Chapter 8

Human Health and Disease

Human Health, Diseases & Immunity

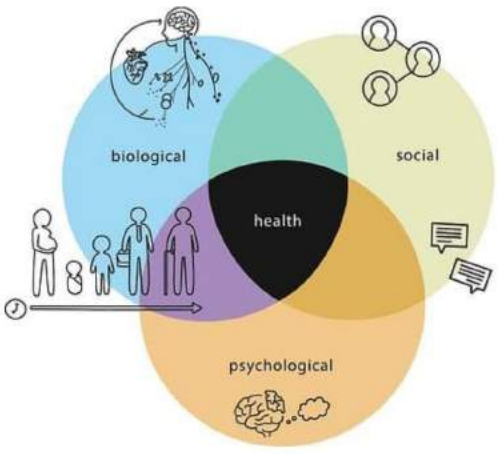
What is Health?

According to the World Health Organization (WHO), health is not only the absence of disease or illness. It is a state of an active and energetic condition of human beings including their physical, mental, and social well-being.

When people are healthy, they are more efficient at work. This increases productivity and brings economic prosperity. Health also increases the longevity of people and reduces infant and maternal mortality.
There are many factors that affect health, such as:

- Poorly balanced diet.
- Genetic Disorders.
- Stress, and anxiety.
- Infection from pathogens.
- Intake of unhealthy and unhygienic food.
- Lack of exercise and other physical activities.

To maintain good health, an individual should include a healthy and balanced diet, maintain personal hygiene along with regular exercise and other physical activities.



Biopsychosocial Model of Health

Everyone should be aware of the different types of diseases and their effects.

What are Diseases?

A disease is an abnormal condition affecting a healthy living organism. It is broadly divided into infectious and non-infectious.

1. Infectious Diseases: These diseases are caused by the pathogens, such as bacteria, viruses, fungi, parasites and can be easily transmitted from one person to another, hence it is also known as a contagious or communicable disease. Common Cold, Tuberculosis, flu, ringworm, malaria are some examples of infectious diseases.

2. Non-infectious Diseases: Diseases that cannot be transmitted from one person to another are called non-infectious disease, it is also known as a non-communicable disease. These diseases can be either caused by genetic disorders, unhealthy diets, lack of physical activity, excessive use of tobacco, drugs, or alcohol, and few environmental factors.

Types of Diseases

The human body suffers from many diseases, it can be due to genetic defects, infections or an unhealthy lifestyle.

Diseases can be classified into two types:

1. **Congenital Diseases:** Genetic defects present by birth. This may be due to gene mutation, chromosomal aberration, or environmental effects. Chromosomal and gene defects are transmitted to the next generation. E.g. Haemophilia, color blindness, Down syndrome, Turner's syndrome, etc.
2. **Acquired Diseases:** Diseases acquired during a lifetime.
   (i) Infectious or communicable disease: transmitted from one person to another
   (ii) Non-communicable disease: doesn't spread by infection
   (iii) Deficiency disease: caused due to deficiency of an important nutrient, enzyme, or hormones, e.g. anemia, kwashiorkor, beriberi, diabetes, etc.
   (iv) Allergies: hypersensitivity to foreign substances, e.g. pollen, dust, mites, etc.

Common Infectious Diseases in Humans

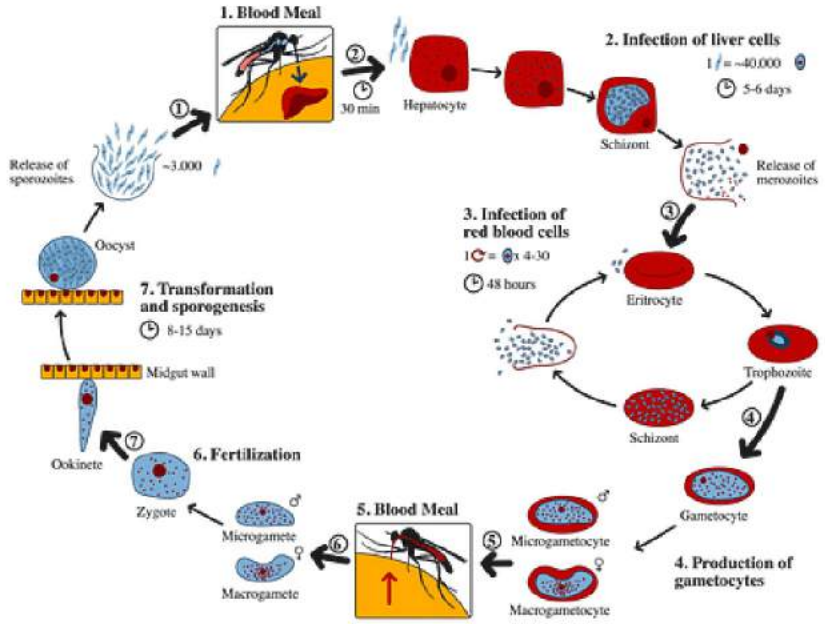
- The disease-causing organism is known as a pathogen, e.g. bacteria, virus, protozoan, fungi, worms
- There are many ways by which a pathogen can enter our body

Name of the disease	Causing agent/ pathogen	Vector/ mode of infection	Symptoms	Effects
Typhoid	Salmonella typhi (Bacteria)	by contaminated food and water	continued high fever, headache, stomach ache, constipation and loss of appetite	- can be diagnosed by Wilda test - intestinal perforation in severe cases
Pneumonia	Streptococcus pneumoniae, Hemophilus influenzae (Bacteria)	by inhaling droplets or aerosols released by an infected person or using infected utensils	fever, chills, cough and headache	respiration problems due to fluid that gets filled in the alveoli
Common cold	Rhinoviruses	by cough, sneezes and contaminated objects	nasal congestion and discharge, sore throat, cough, headache	nose and respiratory passage
Malaria	Plasmodium falciparum, P. vivax (Protozoan)	- female anopheles' mosquito is a vector - spread by mosquito bite	high fever with chills	-the parasite multiplies in liver cells, attacks RBCs and rupture
Amoebic dysentery	Entamoeba histolytica (Protozoan)	- houseflies are a carrier - spread by contaminated food by the faecal matter	constipation, abdominal pain, mucous and blood in the stool	infection in the large intestine
Ascariasis	Ascaris (Helimenthes)	- contaminated water, vegetables, fruits - parasite eggs are excreted us in faeces of the infected person, which contaminates soil	muscular pain, internal bleeding, anaemia, fever	blockage of intestinal passage
Filariasis/ Elephantiasis	Wuchereria bancroftian, W. malayi (Helminthes)	bloodsucking black flies and female mosquitos act as a vector	inflammation of the lower limb and genital organs	lymphatic vessels, especially of the lower limbs, get blocked
Ringworms	Microsporum, Trichophyton, Epidermophyton (Fungi)	spread from the soil, using a towel, clothes or comb of an infected person	dry scaly lesions, itchy skin in the groin or between the toes	effects skin, nail scalp

The Lifecycle of Plasmodium (Malarial Parasite)

- Plasmodium enters the body by the bite of female Anopheles mosquitos
- The infectious form is sporozoites, which comes from the saliva of female anopheles when they bite
- It multiplies in the liver cells and then attacks RBCs resulting in RBCs rupture
- Haemozoin, a toxic substance gets released

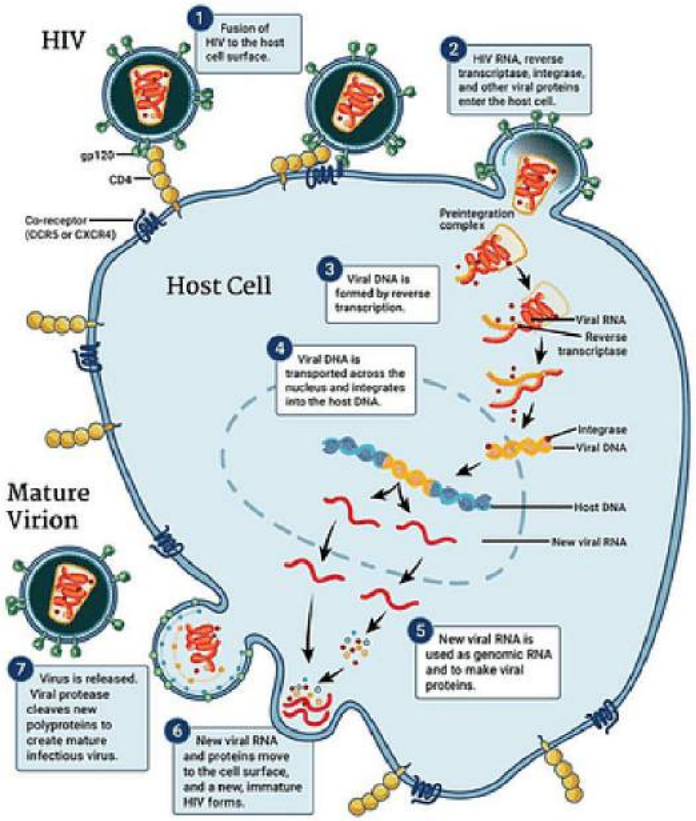
- The gametocyte produced in the human blood gets transferred to the mosquito when it bites an infected person
- Macro and micro gametocyte undergo fertilization, transformation and sporogenesis in the mosquito's intestine and sporozoites are formed
- Sporozoites migrate to the salivary gland of mosquito and the cycle is repeated
- Plasmodium sp needs human and female Anopheles mosquito to complete their lifecycle



AIDS (Acquired Immuno Deficiency Syndrome)

- Caused by HIV (Human Immuno Deficiency Virus)
- It is a retrovirus with RNA as its genome
- The virus produces viral DNA in the host by the enzyme reverse transcriptase
- The viral DNA gets incorporated into the host genome and multiple copies of the virus are produced
- The virus attacks helper T-cells, where it replicates and multiplies, resulting in a marked decrease in the number of T lymphocytes
- The infected person becomes immunodeficient after the virus attacks T-helper cells
- AIDS patients become prone to various infections like mycobacterium, toxoplasma, fungal, and other viral infections
- ELISA (Enzyme-Linked Immuno-Sorbent Assay) is a widely used diagnostic test for AIDS

- AIDS may be transmitted by sexual intercourse, contaminated blood transfusion, using an infected syringe, or from mother to foetus through the placenta
- NACO (National AIDS Control Organisation) works for the awareness and prevention of AIDS by educating people



HIV Virus Replication Cycle

Cancer

- Cancer is caused due to uncontrolled cell division leading to the formation of tumours
- There is a breakdown of regulatory mechanism in the oncogenic transformation of normal cells
- Cancerous cells lack contact inhibition property, which inhibits further growth of cell on contact with other cells
- **Benign tumours** are non-invading and remain confined to their original location

- **Malignant tumours** have invading ability and damage surrounding tissues
- **Metastasis:** It is a property of malignant tumour when cells sloughed off from it reach distant sites and form a tumour in the various parts of the body
- Cancer is caused due to DNA damage or genetic mutation resulting in the faulty regulation of the cell division
- Cancer can also be caused due to the activation of proto-oncogenes present in normals cells under certain condition
- **Carcinogens:** ionising radiation (e.g. X-rays, gamma rays), non-ionising radiation (UV rays), chemical agents (e.g. present in tobacco), viral oncogenes of oncogenic viruses
- Cancer can be diagnosed by using a CT scan (computed tomography), MRI (magnetic resonance imaging), X-ray, PET scan (positron emission tomography) or by histopathological studies of tissue and blood
- Cancer can also be diagnosed using molecular biology techniques to identify inherited susceptible genes for certain cancers
- Antibodies against cancer antigens can also be used for diagnostic purpose
- Cancer can be treated by surgery, transplantation, immunotherapy, radiation therapy
- **α**-interferon act as biological response modifier, which activates the immune system to destroy tumour

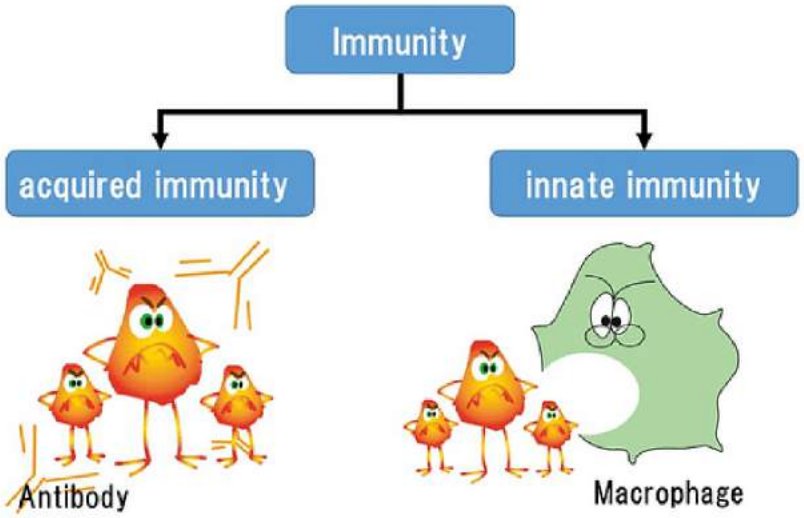
What is Immunity?

Immunity is the ability of the body to defend itself against disease-causing organisms.

- Every day our body comes in contact with several pathogens, but only a few result in diseases.
- The reason is, our body has the ability to release antibodies against these pathogens and protects the body against diseases. This defense mechanism is called **immunity**.

Types of Immunity

1. Innate Immunity or Natural or Non-specific Immunity
2. Acquired Immunity or Adaptive Immunity.



Types of immunity

1. Innate Immunity

- This type of immunity is present in an organism by birth.
- This is activated immediately when the pathogen attacks. Innate immunity includes certain barriers and defense mechanisms that keep foreign particles out of the body.
- Innate immunity refers to the body's defense system.
- This immunity helps us by providing the natural resistance components including salivary enzymes, natural killer cells, intact skin and neutrophils, etc. which produce an initial response against the infections at birth prior to exposure to a pathogen or antigens.
- It is a long-term immunity in which our body produces antibodies on its own. Our body has few natural barriers to prevent the entry of pathogens.

Types of Barriers

The four types of barriers are:

- **Physical barrier**
  These include the skin, body hair, cilia, eyelashes, the respiratory tract, and the gastrointestinal tract. These form the first line of defense. The skin does more than providing us with fair or dark complexions. Our skin acts as a physical barrier to the entry of pathogens. The mucus coating in our

nose and ear is a protective barrier that traps the pathogen before it gets inside.

- **Physiological barriers**
  We know that our stomach uses hydrochloric acid to break down the food molecules. Due to such a strongly acidic environment, most of the germs that enter our body along with the food are killed before the further process is carried on.
  Saliva in our mouth and tears in our eyes also have the antibiotic property that does not allow the growth of pathogens even though they are exposed all day.
- **Cellular barriers**
  In spite of the physical and physiological barriers, certain pathogens manage to enter our bodies. The cells involved in this barrier are leukocytes (WBC), neutrophils, lymphocytes, basophil, eosinophil, and monocytes. All these cells are all present in the blood and tissues.
- **Cytokine barriers**
  The cells in our body are smarter than we give them credit for. For instance, in case a cell in our body experiences a virus invasion, it automatically secretes proteins called interferons which form a coating around the infected cell and prevent the cells around it from further infections.

Cells Involved In Innate Immunity

- **Phagocytes:** These circulate through the body and look for any foreign substance. They engulf and destroy it defending the body against that pathogen.
- **Macrophages:** These have the ability to move across the walls of the circulatory system. They release certain signals as cytokines to recruit other cells at the site of infections.
- **Mast Cells:** These are important for healing wounds and defense against infections.
- **Neutrophils:** These contain granules that are toxic in nature and kill any pathogen that comes in contact.
- **Eosinophils:** These contain highly toxic proteins that kill any bacteria or parasite in contact.
- **Basophils:** These attack multicellular parasites. Like the mast cells, these release histamine.
- **Natural Killer Cells:** These stop the spread of infections by destroying the infected host cells.

- **Dendritic Cells:** These are located in the tissues that are the points for initial infections. These cells sense the infection and send the message to the rest of the immune system by antigen presentation.

2. Acquired Immunity

- Acquired immunity or adaptive immunity is the immunity that our body acquires or gains over time. Unlike innate immunity, this is not present by birth.
- The ability of the immune system to adapt itself to disease and to generate pathogen-specific immunity is termed **acquired immunity.** It is also known as **adaptive immunity.**
- An individual acquires immunity after birth, hence is called the **acquired immunity.**
- It is specific and mediated by antibodies or lymphocytes which make the antigen harmless.
- The main function of acquired immunity is to relieve the victim of the infectious disease and also prevent its attack in the future.
- It mainly consists of an advanced lymphatic defense system that functions by recognizing the own body cells and not reacting to them.
- The immune system of our body identifies the pathogens which have encountered in the past. It is mainly caused when a person comes in contact with the pathogen or its antigen.
- Our body starts producing antibodies to engulf the pathogen and destroy its antigen.
- When it encounters for the first time, it is called a primary response. Once a body gets used to these pathogens, antibodies are ready to attack them for the second time and are known as naturally acquired immunity.
- The acquired immunity in our body has certain special features.

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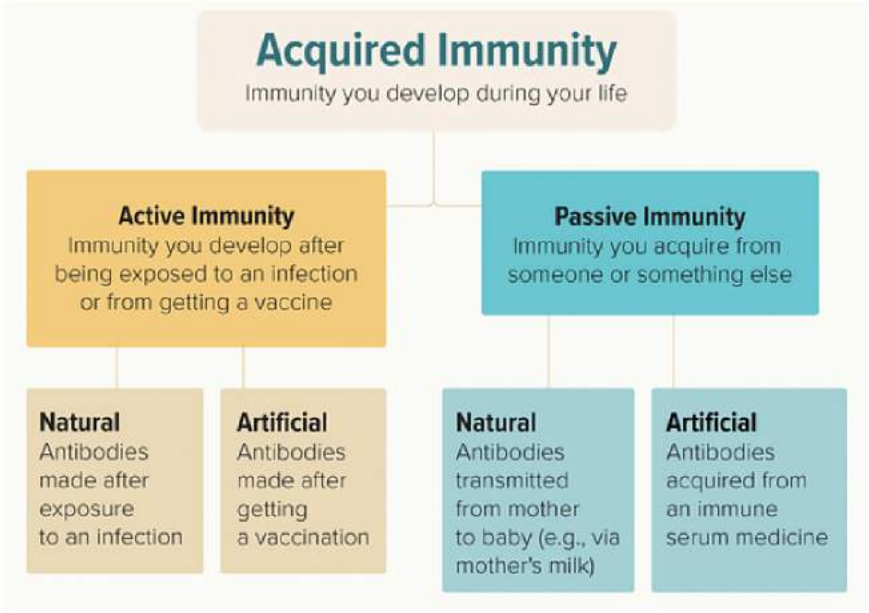


Types of acquired immunity

Features of Acquired Immunity

- **Specificity:** Our body has the ability to differentiate between different types of pathogens, whether it is harmful or not, and devise ways to destroy them.
- **Diversity:** Our body can detect vast varieties of pathogens, ranging from protozoa to viruses.
- **Differentiate between self and non-self:** Our body has the unique ability to differentiate between its own cells and foreign cells. It immediately starts rejecting any foreign cell in the body.
- **Memory:** Once our body encounters a pathogen, it activates the immune system to destroy it. It also remembers what antibodies were released in response to that pathogen, so that, the next time it enters, a similar procedure is followed by the body to eliminate it.

Cells Involved in Acquired Immunity

The acquired immunity involves two types of cells: **B-cells and T-cells**
B-cells

- They develop in the bone marrow.
- These cells are activated on their encounter with foreign agents. These foreign particles act as foreign markers.

- The B-cells immediately differentiate into plasma cells which produce antibodies specific to that foreign particle or so-called antigen.
- These antibodies attach to the surface of the antigen/foreign agent.
- These antibodies detect any antigen in the body and destroy it.
- The immunity dependent on B-cells is called humoral immunity.

T-cells

- They originate in the bone marrow and develop in the thymus.
- T-cells differentiate into helper cells, cytotoxic cells, and regulatory cells. These cells are released into the bloodstream.
- When these cells are triggered by an antigen, helper T-cells release cytokines that act as messengers.
- These cytokines initiate the differentiation of B-cells into plasma cells which release antibodies against the antigens.
- The cytotoxic T-cells kill the cancer cells.
- Regulatory T-cells regulate immune reactions.

Types of Acquired Immune Response

Humoral Immune Response

- The antibodies produced by B-lymphocytes are present in the blood cells and they are transported all over the body. This is why it is called the humoral immune response as it consists of an antibody produced by the lymphocytes.
- It depends upon the action of antibodies circulating in the body. When an antibody on a B-cell binds with an antigen, humoral immunity comes into play. The antigen is internalized by the B cell and presented on the helper T cell. This activates the B-cell.
- The activated B cells grow and produce plasma cells.
- These plasma cells release antibodies in the bloodstream. The memory B cells retain the information about the pathogen to prevent any disease caused by that pathogen in the near future.

Cell-mediated Immune Response

- Cell-mediated immunity is initiated by the T helper cells.
- The cytotoxic T cells eliminate the infected cells from the body by releasing toxins, thereby, promoting apoptosis or programmed cell death.
- The T helper cells help to activate other immune cells. Cell-mediated immunity becomes clear in the case of transplant patients.

- When any of our sense organs stop functioning, it can be transplanted to replace the malfunctioning organs. But it is not that simple with the immune response. It appears that T-lymphocytes are capable of recognizing whether tissue or an organ is from our body or foreign bodies. This is the reason why we cannot transplant and implant the organs into our body even if we find the donor with the same blood group because our body might reject the transplanted organ.
- The T-cells quickly recognize that the tissue or an organ is foreign and do not allow it to become a part of the body. This is why transplant receivers have to take immunosuppressant medication for the rest of their lives. This response is controlled by the T-lymphocytes.

Types of Acquired Immunity

a. Active Immunity

- Active immunity involves the direct response to a foreign antigen within the body. In the case of the acquired or adaptive immune system, the body remembers the pathogens it has encountered in the past. This is a direct result of the active immune system.
- Active immunity occurs when we are in contact with the pathogen or its antigen.
- Antigens stand for antibody generator. It is with the help of antigens released by the pathogen that our body tackles the pathogen.
- So what our body does is, it starts producing antibodies to attack the pathogen based on its antigen. When this happens for the first time, it is called a primary response. Once a body experiences a pathogen for the first time, it keeps a few of the antibodies that attacked the pathogen just in case it attacks for the second time. This is known as natural active immunity.

b. Passive Immunity

- Passive immunity involves the immune response by the antibodies attained from outside the body. The primary response by the body to a pathogen it encounters for the first time is rather feeble, so the first encounter is always a little harsh on the body.

What if we could immunize everyone without the need for them ever getting sick?

- Biotechnology has grown tremendously in the last decade or two and now we are capable of manufacturing antibodies for diseases. These ready-

made antibodies protect the body even if the body hasn't yet experienced a primary response.

- While active immunity may protect us from a disease for a lifetime, passive immunity is more short-term.
- Passive immunity develops immediately and our body could begin its attack on the pathogen right away.

There are two types of passive immunity:

- Natural Passive Immunity
- Artificial Passive Immunity

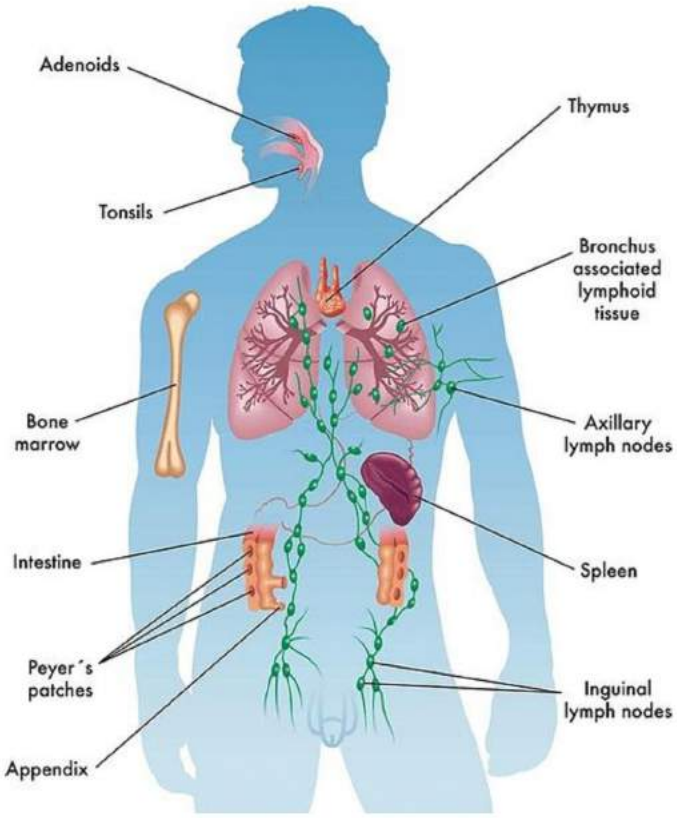
Auto-Immunity

- Sometimes the immune system attacks its own tissues and organs instead of the foreign agents. This is called **autoimmunity**. Type I diabetes is an example of an autoimmune disease.

Vaccines

- A vaccine is made up of the antigens of the pathogen that cause the disease. For eg., the smallpox vaccine contains the antigens of the pathogen causing smallpox disease. When a person is vaccinated with the smallpox vaccine the antibody-producing cells are stimulated that produce smallpox antibodies. Thus, the body is protected against the disease occurring in the future.
- Vaccinating pathogenic microbes into our body deliberately produces a similar response and is termed **artificially acquired immunity.**
- Immunization is a process providing resistance to pathogenic microbes and other infectious diseases by the administration of a vaccine into the body. By immunization, it stimulates the body's immune system to protect against subsequent infection or disease.

Immune System in the Body



Major Immune components of lymphatic system

- The human immune system comprises lymphoid organs, cells and antibodies
- **Primary lymphoid organs:** bone marrow and thymus. Here lymphocytes develop, mature, and differentiate to antigen-specific lymphocytes
- **Secondary lymphoid organs:** spleen, lymph nodes, tonsils, Peyer's patches in small intestine and appendix. These are the site for reaction with antigen and they become effector cells after the proliferation
- The spleen acts as a filter of the blood. It contains lymphocytes and phagocytes and a large number of erythrocytes are present
- Lymph nodes trap the antigens present in the lymph or tissue fluid
- **Mucosa-associated lymphoid tissue (MALT):** the mucosal lining of the respiratory, urinary are digestive tract accounts for 50% of total lymphoid tissues present in the body

Drugs and Alcohol Abuse

- Opioids, cannabinoids, and coca alkaloids are commonly abused drugs

- There are opioid receptors present in our CNS and GI tract, where opioid drugs bind
- Diacetylmorphine is commonly known as heroin or smack. It is extracted from the latex of the poppy plant *Papaver somniferum*. It is obtained by acetylation of morphine
- Cannabinoids bind with the cannabinoid receptors present in the brain. They affect the cardiovascular system
- Cannabinoids, e.g. marijuana, hashish, charas, ganja, etc. are obtained from the flower tops, leaves, resins of the plant *Cannabis sativa*
- Cocaine or coca alkaloid is obtained from the plant *Erythroxylum coca.*
- Cocaine acts by interfering with the transport of dopamine, a neurotransmitter
- *Atropa belladonna* and *Datura* also have hallucinogenic properties
- Sportspersons also take cannabinoids to enhance their performance, muscle relaxation, and reduce anxiety
- Morphine is used as a sedative and pain killer
- Barbiturates, amphetamines, benzodiazepines, etc. are used as a medicine for depression, insomnia, and other mental illness
- Nicotine (alkaloid) present in tobacco stimulates the release of adrenalin and nor-adrenalin hormone by the adrenal gland. It increases heart rate and blood pressure
- Smoking causes oxygen deficiency by increasing the concentration of carbon monoxide in the blood thereby decreasing the concentration of oxygen bound to hemoglobin
- The excessive use of drugs and alcohol damages the nervous system and causes liver cirrhosis
- The misuse of narcotic analgesic, anabolic steroids, diuretics to enhance performance and increase muscle strength is frequently done by sports person
- Anabolic steroids induce masculinization and aggressiveness in females

Common Diseases in Humans - 1

What are Diseases?

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Non-infectious diseases - Diseases which cannot be transmitted from one person to another are called non-infectious disease, it is also known as a noncommunicable disease. These diseases can be either caused by genetic disorders, unhealthy diets, lack of physical activity, excessive use of tobacco, drugs or alcohol and few environmental factors.

Some Common Diseases In Humans

- A pathogenic bacterium known as Salmonella typhi is known to cause typhoid in humans. This fever can be confirmed by Widal test
- Pneumonia is caused by Streptococcus pneumoniae and Hemophilus influenza
- Rhinovirus, a group of virus, is known to cause one of the most of infectious ailments in humans, cold.
- Plasmodium, a small protozoan causes malaria. Another protozoan, Entamoeba histolytica causing amoebiasis (amoebic dysentery)
- Ascaris(an intestinal parasite) causes ascariasis
- Wuchererta, the filarial worm causes filariasis or elephantiasis

Immunity

Immunity is defined as the ability of the body to protect, defend and fight against invading pathogens like bacteria, virus, and other foreign bodies and toxic substances. There are two types of immunity.

- Innate immunity – non specific defence type of immunity present at the time of birth achieved by the provision of 4 barrier types – the physical barrier, physiological barrier, cellular barriers, cytokine barrier
- Acquired immunity – pathogen specific immunity that is characterized by memory.

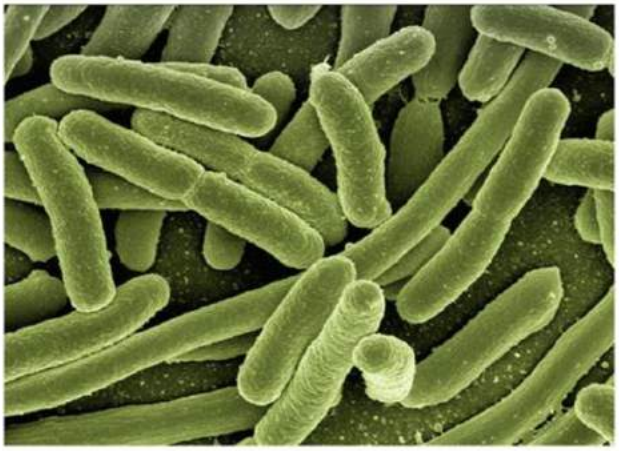
Active and Passive Immunity

Active immunity is where the host produces antibodies in the form of dead or living microbes when it is exposed to antigens. It is a slow process, taking time to provide its full effective response. Passive immunity, on the other hand, is the immunity where ready-made antibodies are given directly to protect the body against any foreign agents.

AIDS

- Acquired Immuno Deficiency Syndrome is caused by HIV(Human Immunodeficiency Virus) a member of the retrovirus group.
- It is generally transmitted through sexual contact with infected person, blood transfusion with contaminated blood and its products, through the share of infected needles, from the infected mother to her child through the placenta. ELISA(Enzyme-linked immunosorbent assay) is the diagnostic test for AIDS

Pathogen



What are Pathogens?

A large variety of entities exist. Some can thrive and grow inside the host. If the organism can inflict infectious diseases, it is an infectious agent. Manual infectious agents that can cause illness and infection are referred to as pathogens.

Classification of Pathogens

Pathogens are classified into four main categories concerned with the classes of pathogenicity relying on general risk analysis and assessment available under the purview of the present practical and theoretical frameworks. These include:

Class 1

One of the below criteria has to be covered by the microbial species like:

- They should not be part of an identified group of disease-causing agents in animals or humans.
- They had proven to be safe in the past history under conditions, without any sort of restrictions physically despite taking into account that species have a difference in virulence between strains within them.

- The species that belong to one of the below classes, but a particular group of the chain might have fewer genes that could create pathogenicity in animals and humans. The species of a particular chain might be put in an exceptional position depending on the degree of attenuation.

This would imply that out of categories 2, 3 and 4 species, the certain chain would be downgraded to a class.

- Both in vivo and in vitro testing, the non-pathogenicity of the species has been demonstrated authoritatively.

Class 2

- Species which spread diseases in humans or animals, might not spread to the humans and that has necessary prophylaxis or therapy.

Class 3

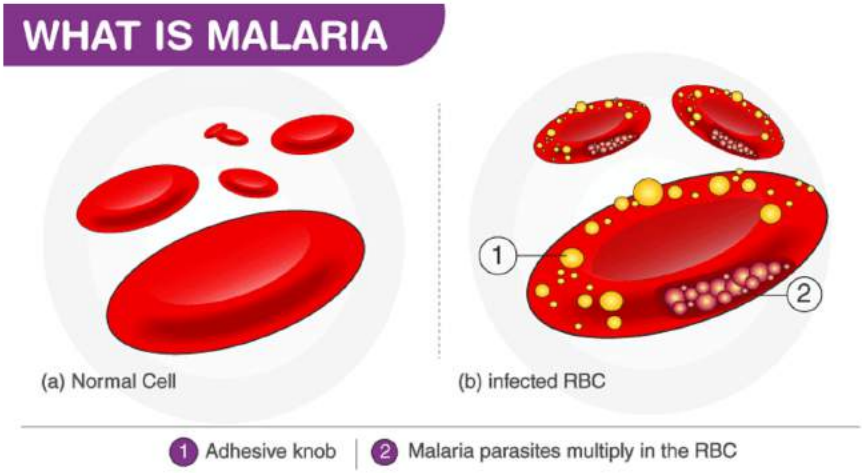
- Species which cause serious disease in humans, spread to the humans while having the necessary prophylaxis or therapy.

Class 4

- Species that cause serious human disease, which is likely to disseminate in the human population and for which no adequate prophylaxis or therapy exists.

What is Malaria?

Malaria is a mosquito-borne infectious disease caused by various species of the parasitic protozoan microorganisms called Plasmodium. Malaria is a disease that man has battled with for a long time. The first evidence of this protozoan came from mosquitoes preserved in amber nearly 30 million years ago.
It is even thought to have brought the Roman Empire to its knees. Malaria was so prevalent during the Roman times that the disease is also called 'Roman Fever'. Today, the credit for actually discovering the parasite is given to Charles Louis Alphonse Laveran, a French physician. He even won the Nobel Prize in 1907 for his findings.



Causes of Malaria

There are many factors that can cause malaria, such as –

- Bitten by a malarial vector (Anopheles stephensi)
- Use of shared and infected syringes.
- Organ transplantation.
- Transfusion.
- From an infected mother to her baby during birth.

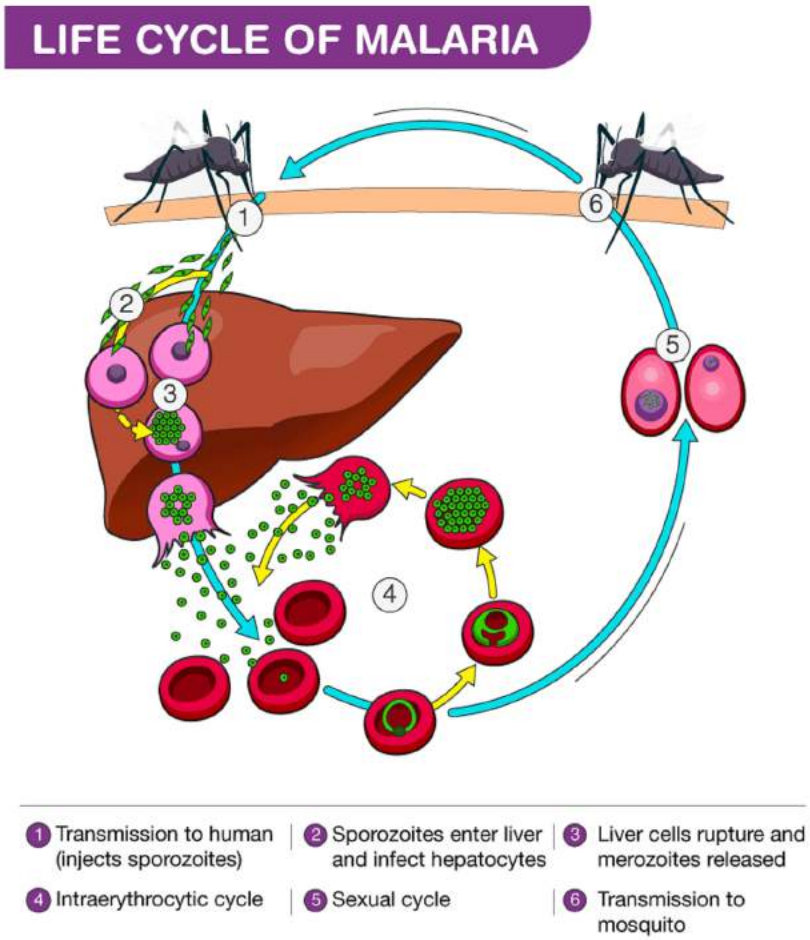
Symptoms of malaria

Symptoms of malaria are exhibited within 7 to 18 days of being infected. Common symptoms include:

- Fever, fatigue, chills, vomiting, and headaches
- Diarrhoea, anaemia and muscle pain
- Profuse sweating and convulsions
- Bloody stools.
- In severe cases, malaria can be devastating; it can lead to seizures, coma and eventually, death.

Sir Ronald Ross and his study on the transmission of the disease helped carve the way for future scientists to effectively combat the disease. His deep research showed that specifically, the female Anopheles stephensi mosquito is the vector of the disease, and addressing this problem will prevent malaria and in turn, save countless lives.

Malaria Life Cycle



Malaria parasite exists in the form of a motile sporozoite. The vector of malaria i.e. the female Anopheles mosquito transmits the malarial sporozoites into the hosts. When an infected mosquito bites a human, the sporozoites are injected into the blood through the mosquito's saliva. The sporozoites travel into our body and accumulate in the liver. These parasites initially multiply within the liver, by damaging the liver and rupturing the blood cells in the body. Malaria kills by causing the destruction of the red blood cells in the host. The parasites reproduce asexually in the RBCs, bursting the cells and releasing more parasites to infect more cells. The rupture of red blood cells by the malaria parasite releases a toxin called hemozoin which causes the patient to experience a condition known as the chills.

When the female Anopheles mosquito bites an infected human, the parasites enter the mosquito's body along the human blood it is drinking. It is inside the mosquito's body that the actual development and maturing of the parasite happens. The parasites produced in the human body reach the intestine of the mosquito where the male and females cells fertilize each other to lead to the

formation of a sporozoite. On maturing, the sporozoite breaks out the mosquito's intestine and migrate to the salivary glands. Once they reach salivary glands, they wait till the mosquito bites another human and the process of infection and disease begins all over again. It is prudent however to observe that the complete development of the malaria parasite takes place in two different hosts; humans and mosquitoes.

Prevention of malaria

Malaria is one of the major causes of preventable death in the world today. It affects more than 500 million people worldwide and causes 1 to 2 million deaths every year. It is a tropical infectious disease and almost 90 per cent of the cases are from Sub-Saharan Africa.
There are two ways to deal with malaria – prevent the mosquito bite from happening (i.e preventative steps) or attack the parasites once they have infected the body.
The first method advocates the use of mosquito nets and mosquito repellent such as permethrin to prevent mosquitoes from biting. The second form of treatment uses a chemical called Quinine present in the bark of a cinchona tree. A form of drug chloroquine has proven very effective against malaria even though it is not a vaccine.

Dengue
Dengue Fever

Dengue is a mosquito-borne viral disease caused by the Dengue virus. In this case, the dengue virus is transmitted by female mosquitoes – Aedes aegypti. These dengue mosquitos generally bite during the daytime and are found everywhere (Both inside and outside the house). These mosquitos are found to be at the peak of their activeness at dawn and dusk. The symptoms can develop only after 6 to 10 days after bitten by an infected mosquito.
Dengue fever is transmitted by mosquitos which carry the dengue virus, which has four varied serotypes to infect human beings. The serotypes mentioned above denotes a set of microorganisms that are exceptionally closely associated. These microorganisms can only be distinguished due to them having somewhat dissimilar antigens (the alien unit that affects the body and making us produce antibodies) which prompt the body to create some dissimilar antibodies. Dengue cases are more common in subtropical and the tropical regions of our planet, including our country.

Signs and Symptoms of Dengue Fever

Dengue has an unexpected attack, viz. a sudden start and these symptoms could be an indicator of its onset.

- Loss of appetite.
- Diarrhoea and vomiting.
- Gum and nose bleedings.
- Severe joint and muscle pain
- Fatigue, Nausea, and Vomiting.
- A sudden drop in blood pressure.
- Multiple rashes and wounds on the skin.
- Pain behind the eyes coupled with extreme headaches.
- The patient might feel week with high fever for 3-7 days.

Diagnosis of Dengue Fever

The presence of the Dengue virus in the blood cells can be diagnosed by isolation of the virus, testing serum samples, and by other molecular methods. A patient with this syndrome is allowed to have a few blood tests to check the total count of red blood cells, blood platelets, and other physical examinations are conducted by the physician to evaluate that the symptoms are caused by a dengue infection.

Treatment for Dengue Fever

Till today, there is no definite treatments or specific medicine to treat dengue infection. In general, the doctor may generally recommend regulating the pain and fever by using paracetamol instead of aspirin(as it might stimulate bleeding) and increasing fluid ingestion. Children below the age of 12 should not be given aspirin until and unless specially prescribed by the doctor. In severe cases, blood transfusions, intravenous (IV) fluid supplementation and 24 hours hospitalization are required.

Prevention of Dengue Fever

The patient should take proper bed rest especially during the days when the fever is at its peak and take exclusion from work, school preschool or childcare. People suffering from dengue must stay away from places where they could get bitten by mosquitoes and should stay at home until they are no longer infectious (around 3-5 days).

For avoiding this illness, make sure your surroundings are free of any water logging issues as the Aedes mosquito prefers to breed in stagnant clean water that could be found easily nearby our habitats. Until now, no vaccine has been developed to prevent Dengue virus. The only prevention is to avoid mosquito bites.

- Cover your skin by wearing long pants, and long-sleeved shirts.
- Use of mosquito repellents, traps, and nets.
- Keep all the doors and windows closed especially at dawn, dusk, and early evening to avoid the entry of Dengue mosquitoes.
- Keep your surrounding clean by removing all the wastes and cleaning the standing water.

Filariasis

Lymphatic Filariasis is also known as Elephantiasis

What is Filariasis?

Filariasis a parasitic disease transmitted by black flies and mosquitoes. These parasites are thin, round, worm-like organisms. They appear white or translucent when observed under a microscope. The life span of filariae would be around 5 to 7 years. During their lifespan, they produce millions of larvae. The size of the female is between 250 and 300 μm long and the size of the males is roughly half as long as the females.

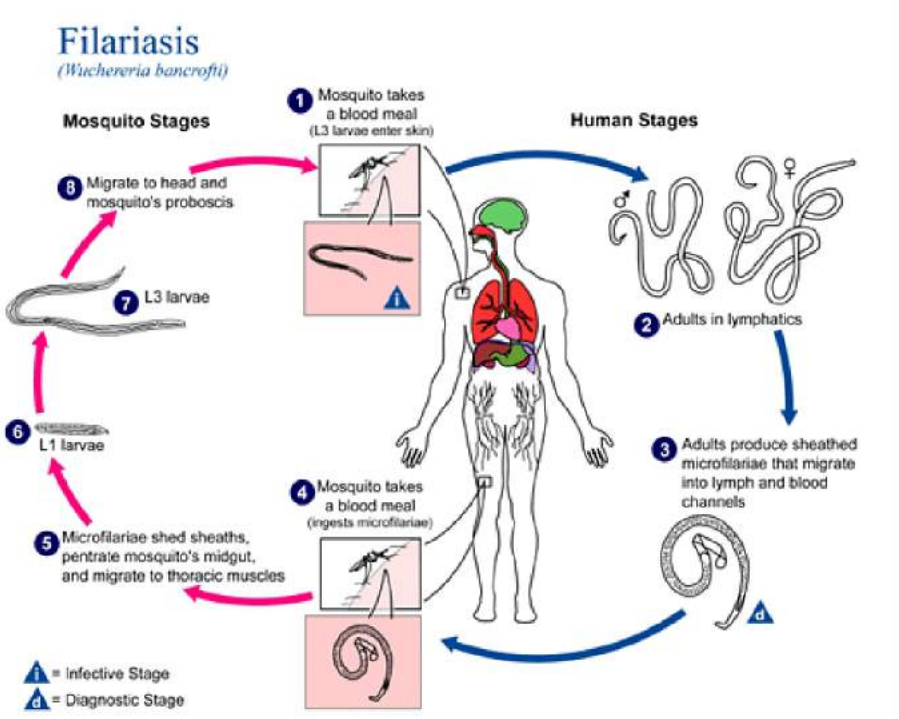
How is Filariasis Transmitted?

The causative organisms for Filariasis is a roundworm of the Filarioidea type. However, this is a vector-borne disease, with the primary vectors being mosquitoes and black flies. The infection spreads when a mosquito bites an already infected individual and then, goes on to bite a healthy person. This causes the larva of this parasite to enter the bloodstream of a healthy host and multiply. The complete stage of the larva to adult filarial worms is carried out within the lymphatic system. Once matured, the adult filarial worm starts to release larval forms called microfilariae. The newly generated microfilariae again enter into the mosquito along with the

host's blood and the cycle repeats itself. This parasitic disease is categorized on the basis of which body part is infected:

- **Lymphatic filariasis**: As the name suggests, this type affects the lymphatic system.
- **Subcutaneous filariasis**: In this case, the bottom layer of the skin and white part of the eyes are infected by the worms.
- **Serous cavity filariasis**: In the case of this disorder, the serous cavity of the abdomen is infected.

There are more than a hundred species of filarial worms currently discovered. Among them, only 8 to 9 are categorized as filarial parasites, which causes infections in human beings.



Filariasis Life Cycle: From larvae to adult

Filariasis Symptoms

The general filariasis symptoms during its early stages include:

- Fever
- Chills

- Headache
- Skin lesions are observed in the beginning stage i.e., between three months to nine months after the insect bite

The filariasis symptoms seen in the later stage include:

- Blockage in the lymphatic system which leads to oedema
- Swelling, redness, and pain in the arms and legs
- Accumulation of pus in cells

The formation of pus in a cell due to the dying worms or a secondary bacterial infection results in:

- Skin rashes.
- Abdominal pain
- Damage to the cornea, choroid, retina and optic nerve finally resulting in loss of vision.
- The hyper or hypopigmented skin on the face, arms, feet, and other parts of the body.
- If these symptoms are neglected, the final stage of this disease would result in gross enlargement of the limbs and genitalia in a condition called elephantiasis.

Filariasis Diagnosis

It is quite difficult to diagnose this disease as the symptoms vary from one type to another type and the symptoms diagnosed in the early stage are similar to normal viral and bacterial infections. However, there are a few diagnostic processes carried out through body analysis, physical examination, body fluid test, including a blood test and urine test. Apart from these tests, few blood tests are carried out during the nighttime as the larvae are found most active at night.
A popular diagnostic procedure involves blood being drawn from a larger vein and smeared on a glass slide. This slide is then examined under an electron microscope to check for the presence of parasitic larval roundworms. The presence of Filariasis is examined with the help of the Giemsa stain. The other diagnosis for subcutaneous filariasis is performed with a skin snip test.

Treatment for Filariasis

Currently, there is no vaccine available for filariasis. Scientists are still working on developing a cure for filariasis. Prevention is better than cure. As we all know, this

disease is caused by the bite of mosquitoes, it is better to prevent the cause of this disease by:

- Wearing long sleeves and pants to prevent the bite of mosquitoes
- Apply DEET- based insect repellents
- Preventing the build-up of stagnant water
- Using mosquito mats, coils and nets if possible
- Though scientifically unproven, dark-coloured clothing attracts mosquitoes, so it might be beneficial to avoid them.

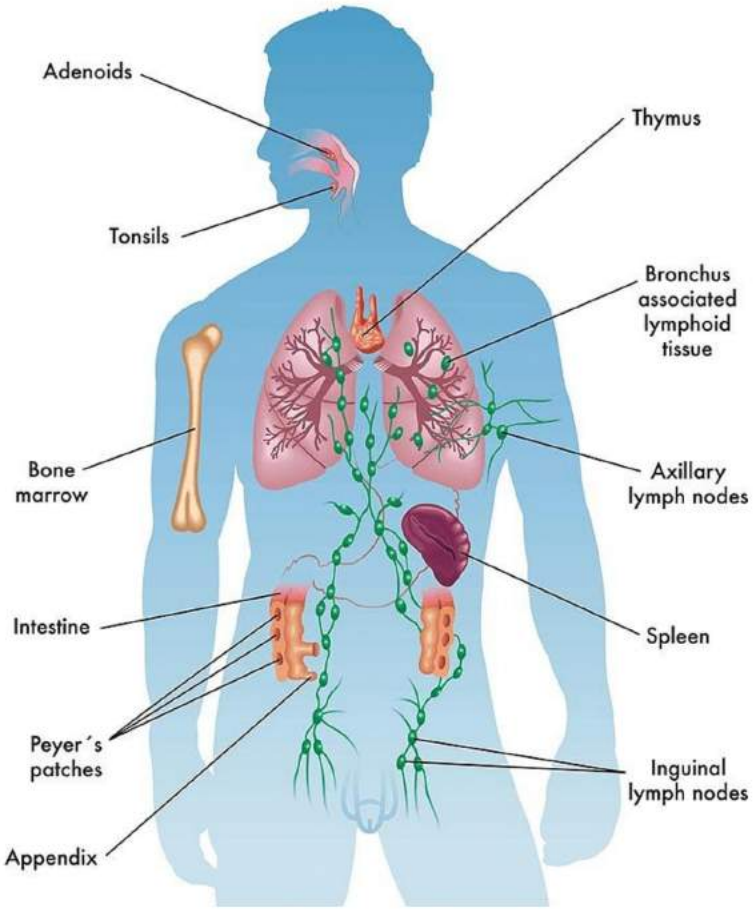
In spite of all these measures, if filariasis is contracted, the best treatment would be a course of anthelmintic drugs or antibiotics. Anthelmintic would be the best option as it directly kills the worms. But if this isn't feasible, antibiotics are a great alternative because they target the symbiotic bacteria that are present inside the worms. When the antibiotics kill these bacteria, the worms cannot survive and thrive inside their hosts, eventually hampering reproduction.

Conclusion

The parasitic roundworms belong to the family of Filarioidea and Phylum Nematoda. This particular species is known by the name filarial worms or filariae and the infection caused by them is called filariasis. General symptoms of filariasis include fever, chills, headache and skin lesions. Further progression of the disease will disfigure the patient with excessive swelling of the limbs.

Immunity & Human Immune System

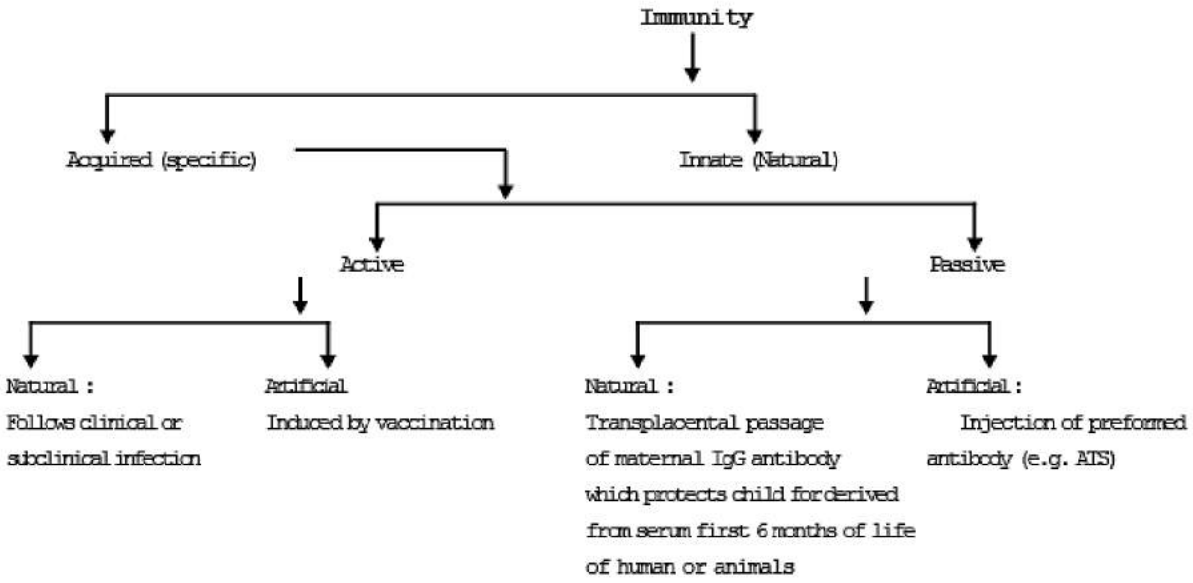
IMMUNE SYSTEM



System of body which protects the body from disease is called immune system.
('Immune = Exempt or Freedom) **Some terms related to immunity** :
(1) **Immunity** : **Resistance** of the body against a pathogen or disease.
(2) **Antigen or Agglutinogen** : Proteinous substance which **stimulates** the production of antibodies.
(3) **Antibody or Agglutinin** : It is a complex glycoprotein **secreted by B-lymphocytes** in response to an antigen.
(4) **Antiserum** : Serum of any animal which **contains the antibody** for a specific antigen is called antiserum.
(5) **Venom (poison) :** Toxic substances secrete by snake and some insect.
(6) **Agglutination** : Antigen antibody reaction is called agglutination and study of antigen-antibody reaction is called **serology**.
(7) **Toxoid :** A bacterial exotoxin which is detoxicated by special procedures to allow its safe use in immunization against the disease.
(8) **Interleukin** : It is a protein substances which stimulate the growth and activate certain kind of W.B.C. that are involved in Immune response, also act as a secondary messenger that activates the immune system.
Ex. IL-1, IL2, IL-3, IL-4, IL-5

Immunity (two types) :

(1) Congenital immunity or innate Immunity or Non-specific immunity.
(2) Acquired immunity or Adaptive or Specific immunity



CONGENITAL IMMUNITY :

It is **present in most of the animals by birth.** It is first line of defence of body. It is made up of following barriers.
(A) **Anatomical Barrier** : It is made up of two parts :-
(i) **Skin :** Outermost layer of skin is dead (str. corneum), so the bacteria does not grow or enter into it. pH of skin destroy the bacteria, sebum of skin also has anti bacterial action.
(ii) **Mucosal surface :** Food and air passage lined by mucosa. Mucosa contain mucosal cells and cilia.
Mucosa entraps the micro-organism and cilia propell the microbes.
(B) **Physiological Barriers** : many physiological functions of body make an unfavourable environment for the growth of microbes.
(i) **Fever :** High temp. of body, inhibit the growth of microbes.
(ii) **pH of body :** Acidic pH of various part of body like oral cavity, stomach and Vagina inhibit the growth of microbes.
(iii) **Secretions :** Secretions of body from Eyes, sebum contain **lysozyme enzyme**, this enzyme destroys the microbes.
(iv) **Interferon :** Anti-viral protein made up to 270 amino acids secreted by virus infected cells and sitmulates the adjacent cells to produce the Translation Inhibiting Protein (T.I.P.) By this mechanism interferon limits the infection of virus.

Certain kind of vertebrate cells when infected with a virus respond by releasing a small amount of a class of glycoprotein called interferons. INFs form **cytokine barrier of innate immunity**.

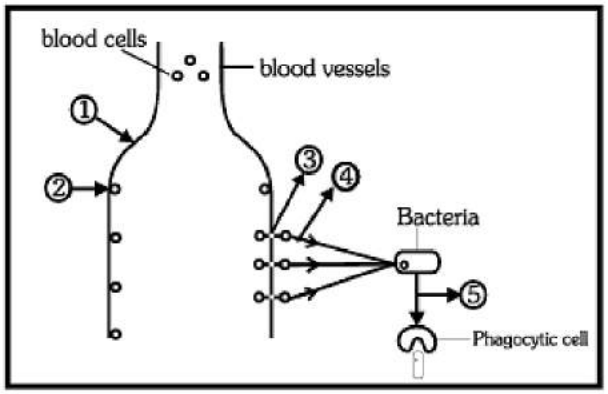
Interferons are **species specific** i.e. interferons produced by one species can protect only cells of same species against viral infection.
Interferons make cells resistant to viral infection by synthesis of antiviral proteins in that cell.

Types of interferons : INFs - α = produced by Leucocytes.
INFs - β = produced by Fibroblasts.
INFs - γ = produced by Lymphocytes..
Interferons can be used for prophylaxis and treatment of viral infections.
INFs - α = activate immune system and destroy tumor. Also has shown some success in causing of regression of **Kaposi sarcoma.**

(C) **Phagocytic Barrier** :- In response to pathogenic infection, the total count of WBC in body increases. Phagocytosis is exhibited by some types of WBC's. Such WBC's are called phagocytes.
Most important phagocytes are **Macrophages** and **Neutrophils**. Monocytes are liberated at the site of infection. These later converted into macrophages.
Macrophages are large irregular shaped cells that engulf microbes, virus, cellular debris etc in response to an infection.

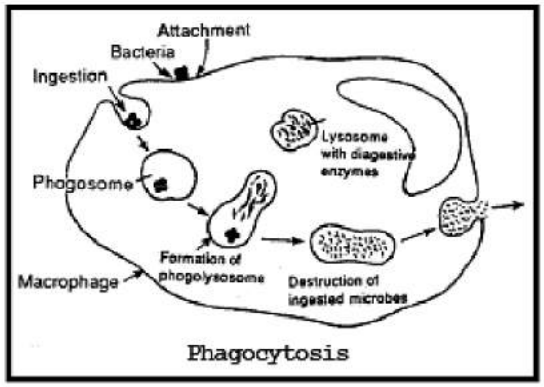
Steps of Phagocytosis –

(1) Vasodilation (Blood stasis)
(2) Adhesion
(3) Migration or diapedesis
(4) Chemotaxis (Neutrophils or Monocytes)
(5) Phagocytosis



Steps of phagocytosis :

(i) **Vasodilation :** At site of entry - Increased diameter of blood vessels.
(ii) **Adhesion :** Accumulation of leucocytes at periphery of blood vessels due to decreased blood flow.
(iii) **Diapedesis :** Now the leucocytes (neutrophils or Monocytes) migrates from the blood vessel by Active movements (Amoeboid movement) into the E.C.F. This kind of active movement of cell, is called diapedesis.
(iv) **Chemotaxis :** Now this leucocyte cells move towards the pathogen by chemotactic movement (Active).
(v) **Phagocytosis :**



Phagocytosis

(a) Attachment (adherence) : The infective agent gets attracted to the membrane of the phagocyte.
(b) Ingestion : Phagocyte engulfs the particular material into a vacuole (phagosome). The membrane of which fuses with a lysosome forming a phagolysosome. Lysosome contains hydrolytic enzymes and other bactericidal substances.

(c) Intracellular killing of bacterium : Most bacteria are slaughtered in the phagolysosome by the hydrolytic enzymes within a few minutes of phagocytosis.

(D) **Inflammatory Barrier** : **Inflammation** : Local response of living mammalian tissue to injury due to any agent. It is the body defence reaction in order to eliminate or limit the spread of infectious agent.
Inflammation is manifested as pain, swelling, redness, and increased temperature in the local area.

Inflammatory response occurs due to :- Release of histamines and prostaglandins from damaged mast cells. At the site of entry of pathogen, there is **redness** (due to vasodilation) and **swelling** of skin due to accumulation of fluids and High temp. (due

to B.M.R.) and **pain**(due to secretion of allergic susbtances like histamine and prostaglandin (PGs) from the damaged cells and PGs stimulate the pain receptors.

NK-Cell : It is a large granular lymphocyte cell.

During this process apart from the phagocytes, another type of cells called **Natural killer cells** kill virus infected cells and tumour cells of body by creating perforin lined pores in the plasma membrane of target cells (i.e. infected cells). Water enters through these pores causing swelling and bursting of the diseased cells.

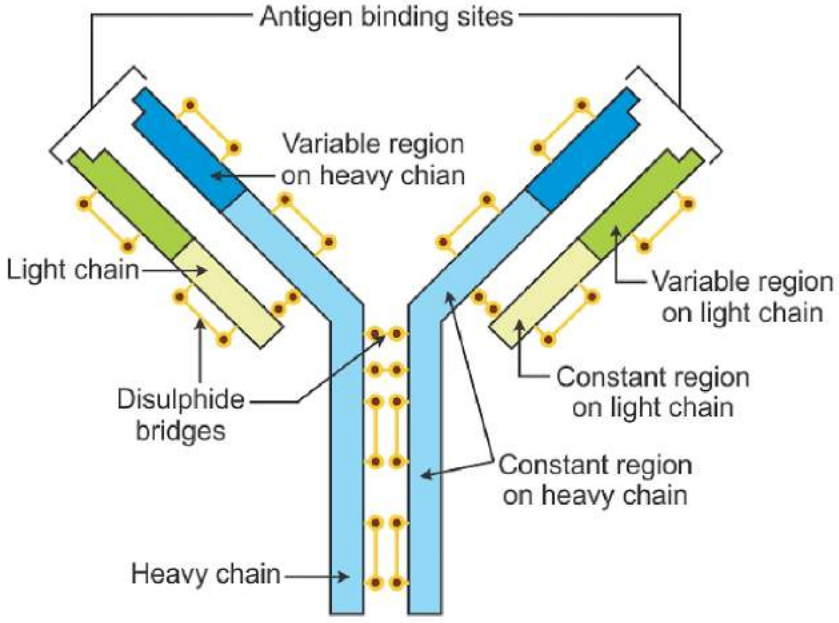
Complementary System :

It is formed by complementary component or C-component and they are inactive but when agglutination occurs in our body they become active and show inflammation, cell lysis and promote phagocytosis. Complement system takes part in both innate and acquired immunity.

Acquired Immunity : It is the resistance that an individual acquires during life. This is generated in response to an exposure to the micro-organism in question.

- This type of immunity is founds only in vertebrates.
- It is also called Adaptive or specific immunity

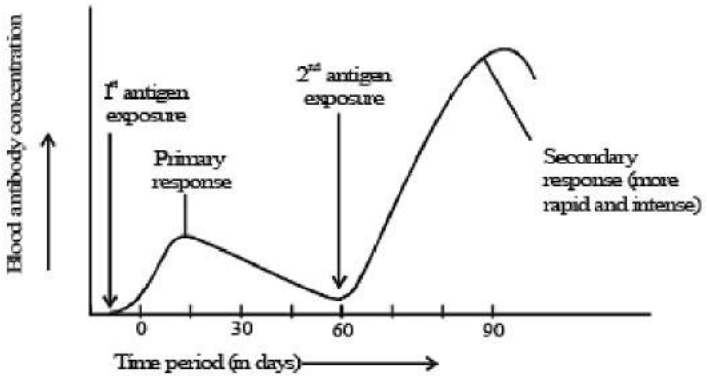
This immunity is **acquired after birth** through experience.
This immunity recognizes and selectively eliminates the pathogen.



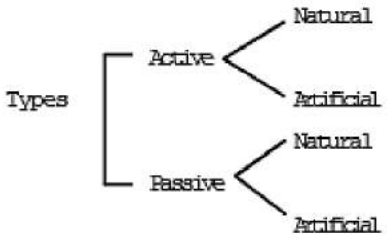
Structure of an antibody

Features of Acquired immunity :

(i) **Specificity** : Acquried immunity is specific for specific micro-organisms.
(ii) **Diversity** : This system recognizes the vast variety of micro-organisms.
(iii) **Discrimination between self and non-self**. It can recognize self (body or tissue) and non self (foreign tissue) and respond according to them.
(iv) **Memory** : When a pathogen enters inside the body, body takes longer time to recognize and respond to it. This is called **primary immune response** but the memory of this encounter remains in immune system.
When this pathogen enters second time inside the body, body's immune system rapidly recognizes this pathogen and respond quickly to it. This is called **secondary immune response**. This is based on memory of immune system.



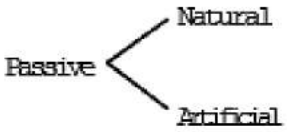
Types of Acquired Immunity :



i) Active acquired immunity :- Resistance developed by an individual as a result an antigenic stimulus.

(a) Natural :- Results from a clinical or inapparents infection by a microorganism.
(b) Artificial :- Resistances induced by vaccine
Vaccines :-Preparation of live or killed microorganism or their products used for immunization.
(ii) Passive Immunity :- It is received passively by host without participation or contribution from host's immune system. Immunological memory is absent here

and the **readymade antibodies** are given in immuno suppressive individual. This is called **passive immunity**.



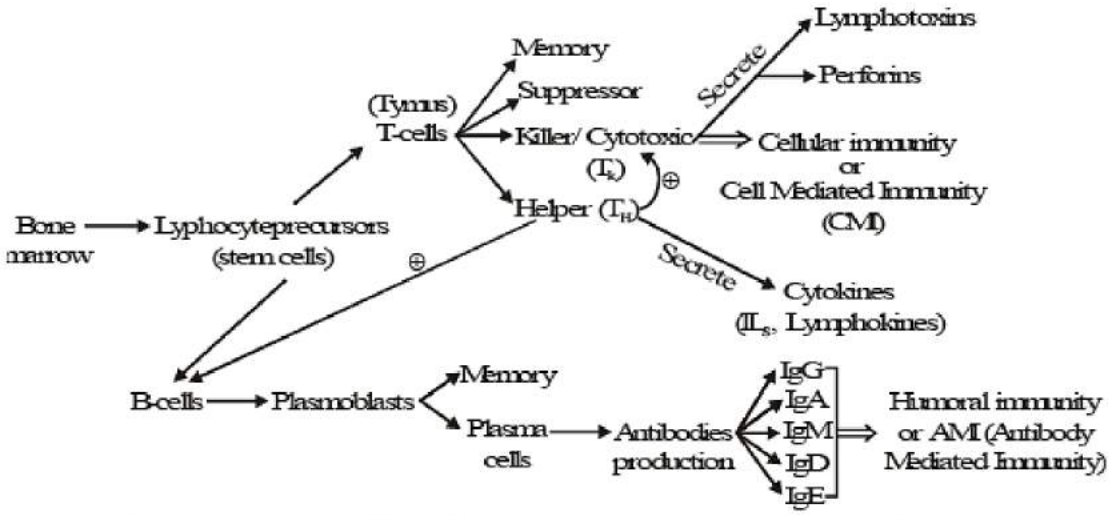
(a) Natural :- Resistance passively transferred from mother to baby. **Mother milk** gives passive immunity to the new born child by **colostrum** (first mother milk) →Ig A type of antibody.
(b) Artificial :- Resistance passively transferred to a recipient by administration of antibodies.
Examples : human immunological administration.
Anti - tetanus serum (ATS), Anti - rabies serum (ARS), Anti - diptheria serum (ADS)

Difference between active and passive immunity

	Active immunity	**Passive immunity**
1.	Produced actively by the immune system of host	Received passively by the host and the host' s immune system does not participate.
2.	Induced by infection or by contacts with immunogen, e.g. vaccines.	Conferred by introduction of ready-made antibodies.
3.	Immune response-durable and effective	Immune response-short lived and less effective.
4.	Immunity develops only after a lag period	Immunity effective immediately.
5.	Immunological memory present. Subsequent challenge with booster dose more effective.	No immunological memory. Subsequent administration of antibody less effective due to "immune elimination:
6.	Serves no purpose in immuno deficient host.	Applicable in immunodeficient host
7.	Used for prophylaxis to increase body resistance.	Used for treatment of acute infection.

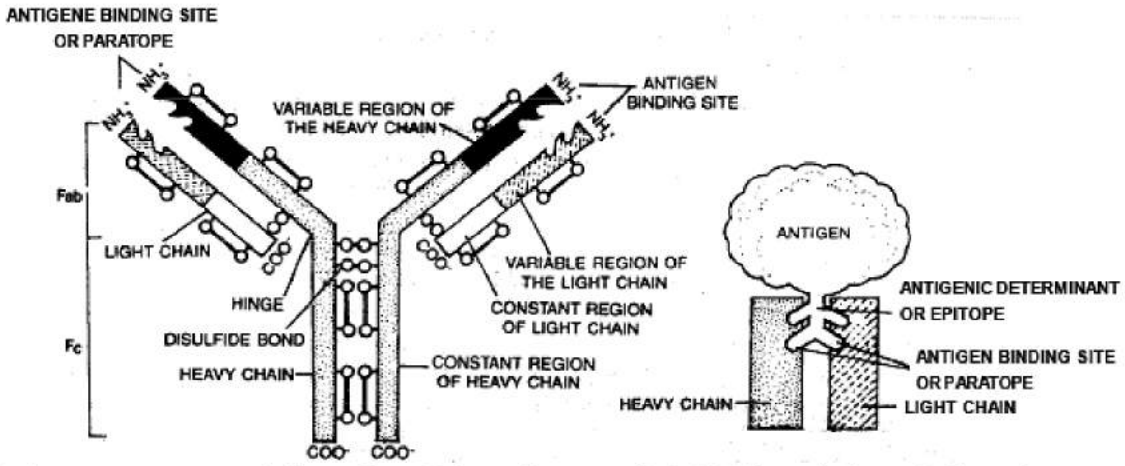
Active Immunity : This immunity develops **after infection or vaccination**.
Active immunity is formed by **lymphocytes**, lymphocytes are produce in **bone marrow (Haematopoisis)**.

After production some of lymphocytes migrates from bone marrow to thymus cells and mature as **T-cells (Thymus cell)**.
Lymphocyte which remain in bone marrow mature as **B - cells (Bone marrow cells)** so, bone marrow and thymus gland are **primary lymphoid organ**.
After maturation some lymphocytes migrate from bone marrow & thymus gland to the spleen & lymph nodes like tonsils, and proliferate (↑ in no.) Here, so spleen, lymph nodes, tonsils and peyer's patches [mucosal associated lymphoid tissue **(MALT)**] are called **secondary lymphoid organs**.



Based on these two type of lymphocytes there are **two types** of active immune system.
(1) C.M.I.S. → Cell mediated immune system or Cellular immunity This immune system is based on T-cells. (60-70%) There are 4 type of T-cell
(i) Helper T-cell
(ii) Killer T-cell or cytotoxic T-cell
(iii) Supressive T-cell
(iv) Memory T-cell When pathogens enter inside the body first macrophage interact with them and activates TH-cell by releasing cytokines or ILs or monokines.
(i) **Helper T-cell** → This activated helper cell stimulates the killer T-cell and B-cell and these killer & B-cell start dividing and produce clone (group of similar cells) this phenomenon is called **clonal selection**.
They produce *lymphokines* (messenger molecules) which cause accumulating of WBCs to the affected site.
TH-cells also stimulate B–cells to produce antibodies and facilitate the action of other T–cells.

(ii) **Killer T-cell** : These cell or clone of these cell **destroy the infected cells or target cell** and kill the pathogen and also the **cancerous cells** by secreting Lymphotoxic substances and secrete lymphokines which attracts phagocytes. These are responsible for cell–mediated immunity. They also destroy transplanted, tumour cells and other foreign cells.
(iii) **Suppressor Cells (T_S) :-** These suppress the functions of T_C and T_H cells. B–cells and plasma cells are also affected by T_S cells by synthesizing suppressor factors and suppress the entire immune system for attacking the own body
(iv) **Memory T-cell** : They don't kill the pathogen or don't form the antibodies but these cell **retain the memory** of every encounter.
They convert into effector cells (T_C) on later encounter with specific antigen even after several years.
(v) **Antigen Presenting Cells :-** In immune mechanism every antigen molecule is processed by antigen presenting cells like macrophages, B-lymphocytes etc. This processed antigen is presented on the surface of these cells.
When a T- helper lymphocyte passes closely by the side of the antigen presenting a cell bearing the antigen on its surface, it recognizes the antigen and becomes activated. Now T-helper cells activate the B-cells and T-killer cells. These cells in turn develop clones by frequent divisions in themselves.
(2) A.M.I.S. (Antibody mediated immune system or humoral immunity)



This immune system is based on B-lymphocyte (10-20%) and these B-lymphocyte secret the antibody.

Antibody or Immunoglobulin : These are complex glycoprotein molecule made up of 4 polypeptide chains - two light and two heavy chains.
These two chains are held together by **disulphide bond** in shape of Y molecule.
Two **top tips** of this molecule bind with antigen [large and complex foreign molecules mainly proteins that activate the specific immunity] like **lock and key fashion** and make antigen-antibody complex.

Function of Antibodies :

(i) **Agglutination** : Antibody attach with the antigen which is present on the surface of pathogen and destroy the pathogen by **cell lysis**.
(ii) **Opsonisation** : Coating of bacteria (Ag) with opsonin Antibody (IgG and IgM) facilitates the phagocyte cells and these antibodies or opsonin promote phagocytosis by combination with antigen.
(iii) **Neutralization** : Antibodies **neutralize the toxin** of bacteria by attaching with them.

TYPE OF ANTIBODIES –

Various Types of Immunoglobulins in Human

S.No.	Group of Antibodies	Total Quantity (%)	Main Characters and occurrence	Functions
1.	IgA	10	The primary antibodies present in colostrum, M.W. 1,70,000 : present in saliva, mucus and other secretions.	Protection of mucous membranes and outer surface of body and protection from inhaled ingested pathogens.
2.	IgD	1-3	Present in trace amount on the surface of lymphocytes in blood, M.W 1,85,000	Activation of B-lymphhocytes and development and maturation of immune reactions.
3.	IgE	0.05	Present in very small quantities, show specific linkage with mast cells and basophils, M.W. 1,88,000	Stimulation of mast cells, related to allergic reactions and protection from parasites.
4.	IgG	75-80	Most abundantly found antibodies main immunoglobulin of blood and interstitial fluid which has capacity to pass through placenta, M.W. 1,46,000 (lightest)	To stimulate the complementary system, to provide immune power to human embryo and specific linkage with

				phagocytic cells for phagocytosis.
5.	IgM	5-10	Oldest and first antibody generated in response to antigens, present in blood plasma (80%) and interstitial fluids and large sized immunoglobulin with pentameric form, M.W. 9,60,000 (heaviest)	First appeared antibody generated at the time of defence, strong agglutination, related to complement system.

Mostly intra-vascular
IgG – Protects body fluids.
IgA – Protects body surfaces.
IgM– Protects body blood stream.
IgE – Mediates regional hypersensitivity.
IgD – Activation of B-lymphocyte

1. First line of Defence : Skin, Mucous membrane
2. Second line of Defence : Neutrophils, Monocytes, Macrophage, interferon, fever.
3. Third line of Defence : Specific immunity by T- and B-lymphocytes

Vaccination & Immunisation

VACCINE

Vaccine is suspension of **inactivated pathogens** or **antigenic protein of pathogen** which is taken orally or injected to provide immunity for that pathogen.

History :

(i) **Edward jenner (1796)** noticed that milkmaid did not suffer from small pox but they had scabs of cow pox. He transport the material from sore of milkmaid who was suffering from cow pox to the young body of 8 year old.
After sometime he injected live small pox material into that boy. But symptoms of disease did not appear. He tried this procedure on other person and got success. He gave the term vaccination for this process.
(ii) **Louis Pasteur**: He discovered the **process of inactivating the pathogen** & prepared vaccines for **Anthrax, chicken cholera, Rabies**.
(iii) **Von Behring** : - He discovered the process of **passive immunization** and prepared the antidiptherial serum by injecting diptheria antigen into sheep.
Von Behring is known as 'Father of passive immunization'.
Principle of vaccination : It is based on **memory** of immune system. When a antigenic material is injected in a healthy person, it **generates antibodies and memory cell** as a **primary immune response.** When this activated pathogen enters for the second time inside the body of vaccinated person, memory cells **rapidly recognize** and respond with massive production of lymphocytes and antibodies. So it destroys pathogen rapidly and disease does not appear. Person becomes **resistant** for that disease after vaccination.

Types :

First generation vaccines :

These vaccines are prepared by inactivating the **whole pathogen** but they have side effects.
(i) Live attenuated (OPV, BCG, Small pox, Influenza etc.)
(ii) Killed (Typhoid, Salk polio, Cholera, Rabies, Plague etc.)
(iii) Toxoid (Diphtheria, Tetanus)
(iv) Combination (DPT, MMR) **Second generation vaccines** : Antigenic polypeptides of pathogens are produced with recombinant DNA technology in transgenic organisms.
These are made by multiplication of **surface antigen** by genetic engineering. They have no side effects. e.g.
Hepatitis B vaccine produced from transgenic yeast, Meningococcal, Pneumococcal etc.

Third generation vaccine : These are highly potent, synthetic in nature & **prepared by genes** they are also called **DNA vaccine**. eg. Leukaemia virus vaccine.
HLA System : Human leucocyte antigens (HLA) were first discovered on leucocytes. Out of the various genes for histo compatibility antigens, most of the transplantation antigens are located on a portion of chromosome-6. This is called MHC or Major Histo Compatibility complex or HLA complex. The recipients immune system can

recognize the histocompatibility antigens on the donar organ and accordingly acceptor reject it.
The array of HLA alleles on a homologue of our chromosome 6 is known as a haplotype. An individual inherits one HLA haplotype from each parent.
Only identical twins can have identical haplotype.
The best HLA matching can be observed within the same family.
Tissue Typing :- The procedure carried out to match HLA proteins of donar and recepient.

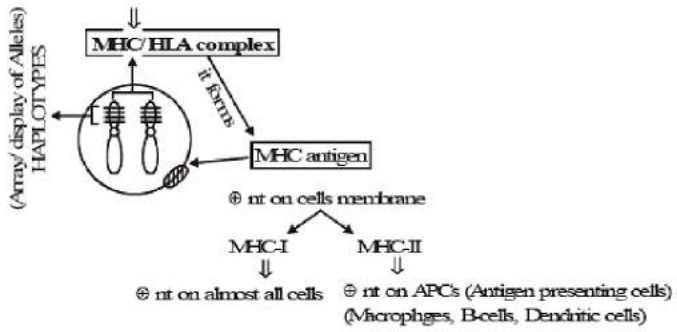
Preference order of transplants :-Identical twins > Sibling > Parent > unrelated donar.

Tissue Grafting – This is based on HLA (Human Leucocyte antigen) or MHC (Major Histocompatibilty Complex). It is present on the surface of Leucocyte. Tissue typing is done before tissue grafting.
Gene of this antigen is present on sixth chromosomes. Cyclosporin drug is used as a immunosup present drug during tissue grafting.

Type of Tissue Grafting –

(i) Autograft : (most successful) Transplantation of tissue from one body part into another body part of **an individual**.
(ii) Isograft : Transplantation of tissue in between the individual of **same genetic constitution** Ex. - Graft between identical twins
(iii) Homo or allograft : Tissue grafting in between the genetically dissimilar **individual of the same species.**e.g. Family members or intra species graft.
(iv) Hetero or Xenograft : Tissue grafting in between organism of **different species.**
Successful graft order :- Self> identical twins> Siblings > Parents > Unrelated donar

Organ Transplantation requires
(i) Blood grouping
(ii) Pre & post operative steroid therapy
(iii) MHC matching (tissue typing)
↓
(group of genes ⊕ nt on 6th chromosome)



IMMUNE SYSTEM DISORDER

Improper functioning of immune system may cause discomfort (Allergy), disease (AIDS) or even death (anaphylactic shock). Improper functioning divided into 3 classes.

(1) Hyper sensitive disorder or Allergy : When a person show hyper response or hyper sensitiveness for a common antigen or agent then it is called allergy.

The agents which cause allergy are called allergen. Common allergens can be pollen grains, food (egg, fish), medicines (penicilline), cold, heat, sunlight, fibres etc.

Physiology of Allergy :-More Secretion of histamine from mast cell & more production IgE antibodies in response to a common antigen or allergen.

Manifestations : (effect) →

(i) Bronchial Asthma : It is common manifestation of allergy. It is allergy of lungs when an allergen enters inside the body by inhalation. It comes in contact with respiratory tube. This is characterised by the spasm of the smooth muscles present in the walls of the bronchiole. It is generally caused due to the hypersensitivity of the bronchiole to the foreign substances present in the air passing through it. The mucous membranes on the wall of the air passage start secreting excess amount of mucous, which may close the bronchi, as well as bronchiole.

Symptoms : coughing and difficulty in breathing mainly during expiration.(Wheezing)

Prevention and cure :

- Avoiding exposure to the foreign substance or allergens is the best preventive measure.
- Hyposensitisation (by exposing small doses of the specific allergen) is the other preventive measure
- Antibiotic therapy for removing the infection, and use of bronchodilator drugs, as well as inhalers for symptomatic relief.

(ii) Hay Fever : Mucosa of eyes and upper respiratory passage become hyper secretory in response to allergen (pollen grain).

(iii) Urticaria - Multiple, Circumscribed raised pinkish itchy blisters of skin
(iv) Eczema (Dermatitis) - Reddening of skin, Vesicle formation then rupture, scales formation.
(v) Anaphylactic shock : This is generalized and severe form of allergy. When a allergen (penicillin) enter into blood, it stimulates the secretion of histamine from the mast cell of whole body, this causes the vasodilation and increase permeability of blood vessel. So large amount of fluid is leaked out form blood vessel into extra cellular space and decrease in blood volume cause fall in blood pressure that may leads to death.

(2) Auto immune disorder : When the immune system does not discriminates between self and non-self antigen, antibodies are formed against the self antigen these antibodies destroy the self antigen and also the self tissue of the body.
So, the antibody formation against self antigen is called. Auto immunity Example –

1. **Myasthenia gravis** : In this disorder, antibodies are formed against acetylcholine receptors so these receptors are destroyed. It causes depressed nerve conduction at myoneuronal junction and B movements of muscles. Muscle become degenerate after some time.
2. **Pernicious (Destructive) anemia :** In this disorder, antibodies are formed against castle intrinsic factor (Stomach) so the vitamin B_{12} is not absorbed in intestine and blood formation is decreased. This deficiency of blood is called pernicious anemia.
3. **Hashimoto disease :** Antibodies are formed against the thyroid gland. These antibodies destroy the thyroid gland and deficiency of thyroid hormone is called Hypothyroidism.
4. **Rheumatoid arthritis** : It is due to presence of rheumatoid factor (a type of immunoglobulin IgM). It is the primary symptom of inflammation of synovial membrane. If it is left untreated, then the membrane thickens and synovial fluid increases, exerting pressure that causes pain. The membrane then starts secreting abnormal granules, called pannus, which after accumulating on the surface of the cartilage, cause its erosion. As a result, the fibrous tissues are attached with the bones and become ossified, making the joints immovable. Treatment : pain and inflammation by heat treatment and physiotherapy.Joint replacement surgery is done in extreme cases.
5. **I.D.D.M :** Insulin dependent diabetes mellitus. Antibodies are formed against the B cell of pancreas that cause the deficiency of insulin in body and this called I.D.D.M..Symptoms are hyperglycaemia, glycosuria, polyuria, polydipsia (excessive thirst), polyphagia (increase food intake)
6. **Multiple sclerosis** : Antibodies are formed against the myline sheath of nerve cells. Destruction of myline sheath causes neurological dysfunction.

(3) Immuno deficiency disorder : May be due to gene mutation, gene deficiency, infection, nutritional deficiency & accidents.

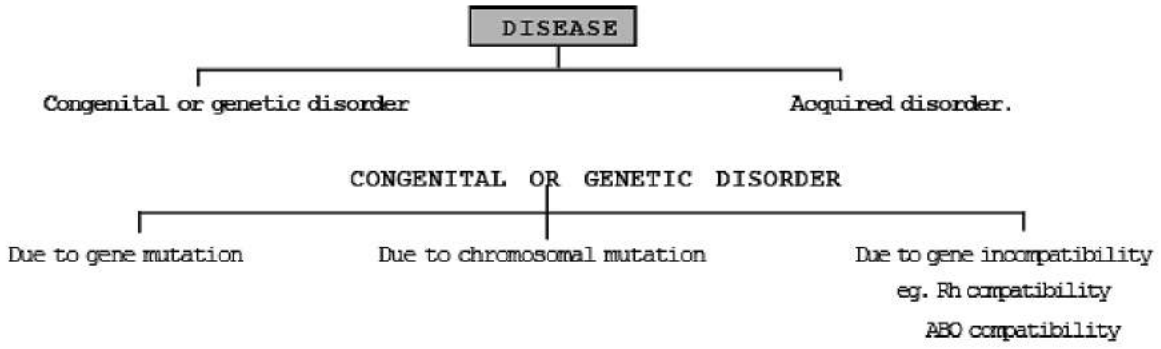
1. **De-George's syndrome or Thymic aplasia-** In this syndrome deficiency of T-cells occurs due to inactive thymus gland.
2. **Bruton's agammaglobulinemia-** Deficiency of gamma antibodies occurs due to deficient fomation of Bcells.
3. **S.C.I.D.** : Severe combined immuno deficiency : This disorder is due to gene mutation or gene deficiency of enzyme adenosin deaminase. This enzyme involved in formation of T and B lymphocytes. SCID is characterized by very low number of circulating thymocytes affected individual die at an early age. Treatment – Gene therapy
4. **A.I.D.S. (Acquired immuno deficiency syndrome) :** HIV attaches on T-helper cells. This cause the decrease count of T-helper cell from normal 950/mm^3 to less than 200/mm^3.

Immuno-therapy : Immuno therapy is a treatment procedure that involves suppression or augmentation of immune responses, to achieve therapeutic effects. Manipulation of the immune response can be carried out by modulating various components involved in it. Cytokines are natural immuno modulators secreted by one type of immune cell that elicits response in another type of immune cell. these include interleukins, interferons and tumour necrosis factors.

Immuno modulators are, principally, drugs that modulate the activity of a patient's immune response, either up or down, until a desired level of therapeutic effect is reached. There are two general clinical approaches of immuno-modulation.

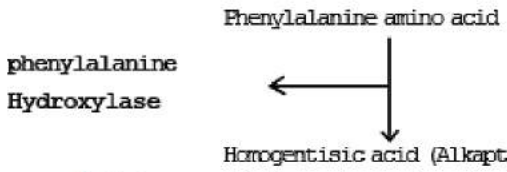
1. **Immuno-potentiation therapies** : This includes administration of immuno-potentiating agents like preformed antibodies, or immuno-potentiating drugs. This strategy augments the immune response.
2. **Immuno-suppressive therapies :** When the patient's immune system becomes activated against his or her own body, in situations such as, autoimmune diseases, the response is suppressed by using specific therapies.

These include inhibitors of cell division, cytokine production, etc.



Gene mutational disorder/Biochemical disorder :-

(1) **Autosomal Recessive** gene mutation disorder :-



(1) Phenyl ketonuria :- Due to deficiency of phenyl alanine hydroxylase, phenylalanine increase in blood & this phenylalanine or phenyl pyruvic acid accumulates in brain & destroy the brain cells. This causes mental retardation. These individuals are called phenyl pyruvicidiots.

(2) Alkaptonuria (Black urine disease) – This disorder is due to deficiency of enzyme homogentisic acid oxidase. So, homogentisic acid does not metabolises into tyrosine. Deposited in amino acid and a concentration of alkaptone or homogentisic acid in blood and tissue like joints, ligament, tendon, cartilage and also excrete in urine so it is called alkaptonuria.

When this urine comes in contact with air, it turns black due to oxidation of homogentisic acid so it is also called black urine disease.

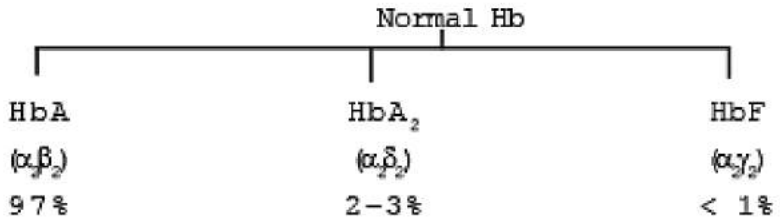
(3) Albinism : This disorder is due to deficiency of enzyme tyrosinase. Therefore the body parts like skin, iris of eye etc., becomes melanin deficient. Melanin provide protection against U.V. rays.

(4) Tay-sach's disease or Infantile amourotic idiocy : This disease was first reported by tay and sac. This genetic disorder is due to deficiency of enzyme β –N acetyl hexose aminidase and is involved in fat metabolism. So, the fat(conjugate lipid) accumulates in brain(ganglioside cell) and spinal cord and damages these cells. This causes mental retardation and paralysis of a normal born child and this child does not survive more than 3-4 years. There is no treatment of Tay-sach's disease.

(5) Thalassemia (Thalassa - sea) (Mediterranean anemia or cooley's anemia) This disorder was, first found in population of mediterranean region. Frame shift mutation causes the deficiency of β and α genes present on 11^{th} & 16^{th} chromosomes respectively. So decrease synthesis of β and α polypetide chain of hemoglobin, (Mainly b–chain is affected) abnormal type or decreased hemoglobin is formed in R.B.C. This deform the R.B.C. and R.B.C. become hemolytic in nature. So hemolytic anemia appear in this disorder.

Treatment : Blood transfusion or bone marrow transplantation.

(6) Sickle cell anemia (11^{th} chromosome): Glutamic acid is replaced by valine at the 6^{th} position of β chain of hemoglobin. This abnormal Hb change the shape of RBC from spherical to sickle shape and these RBC's become hemolytic in nature and produce haemolytic anemia. Sickle cell anemic patients are resistant against malaria (Falciparum malaria)



X-Linked recessive disorders :

(7) G-6-Phosphate dehydrogenase deficiency syndrome – G-6-PD enzyme present in RBC. This enzyme stabilizes the membrane of R.B.C. Deficiency of this enzyme causes rupture of R.B.C. when it comes in contact with sulfa drug, chloroquine, Fava (Favism) bean legumes.

(8) Duchenne's muscular dystrophy – Dystrophin protein is absent in muscles, this protein helps in conduction of Ca^{++} ion. Due to deficiency of dystrophin protein, muscles contraction does not occur properly.

Autosomal dominant gene mutational disorder

(1) Polydactyly : Presence of extra fingers and toes

(2) Brachydactyly : Presence of abnormal short fingers & toes.

(3) Huntington chorea :- In this disorder dominant mutation occur on 4^{th} chromosomes so the mental and muscle degeneration occurs in the patients. This causes abnormal movement of limbs and defective speech.

This disease appears at the age of 25–55 yrs. (late on set) Nerve degeneration causing involuntary shaking of legs, arms and head.

(4) Achondroplasia : Defective formation of cartilagenous bones causing dwarfism

(5) Marfan syndrome – 15^{th} chromosome – Long & thin body, Myopia, long Arachnodactyly fingers, Mitral valve prolapes. Connective tissue disorder effect the skeleton, eye and cardiovascular system

Drugs & Alcohol Abuse

What are Drugs & Drug Abuse?

A majority of the drugs are obtained from plants, which are again nothing but chemicals. Some of these are opioids, coca alkaloids, cannabinoids, etc. which are got from plants. Some other medical formulations such as barbiturates, amphetamines, benzodiazepines, etc. are also misused.

The drugs have an effect on the central nervous system of the body. These chemicals react with the body and put the whole body at risk. Drugs change the way the body feels. The chemicals in the drugs send the wrong signals and messages to different parts of the body, thereby resulting in hallucinations and/or seeing and hearing things that are real.

Sometimes certain actions are also committed by individuals under the influence of drugs, which they normally do not do. The ill effects that drugs have on the body include a faster heartbeat, slow body movements, dry throat, and fast or slow breathing, etc. They also affect the different sensations of smell, sight, hearing, feeling etc.

When drugs are taken in such a manner that they impair the regular bodily functions, in terms of physical, physiological and psychological terms, it is called drug abuse. There is no safe limit for taking any drug. The tolerance levels increase every time an individual takes drugs and this becomes a vicious cycle and the individual gets addicted to drugs.

Drug Dependence:

Fig: Drugs

Meaning: Certain drugs are prescribed by physicians for the prevention or treatment of diseases, or for increasing the physical and mental performance and are withdrawn as soon as the desired effect is achieved.
Repeated use of certain drugs on a periodic or continuous basis may make the body dependent on them. This is called drug dependence. The term "drug–dependence" is now-a–days preferred to "drug–addiction or drug habituation" (WHO, 1964). Some people start taking drugs without medical advice due to one reason or the other and become drug dependent.

Types: Drug dependence is of two types Psychological and Physical or physiological.

(i) Psychological dependence: It refers to the person's belief that the normal state of well being can be attained only with the drug's action.
(ii) Physical (Physiological) Dependence: It refers to the person's state when intake of a drug becomes essential to maintain physiological equilibrium. In such a case, the nervous system functions normally in the presence of the drug only. The physical dependence is, therefore, also called neuro adaptation.
Types of Habituating Drugs: The habituating drugs are grouped into two main categories:

1. Psychotropic drugs and
2. psychedelic drugs.

I. PSYCHOTROPIC DRUGS:

These drugs act on the brain and alter behaviour, consiousness and capacity of perception. Hence, they are also termed mood–altering drugs. The repeated use of the psychotropic drugs makes the body dependent on them. The psychotropic drugs are classified into four major groups: tranquillisers, sedatives and hypnotics, opiate narcotics and stimulants.

(1) Tranquillisers: The tranquillisers decrease tension and anxiety, and promote calmness and soothing without sedating or depressant effect and do not induce sleep.
Examples: phenothiazines and benzodiazepines.

(2) Sedatives and Hypnotics: The sedatives depress ('switch off') the activities of the central nervous system. They reduce excitement and give a feeling of calmness, relaxation or drowsiness. Higher doses induce sleep. The sleep–inducing drugs are also called hypnotics.
Examples: Barbiturates and benzodiazepines.

(3) Opiate Narcotics: Medical use: The opiate narcotics are drugs that suppress brain activity and relieve pain. They are popularly called pain killers. They also have sedative effect. The opiate narcotics are also used for cough relief and for the treatment of vomiting and diarrhoea.
Examples: The opiate narcotics are briefly called opiates or opioids. They include opium and its derivatives; certain semi-synthetic compounds, namely, heroin and smack; and some synthetic drugs such as pethidine and methadone.

(4) Stimulants: The stimulants temporarily stimulate the nervous system; make a person more wakeful, alert and active; and cause excitement. The stimulants do not cause physical dependence because no withdrawal symptoms appear. Psychological dependence is very likely to occur as withdrawal causes depression, anxiety and restlessness. The stimulants include caffeine, cocaine, crack, beetelnut and amphetamines.

II. PSYCHODELIC DRUGS:

Hallucinogens: The hallucinogens act mainly on CNS and greatly alter one's thoughts, feelings and perceptions.
They are known as psychodelic drugs (G. psycho = mind, soul ; deloum = to manifest). They cause optical or auditory hallucinations,i.e., illusions, apparent perception of external objects or sounds not actually present.
The illusions may be pleasant or unpleasant. The hallucinogens are also called vision–producing drugs.

Examples: The hallucinogens include chemicals such as LSD (lysergic acid diethylamide), mescaline, psilocybin, psilocin, PCP (phencyclidine piperidine), MDMA (methylenedioxy methamphetamine) and other products of hemp plant.

Type of drug	Examples	Effects	Clinical Uses
Sedatives and tranquilizers(c b pressent)	Barbiturates Benzodiazepines (e.g., Valium)	Depress brain activity and produce feelings of calmness, relaxation, drowsiness and deep sleep (high chases)	Hypnoti c,anti-anxiety
Opiate narcotics	Opium, morphine, heroin, pethidine, methadone	Suppress brain function, relieve intense pain (physical and mental), produce temporary euphoria	Analgesi c

Opioids bind to specific opioid receptors present in our CNS and gastrointestinal tract.

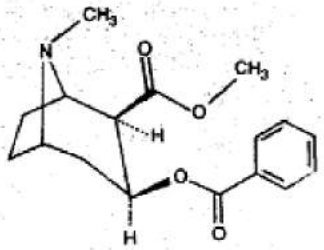


Fig: Chemical Structure of Morphine

Fig. : Opium poppy

Major Categories of Psychotropic Drugs, their Effects and Clinical Uses

Type of drug	Examples	Effects	Clinical Uses
Stimulants	Caffeine (very mild), amphetamines (including dexamphetamine), cocaine and its derivative Novacaine	Stimulate the nervous system:; make a person more wakeful, increase alertness and activity, produce excitement.	Weight control Neurotic (Depressive) disorder

Major Categories of Psychotropic Drugs, their Effects and Clinical Uses

Type of drug	Examples	Effects	Clinical Uses
Hallucinogens	LSD, mescaline, psilocybin, charas, hashish, marijuana (bhang)	Alter thought, feelings and perceptions; hallucinations	None

- Cannabinoid receptors present principally in the brain.
- Cannabinoid generally taken by inhalation and oral ingestion, these mainly affect cardiovascular system of body.

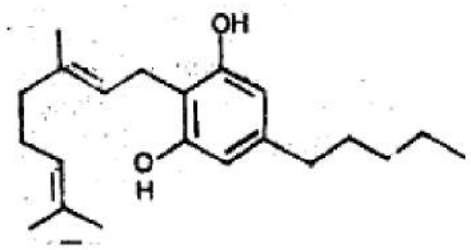


Fig. : Skeletal structure of cannabinoid molecule

Fig. : Leaves of *Cannabis sativa*

Fig. : Flowering branch of *Datura*

LSD (Lysergic acid diethylamide)
- always smoked
- most powerful psychedelic (=hellucinogen)
- extracted from fruiting body of *Claviceps purpurea*
- Causes horrible dreams, emotional outbursts, hellucination, **Chronic psychosis**, severe damage to CNS.

- Atropa belladonna and Datura also have hallucinogenic properties.

MENTAL HEALTH

Mental health is important for the maintenance of physiological health, and social effectiveness.

Mental illness is characterised by the following symptoms:

(i) depression
(ii) insomnia (lack of sleep) or excessive sleeping,
(iii) compulsive actions
(iv) feeling of hopelessness
(v) suicidal thoughts
(vi) unreasonable phobias
(vii) partial or complete loss of memory
(viii) self-destructive behaviour, e.g., excessive gambling, drinking, drug abuse, over-eating and extreme dieting
(ix) delusions (false beliefs) and hallucinations
(x) vocational and social dis-functioning on a day-to-day basis. Hallucination is a subjective disorder of sensory perception, in which one of the senses is involved in the absence of external stimulations.

Types of Mental disorders:

Mental disorders are of many kinds. There are three main types: Psychosis, neurosis or psychoneurosis, and personality and character disorders.

1. Psychosis: It is a severe mental disorder. It arises in the mind itself. It involves gross disorganization of a person's mental capacity and effective response. The patient is "insane" (mad) and out of touch with reality. He cannot cope with the ordinary demands of everyday life. He does not know he is ill and refuses to get treatment.

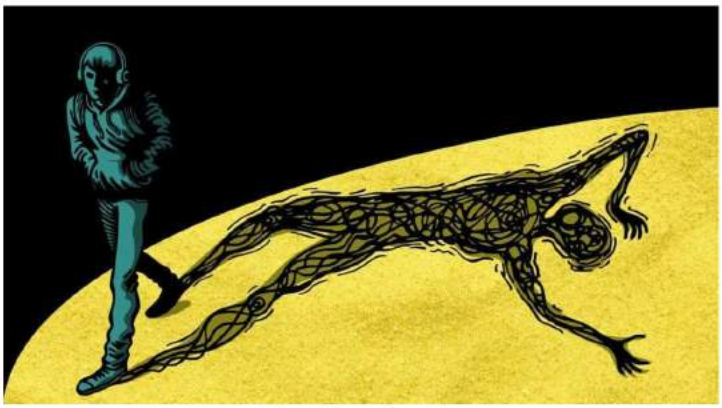


Fig: Psychosis

Psychosis may be associated with physical ailments such as in diabetes, high blood pressure, tuberculosis and brain disorders. Psychosis are of many types. Some common types are mentioned.(i) Alcohol Psychosis: It is a mental disorder resulting from alcoholism. It involves organic brain damage as in delirium.
(ii) Senile Psychosis: It is a mental disturbance occurring in old age.

(iii) Toxic Psychosis: It is caused by some toxic substances, whether endogenous or exogenous.
(iv) Traumatic Psychosis: It results from physical injury or emotional shock.

2. Neurosis: It is a mild mental disorder. It arises due to the effect of environmental factors on the patient, it involves behavioural disorder. The patient is unable to react normally to life situations. There are excessive or prolonged emotional reactions (anxiety, fear, sadness, tension, vague aches) to stresses. A neurotic is not considered "insane" by his associates. He is aware of his problem and seeks help.

3. Personality and Character disorders: These include epilepsy, mental retardation and childhood behavioural problems. These are minor mental illness.

PSYCHOLOGICAL DISORDERS:

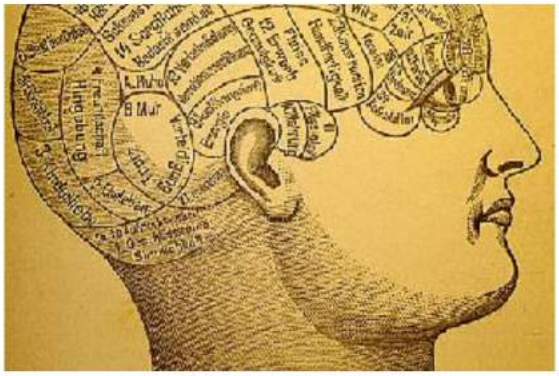


Fig: Disorders

(i) Anxiety disorders: Neurotic anxiety develops when there is an over-reaction to stressful events. It is associated with a range of unpleasant bodily symptoms, including palpitation sweating, nausea, trembling, diarrhoea and muscular tension. The commonest anxiety states seen in childhood and adolescence are separation anxiety disorder and school phobia.

(ii) Obsessive-compulsive disorders: It is Neurotic disorder. Affected persons manifest overwhelming obsessions and compulsions. They are compelled to perform an action or an idea despite their own attempt to resist it (compulsion). The most common obsessions are violence. (Self destructive)

(iii) Attention deficit disorder: It is a neurotic mental health problem among children. It is observed more in boys than in girls. As a result of this disorder, the boys exhibit under achievement, behavioural problems and a tendency to be disliked by other children.

(iv) Mood disorders: These are the occasional bouts of high or low mood, i.e., elevation and depression. Depression is a neurotic mood disorder characterized by sadness, hopelessness, low self-esteem, decline in interest, energy, concentration and changes in sleep pattern and appetite. The cause may be a death in the family, failure in examination or interview, or losing of a job, this disorder can be bipolar, i.e., depressed mood may alternate with exaggerated arousal and over-activity, like non-stop and quick talking.

(v) Schizophrenia: It is psychotic disorder which is characterised by:-
(a) distorted thoughts,
(b) laughing or crying at completely inappropriate times.
(c) dopamine increases

(vi) Borderline personality disorder (BPD): This disorder is an emotionally unstable personality disorder, which is characterised by impulsivity, unpredictable moods, outbursts of emotion, behavioural explosions, quarrelsome behaviour, and conflicts with others. These individuals are highly reactive, and generally experience episodic depression, anxiety, and irritability. They also have problems with anger and anger expression. Individuals with BPD often attempt to injure, mutilate or kill themselves.

AIDS & Cancer

AIDS (Aquired Immuno Deficiency Syndrome)

1. It is not a congenital disease
2. Characterized by decrease in number of helper T-cells.
3. Also called slim disease

4. First detected in homosexual males in USA (1981) at Disease control centre Atlanta.
5. In India first AIDS case was reported in 1986 from chennai.
6. Virus was named variously HCLV-III = Human cell Leukemia Virus-III
   - HTLV-III = Human T-lymphotrophic Virus-III
   - LAV = Lymphoadenophathy associated virus
   - HIV-I = Most common in India (90-120 nm) and widely distributed throughout the world.
   - HIV-II = Most common in West Africa (90-120 nm) Transmission :

(i) Sexual route : due to multiple sex partners, prostetuters, homosexuality, artificial insemination (Probability < 1%).

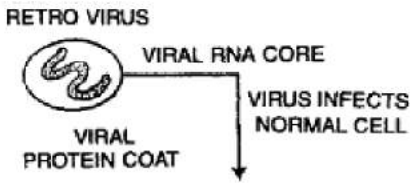
(ii) Parenteral route : through blood contact due to unscreened blood transfusion, tattoeing, infected, poorly sterlized dental instruments.

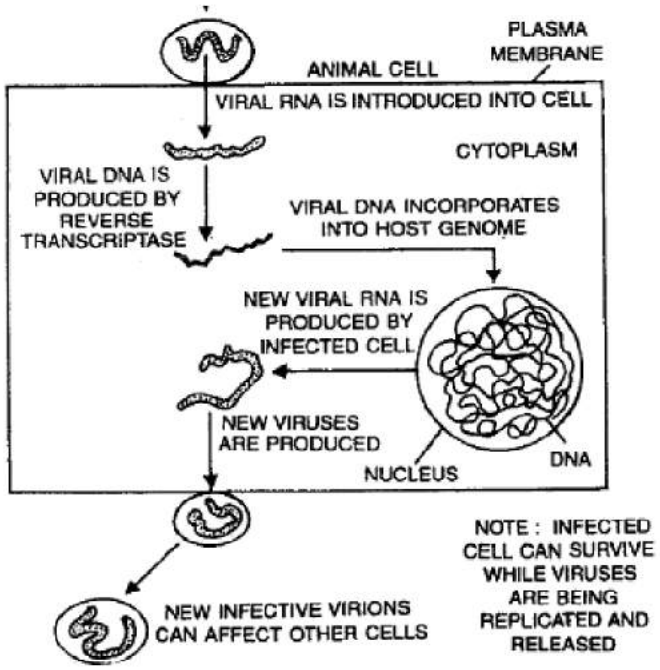
(iii) Transplacental route = from mother to fetus = Vertical transmission, by placenta (33%) = From mother to infants = perinatal transmission, by colostrum.

Misconceptions :

- AIDS do not spread through more touch, physical contact, hugging, kissing, sharing meals, shaking hands, mosquito bites, coughing, sneezing looking after AIDS patients.
- HIV spreads only through body fluids.

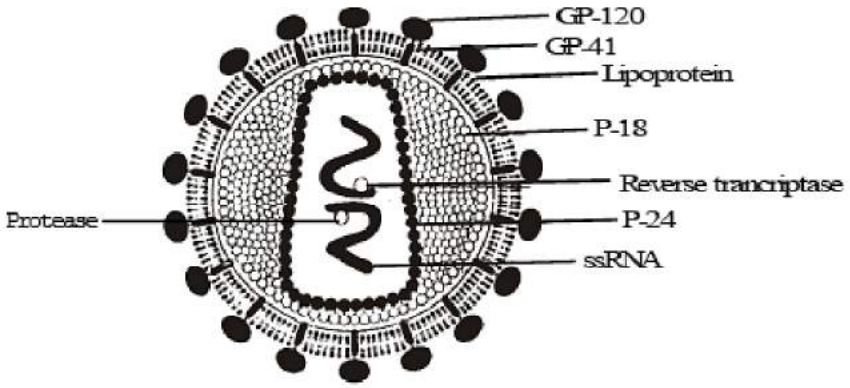
Pathogenicity :





Structure :

- Retro virus (Lenti virus family)
- Core has 2 identical molecules of SSRNAs, enzymes (reverse transcriptase, protease) Core also has
  1. Inner protein coat (P-24)
  2. Outer protein coat (P-18)
- Core is covered by lipoproteins (GP-120 and GP-41)
- GP-120 has complementry sequence to CD-
- receptors present on Macrophages (HIV factory), helper T-cells etc.



Symptoms :

- Asymptomatic phase 2-10 yrs, There is no antibody, protection in 1st (2-12 weeks) so infectivity of patients or activeness of virus is maximum is this period. This period is called window period (No specific symptom appear in this phase so ELISA test is negative in window period)
- AIDS related complex (ARC)

= mild form of HIV
= swollen lymph nodes, bouts of fever, repeated episodes of diarrhoea, weight loss prolonged cough.
= Patient become fully immune deficient in this period. T-lymphocytes or CD_4 count $< 200 \times 10^6$/litre (normal CD_4 count $> 900 \times 10^6$ per/litre) and now this condition is called full blown AIDS.

- Full blown AIDS

= Tuberculosis by Mycobacterium avium.
= Candidiasis of mouth and oesophagus by Candida albicans
= Pneumonia by fungus Pnemocystis carinii
= Sores by Herpes simplex virus -II
= Cancer of skin and lymphnodes (Kaposi' sarcoma), HIV acts as an oncovirus.
= Dysentery by cryptosporidium
= AIDS dementia (memory loss) by Herpes Zoster virus
= Encephalitis by Toxoplasma gondii

- Most of infections are due to opportunistic infections, appear when immunity become weak.

Investigation :

- Screening test : (ELISA) Enzyme linked immuno sorbent assay.

Confirmatory tests : Western blot test which detects antibodies, in patient's serum.
Treatment :
(i) Reverse transcriptase inhibitor = Zidovudin (previously called AZT), Stavudin, Trizivir, DDI (Didexymidine), Foscarnet, etc.
(ii) Protease inhibitor = Ritonavir, Nelfinavir, Sequinavir etc.
(iii) HAART (Highly Active Ant Retroviral Therapy) includes both reverse transcriptase inhibitor and protease inhibitor drugs.
Dr. David Ho. – Cocktal treatment of AIDS in 1993 and research in USA 1995, man of the year.

- Treatment is only partially effective, only prolong the life of the patients but cant prevent death, which is inevitable.

Prevention :

1. Education : NACO (National AIDS Control Organisation) has been set up under health family welfare ministry. (NGOs/ Non government organisation also playing their important role)
2. Screening of blood,
3. Ban on prostetution, Safer sex and awareness about to use of condoms.
4. Use of disposables
5. Sterlization of Ragors, blades and dental equipments.
6. AIDS patients need help and sympathy instead of being shunned by society.
It is a malody that can only be tackled by society and medical fraternity acting together to prevent spread of the disease.

Cancer

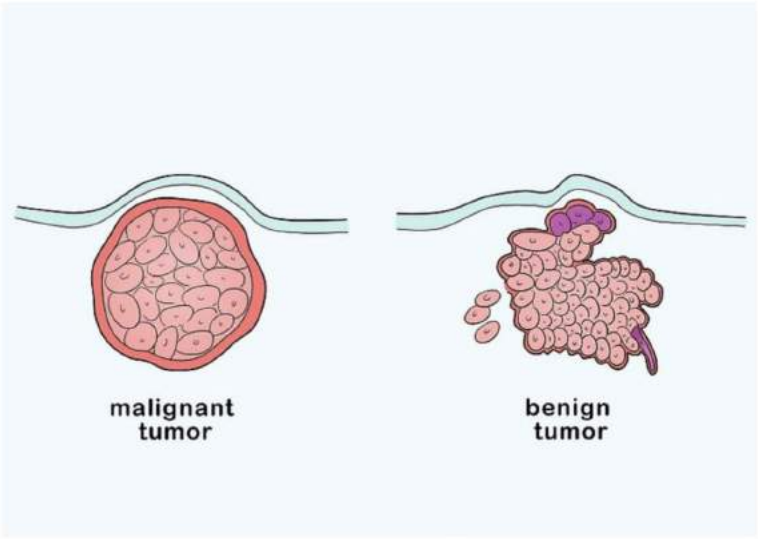
Uncontrolled, Abnormal and excessive mitotic division of cells is called cancer (Crab = cancer).
Study of cancer is called oncology. These abnormal and undifferentiated cells are called cancerous cells.

TUMOUR OR NEOPLASM (New growth) :

Types of Tumours–

(a) Benign Tumour : capsulated, localized to the site of origin & does not spread to another parts of body, it is non metastatic, non-malignant, non-cancerous, Non invasive eg.:-
Bone tumour – Osteoma
Muscle tumour – Myoma
Lymph node tumour – Lymphoma

(b) Malignant Tumour (Malignant = Harmful) : Some of the cancerous cells detach from their origin place and spread to other parts of body by blood and lymph. Now the cancerous cells form fresh colonies there. This is called metastasis or sec. growth. This type of tumour is called metastatic or cancerous tumour. It is Invasive tumour. e.g. All malignant tumour are called cancers.



CANCER IS DIVIDED INTO 3 CLASSES ON BASIS OF ORIGIN

(i) Carcinoma : This tumour originate from the Skin and epithelial tissue eg :
(a) Brain carcinoma
(b) Oral carcinoma
(c) Gastric carcinoma
(d) Colon carcinoma
(e) Lung carcinoma
(f) Cervical carcinoma
(g) Adeno carcinona (gland tumour)
(h) Breast carcinoma
Carcinoma is most common type of tumour (85%)

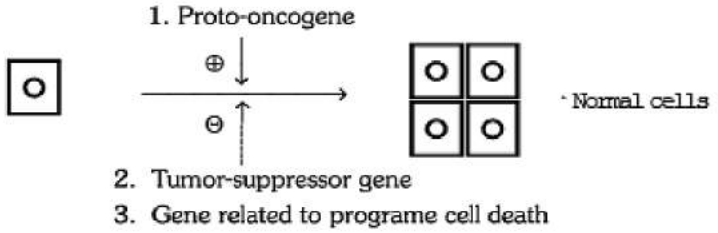
- Breast cancer in female and prostate cancer in males are common incidence in world. Lung cancer accounts for 31.1% of all cancer death in men and 25% in women.
- Cervical (Uterine Cervix) cancer in females and oral cancer in males are common in India.

Melanoma –It is type of carcinomas. These are cancerous growths of melanocytes (a type of skin cells).

(ii) SARCOMA : This is tumour of mesodermal tissue. eg.
Bone cancer – Osteosarcoma
Muscle cancer – Myosarcoma
Lymph node cancer – Lymphosarcoma.
(iii) Leukaemia (Leucocyte = W.B.C.) or Blood Cancer : This is cancer of white blood cells (WBC).

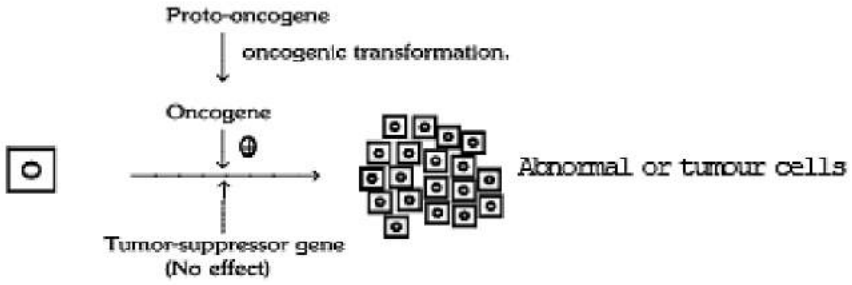
- **Chronic Myelogenous Leukaemia (CML)**: This fatal cancer occurs mainly due to reciprocal translocation between chromosome-22 (Philadelphia chromosome) and chromosome 9.
- **Burkitt's Lymphoma** : This is a type of leukaemia which is produced due to reciprocal translocation between chromosome-8 and chromosome-14.

According to a rough estimate about 8 lakhs cases of cancer are detected in India every year out of which 4 lakhs succumb to death.
Normal mechanism of body growth – Normal cell division regulation by proto-oncogenes and it is suppressed by tumour surppressor gene.



CAUSES OF CANCER

Chemical or physical agents that can cause cancer are known as carcinogen. Depending on their mode of action, carcinogens fall into the following main categories :
(i) Agents that can cause alterations in the genetic material (DNA), resulting in oncogenic transformation.
(ii) Agents that promote the proliferation of cells, which have already undergoes genetic alterations responsible for oncogenic transformation. These agents are called tumour promoter e.g. some growth factors and hormones.
(iii) Cancer causing DNA and RNA viruses (tumour viruses) have been shown to be associated with oncogenic transformation.
Transformation of a normal cell into cancer cell if the regulation is upset.



Cancer cells don't show contact inhibition phenomenon which is shown by normal cells (when normal cells contact with other cells they inhibit uncontrolled growth by activation of tumour suppressor gene of cells).

Carcinogen :

Causative agent cancer - Carcinogen (a) Chemical factor : Tobacco and betal chewing causes oral cancer. Heavy smoking (N–Nitrosodimethylene) causes oral cancer, cancer of larynx and lungs. Combustion product of coal and pesticides, artificial flavour, sweetners, synthetic food, add flavour, hormonal imbalance in body cause cancer.
Hormonal imbalance or estrogen excess causes breast cancer. Urinary bladder cancer is common in dye workers.

Important carcinogens and the organs affected

	Carcinogens	**Affected Organs**
1.	Soot	Skin and lungs
2.	Cigarrete smoke (N-ritrosodimethylene)	Lungs
3.	Coaltar (3, 4-benzopyrine)	Skin and lungs
4.	Aflatoxin (metabolic product of fungi)	Liver
5.	Cadmium oxide	Prostate gland
6.	Mustard gas (b)	Lungs
7.	Asbestos	Lungs
8.	Nickel and Chromium compounds	Lungs, Larynx
9.	Vinyl chloride	Liver
10.	Diethy lstebesterol (DES)	Vagina
11.	Benzene	Blood, Bone marrow
12.	Arsenic	Liver, lungs, Skin

Physical factors ; Sharp teeth cause Tongue cancer. Kashmiri people keep 'Kangri' close to skin that cause skin cancer and this skin cancer is called kangri cancer.
(iii) Radiation factors : Cosmic rays, X-rays and U.V. rays cause cancer. There are 5 times more incidence of leukemia in Hiroshima & Nagasaki due to radiation effect of nuclear bombing.
(iv) Biological factors : Oncogenes (cancer producing genes) and on covirus cause cancer (HIV in AIDS.)

INVESTIGATION :

(i) Blood examination : Detection of the abnormal cells or cancerous cell in blood. Detection of the tumour marker like a-feto protein in blood by blood examination.
(ii) Biopsy : Cancerous tissue examination is called biopsy (Karyoplasmic index high).
(iii) F.N.A.C. (Fine needle aspiration cytology) - eg. breast cyst / tumour.
(iv) C–T scan, M.R.I, X-rays
X-ray of breast is called Mamography
(v) Pap smear : It is used for cervical carcinoma and detects cytological character of cancer.
(vi) Modern techniques monitor and detect the molecular changes that occur in cancer cells; this enables an early diagnosis of cancer. Monoclonal antibodies against cancer-specific antigens are coupled to appropriate radioisotopes. These antibodies are then used for detection of cancer.

Treatment :

(a) Surgery : By removing the entire cancerous tissue and infected lymph nodes.
(b) Radiation : Cobalt therapy (Co–60), X-ray radiations are given. These radiations destroy the rapidly dividing cells.
(c) Chemotherapy : Many anti-cancerous drugs like :-
Drug mechanism :
→ Vincristine (weed – cantharanthus roseus = Vinca rosea)
→ Vinblastin (weed – cantharanthus roseus = Vinca rosea)
→ Cyclophosphamide inhibit the DNA synthesis in cell cycle of cancerous cell but these drugs show many severe side effects.
(d) Immuno therapy → Monoclonal antibodies and vaccine are given in it.
One of the recent approaches of cancer treatment involves augmentation of natural anti-cancer immunological defence mechanisms. Monoclonal antibodies have been used in various ways, e.g., radio immuno therapy,etc., for treatment of cancer. Research is in progress to develop cancer vaccines.

- Most of cancer are treated by combination therapy of surgery, radiation and anti cancerous drug.

BIOMEDICAL TECHNOLOGIES

1. DIAGNOSTIC IMAGES

X-RAY IMAGING :
Introduction : It is one of the oldest method of imaging which began with the accidental discovery of X-ray by Wilhelm Conrad Roentgen, a German physicist, in

1895.
The branch of science that deals with the study of X-ray for detection and treatment of diseases is called radiology.

Principle: High dose X-ray

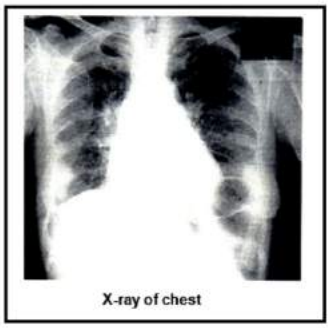
Uses:

(i) X-ray imaging is usually applied in detecting bone fractures and dislocations. This technique is also advantageous in detecting the diseases of heart and lung.
(ii) Barium meal.
(iii) Barium enema.

Advantage : Cheap and easy procedure

Disadvantage : Harmful to our body (Act as carcinogens)

Digital subtraction angiography (DSA) : DSA is an imaging technique that produces clear views of flowing blood in vessels and indicates the presence of blockages, if any. An angiograph (angeion : vessel, graghein : to record) is taken of the organ, for example, heart and its major blood vessels, and stored in a computer. A second angiograph is taken after a contrast agent containing iodine (I^{132}). which is opaque to X-rays, has been injected into the blood stream. The first image is digitally subtracted from the second, leaving behind a clear outline of the blood flow to heart, brain or kidneys.



X-ray of chest

C.T. (COMPUTERIZED TOMOGRAPHY) SCAN :

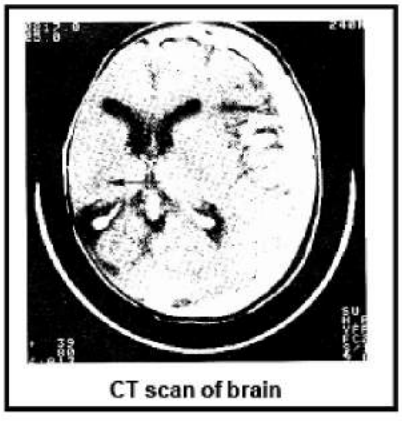
Computerized tomography (CT) is also known as computerized axial tomography (CAT). This technique was invented by English physicist Geoffrey N. Hounsefield in 1972 (Tomo is a greek term 'cut' or 'slice').
Hounsefield is also called father of modern radiology (Nobel Prize in 1978).
The theoretical basis of this technique was provided by the work of the Indian biophysicist, Gopalsamudram N. Ramachandran.

Principal : Low dose X-rays ADVANTAGES :

(i) Improved contrast resolution between tissue not previously on plain radiography, eg.:- liver v/s gall-bladder, etc.
(ii) Ability to display cross-sectional images in the axial plane.

Uses :

CT scans are generally performed of the head and the abdomen. CT is valuable technique commonly used to investigate the brain following a stroke or if a brain tumour is suspected.



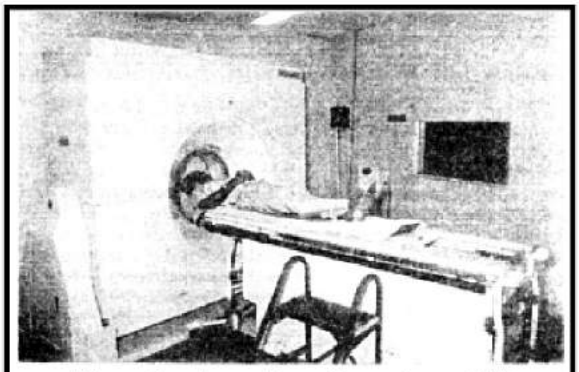
CT scan of brain

DISADVANTAGES :

(i) Expensive
(ii) Ionizing radiation involved.

M.R.I. (MAGNETIC RESONANCE IMAGING)

Given by Bloch + Purcell (N.P. 1952) The technique is based on magnetic resonance generated by the nuclei of hydrogen atoms subjected to an external magnetic field (upto 7–Tesla). It is based on NMR (Nuclear magnetic resonance) because our body cell is having H atom in the form of H_2O molecule therefore our body acts as miniature magnet and generated magnetic field.



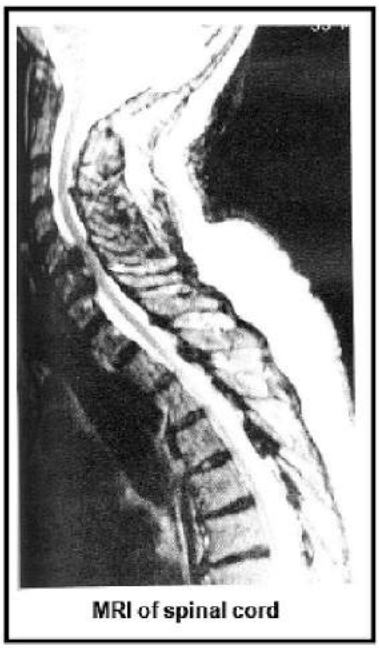
The patient is positioned to undergo MRI

ADVANTAGES:

(i) No ionising radiation is used.
(ii) Images can be taken in any plane and obtain 3D image in single picture.
(iii) The inherent contrast between various tissues is better than with other modalities.
MRI detects water because it focuses on the behaviour of hydrogen atoms in water molecules. This allows MRI to distinguish between water-poor and water-rich tissues. Teeth and bones, which contain little water, do not appear in MRI. Therefore, tissues surrounded by bones, such as spinal cord, are readily observable in MRI. It is used to examine brain and spinal tissue, joint injuries and slipped disk in the spinal column. MRI can also visualize minute cancerous tumours, since radio frequency absorbed by the hydrogen atoms in such tissues for the same field is different from that for normal tissues.

MRI is superior to CT and PET. because -

(i) CT-scan can obtain only cross-sectional images whereas MRI can obtain images in any plane.
(ii) MRI is applicable in diagnosing tumours, infarctions (muscle cell death), haemorrhage, abnormalities related to spine, myocardial infarction (heart attack), myocardial ischaemia, coronary artery disease, etc. A related technique, called Magnetic Resonance Angiography (MRA), can be used to monitor the flow of blood.
(iii) Nuclear magnetic resonance (NMR) or magnetic resonance imaging (MRI) is a new noninvasive method of mapping the internal structure of the body.



MRI of spinal cord

DISADVANTAGES :

(i) Expensive
(ii) Patients with various metallic implants may not be able to undergo MR exams.
(iii) Claustrophobia can lead to inability to examine patients.

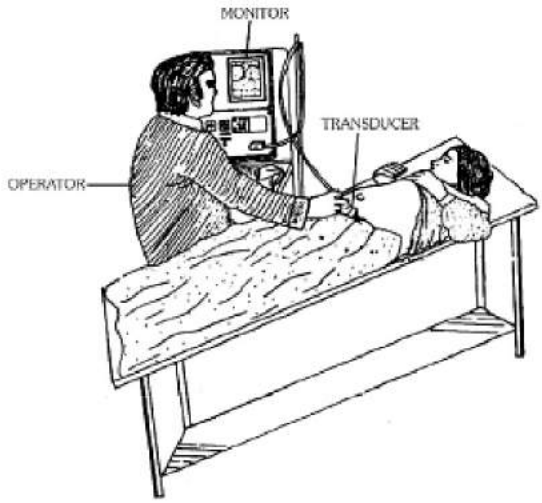
POSITRON EMISSION TOMOGRAPHIC SCANNING (PET) Discovered by Louis Sokoloff, 1987
(i) PET is also a computer based imaging technique but differs from CT Scanning. It provides information on the metabolic and physiological processes of the tissues and organs. The CT Scanning, on the other hand, gives only the 'static' anatomical images.
(ii) This technique involves the use of positron emitting short life radio isotopes (like ^{11}C, ^{13}N,^{15}O and ^{18}F).
These atoms are first incorporated into bio-molecules (such as glucose, amino acids,

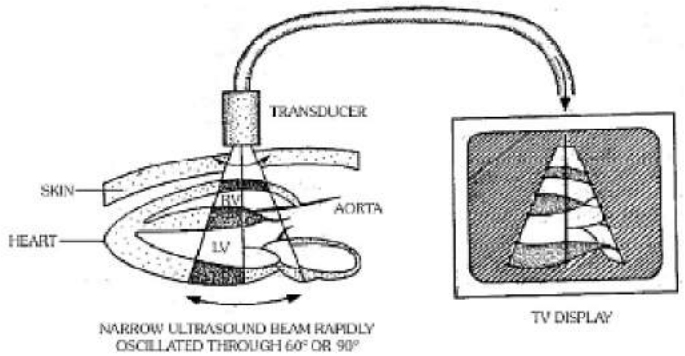
carbon dioxide and ammonia) and then injected in very small amounts into or inhaled by the experimental animal or human subjects.
As the radioactive atom decays, it emits a subatomic particle, called positron. Almost immediately, the emitted positron colloids with it antiparticle, i.e., an electron. This collision releases a burst of electromagnetic energy in the form of a pair of γ-radiation. This double emission is the key to the PET scan. These radiations emerge simultaneously in the opposite directions and they strike crystals in a ring of detectors around the patient's head, causing the crystals to light up.
(iii) A computer records the location of each flash and spots the source of radiation, translating that data into a 3D-image.
A metabolically active tissue will receive a greater blood supply than a relatively inactive tissue. Therefore, it will also get a greater supply of radioactive glucose, and would appear as a brighter area in the PET image. For example, the darkened area on the of brain indicates damage from a stroke.
Bright colours in the rest of the brain show normal blood flow. Thus, by tracing the radioactive glucose, a physician can pinpoint the areas of greater brain activity, e.g., the regions of brain involved in a particular function.
This versatile technique is used to study epilepsy schizophrenia, Parkinson's disease and drug addiction.
(iv) Recently, the scientists in U.K. have located the colour processing centres in the human vision cortex with the help of PET-imaging technique.

PET is useful in measuring :

(i) Metabolic rates.
(ii) Regional blood volume and blood flow.
(iii) Areas of abnormalities like disease and defects.
(iv) Identification of specific centres in brain like colour processing in visual cortex of humans.

SONOGRAPHY/ULTRASOUND IMAGING (Olaf von Ramm ; Donald, 1958) It is a noninvasive technique which uses ultrasound for producing images of internal body parts. Ultrasound is 'sound' beyond human hearing power, that is, above 20000 Hz or 20kHz. Diagnostic ultrasound used in sonography has a frequency of 1–15 MHz (MHz = megahertz = 1million oscillations/sec.) Ultrasound is produced through pizoelectric effect. Here, electric potential is applied to crystals of lead zirconate in a transducer. The crystals vibrate and produce ultrasound. Ultrasound is partly reflected as it passes from one layer to another. The reflected waves are picked up by lead zirconate crystals and changed to electrical signals. The latter produce a visual image which is observed over computer screen. Sonography provides images to all those organs or regions which are different or become different in density from surrounding tissues.





Sonography is also called Echography. For clinical examination, a sonographer places a scan head or transducer in contact with the area to be scanned. A layer of aqueous gel is applied between the skin and scan head to ensure that the sound has an air-free path to the object of interest, e.g., a foetus.
Sonography, safer than radiography, is comfortable and inexpensive.

Uses of USG :

1. It is used to assess foetal growth and to pick up a wide range of abnormalities, such as spinal bifida, and conditions liable to cause difficulty in labour.
2. Ultrasound imaging is used to investigate the internal organs such as liver, gall bladder, kidney, stomach, uterus, heart, etc.
3. A related technique, called Doppler Ultrasound Scanning is used to investigate the flow of blood in vessels and for detecting blood clots (Incoming blood – red, out going blood – blue). Sonography is also used

to image the adult body. It even provides pictures of blood flow through the beating heart, based on a phenomenon known as Doppler effect.

4. Echocardiography is sonographic (ultrasound) imaging of heart, great vessels, heart valves, heart walls, etc. to know abnormality. It is also used to record blood flow velocity and blood turbulence.
5.

ADVANTAGES: There is no exposure to radiation. Ultrasound imaging is non-invasive and painless. There is no harmful effects in man. It is less expensive. The images can be obtained in any plane.

DISADVANTAGES: Ultrasound imaging does not penetrate bones and air filled spaces so it is not useful in diagnotic abnormalities in the skull, lungs or intestine. Resolution power of ultrasound imaging is inferior to CT Scan and MRI

Common Diseases in Humans - 2

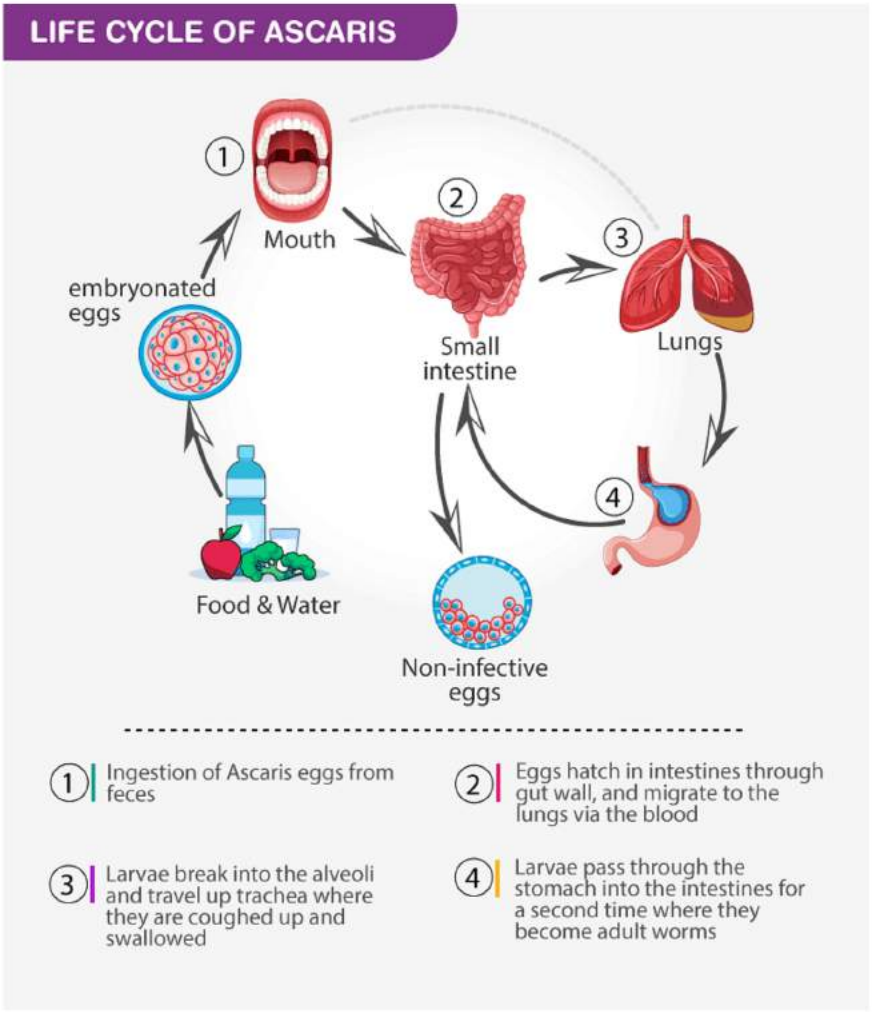
Ascariasis : Common Diseases in Humans

Parasites are organisms that may live either in or on other organisms and survive by deriving nutrients at the expense of the organism it is living in. A variety of parasites affects humans. Ascaris is a parasitic large roundworm which causes Ascariasis disease. Ascaris and Wuchereria are some of the parasitic helminths that infect humans.

Ascariasis

The disease, Ascariasis is caused by an intestinal parasite called Ascaris also known as roundworms. The roundworm is a pale white, long slender tube-like worm that lives in the intestines of humans. The roundworm is present in the faeces of a person infected with it, in the form of eggs. Flies generally are considered the vector for roundworms in humans. Roundworms are generally asymptomatic but symptoms may appear depending on the number of roundworms present in the person. Symptoms include fever, shortness of breath, malnutrition, abdominal swelling and diarrhoea. Children are the most affected by this infection.

Life Cycle of Roundworm



The eggs are transported from the infected faeces to a healthy individual by flies. The point of entry for the parasite usually being from the mouth, i.e., from unhygienic food and water. The eggs hatch and passes through the intestines and enter the lungs through the blood cells. Here they break into the alveoli in the lungs, move up to the trachea where they are swallowed and coughed. When the larvae pass through the stomach for the second time they mature into adult worms.

Roundworm Treatment

Medicines that are used to kill roundworms are called acaricides. The roundworm treatments recommended by the WHO are:

- Albendazole
- Mebendazole

Prevention of Ascariasis

Improved access to sanitation would be the biggest step towards ridding the world of ascariasis. Properly functioning and cleaning of toilets greatly reduce the possibility of a fly picking up a roundworm egg and infecting someone else. Washing hands with soap after using the restroom is another thing we should practice religiously.

Typhoid

What Is Typhoid?

Typhoid is an infectious bacterial disease that mainly spreads through contaminated food or water. It can also spread due to poor hygienic conditions. The major symptoms of this disease are characterized by high fever, loss of appetite and diarrhoea. Salmonella typhi is the bacterium responsible for this disease and humans are the only carriers. The first case of typhoid fever was reported in the United States in the early 1900's. Overall, about 21 million people are infected with this disease annually, and about 200,000 cases are fatal. Furthermore, scientists have identified 2 types of typhoid causing bacterium, namely:

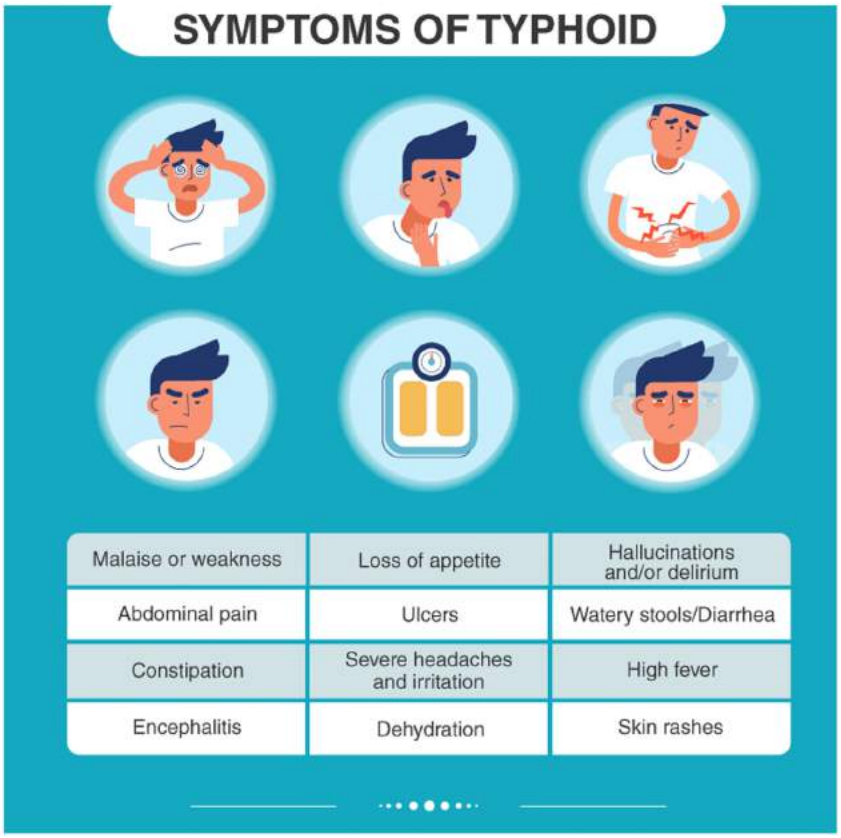
- ST1
- ST2

Causes of Typhoid

Also called as "Salmonella enterica serotype Typhi", this microbe is the causative agent for this disease. It is a gram-negative bacteria characterized by a thin cell wall and an outer membrane. The cells are reddish in colour, with some having black stains in the centre.
It is rod-shaped and grows in the small intestine of the human body. Human beings are the main hosts of these bacteria. This type of species can survive in environments which are rich in oxygen and also, they are found in sewage, water bodies and some eventually make their own on to food.
The bacteria enter the human body through the contaminated foods and water, where it then enters into the intestinal cells of the human body. Later, it passes through the bloodstream and destroys the lymphatic system and spreads throughout the body. This bacterium is mainly carried by the white blood cells present in the liver and also the bone marrow. There, they multiply and re-enter the blood cells, which in turn, causes a number of symptoms to appear in the later stages.

Symptoms of Typhoid

Patients affected with typhoid usually display the following symptoms:

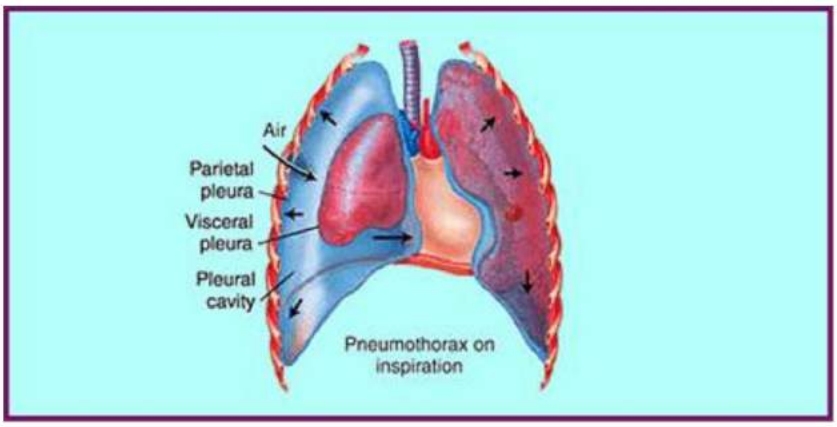


Treatment for Typhoid

Sanitation is one of the most important things that one can do to prevent the infection of such diseases. The other way would be the use of antibiotics that can kill the disease-causing germs. Also by maintaining good and hygienic food habits, one can get rid of diseases easily.

Pneumonia

Pneumonia is a common disease that can have more than 30 different causes and symptoms. It is a highly contagious lung infection characterised by inflammation of air sacs in one or both the lungs. The air sacs get filled with fluid or pus resulting in fever, chills, cough and breathing difficulty. Let us have a look at the different types of pneumonia, its symptoms, treatment and how is it caused.



What is Pneumonia?

Pneumonia is a serious infection of lungs caused by various bacteria, viruses and fungi. It can be mild and sometimes even prove fatal. It affects people with weakened immune systems, older people above 65 years of age, infants and young children. Pneumonia can be bacterial, viral or mycoplasmic. It is a serious health issue and requires proper treatment.

Types of Pneumonia

➤ **Bacterial Pneumonia**

- The most common bacteria causing pneumonia is Streptococcus pneumoniae. It occurs in people with an existing lung disorder, and also those who drink excessively because of which they develop a weaker immune system. It also affects old people whose immunity weakens with increasing age.

➤ **Viral Pneumonia**

- It is caused by various viruses such as the influenza virus. More than 1/3rd of the pneumonia cases are caused by viruses.

➤ **Mycoplasma Pneumonia**

- This is known as atypical pneumonia and shows different symptoms. It is caused by Mycoplasma pneumoniae and causes mild pneumonia that affects all age groups.

➤ **Other Pneumonia**

- These are less common and can be caused by other infectious agents such as fungi.

How is Pneumonia Caused?

Pneumonia is caused by a variety of pathogens such as virus and bacteria. When these pathogens overpower our immune system, they cause pneumonia.

Pneumonia Symptoms

The common symptoms of pneumonia include:

- Coughing with greenish, yellow and sometimes blood in the mucus.
- Shortness of breath
- Fever with chills.
- Sweating
- Loss of appetite
- Nausea
- Chest pain

Pneumonia Treatment

Antibiotics should be given to the patients for a speedy recovery. Pneumonia can be treated at home, but in severe cases, the patient needs to be hospitalized. Viral pneumonia has no specific treatment. It gets cured on its own. The patient needs to increase the fluid intake, take proper nutrition, take oxygen therapy for breathing problems and medicines for pain and cough-relief.

Pneumonia Prevention

Pneumonia can be prevented by the following steps:

Vaccination

A few types of pneumonia can be prevented by certain vaccinations. The vaccination status should be reviewed by the doctor even if you have already received a pneumonia vaccine. There are different vaccine for children below 2 years of age and between 2-5 years of age who are more at risk.

Practice Proper Hygiene

Wash your hands properly or use a proper sanitizer to prevent yourself from any pathogenic infections.

Avoid Smoking and Alcohol Consumption

Smoking and alcohol consumption weakens the immune system and makes it prone to infections. Quit these habits to maintain strong immunity and prevent yourself from any infections.

Key Points about Pneumonia

- Pneumonia is the infection of the lungs caused by bacteria, viruses and fungi.
- It can be diagnosed through physical examinations, blood tests and tests for sputum.
- It ranges from mild to fatal.
- Pneumonia can be characterised by fever, chills, shortness of breath and chest pain.
- It can be treated by certain antibiotics.

Common Cold

What is Common Cold?

Cold or common cold is a disease diagnosed with a headache, runny nose, scratchy throat, fever and non-stop sneezing. It is a viral infectious disease of the upper respiratory tract, which primarily affects the nose and sometimes sinuses, ears, and bronchial tubes.

Causes of Common Cold

A common cold is caused by viruses. Some of them include –

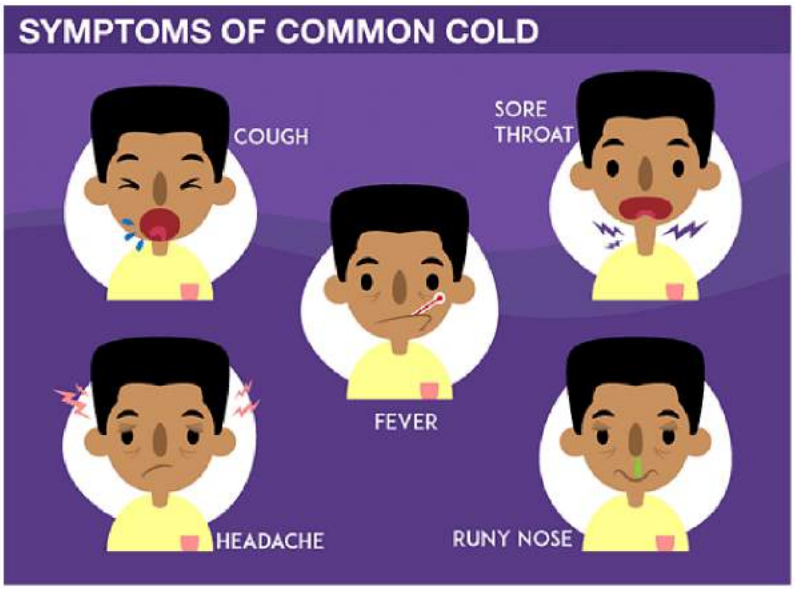
- **Rhinovirus** – This one usually intrudes your system during early fall, spring, and summer. They are behind 10%-40% of colds. Even though these are the main common viruses which affect you, they would rarely make you seriously sick.
- **Coronavirus** – The virus affects the human system during winter and early spring. This virus is behind 20% of colds. There are more than 30 types of coronavirus, out of which only 3 or 4 ones are harmful.
- **RSV and parainfluenza** – These tiny organisms are behind severe infections like pneumonia, in young children.

Pneumonia is a lung infection with symptoms of a cough, fever, and breathing problem. Some more symptoms would include –

- A cough viz. mucus (sputum) from your lungs, which could be rusty or green or tinged with blood.
- Diarrhea
- Fever
- Shaking and "teeth-chattering" chills
- Fast breathing and feeling short of breath
- Fast heartbeat
- Chest pain that often feels worse when you cough or breathe in
- Vomiting and Nausea
- Feeling very weak or tired

You could get infected by a cold infected person. When you touch surfaces or objects used by them, which contains germs and then to your nose or mouth, you are prone to get infected by the germs or virus.
You could get affected by it if you're near a cold infected person, as their sneeze could contaminate the air which you breathe passively. When a virus attaches to the lining of the nose or throat, the infection of cold initiates. The immune system of the body sends out white blood cells (WBC) to attack this invader and this is how cold gets demolished.

Signs and Symptoms of Common Cold



When cold strikes, the following symptoms are usually observed –

Primary Symptoms

- Scratchy or a sore throat
- Sneezing
- Stuffy nose
- A cough
- A Runny Nose
- Watery eyes
- Mucus draining from your nose into your throat

Secondary Symptoms

- High fever
- Muscle aches
- Fatigue
- A headache
- Loss of appetite

These symptoms indicate that you have flu rather than a common cold.

Prevention of Common Cold

It is practically impossible to completely prevent the spread of colds, but you can take certain measures to reduce the chances of getting cold.

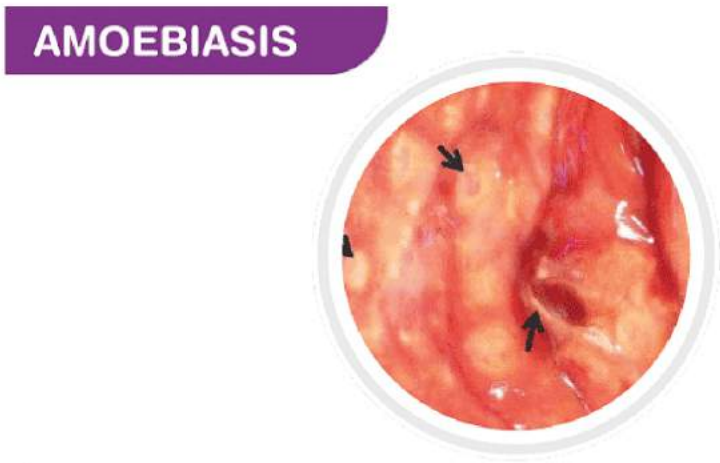
- **Wash your hands often** – It is probably the best measure to prevent the transfer of cold or any kind of infection. Use sanitizer while being in any public places and also make it a point to wash hands before eating. Teach the importance of hand-wash to kids also.
- **Avoid touching your face** – Try not to touch face, mouth, nose & eye areas, when you are near to a person infected with cold.
- **Control stress –** People facing emotional stress regularly have a weaker immune system, which implies that they could catch a cold easily. So, reduce stress and live a healthy life.
- **Cleanliness –** Keep household surfaces like doorknobs, drawer pulls, keyboards, light switches, telephones, remote controls, countertops, and sinks clean. These are the places where viruses lie for hours after they are used by an infected person.
- **Avoid Smoking –** Cigarette smoke could raise the chances of susceptibility to colds and other infections. Avoid passive smoking as well.
- **Drink sufficient amount of water** – Drink water, juice, clear broth, warm lemon water, chicken soup, and other warm fluids. These will help you to stay away from cold or flu.

Myths About Common Cold

Note that getting chilly or wet doesn't trigger the cold sickness. You get infected with cold only when you are more prone to. When you are extremely tired, under emotional distress, or have allergies to nose and throat symptoms, you easily catch a cold. Another myth states that your diet is the cause of such sickness or infection which is not true. Another hoax is when they say that you're getting sick because your tonsils or adenoids are large.

Amoebiasis

"Amoebiasis is an infection caused by the microorganism Entamoeba hystolytica, that is transmitted through contaminated food or water."



Amoebiasis is also called as amebic dysentery. It is an intestinal illness caused by a parasite, **Entamoeba histolytica**. This parasite lives in the intestines and produces eggs (cysts) which are passed from the body in the stool.

What is Amoebiasis?

Amoebiasis is also known as amoebic dysentery. It is caused by a protozoan parasite of the human large intestine, Entamoeba histolytica. They are cosmopolitan, they live in the large intestines and produce eggs or cysts, which are passed out of the body with the stool. It results in diarrhoea and colitis.
Let us have a detailed look at the symptoms and causes of amoebiasis.

Causes of Amoebiasis

Amebiasis is caused by the following ways:

- Living in areas with poor sanitary conditions.
- Ingesting water or food, contaminated by faeces of infected people.
- By swallowing cysts of the parasite. It can also occur by oral-anal sexual contact with an infected person.

Symptoms of Amoebiasis

An individual infected with E. histolytica may have mild to severe symptoms. Sometimes a person may show no symptoms of the disease.

- Fever
- Chills

- Nausea
- Weight loss
- Abdominal discomfort
- Diarrhoea that may include blood or mucus with periods of constipation

Treatment of Amoebiasis

Symptomatic amoebiasis can be treated with administration of metronidazole, followed by eliminating any organisms present in the colon by a luminal amoebicide. Asymptomatic carriers are treated by giving a luminal amebicide. This reduces the risk of transmission.

Ringworm

What is Ringworm?

Ringworm, also known as dermatophytosis, is a fungal infection of the skin. It can affect both humans and animals. The infection initially appears as red patches on the affected areas that later spreads to different areas of the body. It majorly affects the scalp, nails, feet, groin and beard.

Ringworms are not caused by worms, but by fungus instead. It is highly contagious and affects the skin and scalp. This infection is seen primarily in humans and animals.

The ringworm fungus grows well in moist environment such as showers, bathroom floors and walls, swimming pools and also in between the skin folds. The vectors for this disease include pets such as cats and dogs. There are multiple forms of ringworm fungi, which affect different body parts.

Types of Ringworm

Ringworm is classified based on the part of the body it affects.

- **Tinea capitis:** This fungal infection affects the scalp. It is also known by the name of scalp ringworm. (Tinea: Technical term for ringworm.) (Capitis: Latin for "of the head")
- **Tinea corporis:** This fungal infection might occur in any part of the body. Thus it is known as body ringworm. (Corporis: Latin for "of the body")
- **Tinea cruris:** This fungal infection affects the skin around the inner thighs, buttocks, and groin. It is also known as the Jock itch. (Cruris: Latin for "of the leg")
- **Tinea pedis:** This fungal infection affects both the foot, in between the fingernails and toenails. It is also known as Athlete's foot. (Pedis: Latin for "of the foot")

Causes of Ringworm

Ringworm can be caused by the following ways:

- It spreads by skin contact with an infected person.
- It spreads from pets and cows. One should wash hands properly after playing with the pets.
- The fungus causing ringworm might be found lingering on clothes, comb, towels and brushes.
- These fungi are mainly present in the spores of soil. Coming into contact with such soil will result in an infection.

Symptoms of Ringworm

Ringworm symptoms vary depending upon the site of infection. The following are the common characteristic symptoms of ringworm:

- The skin of the feet becomes swollen and itchy between the toes. The soles and heels of the feet may also be affected.
- Itchy, scaly red spots appear on the groin area.
- Ringworm appears like an itchy, scaly, inflamed bald spot on the scalp.
- Ringworm on nails appear to be thick and abnormal in colour and shape.
- In the beard, itchy, red spots appear on the chin, cheeks, and the upper neck.

Diagnosis of Ringworm

Identifying ringworm infection is very easy. It primarily depends on the location and appearance of certain abnormalities in the skin such as bumps, scaly skins etc. Below are common diagnostic procedures done by doctors to diagnose ringworms.

- A black-light (also called UV-A or Wood's lamp) is used to illuminate affected areas on the body. Presence of the fungal infection will glow under the light.
- KOH exam- The scrapings of the infected skin is collected and mixed with the prepared potassium (K) hydroxide (OH) solution. The KOH tests detect the fungi by removing the unaffected cells and leaving the fungal cells aside. The test results are checked under the microscope to detect ringworms.
- Skin biopsy – A small section of skin tissue is cut and examined under a microscope to detect fungi. It can detect a range of infections and disorders
- Fungal culture: A large swab is brushed over the infected areas. These samples are then sent to a lab for analysis to identify the causative microbes. This procedure helps to determine the best course of treatment for the infection.

Ringworm Treatment

A variety of products to treat ringworm infections are available in the market, such as antifungal cream, lotion, and powder. Sometimes, even home remedies are very effective.

- The best antifungal creams used for this infection are miconazole or terbinafine, which should be applied twice in a day on the infected region until the symptoms withdraw
- Amphotericin B is a very powerful fungicide that is used in the most serious cases of fungal infections
- There are many home remedies which help to prevent and control the infections. Using talcum powder is recommended as it helps to control sweating
- Home remedies include neem, which is a particularly effective antimicrobial and antifungal agent

Ringworm Prevention

Following precautions is one of the best methods to avoid ringworms. And more than often, lifestyle choices and decisions affect how the disease is spread. For instance, obesity increases the risk of ringworm.

- Maintain cleanliness and hygiene.
- Wash hands with sanitizers.
- Wear clean ironed clothes.
- Avoid using communal pools.
- Wear loose-fitting cotton clothes to avoid the accumulation of sweat.
- The skin folds have to be kept clean regularly to avoid the accumulation of sweat and dirt between the creases.
- Having a shower twice a day is also recommended.
- Touching or scratching the itchy red patches would help to prevent it from spreading.

Ringworm is not a serious disease, but it is a sign of poor hygiene and a precursor to many other major diseases and infections.