HUMAN HEALTH AND DISEASE

DISEASE

Diseases can be broadly grouped into **infectious and non-infectious.**

1-Infectious disease

Diseases which are easily transmitted from one person to another are called infectious diseases.

Eg : **AIDS**

2-Non infectious disease

Diseases which are not easily transmitted from one person to another

Eg : **cancer , Goiter, ulcer**

COMMON DISEASES IN HUMANS

A)Bacterial disease

It include Typhoid fever, pneumonia, Dysentery, plague, diphtheria, TB, cholera, Leprosy, Whooping cough, Gonorrhoea

a)Typhoid fever

- **Pathogen :** *Salmonella typhi*
- **Part of the body it infect** :

  These pathogens generally enter the **small intestine through food and water** contaminated with them and migrate to other organs through blood.
- **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.**
- **Spread :**

  Contaminated food and water
- **Test :**

  Typhoid fever could be confirmed by **Widal test.**

Mary Mallon :

A classic case in medicine, that of **Mary Mallon** nicknamed **Typhoid Mary**, is worth mentioning here. She was **a cook by profession** and was a typhoid carrier who continued to spread typhoid for several years through the food she prepared.

B) Viral disease

It include Common cold, AIDS, Chicken Pox, Small pox, Polio, Rabies, Mumps,

a)Acquired Immuno Deficiency Syndrome (AIDS)

Introduction

- AIDS means, Deficiency of immune system, acquired during the lifetime of an individual indicating that it is **not a congenital disease**. 'Syndrome' means a group of symptoms.
- AIDS was first reported in **1981 in USA** and in the last twenty-five years or so, it has spread all over the world killing more than **25 million persons**.

- **Pathogen :**

  HIV **(Human immuno deficiency virus)**
- **Part of the body it infect :**

  Helper T lymphocyte/Immune system
- **Symptoms :**
- Progressive **decrease in the number of helper T lymphocytes.**
- During this period, the person suffers from bouts of **fever, diarrhoea and weight loss**..
- Due to decrease in the number of helper T lymphocytes, the person starts suffering from infections that could have been otherwise overcome such as those due to bacteria especially **Mycobacterium, viruses, fungi and even parasites like Toxoplasma.**
- The patient becomes so immuno-deficient that he/she is unable to protect himself/herself against these infections.
- There is always a time-lag between the infection and appearance of AIDS symptoms. This period may vary from a few months to many years **(usually 5-10 years).**
- **Spread :**

  Transmission of HIV-infection Generally occurs by

  (a) Sexual contact with infected person,

  (b) By transfusion of contaminated blood and blood products,

  (c) By sharing infected needles as in the case of intravenous drug abusers

(d)From infected mother to her child through placenta.

Following individual are at high risk of getting HIV infections

1. **individuals who have multiple sexual partners,**
2. **drug addicts who take drugs intravenously,**
3. **individuals who require repeated blood transfusions and**
4. **children born to an HIV infected mother.**

Test :

Enzyme linked immune sorbent assay (ELISA)

HIV/AIDS is not spread by mere touch or physical contact; **it spreads only through body fluids**. It is, hence, imperative, for the physical and psychological well-being, that the HIV/AIDS infected persons are not isolated from family and society.

Treatment of AIDS :

Treatment of AIDS with **anti-retroviral drugs** is only partially effective. They can only prolong the life of the patient

Prevention of AIDS :

- In our country the **National AIDS Control Organisation (NACO**) and other non-governmental organisation (NGOs) are doing a lot to educate people about AIDS. WHO has started a number of programmes to prevent the spreading of HIV infection.

1. **Making blood (from blood banks) safe from HIV,**
2. **ensuring the use of only disposable needles and syringes in public and private hospitals and clinics,**
3. **free distribution of condoms, controlling drug abuse,**
4. **advocating safe sex and promoting regular check-ups for HIV in susceptible populations, are some such steps taken up. but cannot prevent death, which is inevitable.**

C)PROTOZOAN DISEASE

It include **malaria and amoebiasis**

a)Malaria

- **Pathogen** :

  Plasmodium (a tiny protozoan) Different species of Plasmodium (***P. vivax, P. malaria*** **and** ***P. falciparum***) are responsible for different types of malaria.

  Of these, malignant malaria caused by ***Plasmodium falciparum*** is the most serious one and can even be **fatal.**

- **Part of the body it infect :**

  Liver, RBC

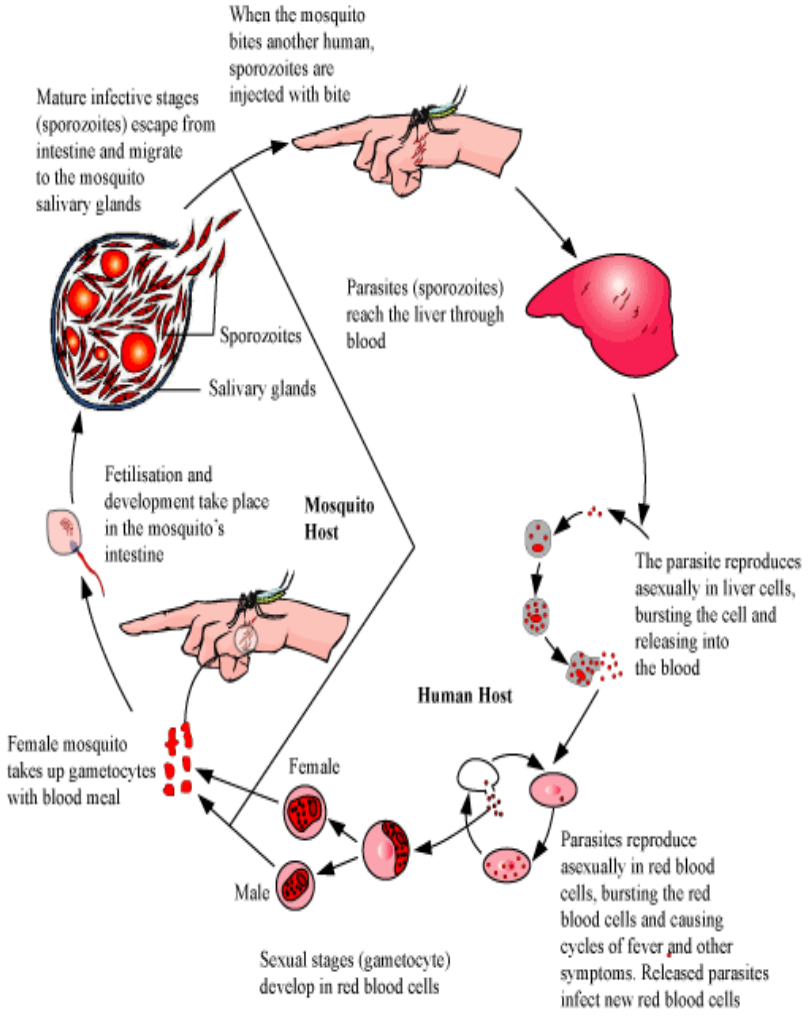
- **Symptoms :**
  - The rupture of RBCs is associated with release of a toxic substance, **haemozoin,** which is responsible for the chill and high fever **recurring** every three to four days

- **Spread :**

  Female Anopheles mosquitoes transmitting agent

Life cycle of Plasmodium

- Plasmodium enters the human body as **sporozoites (infectious form)** through the bite of infected **female Anopheles mosquito.**
- The parasites initially multiply within the liver cells and then attack the red blood cells (RBCs) resulting in their rupture.
- The rupture of RBCs is associated with release of a toxic substance, **haemozoin**, which is responsible **for the chill and high fever recurring every three to four days**.
- When a female Anopheles mosquito bites an infected person, these parasites enter the mosquito's body and undergo further development. The parasites multiply within them to form sporozoites that are stored in their salivary glands.
- When these mosquitoes bite a human, the sporozoites are introduced into his/ her body, thereby initiating the events mentioned above.
- **It is interesting to note that the malarial parasite requires two hosts – human and mosquitoes – to complete its life cycle the female Anopheles mosquito is the vector (transmitting agent) too.**



CANCER

- Cancer is one of the most dreaded diseases of human beings and is a major cause of death all over the globe.
- More than **a million Indians** suffer from cancer and a large number of them die from it annually
- Our body, cell growth and differentiation is highly controlled and regulated.
- In cancer cells, there is breakdown of these regulatory mechanisms.
- Normal cells show a property called **contact inhibition** by virtue of which contact with other cells inhibits their uncontrolled growth. Cancer cells appears to have lost this property. As a result of this, cancerous cells just continue to divide giving rise to masses of cells called tumors.
- Tumors are of two types: **benign and malignant**.

1) Benign tumors

- It normally remain confined to their original location and do not spread to other parts of the body and cause little damage.

2) The malignant tumors,

- **This is** a mass of proliferating cells called neoplastic or tumor cells.
- These cells grow very rapidly, invading and damaging the surrounding normal tissues.
- As these cells actively divide and grow they also starve the normal cells by competing for vital nutrients.
- **Cells sloughed from such tumors reach distant sites through blood, and wherever they get lodged in the body, they start a new tumor there. This property called metastasis is the most feared property of malignant tumors.**

Causes of cancer :

- Transformation of normal cells into cancerous neoplastic cells may be induced by physical, chemical or biological agents. These agents are called carcinogens.

Example for carcinogens

- **Ionising radiations (X-rays and gamma rays)**
- **Non-ionizing radiations (UV)cause DNA damage leading to neoplastic transformation.**
- The chemical carcinogens present in tobacco smoke have been identified as a major cause of lung cancer.
- Cancer causing viruses called **oncogenic viruses have genes called viral oncogenes**.
- Furthermore, several genes called **cellular oncogenes (c-onc) or proto oncogenes** have been identified in normal cells which
- When activated under certain conditions, could lead to oncogenic transformation of the cells.

Cancer detection and diagnosis :

- Early detection of cancers is essential as it allows the disease to be treated successfully in many cases.
- Cancer detection is based on **biopsy and histopathological studies** of the tissue and

blood and bone marrow tests for increased cell counts in the case of **leukemias (blood cancer)**

- **In biopsy,** a piece of the suspected tissue cut into thin sections is stained and examined under microscope (histopathological studies) by a pathologist.
- Techniques like radiography (use of X-rays), CT (computed tomography) and MRI (magnetic resonance imaging) are very useful to detect cancers of the internal organs.
- **Computed tomography** uses **X-rays** to generate a three-dimensional image of the internals of an object.
- **MRI** uses **strong magnetic fields and non-ionising radiations** to accurately detect pathological and physiological changes in the living tissue.
- **Antibodies** against cancer-specific antigens are also used for detection of certain cancers.
- **Techniques of molecular biology** can be applied to detect genes in individuals with inherited susceptibility to certain cancers. Identification of such genes, which predispose an individual to certain cancers, may be very helpful in prevention of cancers. Such individuals may be advised to avoid exposure to particular carcinogens to which they are susceptible (e.g., tobacco smoke in case of lung cancer).

Treatment of cancer :

- The common approaches for treatment of cancer are **surgery, radiation therapy and immunotherapy.**
- **In radiotherapy**, tumor cells are irradiated lethally, taking proper care of the normal tissues surrounding the tumor mass.
- **Several chemotherapeutic drugs** are used to kill cancerous cells. Some of these are specific for particular tumors. Majority of drugs have side effects like hair loss, anemia, etc.
- Most cancers are treated by combination of **surgery, radiotherapy and chemotherapy**.
- Tumor cells have been shown to avoid detection and destruction by immune system. Therefore, the patients are given substances called biological response modifiers such as α-interferon which activates their immune system and helps in destroying the tumor.

IMMUNOLOGY

- The overall ability of the host to fight the disease-causing organisms, conferred by the immune system **is called immunity**. Immunity is of two types:

(i) Innate immunity and
(ii) Acquired immunity.

i) Innate immunity/inborn immunity /non specific immunity

- This type of immunity is present **at the time of birth**. This is accomplished by providing different types of barriers to the entry of the foreign agents into our body. Innate immunity consist of **four types of barriers**. These are

(a) Physical barriers :

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

(b) Physiological barriers :

- **Acid** in the stomach,
- **Saliva** in the mouth,
- **Tears** from eyes–all prevent microbial growth.
- Saliva and tear contain antibacterial agent called **Lysozyme**

(c) Cellular barriers :

- Certain types of **leukocytes** (WBC) of our body like **polymorpho-nuclear leukocytes** (PMNL-neutrophils) and monocytes and **natural killer** (type of lymphocytes) in the blood as well as macrophages in tissues can **phagocytose** and destroy microbes.

(d) Cytokine barriers :

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

ii) Acquired immunity/adaptive immunity/specific immunity

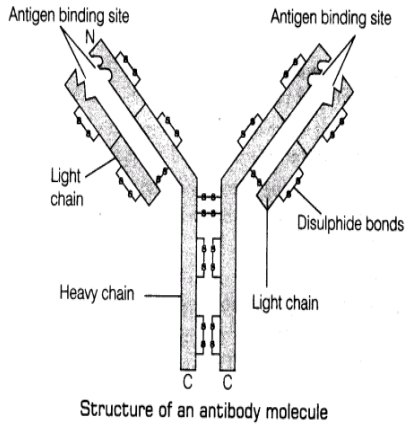
- It is **pathogen specific**.
- It is characterised by **memory**.
- This means that our body when it encounters a pathogen for the **first time** produces a response called **primary response** which is of low intensity. Subsequent encounter with the same pathogen elicits a highly intensified **secondary or anamnestic response.** .

B-lymphocytes and T lymphocytes

- The primary and secondary immune responses are carried out with the help of two special types of lymphocytes present in our blood, **i.e., B-lymphocytes and T lymphocytes.**
- Certain cells of bone marrow produce lymphocytes (Haematopoiesis). These cells mature in the bone marrow lymphocytes. The B-lymphocytes produce an army of proteins in response to pathogens into our blood to fight with them. These proteins are called **antibodie**s. **The B lymphocytes give rise to plasma cells and memory B cells.**
- Some stem cells in the Bone marrow give rise to immature lymphocytes. These lymphocytes migrate via the blood **to the thymus**, where they mature as **T cells**. In the thymus, these cells mature as T lymphocytes. **The T-cells themselves do not secrete antibodies but help B cells produce them**

Structure of Antibody

Each antibody molecule has **four peptide chains**, two small called **light chains** and two longer called **heavy chains**. Hence, an antibody is represented as H_2L_2. Different types of antibodies are produced in our body. IgA, IgM, IgE, IgG are some of them



Structure of an antibody molecule

HUMORAL IMMUNITY & CELL MEDIATED IMMUNITY

- Immune response by the **B-cells** by production of antibody is called **Antibody mediated immune response (AMI) or humoral immune response.**
- Immune response **by T-cells** which detects and destroys the foreign cells and also cancerous cells **called cell mediated immune response.(CMI)**
- Rejection of organs in transplantation are due to **T-lymphocytes.**
- Tissue matching, blood group matching are essential for organ transplantation.
- **Immune-suppressants** (Eg.Cyclosporin A) is required before and after transplantation.

Effects of Drug/Alcohol

- The reckless behavior,
- Vandalism
- Violence.
- Excessive doses of drugs may lead to coma and death due to respiratory failure, heart failure or cerebral hemorrhage.
- A combination of drugs or their intake along with alcohol generally results in overdosing and even deaths.

Warning signs of drug/alcohol abuse

- Drop in academic performance,
- Unexplained absence from school/college,
- Lack of interest in personal hygiene,
- withdrawal,,isolation from family and friends
- Depression,
- Fatigue,
- Aggressive and rebellious behaviour,
- Loss of interest in hobbies,
- Change in sleeping and eating habits
- Fluctuations in weight, appetite, etc.

- If an abuser is unable to get money to buy drugs/alcohol he/she may turn to stealing. The adverse effects are just not restricted to the person who is using drugs or alcohol.
- a drug/alcohol addict becomes the cause of mental and financial distress to his/her entire family and friends.

- Those who take drugs **intravenously (direct injection into the vein using a needle and syringe), are much more likely to acquire serious infections like AIDS and Hepatitis B.**
- The viruses, which are responsible for these diseases, are transferred from one person to another by sharing of infected needles and syringes. Both AIDS and Hepatitis B infections are chronic infections and ultimately fatal. Both can be transmitted through sexual contact or infected blood.
- The use of alcohol during adolescence may also have long-term effects. It could lead to heavy drinking in adulthood. The chronic use of drugs and alcohol damages nervous system and liver (cirrhosis).
- The use of drugs and alcohol during pregnancy is also known to adversely affect the foetus.
- Another misuse of drugs is what certain sportspersons do to enhance their performance. They (mis)use narcotic analgesics, anabolic steroids, diuretics and certain hormones in sports to increase muscle strength and bulk and to promote aggressiveness and as a result increase athletic performance.

The side-effects of the use of anabolic steroids in females

- Masculinisation (features like males),
- Increased aggressiveness, mood swings,
- Depression, abnormal menstrual cycles,
- Excessive hair growth on the face and body,
- Enlargement of clitoris,
- Deepening of voice.

The side-effects of the use of anabolic steroids in Males

- Acne,
- Increased aggressiveness,
- Mood swings,
- Depression,
- Deduction of size of the testicles,
- Decreased sperm production,
- Potential for kidney and
- Liver dysfunction,
- Breast enlargement,
- Premature baldness,
- Enlargement of the prostate gland.

Prevention and Control

'Prevention is better than cure' holds true here also.

- **(i) Avoid undue peer pressure -** Every child has his/her own choice and personality, which should be respected and nurtured. A child should not be pushed unduly to perform beyond his/her threshold limits; be it studies, sports or other activities.
- **(ii) Education and counselling -** Educating and counselling him/ her to face problems and stresses, and to accept disappointments and failures as a part of life. It would also be worthwhile to channelize the child's energy into healthy pursuits like sports, reading, music, yoga and other extracurricular activities.
- **(iii) Seeking help from parents and peers -** Help from parents and peers should be sought immediately so that they can guide appropriately. Help may even be sought from close and trusted friends. Besides getting proper advise to sort out their problems, this would help young to vent their feelings of anxiety and guilt.
- **(iv) Looking for danger signs -** Alert parents and teachers need to look for and identify the danger signs discussed above. Even friends, if they find someone using drugs or alcohol, should not hesitate to bring this to the notice of parents or teacher in the best interests of the person concerned. Appropriate measures would then be required to diagnose the malady and the underlying causes. This would help in initiating proper remedial steps or treatment.
- **(v) Seeking professional and medical help** - A lot of help is available in the form of highly qualified psychologists, psychiatrists, and deaddiction and rehabilitation programmes to help individuals who have unfortunately got in the quagmire of drug/alcohol abuse. With such help, the affected individual with sufficient efforts and will power, can get rid of the problem completely and lead a perfectly normal and healthy life