne pathogens

Tolerence to salinity, drought etc.

Overall increase in the plant growth and development

**ORGANIC FARMING**

The non use of artificial fertilisers and chemical pestic ides and the use of biopesticides and bio fertilisers in agriculture.

STP — Sewage Treatment Plan

IPM — Integrated Pest Management

KVIC — Khadi and Village Industries Commission

CHAPTER – 8

# BIODIVERSITY AND CONSERVATION

The term biodiversity was coined by Edward Wilson

Biodiversity – can be defined as the totality of genes, species and ecosystems of a given region.

**LEVELS OF BIODIVERSITY**

1. Genetic diversity – Diversity of a genes within a species
2. Species diversity – Variety of species within a region
3. Ecological diversity – Variety of habitats, community types and abiotic environments present in a given area

**LEVELS OF ECOLOGICAL DIVERSITY**

1. á Diversity - Within community diversity
2. â Diversity - Between community diversity
3. ã Diversity - Over total landscape

Patterns of diversity:

a) Latitudinal gradients

Species diversity decreases from equator towards poles.

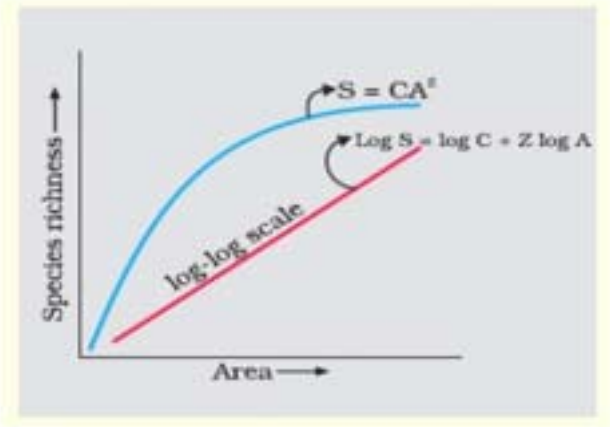
Tropics contain more species than temperate and polar regions. This is because :

1. Tropical latitudes have remained relatively undisturbed for millions of years.
2. Tropical environments are less seasonal, relatively more constant and predictable.
3. More solar radiation is available in the tropical region, so more productivity and therefore great species diversity.

   The Amazonian rain forest ( The Lungs Of The Planet ) in South America has the greatest biodiversity on earth.

b) Species – Area relationship

Alexander Von Humboldt has observed that within a region, species richness increased with increasing explored area, but only upto a limit.



Species Area Relationship

The graph shows a rectangular hyperbola.

On a log scale, the relationship becomes linear ( straight line ) and is described by the equation.

log S = log C + Z log A , where

S = Species Richness

Z = Slope of the line ( Regression Co-efficient )

A = Area

C = y- interceptm

Loss of biodiversity

Some of the animals that have become extinct in recent times are given below :

Red Data Book provides data on endangered animals.

1. Steller's cow ( Russia )
2. Thylacine ( Australia )
3. Dodo ( Mauritices )
4. Quagga ( Africa )

Causes of Biodiversity ( 4 Evil Quartet )

1.Habitat loss and fragmentation

2.Over – exploitation

3.Invasion of alien species

4.Co – extinctions

Effects of Loss of Biodiversity

1.Affect plant production

2.Ecosystem disturbances

3.Decrease of biomass and productivity

CONSERVATION OF BIODIVERSITY

1. In situ conservation ( On – site conservation ) – outside natural habitat

   The endangered species are protected in their natural habitat so that the entire ecosystem is protected.

2. Ex - situ conservation ( Off – site conservation )

The endangered species are protected under the care of humans.

Biosphere Reserves

There are 425 biosphere reserves in the world. They are as follows :

1.Nilgiri
2.Nanda Devi
3.Nokrek
8.Agasthyamala
9.Kanchenjunga
10.Pachmarhi

4.Manas 11.Similipal

5.Sunderbans 12.Dehang-Debang

6.Gulf of Mannar 13.Dibru Saikhowa

7.Great Nicobar 14.Achenankmar-Amarkantak

Hot Spots

Biodiversity rich area, where rare or endemic species are more.

2 Hot Spots :

1. Western Ghats
2. Eastern Himalayas

Endemic species – Species confined to a region and not found anywhere else. Endemic species are rich in hot spots.

IUCN – International Union For Conservation Of Nature and Natural resource

CRYOPRESERVATION

Method of conservation by storage of materials at ultra low temperatures for a very long periods. Gametes of threatened species can be preserved using this technique.

CONVENTIONS ON BIODIVERSITY

1.The Earth Summit

Convention on Biological diversity held in Rio de Janerio in 1992.

a)To take measures for conservation of biodiversity.

b)Sustainable utilisation of the benefits from biodiversity.

2.The World Summit on Sustainable Development

This was held in 2002, in Johannesburg, South Africa.

190 Countries signed commitment to achieve a significant reduction in the current rate of biodiversity loss at global, regional, and local levels by 2010.

Slogans for Biodiversity Conservation

“We together, for life together”

“Be active for active biodiversity”

“Conserve biodiversity and save earth”

WWF – World Wildlife Fund

IBWL – Indian Board for Wildlife