Ch-7

Human Health and Diseases.

* Health for long time.

- Health for a long time was considered as a state of body and mind where there was balance of certain "Humors"
  => Humours means "fluids"

- This is what early greeks like Hippocrates as well as Indian ayurveda system of medicine asserted.

- The discovery of blood circulation by William Harvey.

- William Harvey theory disapproved "Good Humor" hypothesis of health.

* Health

=> Health is a state of complete physical, mental & social well being.

* Essentials for Good Health.

1) Balance diet
2) Personal hygiene
3) Yoga for physical health and mental health
4) Awareness about diseases
5) Proper disposal of waste
6) Control of vectors
7) Maintainance of food and water resources
8) Vaccination.

* Health is affected By :

1) Genetic disorders : Deficiencies with which a child is born and deficiencies / defects which the child inherits from parents from birth

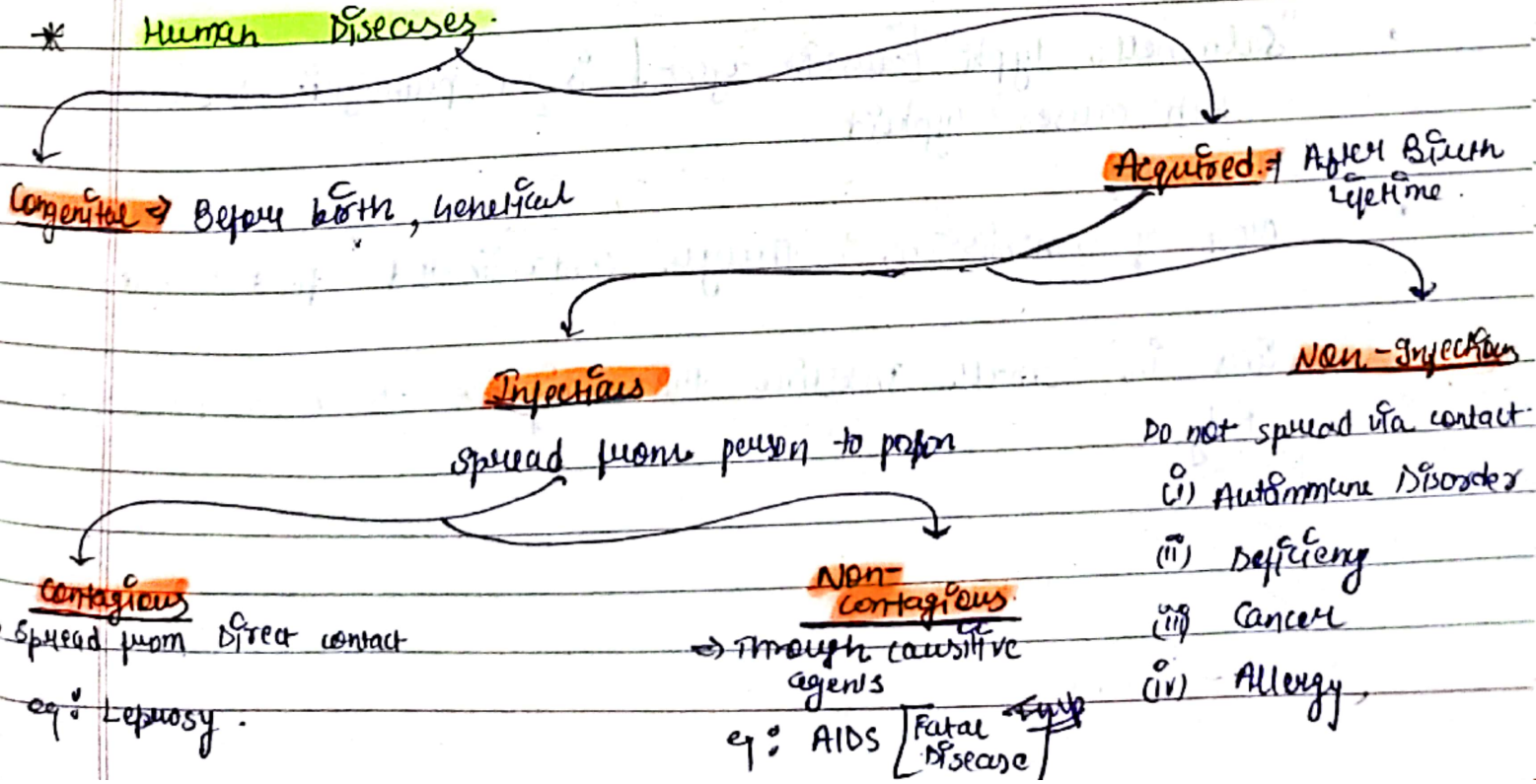
2) Infections

3) Lifestyle including food & water we take, rest and exercise we give to our bodies, habits that we have or lack etc.

* Diseases.

- Disease ⇒ Any deformity in physical & mental well being.
- Pathology ⇒ Study of Diseases.
- Pathogen ⇒ Disease causing organisms are pathogens.
- Incubation period ⇒ Time interval between infection and appearance of first symptom.

* Human Diseases.



* Infectious disease can spread through : mode of transmission.

mode of transmission	Bacterial Disease	Viral Disease	Protozoan Disease	Helminthic Disease.
1. Air [droplet/aerosol] or object borne [pens, knobs etc].	Pneumonia, Diphtheria	Common cold small pox	—	—
2. Direct Contacts	Tetanus	small pox	—	—
3. Contaminated Food & water	Typhoid, Dysentery	polio	Amoebiasis	Ascariasis
4. Insect vector / vector borne	Plague	chikungunya, Dengue	Malaria	Filariasis.
5. Body fluids	Syphilis	AIDS	Trichomoniasis	

Bacterial Disease.

1) Typhoid
2) Pneumonia.

* Typhoid

- "Salmonella typhi" [causative agent] is a pathogenic bacterium which causes typhoid
- Mode of Transmission : Through contaminated food & water.
- Lives in small intestine then migrate to other parts of the body.

- Symptoms : ⇒ Fever [39-40°C] ⇒ Headache
  ⇒ Constipation ⇒ Loss of appetite ⇒ Nausea
  ⇒ Weakness.

- In severe case : Intestinal perforation [holes] and death may occur.

- Prevention : ⇒ Vaccination ⇒ Personal hygine
  ⇒ Proper sanitation.

- Diagnosis : Widal Test • Treatment : Antibiotics.

- Mary Mallon [Also k/a Typhoid Mary]
  ⇒ Professional cook and typhoid carrier
  ⇒ spread disease from the food she prepared for several years.

* **Pneumonia**.

- "Streptococcus Pneumoniae" and "Haemophilus Influenzae" bacteria are responsible for Pneumonia.

- mode of Transmission : Through air droplets / aerosols released by infectious person

- Location affected : Alveoli of lungs are filled with fluid causing difficulty in Breathing

- Symptoms : ⇒ Fever ⇒ Chills ⇒ Difficulty in Breathing
  ⇒ nausea ⇒ cough.

- severe case : The lips & finger nails may turn gray to bluish in colour.
- Prevention : vaccination.
- Treatment : Antibiotics.

Viral Diseases.

* **Common cold.**

- "Rhino viruses" cause one of the most- infectious human ailments → common cold
- Organ affected : Nose, Respiratory passage
- Symptoms : ⇒ nasal congestion and discharge ⇒ sore throat ⇒ hoarseness ⇒ cough ⇒ Headache ⇒ Tiredness etc.
- Mode of transmission : Droplets resulting from cough or sneezes of an infected person, through contaminated objects [pen etc].

Protozoan Diseases.

① Malaria

② Amoebiasis.

* Malaria.

- Causative agent : There are 61 species of Plasmodium but only 4 species cause malaria.

=) Plasmodium - Vivax
=) Plasmodium - Falciparum [most dangerous]
=) Plasmodium - malariae
=) Plasmodium - ovale

- Vectore : female Anopheles mosquito

- Host of Plasmodium : (i) Primary host → Anopheles mosquito [sexual cycle]
(ii) secondary host → Humans [Asexual cycle]

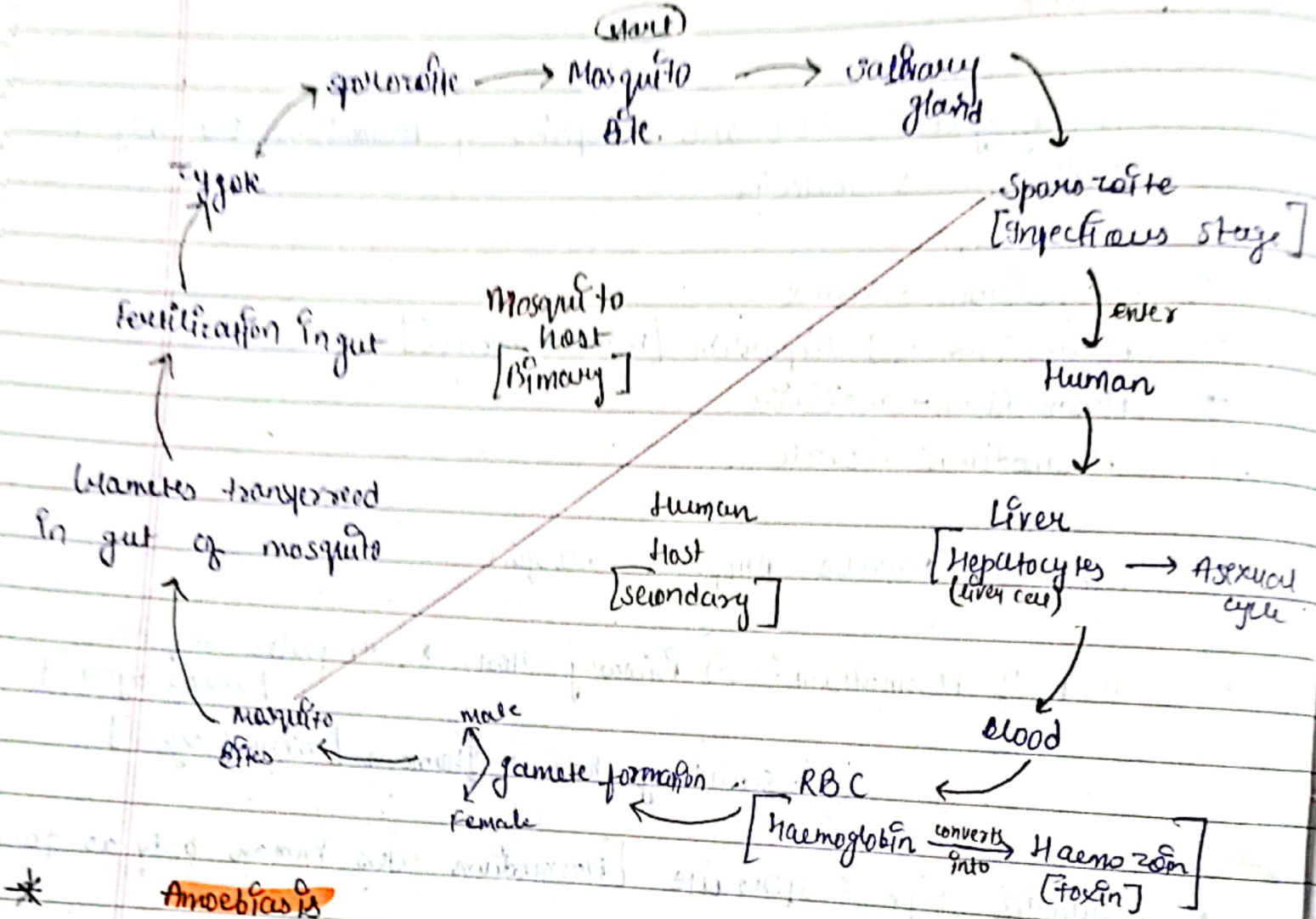
- Infective stage : sporozoite [Plasmodium enters human body as sporozoite]

- Symptoms : Chilli fever → High fever → Profuse sweating → Normal temp.

- Prevention : mosquito Repellant
Gambusia fish [eats mosquito larva]

- Treatments : Quinones [bark of anchora tree]
Chloroquine, primaquine.

life cycle of Plasmodium



* **Amoebiasis**

- Entamoeba histolytica is a protozoan parasite in the large intestine of human which causes Amoebiasis / amoebic dysentery.
- mode of transmission: Contaminated food & water [Housefly act as a carrier]
- location: Large intestine.
- symptoms: ⇒ Fever ⇒ Abdominal pain
  ⇒ Bloody diarrhoea ⇒ Cramps.

Helminthic Diseases.

① Ascariasis ② Filariasis / Elephantiasis

* Ascariasis:

- Pathogen → Ascaris lubricodin [Round worm] causes ascariasis
- Mode of Transmission: contaminated food & water etc.
- Location: Intestine
- Normally present in excreta that pollutes / affects soil, water, f
- Symptoms: ⇒ Fever ⇒ Cramps ⇒ Nausea & Vomiting ⇒ Internal Bleeding ⇒ Intestinal blockage

* Filariasis:

- Also kla as Elephantiasis.
- Wuchereria [W. bancrofti and W. malayi], the filarial worms are causative agents.
- Mode of Transmission / vector: Culex mosquito
- Culex mosquito bites, then chronic inflammation is done in lymph nodes & genital areas resulting in gross deformities
- Organ affected: Lymphatic vessels.

Fungal Diseases.

* Ring worm.

- Trichophyton, Epidermophyton (genera) & microsporum (not next) are responsible for ring worm.
- It is most common infection in humans.
- Symptom : Itching, discomfort.
- Mode of transmission: objects [cloths, comb etc.], towel of infected person; moist areas [soil, wet clothes etc.]
- Appearance : Dry, scaly lesion normally seen on skin, nails scalp etc.

* Prevention of Infectious Disease.

Parameters	Measures.
Personal hygiene	• Keeping the body clean • Consumption of clean drinking water, food veggies, fruits etc.
Public hygiene	• Proper disposal of waste & excreta • Periodic cleaning & disinfection of H_2O reservoirs, pools, tanks • Decontamination of drinking water
Avoid close contact	• Contact with infected persons & belongings should be avoided.
Control vectors & their breeding places	• Avoid stagnation of water in & around residential areas.

- Regular cleaning of house old coolers
- Use of mosquito nets
- Introducing larvifidal fishes like Gambusia in ponds that feed on mosquito larvae
- Spraying of insecticides in ditches, drainage areas
- Door & windows should be provided with wire mesh.

* **Immunity.**

- Even if there are various pathogens around us we do not fall ill everyday because we have a defense system called immune system.

- Overall ability of a host to fight against disease-causing organisms, given by the immune system is kla "Immunity"

⇒ **Unique property of immune system:**

1) Recognise foreign antigen
2) Response to them
3) Remembers them

⇒ **Immunity play important role in:**

1) Allergy
2) Auto immune disorder
3) Organ transplantation.

Immunity

Innate Immunity

- Inborne : present since birth
- Non specific : It does not discrimate b/w foreign bodies
- No memory present

Acquired immunity

Adaptive : with experience / lifestyle
specific : It discriminate b/w foreign bodies & pathogens
memory : It has memory of previous encounter

Innate immunity

- It is situated under some barriers :

1) Physical barrier
2) Physiological barrier
3) Cellular barrier
4) Cytokine barrier

1st line of defence
2nd line of defence

Physical barrier

- Skin on our body is the main barrier which prevents entry of the micro-organisms
- mucus coating of the epithelium lining the respiratory, urogenital, gastrointestinal also helps in trapping microbes

Physiological barriers

- Acid in stomach, saliva in mouth, tears from eyes all prevents microbial growth.
- Acidic environment.

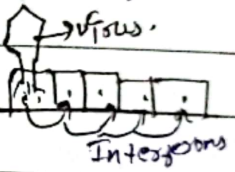
Cellular barrier.

- Certain types of leukocytes [WBC] of our body like polymorpho-nuclear leukocytes, neutrophils, monocytes & natural killer in the blood as well as macrophages in tissues can phagocytose & destroy microbes.

- Natural killer cell: non-phagocytic in nature, create pores in cancer cells, swell & burst.

Cytokine barrier.

- Virus-infected cells secrete proteins called interferons which protect non-infected cells from further viral infections.



Acquired Immunity.

↳ 3rd line of defense.

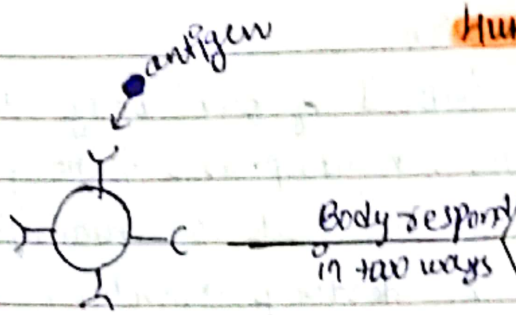
Humoral Immunity

⇒ B-lymphocytes

Cell-mediated Immunity

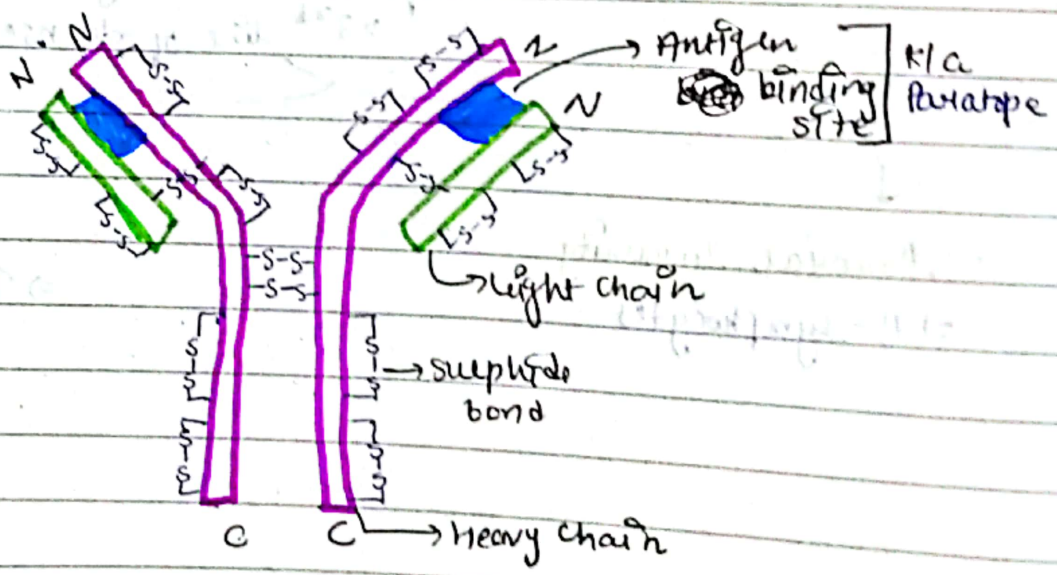
⇒ T-lymphocytes mediate cell-mediate Immunity

Humoral Immunity.



- Antigen : Foreign body / pathogen.
- Antibody : Proteinaceous → protect against diseases.

Structure of an antibody molecule.



=) Total disulphide bond is 16
=) Heavy chain is joined with 2 disulphide ..
=) Heavy & light chain is joined with one disulphide bond

* Important points about antibody structure.

- Each heavy chain is 50 kDa (Kilo Dalton) molecular weight
- Each light chain is 25 kDa molecular weight

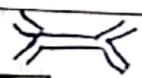
- Paratope : Formed between one heavy chain & one light chain
  - ⇒ Present towards N terminal
  - ⇒ Antigen binding site on Antibody.

- 2 Disulphide bond b/w 2 heavy chains
- 1 disulphide bond each b/w heavy & light chain
- 16 Disulphide bonds overall

Types of Immunoglobin (antibody) [TAKE MAMED]

* IgG
≈ 90%.
- Maxm in body
- ⇒ Small size
- ⇒ That's why passes from mother to foetus via placenta
- ⇒ It is a Monomer

* IgA
~ 10-15 %.
- ⇒ From breast milk [colostrum]
- ⇒ It is a Dimer.



IgM
~ 5-10%.
- ⇒ Pentamer

* IgE
~ Less than 1%
- ⇒ Released during allergy
- ⇒ ~~Dimer~~ Monomer

IgD
~ Less than 1%.
- ⇒ ~~Monomer~~ Dimer

Cell Mediated Immunity

- Formed due to T-lymphocytes.

- 4 types of T-lymphocytes

1) **T helper cell:** It releases certain chemicals that help in differentiation & also helps T killer cells for their activity.

2) **T-killer cell:** Directly kills the pathogen

3) **T-supressor:** Regulates the activity of T helper & T killer cells so that they don't overactivate & attack own body cells

4) **memory T cell:** T helper & T killer cells upon encounter with antigen forms memory T cell which is stored for future.

Acquired immunity

Give response in two types

Primary immune Response

- 1st encounter with a specific pathogen
- Slow response
- Low intensity.

Secondary immune Response / Anamnestic Response

- Subsequent encounter with same pathogen
- Faster response due to memory of 1st encounter
- Highly intensified

* Graft Rejection.

=) Graft = Organ Transplantation.

=) Tissue matching and blood matching are essentials before undertaking any graft / Transplant.

=) In case of graft rejection, they have to take "immuno-suppressants" all his / her life.

=) The body is able to differentiate b/w 'self' & 'non-self' & the "cell-mediated immune responsible for graft rejection".

* Active and Passive immunity.

Active	Passive
• When body is exposed to antigens, the body actively start making antibody	• When ready made or pre formed antibodies are given
• It is slow & takes time	• It is fast
• It has long lasting memory	• No memory short lived.
	eg: • IgA is present in colostrum
	• Foetus also receives some antibodies through the placenta during pregnancy.

Active

Natural A-I

=) Body will form antibodies and attack antigen

Artificial A-I

=) vaccination.
↓
Weak Antigen is injected
↓
forms antibodies prior

Passive

Nature P-I

=) Immunoglobulins [IgG, IgA, IgE etc] already present

Artificial P-I

=) Anti-toxin
↓
Preformed Antibody.
eg: Anti-venom, Anti-Tetanus - etc.

* Vaccination and Immunization.

- Vaccination results in, immunization.
- Vaccination is introduction of weak/dead pathogens or dead pathogens.
- Toxic proteins are released by pathogen, Antigens [proteins] expressed on their surface or DNA of pathogen etc in such a way that it does not cause diseases but activates immune system to generate memory cell [B & T cell]

Edward Jenner introduces 1st vaccine against "small pox"

Q Principle of vaccination is based on the property of "memory" of the immune system. Taking one suitable example, justify the statement.

Ans The principle of vaccination is based on the property of 'memory' of the immune system. In vaccination, a preparation of antigenic protein of the pathogen or weakened pathogen is introduced in the body. The antibodies produced in the body against these pathogens will neutralize the pathogenic agents during actual injection. The vaccine also generates memory B-cells & T-cells that recognize the pathogen quickly on subsequent exposure.
For eg; vaccination against polio prevents the actual pathogen from resulting in infections

* **Allergy**

- The exaggerated immune response of the body towards certain substance called Allergens.

⇒ Allergens: Allergy causing agents like pollen, dust, animal dander, mites, some vegetable etc.

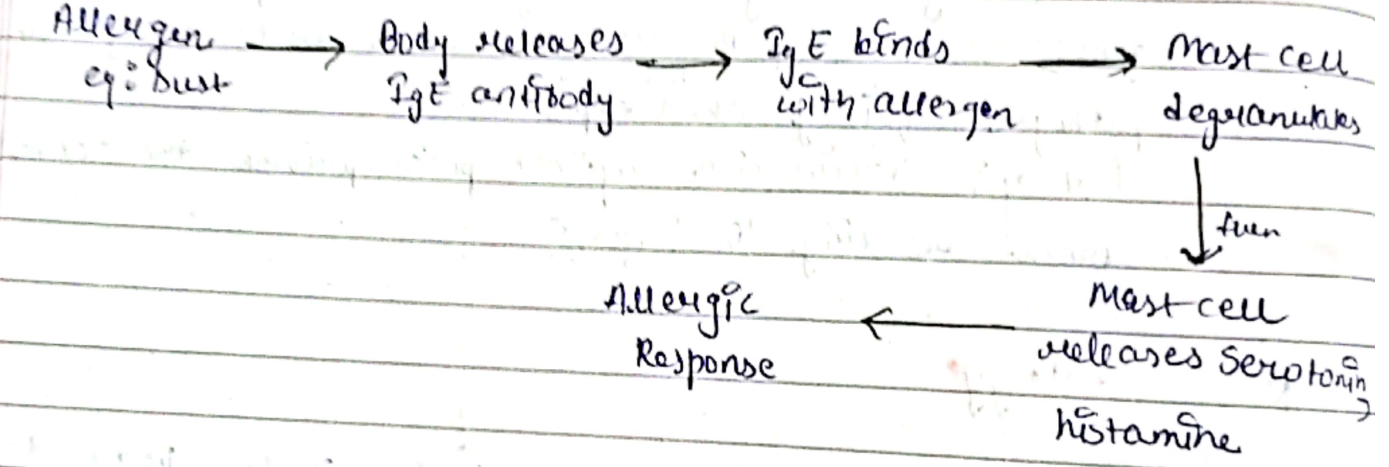
- Symptoms:

- Runny nose
- Itching
- Redness
- watery eyes, red eyed
- Sneezing
- Rashes.

- Eg: → Hay fever → Allergy to pollen grain.
  → Asthma → Allergic difficulty in breathing.

- Treatments:
→ Use of drugs like anti-histamine, adrenaline, steroids quickly reduce the symptoms of allergy.

Fig: **what happens during Allergy?**



* **Autoimmunity.**

- High vertebrates can discriminate b/w self & non-self, they have ability to differentiate b/w foreign organisms.
- when body loses the power of the discrimination & our immune cells start attacking the own cells. This results in damage to the body & is called auto-immune
- eg: Myasthenia gravis, vitiligo, Rheumatoid arthritis

Immune system in the body.

The human immune system consists of lymphoid organs, tissues, cells & soluble molecules like antibodies.

Lymphoid organs

Primary L.O

Those where production, maturation of lymphocytes occur.

Lymphocytes become antigen-sensitive here

eg: Thymus, Bone marrow.

Thymus

Present in chest region

Provides Immunity

Proliferation of T-lymphocytes

With age size of Thymus gland decreases.

Bone marrow

Help in formation of B-lymphocytes & T-lymphocytes.

Secondary L.O

- These are the sites where encounter of lymphocytes occur with Antigen, memory, & effector cells are formed.
- eg: Spleen, lymph nodes, Tonsils, Peyers patches, Appen

Spleen: =) Reservoir of RBC
↳ Bean shaped organ

Lymph nodes: =) Trap the antigens
=). Responsible for the activation of lymphocytes present there & cause the immune response.

- Mucosa Associated Lymphoid tissues [MALT]

- Located within the lining of the major tracts [respiratory, digestive & urinogenital tracts], called MALT.
- It constitutes about 50% of the lymphoid tissue in human body.
- It consists, Appendix

* AIDS [Acquired Immuno deficiency syndrome] → Group of symptoms

- It is a viral disease.
- Acquired during lifetime makes immune system deficient
- It is a Non-congenital disease
- AIDS is caused by the Human Immuno deficiency virus [HIV]
- HIV is a Retro virus [as it has RNA as genetic material and has Reverse transcription].
- Spread through (a) sexual contact with infected person
  (b) by sharing infected needles as in the case of intravenous drug abuses
  (c) by transfusion of contaminated blood & blood products
  (d) from infected mother to her child through placenta
- DO not spread via touch or physical contact
- 1st case reported in 1981 in USA.
- AIDS DAY is celebrated on 1st December.

* MODE of Transmission.

1) From infected mother to foetus
2) using infected needles [drug abuse] / syringe
3) Infected blood transfusion
4) Unprotected sexual intercourse with infected person

* People at High Risk.

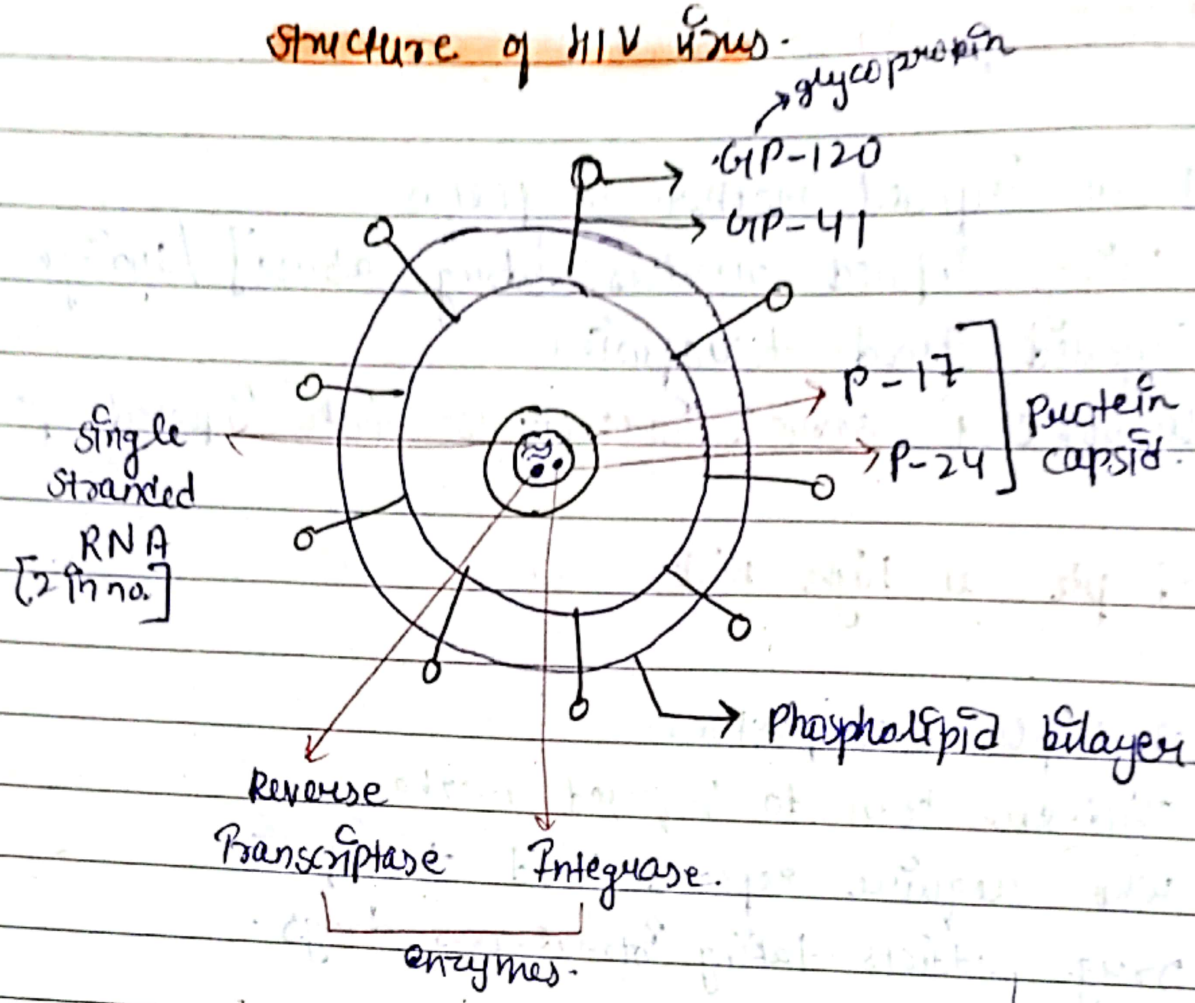
1) multiple sex partners.
2) Children born to infected mother
3) who require repeated blood transfusion
4) Drug addicts taking intravenous drugs.

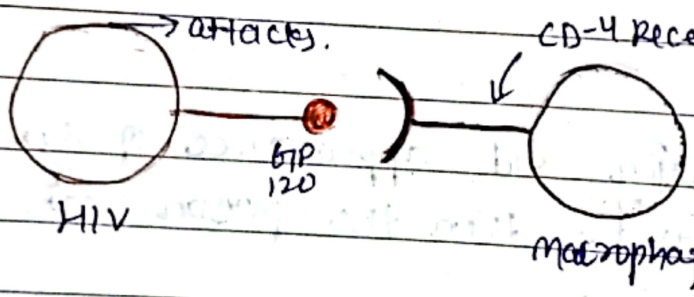
* Symptoms.

- Time lag b/w infection and appearance of symptoms [month, 5-10 years], then the person can be asymptomatic for long.

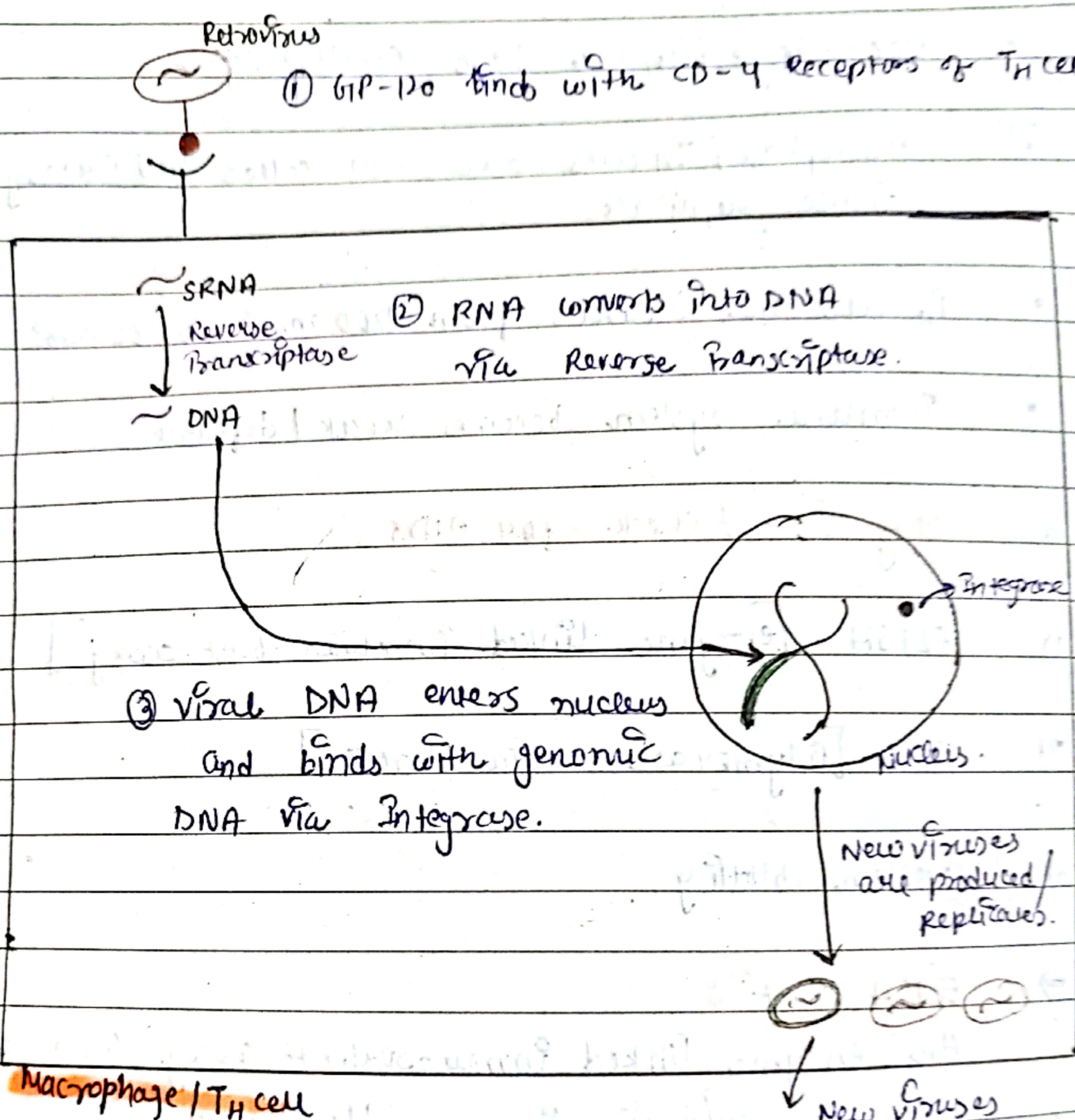
=) Diarrohea.
=) Fever
=) Swollen lymph nodes
=) Flu like symptoms.

Structure of HIV virus.





Replication of Retrovirus.



* Note :

- Macrophage / T_H cell have CD-4 Receptors

Imp

- Macrophage / T_H cells are also called HIV factory because virus replicates

- T_H cell no. reduces from 1200 mm^3 → 200 mm^3 during AI

- Immune system becomes weak / deficien-

* Diagnosis / check for AIDS

1) ELISA [enzyme linked immunosorbent assay]

2) PCR - [Polymerase chain reaction]

3) western blotting

⇒ ELISA Test :

- An enzyme linked immunosorbent assay is a blood test that measures antibodies in your bloodstream

- Also kla EIA test [Antigen antibody test].

* Treatment :

- AIDS can only be prevented not cured

- Use of anti-retro viral drugs in only partially effective can only increase longevity but can't cure.

Prevention from AIDS.

Several NGO's [non-government organisations] and government organisations like NACO [National AIDS control organisation] is working towards educating people about AIDS.

WHO [World health organization] has been doing work to prevent AIDS:

Free distribution of condoms
use of disposable syringes & needles in clinics
making safe blood bank
control drug abuse.

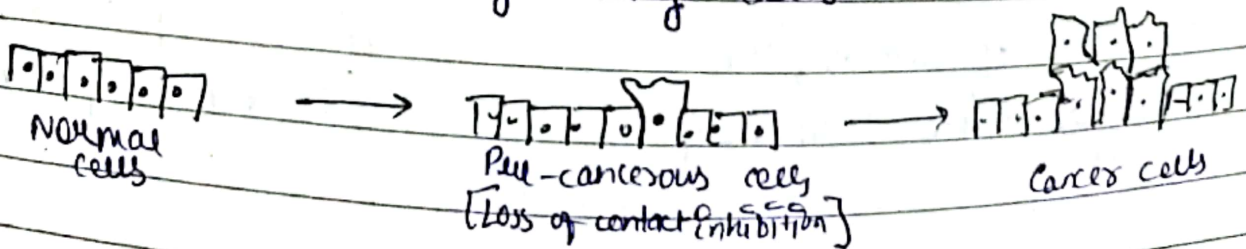
Cancer.

Cancer is one of the most dangerous disease [non-communicable] causing millions of death across the world.

Properties of cancerous cell.

They show uncontrolled, unregulated cell division & differentiation forming Tumors or NEOPLASM

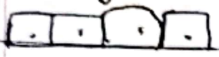
Do not show "CONTACT INHIBITION" they do not stop dividing upon contact with neighbouring cells.



- Compete with normal cell for nutrients as the cancer cells attract New Blood vessel where ever they go and make normal cell deprived of nutrition.

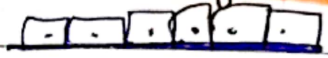
⇒ **Tumor**

Benign



⇒ It will not spread
⇒ Non-cancerous

Malignant



⇒ It will spread
⇒ Concerous
⇒ Show metastasis ;
[continuously divide & spread in body via blood]

- There are some regulatory mechanisms which helps in preventing cancer but there breakdown may cause cancer

There are these two types of cells.

Proto-Onco genes

⇒ In Normal body, they help in cell division

⇒ In case of cancer, the cells divide continously

Tumor suppressor gene

⇒ In Normal body, they helps in stopping cell division.

⇒ In case of cancer, they do not stop cell division.

3) **Causes of Cancer**

- Carcinogens : Cancer causing Agents.

1) **Physical Agents :**
- Ionizing radiations : X rays, gamma rays
- Non ionizing radiation : UV rays

2) **Chemical Agents :**
- Tobacco smoking [lung cancer], soot, coal tar, Asbestos etc.

3) **Biological Agents :**
- Cancer causing virus like HPV [Human papillomavirus], HBV [Hepatitis B Viral] etc. contain cancer causing "viral oncogenes" which they can insert in Normal cells to further cause cancer

4) **Diagnosis :**

① **Biopsy and Histopathological studies.**

→ In biopsy, a piece of the suspected tissue cut into thin sections, stained and examined under microscope. called HISTOPATHOLOGY

② **Bone marrow & Blood test**

→ Usually performed for diagnosis of Blood cancer, in increase no. of WBC in the case of "LEUKEMIA"

3) Radiations

→ Radiations are used for images of internal organs ; X-Rays can be used 2D image , computed Tomography (3D)

4) MRI [Magnetic Resonance Imaging].

→ Strong magnetic fields used to detect cancer of internal organs by obtaining a 3D image

→ One of the safest Techniques.

5) Pre-diagnosis could be done. If cancer runs in family history one can go for prediagnosis of their genes.

6) Antibody test

→ Specific antibodies can be given against cancer Antigens expressed the cancerous cell.

⇒ Treatment

- Surgical Treatment

→ Surgically removing the tumor

- Radiotherapy

→ Gamma rays used to destroy the target tumor cells avoiding the close by normal cells.

- **Chemotherapy**

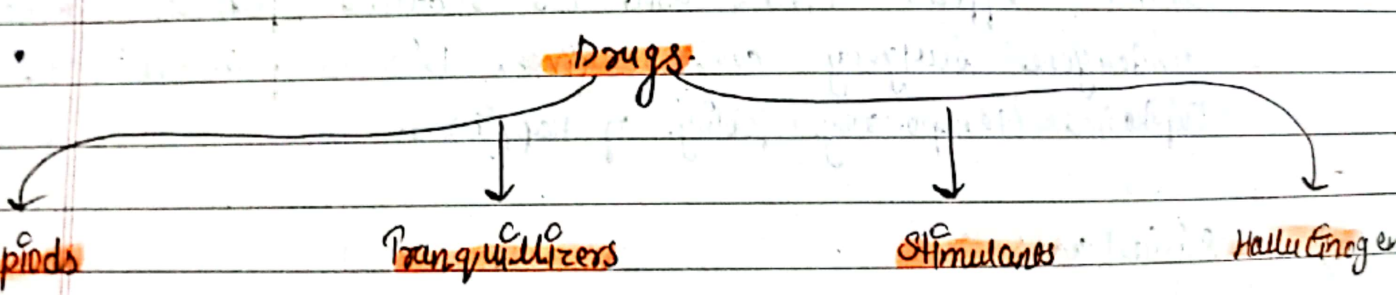
⇒ chemicals / Drugs like Vinblastine can be used to target cancerous cell.

⇒ Side effects like Hairloss, weightloss, Anemia etc can be observed in such patients.

- **Immuno therapy**

⇒ Biological Response modifier like Alpha-Interferons are given to the patient to activate its own immune system to respond against tumor.

* **Drugs and Alcohol Abuse.**

- 

1) **Tranquillizers.**

⇒ It suppress the central nervous system

⇒ It brings calmness

⇒ Promotes sleep.

eg: Benzothiazines, Barbiturate

- Clinical Importance :

⇒ Anti Anxiety

⇒ Treat Insomnia [sleepless ness].

⇒ Anaesthic

2) Opiods [Opium Narcotics].

- Info is obtained from the latex of poppy plant: Papaver Somniferum
- Receptors: Opiods drugs bind to specific opioid receptors present in our CNS & gastrointestinal tract
- Example: (1) Morphine:
  - => obtained from the latex of poppy plant

(2) Heroin:

- => It is obtained by acetylation of morphine.
- => Commonly called as "Smacks"
- => Chemically diacetylmorphine.
- => white, odourless, bitter crystalline compound
- => Function: Affects CNS, used as sedative [patients who have undergone surgery can be given this as pain-reliever. Euphoria [Temporary feeling of happiness.

3) Stimulants

1) Cocaine (Stimulants)

=> Coca alkaloid or cocaine or coke is obtained from "Erythroxylum coca" a native to South America.

=> Cocaine, commonly called 'CRACK' usually snorted.

=> It interferes with the transport of the "NEUROTRANSMITTER DOPAMINE"

=) Since these are stimulants they :

- alerts, activate, give energy to body, sense of euphoria,
- Excessive dosage causes - Hallucination

ii) Amphetamines :

=) Synthetic Drugs
=) It alerts, activate, increase memory, give energy.
=) commonly misused by sportsperson

iii) Tobacco :

=) It is consumed since last 400 years.
=) It can be smoked, chewed or snuffed [powdered].
=) It contains an alkaloid "NICOTINE"
=) may cause lung cancer, throat cancer, Bladder cancer, Bronchi emphysema, coronary artery disease, Gastric Ulcers etc.
=) Nicotine stimulates adrenal gland to release adrenaline & non-adrenaline, which raise blood pressure and increase heart rat
=) Smoking increases CO [carbon monoxide] content in blood & reduces the concentration of haembound oxygen
=) This cause oxygen deficiency in blood.

Hallucinogens

Drugs that causes "Hallucination"

Cannabinoids.

Other well-known plants with hallucinogenic properties are Atropa belladonna and Datura

LSD [lysergic acid diethyl amide] obtained from claviceps purpu

Cannabinoids:

cannabinoids binds with cannaboid receptors present in brain.

These are made by combining the leaves, flowers tops etc.

Also from inflorescences of the plant "Cannabis Sativa".

eg: charas, ganja, Hashish, marijuana.

They causes hallucinations & direct effect on cardiovascular activity [↑ pumping of Heart].

These are too misused by sports person

Can be smoked or orally

* Misuse of drugs of sports persons.

1. Narcotic analgesics
2. Anabolic steroids
3. Diuretics [loss of excessive water in urine
4. Some Hormones [like erythropoietin]

→ These are used to increase muscle strength & Bulk, Aggressiveness and enhance performance

Side effects.

Females

- masculinisation [feature like males]
- Increased aggressiveness
- mood swings
- Depression
- Abnormal menstrual cycle
- Excessive hair growth on body
- Enlargement of clitoris, deepening of voice.

Males

- Acne
- Increased aggressiveness
- mood swings
- Depression
- Reduction of size of the testicles
- Decreased sperm production
- potential kidney & liver dysfunction
- Breast enlargement
- Premature baldness
- Enlargement of the prostate gland.

Alcohol

⇒ Alcohol is absorbed in "liver" in the GI tract (mainly via stomach) & metabolized in liver.

⇒ Affects the CNS mainly "cerebellum"
↳ Because of this body balacing is compromised.

⇒ Alcohol causes → Fatty liver [Accumulation of fat]
→ "Liver Cirrhosis" : serious liver damage.

⇒ If in pregnancy it is consumed : Abnormal foetal development

Addiction and dependence.

- **Addiction** : Psychological on certain effects like euphoria and temporary feeling of wellness etc.

⇒ With repeated use of drug and alcohol : Tolerance level of Receptors ↑ : Receptor respond to higher doses of drugs only.

- **Dependence** : Tendency of body to manifest a characteristic and unpleasant withdrawal syndrome

⇒ If regular dose of drug is abruptly stopped alcohol and may be relieved, when it is consumed again.

- Anxiety
- shakiness

- Nausea
- Sweating etc.

⇒ **Aids and Hepatitis B** : Intravenous drug users by sharing needles and syringes

⇒ Behaviour changes : Immediately changes like violence, vandalism reckless behaviour

⇒ On chronic use CNS and liver may damage [liver cirrhosis], excessive can also cause death

⇒ Damage to foetus during pregnancy

⇒ misuse of drugs by sports person to enhance performance

⇒ Social effects : stealing, family agony.

* **Prevention and control**

⇒ Avoid undue peer pressure
⇒ Education & counselling
⇒ Seeking help from parents & peers
⇒ Look for danger signs
⇒ Seeking professional & medical help.