



Handwritten Notes  
on  
Human Health and Disease



## Human Health and Disease

- Health
- Common disease in Humans
- Immunity
- AIDS and Cancer
- Drugs and Alcohol Abuse.

### Health

Does not simply mean absence of disease or physical fitness.

Definition : Health can be defined as complete physical, mental and social well being.

### Importance of Health

- It increases longevity.
- It makes the person to work efficiently.
- It helps to gain economic prosperity.
- Reduces infant and maternal mortality rate.

### How to achieve good Health?

- Balanced diet
- Maintenance of personal hygiene
- Regular exercise → Yoga has been practised since time immemorial to maintain physical



and mental well being.

- Awareness of diseases.
- Vaccination (or immunisation)
- Proper disposal of wastes.

### • Factors affecting Health.

- Genetic disease.
- Infections
- Life style factors.

### • Disease

It is a state or condition in which the functioning of one or more body organs adversely affected, showing certain signs or symptoms.

- Pathogen: disease causing agent:  
It has to adapt itself according to the environment of host.

### • Types of Diseases



1. Congenital diseases : Disease present by birth or inherited from parents.

e.g. Turner's Syndrome

Klinefelter's Syndrome

Alkaptonuria.

2. Acquired diseases

(i) Communicable / Infectious Diseases.

These diseases are transferred from one person to another.

e.g. Influenza, common cold, tuberculosis etc.

(ii) Non communicable or Non infectious Disease :

These cannot be transferred from one person to another.

a) Deficiency disease :

• Beri-beri : Vitamin B<sub>1</sub> deficiency disease.

• Scurvy : Deficiency of Vitamin C.

• Kwashiorkor and Marasmus : Protein energy malnutrition.

b) Cancer : It is the major cause of death among non-communicable diseases.



## Transmission of Disease

### 1 Direct transmission

No intermediate agent is required for transmission of pathogen from one person to another.

#### a) Contact with Infected Person :

e.g. Chicken Pox  
Small Pox etc.

#### b) Contact with soil :

e.g. Tetanus

#### c) Through Placenta

e.g. AIDS, German measles

#### d) Bite of an animal

rabies.

### 2 Indirect transmission

An intermediate agent is required for transmission.

#### a) Arthropod vectors

Females Anopheles → Malaria

Rat flea : Plague

Housefly : Cholera



## b) Air-borne diseases

Common cold

Pneumonia

Epidemic typhus

## c) Human carriers

e.g. Typhoid

## • How Pathogens cause disease?

a

Tissue Damage

Rabies virus damage brain tissue

b Toxin secretion

• Exotoxin : Toxin is released as soon as secreted.

e.g. Diphtheria, Tetanus

• Endotoxin : Toxin is released when bacteria die or disintegrate.

e.g. Typhoid, Dysentery, cholera

## • Common Diseases in Humans

### I Bacterial diseases

#### 1 Cholera

Causative agent : Vibrio cholerae



Mode of spread : contaminated food and water

Signs / Symptom : Frequent vomiting, stool.

Treatment : Oral rehydration Therapy  
having saline drips to replenish the lost salt and water.

Diagnosis : checking of stool / vomiting.

b) Typhoid

Causative agent : Salmonella typhi



Gram - ve bacillus  
non spore forming

Mode of spread : contaminated food and water

Symptoms :

More prone to persons with achlorhydria  
i.e. absence of HCl in stomach.

- fever ( $39^{\circ}\text{C} - 40^{\circ}\text{C}$ )
- abdominal pain
- constipation
- Intestinal perforation may lead to death.
- Splenomegaly : increase in size of spleen
- Leucopenia : decrease in WBC.



★ Disease .. Agent

(i) Dysentery (shigellosis) : shigella dysentriae

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• Diagnostic Test : Milidal Test

• Human carrier : Mary Mallon (Typhoid mary) she was a cook and continue to spread typhoid for several years through the food she prepared.

### 3 Diphtheria

Causative agent : Corynebacterium diphtheria

Mode of spread : droplet infection

Symptoms : fever, chills, headache.

→ Formation of gray membrane on tonsils and throat which spreads downward causing hoarseness and difficulty in breathing.

• Blood tinged nasal discharge from one nostril.

• Toxin affects heart and nervous system and may prove fatal.

Treatment : DPT Diagnostic Test : Schick Test

### 4 Pertussis (Whooping Cough)

Causative agent : Bordetella pertussis



Mode of spread : Droplet infection

Symptoms : Violent bout of cough which end in a whoop during inspiration at the end of cough.

Treatment : DPT

D : Diphtheria

P : Pertussis

T : Tetanus.

Tetanus (Lock Jaw).

Causative agent : *Clostridium Tetani*

- Mode of spread : The spore of bacteria is present in soil and enters the body through wound.

• Bacteria is found in intestine of horses.

• Spore in the soil may survive for 60 years or more years.

- Symptoms : spasms of the muscles of jaw and face.

• Person is unable to swallow or chew.

Treatment : Antitetanus Serum (ATS)

- Tetanus Toxoid.



## Pneumonia

Causative agent : Diplococcus pneumonia  
and  
Haemophilus influenza.

Mode of spread : droplet infection.

Symptoms : Lymph and mucus is filled  
inside alveoli and bronchioles.

- Surface area for gaseous exchange is reduced.
- Resistance of body lowers down.
- In severe cases the finger nails turn  
grayish to bluish.

Treatment Vaccine : Pneumococcal vaccine.

## • Plague

Causative agent : Bacillus pestis  
(Yersinia pestis).

Mode of spread : Vector (rat flea)  
↓

Xenopsylla cheopis

Symptoms : It is a disease of blood.

Bacteria enters lymph nodes of armpits, groin.



- causes fevers

- Bubonic plague / Black Death

↓

Bubo : inflammatory of lymph nodes of armpit etc.

Tuberculosis (Koch's Disease)

actinomycetes

Causative agent : Mycobacterium tuberculosis

Mode of spread : Through sputum.

Symptoms : Sputum containing blood, fever, loss of weight, loss of appetite, rapid pulse.

Treatment = Vaccine B C G  
Bacillus of Calmette Guérin

DOTS : Directly observed Treatment short course.

Leprosy (Hansen's Disease)

Causative agent : Mycobacterium leprae

Mode of spread : Droplet infection.

Symptoms : Deformities of fingers and toes.  
Light coloured patches on skin.  
Loss of sensation through those parts, skin ulcers.



- Edward Jenner: father of Immunology.

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Treatment: D D S (Diamino diphenyl Sulphone).

## Viral Diseases

### Influenza (Flu)

Causative agent: *Mycovirus influenza*

Mode of spread: Droplet infection.

Symptoms:

- Inflammation of respiratory passage.
- Pain all over the body.
- Coryza: running nose.

### Small Pox (

Causative agent: *Varicella virus*

Mode of spread: Droplet infection.

Symptoms:

- Rash appears first on face than on trunk.
- Scabs fall off leaving behind pock marks.



## Treatment :

- Small pox vaccine.
- It was prepared by Edward Jenner.
- According to WHO, small pox has been completely eradicated from world.

## • Chicken Pox (Chhoti mata)

Causative agent : Varicella zoster

Mode of spread : Droplet infection.

Symptoms :

- Rash first appears on trunk.
- Lesions are more on trunk than on face and limbs.
- Mild fever.

## • Measles (Rubeola disease)

Causative agent : Rubeola virus.

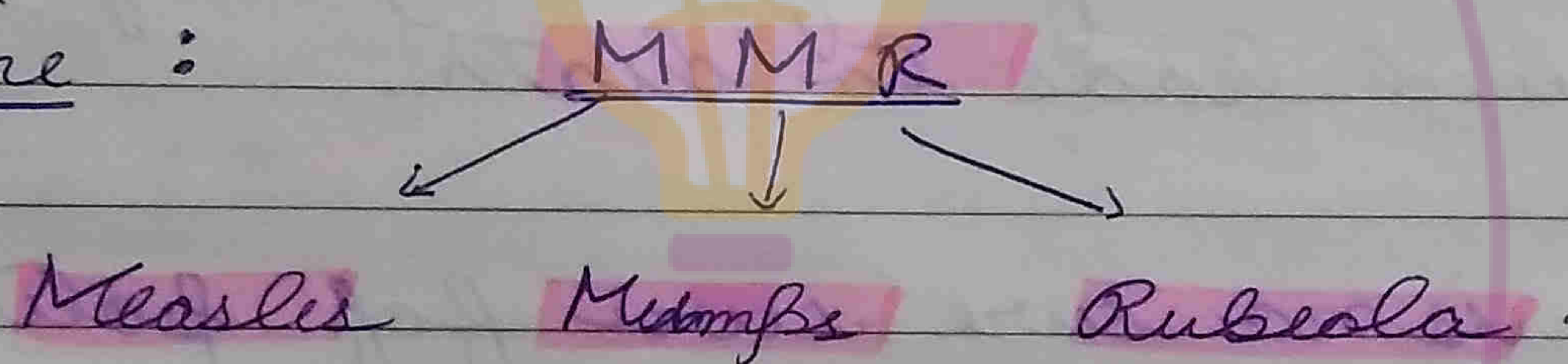
Mode of spread : Droplet infection.



### Symptoms :

- fever and rash over body.
- Catarrh (inflammation) of nose, throat.
- Eyes become red and watery.
- Face is flushed.
- Rash first appears behind the ear and face and then spreads downward.

### Vaccine :



- Mumps (Infectious Parotitis)

Causative agent : Paramyxovirus

Mode of spread : virus is present in saliva.

### Symptoms :

- Painful swelling of parotid salivary glands.
- Inflammation of the testis.



- Polio (Infantile paralysis).

Causative agent : Polio virus. It belongs to Picorna virus group.

Mode of spread : Intestinal discharge.

Symptoms : Attack of paralysis begins with high fever, chilliness, headache.

- Neck becomes stiff.

- If muscles of larynx & pharynx are involved leads to death.

- There is no sure cure for polio but is preventable.

Vaccine :

Salk prepared vaccine for polio (Killed)

Sabin's vaccine : Oral Polio Vaccine (OPV).  
(Live vaccine)

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- Rabies :

Causative agent : Rabies / Rhabdo virus.

Mode of spread : Bite of rabid (mad) dog.

- also spread by bite of cat, Jackal, wolf etc.



★ Dengue is a viral disease whereas malaria is a protozoan disease.

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Symptoms :

- saliva from mouth.
- Hydrophobia (Fear of water)
- The person is not able to swallow fluid due to choked throat.
- Rabies virus destroy brain and spinal cord.
- Rabies is 100% fatal.
- Pet should be given vaccine.

★ Dengue (Break Bone fever)

Causative agent : Arbo (Arthropod born) virus of flavivirus group.

Mode of spread : Female Aedes aegypti mosquito (vector)

a) Classical Dengue fever.

(i) Fever

(ii) Loss of appetite.

(iii) Loss of sensation of taste.

(iv) Muscle and joint pains.



★ Both dengue and chikungunya are viral diseases in which Aedes mosquito is vector. in classmate  
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## B) Dengue Haemorrhagic fever

- (i) Vomiting with or without blood.
- (ii) Skin bruising
- (iii) Pale cold or clammy skin.
- (iv) Aspirin & Disparin are not recommended.

## • Chikungunya

causative agent : chikungunya virus.

Mode of spread : ♀ Aedes mosquito (vector)

Symptoms : - Patient gets "dubled up"  
- Limping joint pains.

## • Hepatitis B

causative agent : Hepatitis-B virus (HBV)

• 42 nm enveloped virus.

• Mode of spread : virus is present in saliva, tears, etc.

- Transmit also through sexual contact, blood transfusion etc.



## Symptoms :

Liver cirrhosis : Hepatocytes are replaced by fibrous / adipose tissue.

Vaccine : Recombinant HB = It is 2<sup>nd</sup> generation vaccine which has been prepared through recombinant DNA (rDNA) technology.

HAV	—	SS RNA	—	Faeco-oral route
HBV	—	(ds) DNA	—	Blood, sexual contact
HCV	—	SS RNA	—	Blood, sexual contact
HDV	—	SS RNA	—	Blood, sexual contact
HEV	—	SS RNA	—	Faecal-oral route

## • Fungal Disease

Agents are called Dermatophytes.

Disease : Dermatophytes / Ring worm / Tinea.

### 3 Generas :

Trichopton : skin, hairs and nails

Epidermophyton : skin, nails

Microsporum : skin, hairs

— Tinea barbae : ringworm of bearded areas.

— Tinea cruris : Ringworm of perineum and



grain region.

- Tinea capitis : Ringworm of scalp.

- Tinea pedis : Ringworm of foot  
"Athlete's foot".

- Growth of fungus requires warm and moist conditions.

## • Protozoan Diseases

### 1. Malaria

causative agent : Plasmodium.

#### Species of Plasmodium

- Plasmodium vivax (Most common species)
  - Plasmodium ovale
  - Plasmodium malariae
  - Plasmodium falciparum
- Primary host : Man.  
(in which disease is caused and asexual cycle is performed)



Tertian malar fever repeated on third day  
Quartan - fever on fourth day.

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- Secondary host : ♀ Anopheles mosquito  
(sexual cycle is performed).
- \* Reservoir host : Monkey.

- Mosquito bites Man releasing sporozoites.
- Sporozoites reach liver (Hepatocytes)
- Sporozoites enter hepatocytes.
- Undergo asexual cycle inside hepatocytes (Schizogony)
- Hepatocytes burst releasing pathogens
- Perform schizogony in RBCs (Erythrocytic Schizogony)
- RBCs burst liberating pathogens.
- Haemozoin is released which causes fever.
- Duration of Erythrocytic Schizogony decides repetition of fever.
- It is 48 hours in *P. vivax*, *P. ovale*, *P. falciparum* → Tertian malaria.
- 72 hours in *P. malariae* → Quartan malaria.



- RBCs burst
- Development of gametocytes in RBC.

### Mosquito Bites

- Gametocytes enter mosquito's stomach.
- Gametocytes form gametes.
- Fertilisation in stomach/intestine.
- Zygote formation
- Formation of sporozites
- Sporozites enter salivary gland of mosquito.
- Mosquito bites another man releasing sporozites.

## 2 Amoebiasis

Causative agent: Entamoeba histolytica.

Mode of spread: contaminated food and water.  
- Houseflies act as mechanical carriers and spread disease.



Symptoms :

- Stool containing mucus and blood.
- Parasite of colon

Monogenetic :

- Infective stage : Quadrinucleate cyst
- Pathogenic stage : Magnaform
- Non Pathogenic stage : Minuta form or Precystic form.
- Reserve food material  $\rightarrow$  Glycogen

Drugs for Treatment - Tinidazole  
- Mitronidazole

### • Helminthic diseases

1. Ascariasis : Ascaris lumbricoides  
- contaminated food and water.

Symptoms : vomiting, diarrhoea, blockage of intestine and colic pain.

Drugs : oil of chenopodium  
Alcopar  
Bendex  
Zental



Filariasis / : *Wuchereria bancrofti*  
Elephantiasis *Wuchereria malayi*

Mode of spread : ♀ *Culex* mosquito.

Symptoms : Chronic inflammation of organs in which the parasite lives for years, usually in the lymphatic vessels of limbs.

## Immunity

Overall ability of the host to fight against disease causing organism, conferred by immune system is called immunity.

### Types of Immunity

- (i) Innate immunity
- (ii) acquired immunity.

1. Innate / Familial / Genetic immunity :  
Immunity present by birth.

It includes four types of barriers which prevent the entry of microorganism into the body.



## (i) Physical Barrier

- (a) Skin: The outermost layer is stratum corneum. It prevents the entry of microbes.
- (b) Mucous membrane: Found in digestive, respiratory and urino-genital tract etc. The mucus traps antigens / microbes.

## (ii) Physiological barriers

- a Lysosome in saliva, tears which is anti-bacterial.
- b Acids in stomach.
- c Bile.
- d Oil from sebaceous glands.
- e Cerumen (Ear wax)  
- repel insect  
- traps dust particles,  
- inhibits proliferation of microbes.
- f Sweat from sudoriferous glands (sweat glands).
- g Friendly bacteria on skin or in vagina which produce lactic acid and inhibits proliferation of other bacteria.



(iii)

Cellular Barriers

It includes cells such as Poly Morpho

Nuclear Leucocytes (PMNL) -

Neutrophils, Monocytes, Natural Killer cells, Macrophages which can engulf the microorganism.

• The process of phagocytosis was described by Metchnikoff

- All the phagocytic cells of body form Reticulo - Endothelial system.

→ Kupffer cells : in liver

→ Dust cells : in Lungs.

(iv)

Cytokine Barrier

Includes interferons (IFNs) which are glycoproteins released by virus infected cells.

• Interferons stimulate the neighbouring cells to release Anti - Viral Proteins (AVPs) to restrict the viral attack.

• Other Barriers

a)

Inflammatory response:

Inflammation is characterised by redness, local heat, pain, swelling.



• ankyretic: lower body temperature.

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## • Microorganism attack cells

- The broken cells release certain chemicals which attract mast cells.
- Mast cells release histamine.
- Histamine is a vasodilator and it increases capillary permeability.
- Increased blood flow results in redness, swelling.
- WBCs move towards site of attack (diapedesis).
- cells also release pyrogens which increase the temperature of body.
- Mild fever is stimulating the attraction of phagocytes<sup>es</sup> and inhibiting the growth of bacteria (defence mechanism).

## b) Complement System

It includes about 30 plasma proteins which kill the microbes by creating pores in the plasma membrane.

Water ions move into microbes through these pores and the latter die as it bursts (lysis).



★ Complement system is part of both innate as well as acquired immunity.

- Natural Killer cells (NK cells)
- These are a type of lymphocytes.
- These cells do not have antigen specific receptors unlike B cells and T cells.
- These cells release Perforin protein which cause pores in the microbial membrane and hence causing their lysis.
- ★ - They work against cancerous as well as viral infected cell.
- In cancer and AIDS patients, no. of NK cells reduce.
- They increase their cytolytic activity by means of  $\gamma$ -interferon.
- ★ - They also release Tumour Necrosis Factors (TNF).

2 Acquired Immunity -  
acquired by individual during its life time.

- Found in vertebrates only.



## Features :

- Specificity : It can differentiate between different antigens.
- Diversity : it can recognise several antigens.
- Discrimination between self and Non-self.
- Memory.

## • Lymphoid Organs

1. Primary (Central lymphoid organ).  
Organs where B-cells and T-cells are formed.  
(originate) and acquire antigen specific receptors.  
(mature).  
e.g. Bone marrow  
Thymus.

Hematopoiesis : formation of blood cells.

## • (B) - Lymphocytes

↳ Derived from Bursa of Fabricius  
(in cloaca of birds).

So, mammalian Bone marrow is considered  
equivalent to Avian Bursa of Fabricius.



- B-lymphocytes are formed and matured in Bone marrow

Immature thymocytes are formed in bone marrow but they migrate to Thymus and get mature there.

↓  
T-lymphocytes

• T-Lymphocytes

Thymus → "Throne of Immunity"

or  
"Training school of T-lymphocytes"

2 Secondary lymphoid organ (Peripheral lymphoid organs).

B-lymphocytes and T-lymphocytes after maturation reach here via blood or lymph differentiate and proliferate here.

e.g. Tonsils

Lymph nodes

Spleen

Peyer's Patches of Intestine

MALT

MALT (Mucosa Associated Lymphoid Tissue)  
found in Lining of respiratory, digestive and uro-  
-genital tract.

- It comprises of 5-10% of the total lymphoid tissue in body.



- Spleen and Lymph Nodes
- They act as

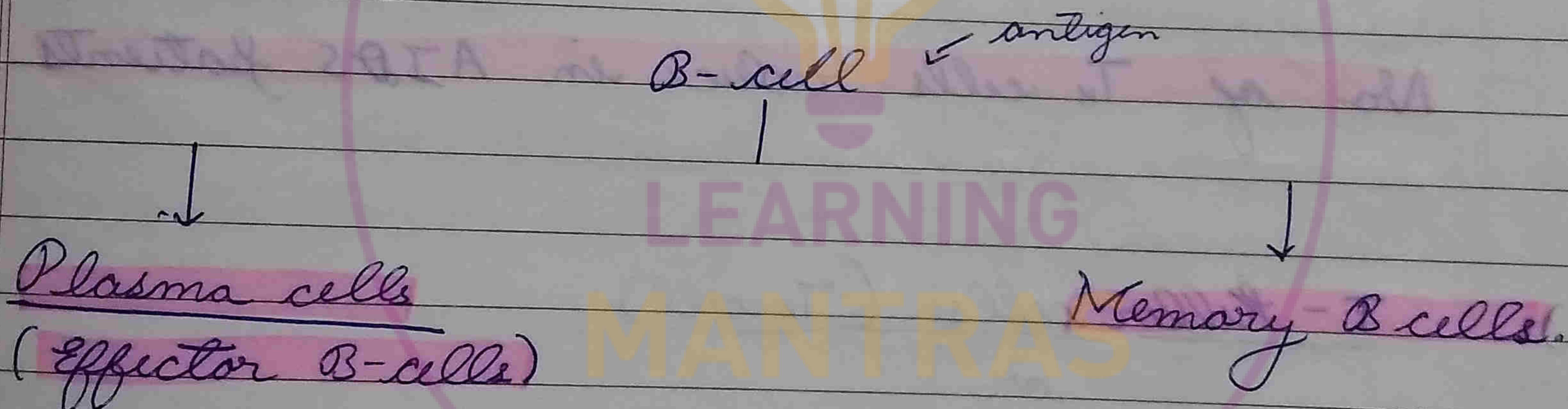
- Immunologic filter

- Immunologic conference centre:

Macrophages bring antigens to these organs and present them to B-cells and T-cells.

- Humoral Immunity System or Antibody Mediated Immune System

It comprises of B-cells.



#### a) Plasma cells

- Receptors absent

- Life span: 4-5 days

- Produce several antibodies per day until they die.

#### b) Memory B cells

- Receptors present

- Sensitised B cells

- Recognise same antigen if it attack second or subsequent times.

- Life span - some years



- Cell-Mediated Immune System (CMI)  
- consists of T-lymphocytes.

4 types of T-cells :-

a) T-helper cells ( $T_H$  cell)

- More numerous
- Release lymphokines



Interleukins and Monocyte colony stimulating factor.

- Interleukin : stimulate B-cells and T-cells
- No. of  $T_H$  cells reduce in AIDS patients

b) T-Killer cells ( $T_K$  cell)

or

Cytotoxic T-cells

- Release perforins
- Release lymphotoxins which kill the microbes infected cells.

★ Act against cancerous cells

★ Graft rejection.



c) T-suppressor cells

Suppress T helper and T killer cells, also suppress immune system.

d) T memory cells

- sensitised T-cells

- Also called Primed cells.

• Differences between B-lymphocytes and T-lymphocytes

• B-Lymphocyte

1. Plasma cells do not migrate to the site of action.

2. Act against bacteria and virus that enter blood and lymph.

3. They do not act against grafts and transplants.

4. They do not have inhibitory effect on immune system.

T-Lymphocyte

They reach the site of action.

Act against pathogens which enter cell including protist and fungi.

They act against graft/transplant.

They possess inhibitory effect on immune system due to presence of T-suppressor cell.



\* Hapten does not result in antibody production

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Antigen  
↓  
Antibody

generating

- They make the body for antibody formation

- Hapten: Incomplete antigen which is not capable of inducing antibody production.

They can induce antibody formation if joined with certain proteins of body.

• Antigen: large macromolecular usually protein or polysaccharides.

- They can be bacteria, virus or any structure such as white of an egg, feather of bird.

- H-antigen: common to all blood groups therefore usually not considered during blood transfusion

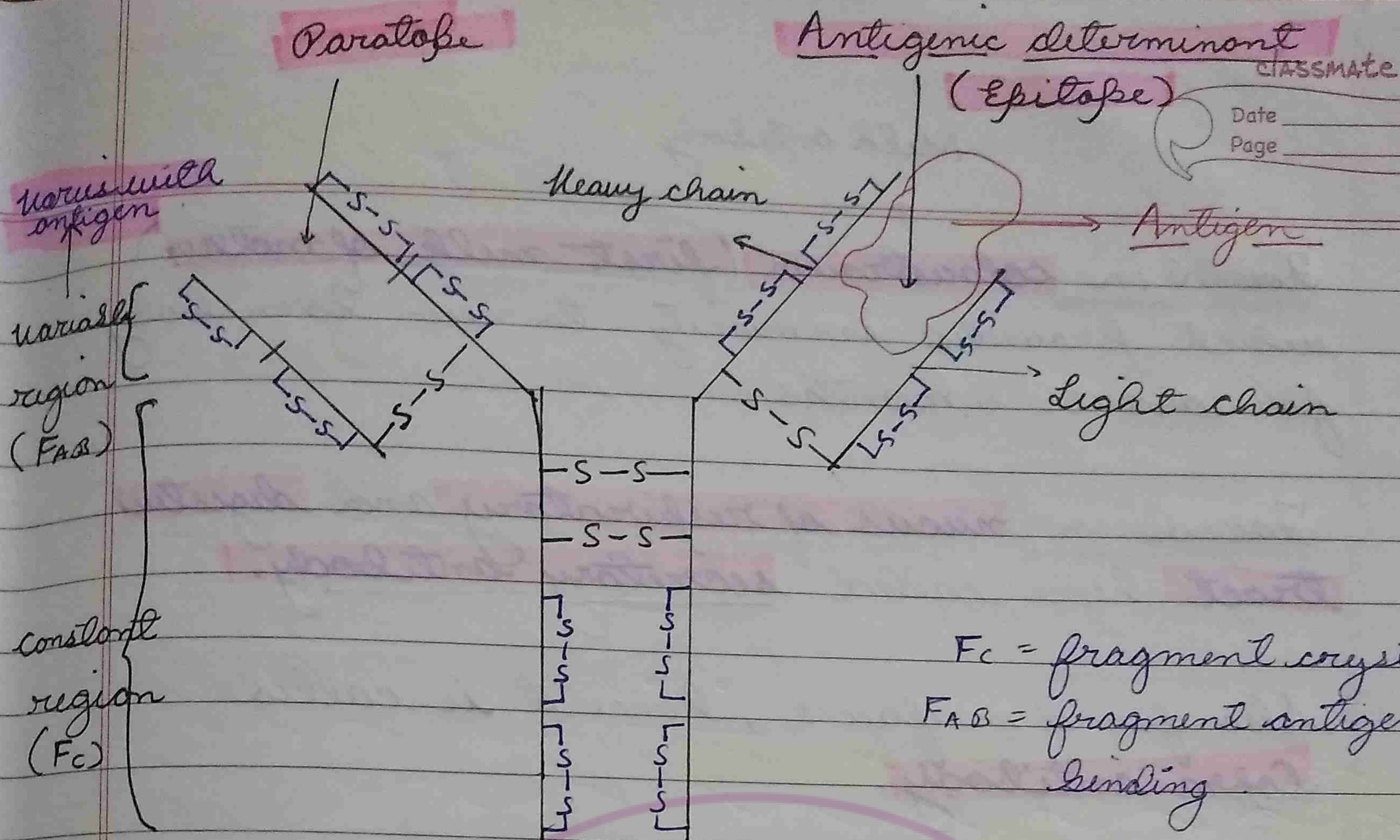
Khende et al (1952) found a rare blood group i.e. Bombay Blood group (O<sup>-</sup> blood group) without H-antigen.

• Antibody / Agglutinin

- Are glycoproteins.

- Contain two light chains and two heavy chains ( $H_2L_2$ ).





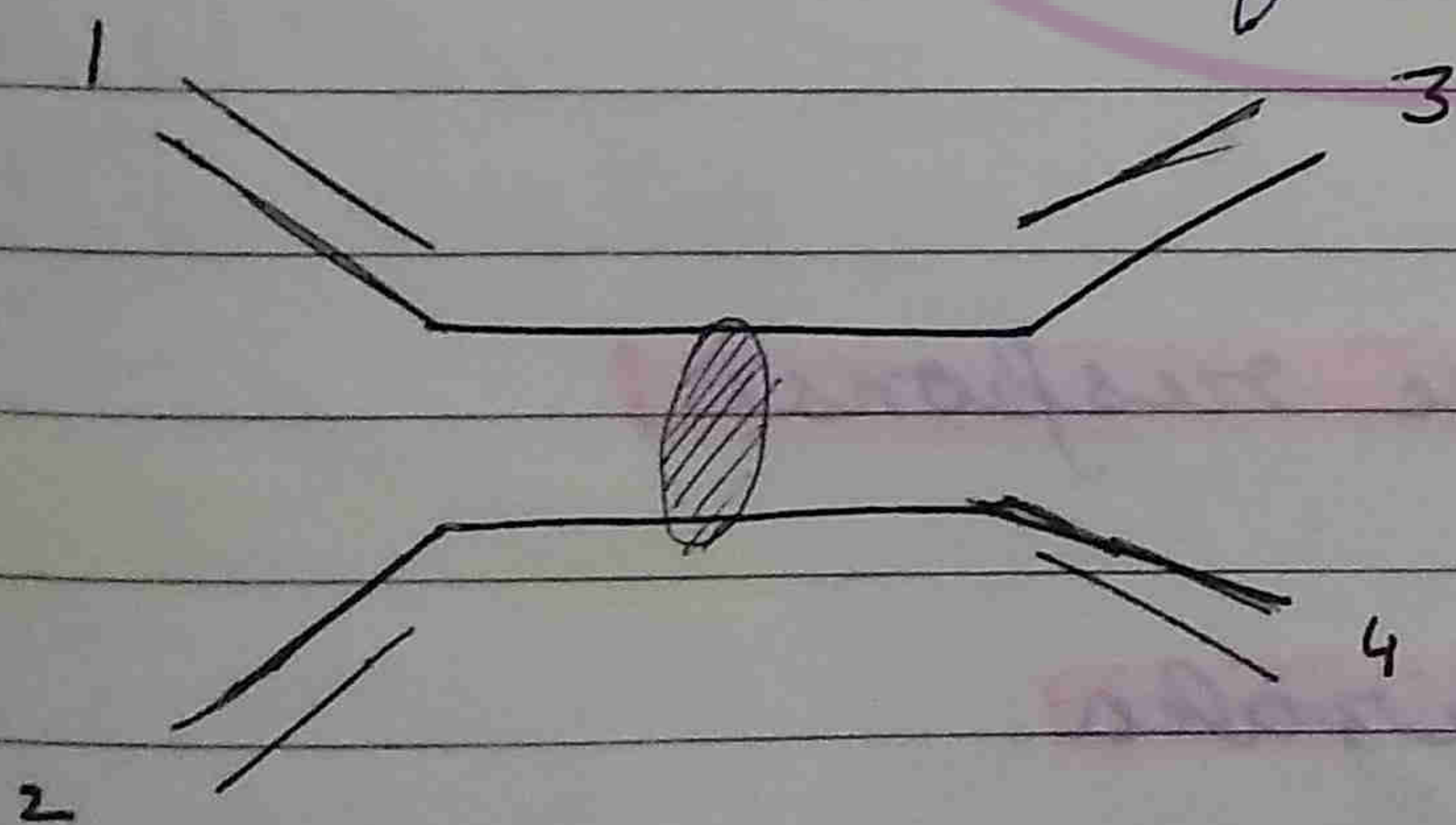
Epitope is part of antigen  
Paratope is part of antibody.

Classes of Antibody:

Ig: Immunoglobulin

Ig A: second most abundant antibody (15-20%)

Exist in dimer form.



No. of paratopes = 4

- J chain is present. (Extra chain)

Functions:

Protect against pathogens which enter in body during inhalation or ingestion.



## Milk antibody

- Found in colostrum (first milk of mother) which provides immunity to new born baby for about 6 months.
- Found in mucus of respiratory and digestive tract hence called secretory antibody.
- Also found in faeces, hence it is called copra antibody.
- Activates complement system.

2 Ig D → Present as receptor on B-cells.

- activates B cells to produce other antibodies.
- Membrane bound antibody.
- Exists as monomer, hence has 2 paratopes.  
Does not have T chain

3 Ig E : very rare

- Mediator in allergic response.
- Discovered by Ishizaka.

4 Ig G :

- Most abundant antibody (75%)
- Monomer = 2 paratopes



- Only antibody that can cross placenta.
- Activates complement system.
- It is neutralising agent (toxins, virus).

• Ig M =

∴ J chain present

- Largest antibody
- Exists as pentamer : 10 paratopes antibody that.
- first <sup>↑</sup> activates during initial attack of antigen.
- It protects the blood by agglutination.
- Earliest antibody to be formed in foetus.
- Oldest Ig class.

### Functions of Antibodies

1. Agglutination : agglutination of particulate matter including bacteria.  
e.g. Ig M
2. Opsonisation : coating of bacteria which facilitates subsequent phagocytosis of it by macrophages, etc.  
e.g. Ig G and Ig M



MHC: major histocompatibility complex.

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3 Neutralisation: Neutralisation of toxins produced by bacteria, etc.  
e.g. IgG

4 Complement Mediated Cell Lysis:  
IgG - IgM  
activate certain enzymes which create pores in antigen.

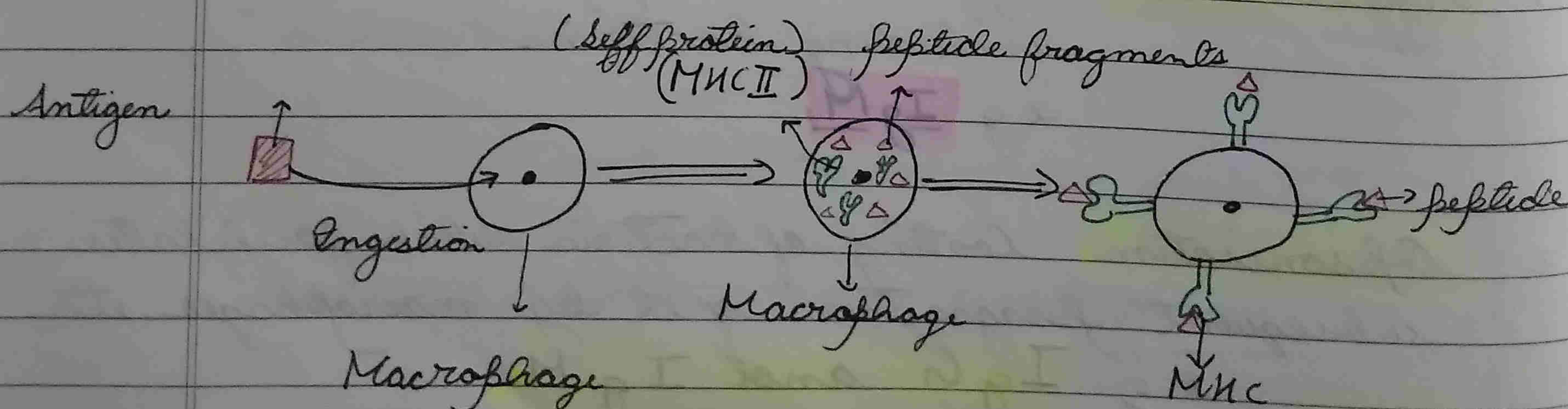
• Antigen Presenting Cells (APCs).  
These include B cells & Macrophages.

• Process of antigen presentation by APCs:

a Ingestion of antigen.

b Breaking of antigen into peptide fragments.

c Fusion of peptide fragments with MHC and presentation over the membrane / surface of cell.





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MHC (Major Histocompatibility Complex):  
These are set of genes present on chromosome 6 in humans.

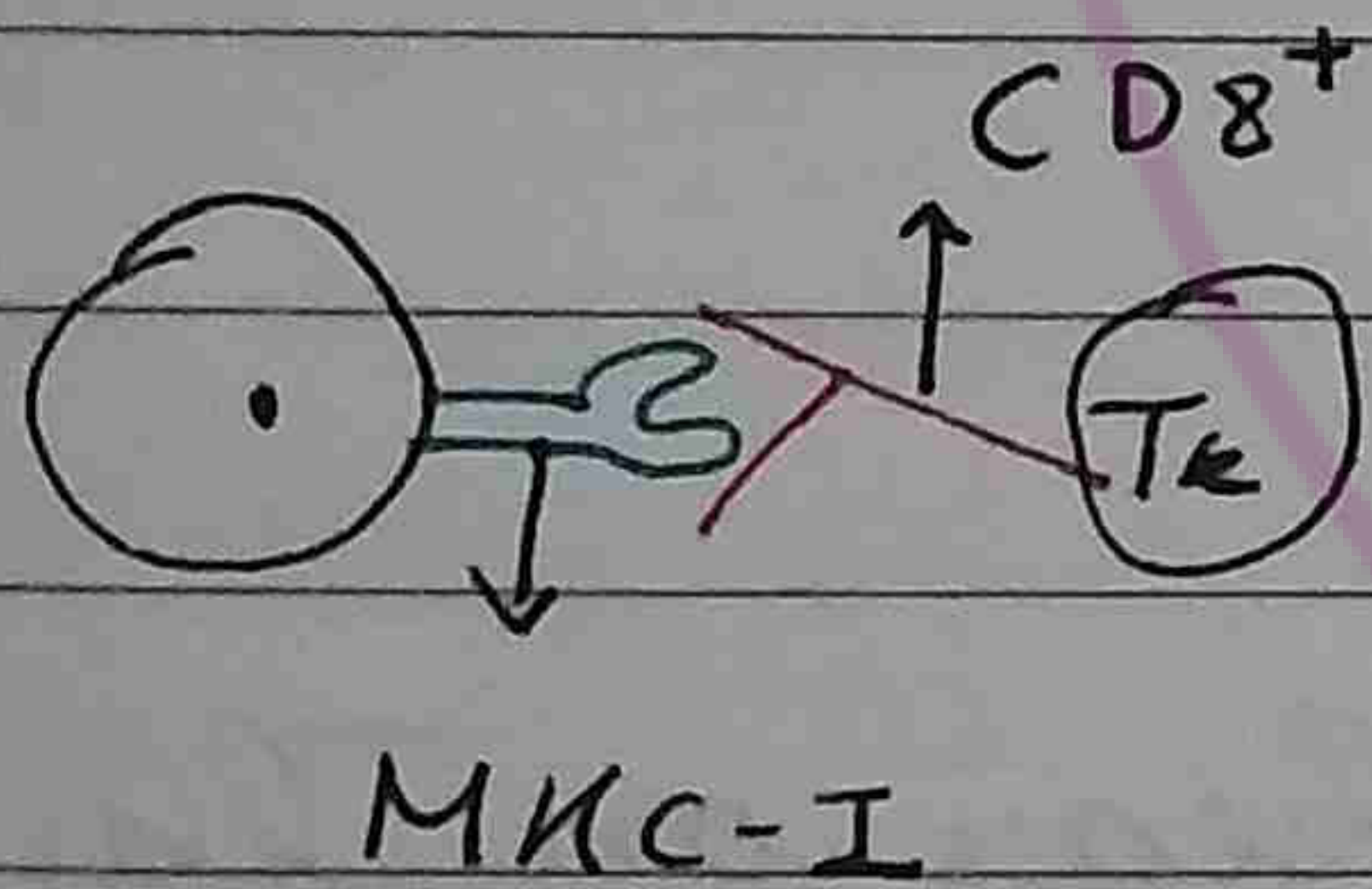
These are called **HLA (Human Leucocyte Antigen)** in Humans.

- A set of genes inherited from individual parent is called haplotype.

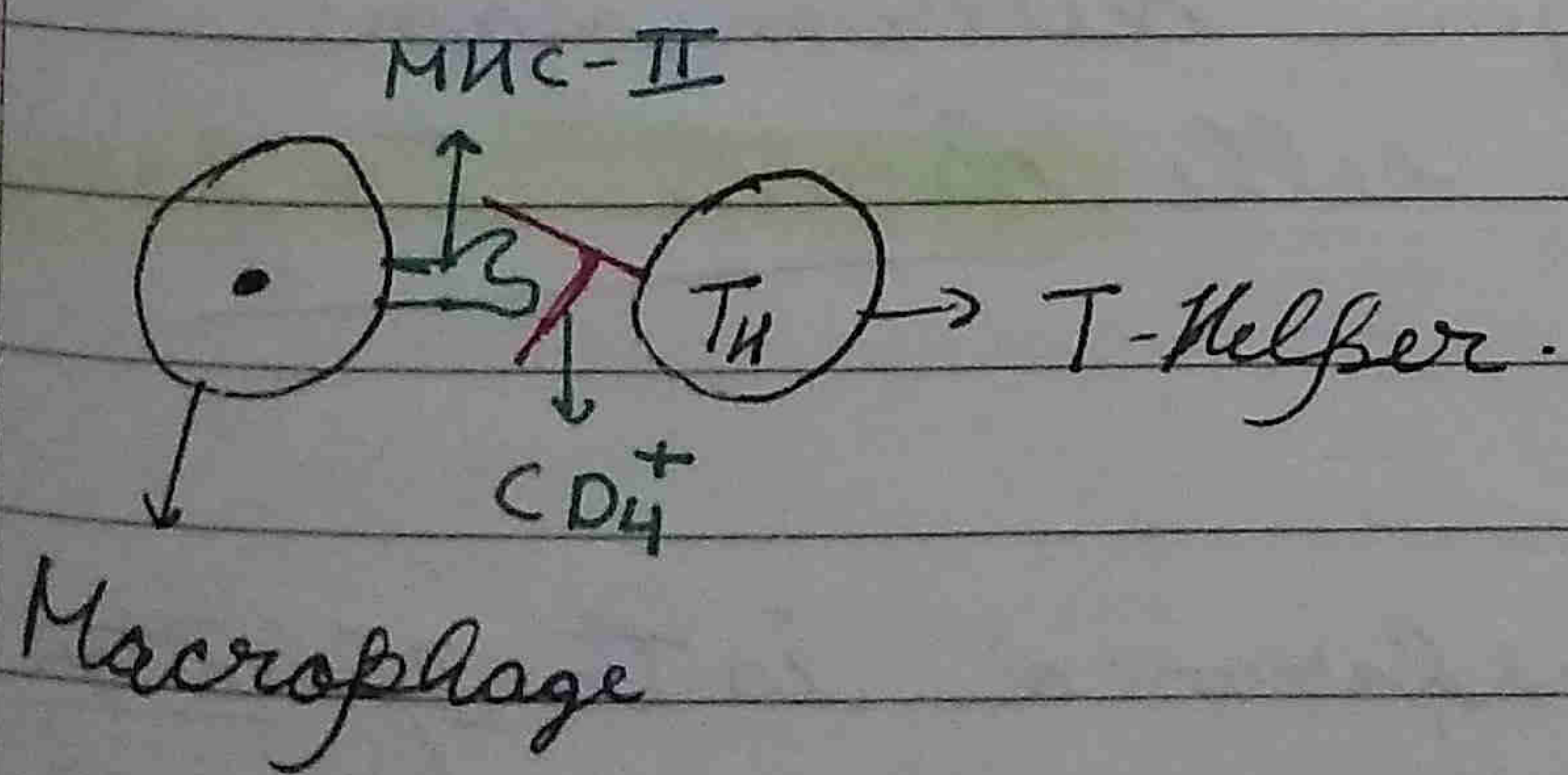
↓  
MHC-I / HLA-I

МКС-II / ИЛА-II

MHC-I : present on every nucleated cell. It interacts with CD8<sup>+</sup> receptor on T-killer cell.



MHC-II : Presentation APCs. It interacts with  $CD_4^+$  of T helper cell.

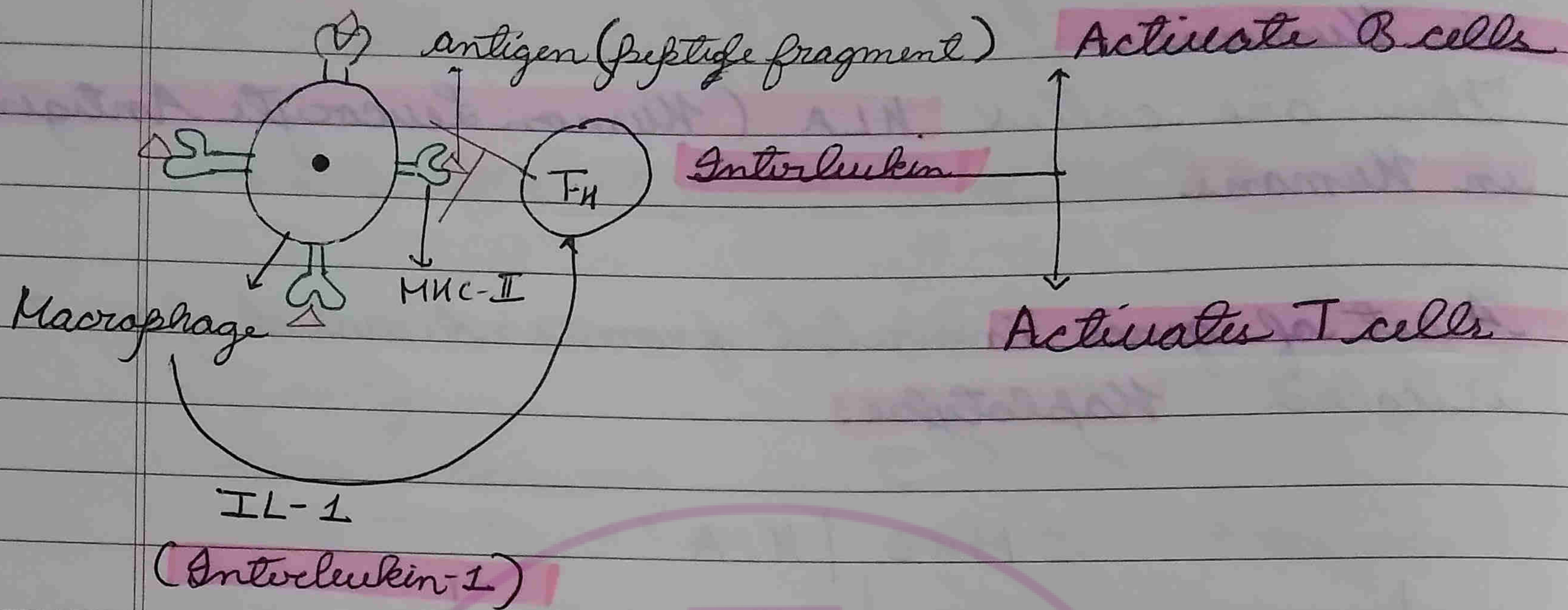


→ B cells

↳ macrophages



## Activation of Acquired Immunity



This function of representing antigen can also be performed by B-cells. They represent it to (peptide fragment) to T-helper cell.

### Clonal selection

- Each B cell and T-cell bear on their surface receptors which receive antigenic determinant specific to it.
- After receiving antigenic determinant specific to it, these cells divide to form a clone of cells.
- These cells are transformed into effector cells i.e., antibody producing plasma cells and cytotoxic T cells and they all have similar specificity for antigenic determinant.



• 1° immune response → Ig M

• 2° immune response → Ig G

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- This is called clonal selection where each T-cell and B-cell is derived from a single parental cell.

- Some cells are transformed into memory cells.

## • Primary and Secondary Immune Response

### Primary immune response

### Secondary immune response.

1 Immune response during first time attack of the antigen

Immune response during second or subsequent attack of same antigen.

2 Primary immune response is feeble or weak.

It is heightened immune response.

3 It takes longer time to establish.

It takes a short time for response.

4 Antibody involved is Ig M.

Antibody involved is Ig G.

Basis of secondary immune is memory of the first encounter



Also called Anamnestic immune response.

## Active and Passive immunity

### Active Immunity

1 When body's own cells start forming antibodies during encounter to the antigen.

2 It is long lasting.

3 There is no side effect of active immunity on body.

4 It provides relief after long period.

### Passive immunity

Antibodies are supplied from outside, prepared in other organisms such as to counter-act the snake venom.

It is <sup>long</sup> (not) lasting.

May cause some reactions in the body.

It provides immediate relief.

## Types of Active Immunity

1 Natural active immunity :  
Due to clinical or subclinical infections.  
e.g. Persons recovering from attack of chicken pox, small pox.



2. Artificial Active immunity :  
Through vaccines, in which the person is deliberately introduced with weakened or attenuated form of antigen/pathogen or any of its product.

### • Types of Passive Immunity

#### 1. Natural Passive immunity

- Antibodies crossing placenta ( $IgG$ ) moving from mother to foetus.
- Presence of  $IgA$  antibody in mother's milk (Colostrum) provided to baby.

#### 2. Artificial Passive immunity - Anti-sera injections Hyper immune sera

Eg : Anti tetanus serum (ATS)  
Anti diphtheric serum (ADS)  
Anti gas-gangrene serum (AGS)  
Serum against snake venom



## Vaccination and Immunisation

**Vaccine** : It is a preparation or solution containing weak / killed attenuated germ or its product (Toxin of bacteria which is neutralised) which has ability to evoke body for antibody formation.

**Vaccination** : Introduction of vaccine into body.

**Immunisation** : The property by which body starts forming antibodies against the antigen introduced.

• Vaccine helps in generating memory B-cells and memory T-cells.

• Father of Immunology is Edward Jenner

He was the first to prepare safe and effective means of active immunity against small pox.

• **Louis Pasteur** prepared vaccine for

- chicken cholera
- anthrax
- rabies.



- Enders prepared vaccine against Measles.
- Discoverer of passive immunisation is Emil von Behring.

### • Koch's Postulates

- Robert Koch discovered bacteria of cholera and tuberculosis.

#### - Postulates :

- (i) The pathogen causing disease should be regularly found in the host.
- (ii) The pathogen should be isolated and grow in pure culture or artificial media.
- (iii) It should cause the same disease when injected into other animal.
- (iv) The pathogen can be easily isolated from the injected animal.

#### Exceptions :

- Viruses
- Mycobacterium leprae
- Treponema pallidum.



## Bacterial Vaccines

### 1 Live Vaccines

BCG

Bacillus of Calmette-Guérin against Tuberculosis

### 2 Killed vaccine

TA B

Typhoid

Paratyphoid A

Paratyphoid B

## Viral Vaccine

1 Live : Yellow fever  
Influenza  
MMR

Sabin Vaccine for Polio. (OPV)

2 Killed : Salk vaccine for polio.

Toxoid : Neutralised toxin of bacteria, etc.

E.g. Tetanus toxoid

Diphtheria toxoid

Bacterial Products : Polysaccharide part of outer coat.

Eg. Pneumococcal vaccine



Recombinax: first commercialised recombinant vaccine.

classmate

Date \_\_\_\_\_

Page \_\_\_\_\_

- Meningococcal vaccine
- Hepatitis B Polypeptide vaccine.

### First generation vaccine

- Prepared through conventional methods using whole microorganism.
- They are not of high purity.

### Second generation vaccine:

- Prepared through recombinant DNA technology.

Eg.: Recombinax HB: Vaccine for Hepatitis B prepared from transgenic yeast.

### Third generation vaccine:

- Synthetic vaccines

- High Purity

E.g.: Diphtheria toxin vaccine.  
Leukemia virus vaccine.

## Immune System Disorders

### 1. Hypersensitivity / Allergy

T<sub>H</sub> E

- Mast cells secrete Histamine and serotonin
- Exaggerated immune response

Allergen: allergy causing agent.



e.g. Pollen, fabric, spores, feather, food item, heat, cold, sunlight etc.

★ Allergy is also called Cytolytic reaction as there is lysis of some cells.

a Hay fever (Allergic rhinitis)

- pollen
- upper respiratory tract affected
- reddening of eyes and running nose.

b Asthma

- Involves lower respiratory tract.
- Fluid accumulation around air tubes causing pressure on it.

c

Mitricaria

- blisters on skin
- due to creams, lotions etc.

d

Eczema

- reddening of skin followed by blisters.

e ★

Anaphylactic shock

Involves nearly all tissues

e.g. Penicillin, Bee sting

Mast cells

- release of histamine
- fall in blood pressure
- Unconsciousness and eventually death.



## Treatment of allergy

- Antihistamine drugs
- Prednisolone
- Steroids
- adrenaline.

## 2 Autoimmune Diseases

When body's own immunity goes against itself.

- Examples -
- Rheumatoid arthritis
  - Myasthenia gravis
  - Multiple sclerosis
  - Chronic anaemia : RBCs
  - Chronic hepatitis : Hepatocytes
  - Insulin dependant Diabetes Mellitus (IDDM) (Type - I Diabetes Mellitus) :  $\beta$  cells

Autoantigen : part of our body which acts as antigen.



# IMMUNE SYSTEM DISORDERS

GRAFT REJECTION -

Recipients' immune cells reject grafts

↓  
T-killer cells

ISO GRAFT -

grafting b/w identical twins

AUTO GRAFT -

grafting on same body (eg skin)

ALLOGRAFT -

grafting b/w members of same species

XENO GRAFT -

b/w different species

IMMUNOSUPPRESSANT DRUGS -

suppress immunity for acceptance of graft

eg ①

CYCLOSPORINE A -

blocks

Helper cells

②

CORTISOL

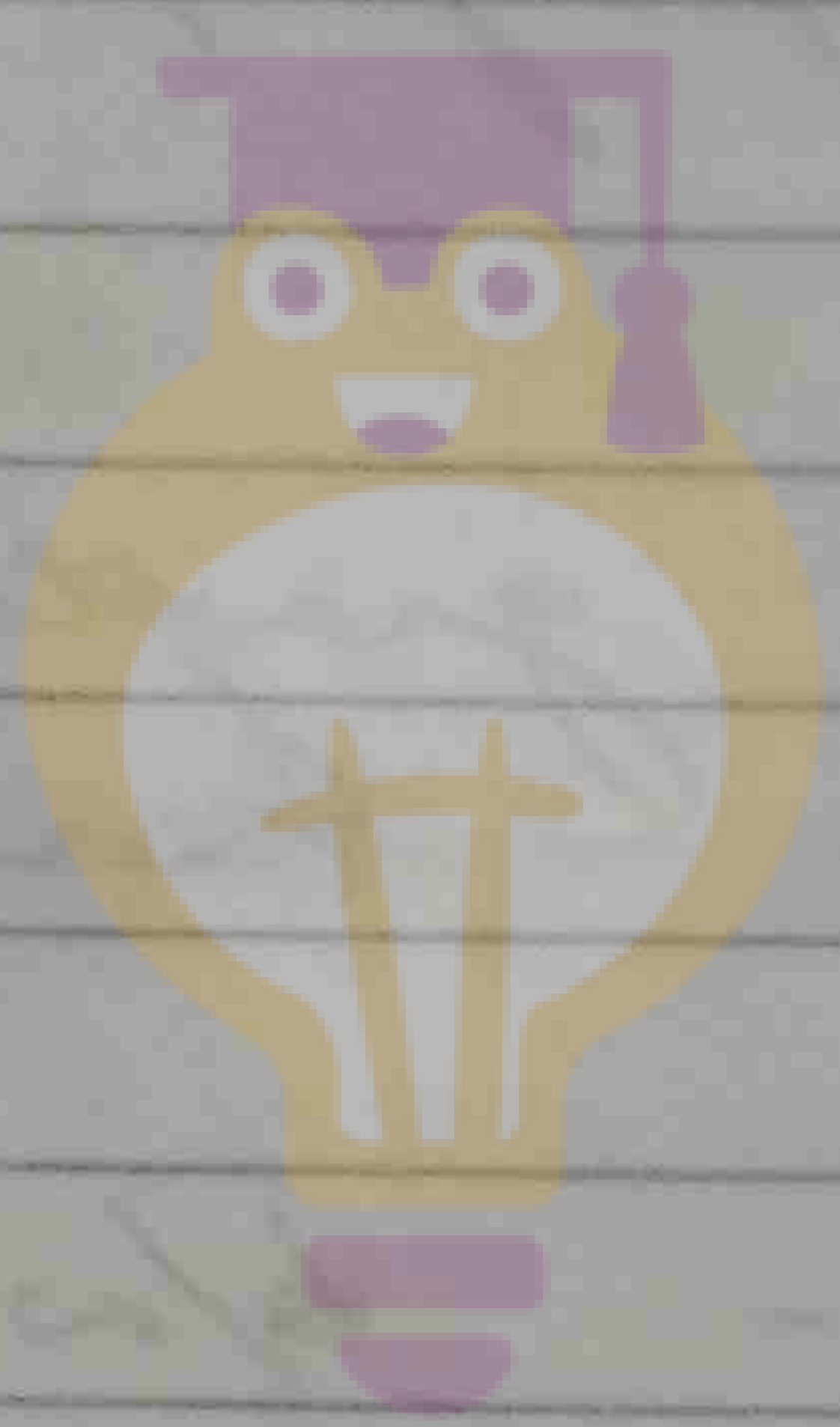
(hormone from adrenal gland)



# IMMUNODEFICIENCIES

SCID (Severe combined immunodef.)

Both B-cells & T-cells are absent



LEARNING  
MANTRAS



## Types of Cancer

**Carcinoma** - Malignant outgrowth of epithelial tissue (ectodermal) lining  
85% in humans

eg Breast Cancer  
Skin Cancer  
Stomach  
Brain  
Lungs etc

**Sarcoma** - Malignant outgrowth of tissue derived from primitive mesoderm  
Rare - only 1%

eg **Myoma** - (muscle cancer)

**Osteoma** - bone cancer

**Lymphoma** - lymphatic tissue

**Leukemia** - Blood cancer  
Malignancy of blood cells  
precursors in bone-marrow  
WBC count increases excessively



MELANOMA - Cancer of melanocytes of skin

GLIOMA - Cancer of glial cells

ADENOMA - Cancer of glands

LIPOMA - Cancer of adipose tissue

Causes of CANCER

ONCOLOGY - study of Cancer

① Transformation of Proto-oncogene into Oncogene (Inactive)

↓

Oncogenic transformation

↓

(Genetic - DNA)

② Tumor Promoters -

Hormones & Growth factors

③ Tumor viruses

V- onc

↓

Viral oncogenes

(1/5<sup>th</sup> of

total cancers)

↓

Viruses



Human T-cell Leukemia Virus (HTLV)

↓  
Leukemia, Lymphomas

Human Papilloma Virus (HPV)  
genital warts.

Cervix cancer  
Vaginal  
Penis

Herpes Simplex Virus II - HSV II

Cancer of Cervix, Uterus etc

Human immunodeficiency Virus (HIV)

↓  
Kaposi's Sarcoma

Epstein Bar Virus (EBV)

↓  
Nasopharyngeal carcinoma  
Burkitt's lymphoma

Hodgkin's disease (lymphoma)



(f) Hepatitis B Virus HBV  
↓  
Liver Cancer

## Carcinogens

### ① Physical irritants

a) Kargi - T & K (constant Δ)  
↓  
abdominal skin cancer

b) Betel & Tobacco chewing -  
Oral cancer

c) Heavy smoking - Lung Cancer

d) Jagged teeth - Tongue Cancer  
(sharp)

### ② Chemical irritants

a - Soot - Lungs, Skin cancer

b - Coal tar - Lungs, skin  
(3, 4 benzopyrene)



- (c) - Cigarette smoke - Lungs  
(N-nitrosodimethylamine)
- (d) - Mustard gas - Lungs
- (e) - Cadmium Oxide - Prostate
- (f) - Aflatoxin - Liver
- (g) - Vinyl chloride - Liver
- (h) - Nickel & Chromium compounds - Lungs
- (i) - Diethylstilbestrol → vaginal cancer.  
- Charney sweeper - scrotum cancer
- Dye workers - bladder
- Artificial sweetener
- Animal Protein

Radiations (ionising - X,  $\gamma$   
non-ionising - UV)



# AIDS

## SLIM DISEASE

disorder of cell mediated immune system

T-helper cells count reduces

(stimulate B-lymphocytes for production of antibodies)

1st case - in USA (June 1981)

- CDC (centre for disease control & prevention)

rare case of pneumonia caused by fungus

*Pneumocystis carinii* (pneumonia)

2nd / New York - Kaposi's sarcoma

also reported



Pathogen -

HIV

(disc. by Luc MONTAGNIER

France

&  
ROBERT GALLO USA

named HTLV III

Human Cell Leukemia Virus III

named HIV by International  
Committee on Viral nomenclature  
1986

Form (a)

HIV - I (more common)

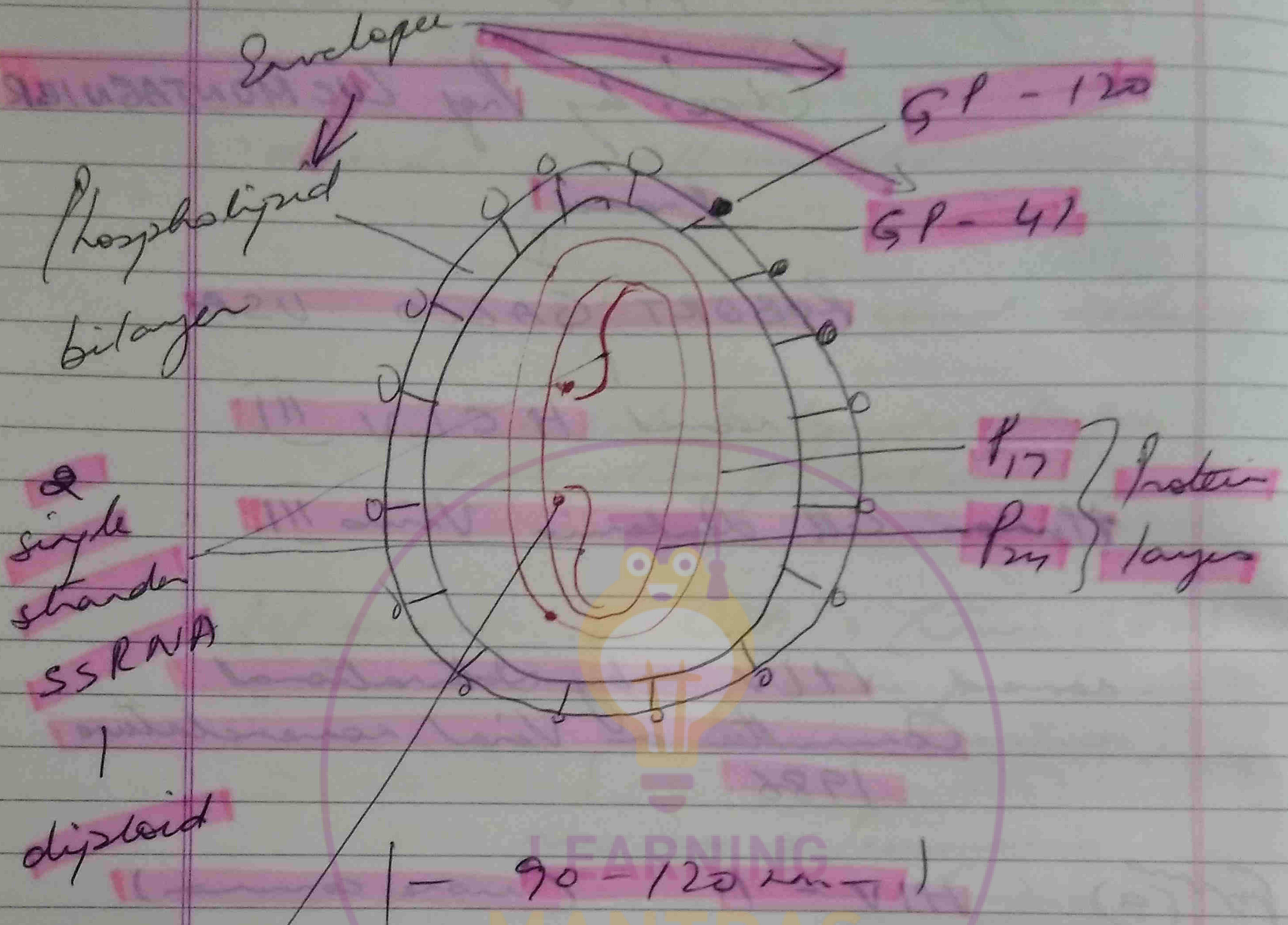
America, Europe, India

(b) HIV - II - found in Africa

First AIDS case in India - 1986



# Structure of HIV



Reverse Transcriptase  
enzyme

(RNA  $\rightarrow$  DNA)



Mode of action of AIDS virus  
- Virus enters / into cell by a process called  
Receptor mediated endocytosis (entry)  
interacts with  
GP-120  $\uparrow$  CD<sub>4</sub><sup>+</sup> receptors (interacts)  
CCR-5 (coreceptors)

Macrophages - factory of HIV

Virus enters cell

RNA enters

(Reverse transcription)

DNA

Genome

Forms viral RNA, viral proteins

virions (progeny viruses)

released from cell



Infected cell may not die - produces more virus

- HIV attacks T-Helper cells



number decreases



killed



Body prone to infection

→ Symptoms -

- ARC (AIDS related complex)

— mild form of AIDS (prodromal AIDS)



Night sweats

Lymphadenopathy (swollen lymph nodes)



## Full Blown AIDS

T-helper cells counts  $< 200/\text{mm}^3$

Opportunistic infections, occur

— PCP — Pneumocystis  
Carinii pneumonia

- Kaposi's Sarcoma
- Tuberculosis
- Toxoplasma infection
- Leukoencephalitis (white patches on  
uncus membrane) (fungal)
- Cytomegalovirus (blindness, dementia)

HIV +ve



ARC



AIDS



Death

• Sequences of AIDS infected  
person



# Incubation Period

~~from~~ few months  $\rightarrow$  5-10 yrs

## Transmission -

- 1) Blood
- 2) Needle sharing etc
- 3) Sexual contact with infected persons
- 4) Transplacental transmission -  
(mother - child)  
    \ through placenta  
    \ through milk)

## Diagnosis

- (a) ELISA - Enzyme Linked  
Immunosorbent Assay
- (b) Confirmatory test of AIDS -  
Western Blot  
    |  
    (study antibodies in body)



Treatment -  
(base analogs which  
Inhibit RNA  $\rightarrow$  DNA)

(a) AZT (azidothymidine or  
zidovudine)

(b) DDI (dideoxy inosine)

(c) ddC (dideoxy cytidine)

(d) ddT as Stavudine

★ Zidovudine & Nevirapine  $\rightarrow$   
pregnant women  $\rightarrow$  prevent infection  
of fetus

PREVENTION OF AIDS

NACO - national aids control organisation

NGOs

NARIT - national aids research  
institute

World AIDS day - 1st December



# Drugs & Alcohol abuse

- ① Sedative Hypnotics
- ② Opioids / Opiates narcotics
- ③ Stimulants
- ④ Hallucinogens - Cannabinoids

① Sedative (reduces excitement)  
Hypnotics (induces sleep)

CNS depresses (anti anxiety)

TRANQUILISERS

eg - Barbiturates

Benzodiazepines

(Valium, Diazepam)

Derivates of Barbituric acid  
(Malonic acid + Urea)



## ② Opioids / Opiate narcotics

Opium - dry latex of unripe capsules/prints of Poppy  
(Papaver Somniferum)

## ③ Receptors of opioids - CNS - GI tract

- Slow down respiration
- Constrict pupil
- Suppress brain function
- Relieve mental / phy. pain  
(analgesics)

## ④ Opiate narcotics

Natural

Semisynthetic

Synthetic

Morphine  
Codeine

Heroin

Pethidine

Methadone



① Morphine - analgesic  
post-operative surgery  
main alkaloid

② Codeine - mild analgesic  
cough syrup

③ Heroin - Diacetyl morphine  
or  
Diamorphine

- acetylation of morphine
- most addictive
- Snack/Brown sugar
- 3 times more potent than morphine
- Inhaled
- Injected
- Smoked



(4) Pethidine

Chemically unrelated to morphine

Similar effects

safer in asthmatics as less histamine released

(5) Methadone

chem. unrelated to morphine  
similar effects

★

STIMULANTS - nervous system  
- increases alertness  
- wakefulness

Clinical use -

- ① attention
- ② Narcolepsy
- ③ Weight control

eg -

- ① Caffeine
- ② Cocaine
- ③ Amphetamine



① Caffeine

1,3,7 trimethyl xanthine

(leaves of tea - Thea sinensis  
Thea chinensis)

(seeds of coffee - Coffea arabica)

(seeds of cocoa - Theobroma  
cacao)

Increases respiratory & cardiac activity  
disturbs renal function  
diuretic  
indigestion  
loss of appetite

② Cocaine - Coca alkaloid

Coke / Crack

Leaves of Coca plant - (Erythroxylum  
coca)

S. America

(Sniffed)



interferes in the transport of neurotransmitter - **DOPAMINE**

High dose - hallucinations



Atropa Belladonna } plants  
Datura

③ Amphetamines - synthetic analog of **ADRENALINE**

PEP PILLS

antislip drugs

SPEED UPPEERS

increases confidence

increases talkativeness

work capacity

Abused by Sports persons

Dope test - appear in Urine  
(slowly metabolised in body)

④ **HALLUCINOGENS** - alter feeling's  
thoughts  
perceptions  
(person can see sound  
hear colours)



g - LSD - Lysergic acid Diethylamide

obt. from fruits of CLAVICEPS PURPUREA  
(ergot fungus)

damages CNS

damages foetus

(ii) Mescaline - <sup>obtained from</sup> (Peayote cactus)  
<sub>scientific name</sub>  
Lophophora williamsii

(iii) Psilocybin (Psilocybe  
mexicana)

Mexican mushroom

(iv) PCP (Phencyclidine)

Veterinary use - used to immobilise  
large animals



✓) Cannabinoids - CANNABIS SATIVA

The active ingredient is  $\Delta$  THC - Tetrahydrocannabinol

- receptors in brain
- cause dilation of Pupil
- uncontrolled laughter

Ganja

Hashish

Flower tops, leaves, resin used in various combination drugs -

eg Bhang, Chanaas, Ganja, Hashish

obtained from:  
Ganja - unfertilised dried ♀ inflorescence



# adolescents ALCOHOL ABUSE

## Problems

- ① Acne - (sex hormones)
- ② HYPERCHONDRIA - undue concern of health

## Addiction & dependence

### Alcohol Abuse

- ① Fatty liver

hepatocytes get filled with large fat globules - nucleus shifts towards one side

- ② Alcoholic Hepatitis

Hepatocytes degenerated &

surrounded by PMNL

(Polymorphonuclear leucocytes)



(c) **Alcoholic Cirrhosis**  
Hepatocytes / Fibroblasts degenerate  
Deposition of collagen protein

(d) **Cholestasis** - cessation of bile formation

(i) **Effect on Cerebellum**  
loss of muscular coordination

(ii) inflammation of neurons (**NEURITIS**)

(iii) deficiency of Vit B<sub>1</sub> (**Thiamine**)  
↓

**Wernicke's - Korsakoff Syndrome**

(iv) Gastritis -  
Oesophagitis  
Peptic Ulcer

A logarithmic tear appears at G-I junction - during vomiting

**MALLORY WEIS SYNDROME**



(v) No of RBC, WBC, Platelets decrease

Size of RBC increases

(vi) Immunity decrease

(vii) Decrease Vasopressin (ADH)  
dilute urine  $\rightarrow$  dehydration

(viii) FAS fetal alcohol syndrome

facially abnormal

defects in atria & ventricle

poorly developed concha

(ix) Alcoholic myopathy

swollen muscles

Increase in serum

Creatinine Phosphokinase

(x) Small amounts of alcohol daily



High Density Lipoprotein -  
good cholesterol



HDL - Good cholesterol

decrease LDL precipitation  
Bad cholesterol

← Absorption of alcohol -  
↓

mucous membrane of mouth

Stomach

SI (majorly absorbed)

LI (moderately absorbed)

Alcohol (Ethanol)

↓  
Acetaldehyde in liver

↓

⇒ Tobacco addiction

Leaves of ① Nicotiana glauca

② Nicotiana glauca



Major alkaloid - Nicotine

stimulates adrenal gland  
to release adrenaline,  
noradrenaline

Smoking - Lung cancer  
Emphysema

Bronchitis

Urinary bladder cancer

Gastric / duodenal ulcer

Tobacco chewing - Oral cancer



Use of anabolic steroids

On Males

- 1 aggression
- 2 mood swing
- 3 depression

decrease of size of testicles  
low sperm production  
potential kidney/liver damage  
enlargement of prostate gland

On Females - same 1, 2, 3

abnormal menstrual cycle  
enlargement of clitoris  
masculinisation  
body hairs increase

Prevention & Control