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Human Health and Diseases

INTRODUCTION

Health can be defined as a state of complete physical, mental and social well-being.

Health is affected by three factors

- Genetic disorders - Disorders which the child inherit from parents from birth.
- Infections - caused due to pathogens
  ↓
  (disease causing organism)
- Life Style - Includes the habits that we have or lack such as intake of food and water, rest and exercise which we give to our body etc.

★ When people are healthy they are more efficient to work which increases productivity & brings economic prosperity.

The factors which are responsible for maintaing good heath are-

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- Balanced diet - the diet which contains all kinds of essential nutrients in a proportionate manner.
- Personal hygiene.
- Regular exercise, Meditation, Yoga.

Aspects which are needed to be added to achieve good health are -

- Awareness about diseases.
- Proper disposal of Waste Wastes.
- Control of vectors.
- Maintenance of hygiene.

DISEASES

- The Conditions in which one or more organs of the body are not working properly, characterized by various signs and symptoms are called diseases.
- The organisms which cause diseases are called pathogens

TYPES OF DISEASES

- **Congenital**
  (Genetic disorder)
  Present by birth
  e.g Down's Syndrome
- **Acquired**
  (Developed after birth)
  infection.
  e.g - AIDS
  - **Communicable**
    (Infectious)
    - Bacterial Disease
      e.g Typhoid
    - Viral Disease
      e.g Common cold
    - Protozoan Disease
      eg Malaria
    - Helminthic Disease
      eg Taeniasis
    - Fungal diseases
      eg Ringworm
  - **Non-Communicable**
    (Non-infectious)
    - DEFICIENCY
      eg beri-beri
    - DEGENERATING
      e.g heart disease
    - ALLERGIC
      eg Asthma
    - CANCER

★ **NOTE** - Disease that is associated with the way a person or a group of people lives is called lifestyle disease. eg arthritis, obesity etc.

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Infectious diseases- Infectious diseases are those which are transmitted from an infected person to another healthy person.

★ Viral & bacterial infections are the most common causes of infectious disease. However, fungi and one-celled organism called protozoa can also be responsible.

Non-infectious diseases - Non-infectious diseases are those which are not transmitted from an infected person to another person.

Infectious Diseases

I Bacterial diseases – Caused by bacteria

★ ① **Typhoid** → Caused by *Salmonella typhi* ★

Affect - Small intestine and then migrates to other parts of the body through blood.

Transmitted by Contaminated food & water

Symptoms- Sustained high fever (39° to 40°C), weakness, stomach pain, Constipation, headache and loss of appetite, intestinal perforation and death may occur in severe cases.

★ Typhoid fever is confirmed by Widal test

★ ② Pneumonia → Caused by Streptococcus pneumoniae and Haemophilus influenzae.

Affect - Alveoli of lungs

Transmitted by - droplets released by infected person, shaving glasses and utensils.

Symptom - fever, chills, cough & headache and in severe cases lips and finger nails turn gray to bluish colour.

II Viral disease - Caused by Virus

★ ① Common cold - Caused by Rhino Virus

Affects - nose & respiratory organs.

Transmitted by direct inhalation of droplets from Cough & Sneeze of infected person through Contaminated objects like pen, books, cups etc.

Symptoms - Nasal Congestion and discharge, Sore throat, hoarseness, cough.

★ (2) Dengue fever - It is caused by flavivirus transmitted by - the bite of Aedes mosquito infected with a dengue virus. The mosquito becomes infected when it bites a person with dengue virus in their BLOOD. It can't be spread directly from one person to other person.

There is no Vaccine or any specific medicine to treat dengue. People who have dengue fever should rest and drink plenty of fluids.

Symptoms - usually begin 4 to 6 days after infection & last for up to 10 days
Sudden, high fever, Severe headaches, Pain behind the eyes, sever joint & muscle pain, vomiting, Skin rash, (after 2 to 5 days after the onset of fever)

★ (3) Chikungunya - Caused by alphavirus called Chikungunya Virus

It generally spread through Ades aegypti mosquito

Symptoms - usually begin 3-7 days after being bitten by an infected mosquito.

- The most Common Symptoms are fever & joint pain
- other Symptoms may include, muscle pain, joint swelling or rash.
- Chikungunya disease does not often result in death, but the Symptoms can be severe and disabling. There is no vaccine to prevent or medicine to treat chikungunya virus.

Treat the Symptoms

- Get plenty of rest
- Drink fluids to prevent dehydration.

III Protozoan Diseases - Caused by Protozoan

★ ① Malaria → Caused by plasmodium
↓
(Vivax, P. malaria and P. falciparum

Affect → liver and RBC

Transmits by → biting of female anopheles mosquitos which acts as a vector.

Symptoms - High fever occuring on alternate days, chill, vomiting.

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★ Malarial parasite requires two hosts to complete their life cycle.

① Human
② Anopheles mosquito

Life cycle of malarial parasite.

- Female Anopheles mosquito bites a healthy human and injects sporozoites (infective stage) with bites.
- The parasites reach the liver by through blood and start multiplying within the liver cells.
- Parasites then attack the red blood cell and reproduce asexually in the blood cells & rupture the red blood cells which release a toxic substance called haemozoin responsible for chill & high fever recurring every 3 to 4 hours.
- Some of the parasites differentiate into male & female gametocytes which are taken up by the mosquito during biting and sucking blood.
- Formation of gametes & fertilization takes place in the intestine of mosquito.
- The zygote develops & forms thousands of sporozoites which migrate into the salivary gland of the mosquito.

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- when the mosquito bites another human, the sporozoites are injected.

★ ② Amoebiasis (amoebic dysentery)
Caused by Entamoeba histolytica

Affects → large intestine of man.

Transmitted by → house flies which are mechanical carrier and food contaminated with cysts of Entamoeba.

Symptoms → Constipation, abdominal pain, cramps, stools with mucous and blood clots

IV Helminthic Diseases caused by helminth

★ ①. Ascariasis → Caused by Ascaris lumbricoides (roundworm)

Affects → Intestine of man.

Transmitted by → Contaminated water, vegetable, fruits etc.

Symptoms → Internal bleeding, muscular pain, fever, anemia, blockage of intestinal passage.

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★ ② Elephantiasis or Filariasis
Caused by Wuchereria bancrofti and wuchereria malayi.
Vector → Culex Mosquito

Affects → lymphatic vessels of the lower limbs, genital organs.

Transmitted by → biting of infected female Culex mosquito.

Symptoms → Chronic inflammation of the organs where they live, abnormal swelling of the lower limbs, scrotum, penis.

V Fungal Disease Caused by Fungi

★ ① Ring worm → Caused by Microsporum, Trichophyton, Epidermophyton.

Affects → skin, nails, folds of skin, groin.

Transmitted by → Sharing towel, clothes or even comb with infected person.

Symptoms → Appearance of dry skin, scaly lesions in nails and scalp with intense itching.

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Control Measures for infectious Diseases.

Maintenance of hygiene is very important for prevention and control of diseases.

1. For personal hygiene-
   Measures for hygiene include keeping the body clean; Consumption of clean drinking water, food vegetables, fruits etc.

2. For public hygiene-
   Proper disposal of waste and excreta; periodic cleaning and disinfection of water reservoirs, pools, cesspools and tanks.

3. For air-borne disease- close contact with the infected person and his belongings should be avoided.

4. For vector borne disease such as Malaria.
   - Control or eliminate the vectors and their breeding places.
   - Avoiding stagnation of water in and around residential areas.
   - Regular cleaning of household coolers.
   - use of mosquito nets.
   - Introducing fishes like Gambusia ponds that feed on mosquito larva
   - Spraying of insecticides in ditches, drainage areas and swamps, etc.

- Doors and windows should be provided with wire mesh to prevent the entry of mosquitoes

5. Vaccination and immunisation -
These programmes has enabled to control diseases. like - smallpox, diphtheria, polio, pneumonia, tetanus etc.

Non- infectious Disease

These disease cannot be transmitted from one person to another and are not caused by pathogens. They occur either by nutritional deficiency, malfunctioning of organs etc.
eg - Cancer, scurvy.

CANCER

- Cancer is the uncontrolled cell division leading to the formation of a mass of cells called a tumours

- Contact inhibition is the property of normal cells by virtue of which contact with other cells inhibits their uncontrolled growth.

- Cancer cells lost the property of contact inhibition and as a result of this, cancerous cells continue to divide giving rise to masses of cells called tumours

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★ Tumours are of 2 types

Benign | malignant

Benign tumors normally remain confined to their original location and do not spread other parts of the body.

Malignant tumors are a mass of proliferating cells called neoplastic or tumor cells. Malignant tumors grow very rapidly and invade and ultimately damage surrounding tissues.

- The property by which cancer cells moves to distant places from their origin by blood and invade the normal cells and make them cancerous is called as metastasis

Causes of Cancer

- Transformation of normal cells into cancerous cells may be induced by physical, chemical or biological agents called as Carcinogens.

1. Physical Carcinogens - ionizing radiation like X-rays, gamma rays and non-ionizing radiations like UV radiation of sun.

2. Chemical Carcinogens
tobacco smoke and some other chemica

3. Biological Carcinogens

i) Cancer causing viruses are called oncogenic viruses - have genes called viral oncogenes.

ii) Cellular oncogenes or proto-oncogenes in normal cells, when get activated lead to oncogenic transformation of normal cells.

Cancer Detection and Diagnosis

- Biopsy and histo-pathological study of the tissues under microscope.
- Radiography by using X-rays, CT (Computed tomography)
- MRI (magnetic resonance imaging)
- use of antibodies against Cancer-specific antigens.
- Blood & Bone marrow tests to know increase in number of cell counts as in leukemia.

Treatment of Cancer

Most Cancers are treated by the Combination of procedures Surgery, radiotherapy and Chemotherapy and immunotherapy.

1- Surgery - Tumours are removed by surgery to check further spread of cancer cells.

2- Radiation therapy- tumour cells are irradicated by lethal does of radiation, while protecting the surrounding normal cells.

3- Chemotherapy- drugs are used to kill Cancer cells. But their side effects like - hair loss, anaemia are also reported. (-chemotherapeutic)

4- Immunotherapy - Biological response modifiers - alpha - interferon which activate the immune System & help in destroying the tumour).

Immunity

The overall ability of the body to fight against disease causing microorganisms which the help of immune system is called immunity.

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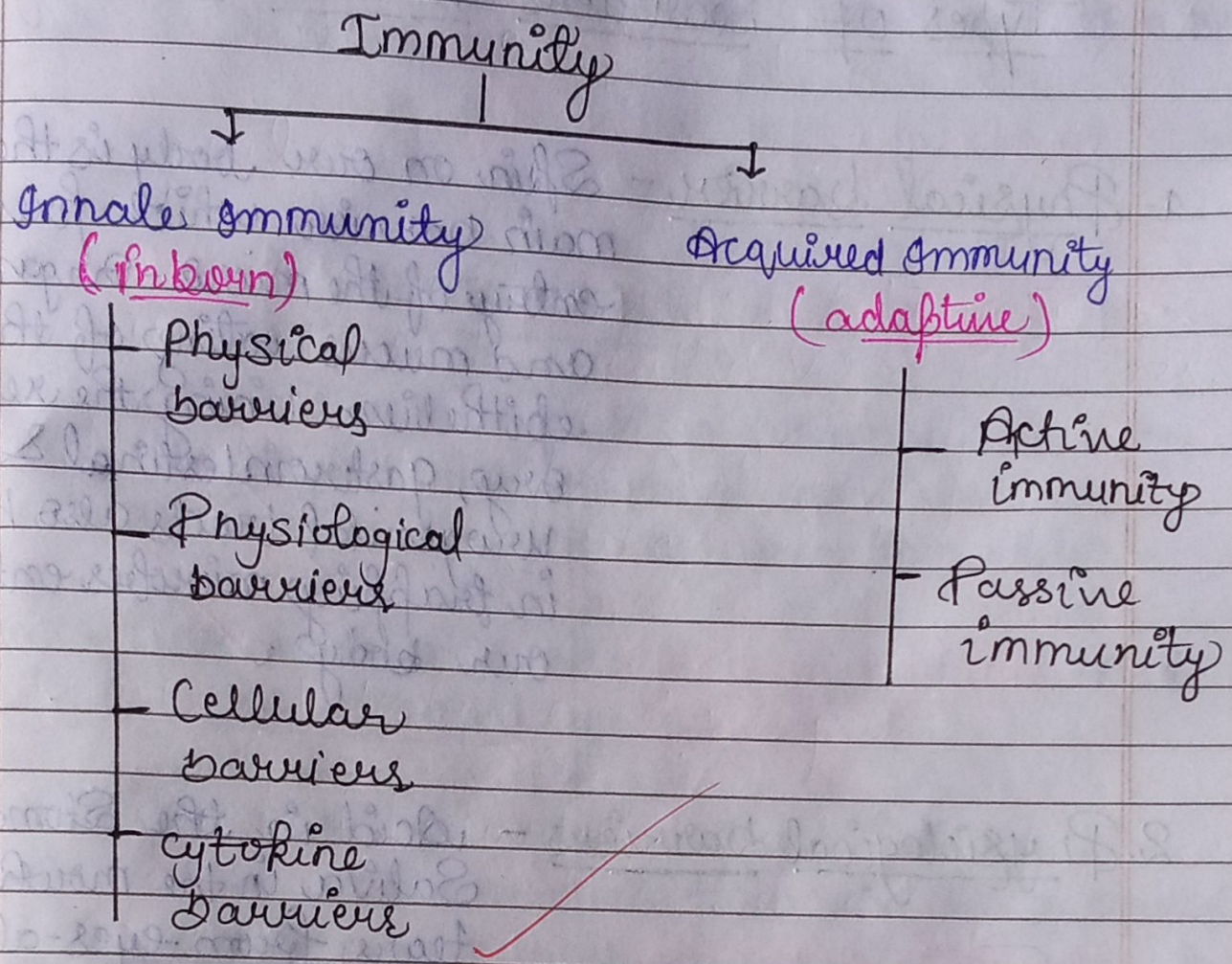

Innate immunity

- The immunity which occurs by birth is called innate immunity.
- Innate immunity is non-specific type of defense.
- Innate immunity consist of various barriers which prevent the entry of microorganisms into the body.

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Types of Barriers in innate Immunity

1. Physical barrier - Skin on our body is the main barrier which prevents entry of the micro-organisms and mucus coating of the epithelium lining the respiratory, gastrointestinal & urogenital tracts also help in trapping microbes entering our body.

2. Physiological barriers - Acid in the Stomach, Saliva in the mouth, tears from eyes - all prevent microbial growth.

3. Cellular barriers - Certain types of leukocytes (WBC) of our body like Polymorpho-nuclear leukocytes (PMNL - neutrophils) (types of lymphocytes) in the blood as well as macrophages in tissue can phagocytose & destroy microbes.

4. Cytokine barriers - Virus-infected cells Secrete Protein Called interferons

protect non-infected cells from fur
infection.

Acquired Immunity

- The immunity which develops during lifetime by exposure to suitable foreign agents like microorganisms is called acquired immunity.

- Acquired immunity is pathogen specific and it is characterized by memory

- when the body first encounters a pathogen it produces a response which takes long time to develop and low intensity called as Primary immune response

- and if the body encounters the same pathogen it produces highly intensified and quick response called as Secondary immune response.

- After responding to the forgin micro organisms and elimination of the pathogen, the immune system keeps the memory of the that encounter (Primary response) and during its second encounter with the same pathogen produces a highly intensified immune response (Secondary response)

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★ The Primary and Secondary immune responses are carried out with the help of two special type of lymphocytes present in our blood.

- B-Lymphocytes – The B-lymphocytes produce an army of proteins in response to pathogens into our blood to fight with them called as antibodies.

- T-Lymphocytes – The T-cells themselves do not produce antibodies but help B cells to produce them.

★ Based on the type of immune cell acting against the antigens, immunity can be classified into 2 types

① Humoral immunity – the immunity which is mediated by antibodies produced by B-lymphocytes is called humoral immunity

Also known as AMI – Antibody mediated immunity.

② Cell-mediated immunity – ① Killer T cells
② Helper T-cells (activate) B cells.

The immunity which is medicated by T-lymphocytes by directly attaching themselves to the antigens is called cell mediated immunity.

During organ transplantation, tissue matching and blood group matching are essential before undertaking any graft/transplant and even after this the patient has to take immuno-Suppressants all his/her life because the body is able to differentiate Self and non Self and the cell mediated immune response is responsible for the graft rejection.

* Based on the nature of antibodies, immunity is divided into two types.

- Active immunity

When a host is exposed to antigens which may be in the form of living or dead microbes or other proteins, antibodies are produced in the hosed body, this type of immunity is called active immunity.

ex- antibody produced when any micro-organism enters the body (Polio Vaccination)

- Passive immunity

When ready-made antibodies are directly given to protect the body against

foreign agents this type of immunity is called passive immunity.

ex- The yellowish fluid Colostrum secreted by mother during the initial days of lactation has abundant antibodies (IgA) to protect the infant.

Active Immunity	Passive Immunity
① It has no or few side effects	① It may cause reaction.
② It has slow & long lasting response.	② It has fast response but lasts only for few days.
③ It takes time to develop its response.	③ antibodies in colostrum
① Artificial developed by vaccination	
② Natural developed during natural infection	

Structure Of Antibody

Each antibody molecule has four peptide chains, two long chains & two short chains arranged in a Y-shaped Structure.

Two long chains are called heavy chains and two short chains are called light chains, hence an antibody is represented as H_2L_2.

Antibodies are also called as immunoglobulins (Ig)

- Different types of antibodies are produced in our bodies which are IgA, IgM, IgE, IgG and IgD.

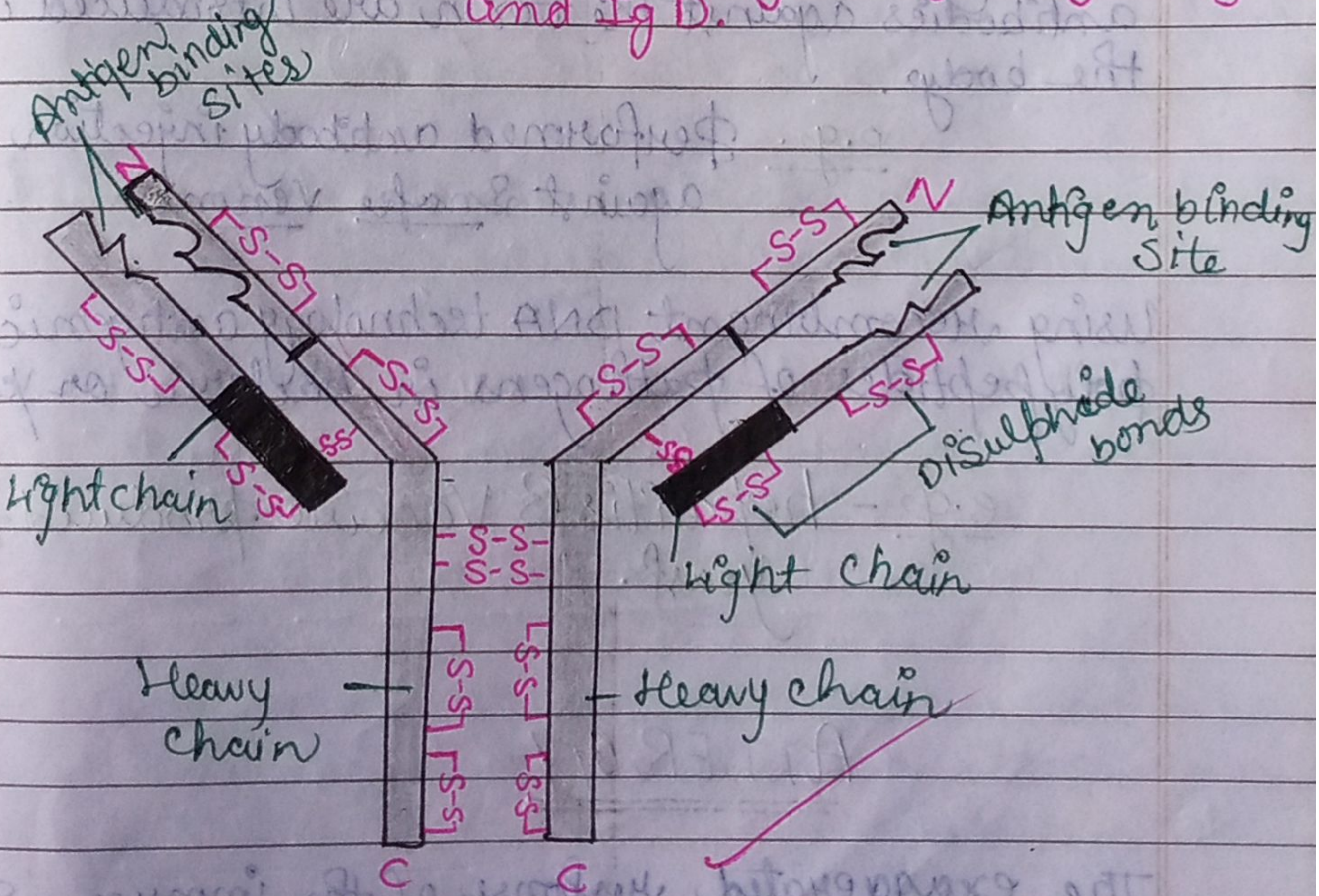

Fig - Structure of an antibody molecule

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VACCINATION AND IMMUNISATION

Vaccination is the process of introduction of vaccines into the body to produce antibodies against the antigens to neutralize the effect of pathogens during actual infection.

- Vaccines are the dead or weakened pathogens into the body.
- The dead or weakened pathogen leads to the production of antibodies which neutralizes the pathogenic agents during actual infection with the same pathogen.
- Immunization is the process where performed antibodies against the toxin are introduced into the body.

e.g. Performed antibody injection against Snake venom

Using recombinant DNA technology antigenic polypeptides of pathogens in bacteria or yeast.

e.g - hepatitis B Vaccine produced from yeast.

ALLERGY

The exaggerated response of the immune System to certain antigens present in the environment

is called allergy.

- ~~Common~~ The substances to which immune response is produced are called allergens.
- Common examples of allergens are mites in dust, pollens, animal dander etc.
- Allergy is due to the release of chemicals like histamine & serotonin from the mast cells.
- The antibodies produced to these are of IgE type.
- Symptoms of allergic reactions include sneezing, watery eyes, ~~runin~~ running nose & difficulty in breathing.
- The patient is diagnosed by injecting or exposing the patient to very small doses of allergens.
- Drugs like anti-histamine, adrenalin & steroids quickly reduce the symptoms of allergy.

AUTOIMMUNITY

- An autoimmune disease is a condition in which your immune system mistakenly attacks your body.
- Due to genetic and other unknown reasons, the body attacks self-cell which results in

damage to the body & is called auto immune disease.

- The immune system normally guards against germs like bacteria & virus, when it senses these foreign invader, it sends out an army of fighter cell to attack them.

- Normally, the immune system can tell the difference b/w foreign cells & your own cells.

- In an autoimmune disease, the immune system mistakes part of your body - like your joints or skin - as foreign it release Proteins called autoantibodies that attack healthy cells.

Rheumatoid arthritis (RA)

In rheumatoid arthritis (RA), the immune system attacks the joints

This attack causes redness, warmth, soreness and stiffness in the joints

Immune System in the body

Immune system Consists of -

- ✯ Lymphoid organs
- ✯ Lymphoid tissues
- ✯ B-cells & T-cells,
- ✯ Antibodies.

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Lymphoid Organs

Organs where lymphocytes originate, proliferate and get matured are known as lymphoid organs. They can be categorised as

① Primary lymphoid organ

In primary lymphoid organs, immature lymphocytes differentiate to mature ones into an antigen sensitive lymphocytes and after maturation, lymphocytes migrate to secondary lymphoid organs.

These are of 2 types

ⓐ Bone marrow
ⓑ Thymus

- **Bone Marrow**
  It is the main lymphoid organ, where all the lymphocytes and all the body cells are produced and T-lymphocytes are developed.

- **Thymus**
  It is lobed organ located near the heart and beneath the breast bone. It is large at the time of birth but with age, the size keep on reducing and becomes very small by attaining puberty. Growth & maturation of T-lymphocytes takes place in thymus only.

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② Secondary Lymphoid Organs:

These organs provide the sites for the interaction of lymphocytes with the antigen, which then proliferate to become effector cells.

These are of following types :-

ⓐ Spleen
ⓑ lymph nodes,
ⓒ Mucosal associated lymphoid tissue (MALT)

Peyer's patches of small intestine & appendix are also some of the secondary lymphoid organs.

ⓐ Spleen (large reservoir of ~~Erth~~ erythrocytes. It a large bean-shaped organ containing lymphocytes & phagocytes. It filters the blood by trapping the pathogens in it.

ⓑ Lymph Nodes
These are small solid structures located at different points along the lymphatic system. Their function is to trap the microorganisms or other antigens, that enter the lymph and tissue fluid.

ⓒ Mucosal Associated Lymphoid Tissue (MALT)
This is located within the lining of main tracts in the body like respiratory, digestive, urogential

tracts. MALT constitutes about 50% of the lymphoid tissues in human body.

AIDS

- The term AIDS stands for Acquired Immuno Deficiency syndrome
- The disease is ~~aa~~ acquired during life time
- AIDS is caused by human immune deficiency virus (HIV)
- HIV is a retrovirus having RNA as the genetic material.

Mode of transmission

- Sexual contact with infected person.
- By transfusion of contaminated blood & blood product.
- By sharing infected needles in the case of intravenous drug abusers.
- From infected mother to her child through placenta.

Life cycle of HIV

- After getting into the body, the virus enters into macrophages or T- helper cells.
- The Viral RNA genome replicated to form viral DNA with the enzyme called reverse transcriptase.
- The viral DNA gets incorporated into the host cell's DNA and directs the infected cells to produce virus particles and the macrophages continue to produce virus.
- Viruses released from macrophages attack T- helper cells & cause a progressive reduction in the number of T- helper cells and due to which the person starts suffering from infections with several other microorganisms.
- The person experiences periods of fever, diarrhoea and weight loss during this period.
- Diagnosed by ELISA (enzyme linked immune sorbent assay), PCR (Polymerase chain reaction and western blotting etc.
- Treated with anti-retroviral drugs but that is only partially effective.
- It has no cure,

Prevention of AIDS

- Awareness & precautions are the only option to prevent AIDS.
- NACO — National AIDS Control Organisation started in 1991 in India & many other NGOs are doing a lot to spread awareness.
- WHO has started a number of programmes to prevent the spread of HIV
- Some main strategies of prevention are
  - To follow safe blood transfusion
  - To use disposable needles.
  - To distribute free condoms.
  - To prevent drug abuse
  - Promoting regular check-ups for HIV in susceptible people.

Adolescence: Drug and Alcohol abuse

The drugs which are commonly abused are opiods, cannabinoids and coca alkaloids.

Opioids

Opioids are the drugs which bind to specific opioid receptors present in our central nervous system and Gastrointestinal tract.

Heroin

Commonly called Smack is chemically diacetylmorphine which is white, odourless bitter crystalline compound and is obtained by acetylation of morphine extracted from the latex of poppy plant Papaversomniferum. Heroin is a depressent & shows down body functions.

* It is an effective sedative and a pain killer used by patients who underwent Surgery.

Mode of intake → injection and Snorting

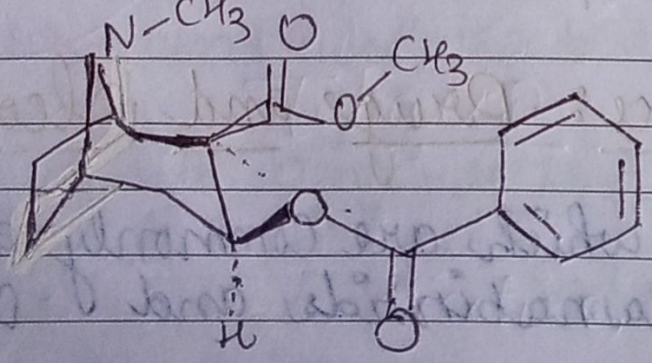

Fig- Chemical Structure of morphine

Cannabinoids

- Cannabinoids interact with cannabinoid receptors present principally in the brain
- Natural cannabinoids are obtained from the inflorescences of the plant Cannabis Sativa
- The flower tops, leaves and the resin of cannabis plant are used in various combinations to produce marijuana, hashish, charas and ganja

Effects on Cardiovascular System of the body.

Mode of intake → By inhalation and oral digestion

These days, they are also being abused by some sport person.

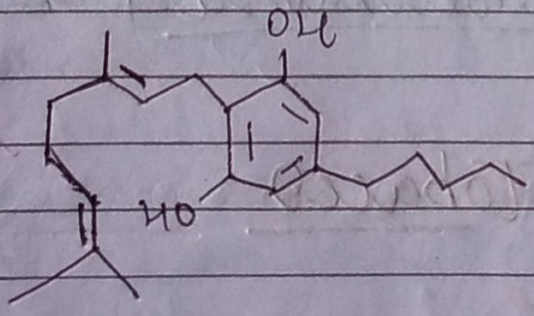

Fig - Skeletal Structure of Cannabinoid molecule.

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Coca alkaloid Cocaine

- Coca alkaloid or Cocaine is obtained from coca plant Erythroxylum coca.
- Coca alkaloid interferes with the transport of the neuro-transmitter dopamine
- Cocaine, commonly called as Coke or Crack
- Mode of intake - Sniffing & Snorting
- It has a potent stimulating action on Central Nervous System producing a sens of euphoria and increased energy.
- Excessive dosage of Cocaine causes hallucinations
- Morphine is a very effective sedative & pain killer is often abused.
- Some plant with hallucinogenic properties are Atropabelladona, Dhatura

Tobacco

- Tobacco Contains nicotine, an alkaloid.

- Nicotine stimulates adrenal gland to release adrenaline and nor-adrenaline into blood circulation, both of which raise blood pressure and increase heart rate.

- Smoking of Tobacco is associated with increased incidence of Cancers of lung, urinary bladder, throat, oral cavity, bronchities, emphysema, coronary heart disease, gastric ulcer etc.

Adolescence and Drug / Alcohol Abuse

- Alcohol use often turns to abuse & addiction

- Adolescence means both 'a period' and 'a process' which a child becomes mature in term of his/her attitudes & beliefs for effective participation in society.

- 12-18 years of age may be thought of as adolescence period.

- Adolescence is accompained by several biological & behavioural changes.

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- Curiosity, need for adventure and excitement and experimentation, constitute common causes, which motivate youngsters towards drugs and alcohol use.

Addiction And Dependence

- Addiction is a psychological attachment to certain effects - such as euphoria and a temporary feeling of well-being - associated with drugs & alcohol.

- With repeated use of drugs, the tolerance level of the receptors present in our body increases & consequently the receptors respond only to higher doses of drugs or alcohol leading to greater intake & addiction.

- Dependence is the tendency of the body to manifest a characteristic & unpleasant withdrawal syndrome if regular does of drugs/alcohol is abruptly discontinued.

- Withdrawal Syndrome is characterised by anxiety, shakiness, nausea & sweating.

- Acute - or short ~~term~~, term, tolerance is caused by repeated exposure to a drug over a relatively short period of time. Cocaine abuse often results in

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acute tolerance

- Chronic - or long-term tolerance develops when an individual's body adapts to constant exposure to a drug over weeks or months.

Effects, Prevention And Control of Drug / Alcohol Abuse

- Immediate effects are reckless behaviour vandalism & violence.
- Excessive of doses of drugs may lead to coma and death due to respiratory failure or cerebral hemorrhage.
- Those who take drugs intravenously can get infected with AIDS, hepatitis B.
- The chronic use of drugs & alcohol damages nervous system & cause liver cirrhosis.
- The use of drugs & alcohol during pregnancy is also known to adversely effect the foetus.
- use of anabolic in females - Can cause masculinisation, increased aggressiveness, mood swings, depression, abnormal menstrual cycle, excessive hair, growth on the

face & body, enlargement of clitoris, deepings of voice.

- In males anabolic Steroids —
Can cause acne, increased aggressiveness, mood swings, depression, reduction of size of the testicles, decreased sperm production, potential for kidney & liver dysfunction, breast enlargement, premature baldness, enlargement of the prostate gland.

Prevention and Control

- Avoid undue peer pressure on children.
- Children should be educated and Counseled to bear problems & stress in life.
- The child should seek help from parents and elders.
- Affected individuals should seek medical help of qualified psychologists, ~~Psycho~~ psychiatrists, and de-addiction & rehabilitation programmes.