10 Human Health and Diseases

Can you recall?

1. Generally individuals are conscious about their health. So define health.
2. Define infectious and non infectious disease? Give their examples.

Health does not simply mean 'absence of disease' or physical fitness. In fact, it is difficult to aptly define health. According to the World Health Organization, health is defined as the state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. In short, health is birth right of humans. Health also reflects the metabolic and functional efficiency of living organisms. Hygiene is a science of rules of health. To achieve good health, it is therefore, necessary that we have hygienic balanced diet, clean drinking water, personal and community hygiene, regular physical exercise, knowledge about diseases and their effect on body, proper disposal of waste and control of vectors.

Everyday we are exposed to various foreign bodies, including infectious agents like bacteria, viruses, etc. Despite constant exposure to variety of pathogens, most of us remain healthy. This is due to fact that the human body has ability to resist almost all type of these foreign bodies. The system which protects us from various infectious agents, is called **immune system**. Resistance is the ability to prevent the damage or disease, through our defense mechanism.

10.1 Immunity:

The term 'immunity' has traditionally referred to as the resistance exhibited by the host towards injury caused by pathogens and their products. However, protection against infectious diseases is only one of the many consequences of immune response, which is entirely concerned with the reaction of the body against any foreign **antigen**.

Immunity is in fact the "freedom" or "exempt". The concept of immunity is believed to be started by **Edward Jenner** in England. He developed cowpox vaccine for the protection against the attack of small pox (virus). **Immunology** is a branch of science which deals with the study of immune system, immune responses to foreign substances and their role in resisting infection by pathogens.

The most important characteristic of immune system is that it distinguishes self (body's own cells) and non-self (foreign molecules or invading cells). So, the immune system differentiates between the body cells and the invaders. Any foreign substance invading body and capable of stimulating an immune response, is called an **antigen**. The protective chemicals produced by immune cells in response to antigens are called **antibodies**.

A. Types of immunity:

There are two types of immunity as Innate or Inborn (inherited) immunity and Acquired or Adaptive immunity.

i. Innate immunity or Inborn immunity:

Innate immunity is the resistance to infections that an individual possesses by virtue of his or her genetic make-up. It is the natural (inborn) defense system of the body. It is not affected by prior contact with microorganisms or immunization. It is nonspecific, when it indicates a degree of resistance to infection in general, or specific where resistance to a particular pathogen is concerned. One form of innate immunity comprises the various types of barriers which prevent entry of foreign agents into the body.

a. Epithelial surface :

The intact skin and mucous covering the body, protect it considerably against invasion by microorganism(s).

The healthy skin possesses bactericidal activity due to the presence of high concentrations of salt in drying sweat. Sebaceous secretions and long chain of fatty acids have bactericidal and fungicidal properties. The mucosa of the respiratory tract has several innate mechanisms of defense. The nose prevents entry of microorganisms to a large extent, the inhaled particles being arrested through hair at or near the nasal orifices. Those that pass beyond are held by mucus lining the epithelium and are swept back to pharynx where they tend to swallowed or coughed out.

The cough reflex is an important defence mechanism of respiratory tract. The mouth is constantly bathed in saliva which has inhibitory effect on microorganisms. The acidity of gastric secretions in the stomach destroys microorganisms. The flushing action of urine eliminates bacteria from the urethra. Spermine and zinc present in semen are antibacterial.

Knowledge Enhancer:

The conjunctiva is freed of foreign particles by the flushing action of lachrymal secretions. Eyes become susceptible to infection when lachrymal secretion is absent. Tears contain the antibacterial substance Lysozyme (Ist described by A. Fleming). This is a thermolabile, low molecular weight, basic protein which acts as a muramidase. Lysozyme is active only against some pathogenic Gram +ve bacteria.

b. Antimicrobial substances in blood and tissues:

The complement system contains more than 30 serum proteins, circulating in the blood in an inactive state. The presence of microbial pathogens activates the 'Complement cascade' to eliminate pathogens. The interferons are a class of cytokines (soluble proteins) released by cells infected with viruses and certain white blood cells to stimulate other cells to protect themselves from viral infection.

c. Cellular factors in innate immunity :

Natural defence against the invasion of blood and tissues by microorganisms and other foreign particles, is mediated to a large extent by phagocytic cells which ingest and destroy them. Phagocytic cells (discovered by Metchnikoff in 1882) are grouped as microphages and macrophages. They remove foreign particles that enter the body. A class of lymphocytes called Natural killer (NK) cells is important in nonspecific defence against viral infections and tumors.

d. Fever :

Increase in the body temperature following the infection is a natural defense mechanism. It helps to accelerate the physiological processes to destroy the invading pathogens. Fever stimulates the production of interferon and helps in recovery from viral infections.

e. Acute phase proteins (APPs):

Infection on injury leads to a sudden increase in concentration of certain plasma proteins, collectively called acute phase proteins. These include C Reactive Protein (CRP), Mannose binding protein, Alpha-1-acid glycoprotein, Serum Amyloid P, etc. APPs are believed to enhance host resistance, prevent tissue injury and promote repair of inflammatory lesions.

ii. Acquired immunity:

The resistance that an individual acquires during life is known as "Acquired immunity". It is also known as Adaptive or Specific immunity". It involves the formation of antibodies in the body, which neutralize the antigens. Acquired or Adaptive immunity has the following unique features.

a. **Specificity:** It can produce specific antibody or T-lymphocyte against a particular antigen/pathogen.

b. **Diversity:** It can recognize a vast variety of diverse pathogens or foreign molecules.

c. **Discrimination between self and non-self:** It differentiates between own body cells (self) and foreign (non-self) molecules.

d. **Memory:** When the immune system encounters a specific foreign agent for the first time, it generates an immune response and eliminates the invader. This is called first encounter. The immune system retains the memory of the first encounter. As a result, a second encounter with same pathogen brings about quicker and stronger immune response.

Types of Acquired Immunity:

Acquired immunity is of two types Active and Passive.

a. Active immunity:

It is the resistance developed by individuals as a result of an antigenic stimulus. It also known as "Adaptive immunity". Active immunity may be natural or artificial.

1. **Natural Acquired Active immunity:** Immunity acquired due to infection is called natural active immunity. It is developed after entry of pathogens in the body. It is long-lasting immunity. e.g. person who has recovered from attack of measles develops natural acquired active immunity to measles, for the life time.
2. **Artificial Acquired Active immunity:** It is the resistance induced by vaccines. Vaccine is introduced into the body to stimulate the formation of antibodies by the immune system. e.g. Polio vaccine, BCG vaccine etc. such immunity may be temporary or permanent.

b. Passive immunity:

Passive immunity is acquired when ready-made antibodies are received by the body cells. i.e. Body cells do not take any active part in the production of immunity. Passive immunity can be acquired either naturally or artificially.

1. **Natural Acquired Passive immunity:** Before birth maternal antibodies are transferred from mother to foetus through placenta. After birth, antibodies are transferred from mother to infant through colostrum (first milk of mother) and continue throughout the period of breast feeding. The antibodies received by baby from mother remain in the body for a short time. Therefore, natural acquired passive immunity is short lived.
2. **Artificially Acquired Passive immunity:** This immunity is developed by injecting previously prepared antibodies using serum from humans or animals. For e.g. Antibodies obtained from hyper immunised horses are injected to humans against rabies pathogens. It is short lived.

B. Cells of Immune System:

There are two main types of cells involved in the working of Immune system. They are (a) Lymphocytes and (b) Antigen Presenting cells.

a. Lymphocytes:

Lymphocytes are the main cells of the immune system. They, like the other blood corpuscles, arise from the stem cells, the haemocytoblasts, present in liver of the foetus and in the bone marrow in adult. Some of them undergo differentiation in the gut – associated bursal lymphoid tissues (Tonsils, Peyer's patches) and are called **Bursal** or **B-lymphocytes**; others are differentiated in the thymus gland and are termed as **T-lymphocytes**. The mature lymphocytes pass into body fluids (blood and lymph) and circulate in the body.

Many of them stay in the lymph nodes. The B-lymphocytes and T-lymphocytes form humoral or antibody-mediated immune system (AMIS) and cell-mediated immune system (CMIS) respectively. Both the immune systems need antigens to come into action, but they respond in different ways.

Mechanism of response of T-lymphocytes to antigens: On coming in contact with an antigen, a T-lymphocyte forms clones of T-cells which are similar but they perform different functions. The clone has four types of T-lymphocytes:

i. **Helper T-cells:** Sensitized helper T-cells produce lymphokines for performing several types of functions like proliferation of other T-cells, stimulation of B-lymphocytes, macrophages, etc.

ii. **Killer T-cells** or **Cytotoxic T-cells:** They directly attack and destroy invading microbes, infected body cells and cancer cells. Killer T-cells bind to infected cell and secrete perforins. Then perforins form a hole in infected cell. It also releases substances that kill the cell, hence the name cytotoxic T-cell.

iii. **Suppressor T-cells:** These cells suppress entire immune system against attack on the own body cells.

iv. **Memory T-cells:** These are previously sensitized cells which retain the sensitization memory for long time in the future.

Mechanism of action of B-lymphocytes to antigens:

B–lymphocytes are sensitized directly by both antigens as well as by helper T-cells. Activated B-lymphocyte multiplies very fast to produce clone of plasma cells and memory B-cells. The plasma cells produce specialized glycoproteins, called antibodies which are circulated through body fluids (humor) like blood and lymph. The antibody molecules may bind to a cell membrane or they remain free.

The free antibodies have three main functions:

i. **Agglutination** of particulate matter, including bacteria and viruses. The immobilized mass is then engulfed by phagocytes.

ii. **Opsonisation** or coating of bacteria to facilitate their subsequent phagocytosis by macrophages.

iii. **Neutralization** of toxins released by bacteria e.g. tetanus toxin.

Each antibody is specific for a particular antigen.

b. Antigen Presenting cells:

Antigen presenting cells engulf invading pathogens and process the antigens. Then the processed antigens are presented on their own surface. These cells are able to deliver a stimulatory signal that is necessary for activation of helper T-cell.

Can you tell?

Which is kind of immunity provided by vaccination?

Can you recall?

1. Why are vaccines considered as antigen containing material?
2. How are vaccines produced?
3. Who was Edward Jenner?

C. Vaccination :

Administration of vaccine (i.e. inactivated pathogen or antigenic protection of particular pathogen) to protect against a particular pathogen, is called vaccination.

The body's immune system helps to protect against pathogens that cause infection. It's an efficient system, most of the time,. It either keeps microorganisms out or tracks them down and gets rid of them. However, some pathogens can overwhelm the immune system. When this happens, it can cause serious illness. The pathogens most likely to cause problems, are the ones the body doesn't recognize.

Vaccination is a way to "teach" the immune system as to how to recognize and eliminate pathogenic organism. That way, body is always prepared if you are ever exposed.

Vaccination is an important form of primary prevention, that can protect people from getting sick. Vaccination has allowed us to control diseases like measles, polio, tetanus and whooping cough that once threatened many lives. It's important that as many people as possible get vaccinated. Vaccinations don't just protect individuals, when enough people are vaccinated. It also helps to protect the society.

Do you know ?

How does vaccination work?

Healthy immune system defends against invaders. Immune system consists of several types of cells. These cells defend against harmful pathogens. However, they have to recognize an invader. Vaccination teaches the body to recognize new pathogens causing diseases. It stimulates the body to make antibodies against antigens of pathogens. It also primes immune cells to remember the types of antigens. This allows a faster response to the pathogen in future.

Vaccines work by exposing you to a safe version of pathogen. Vaccines may be in the form of:

- A protein or sugar from the pathogen.
- A dead or inactivated form of a pathogen.
- A toxoid containing toxin produced by a pathogen.
- A weakened (attenuated) pathogen.

When the body responds to the vaccine, it builds an adaptive immune response. This helps to equip the body to fight off an actual infection.

Internet my friend

Find out different types of vaccines available in the market and their significance.

Vaccinations are safe:

Vaccines are considered to be safe. They are rigorously tested and go through many rounds of study, examination, and research before they are used for the general public.

Extensive research and evidence shows that vaccines are safe their side effects are rare and typically mild.

Internet my friend

1. Whether vaccination can be done during or before pregnancy?
2. Will it be helpful to protect the mother and baby both?
3. Which vaccines can be administered before pregnancy? When can it be?
4. How will you increase awareness in the society on this issue?

10.2 Structure of Antibody:

Antibodies are glycoproteins which are highly specific to specific antigens. They are also known as **Immunoglobulins** (Igs), produced in response to antigenic stimulation. Antibodies are produced by plasma cells which in turn are formed by B–lymphocytes. The mature plasma cells produce antibodies at an extremely rapid rate i.e. about 2000 molecules per second.

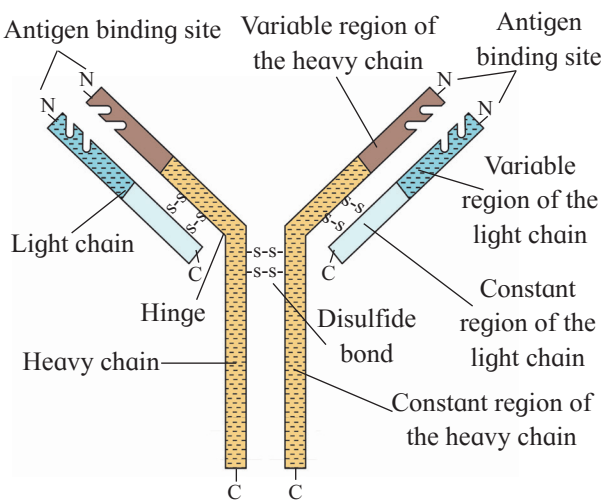

Fig. 10.1 : Structure of antibody

Structure:

Antibody is a 'Y' shaped molecule. Each immunoglobulin molecule is made up of four polypeptide chains. There are two heavy or **H-chains** and two light or **L-chains**. The four polypeptide chains are held together by **disulfide bonds** (-s-s-) to form a 'Y' shaped structure. The region holding together arms and stem of antibody, is termed as hinge. Each chain of the antibody includes two distinct regions, the variable region and the constant region. **Variable regions** constitute the antigen-binding site (**paratope**). This part of antibody recognizes and binds to the specific antigen to form an antigen-antibody complex. Since most antibodies carry two antigen binding sites, they are said to be bivalent.

Find out

Collect information about IgG, IgA, IgM, IgD and IgE antibodies from internet / reference book / teacher and prepare a chart / power point presentation.

Formation of antigen-antibody complex:

Study of antigen-antibody interactions is called **serology**. Each antibody is specific for a particular antigen. Combining sites of antigen, called antigenic determinants (**epitopes**) react with the corresponding antigen binding sites of antibodies called **paratopes**. The antigen binding sites (paratopes) are located on the variable regions of the antibody. Small variations in the variable regions make each antibody highly specific for a particular antigen. The variable region enables the antibody to recognize the specific antigen and bind to specific antigen in a lock and key manner forming an antigen-antibody complex.

Antigen on Blood Cells:

There are several known antigens on the surface of human red blood cells. These antigens give rise to different blood groups. There are many genetically determined blood groups system like ABO, Rh, Duffy, Kidd, Lewis, P, MNS, Bombay blood group, etc.

ABO Blood Groups:

The A, B and O blood groups were discovered by Karl Landsteiner in 1900. Later on, the blood group AB was discovered by Landsteiner's students Decastello and Sturli in 1902. Landsteiner was awarded the Nobel prize for his discovery of human blood groups. He found two antigens or agglutinogens on the surface of human red blood cells and named them as antigen A and antigen B. He also noticed the corresponding antibodies or agglutinins in the serum called 'a' and 'b'.

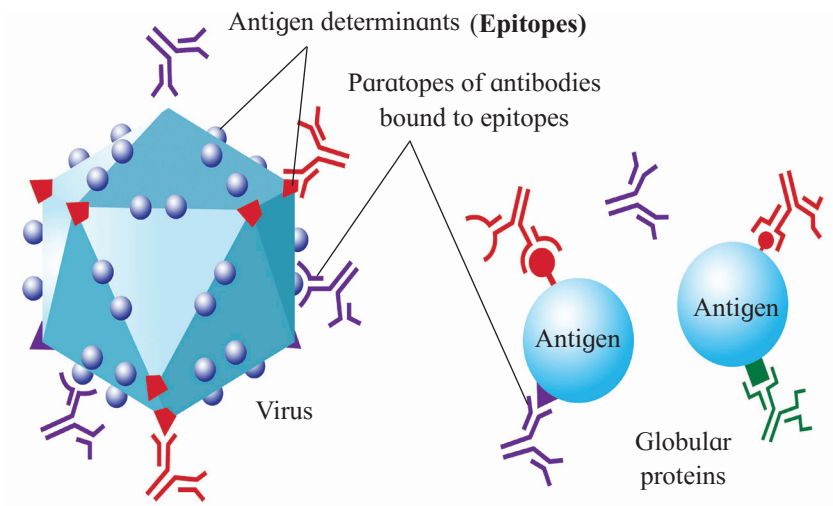

Fig. 10.2 : Formation of antigen- antibody complex

Table 10.3 : ABO Blood groups in man

Blood group	Genotype	Antigen on Surface of RBC	Antibody in Serum	Can donate blood to	Can receive blood from
A	$I^A I^A$ or $I^A I^O$	A	Antibody b	A, AB	A, O
B	$I^B I^B$ or $I^B I^O$	B	Antibody a	B, AB	B, O
AB (universal acceptor)	$I^A I^B$	A and B	Nil	AB	A, B, AB, O
O (universal donor)	$I^O I^O$	Nil	Both Antibody a and Antibody b	A, B, AB, O	O

In ABO system, the blood groups are determined by the presence or absence of antigen A and antigen B, the blood group of person is classified into four groups A, B, AB and O.

Blood group A : Individuals, with blood group 'A' have the antigen A on the surface of their red blood cells (RBCs) and antibody 'b' in their plasma.

Blood group B : Individuals with blood group 'B' have the antigen B on the surface of their RBCs and antibodies 'a' in their plasma.

Blood group AB : Individuals with blood group 'AB' have both antigens A and B on the surface of their RBCs and no antibodies in their plasma.

Blood group O – Individuals with blood group 'O' lack both antigens A and B on the surface of their RBCs and show presence of both 'a' and 'b' antibodies in their plasma.

Rh factor:

Rh is the most complex of the blood group system. Rh factor is an antigenic protein present on the surface of the red blood cells in the human beings. It was first discovered by Landsteiner and Wiener (1940), on the surface of RBCs of Rhesus monkey, so it is called Rh factor (also called D antigen). Person having Rh factor (D antigen) are called Rh positive (Rh +ve) and those lacking D antigen are called Rh negative (Rh -ve).

Rh (D) antigen induces a strong immunogenic response when introduced into Rh-ve individuals. Rh blood group is an important factor in blood transfusion and is involved in haemolytic diseases of the newborn (HDN), which is called **erythroblastosis foetalis** (destruction of the erythrocytes of the foetus). It occurs when an Rh -ve mother conceives Rh+ve foetus.

The Rh +ve RBCs from the foetus may enter the mother's circulatory system during child birth, causing her to produce anti-Rh antibodies. As a result, subsequent Rh+ve foetuses will be exposed to the anti-Rh antibodies produced by mother, which result in HDN. In order to prevent HDN, Rh -ve mother is injected with the anti-Rh antibody during all pregnancies carrying Rh +ve foetus.

Can you tell?

1. The blood group of Krutika is O Rh +ve. What would be the possible blood groups of her parents?
2. Mrunmayi is called as universal blood acceptor. What is her blood group?

Use your brain power

Can a person with blood group O Rh+ve donate blood to a patient with blood group O Rh-ve? Why?

10.3 Common Human Diseases:

Disease is defined as condition of disturbed or deranged functioning of one or more organs or organ systems of the body, caused due to infections, defective diet or heredity. All human diseases can be broadly categorized into **congenital** diseases and **acquired** diseases.

Congenital diseases are present from birth; may be caused by genetic abnormality or metabolic disorder. They may be permanent and were practically incurable. However, modern research has helped to cure some inborn diseases through gene therapy, enzyme replacement therapy, etc.

Acquired diseases develop after the birth and can be subdivided into (a) Communicable or infectious diseases or (b) Non- Communicable or Non-infectious diseases.

The diseases which are transmitted from infected person to another healthy person either directly or indirectly, are known as **Communicable** or Infectious diseases. Malaria and other diseases which are to be studied in this chapter, are examples of this type.

The diseases that cannot be transmitted from infected person to another healthy one either directly or indirectly are known as **Non- Communicable** or Non - Infectious diseases. Cancer and deficiency diseases are examples of this type.

Communicable diseases are caused by pathogens like viruses, bacteria, fungi, helminth worms, etc. All the disease causing organisms are called '**Pathogens**'.

Many pathogens use another organism, the '**Vector**' to reach us. These vectors are actually parasites which we regularly come across. **Parasite** is an organism that lives in or on the body of another organism and derives its nutrition from that of host organism. Parasites are of two categories viz. : 1. Ectoparasite E.g. bedbug 2. Endoparasite. e.g. *Plasmodium*.

A. Malaria :

It is a vector borne infectious disease caused by the protist, the *Plasmodium.*

There are four species of *Plasmodium* as *P. vivax , P. ovale, P. malariae, P. falciparum.* Only *P. falciparum* causes serious illness while others are rarely fatal. Based on the species, there are 4 - types of malaria.

Signs and symptoms of malaria **:-**

Symptoms of malaria begin to appear about 7 to 15 days after the bite of infective mosquito.

- Initial symptom are fever, headache, and chills, may be difficult to recognize as malaria.
- Classical symptoms of malaria is cyclic occurrence of high fever followed by sweating and sudden shievering. Such entire episode lasts for four to six hours and recurs every two days or three days.
- Vomiting and convulsions.
- Arthralgia (joint pain), aneamia due to rupturing of RBCs.
- Haemoglobinuria, hepatomegaly (liver enlargement).
- Retinal damage (eye).
- Cerebral malaria (brain infection).

Table 10.4 : Table showing different species of *Plasmodium*

Species of *Plasmodium*	Incubation period	Pattern of high fever
P. vivax	14 days	High fever after 48 hr interval
P. malariae	28 days	High fever after 72 hr interval
P. ovale	17 days	High fever after 48 hr interval
P. falciparum	12days	High fever at irregular intervals between 22-48 hrs

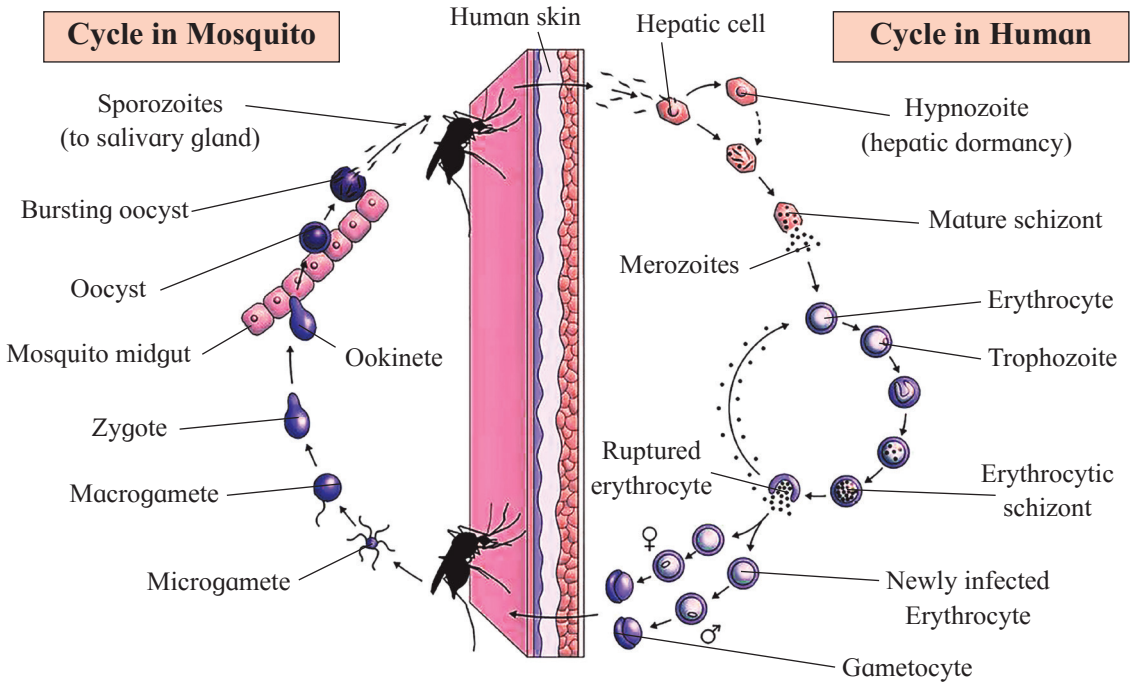

Fig. 10.5 : Stages in the life cycle of *Plasmodium* in mosquito and human

Mode of transmission :

Plasmodium is transmitted from one person to other through an insect vector- female *Anopheles* mosquito.

When infected female Anopheles sucks the human blood, it may transfer sporozoites to human circulation. Sporozoites reproduce asexually through fission (schizogony) in the liver cells or erythrocytes. The cells formed are now called merozoites. The cells formed within erythrocytes function as gametocytes (gamogony). Besides, it forms gametocytes within erythrocytes (gamogony).

Gametocytes if taken up by female Anopheles, fertilization occurs in its gut. Diploid zygote is formed which transforms into oocyst. Oocyst forms large number of haploid sporozoites through meiosis (sporogony). Sporozoites migrate to salivary glands and are ready to infect new human host.

Diagnosis and Treatment :

Malaria can diagnosed by microscopic study of blood smear. Besides, other rapid diagnostic tests based on nucleic acid amplification techniques are also used.

Treatment of malaria includes Artemisinin based combination therapies (ACTs). WHO has recommended 5 different ACTs which includes various combinations of artesunate, sulfadoxine, pyrimethamine, etc. In addition, quinine is also used.

Prevention and Control :

1. Prevention of mosquito bite by using mosquito nets and insect repellents.
2. Spraying insecticides and draining stagnant water where mosquito lays eggs.
3. Mosquito larve can be controlled by using *Gambusia* fresh water fish (biocontrol).

Always Remember

The time interval from the invasion of a pathogen to the development of clinical manifestations, is known as Incubation period.

B. Amoebiasis :

- Amoebiasis is also known as Amoebic dysentry. It's a common infection of human gastro-intestinal tract, which affects 15 % population of India.

- Amoebiasis is caused by a protist parasite- *Entamoeba histolytica.*

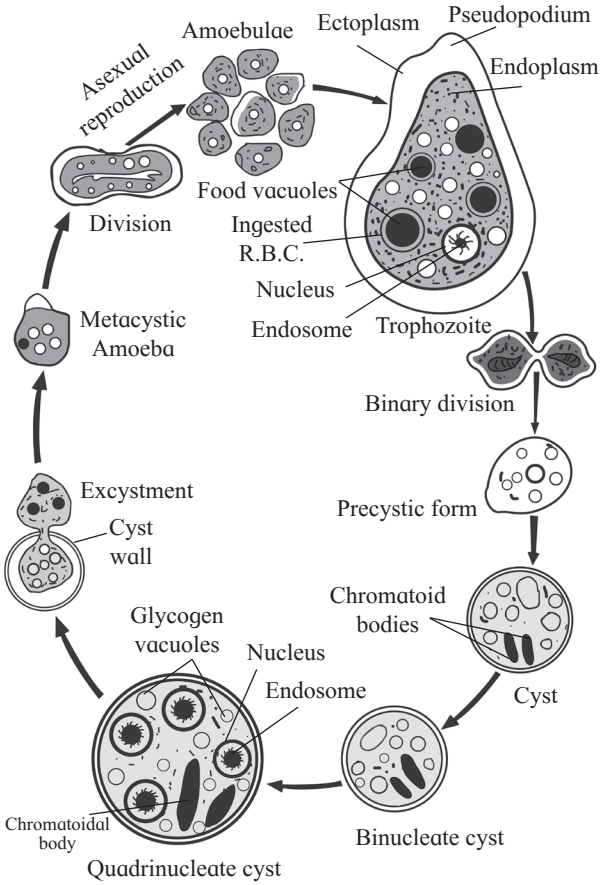

Fig. 10.6 : Life cycle of *Entamoeba histolytica*

Signs and symptoms:

- Diarrhoea, flatulence, stool with mucus and abdominal pains (cramps) are common.
- Passing of blood with stool is common in severe cases.
- Hepatomegaly occurs if parasite enters the liver. Liver develops amoebic liver abscess accompanied with fever and pain in right abdomen.

Mode of transmission :

- Faeco-oral route.
- Eating with dirty hands.
- Contaminated food and water.

Diagnosis and Treatment : Diagnosis of amoebiasis is made through microscopic examination of the stool sample.

Amoebiasis is treated by the use of Metronidazole and Tinidazole which can destroy the *E. histolytica* in the digestive tract as well as other tissues.

Prevention and Control : Wash hands with hot water and soap after using toilets and changing baby's diaper.

Drink boiled water. Otherwise, water must be chlorinated and filtered. Avoid eating unhygenic food. Vegetables must be properly washed and cooked. Proper sanitary facilities including sewage disposal help in prevention.

Internet my friend

Gather information about tropozoite and its occurrence in the life cycle of other parasitic protozoans.

C. Ascariasis :

It is an infectious disease of human intestinal tract, caused by roundworm- *Ascaris lumbricoides.Ascaris lumbricoides* is an endoparasitic round worm or nematode.

Signs and symptoms :

- Gastro-intestinal discomfort accompanied with vomiting and fever.
- Presence of live worms in feacal matter.
- Pulmonary disorders occur in some patients. Pneumonitis (inflammation in alveolar wall).
- Loss of apetite and weight loss.
- Eosinophilia (number of eosinophils is increased).

Mode of transmission: Food and drinks contaminated with the eggs of these worm is the main mode of transmission. Eggs hatch inside the intestine of the new host. The larvae pass through various organs and settle as adults in the digestive system.

Diagnosis and Treatment: Diagnosis can be done by microscopic examination of the stool.

Anti-helminthic drugs like Piperazine, Mebendazole, Levamisole, Pyrantel are effective against *Ascaris lumbricoides.*

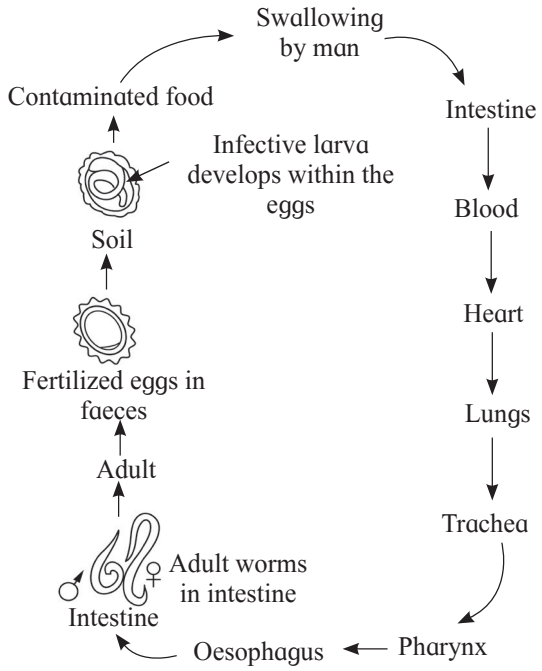

Fig. 10.7 : Life cycle of *Ascaris lumbricoides*

Prevention and Control : Avoiding defaecation in open space, prevents the spread of *Ascaris*. Personal hygienic habits like washing hand with water and soap after using toilet are also important. Washing vegetables throughly before cooking and avoiding raw vegetables is important for prevention of ascariasis.

D. Filariasis/ Elephantiasis :

Filariasis is caused by thread like worms-nematodes. These nematode parasites are transported from person to person via mosquito bite. Filariasis can be divided into 3 subtypes as 1) Lymphatic Filariasis, 2) Subcutaneous Filariasis (e.g. *Loa loa, Mansonella* spp.) and 3) Serous (abdominal)cavity Filariasis (e.g. *Mansonella* spp.).

Lymphatic Filariasis (Elephantiasis) is caused by the worms - *Wuchereria bancrofti*, *Brugia malayi, Brugia timori*.

Signs and symptoms :-

- Edema with thickening of skin and underlying tissue.
- *Wuchereria bancrofti* affects the legs, arms, breasts, scrotum, etc.
- In lymphatic filariasis, worms infect lymphatic system and causes enlargement of lymph vessels and nodes. This is elephantiasis i.e. limbs are swollen like legs of elephant.
- Lymphedema i.e. accumulation of lymh fluid in tissue causing swelling.

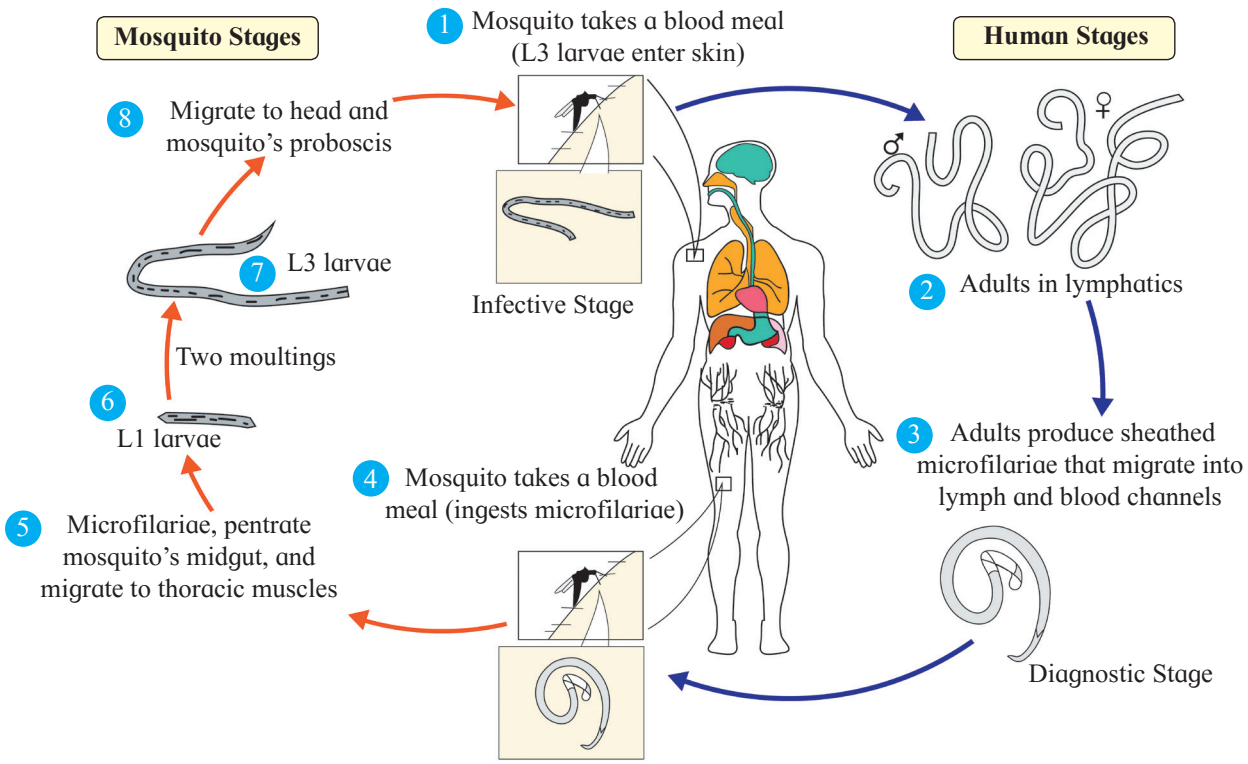

Fig. 10.8 : Mode of transmission - Filariasis (*Wuchereria bancrofti*)

- Hydrocele i.e. testis are enlarged due to accumulation of lymphatic fluid in testis.

Mode of transmission : *Wuchereria bancrofti* is transmitted to human body by female *Culex* mosquito.

The larvae escape mosquito body and arrive on the human skin. They penetrate the skin, undergo two moultings before they become adults and settle in the lymphatic system. Incubation period can be as long as 8-16 months.

Diagnosis and Treatment : Use of diethyl -carbamazine citrate twice a day for three weeks and thereafter for five days every six month is effective against filarial worms.

Prevention and Control : Avoid mosquito bite by using mosquito nets and insect repellents. Eradication of mosquitoes is essential for control of filariasis.

E. Typhoid :

Typhoid is an acute infection of intestine. It is caused by *Salmonella typhi.* It is Gram -ve bacteria found in intestinal lumen of infected preson. Pathogenicity is due to "O"- antigen, a lipopolysaccharide (LPS), present on surface coat. Flagella contains "H"- antigen.

Signs and Symptoms :

- Prolonged fever as high as 104^0F.
- General nausea, fatigue, headache.
- Abdominal pain, constipation or diarrhoea.
- Rose-coloured rash on skin.
- White coat on tongue, cough.
- Anorexia (loss of apetite).
- If not treated- breathlessness, irregular heartbeats, haemorrhage.

Mode of transmission :

- It is a food and water borne disease.
- Insects like housefly and cockroaches feeding on fecal matter, may transfer the bacteria to food material.
- Poor hygiene habits and poor sanitation conditions are responsible for the spread of typhoid.

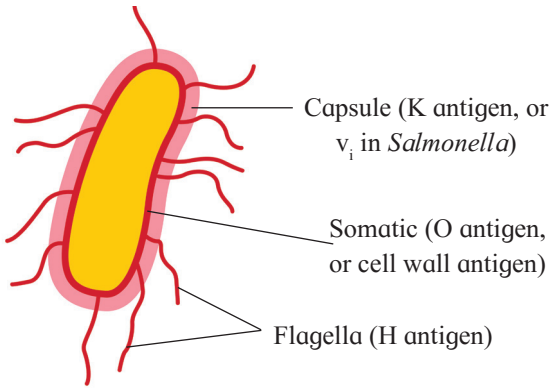

Fig. 10.9 : *Salmonella typhi*

Diagnosis and Treatment :- Widal test is used for diagnosis of typhoid. Treatment of typhoid involves surgical removal of gall bladder in severe cases. Antibiotics like Chloromycetin is helpful treatment.

For prevention of typhoid WHO recommendes two vaccines as oral (Ty21a vaccine) and injectable (Typhoid polysaccharide vaccine) sold as- typhim vi and typherix.

F. Pneumonia :

Pneumonia is an inflammatory condition of lungs or alveoli of lungs. It is caused by a variety of pathogens which may be viruses like influenza virus, adenovirus, para influenza and Respiratory Syncytial Virus (RSV) or bacteria like *Streptococcus pneumoniae* or *fungal pathogens* e.g. *Pneumocystis jirovecii* and *Pneumocystis carinii*. Pneumonia can also be caused by chemical burns or physical injury to lungs.

Signs and Symptoms :-

- Cough produces yellow or greenish sputum or phlegm.
- High fever.
- Shortness of breath (Dyspnea).
- Chest pain during deep breath or coughing.
- Loss of appetite, fatigue, headaches, vomiting, joint pains and muscle aches.

Mode of transmission : Pneumonia mostly spreads by direct person to person contact.

It can also spread via droplets released by infected person or even by using shared clothes and utensils.

Diagnosis and Treatment :- Course of treatment depends upon pathogen leading to the disease. For bacterial pneumonia, antibiotics like Benzyl penicillin, Ampicillin and Chloramphenicol are effective.

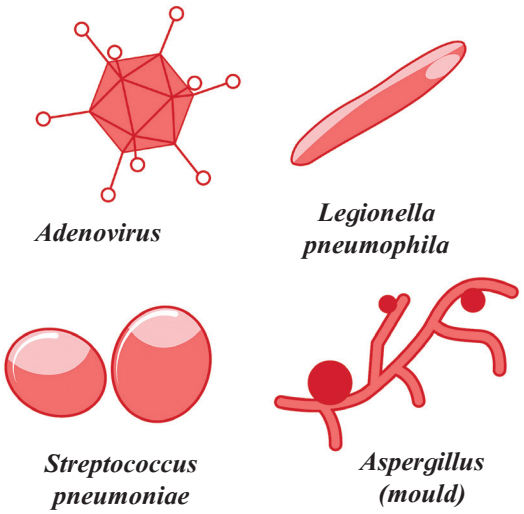

Fig. 10.10 : Pneumonia -Infectious agents

Prevention and Control :-

- Vaccination is important prevention in both children and adults.
- Vaccines against *Haemophilus influenzae* and *Streptococcus pneumoniae* in first year of life, help greatly to reduce the chances of causing Pneumonia.

Internet my friend

Find out other modes of infection by which a pathogen spreads from person to person.

G. Common Cold :

It is a viral infectious disease of upper respiratory region. It is also known as **nasopharyngitis**, acute viral rhinopharyngitis, acute coryza or a cold .

It is caused by a group of viruses known as Rhinoviruses and Coronaviruses.

Signs and Symptoms :

- Cough , sore throat, running nose and fever.
- Nasal congestion, sneezing.
- Conjunctivitis (red eyes)
- Muscle rashes, fatigue, headache, shivering and loss of appetite.

Prevention and Control :

- Staying away from person suffering from common cold.
- Washing hands with soap and water.
- Use of handkerchief to cover the nose and mouth during coughing and sneezing.
- Alcohol based hand sanitizer can also be used.

Can you tell?

Why do we suffer from common cold repetatively in our life, but other viral diseases like Influenza or Small pox only once?

H. Ring Worm (Dermatophytosis) :

It is fungal infection of skin. It is caused by many fungal species belonging to the genera *Trichophyton and Microsporum*. These fungi feed on keratin in skin, hair and nails.

Signs and Symptoms :

- Infected skin shows enlarged, red ring caused due to **ringworm**.
- Appearance of dry, scaly lesions on various parts of the body. These red patches cause intense itching.
- Infection to nails is termed as **onychomycosis**, in which nails become thick, discoloured and disfigured.
- Athlete's foot is the fungal infection that usually begins between the toes.

Mode of transmission :- Ringworm spreads by sharing of clothes, comb of infected person, etc. Close contact with infected person is another mode of infection.

Diagnosis and Treatment: Diagnosis is by physical examination and treatment uses drugs like nystatin, fluconazole, itraconazole, etc.

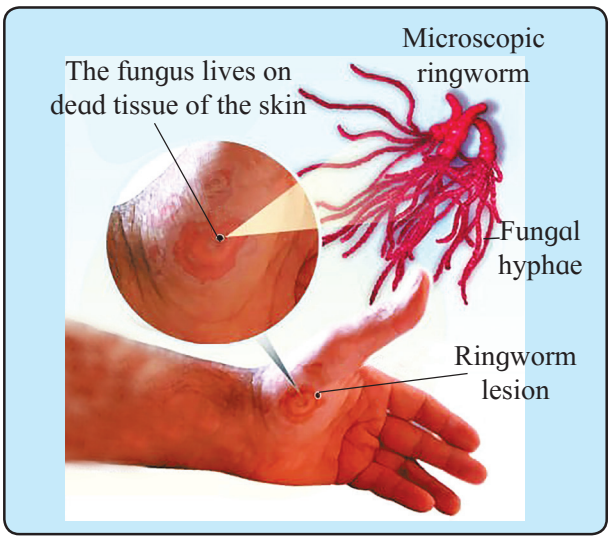

Fig. 10.11 : Ring Worm

Prevention and Control :

Avoid close contact, sharing of clothes, sport equipments. Washing clothes in hot water with fungicidal soap help to destroy fungal pathogen.

I. Dengue :

Dengue fever is a painful, debilitating vector borne disease, caused by any one of four closely related dengue viruses. Dengue virus is transmitted through the bite of female *Aedes* mosquito. The mosquito takes up the dengue virus when it sucks blood of a person suffering from dengue. It can not spread directly from one person to another person.

Can you tell?

1. Which are the diseases that can be avoided by eradication of mosquitoes in your area?
2. What are the various ways in which mosquitoes can be eradicated from any area?
3. What precautions will you take if you are travelling in an area which has lot of mosquitoes?

J. Cancer:

Abnormal, uncontrolled and purposeless division of cells may lead to the formation/ development of mass of undifferentiated cells i.e. tumor. When tumor is malignant, it is described as cancer and has ability to invade other tissues.

Cancer harms the body when cancerous cells divide uncontrollably to form new lumps or masses of tissue called **neoplasm** (except in the case of leukemia). Tumors can grow and interfere with the normal functioning of various organs. They also release secretions which alter body function(s).

It is one of the main killer diseases nowadays. Physicians and researchers who specialize in the study, diagnosis, treatment and prevention of cancer are called **oncologists**.

Tumors may develop anywhere in the body. However, all tumors are not cancerous. There are two types of tumors: **benign** or nonmalignant and cancerous or **malignant**.

1. Benign or Nonmalignant Tumor :

It grows slowly, may attain quite a large size, but it remains restricted to the site of its origin (localized) and does not spread to other part of the body. This does not necessarily mean that the benign tumors are not troublesome. Some benign tumors are harmful and fatal e.g. brain tumor (A brain tumor may cause death because the brain is squeezed against the hard skull). Moreover, the benign tumors may sometimes become malignant. e.g. Adenoma and Fibroid.

2. Malignant tumor or cancer :

The growth rate of this tumor is rapid and mortality rate is comparatively more than benign tumor. Rapid growth of tumors causes overcrowding and disruption of normal cells. The cancerous cells compete with the normal cells for nutrients and finally kill them.

These cells are spread from one organ to other via blood or lymph and form new tumors called secondary tumors. This migratory process is called **metastasis**.

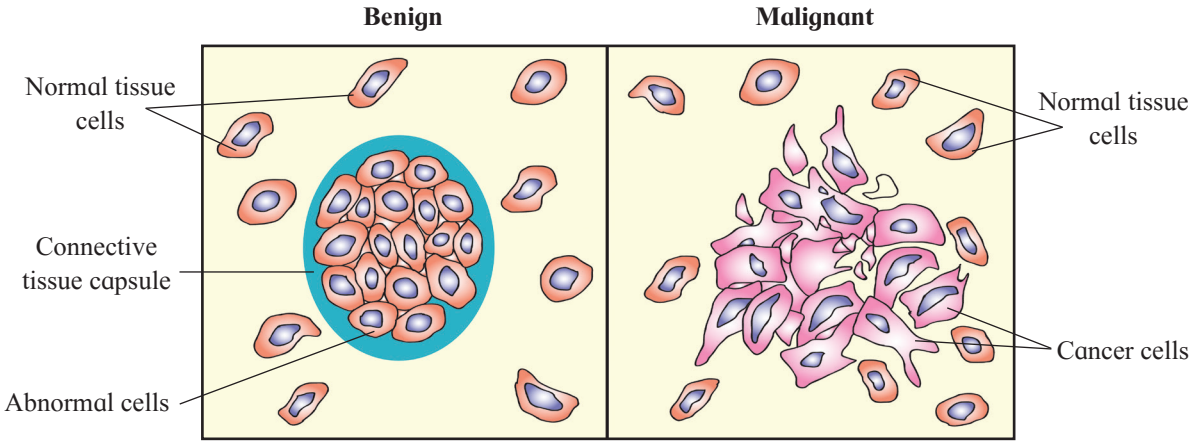

Fig. 10.12 : Benign and Malignant Tumor

a. Types of Cancer:

There are five main types of cancers according to the type of tissue affected. Cancers are named according to the tissue from which they arise.

i. **Carcinoma:** Cancer that arise from epithelial tissue covering or lining the body organs is known as carcinoma. It include breast cancer, lung cancer, cancer of stomach, skin cancer. etc.

ii. **Sarcoma:** Cancer that arises from connective tissue is called sarcoma. It include bone tumors (osteosarcoma), muscle tumors (myosarcoma), cancer of cartilage (chondrosarcoma) and cancer of adipose tissue (liposarcoma).

iii. **Lymphoma:** Cancer that arises from lymphatic tissue, is called lymphoma. It occurs in the lymphatic nodes, spleen and tissues of immune system.

iv. **Leukemia:** It is a type of blood cancer in which there is excessive formation of white blood cells (WBCs) or leucocytes in the bone marrow. People suffering from leukemia have very high leucocyte count. The blood contains millions of abnormal immature WBCs or leucocytes that are incapable of fighting infections. There are various types of leukemia such as monocytic leukemia, lymphoblastic leukemia etc.

v. **Adenocarcinoma:** Adenocarcinoma cancer arises in thyroid, pituitary, adrenal and other glandular tissues.

Find out

Collect information about different types of lymphoma and hereditary cancer syndromes.

b. Causes of Cancer:

Although, it is still not very clear as to how the cancer is caused, several factors are now known to be cancer- causing i.e. **carcinogenic**. These factors are as follows.

i. **Chemicals :** Several chemicals are known to induce cancer. These include nicotine, caffeine, products of combustion of coal and oil. Several polycyclic hydrocarbons, some sex hormone and steroids, if given or secreted in large amounts, may cause cancer. Breast cancer seems to have hormonal relationship. It is more commonly observed in women who avoid breast feeding.

ii. **Radiation :** The x-rays, gamma-rays cosmic rays, ultra-violet rays etc. are carcinogenic. Incidence of skin cancer is higher in the people working in very sunny areas due to UV radiation in the sunlight.

iii. **Viruses :** Viruses causing cancer have genes called viral oncogenes (v-onc genes).

These viruses are also called oncogenic viruses. e.g. EBV(Epstein-barr virus), HPV (Human papiloma virus) etc.

iv. **Oncogenes :** Several genes called cellular oncogenes (c-onc genes) or proto-oncogenes have been identified in normal cells which when activated under certain condition could lead to oncogenic transformation of cells.

v. **Addiction :** Different types addictions likes smoking, chewing of tobacco lead to cancer of mouth, lips and lungs. Alcohol consumption may result in cancer of oesophagus, stomach, intestine and liver. Drugs also cause cancer e.g. Marijuana, anaerobic steroids etc.

Try This

1. Find the Oncocenters nearby your area.
2. Prepare a chart of types of cancer and their preventive measures.
3. Organize a street-play on awareness about cancer and present it in your area.

Table 10.13 : Carcinogens and Organ Affected

Carcinogen	Organ affected
1. Soot	Skin, lungs
2. Coal tar (3,4 benzopyrene)	Skin, lungs
3. Cigarette smoke (N-nitrosodimethlene)	Lungs
4. Cadmium oxide	Prostate gland
5. Aflatoxin (a metabolite of *Aspergillus flavus*, a mould)	Liver
6. 2-naphthylamine and 4-aminobiphenyl	Urinary bladder
7. Mustard gas	Lungs
8. Nickel and chromium compounds	Lungs
9. Asbestos	Lungs
10. Diethylstilbestrol (DES)	Vagina
11. Vinylchloride (VC)	Liver

c. Treatment of Cancer:

Cancer treatment consists of combination of a number of therapies which are follows:

i. **Chemotherapy:** Chemotherapy comprises administration of certain anticancer drugs. The anticancer drugs check cell division by inhibiting DNA synthesis or are more toxic to cancerous cell than to normal cells. Chemotherapy may lead to hair loss or anaemia but both get corrected after the treatment is stopped.

ii. **Radiotherapy:** It is used in addition to chemotherapy. In radiotherapy, the basic principle is to bombard the cancerous tissue or cells with the rays from radioactive materials. For treatment, the cancer tissue or cells are exposed to radiations from radioactive materials such as cobalt, iridium and iodine. The x-rays, gamma rays and charged particles are used to destroy the cancerous tissue or cells but cause minimum damage to the surrounding normal tissue or cells.

iii. **Surgery:** In surgery, the entire cancerous tissue or cells are removed surgically. It has limited utility. In certain cases such as breast tumor or uterine tumor, the surgery is most effective, but other treatments are also given to kill any cancerous cell that may have been escaped in surgery.

iv. **Immunotherapy:** Tumor cell 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.

v. **Supportive therapy:** Supportive therapy is used to treat symptoms of cancer and side effects of cancer treatments. Objective of this therapy is to improve the quality of life of cancer patient. This therapy varies depending upon condition of individual patient.

Do you know ?

The Tata Memorial Hospital is situated at Khargar (Mumbai), Maharashtra in India. It is a special cancer treatment and research centre, closely associated with the Advanced Centre for Treatment, Research and Education in Cancer. It is recognized as one of the leading cancer centres in South Asia. It is an autonomous body funded and controlled by Department of Atomic Energy, Government of India which also oversees the administration of Institute since 1962.

K. AIDS :

AIDS, the **acquired immuno deficiency syndrome**, is a usually fatal illness caused by a retrovirus (ss RNA) known as the **human immuno deficiency virus (HIV)** which weakens the body's immune system, leaving the victim vulnerable to life –threating opportunistic infections, neurological disorders and unusual malignancies. AIDS can be called a modern pandemic (world wide), affecting both industrialized and developing countries.

AIDS was first noticed in USA in 1981. In India, first confirmed case of AIDS was in April 1986 from Tamil Nadu.

Structure of HIV:

HIV is 100 to 140 nm in diameter. It is spherical. Virus particle shows centrally located two ss RNA molecules along with reverse transcriptase enzymes. It is covered by two layers of proteins. The outer layer is of matrix protein (p17) while in inner layer is capsid protein (p24).

Over the matrix protein layers there is an additional layer of lipids. Impregnated with glycoprotein GP120 and GP 41 (Refer Fig. 10.14). The virus replicates in actively dividing T_4 lymphocytes and can remain in a latent state/stage in the lymphoid cells. The virus has unique ability to destroy human T_4 lymphocytes.

HIV is found in greatest concentration in blood, semen and cerebrospinal fluid (CSF) and to lesser extent in tears, milk, urine, saliva, cervical and vaginal secretions.

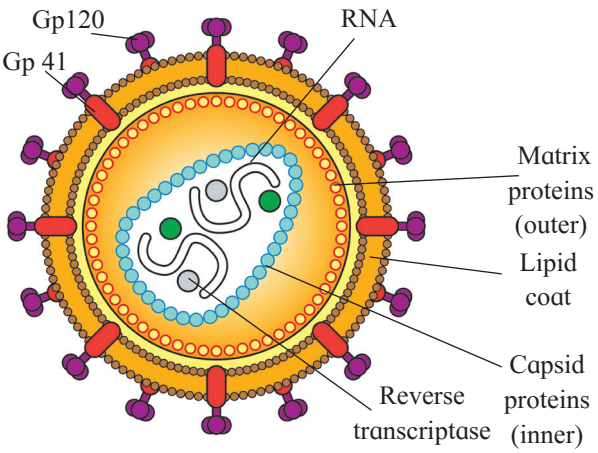

Fig. 10.14 : Structure of HIV

The virus can be transmitted through :

1. **Unsafe sexual contact:** Including oral, vaginal and anal sex.
2. **Blood :** Via blood transfusions or needle sharing.
3. **From mother to child** (Transplacental)**:** A pregnant woman can transmit the virus to her foetus through their shared blood circulation, or a **nursing mother** can transmit it to her baby from her breast milk.

Other methods of spreading of the virus are rare and include accidental needle injury, artificial insemination with infected donated semen and transplantation with infected organs.

AIDS virus has been found in urine, tears, saliva, breast milk and vaginal secretions but it seems not to be transmitted by these fluids unless it gets into injuries.

Always Remember

HIV infection is not spread by:

Causal contact such as hugging, insect bite (mosquitoes), participation in sports, touching items previously touched by a person infected with the virus, hand shake, sharing clothes, swimming pools etc.

Clinical manifestations:

The clinical manifestations (symptoms) of AIDS have been classified into four broad categories.

i. **Initial infection** with the virus and formation of antibodies, usually 2-8 weeks after initial infection.

ii. **Asymptomatic carrier state** in which no signs of disease, are seen. Incubation period ranges for 6 months to 10 years.

iii. **AIDS related complex** (ARC) with one or more of the following clinical signs: recurrent fever for longer than one month, fatigue, unexplained diarrhea, night sweats, shortness of breath, loss of more than 10 per cent body weight, etc.

iv. **AIDS** is the end stage of HIV infection. It is characterised by life threatening opportunistic infections (like pneumonia, tuberculosis, kaposi sarcoma, etc.).

Preventive measures:

AIDS has no cure, hence prevention is the best choice. The following steps help in preventing this dreadful disease-

i. People, particularly those in high –risk group, should be educated about HIV transmission.

ii. Disposable needles and syringes should be used and disposed off properly and immidiately.

iii. Sexual habits should be changed immediately.

iv. High-risk groups should refrain from donating blood.

v. Tooth brushes, razors, other articles that can become contaminated with blood should not be shared.

vi. Before receiving blood, ensure that it has been screened for not containing HIV infections.

vii. Routine screening must be done for –
- Blood donors.
- Organ donors (kidney, liver, lung, cornea).
- Donors of semen and growth hormone.
- Patients undergoing hemodialysis and females in high risk group who are pregnant or contemplating pregnancy.

Do you know ?

- Every year, December 1st is observed as World AIDS Day.
- India started a National AIDS control Programme in 1987.

"A red ribbon" is worn on World AIDS Day as a universal symbol of awareness and support for people living with HIV.

- In India, 5 AIDS reference centers have been established-
  1. AIIMS – New Delhi.
  2. National Institute of Virology, Pune.
  3. National Aids Research Institute, Bhosari, Pune (NARI)
  4. Center of advanced research on Virology, Vellore.
  5. National institute of communicable diseases, New Delhi.
- National AIDS Control Organization (NACO) was set up in year 1992 by the Ministry of Health and Family Welfare. The aim of this organization is to prevent further transmission of HIV, to decrease morbidity and mortality associated with HIV infection and to minimize the socio-economic impact resulting from HIV infection.

Laboratory diagnosis:

At first a test is used to detect the HIV antibodies, while a second confirmatory test is used to weed out any false positive results. The first test is **ELISA** (Enzyme-Linked Immunosorbent Assay). The confirmatory test, usually a **Western Blot**, is a highly specific test. It is based on detecting specific antibody to viral core protein and envelope glycoprotein.

Treatment of AIDS :

Although AIDS has no cure, certain medicines called as Antiretroviral drugs can help in reducing the viral load and prolong the life of HIV patient. Examples of these drugs used in Antiretroviral therapy (ART) are TDF (tenofovir), EFV(Efavirenz), Lamivudine (3TC), etc.

The advancements made in biological sciences have helped us to deal effectively with many infectious diseases. The use of vaccines and immunization programmes have enabled us to eradicate completely the dreadful diseases like small pox. A large number of other infectious diseases like polio, diphtheria, pneumonia and tetanus have been controlled to a large extent by the use of vaccines. Biotechnology is on the verge of making available newer and safer vaccines. Discovery of antibiotics and various drugs has also enabled us to treat effectively infectious diseases like tuberculosis.

10.4 Adolescence :

It is the period of begining with the appearance of secondary sexual characters and the termination with ceassation of somatic i.e. body growth. It can also be regarded as a transitional stage of physical and mental development of child occurring between puberty and the legal adulthood between 10 to 19 years of age where individual is no loger a child but not yet an adult.

Adolescence in fact is a phase rather than fixed time period in the life. It is a phase of development on many fronts like sexual and reproductive maturity, mental development, adult identity and transition from socio-economic and emotional dependence to relative independence.

Stages of Adolescence :

Adolescents are defined as individuals of 10 to 19 year age group. The government of India in its National youth policy defines adolescents as 13-19 years. Adolescence is divided in three stages (periods) viz. early stage, middle stage and late stage.

i. Early period (10 to 14 years) :

The changes include begining of the appearance of secondary sexual characters ; growth reaches to its peak; rapid physical growth; concrete thinking; defining boundries of dependence/independence; self exploration; developing body image; development of intense friendship; seeking to counter instability and evaluation.

ii. Middle period (15 to 17 years) :

It is characterized by almost complete development of secondary sexual characters; physical growth slows down, approximately 95 % of the adult stature is attained; thinking is more abstract; concrete thinking under stressful conditions; capablity for long range thinking; reestablishing of body image; sense of leadership and all powerfulness; preoccupied with romantic fantacy and attraction towards opposite sex; establishing peer group defining behavioral code; etc.

iii. Late period (18 to 19 years) :

It is characterized by establishment of total physical maturity, established abstract thinking, intellectual and functional identity; peer group recedes in favor of individual relationship, stable relationship and change from childhood to adulthood relationship.

Physical changes of adolescence :

- **Growth spurt** occurs in both boys and girls. In boys muscles develop, skin become oily, broadening of shoulders, cracking of voice, development of underarm and chest hair, pubic hair, facial hair, enlargement of penis and testis. In girls development of breast, widening of hip, development of underarm and pubic hair, enlargement of uterus and ovaries.
- **Sexual development :** Sex organs mature and enlarge, sexual desire, errection of penis in boys, sperm production, ejaculation, ovulation, menstruation and initiation of sexual behaviour.

Emotional and social changes :

These include - establishing own identity, fantacy, day dreaming, attention seeking behavior, emotional instability, full of energy, sexual attraction, rapid mood changes, conflicts with family, behavioural code (influence of peer group), self exploration and evaluation, formation of new relationships, peer pressure, etc.

Always Remember

- Avoid looking at your parents as the enemy. Try to understand that your parents are human beings, with their own needs and feelings.
- Listen to your parents with an open mind, and try to see their point of view.
- Share your feelings with your parents so that they can understand you better.
- Live up to your responsibilities at home and in school so that your parents will be more inclined to grant you the kind of independence you want and need.
- Bolster your criticisms of family, school and government with suggestions for practical improvements.
- Be as courteous and considerate to your own parents as you would be to the parents of your friends.

Mental Health and Adolescence:

Many of the emotional and social changes have implication on the mental health. Most of the mental health issues that people confront as adults begin to appear in adolesence . The mental health implication includes confusion, irritation, moodiness, frustration, nausea, less concentration, hyperactivities, anger, effects on life styles like obesity, addictions, accidents, leading to ill health, etc. The mental illness in fact is in terms of different forms of depression like insomnia and loss of energy.

Thus, mental illness (disorders or unfavourable changes) is associated with psychological or behavioural manifestations. These are broadly classified as either psychoses or neuroses. Psychoses include delusions, hallucinations, distrubance in the thinking process, etc. The psychoses lead to Alzheimer's disease, schizophrenia, depressive psychosis, amnesia (loss of memory), bullimia (extreme over indulgence in food), anxiety (fear or apprehension), anorexia nervosa (emotional aversion to food) and depression (sadness, inactivity reduced interest to enjoy life), etc. Neuroses include schizophrenia, illusions, hallucination, etc.

Adolescence is thus characterized by number of cognitive, emotional, behavioural, physical and attitudinal changes. These may lead to positive personality development which depend upon the relation with parents or to other conditions, or to conflicts with others. Infact, adolescents view their friends, peer group more important and influential than their parents. This may lead to various kinds of addictions like smoking, taking drugs, etc.

Treatment :

Treatment of such disorders should be preferentially with non-pharmacological approach with due respect to the rights of children. WHO has recommended evidence based guidelines under mental health Gap Action Programme (mhGAP).

10.5 Addiction :

This is a complex condition characterised by compulsive use of substance despite of its harmful consequences. Addiction may involve the use of substances (drugs) such as alcohol, opioids, cocaine, nicotine and others or behaviours such as gambling.

There is scientific evidence that the addictive behaviours share key neurobiological features. They intensely involve brain pathways of reward and reinforcement, affecting motivation, which involve the neurotransmitter dopamine. It is important to know that the neurological changes are reversible after the substance-use or behaviour is discontinued.

Addiction overall result in the impairment of physical, physiological and psychological functions of the body.

Causes of substances abuse during Adolescence

- Insufficent parental supervision and monitoring.
- Lack of communication between child and parents.
- Poorly defined rules.
- Family conflicts.
- Favorable parental attitudes towards alcohol and drug uses.
- Expectations from drugs use.
- Risk taking behavior.

Methods /measures to control drug abuse :-

1. Always remember 'Prevention is better than cure'.
2. Avoid undue pressure – A child should not be forced to perform beyond his /her capacities in studies, sports and other activities.
3. Education and Counselling of child to face problems and stress, to accept disappointments and failures as a part of life. Channelize the energy of child in sports, studies and other constructive activities.

10.6 Drugs Abuse :

Surveys and statistics show that use of drugs and alcohol has been on the rise especially among the youth. This is really a cause of concern as it could result in many harmful effects. Proper education and guidance would enable youth to safeguard themselves against these dangerous behaviour pattern and follow healthy lifestyle. **The drugs, which are commonly abused, are opioids, cannabinoids and alkaloids of coca.**

a. Opioids :

These drugs binds to opioid receptors present in central nervous system and gastro-intestinal tract. **Heroin**, otherwise called **smack** is chemically di-acetyl morphine. It is extracted from latex of poppy plant ***Papaver somniferum***. Heroin is depressent and slows down the activity of body.

b. Cannabinoids :

Interact with receptors present in brain. Inhalation and ingestion of these substances affect the cardiovascular system. These are obtained from inflorescences and the parts of *Cannabis sativa*. Marijuana, hashish, charas and ganja are other different forms of drugs obtained from this plant.

c. Cocain :

This is an alkaloid obtained from coca plant- *Erythroxylum coca*. It increases level of neurotransmitter-dopamine. Its excessive dosage causes extreme happiness, irritability, paranoia.

Hallucinogens (mind expanding drugs) **:**

These are alkaloids causing day-dreaming. Lysergic acid and cannabis are hallucinogenic substances. *Atropa bellodona* and *Datura*

spp. also have hallucinogenic properterties. Hallucination are unreal perceptions of unreal object due to the disorder of nervous system.

Do you know ?

Drugs like barbiturates, amphetamine, benzo-diazepins, lysergic acid diethylamide (LSD) are derived from plant *Cannabis sativa* are used as a medicine. It help the patient in contracting insomnia and depression.

Addiction and Dependence :

Because of the perceived benefits, drugs are used repeatedly. The most important thing, which one fails to realize, is the inherent addictive nature of alcohol and drugs. Addiction is a psychological attachment to certain effects –such as euphoria and a temporary feeling of well-being –associated with drugs and alcohol. These drive people to take them even when these are not needed, or even when their use becomes self-destructive. 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 and addiction. However, it should be clearly borne in mind that use of these drugs even once, can lead to addiction. In the absence of any guidance or counselling, the person gets addicted and becomes dependent on their use. Dependence is the tendency of the body to manifest a characteristic and unpleasant **withdrawal syndrome** if regular dose of drugs/ alcohol is abruptly discontinued. This is characterized by anxiety, trembling, nausea and sweating, which may be relieved when use is resumed.

Effects of Drug/ Alcohol Abuse :

The immediate adverse effects of drugs and alcohol abuse are manifested in the form of reckless behaviour, vandalism and 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 overdose and even deaths.

The most common **warning signs** of drug and alcohol abuse among youth include drop in academic performance, unexplained absence from school/college, lack of interest in personal hygiene, withdrawal, isolation, depression, fatigue, aggressive and rebellious behaviour, deteriorating relationships with family and friends, loss of interest in hobbies, change in sleeping and eating habits, fluctuations in weight, appetite, etc.

There may even be some far-reaching implications of drug/alcohol abuse. If an abuser is unable to get money to buy drugs/ alcohol he/she may turn to crime. At times, 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 likely to acquire serious infections like HIV and hepatitis B. Use of alcohol during adolescence may also have long-term effects like loss balance, liver cirrhosis, pancreatitis. It could lead to heavy drinking in adulthood.

Chronic use of drugs and alcohol damages nervous system and liver **(cirrhosis)**. Use of drugs and alcohol during pregnancy adversely affects the foetus.

Another misuse of drugs is that certain sports persons use drugs to **enhance performance**. They (mis)use narcotic analgesics, anabolic steroids, diuretics and certain hormones to increase muscle strength and bulk and to promote aggressiveness and overall improvement in their performance. Side-effects of the use of **anabolic steroids** in females include masculinization (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.

In males it includes acne, increased aggressiveness, mood swings, depression, and reduction of size of the testicles, decreased sperm production, kidney and liver dysfunction, breast enlargement, premature baldness, enlargement of the prostate gland. These effects may be permanent with prolonged use.

Prevention and Control :

The age-old adage (i.e. proverb) is 'prevention is better than cure' holds true for all addictions. It is also true that habits such as smoking, taking drug or alcohol are more likely to be taken up at a young age, more during adolescence. It is best to identify the situations that push an adolescent towards use of drugs or alcohol, and to take remedial measures well in time. **In this regard, the parents and the teachers have a special responsibility.**

Use your brain power

Deaddiction may be difficult but not impossible. Collect information about NGOs, working in the field of deaddiction.

Activity :

1. **Identify the name of the plant. Enlist different types of drugs derived/obtained from the same.**

2. **Prepare chart of different stages of adolescence mentioning the changes in growth, sexual development and emotional and social changes.**

Stages / Changes	I		II		III	
	Boy	Girl	Boy	Girl	Boy	Girl
Growth 1. 2. 3.						
Sexual development 1. 2. 3.						
Emotional and social 1. 2. 3.						

Exercise

Q. 1 Multiple Choice Questions

1. Which of the following is NOT caused by unsterilized needles?
   a. Elephantiasis
   b. AIDS
   c. Malaria
   d. Hepatitis B
2. Opium derivative is .....
   a. Codeine b. Caffeine
   c. Heroin d. Psilocybin
3. The stimulant present in tea is .....
   a. tannin b. cocaine
   c. caffeine d. crack
4. Which of the following is caused by smoking?
   a. Liver cirrhosis
   b. Pulmonary tuberculosis
   c. Emphysema
   d. Malaria
5. An antibody is .....
   a. molecule that binds specifically to an antigen
   b. WBC which invades bacteria
   c. secretion of mammalian RBC
   d. cellular component of blood
6. The antiviral proteins released by a virus-infected cell are called .....
   a. histamines b. interferons
   c. pyrogens d. allergens
7. Both B-cells and T-cells are derived from .....
   a. lymph nodes
   b. thymus glands
   c. liver
   d. stem cells in bone marrow
8. Which of the following diseases can be contracted by droplet infection?
   a. Malaria b. Chicken pox
   c. Pneumonia d. Rabies
9. Confirmatory test used for detecting HIV infection is .....
   a. ELISA b. Western blot
   c. Widal test d. Eastern blot
10. Elephantiasis is caused by .....
    a. *W. bancrofti* b. *P. vivax*
    c. Bedbug d. Elephant
11. Innate immunity is provided by .....
    a. phagocytes
    b. antibody
    c. T- Lymphocytes
    d. B- Lymphocytes

Q. 2 Very Short Answer Questions

1. What is the source of cocaine?
2. Name one disease caused by smoking?
3. Which cells stimulate B-cells to form antibodies?
4. What does the abbreviation AIDS stand for?
5. Name the causative agent of typhoid fever?
6. What is Rh factor?
7. What is schizont?
8. Name the addicting component found in tobacco.
9. Name the pathogen causing Malaria.
10. Name the vector of Filariasis.
11. Give the name of the causative agent of ringworm.
12. Define health.

Q. 3 Short Answer Questions:

1. What are acquired diseases?
2. Differentiate between antigen and antibody.
3. Name the infective stage of *Plasmodium*. Give any two symptoms of malaria.
4. Explain the mode of infection and cause of elephantiasis.
5. Why is smoking a bad habit?

6. What do the abbreviations AIIMS and CMIS denote?
7. What is a carcinogen? Name one chemical carcinogen with its target tissue.
8. Distinguish between active immunity and passive immunity.

Q. 4 Short Answer Questions

1. Differentiate between B-cells and T-cells.
2. What are the symptoms of malaria? How does malaria spread?
3. Write a short note on AIDS.
4. Give the symptoms of cancer.
5. Write a note on antigens on blood cells.
6. Write a note on antigens-antibody complex.
7. What are the various public health measures, which you would suggest as safeguard against infectious diseases?
8. How does the transmission of each of the following diseases take place?
   a. Amoebiasis b. Malaria
   c. Ascariasis d. Pneumonia
9. What measure would you take to prevent water-borne diseases?
10. Write a short note on typhoid.

Q. 5 Match the following.

Column I	Column II
a. AIDS	i. Antibody production
b. Lysozyme	ii. Activation of B-cells
c. B-cells	iii. Immunoglobulin
d. T-helper cells	iv. Tears
e. Antibody	v. Immuno deficiency

Q. 6 Long Answer Questions

1. Describe the structure of antibody.
2. Write a note on Vaccination.
3. What is cancer? Differentiate between bening tumor and malignant tumor. Name the main five types of cancer.
4. Describe the different type of immunity.
5. Describe the ill –effects of alcoholism on health.
6. In your view, what motivates the youngsters to take to alcohol or drugs and how can this be avoided?
7. Do you think that friends can influence one to take alcohol/drugs? If yes, how may one protect himself/herself from such an influence?

Project :

1. Collect information about the, symptoms and preventive measures treatments for Dengue, Swine flu and Tuberculosis (TB).
2. Browse the information about **COVID - 19** with respect to
   a. Structure
   b. Modes of infection
   c. Preventive measures
   d. Treatment