XII
8

HUMAN HEALTH AND DISEASE

SYLLABUS

Health and Disease; Pathogens; parasites causing human diseases (Malaria, Filariasis, Ascariasis. Typhoid, Pneumonia, common cold, amoebiasis, ring worm); Basic concepts of immunology-vaccines; Cancer, HIV and AIDS; Adolescence, drug and alcohol abuse.

KEY CONCEPTS

INTRODUCTION

* **Disease :** Any change from the normal state that causes discomfort or disability or impairs the health is called as disease.
* **Health :** Health is a state of complete physical, mental and social well being, and not merely an absence of disease or infirmity (W.H.O-1948)
* **Prophylaxis or preventive measures :** Preventive measure for a disease is called prophylaxis.
* **Epidemiology :** The study of causes and spread of disease is called Epidemiology.
(epi = among, demos = Human, logy = study)
* **Etiology :** Study of the cause of disease is called Etiology.
* **Incubation period :** Time interval between the entry of pathogen and appearance of symptoms is called incubation period.
Window period : Period between infection to the time when it can be laboratrically detected.
* **Chemotherapy:** Treatment with chemicals (Medicine)
* **Antibiotics:** Substances which are secreted by microorganism that inhibit the growth or destroy the other microorganism are called antibiotics. This term was given by Walksman (Streptomycin-first bacterial antibiotic obtained from bacteria -*Streptomycin griseus*).
Example - Bacteriostatic- Tetracycllin, Chloramphenicol, Bacteriolytic or Bacteriocidal- Streptomycin, Ciprofloxacin, Ampicillin.
* **Analgesics :** Substance that relieves pain.
Example - Opioid analgesics - Morphine, Codeine, Diclofenac sodium, Nemuslide.
* **Antipyretics (Antifebrile) :** (Pyrexia - Fever) Substance that reduces temperature or fever of body. Example - Aspirin (Acetyl salicylic acid)- (It produces gastric ulcer so not extensively recommended as a analgesic), Ibuprofen, Paracetamol, Nemuslide.
* **Antihistaminic drug:** These drugs give relief from allergies by neutralizing histamines that is released from the ruptured mast cell. e.g. cetrizine
* **Tranquillisers and Hypnotics and Sedative drug:**

(i) **Tranquilliser drug :** A drug that act to reduce mental tension and anxiety without interfering with normal mental activity.

(ii) **Sedative drug:** A drug that calms the subject without inducing sleep.

(iii) **Hypnotic drug :** A drug that induces sleep.

* **Antiseptic and Disinfectant :** Agent that inhibit or kill microbes on contact. Conventionally agents used on living surfaces are called antiseptics while those used for inanimate objects are called disinfectants.

* **Disinfection:** In this process, kill only vegetative form of bacteria.
* **Sterlisation :** In this process, kill all form of pathogens including spores.

Medical Terms

1. Arthro - Joint (Arthritis)
2. Aesthesia - Sensation (Anaesthesia means lack of sensation)
3. Bracy - Short (Bracydactyly)
4. Brady - Slow (Bradycardia)
5. Coronary or Cardia - Heart
6. Dropsy - Due to *Argimone maxicana's* seeds. These seeds mix with mustard oil and produce poisoning.
7. Encephalon - Brain
8. Enteron - Intestine
9. .....emia-Blood(Anemia, protenemia, Hyperglycemia)
10. Gastric - Stomach
11. Hepatic - Liver
12. ..... itis - Infection or inflammation
13. Myo - Muscles
14. Metastasis - Cancer cells or tissue spread from one part to another part of body.
15. Nephric/Renal - Kidney
16. Pulmonary - Lungs
17. Patho - Disease
18. .....Penia-Decrease (Neutropenia, Leucopenia)
19. .... Philia or Cytosis - Increase (Neutrophilia, Lymphocytosis)
20. Phobia - Acrophobia, Hydrophobia, Agoraphobia
21. Plegia -Paralysis, (Hemiplegia, Paraplegia)
22. Phrenic -Diaphargm
23. Rhine - Nose
24. Tachy - Fast (Tachycardia-fast heart rate)
25. ....uria - Urine (Haematuria)

SCIENTISTS

* Man of Medicine : Atreya
* Father of Medicine: Hippocrates – He gave scientific explaination of disease first time.
* Father of Surgery: Susruta – He used non-poisonous leeches as an anticoagulant during surgery.
* Father of Ayurveda : Charaka (Ayu → Life, Veda → Knowledge)
  He first gave concept of digestion, metabolism and immunity.
* Father of Modern Pathology: Rudolf virchow.
* Father of Immunity: Edward Jenner (Small pox vaccine).
* Father of Blood grouping : C. Landstainer.
* Father of Modern Bacteriology : Robert Koch (Anthrax, T.B., Cholera).
* Nobel Prize (in 2004) for odourent receptor (olfaction) is given to Richard Axel and Linda B.Buck.
* Nobel Prize (in 2005) = Marshal and Warren for *Helicobacter pylori* bacterium.
* Nobel Prize (in 2006) = Fire and Melo for RNA interference.
* Nobel Prize (in 2009) = V. Ramkrishan et. al for antibiotic and ribosome relationship.

Important days

30 January	-	Leprosy day
24 March	-	Tuberculosis day
07 April	-	World Health day
26 June	-	International day against drug abuse and Illicit trafficking.
01 July	-	Doctor's day
11 July	-	World population day
01 Dec.	-	AIDS day

DISEASE

* Any change from the normal state that causes discomfort or disability or impairs the health is called a disease.
* Disease causing organisms are said to be pathogen.

Categories of Diseases

* The diseases can be broadly divided into two groups congenital and acquired diseases.

(A) **Congenital Diseases** : They occur since birth and may result from metabolic disorder or defect in development.

(B) **Acquired Diseases** : They develop after birth and can be further divided into two main categories

(a) *Infectious or* **Communicable diseases** which rapidly spread from one person to another, they include infectious diseases.
Examples (i) Viral Diseases eg. polio, common cold, measles,rabies (ii) Bacterial diseases eg. Typhoid, pneumonia, Diptheria,Tetanus, (iii)Fungal diseases - eg. Ring worm & Scabies (v)Helminthic diseases - eg Ascariasis, Filariasis, taeniasis.

(b) Non - infectious or Non-communicable : Diseases which do not spread from person to person, they include all other acquired diseases. Among non-infectious diseases, cancer is the major cause of death.

COMMON INFECTIOUS DISEASES

(A) BACTERIAL DISEASES

(i) Typhoid :

* **Pathogen:** *Salmonella typhi* (bacterium)
* **Organs affected:** small intestine, migrate to other organs through blood.
* **Method of transmission:** contamination of food and water.
* **Symptoms:** High fever, weakness, stomach pain, constipation, headache and loss of appetite, intestinal perforation and death may occur in severe cases.
* **Test:** Typhoid fever could be confirmed by **Widal test.**
* A classic case in medicine, that of Mary Mallon nicknamed Typhoid Mary. She was a cook by profession and was a typhoid carrier who continued to spread typhoid for several years through the food she prepared.

(ii) Pneumonia :

* **Pathogen:** *Streptococcus pneumoniae & Haemophilus influenzae.*
* **Organs affected:** Alveoli of lungs, alveoli get filled with fluid.
* **Method of transmission:** inhaling the droplets/ aerosols released by infected person.
* **Symptoms:**
  - Fever, chills, cough and headache.
  - In severe cases the lips and finger nails turn gray to bluish colour.

(iii) Diphtheria:

* This disease is caused by *Corynebacterium diphtheriae* usually affecting children upto five years of age.
* It maystart as sore throat, chills with mild fever, sometimes vomiting and headache.
* Throat and or tonsils show a grey membrane which may spread down and cause hoarseness and difficulty in breathing.
* Nose may be affected giving rise to a blood-tinged nasal discharge from one nostril.
* If the disease is not treated early and properly, the toxin produced by the germs affects the heart and the nervous system, and proves fatal.
* The most important preventive measure-against this disease is that all babies should be, immunised within the first six weeks of birth using DPT vaccine.

(iv) Tetanus (Lock Jaw) :

* It is caused by *Clostridium tetani.*
* The first indications of this disease are irritability and restlessness, the neck becomes stiff and there is difficulty in chewing and swallowing.
* Subsequently spasms of muscles of the jaw and face take place and thus "Lock Jaw" occurs.
* There is a severe pain.
* It is often a fatal disease.
* The toxin affects 'voluntary muscles' mainly.
* Tetanus organisms live in the intestine of horses and other animals without doing any harm.
* The spores, are therefore, abundant in the soil manufactured with animal dung.
* Spores may survive for 60 or more years in contaminated soil.
* On entering the body by way of wounds, the spores release active bacteria.
* The latter multiply and secrete powerful exotoxin into the tissue and blood.
* The exotoxin known as **Tetanospasmin** brings about tetanus.
* Anti tetanus serum (ATS) injection should be administered in case of an injury.

(v) Plague:

* This disease is characterized by high fever and a bubo (painful swelling) in the groin or the armpit.
* Plague is caused by *Yersinia pestis,* a deadly bacterium.
* It is primarily a disease of rodents but it accidently affects man.
* It goes from rat to rat through the rat fleas.
* But when the rats die of plague, the fleas leave the dead rat and if any man is round about, they bite him and accidently inject into his blood some plague germs.

(vi) Tuberculosis (TB) :

* It is also called **Koch's disease**.
* It a caused by *Mycobacterium tuberculosis.*
* The bacteria damage the tissues and release a toxin named tuberculin which produces the disease.
* It affects the lungs, lymph nodes, bones and joints.
* Incubation period is quite variable.
* Symptoms of pulmonary (lungs) tuberculosis are fever, cough, blood containing sputum, pain in the chest and loss of weight, excessive fatigue, failure of appetite, rise of temperature in the evening, hoarseness of throat, night sweating and rapid pulse.
* BCG vaccine gives considerable protection against tuberculosis.

(vii) Leprosy (Hansen's Disease) :

* This disease is caused by *Mycobacterium leprae,* which was discovered by **Hansen**.
* Symptoms of leprosy include appearance of light coloured patches on the skin, thickening of the nerves, partial or total loss of sensation in the affected parts of the body.
* These are accompanied by fever, pain, ulcers and skin eruptions.
* Deformities of toes and fingers may also develop.
* The bacilli leave the body in nasal discharge, from the throat during coughing, sneezing and even speaking and through broken skin lesions.
* The patient is treated with DDS (diamino diphenyl sulphone).

(B) VIRAL DISEASES

(i) Common cold / Rhinitis :

* **Pathogen**: Rhino viruses.
* **Organs affected**: nose and respiratory passage
* **Method of transmission:** (a) Direct inhalation of droplets from infected person. (b) Through contaminated objects like pen, books, cups, computer key board.
* **Symptoms:** Nasal congestion and discharge, sore throat, hoarseness, cough.

(ii) Influenza:

* It is commonly known as "Flu" and is highly infectious.
* It causes fever and pain all over the body and affects the nose, throat and air passages as in common cold.
* The disease is caused by various types of influenza viruses *(e.g., Myxovirus influenzae).*
* It starts with fever, headache, sore throat, cold with sneezing and pain all over the body with restlessness.
* In neglected cases, complications like pneumonia, bronchitis and ear infections may develop.
* There is no vaccine at present which can give protection against all types of influenza viruses as each epidemic is of a different type.

(iii) Small Pox (Variola) :

* It is highly infectious disease starting with high fever, chill, backache and headache, followed by appearance of rash on the third day of illness.
* The rash appears first on the face, then on the rest of the body.
* It is more on the face and limbs and less on the trunk.
* The rash starts as small reddish spots which change into papules.
* These in turn change into small vesicles containing clear fluid.
* Vesicles change into pustules.
* Finally, a scab is formed and it falls off by the third week.
* These scabs leave deep pits or scars known as pock marks.
* Many children become blind and develop discharge from the ear.

* This disease is caused by a small pox virus named *Variola virus* (ds DNA virus).
* The virus is present in the oral and nasal discharges of the patients and is ejected during the acts of coughing, sneezing, fomites etc., and infects the healthy people.
* Vaccination against small pox is one of the best preventive remedies available today.
* This was discovered by Edward Jenner in 1798.
* Small-pox has been eradicated from India.

(iv) Chicken Pox (Varicella) :

* It is a mild but highly infectious disease causing slight fever and a rash which undergoes changes into vesicles, pustules and finally a dark brown scab which falls off leaving no scar unlike smallpox.
* The rash comes out in crops and with each fresh crop, there may be slight fever again.
* The rash first appears on the trunk and there are more lesions on the trunk than on the face and limbs.
* The disease is caused by a virus of chicken-pox named *Varicella zoster* which is passed out in the discharges of the respiratory tract of an infected person directly as droplets or through contaminated articles used by the patient.
* Vaccination against chicken-pox is now available.
* The most common late complication of chicken-pox is shingles caused by reactivation of varicella zoster.

(v) Measles (Rubeola Disease) :

* Measles is a highly infectious disease causing fever, inflammation of the air passages and a rash all over the body.
* It attacks especially the children below the age of 5 years and those who have escaped may be attacked even in the later life.
* It is caused by *Rubeola virus* (RNA virus) which is passed out in the secretions of nose and throat of the infected persons as droplets or in articles soiled by these secretions.
* The disease starts with catarrh' of the nose and throat, and fever.
* The eyes are red and watery, and the face is flushed.
* The rash which is slightly pinkish in colour appears first on the back of the ear and face, and spreads downwards on the body.

(vi) Mumps (Infectious Parotitis):

* It is infectious disease causing fever, difficulty in opening the mouth and painful swelling of the parotid glands which lie just below the lobe of the ears.
* It is caused by *Paramyxovirus* (RNA virus), which comes out in the saliva of the infected person.
* The patient should take complete bed rest till the swelling subsides in order to avoid complications.
* Usually, there are no complications, but in some cases there may be pain and swelling of the testes (orchitis) or pain in the abdomen.

(vii) Rabies (Hydrophobia) :

* It is caused by a virus named as *Rhabdo virus.*
* It is introduced in the body by the bite of rabid (mad) dogs usually.
* It can be injected by the bite of jackels, wolves, cats etc., Incubation period is from 10 days to one year.
* Fear of water is the most important characteristic symptom of this disease.
* Other symptoms are saliva from the mouth, severe headache, high fever, alternating periods of excitement and depression, inability to swallow even fluids due to choked throat.
* The virus destroys the brain and spinal cord. Rabies is 100% fatal.
* There should be compulsory immunisation of dogs and cat population.

(viii) Dengue fever:

* Dengue fever is caused by a RNA containing Arbovirus (Arthropod borne virus) of flavi virus group which also causes yellow fever (not found in India).
* Thus, the virus which causes dengue fever is a mosquito borne flavi-ribo virus.
* The virus of dengue fever is transmitted by the bite of female *Aedes aegypti* (mosquito).
* Incubation period is 3-8 days.

* **Two types:** Classical dengue fever and dengue haemorrhagic fever are known to occur.
* **Symptoms of Classical Dengue Fever** are

(i) Abrupt onset of high fever.
(ii) Severe frontal headache.
(iii) Pain behind the eyes which worsens with eye movement.
(iv) Muscles and joint pain.
(v) Loss of sense of taste and appetite.
(vi) Measles like rash over chest and upper limbs.
(vii) Nausea and vomiting.

(ix) Chikungunya:

* It is caused by *Chikungunya virus*.
* This virus was first isolated from human patients and *Aedes aegypti* mosquitoes from Tanzania in 1952.
* The name 'Chikungunya' is derived from the native word for the disease in which patient walks "doubled up" due to severe joint pain.
* Its symptons include sudden onset of fever, crippling joint pain, lymphodenopathy and conjuctivitis.

(C) DISEASES CAUSED BY HELMINTHES

(i) Ascariasis :

* **Pathogen:** *Ascaris lumbricoids* (nematode)
* **Organs affected:** intestine of man
* **Method of transmission:** Contaminated water, vegetables, fruits.
* **Symptoms:**
  - Internal bleeding, muscular pain, fever, anaemia.
  - Blockage of the intestinal passage.
* **Prevention**:
  - The disposal of human faeces by underground sewer canals is an efficient measure to prevent the spread.
  - Washing of vegetables and fruits before eating help of keep away the eggs of the worm.

(ii) Filariasis or Elephantiasis :

* **Pathogen:** Wuchereria (*W.bancrofti* and *W. Malayi*) (nematode parasite)
* **Organs affected**: lymphatic vessels of the lower limbs, genital organs.
* **Methods of transmission**: biting of infected female culex mosquito.
* **Symptoms:**
  - Chronic inflammation of the organs where they live for many years.
  - Abnormal swelling of lower limb, scrotum, penis.
  - Hence the disease named as **elephantiasis** or **Filariasis.**

Figure : Diagram showing inflammation in one of the lower limbs due to elephantiasis

(D) FUNGAL DISEASES

Ring worms :

* **Pathogen**: *Microsporum, Trichophyton* and *Epidermophyton* (fungi)
* **Organs affected**: Skin, nails, folds of skin, groin.
* **Method of transmission:**
  - Acquired from the soil.
  - Using towel, clothes or even comb of infected individuals.
* **Symptoms:**
  - Appearance of dry, scaly lesions in skin nails and scalp.
  - Lesion accompanied with intense itching.
  - **Heat** and **moisture** help these fungi to grow.

(E) DISEASES CAUSED BY PROTOZOANS

(i) Malaria :

* **Pathogen:** *Plasmodium. (P. vivax, P. malariae, P. ovale, P. falciparum)*
* **Malignant malaria** caused by **P. falciparum** is fatal.
* **Organs affected**: liver, RBC.
* **Method of transmission**: by biting of female anopheles mosquito (vector)
* **Symptoms:** high fever and chill, fever occurs on every alternate day, vomiting.

* **Prevention :** Eradication of vector and keeping the surrounding clean.
* **Treatment:** It involves the use of medicine like quinine and protection of patients from the mosquitoes.

Life cycle of malaria parasite:

* Life cycle of plasmodium starts with inoculation of **sporozoites** (infective stage) through the bite of infected female ***Anopheles*** **mosquitoes.**
* The parasite initially multiplied within the liver cells and then attack the red blood cells (RBCs) resulting in their rupture.
* There is release of a toxic substance called **hemozoin** from the ruptured RBCs which responsible for the **chill and high fever**.
* From the infected human the parasite enters into the body of Anopheles mosquito during biting and sucking blood.
* Further development takes place in the body of Anopheles mosquitoes.
* The female mosquito takes up **gametocytes** with the blood meal.
* Formation of gametes and fertilization takes place in the intestine of mosquito.
* The zygote develops further and forms thousands of sporozoites which migrated into the salivary gland of mosquito.
* When the mosquito bite another human sporozoites are injected.
- The malarial parasite requires two hosts – human and Anopheles, to complete their life cycle.

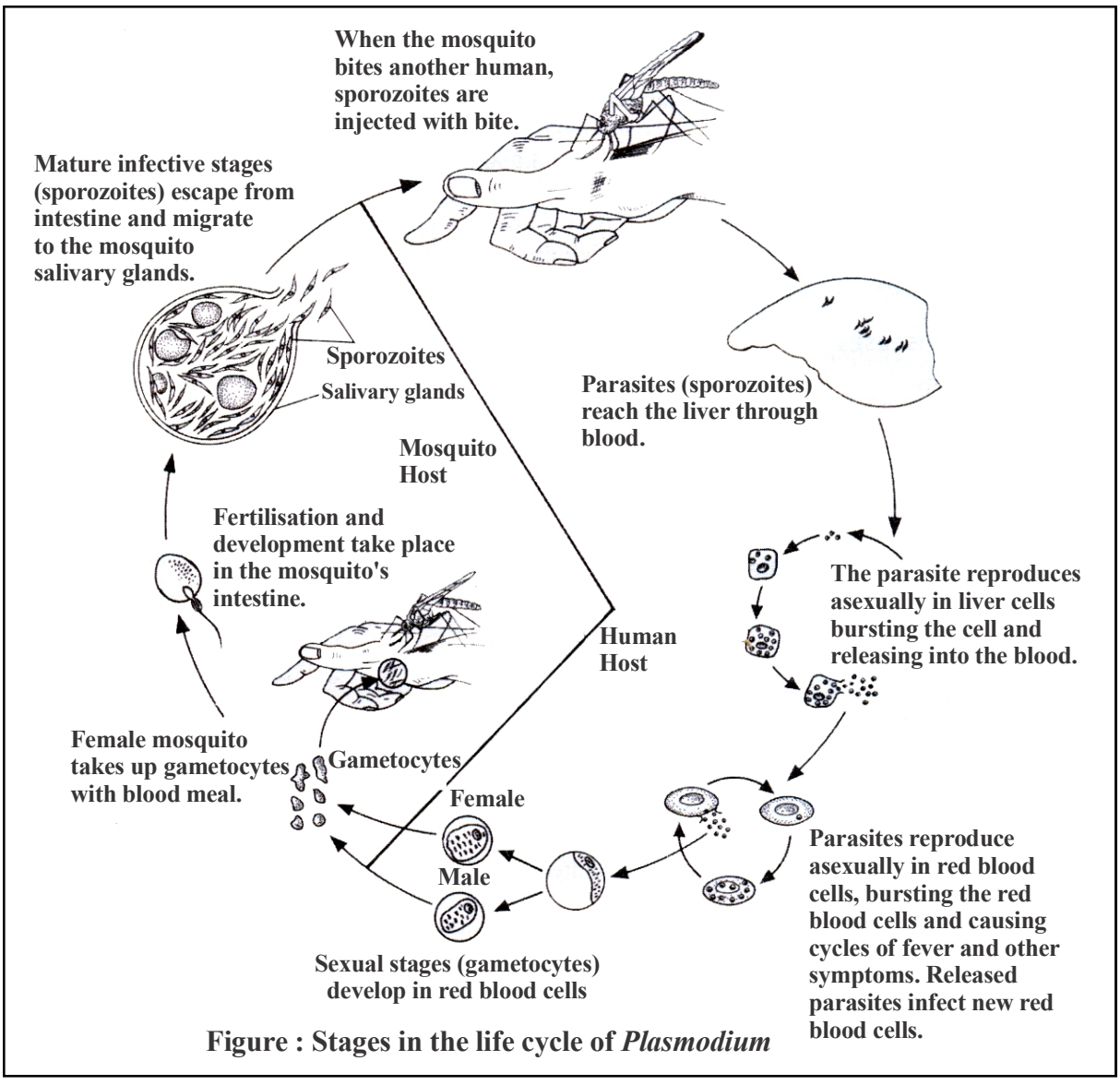


Figure : Stages in the life cycle of *Plasmodium*

(ii) Amoebiasis (Amoebic dysentery)

* **Pathogen:** *Entamoeba histolytica* a protozoan parasite.
* **Organs affected:** large intestine of man
* **Method of transmission:**
  - House fly acts as mechanical carrier.
  - Contamination water and food with faecal matter.
* **Symptoms:**
  - Constipation, abdominal pain and cramps.
  - Stools with excess mucous and blood clots.
* **Prevention :** Proper disposal of faecal matter of the patient. Vegetables and fruits when used raw, should be thoroughly washed. Water should be boiled before drinking.

PREVENTION AND CONTROL OF INFECTIOUS DISEASES

* Maintenance of personal and public hygiene is very important for prevention and control of many infectious diseases.

Personal hygiene includes:

* Consumption of clean drinking water, food vegetable fruits.
* Keeping the body cleans.

Public hygiene includes:

* Proper disposal of waste and excreta
* Periodic cleaning and disinfection of water reservoirs, pools, cesspools.
* Standard practices of hygiene in public catering.
* In case of air-borne diseases, close contact with the infected persons or their belongings should be avoided.

For vector borne diseases

* To control or eliminating the vectors and the breeding places.
* Avoiding stagnation of water in and around residential areas.
* Regular cleaning of household coolers.
* Use of mosquito nets.
* Introducing fishes like *Gambusia* in pond that feeds on mosquito larvae.
* Spraying of insecticides in ditches, drainage area and swamps.
* Window and doors must be fitted with wire mesh.
* All these precautions are useful for vector borne disease like dengue and Chickungunya, malaria and filarial etc.

Vaccination and Immunization:

* By massive immunization there is complete eradication of disease like smallpox.
* Diseases like polio, diphtheria, pneumonia, and tetanus have been controlled to large extent.

IMMUNE SYSTEM

* System of body which protect 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 is called antigen.

(3) Antibody: It is a complex glycoprotein secreted by B-lymphocytes in response to an antigen. It is also called Agglutinin.

(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.

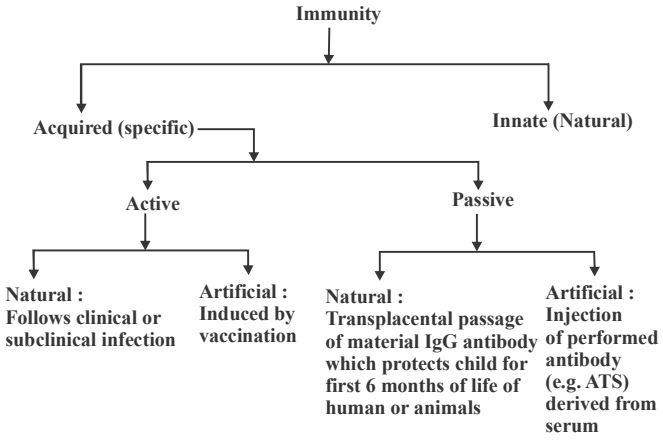
(7) Toxoid: A bacterial exotoxin which is detoxicated by special procedures to allow its safe use in immunization against the disease.

(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 messanger that activates the immune system.
Ex. IL-l, IL-2, 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



INNATE IMMUNITY

* **Nonspecific immune responses**, or innate immunity, provide general protection against pathogens, parasites, some toxins and drugs, and cancer cells.
* Nonspecific immune responses prevent most pathogens from entering the body and rapidly destroy those that do penetrate the outer defenses.
* For example, the cuticle or skin provides a physical barrier to pathogens that come in contact with an animal's body.
* Phagocytosis, another nonspecific defense, destroys bacteria that invade the body.
* Some of the molecules important in nonspecific immune responses recognize and attack certain pathogen-associated molecular patterns, which are shared by whole groups of viruses, bacteria, or fungi.
* Innate immunity consist of four types of barriers. These are

(i) Physical barriers :

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

(ii) Physiological barriers :

* Acid in the stomach, saliva in the mouth, tears from eyes–all prevent microbial growth.
* The sweat also contains an enzyme named **lysozyme** that destroys the cell walls of many bacteria.
* Lysozyme is also present in tears and checks eye infections.
* Lysozyme is also present in the saliva which kills bacteria present in food.
* Bile checks the growth of foreign bacteria in the intestine.
* The mesh of fine hair in our nostrils filters out particles which may carry pathogens. Nasal secretions also destroy the harmful foreign germs with their lysozyme.

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

(iv) Cytokine barriers : Virus-infected cells secrete proteins called interferons which protect non-infected cells from further viral infection.

Cytokines are important signaling molecules

* **Cytokines** are a large group of peptides and proteins (most are glycoproteins) that serve as signals and perform regulatory functions during both nonspecific and specific immune responses.
* Cytokines help regulate the intensity and duration of immune responses, and they are also important in regulating many other biological processes, such as cell growth, repair, and cell activation.
* Cytokines can act as autocrine agents, affecting the very cells that produce them, or as paracrine agents regulating the activity of nearby cells. Some cytokines circulate in the blood and affect distant tissues.
* Four groups: interferons, interleukins, chemokines, and tumor necrosis factors.
* When infected by viruses or other intracellular parasites (some types of bacteria, fungi, and protozoa), cells respond by secreting cytokines called **interferons**. Type I interferons are produced by either macrophages, which are large phagocytic cells, or fibroblasts, cells that produce the fibers of connective tissues. Type I interferons inhibit viral replication and also activate natural killer cells that have antiviral actions. Viruses produced in cells exposed to Type I interferons are not very effective at infecting other cells.

* Type II interferons, produced as a specific immune response, also exhibit anti-viral activity, but in addition, they enhance the activities of other immune cells. For example, Type II interferons stimulate macrophages to destroy tumor cells and host cells that have been infected by viruses.

* **Interleukins** are a diverse group of cytokines secreted mainly by macrophages and lymphocytes. Interleukins are numbered according to their order of discovery. They regulate interactions between lymphocytes and other cells of the body, and some interleukins have widespread effects. For example, during infection *interleukin-I (IL-l)* can reset the body's thermostat in the hypothalamus, resulting in **fever** and its symptoms. Just as there are overlaps between the functions of nonspecific and specific immune responses, the actions of cytokines of these subsystems also overlap. For example, cytokines produced by nonspecific cells such as macrophages can activate lymphocytes involved in specific immune responses.

* **Chemokines,** a large group of cytokines, are signaling molecules that attract, activate, and direct the movement of various cells of the immune system. Some chemokines are produced in response to infection and are key mediators of the inflammatory response.

* **Tumor necrosis factors (TNFs)** are cytokines secreted by macrophages and by lymphocytes called T cells.TNF stimulates immune cells to initiate an inflammatory response. TNF also kills tumor cells, offering promise in terms of immunotherapy for cancer patients. Sometimes infection by Gram-negative bacteria, such as *Salmonella typhi*, results in the release of large amounts of TNF and other cytokines. This results in a cascade of reactions leading to septic shock, a potentially fatal condition that may involve high fever and malfunctioning of the circulatory system. Thus cytokines can sometimes have harmful effects.

Complement leads to the destruction of pathogens

* Cytokines produced by phagocytes can activate the complement system. **Complement**, so named because it "complements" the action of other defensive responses, consists of more than 20 proteins present in plasma and other body fluids. Similarities in complement proteins in many species, including horseshoe crabs, sea urchins, tunicates, and mammals, suggest these molecules evolved millions of years ago and have been conserved.
* Normally, complement proteins are inactive until the body is exposed to an antigen. Certain pathogens activate the complement system directly. In other cases, the binding of an antigen and antibody stimulate activation. Complement activation involves a cascade of reactions; each component acts on the next in the series. Proteins of the complement system then work to destroy pathogens.

Phagocytes and natural killer cells destroy pathogens

* **Neutrophils**, the most common type of white blood cell and macrophages are the main phagocytes in the body. Recall that **phagocytosis** is a type of endocytosis in which cells engulf microorganisms, foreign matter, or other cells. A neutrophil can phagocytize about 20 bacteria before it becomes inactivated (perhaps by leaking lysosomal enzymes) and dies.

* **Macrophages** are large phagocytes that develop from nongranular white blood cells called monocytes. A macrophage can phagocytize about 100 bacteria during its life span. Some macrophages patrol the body's tissues, phagocytizing damaged cells or foreign matter (including bacteria) and, when appropriate, they release antiviral agents. Others stay in one place and destroy bacteria that pass by. For example, air sacs in the lungs contain large numbers of macrophages that destroy foreign matter entering with inhaled air.

* Vertebrate macrophages have **Toll-like receptors** (a family of receptors related to the Toll receptors of insects) that recognize certain Pathogen associated molecular pattern (PAMPs) and respond by producing cytokines e.g. TNF. For example, when stimulated by a lipopolysaccharide found on Gram-negative bacteria, macrophages release molecules that enhance the inflammatory response.

* **Natural killer (NK) cells** are large, granular lymphocytes that originate in the bone marrow. They account for about 10% of circulating lymphocytes. NK cells are active against tumor cells and cells infected with some types of viruses. They destroy target cells by both nonspecific and specific (antibody-mediated) processes.

ACQUIRED IMMUNITY

It is the resistance that an individual acquires during life. This is generated in response to an exposure to the microorganism in question.

* This type of immunity is founds only in vertebrates.
* It is also called Adaptive or spedic immunity.
* This immunity is accquired after birth by experience.
* This immunity recognise and selectively eleminate the pathogen.
* There are two components of immune system in body : Humoral immune system and cell-mediated immune system.

Features of Acquired immunity :

(i) **Specificity :** Acquried immunity is specific for specific micro-organisms.

(ii) **Diversity:** This system recognise the vast variety of micro-organisms.

(iii) **Discrimination between self and non-self :** It can recognise self (body or tissue) and non self (foreign tissue) and respond according to them.

(iv) **Memory:** When a pathogen enter inside the body, body takes longer times to recognise and respond to it this is called primary immune response but the memory of this encounter remain in immune system. When this pathogen enters second time inside the body, body immune system rapidly recognise this pathogen and respond quickly to it. This is called secondary immune response. This is based on memory of immune system.

Specific Immunity Involves two types of Cells

1. Lymphocytes and
2. Antigen presenting cells

1. Lymphocytes:

* Lymphocytes (a type of WBCS) are the main cells of immune system of the body.
* Lymphocytes, meant for immune system, are of two types: T-cells and B-cells.
* Both types of cells develop from the stem cells found in the liver of the foetus and in the bone marrow cells of the adult.
* Those lymphocytes that migrate to the thymus and differentiate under its influence are called **'T-cells'**, while those cells that continue to be in the bone marrow for differentiation are known as **'B-cells'**.
* The final maturation of young lymphocytes occur in lymphoid tissues like lymph nodes, spleen and tonsils.
* T-cells are responsible for cellular immunity, however, B-lymphocytes produce antibodies that take part in the humoral immunity.
* Both T-cells and B-cells require antigens to trigger them into action but they respond differently.
* B-lymphocytes are independent of the thymus and in man probably complete their early maturation within the bone marrow.
* They are called **B-cells** because they mature within the Bursa of Fabricius found in the cloaca of birds.
* Millions of B cells are produced in the bone marrow daily. Each B cell is genetically programmed to encode a glycoprotein receptor that binds with a specific type of antigen. When a B cell comes into contact with an antigen that binds to its receptors, it becomes activated.
* B-cell activation is a complex process that typically requires the participation of a particular type of T cell.

* Once activated, a B cell divides rapidly, forming a clone of identical cells. The cloned B cells differentiate into plasma cells, which produce antibody, a soluble form of the cell's glycoprotein receptor molecule that can be secreted.
* A plasma cell can produce more than 10 million molecules of antibody per hour. The antibody binds to the antigen that originally activated the B cells. Some activated B cells do not become plasma cells, but instead become long living **memory B cells** that continue to produce small amounts of antibody after the body overcomes an infection.
* On their way from the bone marrow to the lymph tissues, T cells are processed in the **thymus gland**.
* The thymus makes T cells *immunocompetent*, capable of immunological response. As T cells move through the thymus, they divide many times and develop specific surface proteins with distinctive receptor sites.
* Only the T cells that have specific receptors are selected to divide; this is a form of positive selection
* T cells that react to self-antigens undergo apoptosis. This is a form of negative selection. Immunologists estimate that more than 90% of developing T cells are negatively selected. The remaining T cells differentiate and leave the thymus to take up residence in other lymph tissues or to launch immune responses in infected tissues. By selecting only appropriate T cells, the thymus gland ensures that T cells can distinguish between the body's own molecules and foreign antigens.
* Most T cells in the thymus differentiate just before birth and during the first few months of postnatal life.
* If the thymus is removed before this processing takes place, an animal does not develop cell-mediated immunity.
* If the thymus is removed after that time, cell-mediated immunity is less seriously impaired.
* T cells are distinguished by the **T-cell receptor (TCR)** which recognizes specific antigens. Two main populations of T cells develop in the thymus: T cytotoxic and T helper cells.
* **T cytotoxic (T_C) cells** are also known as CD8 cells because they have a glycoprotein designated CD8 on their plasma membrane surface. Known less formally as killer T cells, T_C cells recognize and destroy cells with foreign antigens on their surfaces. Among their target cells are virus-infected cells, cancer cells, and foreign tissue grafts.
* **T helper (T_H) cells**, also known as CD4 cells, have a surface glycoprotein designated CD4. T_H cells are regulatory cells. They secrete cytokines that activate B cells and macrophages. After an infection, both cytotoxic and helper **memory T cells** remain in the body.

2. Antigen presenting cells:

* Antigen presenting cells (APCs) are a special class of cells which process and present exogenous antigens.
* APCs include macrophages, B-cells, and dendritic cells.
* APCs are strategically located in places where antigens are likely to penetrate non specific defenses and enter the body.
* These are the epidermis and dermis of the skin, mucus membranes that line the respiratory, urinary, reproductive tracts.
* The steps in processing and presenting an exogenous antigen by an APC include

(a) Ingestion of antigen
(b) Digestion of antigen into peptide fragments
(c) Fusion of peptide fragments to MHC (Major Histocompatibility complex) and its insertion into the plasma membrane. This triggers either a cell mediated immune response (CMI) or Humoral mediated immune (HMI) response.

Antigens:

* The antigens are foreign 'molecules' that invade the body of an organism.
* The word 'antigen' is a shortened form of 'antibody generating' because they stimulate the production of antibodies in response to infection.
* Antigens are generally large molecules.
* The majority of them are made of proteins or polysaccharides found on the cell walls of bacteria and other cells or on the coats of viruses.

* All antigens are not the parts of microorganism.
* Other structures like pollen grains, white of an egg, shell fish, certain fruits and vegetables, chicken, feathers of birds, blood cells from other persons or animals, drugs, chemicals, etc. can also induce the immune system to produce antibodies.
* Antibodies are an army of proteins produced by plasma cells.

Structure of Antibody (Immunoglobulins **Ig)**

* These are complex glycoprotein molecule made up of 4 polypeptide chains two light and two heavy chains. These two chain held together by disulphide bond in shape of Y molecule.

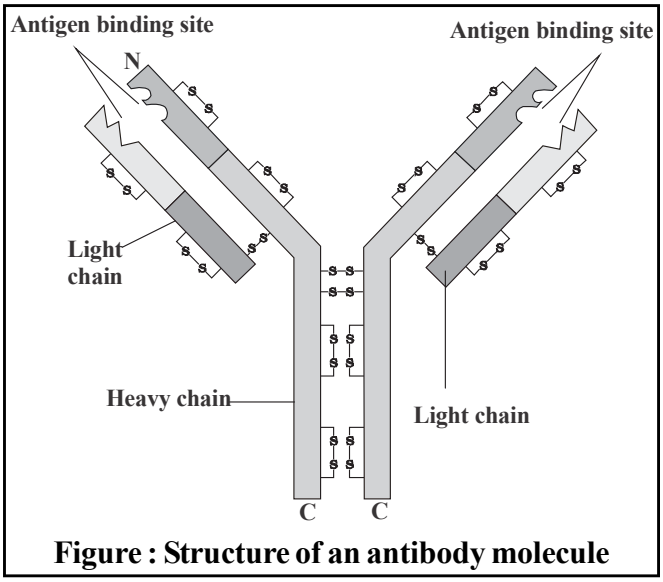


Figure : Structure of an antibody molecule

* 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.
* There are 5 classes ('**Isotypes**') of Ig; IgM, IgG, IgA, IgD and IgE.

(i) IgA forms 15% of total antibody count.

* It is found in mucous secretions of the respiratory tract and the upper part of the digestive tract and the vagina.
* It is also found in colostrum.
* Colostrum is a golden liquid substance that a nursing mother expels from her breasts 24-48 hours after delivery. This substance is produced before the milk and is very important in the transfer of antibodies to a newborn infant.
* IgA given by the mother in the colostrum will protect the baby for about six months.

(ii) **IgD forms less than 1%** of the total antibodies appears to have a role in activating and suppressing lymphocyte activity found in large quantities in the cell walls of many B-cells.

(iii) **IgE is less than 1%** of total antibodies. Mediator in allergic responses. Most importantly activates histamine secreting cells. Also appears to play a role in parasitic infection.

(iv) **IgG-composes 75% of our immunoglobulin pool.** IgG stimulates phagocytic cells, activates the complement system , binds neutrophils, opsonizes and can neutralise toxins. Most importantly, it is the only antibody that can cross the placenta and confer immunity on the foetus.

(v) IgM-makes up 7-10% of our total antibodies.

* This is the predominant early antibody; the one that first activates in an initial attack of antigen.
* Because of its high number of antigen binding sites (10), it is an effective agglutinator of antigen.
* This is important in the initial activation of B-cells, macrophages, and the complement 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 immunisation.

(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).

(b) **Artificial:** Resistance passively transferred to a recepient by administration of antibodies.
Examples : Human immunological administration.
Anti - tetanus serum (ATS)
Anti - rabies serum (ARS)
Anti - diptheria serum (ADS)

* **Difference between Active Immunity and Passive Immunity**

S.No.	Active Immunity	Passive Immunity
1.	It is developed when the person's own cells produce antibodies in response to infection or vaccine.	It is develop when antibodies produced in other organisms are injected into a person to counter act antigen such as snake venom,
2.	It provides relief only after long period.	It provides immediate relief.
3.	It has no side effects.	It may cause reaction.
4.	It is long lasting.	It is not long lasting.

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.
Sequence: Virus invades body cell → infected cell displays foreign antigen-MHC class I antigen complex → specific T_C cell activated by this complex → clone of T_C cells produced → T_C cells migrate to area of infection → T_C cells release proteins that stimulate destruction of target cells.

(2) **A.M.I.S. (Antibody mediated immune system or humoral immunity) :** This immune system is based on B-Iymphocyte (10-20%) and these B-Iymphocyte secret the antibody.
Sequence :
Pathogen invades body → APC phagocytizes pathogen → foreign antigen-MHC complex displayed on APC surface → T_H cell binds with foreign antigen-MHC complex → activated T_H cell interacts with a B cell that displays the same antigen → B cell activated → clone of B cells → B cells differentiate, becoming plasma cells → plasma cells secrete antibodies → antibodies form complexes with pathogen → destroy pathogen.

DISORDERS OF IMMUNE SYSTEM

1. Allergies

* The exaggerated response of the immune system to certain antigens present in the environment is called **allergy**.

* The substances to which such an immune response is produced are called allergens. The antibodies produced to these are of IgE type.

* Common examples of allergens are mites in dust, pollens, animal dander, etc. Symptoms of allergic reactions include sneezing, watery eyes, running nose and difficulty in breathing.

* Allergy is due to the release of chemicals like histamine and serotonin from the mast cells.

* For determining the cause of allergy, the patient is exposed to or injected with very small doses of possible allergens, and the reactions studied.

* The use of drugs like anti-histamine, adrenalin and steroids quickly reduce the symptoms of allergy.

2. Autoimmunity :

* Sometimes it may also happen that the immune system of the body goes off the track and starts behaving against the 'own body' or 'self'. This leads to a variety of diseases known as autoimmune diseases.

* This type of diseases depends on which type of 'self-antigen' is involved.

* When the cells acting as antigens in the same body, they are called autoantigens.

* The nature of autoimmune diseases depends on the autoantigens involved. For example, if the autoantigens are RBC then the body destroys its own RBC, resulting in chronic anaemia; if the autoantigens are muscle cells then it results in the destruction of its own muscles resulting in severe weakness (*myasthenia gravis*); if the autoantigens are liver cells, then it results in chronic hepatitis, etc.

* Other autoimmune diseases are insulin-dependent diabetes, Addison's disease, ulcerative colitis and rheumatoid arthritis.

IMMUNE SYSTEM IN THE BODY

* The human immune system consists of lymphoid organs, tissues, cells and soluble molecules like antibodies.
* The immune system recognises, respond to foreign antigens and remembers them (memory).
* Human immune system also plays an important role in allergic reactions, auto immune diseases and organ transplantation.

Lymphoid organs:

* Lymphoid organs are those organs where the maturation and proliferation of lymphocytes take place.

Types of Lymphoid Organs :

* There are two types

(a) Primary Lymphoid' Organs (= Central lymphoid organs)

* The primary lymphoid organs are bone marrow and thymus where immature lymphocytes differentiate into antigen-sensitive lymphocytes.
* After maturation the lymphocytes migrate to secondary lymphoid organs like spleen, lymph nodes, tonsils, Peyer's patches of small intestine and appendix.
* The bone marrow produces B-cells, NK cells, granulocytes and immature thymocytes, in addition to red blood cells and platelets.
* Thymus is also called **"Throne of immunity"** or **"Training school of T -lymphocytes"**.
* The function of the thymus is to produce mature T cells.
* Immature thymocytes / prothymocytes leave the bone marrow and migrate into the thymus.
* Through a remarkable maturation process, sometimes referred to as thymic education, T -cells that are beneficial to the immune system are spread, while those T -cells that might evoke a detrimental auto-immune response are eliminated.
* The mature Tcells are then released into the blood stream.
* The location of various lymphoid organs in the human body is shown in Figure

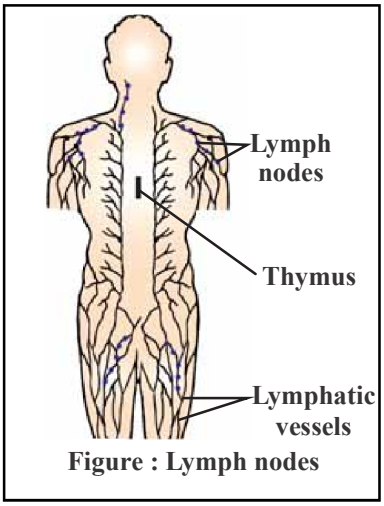


Figure : Lymph nodes

(b) Secondary Lymphoid Organs (=Peripheral lymphoid organs)

* After maturation, B -lymphocytes and T-lymphocytes migrate via blood vascular and lymphatic system to the secondary lymphoid organs where they undergo proliferation and differentiation.
* The secondary lymphoid organs are lymph nodes, spleen, tonsils, peyer's patches of the small intestine, appendix and mucosal associated lymphoid tissues **(MALT).**
* MALT is located within the lining of the major tracts (digestive, respiratory and urinogenital).
* It constitutes about 50% of the lymphoid tissue in human body.

Spleen

* The spleen is an **immunologic filter** of the blood.
* It contains B cells, T cells, macrophages, natural killer cells and red blood cells.
* In addition to capturing foreign materials (antigens) from the blood that passes through the spleen, migratory macrophages bring antigens to the spleen via the bloodstream.
* An immune response is initiated when the macrophages present the antigen to the appropriate B or T cells.
* This organ can be thought of as an **immunological conference center.**

* In the spleen, B cells become activated and produce large amounts of antibody.
* Also, old red blood cells are destroyed in the spleen.

Lymph Nodes

* The lymph nodes function as an **immunologic filter** for the body fluid known as lymph.
* Lymph nodes are found throughout the body.
* Composed mostly of T cells, B cells, and macrophages, the nodes drain fluid from most of our tissues.
* Antigens are filtered out of the lymph in the lymph node before returning the lymph to the circulation.
* In a similar fashion as the spleen, the macrophages that capture antigens present these foreign materials to T and B cells, consequently initiating an immune response.

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 pasture:** 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 generate antibodies and memory cell as a primary immune respone.
* When this active pathogen enter second time inside this body of vaccinated person memory cells rapidly recognise and respond with massive production of lymphocytes and antibodies. So it destroys pathogen rapidly and disease does not appear.
* Person become resistant for that disease after vaccination.

Types:

* **First generation vaccines:** These vaccines are prepared by inactivating the whole pathogen but they have side effects. e.g. oral polio vaccine (OPV), DPT
* **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.
* **Third generation vaccine :** These are highly potent, synthetic in nature & prepared by genes they are also called DNA vaccine.

Passive immunisation

* When preformed antibodies are injected to provide quick immune response it is called as passive immunisation. e.g. If a person is infected with some deadly microbes as in tetanus, to which quick immume response is required we need to directly inject the preformed antibodies or antitoxin (a preparation containin antibodies to the toxin).
* Even in case of snake bites, the injection which is given to the patients, contain preformed antibodies against snake venom. This type of immunisation is passive immunisation

AIDS

(Acquired Immuno deficiency syndrome)

* Deficiency of immune system that acquired during life time and not congenital disease.
* Syndrome means a group of symptoms.
* AIDS was first reported in 1981 (America).
* AIDS is caused by HIV (Human Immuno deficiency Virus)
* **Virus :** Retro virus, HIV (Human immuno deficiency virus) or LAV (Lymphadenopathy associated virus) or HTLV III (Human T-cell lymph) Lymphotropic or Leukemia virus
* **Reason :**
  - Sexual contact (most common mode of transmission).
  - Transfusion of contaminated blood and blood products.
  - By mother to child by placenta, By mother milk
* **Investigation : Screening test :** (E.L.I.S.A.) Enzyme linked immuno sorbent assay.
* **Confirmatory tests :** Western blot test : detects antibodies (Proteins) in patient's serum.
* **Treatment :** Drugs used –
  (1) AZT (Azidothymidine) or Zidowdine
  (2) DDI (Dideoxyinosine)
  (3) Foscarnet
  These drugs inhibit the enzyme 'REVERSE TRANSCRIPTASE' of HIV.
  Dr. David Ho. (Cocktail treatment of AIDS in 1993 and research in U.S.A. 1995 (man of the year) Highly active antiretro viral treatment (HAART) - It is a new modern technique.).

Life cycle of HIV

* After getting into the body the HIV enters into macrophages or T-helper cells.
* The viral RNA genome replicated to form viral DNA with the enzyme called reverse transcriptase.
* The viral DNA gets incorporated into the host cell's DNA by an enzyme called integrase, and directs the infected cell s to produce virus particle.
* The macrophage continues to produce virus and acts as HIV factory.
* Virus released from macrophage attack T-helper cells.
* There is progressive reduction in the number of T-helper cells.
* Due to reduction of T-helper cells the person starts suffering from infections of other virus, fungi and even parasites like Toxoplasma.
* The patient becomes immuno deficient and more prone to other disease.

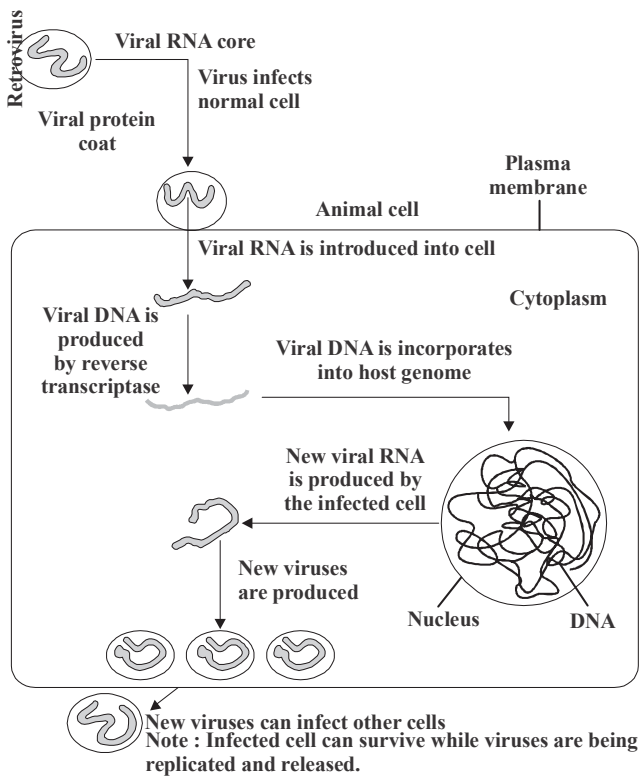


Figure : Replication of retrovirus

* **3 Phases**

(a) **Asymptomatic phase** - 2-10 yrs. There is no antibody protection in 1st (2-12 weaks) so infectivity of patients or activeness of virus is maximum in this period. This period is called window period (No specific symptom appear in this phase so ELISA test is negative in window period.)
Low grade fever body aches, sore throat.

(b) **AIDS related complex (A.R.C.)-3 to 6 weeks**

* Diarrhoea
* Weight loss (> 1 0%)
* Cough
* Generalised lymphadenopathy
* Fever.

(c) Full blown AIDS

* Patient become fully immune deficient in this period.
* T-lymphocytes or CD_4 count ($< 200 \times 10^6$/1itre) Myco bacte

(i) Mycobacterium avium (tuberculosis)
(ii) Pneumocystis carni Pneumonia (lungs infection)
(iii) Toxoplasmic encephalitis (memory loss)
(iv) Kaposi sarcoma (AIDS virus behave as a oncogenic virus and cause cancer of blood vessels) Skin appear Purple in this cancer.

Prevention of AIDS

* AIDS has no cure, prevention is the best option.
* National AIDS Control Organisation (NACO) established in 1991 and other non-governmental organisation (NGOs) educate people about AIDS.
* Safe blood for transfusion
* Use of disposable needles
* Free distribution of condoms.
* Prevention of drug abuse
* Advocating safe sex and promoting regular checkup.

CANCER

* Uncontrolled cell division (mitotic) leads to production of mass of cell called cancer.
* Cancerous cell lose the property of **contact inhibition**.
* Cancerous cell just continue to divide giving rise to masses of cell called **tumors.**

Types of tumour :

(i) **Benign tumour:** Remains confined to a particular location and does not spread.

(ii) **Malignant tumour:** Cells divides and invades new locations by getting transported through blood to distant sites. **Metastasis:** Property of malignant tumour to invade the distant body parts, thereby initiating formation of new tumours.

Causes of Cancer :

* Normal cells transformed into cancerous neoplastic cells by physical, chemical and biological agents. These agents are called **carcinogen.**

Some Cancer causing agents and their targets :

Carcinogen	Target Tissue
Soot	Skin and lungs
Coal tar (3, 4-benzopyrene)	Skin and lungs
Cigarette smoke (N-nitrosodimethylene)	Lungs
Cadmium oxide	Prostate gland
Aflatoxin (a mould metabolite)	Liver
Mustard gas	Lungs
Nickel and chromium compounds	Lungs
Asbestos	Lungs
Diethylstilbestrol (DES)	Vagina
Vinylchloride	Liver

* **Physical agents:** ionizing radiation like X-rays, gamma rays non-ionizing radiations like UV-rays.
* **Chemical agents:** Tobacco smoke, sodium azaide, Methyl ethane sulphonate.

Biological agents:

* Cancer causing viruses called oncogenic viruses have a gene called viral oncogenes, induce transformation of neoplastic cells.
* Cellular oncogenes (c-onc) or proto oncogenes in normal cells, when activated lead to oncogenic transformation of the normal cells.

Types of Cancer :

(i) **Carcinoma :** It is cancer of epithelial tissue, e.g., skin cancer.

(ii) **Melanoma :** It is cancer of melanocytes of skin.

(iii) **Sarcoma :** It is cancer of mesodermal tissue.

(iv) **Leukemia and lymphoma :** It is cancer of haemopoietic cells.

Cancer detection and diagnosis:

* **Biopsy** and histopathological study of the tissues. In biopsy, a piece of the suspected tissue cut into thin sections is stained and examined under microscope by a pathologist.
* **Radiography** like X-rays : X-rays are used to detect cancer of the internal organs.
* **CT (computerized tomography):** It uses X-rays to generate a three-dimensional image of the internals of an object.

* **MRI (magnetic resonance Imaging) :** MRI uses strong magnetic fields and non-ionising radiations to accurately detect pathological and physiological changes in the living tissue.
* Presence of antibodies against cancer-specific antigen.

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 :** Drugs are used to kill cancerous cells, but shows side effects like hair loss, anemia, etc.

(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., radioimmunotherapy, etc., for treatment of cancer. Research is in progress to develop cancer vaccines.

Note : The patients are given substances called biological response modifiers such as **α-interferon** which activates their immune system and helps in destroying the tumor.

DRUGS AND ALCOHOL ABUSE

* When drugs and alcohol are taken for purposes other than medicinal or taken in amounts or frequencies that impairs physical, physiological or psychological functions, it is called **drug abuse** and **alcohol abuse**.

Opioid:

* The drugs which bind to specific opioid receptor present in central nervous system and gastrointestinal tract.
* **Heroin** commonly called smack, chemically diacetylmorphine.

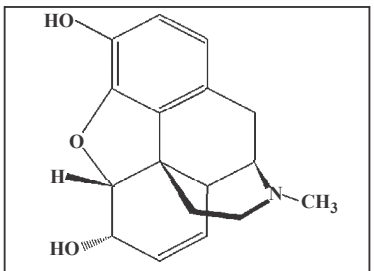
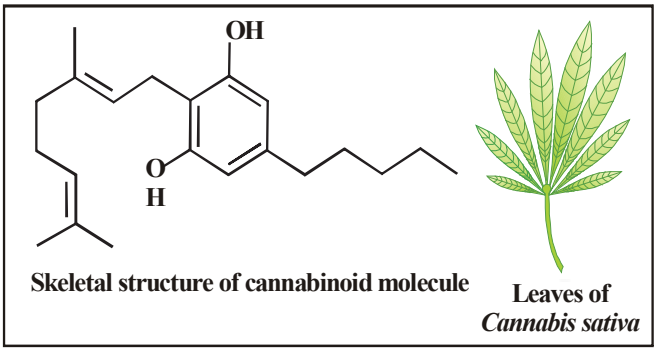


Figure : Chemical structure of Morphine

* It is white, odourless, bitter crystalline compound.
* Obtained by acetylation of morphine.
* Extracted from latex of poppy plant *Papaver somniferum*.
* Generally taken by snorting and injection.
* Heroin is depressant and slows down body function.

Cannabinoids:

* Group of chemicals that interact with the canabinoid receptors of brain.
* Obtained from inflorescence of *Cannabis sativa*.



Skeletal structure of cannabinoid molecule

Leaves of *Cannabis sativa*

* Flower top, leaves and resin of cannabis plant are used in various combinations to produce **marijuana, hashish, charas and ganja.**
* Generally taken by inhalation and oral ingestion
* Effects on **cardiovascular system** of the body.
* Cannabinoids are also being abused by some sportspersons.

Cocaine:

* Coca alkaloid or cocaine is obtained from coca plant *Erythroxylum coca*.
* It interferes with transport of neuro-transmitter **dopamine**.
* Cocaine is commonly called as **coke or crack** is usually snorted.

* Potent stimulating effect on central nervous system.
* Produces sense of **euphoria** and increased energy.
* Excessive dosage causes **hallucination.**

Hallucinogens :

* Obtained from the plant like, *Atropa belladona* and *Datura sps*. Lysergic and diethyl amides (LSD) is derived from the fungus *Claviceps purperea*.

Figure : Flowering branch of *Datura*

* These drugs are called **psychedelic drugs** because of their effect on the cerebrum and sense organs.
* These drugs effect thoughts, feelings and perceptions of an individual. Medically these are given to patients to cope with mental illnesses like depression and insomnia.

Tobacco:

* It is smoked, chewed or used as a snuff.
* Tobacco contains nicotine an alkaloid.
* Nicotine stimulates Adrenal glands to raise blood pressure and increased heart rates.
* Smoking tobacco is associated with cancer of lung, urinary bladder, and throat, bronchitis, emphysema, coronary heart disease, gastric ulcer etc.
* Smoking increased CO content of blood reduce oxygen carrying capacity of hemoglobin.
* Tobacco chewing is associated with cancer of oral cavity.

Adolescence and Drug/Alcohol Abuse :

* The period between 12-18 years of age may thought of an adolescent period.
* Adolescent is a bridge linking childhood and adulthood.
* Curiosity, need for adventure and excitement, and experimentation, are the common cause of drug/ alcohol abuse.

* **Categories of Psychotropic Drugs, their Effects and Clinical uses :**

Type of drug	Examples	Effects	Clinical Uses
Sedatives and tranquilizers (depressent)	Barbiturates Benzodiazepines (e.g., Valium)	Depress brain activity and produce feelings of calmness, relaxation, drowsiness and deep sleep (high doses)	Hypnotic, antianxiety
Opiate narcotics	Opium, morphine, heroin, pethidine, methadone	Suppress brain function. relieve intense pain (physical and mental) produce temporary euphoria	Analgesic
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 excitemnt.	Weight control Neurotic (Depressive) disorder
Hallucinogens	Mescaline, psilocybin. charas, hashish. marijuana (bhang)	Alter thought, feelings and perceptions; hallucinations.	None

CONCEPT REVIEW

* The body defends itself against **pathogens**, toxins, and other harmful agents. **Immunology** is the study of internal defensive responses. An **immune response** is the process of recognizing foreign or dangerous macromolecules and responding to eliminate them.
* **Nonspecific immune responses** provide general and immediate protection against pathogens, some toxins and drugs, and cancer cells.
* **Specific immune responses** are highly specific and include immunological memory. An **antigen** is a molecule specifically recognized as foreign or dangerous by cells of the immune system. **Antibodies** are highly specific proteins that recognize and bind to specific antigens.
* Invertebrates depend on nonspecific immune responses such as physical barriers (cuticle, skin, mucous membranes), **phagocytosis,** and **antimicrobial peptides,** soluble molecules that destroy pathogens.
* Vertebrates use both nonspecific and specific immune responses.
* Vertebrate nonspecific immune responses include physical barriers, such as the skin and the mucous linings of the respiratory and digestive tracts. When pathogens break through these firstline defenses, other nonspecific defenses are activated.
* Soluble molecules important in immune responses include antimicrobial peptides, regulatory peptides, and proteins that destroy pathogens.
* **Cytokines** are signaling proteins that regulate interactions between cells. Important groups are interferons, interleukins, chemokines, and tumor necrosis factors. **Interferons** inhibit viral replication and activate natural killer cells. **Interleukins** help regulate interactions between lymphocytes and other cells of the body; some have widespread effects. **Chemokines** attract, activate, and direct the movement of certain cells of the immune system.

  Tumor necrosis factors (TNFs) kill tumor cells and stimulate immune cells to initiate an inflammatory response.
* **Complement** proteins lyse the cell wall of pathogens, coat pathogens, enhancing phagocytosis, and attract white blood cells to the site of infection. These actions enhance the inflammatory response.
* **Phagocytes**, including **neutrophils** and **macrophages,** destroy bacteria. **Natural killer cells (NK cells)** destroy cells infected with viruses and foreign or altered cells such as tumor cells.
* When pathogens invade tissues, they trigger an **inflammatory response**, which includes three main processes: vasodilation (increased blood vessel diameter); increased capillary permeability, which allows fluid and antibodies to leave the circulation and enter the tissues; and increased phagocytosis. In response to tissue injury, several types of molecules in the plasma that mediate inflammation are activated. **Mast cells** release **histamine** and other compounds that cause vasodilation and increased capillary permeability.
* In **cell-mediated immunity**, specific T cells are activated; these cells release proteins that destroy cells infected with viruses or other intracellular pathogens.
* In **antibody-mediated immunity**, specific B cells are activated; they multiply and differentiate into plasma cells, which produce antibodies.
* Two main types of cells important in specific immune responses are lymphocytes and antigen-presenting cells.
* Lymphocytes develop from stem cells in the bone marrow.

  T cells are lymphocytes responsible for cell-mediated immunity. The **thymus gland** confers immunocompetence on T cells by making them capable of distinguishing between self and nonself. Three types of T cells are **T cytotoxic cells (T_C cells), T helper cells (T_H) and memory T cells**. T cells are distinguished by their **T-cell receptors (TCRs).**
* **B cells** are lymphocytes responsible for antibody-mediated immunity. B cells differentiate into **plasma cells**, which produce antibodies.

Some activated B cells become **memory B cells,** which continue to produce antibodies after an infection has been overcome.

* **Antigen-presenting cells (APCs)** display foreign antigens as well as their own surface proteins. Dendritic cells, macrophages, and B cells are important APCs. **Dendritic cells** are located in the skin and other tissues of the body that interact with the environment.They are specialized to process, transport, and present antigens.
* In cell-mediated immunity, specific T cells are activated by a foreign antigen-MHC complex on the surface of an infected cell. A co-stimulatory signal and interleukins are also required.
* Activated T_c cells multiply, giving rise to a clone. These cells migrate to the site of infection and destroy pathogen-infected cells.
* Plasma cells produce specific antibodies, also called **immunoglobulins (Ig)**, in response to the specific antigens that activated them.
* An antibody combines with a specific antigen to form an **antigen-antibody complex**, which may inactivate the pathogen, stimulate phagocytosis, or activate the complement system.
* A typical antibody is Y-shaped; the two arms combine with antigen. An antibody molecule consists of four polypeptide chains: two identical heavy chains and two shorter light chains. Each chain has a **constant (C) region** and a **variable(V) region.**
* Rearrangement of DNA segments during the differentiation of B cells is the main factor responsible for antibody diversity; millions of different types of B (and T) cells are produced.
* **Active immunity** develops as a result of exposure to antigens; it may occur naturally after recovery from a disease or can be artificially induced by immunization with a vaccine.
* **Passive immunity** is a temporary condition that develops when an individual receives antibodies produced by another person or animal.
* **Acquired immunodeficiency syndrome (AIDS)** is caused by the **human immunodeficiency virus (HIV)**, a retrovirus. HIV destroys T helper cells, severely impairing immunity and placing the patient at risk for opportunistic infections.
* In an **allergic reaction**, an **allergen** stimulates the production of IgE, which combines with receptors on mast cells. The mast cells release histamine and other molecules that cause inflammation and other symptoms of allergy. **Systemic anaphylaxis** is a rapid, widespread allergic reaction that can lead to death.

IMPORTANT POINTS

* Humorial immunity is due to B-lymphocytes/ Plasma cells.
* A yellow fever is a viral disease.
* Trypanosomiasis is spread by Tse-Tse fly.
* Mumps is viral disease that causes inflammation of parotid gland.
* Cholera is due to bacterium.
* Leprosy is due to *Mycobacterium*.
* Clinical fever in malaria is due to erythrocytic schizogony.
* Jaundice is disease of liver.
* AIDS is due to reduction in number of helper T-cells.
* AIDS virus has single strand RNA.
* Antibody is formed by WBC.
* December 1 = AIDS day
* Antibodies are gamma globulins.
* Most abundant immunoglobulin is IgG.
* BCG vaccine provides protection against T.B.
* Western blot is used for confirmation of AIDS.
* "Lock jaw" is another name of Tetanus.
* Anthrax is a bacteria disease.
* ELISA is used in detection of AIDS.
* Spleen gland gets enlarged in malaria.
* After entering T-cell, HIV first forms dsRNA.
* Tuberculosis is caused by bacteria.
* Opiates = Opium and Heroin
  Stimulants = Benzedrine & Methadrine
  Hallucinogens = Ganja and Charas
  Depressants = Nembutal and seconal
* Stimulant cocaine is obtained from *erythroxylon*.
* Brown sugar is diacetyl morphine hydrochloride.
* *Papaver album* provides morphine.
* Marijuna is obtained from *Cannabi's sativa*.
* IgG - Protects body fluids.
  IgA - Protects body surfaces.

IgM - Protects body blood stream
IgE - Mediates regional hypersensitivity.

* Types of Malaria

Disease	Causative agent
Tertian malaria	*Plasmodium vivax*
Benign tertian malaria	*Plasmodium vivax*
Vivax malaria	*Plasmodium vivax*
Mild tertian malaria	*Plasmodium ovale*
Ovale malaria	*Plasmodium ovale*
Subtertian malaria	*Plasmodium falciparum*
Estivo-autumnal malaria	*Plasmodium falciparum*
Malignant tertian malaria	*Plasmodium falciparum*
Cerebral malaria	*Plasmodium falciparum*
Black water fever	*Plasmodium falciparum*
Quartan malaria	*Plasmodium malariae*
Quotidian malaria	Mixed infections

* Distribution of B- and T-Cells in Man

S.No.	Tissue	B-Cells %	T-Cells %
1.	Blood	15-25%	75-85%
2.	Spleen	55-75%	5-45%
3.	Bone marrow	Abundant	Few
4.	Thoracic duct	10-20%	80-90%
5.	Lymph nodes	20-30%	60-70%
6.	Thymus gland	Few	Abundant

Differences between Antibodies and Interferons

Antibodies	Interferons
These act inside the cells.	These act outside the cells.
They are slow acting.	They are quick acting.
They act against bacteria and viruses.	They act only against viruses.
Their action is long lasting	Their action is temporary.

* Cells of Immune System

S.No.	Cell Type	Function
1.	Helper T Cell	Assists the immune process by helping other cells in the immune system to achieve an efficient immune response.
2.	Cytotoxic T Cell	Detects and kills infected body cells recruited by helper T cells.
3.	Suppressor T Cell	Guards against the overproduction of antibodies and over activity of cytotoxic T cells.
4.	Memory cell	"Remembers" the original stimulation by the immune system and remains in the lymphoid tissue.
5.	Natural killer cell (NK)	The lymphocyte without receptor site and help to attack and neutralize virus-infected and tumor cells.
6.	B Cell	Precursor of plasma cell, specialized to recognize a specific foreign antigen.
7.	Plasma cell	Biochemical factory devoted to the production of antibodies directed against a specific antigen.
8.	Mast cell	Initiator of the inflammatory response which aids the arrival of leucocytes at a site of infection, secretes histamine and is important in allergic response.
9.	Monocyte	Precursor of macrophage.
10.	Macrophage	The body's first cellular line of defense; also serves as antigen presenting cell to B and T cells and engulfs antibody covered cells.

* Viral Diseases in Humans

S.No.	Disease	Pathogen	Habitat	Main Symptoms	Mode of Infection	I.P.
1.	Influenza	Myxo viruses	Mucous membrane of respiratory tract	Nasal discharge, sneezing, coughing	By droplets from nose & throat	24 to 72 hours
2.	Smallpox	Variola virus		Skin rash changing to pustules, then to scabs	By contact, droplets and fomite	12 days
3.	Chicken pox	Varicella zoster		Skin sores that open & emit fluid	By contact and fomite	2 to 5 weeks
4.	Measles	Rubeola virus		Red watery eyes, skin rash	By droplets from nose & throat	10 days
5.	Rabies (Hydrophobia)	Rabies virus	Brain & spinal cord cells	Biting behaviour, fear of water, inability to swallow	Bite by rabid dog	1 to 3 months
6.	Mumps (Infectious parotitis)	Paramyxo virus	Salivary glands	Painful enlargement of parotid glands, difficulty in opening mouth	By contact and droplets from throat	12 to 26 days
7.	Poliomyelitis (polio)	Polio virus	Nerve cells	Inflammation of nervous system, muscle shrinkage, limb paralysis	By contaminated food & water	7 to 14 days
8.	Trachoma	*Chlamydia trachomatis*	Eyelids, conjunctiva & cornea of eye	Granules on inner surface of eyelids, watery eyes	By contact and fomite	5 to 12 days
9.	Acquired immune deficiency syndrome (AIDS)	Human immunodeficiency virus		Infections, cancer, brain damage, WBC destruction	By contact with blood	28 months average,
10.	Hepatitis viral (Epidemic jaundice)	Infectious & serum hepatitis viruses	Liver	Jaundice due to damaged liver cells	By contaminated food and water	20-35 days

* Bacterial Disease in Human

S.No.	Disease	Pathogen	Habitat	Main Symptoms	Mode of Infection	I.P.
1.	Cholera	*Vibrio comma (V.cholerae)*	Intestine	Severe diarrhoea and vomiting	By contaminated food and water	2 to 3 days
2.	Pneumonia	*Diplococcus pneumoniae*	Lungs	Difficulty in breathing	By patient's sputum	1 to 3 days
3.	Typhoid	Salmonella typhi	Intestine	Constant fever	By contaminated food and water	1 to 3 weeks
4.	Tetanus (Lockjaw)	Clostridium tetani	Tissues	Painful muscular spasms and paralysis	Through wounds and burns	4 days to 3 weeks
5.	Diphtheria	Corynebacterium diphthriae	Mucous membrane of nose, throat & tonsils	Sore throat, difficulty in breathing	By oral & nasal discharges	2 to 5 days
6.	Whooping cough (pertusis)	Bordetella pertussis	Respiratory tract	Severe coughing characteristic gasping 'whoop'	By throat discharges and contact	10 to 16 days
7.	Tuberculosis	Mycobacterium tuberculosis	Lungs	Cough, bloody sputum, chest pain	By patient's sputum	Variable
8.	Plague	Pasteurella pestis	Blood and lymph	Painful pubo of lymph nodes	By rat-flea bite	2 to 6 days
9.	Leprosy	Mycobacterium leprae	Skin mucous membranes, peripheral nerves	Hypopigmented skin patches, ulcers, deformity of digits	Long and close contact with patients	2 to 5 years
10.	Syphilis	Treponema pallidium	Oral, genital, rectal mucosa	Lesions	By contact	3 weeks
11.	Gonorrhoea	Neisseria gonorrhoeae	Urinogenital mucosa	Burning sensation in micturition	By sexual contact	2 to 5 days
12.	Diarrhoeal diseases	Shigella dysenteriae, Salmonella, Escherichia coli, Campylobacter	Intestine	Diarrhoea	By contaminated food, water, hands, fomite	

* Sexually Transmitted Diseases (STD) in Human

S.No.	Disease	Causative organism	Nature of Disease	Symptoms – Treatment
1.	**AIDS (Acquired Immuno deficiency Syndrome)**	Retrovirus – HIV	Viral	Enlarged lymph nodes, long fever, weight loss – Nil
2.	**Genital Herpes**	Herpes simplex virus	Viral	Painful ulcer on genitals – Nil
3.	**Genital warts**	Human papilloma virus (HPVs)	Viral	Tumor of the vulva, vagina, anus and penis – Nil
4.	**Gonorrhoea**	*Neisseria gonoerrheae*	Bacterial	Infection of all genital organs or PID – Penicillin
5.	**Chlamydiasis**	*Chlamydia trachomatis*	Bacterial	White patches on vagina or PID – Nystatin
6.	**Syphilis**	*Treponema pallidum*	Bacterial	Cancer and skin eruption – Benzene and Penicillin
7.	**Trichomoniasis**	*Trichomonas vaginalis*	Protozoan	Greenish-yellow vaginal discharge–Metronidazole.
8.	**Chancroid**	*Haemophilus ducreyi*		Foul discharge and ulcer Drug : Sulphonamide
9.	**Lymphogranuloma venerum**	*Lymphogranuloma psittacosis bacteria*		Inguinal lymphadenopathy Drug : Tetracycline

* Some Important Vaccines

S. No.	Name of Vaccine	Category of Vaccine	Used for treatment of
1.	B.C.G.	Live vaccine (actual weakened germs)	Tuberculosis
2.	Cholera Vaccine	Killed vaccines (micro-organisms are killed)	Cholera
3.	Mumps Vaccine (MMR)	Live vaccine (actual weakened germs)	Mumps Measles & Rubella
4.	Oral Polio Vaccine (OPV)	Live vaccine	Polio, 1st dose given when child is 3 months old. Booster does is given after 1 year
5.	Rubella Vaccine	Live vaccine	German measles and small pox
6.	Rubeolla Vaccine	Live vaccine	Measles
7.	Tetanustoxoid (TT)	Toxoid (bacterial toxin looses toxicity but retains antigenicity)	Tetanus
8.	Toxoid Serum	Toxoid (bacterial toxin looses toxicity but retains antigenicity)	Diphtheria
9.	Typhoid Vaccine (TAB)	Killed vaccine (micro organisms are killed)	Typhoid (Typhoid & Paratyphoid)
10.	Triple Antigen (DPT) (Diphtheria, Pertussis Tetanus)	Toxoid	Diphtheria, tetanus and whooping cough, Ist dose given when child is 3 months old. Booster dose at 2 years.

QUESTION BANK

EXERCISE - 1 (LEVEL-1) [NCERT EXTRACT]

SECTION - 1 (VOCABULARY BUILDER)

Choose one correct response for each question.
For Q.1-Q.4
Match the column I with column II.

Q.1 Match the following columns.

	Column I	Column II
a.	Vector borne diseases	i. Pneumonia and common cold
b.	Air borne diseases	ii. Dengue and chikengunya
c.	Through contaminated food and water	iii. Ringworm
d.	Fungal disease	iv. Typhoid and amoebiasis

Codes
(A) (a) – (ii), (b) – (i), (c) – (iv), (d) – (iii)
(B) (a) – (i), (b) – (iv), (c) – (iii), (d) – (ii)
(C) (a) – (iv), (b) – (ii), (c) – (i), (d) – (iii)
(D) (a) – (ii), (b) – (i), (c) – (iii), (d) – (iv)

Q.2

	Column I (Immunity)	Column II (Examples)
a.	Natural active	i. Immunity developed by heredity
b.	Artificial passive	ii. From mother to foetus through placenta
c.	Artificial active	iii. Injection of antiserum to travellers
d.	Natural passive	iv. Fighting infections naturally
		v. Induced by vaccination

Codes
(A) (a) – (i), (b) – (ii), (c) – (iii), (d) – (v)
(B) (a) – (iv), (b) – (iii), (c) – (v), (d) – (ii)
(C) (a) – (iv), (b) – (v), (c) – (ii), (d) – (iii)
(D) (a) – (v), (b) – (iv), (c) – (iii), (d) – (i)

Q.3

	Column I	Column II
(a)	Typhoid	i. WIDAL test
(b)	Malignant malaria	ii. *Plasmodium falciparum*
(c)	Common cold	iii. Rhinovirus
(d)	*Trichophyton*	iv. Ringworm

Codes
(A) (a) – (i), (b) – (ii), (c) – (iii), (d) – (iv)
(B) (a) – (ii), (b) – (iii), (c) – (iv), (d) – (i)
(C) (a) – (iii), (b) – (iv), (c) – (i), (d) – (ii)
(D) (a) – (iv), (b) – (i), (c) – (ii), (d) – (iii)

Q.4

	Column I (Disease)	Column II (pathogen/prevention/ treatment)
a.	Amoebiasis	i. *Treponema pallidum*
b.	Diphtheria	ii. Use only sterilised food and water
c.	Cholera	iii. DPT vaccine
d.	Syphilis	iv. Use of oral rehydration therapy

Codes
(A) (a) – (i), (b) – (ii), (c) – (iii), (d) – (iv)
(B) (a) – (ii), (b) – (iv), (c) – (i), (d) – (iii)
(C) (a) – (ii), (b) – (iii), (c) – (iv), (d) – (i)
(D) (a) – (iv), (b) – (i), (c) – (ii), (d) – (iii)

SECTION - 2 (BASIC CONCEPTS BUILDER)

For Q.5 to Q.21 :
Choose one word for the given statement from the list.

Emphysema, Malaria, Passive, Oncogenic Viruses, Viral oncogenes, *Wuchereria bencrofti,* Heart, Breast bone, Pathogens, sporozoite, *Cannabis sativa,* Yeast, Widal-Test, Large, Metastasis, Four, Reducing , *Cannabis sativa*, Interferon, Metastasis, Interferon.

Q.5 Female *Anopheles* mosquito is a vector of ____.

Q.6 The thymus is a lobed organ located near the ____ and beneath the _____.

Q.7 Hepatitis-B vaccine is produced from ____.

Q.8 Virus-infected cells secrete proteins called ____.

Q.9 In heavy smokers, the alveoli of the lungs are enlarged and damaged, which reduces the surface area for the exchange of respiratory gases. This condition is called ____.

Q.10 Colostrum provides the infant with ____ immunity

Q.11 The invasion of cancerous cells from one part of the body to another of body is called ____.

Q.12 The causative agent of filaria is ____.

Q.13 The organisms which cause diseases in plants and animals are called ____.

Q.14 Thymus is ___ at the time puberty but it ____ with age.

Q.15 The substance produced by a cell in viral infection that can protect other cells from further infection is ____.

Q.16 Tumour viruses or cancer causing viruses are called ____ have ____.

Q.17 The chemical test that is used for diagnosis of typhoid is ____.

Q.18 Cannabinoids is obtained from inflorescence of the plant _____

Q.19 In malignant tumors, the cells proliferate, grow rapidly and move to other parts of the body to form new tumors. This stage of disease is called ____.

Q.20 ____ variable segments are present in the basic structure of an antibody molecule.

Q.21 Malarial parasite is introduced into the blood man as a ____.

SECTION - 3 (ENHANCE PROBLEM SOLVING SKILLS)

Choose one correct response for each question.

PART - 1 : COMMON DISEASES IN HUMANS

Q.22 Malaria is caused by
(A) *Plasmodium vivax*
(B) *Plasmodium malariae*
(C) *Plasmodium falciparum*
(D) All of these

Q.23 *Entamoeba histolytica* is a
(A) viral parasite (B) bacterial parasite
(C) protozoan parasite (D) fungal parasite

Q.24 Which of the following disease caused internal bleeding, muscular pain, fever, anaemia and blockage of the intestinal passage?
(A) Ascariasis (B) Filariasis
(C) Amoebiasis (D) Trypanosomiasis

Q.25 Which of the following disease is communicable?
(A) Rickets (B) Amoebiasis
(C) Diabetes (D) Cancer

Q.26 *Plasmodium* is a –
(A) symbiont (B) parasite
(C) saprophyte (D) None of these

Q.27 The sporozoites that cause infection when a female Anopheles mosquito bites a human being are formed in:
(A) Liver of human
(B) RBCs of mosquito
(C) salivary glands of mosquito
(D) intestine of human

Q.28 Which of the following is a protozoan disease?
(A) Malaria (B) Amoebiasis
(C) Sleeping sickness (D) All of these

Q.29 If a certain patient is suspected to be suffering from typhoid. Which diagnostic technique will you recommend for its detection?
(A) ELISA (B) WIDAL
(C) MRI (D) CT scan

Q.30 The pathogen *Microsporum* responsible for ringworm disease in humans belongs to
(A) virus (B) bacteria
(C) fungi (D) Protozoa

Q.31 *Plasmodium* completes its life cycle in
(A) one host (B) two hosts
(C) multiple host (D) None of these

Q.32 *Plasmodium*, a small protozoan causes
(A) malaria (B) filariasis
(C) amoebiasis (D) typhoid

Q.33 Who among the following is recognised as the Father of Medicine?
(A) Robert Koch (B) Hippocrates
(C) Louis Pasteur (D) Edward Jenner

Q.34 The disease chikunguniya is transmitted by:
(A) house flies (B) Aedes mosquitoes
(C) cockroach (D) female Anopheles

Q.35 Which one of the following diseases spread by housefly?
(A) Dengue fever (B) Encephalitis
(C) Filariasis (D) Typhoid

Q.36 Typhoid is caused by
(A) bacteria (B) virus
(C) Protozoa (D) fungus

Q.37 *Entamoeba histolytica* causes
(A) malaria (B) amoebiasis
(C) typhoid (D) filariasis

Q.38 Which one of the following pairs of diseases are viral as well as transmitted by mosquitoes?
(A) Elephantiasis and dengue
(B) Malaria and yellow fever
(C) Ringworm and dengue
(D) Yellow fever and dengue

Q.39 Malignant malaria is caused by
(A) *Plasmodium falciparum*
(B) *Plasmodium ovale*
(C) *Plasmodium vivax*
(D) *Plasmodium malariae*

Q.40 Which one of the following is a protozoan disease?
(A) Polio (B) AIDS
(C) Taeniasis (D) Malaria

Q.41 Infection of pneumonia occurs due to –
(A) droplets released from an infected person.
(B) released droplets inhaled by healthy person
(C) sharing contaminated objects such as glasses and utensils with an infected person
(D) All of the above

Q.42 Fungi belonging to genera *Microsporum, Trichophyton* and *Epidermophyton* are responsible for –
(A) ringworm (B) skin allergy
(C) amoebiasis (D) measles

Q.43 Intermediate host of *Wuchereria* is
(A) female *Anopheles* (B) female *Aedes*
(C) female *Culex* (D) None of these

Q.44 All stages of *Plasmodium* get digested in stomach female *Anopheles* except –
(A) sporozoite (B) gametocyte
(C) erythrocyte (D) None of these

Q.45 Among the following a non-communicable disease is –
(A) measles (B) rabies
(C) diphtheria (D) diabetes

Q.46 Which of the following is a viral disease?
(A) Typhoid (B) Polio
(C) TB (D) Leprosy

Q.47 Which of the following disease is caused by bacteria *Salmonella typhi* ?
(A) Typhoid (B) Pneumonia
(C) Malaria (D) Cold

Q.48 Ringworm is caused by
(A) bacteria (B) virus
(C) Protozoa (D) fungi

Q.49 Which of the following disease is caused by protozoan and transmitted by mosquito?
(A) Pneumonia (B) Malaria
(C) Filariasis (D) Typhoid

Q.50 Which of the following health disorder includes symptoms of fever, chills, cough, headache, gray or bluish lips and finger's nails?
(A) Filariasis (B) Typhoid
(C) Pneumonia (D) Malaria

Q.51 The filariasis pathogens are transmitted to a healthy person through the bite of –
(A) female mosquito (B) housefly
(C) cockroach (D) None of these

Q.52 *Plasmodium* life cycle is
(A) digenetic (B) monogenetic
(C) Both (A) and (B) (D) None of these

Q.53 Infective stage of *Plasmodium* for men is
(A) merozoites (B) ookinetes
(C) sporozoites (D) None of these

Q.54 Give the name of two helminths, which causes ascariasis and filariasis respectively.
(A) *Ascaris* and *Wuchereria*
(B) *Wuchereria* and *Ascaris*
(C) Roundworm and Flatworm
(D) *Plasmodium* and *Wuchereria*

Q.55 Communicable disease means –
(A) the disease transmitted from man to man
(B) the disease caused by biological agents
(C) Both (A) and (B)
(D) present from birth or inherited

Q.56 The pathogen of typhoid is directly transmitted through
(A) urine (B) water
(C) blood (D) hormone

Q.57 The primary host of *Plasmodium* is –
(A) man (B) male *Culex*
(C) sheep (D) female *Anopheles*

Q.58 The infectious form (after entering into human blood) of malarial parasite migrate to the –
(A) erythrocytes of human
(B) liver cells of human
(C) stomach of mosquito
(D) salivary gland of mosquito

Q.59 Rhinovirus causes
(A) common cold (B) rnalaria
(C) AIDS (D) pneumonia

PART - 2 : IMMUNITY

Q.60 Innate immunity is also called
(A) familial (B) inborn
(C) genetic (D) All of these

Q.61 Primary lymphoid organs among the following are –
(A) bone marrow (B) thymus
(C) Both (A) and (B) (D) thyroid of thymus

Q.62 Immunoglobulins are made up of –
(A) two polypeptide chains
(B) four polypeptide chains
(C) three amino acids
(D) five nucleotides

Q.63 Anti venom against snake poison contains:
(A) Antigens
(B) Antigen-antibody complexes
(C) Antibodies
(D) Enzymes

Q.64 Which of the following is related to humoral immunity?
(A) T-lymphocyte (B) B-lymphocyte
(C) Neutrophil (D) Phagocyte

Q.65 The major phagocytic cells are –
(A) antibody (B) antigen
(C) lymphocytes (D) macrophages

Q.66 Transplantation of tissues/organs to save certain patients often fails due to rejection of such tissues/ organs by the patient. Which type of immune response is responsible for such rejections?
(A) auto-immune response
(B) humoral immune response
(C) physiological immune response
(D) cell-mediated immune response

Q.67 Full form of PMNL is
(A) Poly Morpho-nuclear Leukocytes
(B) Para Morpho-nuclear Lymphocytes
(C) Penta Morpho-nuclear Leukocytes
(D) Poly Morpho-nuclear Lymphocytes

Q.68 Immunological destruction of body tissue or its products due to antibodies reacting with it as foreign antigen is called
(A) immunodeficiency disease
(B) auto-immune disease
(C) prophylaxis
(D) None of the above

Q.69 Broad spectrum antibiotic is the one which –
(A) acts on all bacteria and virus
(B) is effective in very small amount
(C) acts on both pathogen and host
(D) acts on a variety of pathogenic microorganisms

Q.70 Full form of MALT is
(A) Mucosal Associated Lymphoid Tissue
(B) Memory Associated Lymphoid Tissue
(C) Memory Associated Lymphocyte Tissue
(D) Mucosa Associated Lymphocyte Tissue

Q.71 Vaccination protects a person from disease because it –
(A) helps in RBC production
(B) produces antibodies
(C) helps in digestion
(D) correct body function

Q.72 Secondary lymphoid organs include
(A) spleen (B) tonsils
(C) Both (A) and (B) (D) None of these

Q.73 The type of antibody present in colostrum secreted by mammary gland during the initial days of lactation is
(A) IgA (B) IgM
(C) IgG (D) IgE

Q.74 Interferon is a type of protein, which is used to cure –
(A) homeostatic disorder
(B) hepatitis caused by virus
(C) common cold caused by virus
(D) Both (B) and (C)

Q.75 Antibody production is assisted by –
(A) monocytes (B) natural killer cells
(C) T-lymphocytes (D) phagocyte

Q.76 Which among the following is an autoimmune disease?
(A) Rheumatoid arthritis (B) AIDS
(C) Hepatitis-B (D) Swine flu

Q.77 Mast cells have important role in the development of –
(A) allergens (B) allergy
(C) inflammation (D) Both (B) and (C)

Q.78 Physiological barrier which prevents entry of microorganisms in our body is/are
(A) acid in the stomach (B) saliva in the mouth
(C) tears from eyes (D) All of these

Q.79 The organ related with immunity is
(A) liver (B) parathyroid
(C) thymus (D) pineal

Q.80 Interferons protect healthy cells in human from
(A) viral infection (B) bacterial infection
(C) fungal infection (D) protozoan infection

Q.81 Surgical removal of thymus of a new born shall result in the failure to produce
(A) basophils (B) neutrophils
(C) B-lymphocyte (D) T-lymphocyte

Q.82 Your immune system helps to protect you against viruses and bacteria that can cause sickness. Which cell is a part of immune system?
(A) White blood cells (B) Red blood cells
(C) Nerve cells (D) All of the above

Q.83 The immunoglobulin abundant in colostrum is
(A) IgG (B) IgM
(C) IgD (D) IgA

Q.84 What is injected into the patient's body for determining the cause of allergy?
(A) Pure allergen to which the patient is allergic
(B) IgG
(C) IgE
(D) Steroids

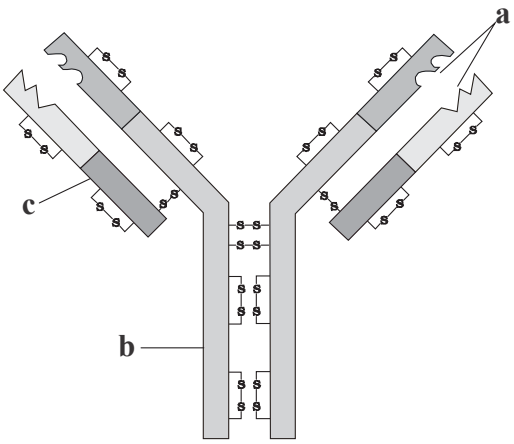
Q.85 Damage of thymus in a child may lead to–
(A) loss of cell-mediated immunity
(B) reduction in the haemoglobin content in blood
(C) reduction in the amount of plasma proteins
(D) loss of antibody mediated immunity

Q.86 The spleen
I. is a large bean-shaped organ.
II. mainly contains lymphocytes and phagocytes,
III. acts as a filter of the blood by trappin blood-borne microorganisms.
Which of the statements given above are correct
(A) I and II (B) I and III
(C) II and III (D) I, II and III

Q.87 If a person is infected with tetanus. We should develop tetanus immunisation by administering
(A) preformed antibodies (B) weakened germs
(C) pathogenic agent (D) None of these

Q.88 Interferon is a type of –
(A) anti-bacterial protein
(B) anti-viral protein
(C) complex protein
(D) anti-clotting protein

Q.89 The figures given below shows an antibody molecule. Name the parts a, b and c.



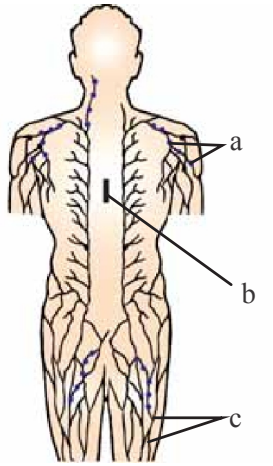
(A) a-Antigen binding site, b-Heavy chain, c-Light chain
(B) a-Antibody binding site, b-Light chain, c-Heavy chain
(C) a-Antigen binding site, b-Short chain, c-Long chain
(D) a-Antibody binding site, b-Long chain, c-Short chain

Q.90 Active immunity development is related to
(A) natural killer cells (B) memory cells
(C) helper T-cells (D) suppressor T-cells

Q.91 Cell-mediated immunity is responsible for
(A) graft rejection (B) passive immunity
(C) organ surgery (D) innate immunity

Q.92 Immunodeficiency makes a person highly susceptible to infection. It is caused by –
(A) lack of B-cells (B) lack of T-cells
(C) Both (A) and (B) (D) lack of WBC

Q.93 Given below the diagrammatic representation of lymph nodes. Label a, b and c.



(A) a-Lymph nodes, b-Thymus, c-Lymphatic vessels
(B) a-Lymphatic vessels, b-Thyroid, c-Lymph nodes
(C) a-Tonsils, b-Peyer's patchs, c-Lymphatic vessels
(D) a-Tonsils, b-Thymus, c-Peyer's patches

Q.94 Antigen binding site in antibody is found between
(A) two light chains
(B) two heavy chains
(C) one heavy and one light chain
(D) either between two light chains or between one heavy and one light chain depending upon the nature of antigen.

Q.95 Antibody production is controlled by
(A) B-lymphocytes (B) T-lymphocytes
(C) Both (A) and (B) (D) Interferon

Q.96 Passive immunity can be obtained through –
(A) antigen (B) vaccines
(C) antibiotics (D) antibodies

PART - 3 : AIDS

Q.97 AIDS virus contains
(A) RNA with protein (B) DNA with protein
(C) DNA without protein (D) DNA only

Q.98 HIV belongs to which of the following families of viruses?
(A) Retrovirus (B) Togavirus
(C) Adenovirus (D) Lentivirus

Q.99 The AIDS virus spreads by decreasing –
(A) killer T-cells (B) helper T-cells
(C) suppressor T-cells (D) cytotoxic T-cells

Q.100 Choose the wrong statement regarding AIDS.
(A) AIDS is an immunodeficiency disease.
(B) AIDS is caused by the retrovirus HIV
(C) HIV selectively infects and kill B-lymphocytes
(D) Retroviruses have RNA genomes that replicate via DNA intermediate.

Q.101 AIDS is caused by HIV. Among the following, which one is not a mode of transmission of HIV?
(A) Transfusion of contaminated blood
(B) Sharing the infected needles
(C) Shaking hands with infected persons
(D) Sexual contact with infected persons

Q.102 The confirmatory test used to diagnose AIDS is
(A) ELISA (B) Schick
(C) WIDAL (D) None of these

Q.103 Incubation period for AIDS is usually –
(A) 5-10 month (B) 5-10 years
(C) 2-12 month (D) 2-12 weeks

PART - 4 : CANCER

Q.104 Benign tumours
I. remain confined to their original location and do not spread to other parts.
II. cause little damage.
Which of the statements given above is/are correct?
(A) Only I (B) Only II
(C) I and II (D) None of the above

Q.105 Cancer causing viruses are called –
(A) oncogenic viruses (B) retroviruses
(C) adenoviruses (D) poxviruses

Q.106 Cancerous cells spread through
(A) lymph
(B) blood
(C) secondary growth of malignant tumour
(D) All of the above

Q.107 Physical carcinogens are
(A) UV-rays (B) X-rays
(C) γ-rays (D) All of these

Q.108 Alpha-interferons
(A) activate the immune system
(B) help in destoying the tumour
(C) Both (A) and (B)
(D) None of the above

PART - 5 : DRUGS AND ALCOHOL ABUSE

Q.109 Smack is chemically a ____ which is white and odourless and crystalline in nature. This is obtained by ____.
(A) diacetyl morphine; acetylation of morphine
(B) morphine; acetylation of hashish
(C) stimulant; acetylation of morphine
(D) hallucinogen; acetylation of hashish

Q.110 Which part of the brain is involved in loss of control when a person drinks alcohol?
(A) Cerebellum (B) Medulla oblongata
(C) Cerebrum (D) Pons varoli

Q.111 Tobacco consumption is known to stimulate secretion of adrenaline and nor-adrenaline. The component causing this could be:
(A) Nicotine (B) Tannic acid
(C) Curaimin (D) Catechin

Q.112 Morphine, obtained from opium is
(A) latex (B) mucilage
(C) alkaloid (D) tannin

Q.113 Products from plants like *Datura* sp. are
(A) hallucinogen (B) stimulants
(C) sedatives (D) pain killers

Q.114 Heroin is also known by the name of
(A) hemp (B) smack
(C) coke (D) bhang

Q.115 Which of the following is an opiate narcotic?
(A) Morphine (B) LSD
(C) Amphetamines (D) Barbiturates

Q.116 Cirrhosis is –
(A) alcohol related disease
(B) smoke related disease
(C) junk food related disease
(D) polluted air related disease

Q.117 Heroin –
(A) is a depressant
(B) slows down body functions
(C) is commonly called smack
(D) All of the above

Q.118 Cocaine is obtained from
(A) *Erythroxylum coca* (B) *Cannabis sativa*
(C) Datura (D) Opium plant

Q.119 Smack is a drug obtained from the –
(A) latex of *Papaver somniferum*
(B) leaves of *Cannabis sativa*
(C) flowers of *Datura*
(D) fruits of *Erythroxylum coca*

Q.120 Opium is extracted from –
(A) *Atropa belladona*
(B) *Papaver somniferum*
(C) *Vinca rosea*
(D) *Azadirachta indica*

EXERCISE - 2 (LEVEL-2)

Choose one correct response for each question.

Q.1 Choose incorrect matching with regards to innate immunity
(A) Physical barriers = Skin, mucosa
(B) Cytokine barriers = Interferons
(C) Cellular barriers = PMNL neutrophils
(D) Physiological barriers = Epithelial lining

Q.2 Withdrawal syndrome is characterised by:-
(a) Anxiety (b) Shakiness
(c) Nausea (d) Sweating
(A) a, c (B) b, c
(C) a, c, d (D) a, b, c, d

Q.3 H_2L_2 represents ____ molecule –
(A) Antibody (B) Antigen
(C) Pathogen (D) Both (A) and (B)

Q.4 In an allergic reaction –
(A) the body is immunodeficient
(B) an allergen binds with IgE
(C) T helper cells release histamine
(D) allergen stimulates graft rejection

Q.5 Active immunity can be artificially induced by –
(A) transfusions
(B) injecting vaccines
(C) passing maternal antibodies to a fetus
(D) injecting gamma globulin

Q.6 A typical antibody –
(A) is activated by APCs
(B) has four identical heavy chains and four identical light chains.
(C) has IgG and IgD components
(D) has a Y shape

Q.7 The drugs, which are commonly abused are opioid, cannabinoids and coca alkaloid. Majority of these are obtained from ____, while some are obtained from ____.
(A) Fungi, non-flowering plants
(B) Flowering plants, fungi
(C) Fungi, flowering plants
(D) Non flowering plants, fungi

Q.8 Immunoglobulin A –
(A) combines with mast cells in allergic reactions
(B) combines with NK cells.
(C) prevents pathogens from attaching to epithelial surfaces.
(D) is found mainly on B-cell surfaces.

Q.9 Which immune response / immunity is responsible for graft rejection ?
(A) Cell-mediated (B) Humoral
(C) Antibody mediated (D) All of these

Q.10 Antibodies are found in –
(A) Blood (B) Pathogen
(C) Antigen (D) Neurons

Q.11 Which cell acts as factory of HIV ?
(A) Macrophage (B) T_H cells
(C) T_K cells (D) N.K. cells

Q.12 ATS provides –
(A) Natural active innate immunity
(B) Natural passive innate immunity
(C) Artificial active acquired immunity
(D) Artificial passive acquired immunity

Q.13 Which of the following cells are antigen presenting cells?
(A) NK cells and monocytes
(B) macrophages and plasma cells
(C) dendritic cells and macrophages
(D) mast cells and B cells

Q.14 AIDS is not spread due to –
(A) Mere touch (B) Physical contact
(C) Body fluids (D) Both (A) and (B)

Q.15 In full blown AIDS, oppurtunistic infections are especially caused by –
(A) *Mycobacterium* (B) *Toxoplasma*
(C) Viruses and fungi (D) All of these

Q.16 ELISA is diagnostic test for –
(A) Bacteria (B) Viruses
(C) AIDS (D) Dreaded diseases only

Q.17 Which measure would be particularly useful for prevention and control of alcohol and drug abuse among adolescents?
(a) Avoid undue peer pressure
(b) Seeking professional and medical help
(c) Looking for danger sign
(d) Education and counselling
(e) Seeking help from parents and peers
(A) a, b, d (B) a, c, d, e
(C) c, e (D) a, b, c, d, e

Q.18 "Don't die of ignorance" slogan is mainly used for –
(A) AIDS (B) Cancer
(C) Typhoid (D) Rabies

Q.19 A molecule recognized as foreign by cells of the immune system is a (an)
(A) antibody (B) antigen
(C) immunoglobulin (D) interferon

Q.20 Nonspecific (innate) immune responses include
(A) inflammation
(B) antigen-antibody complexes
(C) immunoglobulin action
(D) complement and memory T cells

Q.21 Invertebrate defense responses include –
(A) phagocytosis
(B) antimicrobial peptides
(C) ability to distinguish between self and nonself
(D) answers A, B, and C are correct

Q.22 When a person is exposed to the same antigen a second time, the response is
(A) called a secondary immune response
(B) more rapid
(C) mediated by dendritic cells
(D) answers A and B only

Q.23 Which of the following is not an action of complement?
(A) enhances phagocytosis
(B) enhances inflammatory response
(C) coats pathogens
(D) stimulates allergen release.

Q.24 HIV –
(A) is a retrovirus
(B) destroys T cytotoxic cells
(C) is attacked mainly by B cells
(D) answers A, B, and C are correct

Q.25 Which is safe technique to detect cancer ?
(A) Radiography
(B) CT (Computed tomography) Scanning
(C) MRI (Magnetic Resonance Imaging)
(D) Biopsy

Q.26 Most cancers are treated by combination of
(a) Surgery (b) Radiotherapy
(c) Chemotherapy
(A) a and b (B) a and c
(C) band c (D) a, b and c

Q.27 Which of the following cells are especially adept at destroying tumor cells?
(A) NK cells (B) plasma cells
(C) neutrophils (D) B cytotoxic cells

Q.28 Which of the following cells become immunologically competent after processing in the thymus gland?
(A) NK cells (B) T cells
(C) macrophages (D) B cells

Q.29 Cancer detection is based on –
(a) Biopsy
(b) Histopathological studies of tissue
(c) Blood test
(d) Bone marrow test
(A) a, b (B) a, c & d
(C) a, b & c (D) a, b, c & d

Q.30 The major histocompatibility complex (MHC)
(A) encodes a group of cell surface proteins
(B) encodes certain antibodies
(C) is important mainly in allergic reactions
(D) inhibits complement release from macrophages

Q.31 Cytokines –
(A) are regulatory nucleic acids
(B) prevent the inflammatory response
(C) include interferons and interleukins
(D) are immunoglobulins

Q.32 Nonspecific defense mechanisms in vertebrates include–
(i) skin. (ii) acid secretion. (iii) inflammation. (iv) phagocytosis by phagocytes.
(A) i, iii, iv (B) i, ii, iii, iv
(C) ii, iii, iv (D) i, iv

Q.33 Which interferon is biological response modifiers, which activates immune system to destroying tumor?
(A) α (B) β
(C) γ (D) Both (B) and (C)

Q.34 Cells that have a surface marker called CD4 are
(A) NK cells (B) T cytotoxic cells
(C) T helper cells (D) B cells

Q.35 The period between of age may be thought of as adolescence period
(A) 18-21 yrs. (B) 12-21 yrs.
(C) 12-18 yrs. (D) 18-25 yrs.

Q.36 Which is related with ringworm?
(a) *Microsporum* (b) *Trichophyton*
(c) *Epidermophyton*
(A) a (B) a, b
(C) a, c (D) a, b, c

Q.37 Find odd one out with regards to secondary immune response
(A) Booster
(B) Anamnestic
(C) Low intensified
(D) Develop after 1st contact of antigen

Q.38 Elephantiasis causing organism belongs to –
(A) Aschelminthes (B) Platyhelminthes
(C) Cnidaria (D) Porifera

Q.39 The carnivorous fish used for eradication of mosquito larva in stagnated water is
(A) *Gambusia* (B) *Anabas*
(C) Rohu (D) *Catla catla*

Q.40 The secondary immune response is due to –
(A) killer T cells (B) memory cells
(C) plasma cells (D) macrophages

Q.41 Nucleic acid in HIV –
(A) ss RNA (B) ds RNA
(C) ss DNA (D) ds DNA

Q.42 HIV infects –
(A) RBC (B) T-helper cells
(C) B-cells (D) Basophils

Q.43 During injury mast cells secrete –
(A) Histamine (B) Heparin
(C) Prothrombin (D) Antibodies

Q.44 Which of the most infectious disease is –
(A) Hepatitis-B
(B) AIDS
(C) Allergic Cough and cold
(D) Malaria

Q.45 Stool of a person contain whitish grey colour due to malfunction of which type of organ –
(A) Pancrease (B) Spleen
(C) Kidney (D) Liver

Q.46 Cancerous cells can easily be destroyed by radiations due –
(A) Rapid cell division (B) Lack of nutrition
(C) Fast mutation (D) Lack of oxygen

Q.47 Which disorder is not related with smoking?
(a) Lung cancer (b) Bronchitis
(c) Emphysema (d) Coronary heart disease
(e) Gastric ulcer (f) Urinary bladder cancer
(g) Throat cancer
(A) a, b, e, g (B) a, b, c, f, g
(C) c, d, f (D) None (all are related)

Q.48 Antibodies are the macromolecule of –
(A) Fats (B) Protein
(C) Carbohydrate (D) Nucleic acid

Q.49 Agglutination occurs in blood present in a test tube. This indicate –
(A) Antibodies are present in plasma
(B) Antigens are present on R.B.C.
(C) Antigens are present in plasma
(D) Antibodies are present on R.B.C

Q.50 Which of the following toxic substances is responsible for the high malarial fever?
(A) Haemoglobin (B) Haemocyanin
(C) Haemozoin (D) Haemoriden

Q.51 A person with sickle cell anemia is
(A) more prone to malaria
(B) more prone to typhoid
(C) less prone to malaria
(D) less prone to typhoid

Q.52 The group of diseases carried (transmitted) by insects is
(A) typhoid, jaundice, tuberculosis
(B) mumps, measles, smallpox
(C) scrabies, ringworm, swine flu
(D) malaria, filaria, yellow fever

Q.53 Note the following words.
I. Skin II. Phagocytes
III. B-cells IV. Inflammation
V. Antibodies VI. T-cells
VII. Fever VIII. NK-cells
Identify the factors involved in second line of defence.
(A) II, IV, V II and VIII
(B) II, III,V and VI
(C) IV, VI, VII and VIII
(D) III, V, VII and VIII

Q.54 Which of the following is not a lymphoid tissue?
(A) Spleen (B) Tonsils
(C) Appendix (D) Thymus

Q.55 The lymph nodes
I. are small solid structures throughout the body,
II. filter lymph fluid as it flows through them, trapping bacteria, viruses and other antigens, which are then destroyed by lymphocytes,
Which of the statements given above is/an correct?
(A) Only I (B) Only II
(C) I and II (D) None of these

Q.56 One of the following is not the causal organism for ringworm
(A) Microsporum (B) Trichophyton
(C) Epidermophyton (D) Macrosporum

Q.57 Where will you look for the sporozoites of the malarial parasite?
(A) RBCs of humans suffering from malaria.
(B) Spleen of infected person.
(C) Salivary glands of freshly moulted female Anopheles mosquito.
(D) Saliva of infected female *Anopheles* mosquito

Q.58 Which one of the following is a matching pair of a drug and its category?
(A) Amphetamines – Stimulant
(B) Lysergic acid dimethylamide – Narcotic
(C) Heroin – Psychotropin
(D) Benzodiazepan – Pain killer

Q.59 Fever in malaria is due to
(A) release of merozoites from RBCs.
(B) entry of sporozoites into blood capillaries.
(C) entry of cryptomerozoites into RBCs.
(D) entry of merozoites into liver cells

Q.60 Which of the following glands is large sized at birth but reduces in size with aging?
(A) Pineal (B) Pituitary
(C) Thymus (D) Thyroid

Q.61 Which of the following is a suitable example of innate immunity?
(A) PMNL-neutrophils (B) T-lymphocytes
(C) B-lymphocytes (D) TH cells

Q.62 Diseases are broadly grouped into infectious and non-infectious diseases. In the list given below, identify the infectious diseases.
i. Cancer ii. Influenza
iii. Allergy iv. Small pox
(A) i and ii (B) ii and iii
(C) iii and iv (D) ii and iv

EXERCISE - 3 (LEVEL-3)

Choose one correct response for each question.

Q.1 T cells –
(i) are lymphocytes
(ii) are called LGLs
(iii) mature in the thymus gland
(iv) are involved in adaptive immunity
(A) i, iii, iv (B) i, ii, iii
(C) ii, iii, iv (D) i, iv

Q.2 Which radiations cause DNA damage leading to neoplastic transformation ?
(a) lonising radiations (b) X-rays
(c) Non-ionising radiations (d) UV-rays
(A) a and c (B) b and d
(C) a and b (D) a, b, c and d

Q.3 B cells –
(i) are granular
(ii) are lymphocytes
(iii) clone after contacting its targeted antigen
(iv) are derived from plasma cells
(v) include many antigen-binding forms
(A) ii, iii, v (B) i, ii, iii
(C) ii, iii, iv (D) i, iv

Q.4 (a) Haemophilus influenzae
(b) Streptococcus strain
(c) Infects alveoli of lungs
(d) Fluid present in alveoli in severe cases
(e) Lips and finger nails may turn gray to bluish in colour
(f) Droplet or aerosol infections
Above features are related with –
(A) Pneumonia (B) Common cold
(C) Influenza (D) Swine flu

Q.5 T cell receptors –
(i) bind antigens
(ii) have no known function
(iii) are identical in all T cells
(iv) are found on killer cells
(A) i, iii, iv (B) i, ii, iii
(C) ii, iv (D) i, iv

Q.6 (a) Smack (b) Diacetylmorphine
(c) White (d) Odourless
(e) Bitter crystalline compound
(f) Extracted from latex of poppy plant
Above statements/informations are correct for:-
(A) Morphine (B) Heroin
(C) Coccain (D) Barbiturates

Q.7 Which sequence most accurately describes antibody-mediated immunity?
(a) B cell divides and gives rise to clone.
(b) antibodies produced.
(c) cells differentiate, forming plasma cells.
(d) activated helper T cell interacts with B cell displaying same antigen complex.
(e) B cell activated.
(A) a → b → c → d → e
(B) c → b → a → d → e
(C) d → e → c → d → a
(D) d → e → a → c → b

Q.8 Complement –
(i) is a system of many proteins.
(ii) is an antibody.
(iii) is highly antigen specific.
(iv) helps destroy pathogens.
(A) i, iii, iv (B) i, ii, iii
(C) ii, iv (D) i, iv

Q.9 An allergic reaction involves –
(i) killer T cells
(ii) mast cells
(iii) over production of histamine
(iv) production of IgE
(A) i, iii, iv (B) i, ii, iii
(C) ii, iii, iv (D) i, iv

Q.10 (a) *Salmonella* is pathogenic bacterium
(b) Sustained high fever (39°C to 40°C)
(c) Intestinal perforation in severe cases
(d) Confirmed by "widal test"
(e) Marry Mallon was carrier
Above statements are true for :-
(A) Plague (B) Diphtheria
(C) Typhoid (D) Dysentery

Q.11 The histocompatibility complex is –
(i) found in cell nuclei.
(ii) different in each individual.
(iii) the same on individuals comprising a species.
(iv) derived from a group of closely linked genes
(A) i, iii, iv (B) i, ii, iii
(C) ii, iv (D) i, iv

Q.12 Which is showing accurate pairing –
(A) Syphilis- Treponema pallidum
(B) AIDS - Bacillus conjugalis
(C) Gonorrhoea - Leishmania denovoni
(D) Typhoid - mycobacterium leprae

Q.13 Which of the following is used in the treatment of Thyroid cancer –
(A) I_{131} (B) U_{238}
(C) Ra_{224} (D) C_{14}

Q.14 Which one of the following conditions though harmful in itself, is also a potential saviour from a mosquito borne infectious disease –
(A) Thalassaemia (B) Sickle cell anaemia
(C) Pernicius anaemia (D) Leukemia

Q.15 Severe Acute Respiratory Syndrome (SARS)
(A) Is caused by a variant of Pneumococcus pneumoniae.
(B) Is caused by a variant of the common cold virus (corona virus).
(C) Is an acute form of asthma.
(D) Affects non-vegetarians much faster than the vegetarians.

Q.16 The treatment of snake-bite by antivenine is an example of –
(A) Artificially acquired active immunity.
(B) Artificially acquired passive immunity.
(C) Naturally acquired passive immunity.
(D) Specific natural immunity.

Q.17 Graft transplantation to save certain patients fails due to the rejection of such organs by the patient. Which type of immune response is responible for such type of rejection?
(A) Cell-mediated immune response
(B) Humoral immune response
(C) Both (A) and (B)
(D) Innate immune response

Q.18 Match the following bacteria with the diseases

	Column I	**Column II**
a.	Treponema pallidum	1. Plaque
b.	Yersinia pestis	2. Anthrax
c.	Bscillus anthrasis	3. Syphilis
d.	Vibrio	4. Cholera

(A) a-3, b-1, c-2, d-4
(B) a-4, b-1, c-2, d-3
(C) a-3, b-2, c-1, d-4
(D) a-3, b-4, c-2, d-1

Q.19 Match the names of disease listed under column I with meanings given under column II

Column I (Name of disease)		**Column II (Meanings)**
a. Jaundice	p.	Allergic inflammation of nose.
b. Stenosis	q.	Loss of motor functions.
c. Rhinitis	r.	Heart valve defect.
d. Paralysis	s.	Increase in bile pigments in the blood.
	t.	Septal defect of heart

(A) a = q; b = r; c = p; d = s
(B) a = s; b = r; c = p; d = q
(C) a = s; b = p; c = r; d = q
(D) a = p; b = r; c = s; d = q

For Q.20-Q.21
(A) Statement- 1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.
(B) Statement -1 is True, Statement -2 is True ; Statement-2 is NOT a correct explanation for Statement-1.
(C) Statement - 1 is True, Statement- 2 is False.
(D) Statement -1 is False, Statement -2 is True.

Q.20 **Statement 1:** Myaesthemia gravis is autoimmune disease.
Statement 2: Immune system rejects the transplant muscles.

Q.21 **Statement 1:** Interferons are a type of antibodies produced by body cells infected by bacteria.
Statement 2: Interferons stimulates inflammation the site of injury.

Q.22 During an allergic reaction, the binding of antigens to IgE antibodies initiates a response, in which chemicals causes the dilation of blood vessels and physiological changes. Such chemicals are
(A) interferons (B) hormones
(C) histamines (D) acetylamine

Q.23 The complexes formed during immune complex mediated hypersensivity are removed by –
(A) eosinophils and T_C-cells
(B) monocytes and B-lymphcytes
(C) eosinophils and monocytes
(D) eosinophils and basophils

Q.24 Match the causative organims with their diseases.

	Column I	Column II
a.	*Haemophilus influenzae*	i. Malignant malaria
b.	*Entamoeba histolytica*	ii. Elephantiasis
c.	*Plasmodium falciparum*	iii. Pneumonia
d.	*Wuchereria bancrofti*	iv. Typhoid
e.	*Salmonella typhi*	v. Amoebiasis

Codes
(A) (a)–(i), (b)–(v), (c)–(iii), (d)–(ii), (e)–(iv)
(B) (a)–(iii), (b)–(v), (c)–(i), (d)–(ii), (e)–(iv)
(C) (a)–(v), (b)–(i), (c)–(iii), (d)–(iv), (e)–(ii)
(D) (a)–(i), (b)–(iii), (c)–(ii), (d)–(v), (e)–(iv)

Q.25 Which of the following are the reason(s) for Rheumatoid arthritis? Choose the correct option.
i. Lymphocytes become more active
ii. Body attacks self cells
iii. More antibodies are produced in the body
iv. The ability to differentiate pathogens or foreign molecules from self cells is lost
(A) i and ii (B) ii and iv
(C) iii and iv (D) i and iii

EXERCISE - 4 (PREVIOUS YEARS AIPMT/NEET EXAM QUESTIONS)

Choose one correct response for each question.

Q.1 Infection of Ascaris usually occurs by **[NEET 2013]**
(A) Tese-tese fly
(B) Mosquito bite
(C) Drinking water containing eggs of Ascaris
(D) Eating imperfectly cooked pork

Q.2 The cell-mediated immunity inside the human body is carried out by – **[NEET 2013]**
(A) Thrombocytes (B) Erythrocytes
(C) T-lymphocytes (D) B-lymphocytes

Q.3 Which one of the following fungi contains hallucinogens – **[AIPMT 2014]**
(A) *Morchella esculenta*
(B) *Amanita muscaria*
(C) *Neurospora sp.*
(D) *Ustilago sp.*

Q.4 Which is the particular type of drug that is obtained from the plant whose one flowering branch is shown here ? **[AIPMT 2014]**

(A) Hallucinogen (B) Depressant
(C) Stimulant (D) Pain - killer

Q.5 At which stage of HIV infection does one usually show symptoms of AIDS ? **[AIPMT 2014]**
(A) Within 15 days of sexual contact with an infected person.
(B) When the infected retro virus enters host cells.
(C) When HIV damages large number of helper T-Lymphocytes.
(D) When the viral DNA is produced by reverse transcriptase.

Q.6 Match each disease with its correct type of vaccine **[AIPMT 2015]**

Column I	Column II
(a) Tuberculosis	(i) Harmless virus
(b) Whooping cough	(ii) Inactivated toxin
(c) Diphtheria	(iii) Killed bacteria
(d) Polio	(iv) Harmless bacteria

(A) a-iv, b-iii, c-ii, d-i (B) a-i, b-ii, c-iv, d-iii
(C) a-ii, b-i, c-iii, d-iv (D) a-iii, b-ii, c-iv, d-i

Q.7 The active form of Entamoeba histolytica feeds upon – **[AIPMT 2015]**
(A) food in intestine
(B) Blood only
(C) Erythrocytes, mucosa and submucosa of colon.
(D) Mucosa and submucosa of colon only.

Q.8 HIV that causes AIDS, first starts destroying **[AIPMT 2015]**
(A) Helper T-lymphocytes (B) Thrombocytes
(C) B-lymphocytes (D) Leucocytes

Q.9 If you suspect major deficiency of antibodies in a person, to which of the following would you look for confirmatory evidence ? **[RE-AIPMT 2015]**
(A) Haemocytes (B) Serum globulins
(C) Fibrinogen in plasma (D) Serum albumins

Q.10 Which of the following immunoglobulins does constitute the largest percentage in human milk **[RE-AIPMT 2015]**
(A) I_gA (B) I_gM
(C) I_gD (D) I_gM

Q.11 Which of the following diseases is caused by a protozoan – **[RE-AIPMT 2015]**
(A) Babesiosis (B) Blastomycosis
(C) Syphilis (D) Influenza

Q.12 Grafted kidney may be rejected in a patient due to – **[RE-AIPMT 2015]**
(A) Passive immune response
(B) Innate immune response
(C) Humoral immune response
(D) Cell-mediated immune response

Q.13 In higher vertebrates, the immune system can distinguish self-cells and non-self. If this property is lost due to genetic abnormality and it attacks selfcells, then it leads to **[NEET 2016 PHASE 1]**
(A) Allergic response (B) Graft rejection
(C) Auto-immune disease (D) Active immunity

Q.14 Antivenom injection contains preformed antibodies while polio drops that are administered into the body contain **[NEET 2016 PHASE 1]**
(A) Activated pathogens
(B) Harvested antibodies
(C) Gamma globulin
(D) Attenuated pathogens

Q.15 Which of the following statements is not true for cancer cells in relation to mutations? **[NEET 2016 PHASE 1]**
(A) Mutations in proto-oncogenes accelerate the cell cycle.
(B) Mutations destroy telomerase inhibitor
(C) Mutations inactivate the cell control
(D) Mutations inhibit production of telomerase

Q.16 Which of the following sets of diseases is caused by bacteria? **[NEET 2016 PHASE 2]**
(A) Cholera and tetanus
(B) Typhoid and smallpox
(C) Tetanus and mumps
(D) Herpes and influenza

Q.17 Transplantation of tissues/organs fails often due to non-acceptance by the patient's body. Which type of immune-response is responsible for such rejections? **[NEET 2017]**
(A) Autoimmune response
(B) Cell-mediated immune response
(C) Hormonal immune response
(D) Physiological immune response

Q.18 MALT constitutes about ___ percent of the lymphoid tissue in human body **[NEET 2017]**
(A) 50% (B) 20%
(C) 70% (D) 10%

Q.19 Which part of poppy plant is used to obtain the drug "Smack"? **[NEET 2018]**
(A) Roots (B) Latex
(C) Flowers (D) Leaves

Q.20 In which disease does mosquito transmitted pathogen cause chronic inflammation of lymphatic vessels? **[NEET 2018]**
(A) Ringworm disease (B) Ascariasis
(C) Elephantiasis (D) Amoebiasis

Q.21 Which of the following is not an autoimmune disease? **[NEET 2018]**
(A) Alzheimer's disease (B)Rheumatoid arthritis
(C) Psoriasis (D) Vitiligo

Q.22 Colostrum the yellowish fluid, secreted by mother during the initial days of lactation is very essential to impart immunity to the new born infants because it contains **[NEET 2019]**
(A) Natural killer cells (B) Monocytes
(C) Macrophages (D) Immunoglobulin A

Q.23 Drug called 'Heroin' is synthesized by **[NEET 2019]**
(A) methylation of morphine
(B) acetylation of morphine
(C) glycosylation of morphine
(D) nitration of morphine

Q.24 Identify the correct pair representing the causative agent of typhoid fever and the confirmatory test for typhoid. **[NEET 2019]**
(A) *Plasmodium vivax* / UTI test
(B) *Streptococcus pneumoniae* / Widal test
(C) *Salmonella typhi* / Anthrone test
(D) *Salmonella typhi* / Widal test

ANSWER KEY

EXERCISE-1 (SECTION-1&2)

(1) (A) **(2)** (B) **(3)** (A) **(4)** (C)
(5) Malaria **(6)** Heart; breast bone **(7)** Yeast
(8) Interferon **(9)** Emphysema **(10)** Passive
(11) Metastasis **(12)** *Wuchereria bencrofti*
(13) Pathogens **(14)** Large; reducing **(15)** Interferon
(16) Oncogenic viruses, viral oncogenes
(17) Widal-Test **(18)** *Cannabis sativa*
(19) Metastasis **(20)** Four **(21)** Sporozoite

EXERCISE - 1 [SECTION-3]

Q	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
A	D	C	A	B	B	D	D	B	C	B	A	B	B	D	A	B	D	A	D	D	A	C	B	D	B	A
Q	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73
A	D	B	C	A	A	C	A	C	B	D	B	A	D	C	B	C	B	D	D	A	B	D	A	B	C	A
Q	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
A	D	C	A	D	D	C	A	D	A	D	A	A	D	A	B	A	B	A	C	A	C	C	D	A	A	B
Q	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120					
A	C	C	A	B	C	A	D	D	C	A	C	A	C	A	B	A	A	D	A	A	B					

EXERCISE - 2

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
A	D	D	A	B	B	D	B	C	A	A	A	D	C	D	D	C	D	A	B	A	D	D	D	A	C
Q	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
A	D	A	B	D	A	C	B	A	C	C	D	C	A	A	B	A	B	A	A	D	A	D	B	B	C
Q	51	52	53	54	55	56	57	58	59	60	61	62													
A	C	D	A	C	C	D	D	A	A	C	A	D													

EXERCISE - 3

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
A	A	D	A	A	D	B	D	D	C	C	C	A	A	B	B	B	A	A	B	C	D	C	C	B	B

EXERCISE - 4

Q	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A	C	C	B	A	C	A	C	A	B	A	A	D	C	D	D	A	B	A	B	C	A	D	B	D

SOLUTIONS

EXERCISE-1

(1) (A) **(2)** (B) **(3)** (A) **(4)** (C)
(5) Malaria **(6)** Heart; breast bone **(7)** Yeast
(8) Interferon **(9)** Emphysema **(10)** Passive
(11) Metastasis **(12)** *Wuchereria bencrofti*
(13) Pathogens **(14)** Large; reducing **(15)** Interferon
(16) Oncogenic viruses, viral oncogenes
(17) Widal-Test **(18)** *Cannabis sativa*
(19) Metastasis **(20)** Four **(21)** Sporozoite

(22) **(D).** Different species of *Plasmodium* (*P. vivax, P. malariae, P. falciparum* and *P. ovale*) are responsible for different types of malaria.

(23) **(C).** *Entamoeba histolytica* is gastrointestinal protozoan parasite that possess a serious health problem, with 50 million annual infections throughout the world.

(24) **(A).** Symptoms of ascariasis disease includes internal bleeding, muscular pain, fever, anaemia and blockage of the intestinal passage. Ascariasis is caused by an endoparasite of human, *Ascaris lumbricoids* commonly called roundworm.

(25) **(B).** Communicable diseases are transferred from one diseased person to a normal person. Amoebiasis (protozoan disease) is a communicable disease.

(26) **(B).** *Plasmodium* is a parasite. Malaria is caused by a protozoans, parasite *Plasmodium* and transmitted by mosquito.

(27) **(D).** When a female *Anopheles* mosquito bites an infected person, gametocyte of *Plasmodium* enter the mosquito's body and undergo further development. Mature infective stage (sporozoite) escape from intestine and migrate to salivary gland of mosquito. When these mosquitoes bite a human, the sporozoites are introduced into his / her body, thereby initiating the disease in the host's body.

(28) **(D).** Malaria, amoebiasis and sleeping sickness all are protozoan diseases caused by protozoans *Plasmodium, Amoeba* and *Trypanosoma* respectively.

(29) **(B).** The WIDAL test is one of the most utilised diagnostic tests for typhoid fever.

(30) **(C).** *Microsporum* is a genus of fungi that causes tinea capitis, tinea corpus, ringworm, and other dermatophytoses (fungal infections of the skin).

(31) **(B).** *Plasmodium* completes its life cycle in two hosts (digenetic) i.e., Man and female *Anopheles* mosquito.

(32) **(A).** Malaria is caused by a protozoan Plasmodium (*P. vivax, P. malariae, P. falciparum* and *P. ovale*).

(33) **(B).** Hippocrates is known as the father of medicine because many of the things he discovered are still practiced today.

(34) **(B).** Chikungunya is caued by chikunganya virus. The virus was first isolated from human patients and *Aedes aegypti* mosquitoes from tanzania in 1952. The disease is transmitted by the bite of *Aedes aegypti* mosquito.

(35) **(D).** Typhoid is caused by bacterium, *Salmonella typhi*. The disease is spread by contaminated food & water through housefly.

(36) **(A).** Typhoid fever is caused by a type of bacteria called *Salmonella typhi*. It is spread by contaminated food and water.

(37) **(B).** Amoebiasis is an infection of intestine caused by the parasite *Entamoeba histolytica*.

(38) **(D).** Yellow fever and dengue both are viral diseases as well as transmitted by mosquitoes.

(39) **(A).** Malignant tertian/irregular/quotidian (cerebral malaria) is caused by *Plasmodium falciparum*, which is tropical in distribution.

(40) **(D).** Malaria is a protozoan disease. It is caused by the protozoan *Plasmodium* sp.

(41) **(D).** A healthy person acquires the pneumonia infection by inhaling the droplets/aerosols released by an infected person or even by sharing glasses and utensils with an infected person.

(42) **(A).** A fungus parasitic upon the skin, usually a species of *Microsporum, Epidermophyton* or *Trichophyton* is responsible for ringworm. They are also called cutaneous fungus.

(43) **(C).** Intermediate host of *Wuchereria* is female *Culex* mosquito.

(44) **(B).** The gametocytes of *Plasmodium* are not affected by the digestive enzymes of host mosquito.

(45) **(D).** Diabetes mellitus is a non-communicable disease. It is characterised by chronic hyperglycemia, which is excessive concentration of glucose in the blood. Diabetes is primarily a result of relative or complex lack of insulin secretion by the β-cells of islets of Langerhans in pancreas.

(46) **(B).** Polio or polio myelitis is an infective viral disease in infants and childrens. It is caused by a small RNA virus (polio virus or enterovirus).

(47) (A)

(48) **(D).** Ringworm is a skin infection caused by a fungus species of *Microsporum, Epidermophyton* or *Trichophyton.*

(49) **(B).** Malaria is caused by Protozoa *Plasmodium* and transmitted by mosquito (*Anopheles*).

(50) **(C).** The symptoms of pneumonia includes fever, chills, cough and headache. In severe cases, the lips and finger nails may turn gray to bluish in colour.

(51) **(A).** The filariasis pathogens are transmitted to a healthy person through the bite of female mosquito (*Culex*) vectors.

(52) **(A).** *Plasmodium* life cycle is digenetic. *Plasmodium* completes its life cycle in two hosts (digenetic). i.e., man and female *Anopheles* mosquito.

(53) **(C).** Infective stage of malaria is sporozoite. *Plasmodium* enters the human body as sporozoites (infectious form) through the bite of infected female *Anopheles* mosquito.

(54) **(A).** Ascariasis is caused by an intestinal endoparasite human *Ascaris lumbricoides*, commonly called roundworm.
Filariasis is caused by filarial worms, *Wuchereria bancrofti* and *Wuchereria malayi*.

(55) **(C).** A communicable disease is an illness transmitted through contact with microorganisms or any other means. People, animals, food surfaces, and air can all be the carriers of the microorganisms that pass infectious illnesses from one host to the next. The exchange of fluids or contact with a contaminated substance or individual may be enough to allow a communicable disease to spread.

(56) **(B).** The pathogen of the typhoid is directly transmitted through water. Typhoid is caused by pathogenic bacterium *Salmonella typhi*.

(57) **(D).** Plasmodium is a protozoan parasite, which causes malaria in human beings. The primary host of *Plasmodium* is female *Anopheles* mosquito.

(58) **(B).** A mosquito causes infection by taking a blood meal. First, sporozoites enter the bloodstream, & migrate to the liver of man.

(59) **(A).** Rhinoviruses represent one such group of viruses, which causes one of the most infectious human ailments the common cold.

(60) **(D).** Innate immunity is also known as inborn/familial/natural or genetic immunity. Innate immunity is non-specific type of defence that is present at the time of birth.

(61) (C) **(62)** (B) **(63)** (C) **(64)** (B)

(65) **(D).** The major phagocytic cells are macrophages. Phagocytosis is the process of engulfing a solid particle by a phagocyte.

(66) **(D).** Cell mediated immune response is responsible for graft rejection. Tissue matching, blood group matching are essential before undertaking any graft/transplant and even after this the patient has to take immuno-suppressants throughout his/her life as body is able to differentiate 'self' from 'non self'.

(67) (A)

(68) **(B).** Immunological destruction of body tissue or product due to antibodies reacting with it as non self antigen is called autoimmune disease.

(69) **(D).** An antibiotic that is effective against a wide range of infectious microorganisms, which includes both Gram positive and Gram negative bacteria, is called as a broad spectrum antibiotic.

(70) (A)

(71) **(B).** Vaccines are made from microbes that are dead or inactive so that they are unable to cause the disease. The antigen in the vaccine is the same as the antigen on the surface of the disease-causing microbe. The vaccine stimulates the body to produce antibodies against the vaccine.

(72) **(C).** Spleen and tonsils, are called secondary lymphoid organs.

(73) **(A).** The type of antibody present in colostrums secreted by mammary gland during the initial days of lactation is IgA. Colostrum is the first fluid secreted by the mammary glands after childbirth.

(74) **(D).** Interferon (a kind of protein) is a polypeptide produced by a T-cell infected with a virus that diffuses to surrounding cells and stimulates them to manufacture bio-chemicals that harm viral replication.

(75) **(C).**

(76) **(A).** Rheumatoid Arthritis (RA) is a form of inflammatory arthritis and an auto-immune disease.

(77) **(D).** Mast cells play a critical role in allergy and inflammation. Allergy is due to the release of chemicals like histamine and serotonin from the mast cells.

(78) (D) **(79)** (C)

(80) **(A).** Interferons block viral reproduction in healthy cells.

(81) **(D).** Surgical removal of thymus of a new bom shall result in failure to produce T-lymphocyte. Thymus provides the micro-environment for the development and maturation of T-lymphocytes.

(82) **(A).** WBCs (Polymorpho-nuclear leukocytes and monocytes, natural killer lymphocytes) and macrophages, phagocytose and destroy microbes.

(83) **(D).** IgA antibody is secretory antibody and is present abundantly in mucous linings of gastrointestinal, respiratory and genitourinary tracts, tears, colostrum and saliva. Thus, secretory IgA contributes to the humoral defense mechanism against the pathogens on mucosal surfaces.

(84) **(A).** For determining the cause of allergy, the patient is exposed to or injected with very small doses of possible allergens, and the reactions studied.

(85) **(A).** Thymus is the 'seedbed' of thymic lymphocytes (T-lymphocytes). Some stem cells in the bone marrow give rise to immature lymphocytes. These lymphocytes migrate via the blood to the thymus, where they mature as T-lymphocytes, and produce cell-mediated immunity. Thus, damage to thymus in a child may lead to loss of cell-mediated immunity.

(86) **(D).** The spleen is a large bean-shaped organ. It mainly contains lymphocytes and phagocytes. It acts as a filter of the blood by trapping blood-borne microorganisms. Spleen is a reservoir of erythrocytes.

(87) **(A).**

(88) **(B).** Interferons block viral reproduction in healthy cells through the production of antiviral proteins.

(89) **(A).**

(90) **(B).** Active immunity development is related to memory cells, when B-cells and T-cells are activated by a pathogen, memory B-cells and T-cells develop.

(91) **(A).** Transplant rejection is caused by the body's immune response to foreign material. Cell-mediated immunity is responsible for graft rejection.

(92) **(C).** The B-cells and T-cells are produced in bone marrow. The T-cells (T-helper cells) stimulate B-cells to produce antibodies. Antibodies are the main component of immune system. Immunodeficiency is characterised by a very low number of circulating lymphocytes (B and T-cells) and the affected persons usually die at an early age.

(93) **(A).**

(94) **(C).** Antigen binding site in antibody is found between one heavy and one light chain.

(95) **(C).** The B-lymphocytes produce an army of proteins in response to pathogens into our blood to fight them. These proteins are called antibodies. The T-cells themselves do not secrete antibodies but help B-cells to produce them.

(96) **(D).** Passive immunity results when antibodies are produced by one individual and then acquired by another.

(97) **(A).**

(98) **(A).** AIDS is caused by Human Immunodeficiency Virus (HIV). It is a lentivirus belonging to the family-Retroviridae. The core of this lentivirus contains two single strands of RNA molecules, proteins and the enzyme reverse transcriptase.

(99) **(B).** HIV enters into helper T-lymphocytes (TH), replicates and produce progeny viruses. The progeny viruses released in the blood attack other helper T-lymphocytes. This process is repeated several times, leading to a progressive decrease in the number of helper T-lymphocytes in the body of the infected person.

(100) (C) **(101)** (C)

(102) **(A).** Diagnosis of AIDS is done by Enzyme Linked Immuno Sorbent Assay (ELISA)

(103) (B)

(104) **(C).** Benign tumour is a non-cancerous Tumour. It does not show metastasis and is non-invasive. It is less fatal to the body.

(105) **(A).** An oncogene is a gene that has the potential to cause cancer. In tumour cells, they are often mutated or expressed at high levels. Tumour virus or cancer causing viruses are called oncogenic viruses.

(106) **(D).** Lymph, blood and secondary growth of malignant tumour spread cancerous cells.

(107) **(D).** The term 'physical carcinogens' includes a wide range of agents. Ionising radiations like X-rays and gamma rays and non-ionizing radiations like UV rays causes DNA damage leading to neoplastic transformation.

(108) **(C).** Tumour cells have been shown to avoid detection and destruction by immune system. Therefore the patients are given substances called biological response modifiers such as α-interferon, which activates their immune system and helps in destroying the tumours.

(109) (A) **(110)** (C) **(111)** (A)

(112) **(C).** Morphine extracted from the latex of poppy plant *Papaver somniferum* is an alkaloid.

(113) **(A).** Products from plants like *Datura* sp. are hallucinogem Hallucinogens are a diverse group of drugs that cases alteration in perception, thought or mood.

(114) **(B).** Some slang names for heroin are smack, junk, H, black tar, horse, etc.

(115) **(A).** Morphine is a potent opiate analgesic drug that is used to relieve severe pain. Morphine is the most abundant opiate found in opium, the dried latex extracted by shallowly slicing the unripe seedpods of the *Papaver somniferum* (poppy).

(116) **(A).** Alcohol can cause inflammation in the liver. Over time, scarring and cirrhosis can occur. Cirrhosis is the final phase of alcoholic liver disease.

(117) **(D).** Heroin or smack is a central nervous system depressant, which means it slows down brain function and affects breathing (which can slow down or even stop).

(118) **(A).** Cocaine is a crystalline alkaloid that is obtaned from the leaves of the coca plant (*Erythroxylum coca*).

(119) **(A).** Smack is obtained by acetylation of morphine, which is extracted from the latex of poppy plant *Papaver somniferum*.

(120) **(B).** Opium is obtained from poppy plant or *Papaver somniferum* (family-Papaveraceae).

EXERCISE-2

(1) (D) **(2)** (D) **(3)** (A) **(4)** (B)

(5) (B)

(6) **(D).** Antibodies, also called immunoglobulins, are large Y-shaped proteins which function to identify and help remove foreign antigens or targets such as viruses and bacteria.

Every different antibody recognizes a specific foreign antigen.

(7) (B) **(8)** (C) **(9)** (A) **(10)** (A)

(11) **(A).** Antigen presenting cells- a heterogeneous group of immunocompetent cells that mediate cellular immune response by processing and presenting antigens to the T-cell receptor. Traditional antigen-presenting cells include macrophages, dendritic cells, langerhans cells, and B-lymphocytes.

(12) (D) **(13)** (C) **(14)** (D) **(15)** (D)

(16) (C) **(17)** (D) **(18)** (A) **(19)** (B)

(20) **(A).** Inflammation is triggered when innate immune cells detect infection or tissue injury.

(21) (D) **(22)** (D) **(23)** (D) **(24)** (A)

(25) (C) **(26)** (D)

(27) **(A).** Natural killer (NK) cells are lymphocytes that were first identified for their ability to kill tumor cells without deliberate immunization or activation.

(28) (B) **(29)** (D) **(30)** (A) **(31)** (C)

(32) (B) **(33)** (A)

(34) **(C).** Helper T cells are arguably the most important cells in adaptive immunity, as they are required for almost all adaptive immune responses. They not only help activate B cells to secrete antibodies and macrophages to destroy ingested microbes, but they also help activate cytotoxic T cells to kill infected target cells.

(35) (C) **(36)** (D) **(37)** (C)

(38) **(A).** The disease elephantiasis is caused by *Wuchereria bancrofti*, a member of phylum-Aschelminthes. It is an endoparasite of humans that lives in the lymphatic system. The disease is marked by an excessive growth of connective tissue enormous swelling of affected parts, such as the scrotum, legs, arms and more rarely the vulva and breasts.

(39) **(A).** The carnivorous fish used for eradication of mosquito larva in stagnated water is *Gambusia*. *Gambusia* is a large genus of fish in family-Poecilidae (order-Cyprinodontiformes) .

(40) **(B).** Memory responses, which are called secondary, tertiary, and so on, depending on the number of exposures to antigen, differ qualitatively from primary responses.

(41) **(A).** The human immunodeficiency virus type 1 (HIV-1) contains two copies of single-stranded RNA (ssRNA), which are transcribed into double-stranded DNA (dsDNA) by a complex reverse transcription process.

(42) (B)

(43) **(A).** Histamine is a chemical stored within our body. It is produced by cells known as mast cells. Histamine is a protein molecule with the chemical formula $C_5H_9N_3$. It serves as an important part of our body's immune response. When we come into contact with an allergen, such as pollen or animal dander, histamine is released by the body to the site of contact.

(44) **(A).** Hepatitis B is a potentially life-threatening liver infection caused by the hepatitis B virus. It is a major global health problem. It can cause chronic infection and puts people at high risk of death from cirrhosis and liver cancer.

(45) (D) **(46)** (A) **(47)** (D)

(48) **(B).** Macromolecules are large molecules that are composed of smaller units. The four major macromolecules are carbohydrates, lipids, nucleic acids, and proteins.
Proteins are polymers that are made up of amino acids.
he common types of proteins that are found in biological systems are enzymes, antibodies, transport proteins, regulatory proteins, and structural proteins.

(49) (B)

(50) **(C).** Release of a toxic substance, haemozoin is responsible for chill and high malarial fever.

(51) **(C).** Sickle cell trait protects against malaria. Malarial parasite is unable to penetrate the erythrocyte membrane as sickle haemoglobin might get in the way of *Plasmodium* parasite infecting red blood cells, reducing the number of parasites that actually infect the host thus conferring some protection against the disease.

(52) **(D).** Mosquitoes are carriers of
Malaria – *Anopheles* mosquito (female)
Filariasis – *Culex* (female)
Yellow fever – *Aedes* (female).

(53) **(A).** The second line of non-specific defence is primarily dependent upon neutrophils and macrophages, phagocytic white cells (phagocytes) in blood and lymph. Natural killer cells (NK-cells) also participate in it. Second line also include function like interferon, histamine and antimicrobial protein.

(54) **(C).** Lymphoid organs are the organs where origin and/or maturation and proliferation of lymphocytes occur. The primary lymphoid organs are bone marrow and thymus, where immature lymphocytes differentiate and proliferation of lymphocytes occur. The primary lymphoid organs are bone marrow and thymus where immature lymphocytes differentiate into antigen-sensitive lymphocytes. After maturation the lymphocytes migrate to secondary lymphoid organs like spleen, lymph nodes, tonsils, Peyer's patches of small intestine and appendix. The secondary lymphoid organs provide the sites for interaction of lymphocytes with the antigen, which than proliferate to become effector cells. Pancreas is not a lymphoid tissue.

(55) **(C).** The lymph nodes are small solid structures located at different points along the lymphatic system. Lymph nodes serveto trap the microorganisms or other antigens, which happen to get into the lymph and tissue fluid.

(56) **(D).** Many fungi belonging to the genera *Microsporum*, *Trichophyton* and *Epidermophyton* are responsible for ringworms which is one of the most common infectious diseases in man. Appearance of dry, scaly lesions on various parts of the body such as skin, nails and scalp are the main symptoms of the disease.

(57) **(D).** When an infected female *Anopheles* bites a healthy person, Plasmodium in the form of 'Sporozoits' are transmited from saliva of mosquito into the human body.

(58) **(A).** Lysergic acid dimethylamide-Psychodelic drug, Heroin-Analgesic and Benzodiazepan - Psychoactive drug.

(59) **(A).** Erythrocyte cycle of Plasmodium occurs in RBCs and begins when a cryptomerozoite or micrometacryptomerozoite enters into RBC. After entering into RBC, a merozoite becomes rounded disc-like young trophozoite. The accumulation of haemozoin granules (acquire trophozoite) and probably also some other toxic substances in blood causes the characteristic attack of malarial fever initially after about four erythrocytic cycles and than after each cycle.

(60) **(C).** The thymus is a lobed organ located near the heart and beneath the breastbone. The thymus is quite large at the time of birth but keeps reducing in size with age and by the time puberty is attained it reduces to a very small size.

(61) **(A).** Innate immunity is inherited by the organisms from their parents and protects it from birth to throughout life. PMNL - neutrophils are example of innate immunity.

(62) **(D).** Diseases can be broadly grouped into infectious and non-infectious. Diseases which are easily transmitted from one person to another, are called infectious diseases. Influenza and small pox are infectious diseases which are spreaded by direct contact, inhalation and droplet infections. Cancer and allergy are non-communicable diseases as these diseases remained confined to the person who suffer from them. They are not transmitted from infected person to other person.

EXERCISE-3

(1) (A)

(2) **(D).** Neoplastic transformation - Conversion of a tissue with a normal growth pattern into a malignant tumor.

(3) **(A).** (ii) is correct because B cells are lymphocytes that arise from stem cells in the bone marrow; (iii) is correct because

when a cell encounters an antigen, it incorporates it into the cell and presents it on its surface. The B cells are induced to proliferate when they encounter and bind to a helper T cell presenting the same antigen on its surface, producing a clone of B cells with identical B cell receptors. Some of these clones differentiate into plasma cells which secrete the same antibody that was originally displayed on the parent B cell's surface; (v) is correct because each unique antigen would result in a unique B cell clone.

(4) (A)

(5) **(D).** The T cell receptor or TCR is a molecule found on the surface of T lymphocytes (or T cells) that is responsible for recognizing fragments of antigen as peptides bound to major histocompatibility complex (MHC) molecules.

(6) (B) **(7)** (D)

(8) **(D).** (i) and (iv) are correct because complement is a complex of proteins in the plasma; some of these, when activated, attach to the surface of pathogens, resulting in the perforation of their membrane and destruction.

(9) **(C).** (iv) is correct because allergens induce B cells to make an overabundance of IgE, which, in turn, stimulates mast cells to overproduce histamine.

(10) **(C).** Typhoid fever is an acute illness associated with fever caused by the Salmonella typhi bacteria. It can also be caused by Salmonella paratyphi, a related bacterium that usually causes a less severe illness. The bacteria are deposited in water or food by a human carrier and are then spread to other people in the area.

(11) (C)

(12) **(A).** Syphilis is a sexually transmitted infection caused by the bacterium Treponema pallidum subspecies pallidum.

(13) (A)

(14) **(B).** Sickle cell anaemia is a serious inherited blood disorder where the red blood cells, which carry oxygen around the body, develop abnormally.

(15) **(B).** Severe acute respiratory syndrome (SARS) is a serious form of pneumonia.
It is caused by a virus that was first identified in 2003. Infection with the SARS virus causes acute respiratory distress (severe breathing difficulty) and sometimes death.SARS is caused by a member of the coronavirus family of viruses (the same family that can cause the common cold).

(16) (B)

(17) **(A).** Cell-mediated immune response is mediated by T-lymphocytes. It is responsible for graft rejection in organs transplant because of its ability to differentiate between 'self' and 'non-self'.

(18) (A) **(19)** (B) **(20)** (C)

(21) **(D).** Interferon is a glycoprotein, production of which is induced within virally infected cells. Interferon induces an antiviral state with in adjacent cells.

(22) **(C).** Histamine is released from mast cells during allergic reactions. Histamine can occur in various tissues but is concerntrated in connective tissue. It is formed from the amino acid histidine. It causes dilation and increases permeability of small blood vessels, which results in such symptoms as localised swelling, itching, sneezing and runny eyes and nose.

(23) **(C).** In type III hypersensivity reaction immune complex are formed which are removed by phagocytosis by eosinophils & monocytes.

(24) **(B).** Bacteria like *Streptococcus pneumoniae* and *Haemophilus influenzae* are responsible for the disease pneumonia.
Entamoeba histoiytica is a protozoan parasite in the large intestine of human, which causes amoebiasis (amoebic dysentery) . *Plasmodium falciparum* causes malignant malaria.
Wucheraria bancrofti, the filarial worm causes elephantiasis or filariasis. *Salmonella typhi* is a pathogenic bacterium, which causes typhoid fever in human beings.

(25) **(B).** The body is normally able to distinguish its own self-antigens from foreign nonself antigens and does not attack (immunologic) against its self.

At times the body loses tolerance and mounts an abnormal immune attack. Autoimmue disease results from the activation of self reactive T and B cells. Rheumatoid arthritis is an example of auto immune disease.

EXERCISE-4

(1) **(C).** *Ascaris*, an intestinal parasite causes ascariasis. A healthy person acquires this infection through contaminated water, vegetables, fruits, etc.

(2) **(C).** Cell-mediated immune response or cell-mediated immunity (CMI): The T-lymphocytes mediate CMI.

(3) **(B).** *Amanita muscaria* is noted for its hallucinogenic properties, with its main psychoactive constituent being the compound muscimol.

(4) **(A).** The plant illustrated in diagram is *Datura* which has hallucinogenic properties.

(5) **(C).** Symptoms of AIDS would appear in the late stage of HIV infection, when the virus attacks 'Helper-T-cells' and causes their depletion.

(6) **(A).** Correct match is as follows:
(a) Tuberculosis – Attenuated a harmless strain of *Mycobacterium tuberculosis*.
(b) Whooping – Killed strain of bacteria cough *Bordetella pertusis*.
(c) Diphtheria – Inactivated toxin
(d) Polio – Attenuated strain of virus or harmless virus.

(7) **(C).** Magna (Trophozoite) stage of *Entamoeba histolytica* feeds on mucus & RBC.

(8) **(A).** The AIDS retrovirus, called human immunodeficiency virus (HIV), mounts a direct attack on $CD4^{+}$T cells because it recognizes the CD4 coreceptors associated with these cells.

(9) **(B).** Antibodies are γ-Globulin.

(10) **(A).** I_gA is present in external body secretion including colostrum and milk. They provide naturally acquired passive immunity to child.

(11) **(A).** Babesiosis is caused by sporozoan protozoon-babesia. In this disease haemoglobinuric fever occur.

(12) **(D).** Cell mediated immunity (CMI) is responsible for graft rejection.

(13) **(C).** In autoimmune diseases, the immune cells are unable to distinguish between self cells and non-self cells and attack self cells.

(14) **(D).** Oral polio vaccine consists of attenuated pathogen.

(15) **(D).** Cancerous cells have high telomerase activity. Telomerase inhibitors are used in cancer treatment.

(16) **(A).** Cholera is caused by a bacterium *Vibrio cholerae* and tetanus is caused by a bacterium *Clostridium tetani*.

(17) **(B).** Non acceptance or rejection of graft or transplanted tissues/organs is due to cell mediated immune response.

(18) **(A).** MALT is Mucosa Associated Lymphoid Tissue & it constitutes about 50 percent of the lymphoid tissue in human body.

(19) **(B).** 'Smack' also called as brown sugar/Heroin is formed by acetylation of morphine. It is obtained from the latex of unripe capsule of Poppy plant.

(20) **(C).** Elephantiasis is caused by roundworm, *Wuchereria bancrofti* and it is transmitted by Culex mosquito.

(21) **(A).** Rheumatoid arthritis is an autoimmune disorder in which antibodies are produced against the synovial membrane and cartilage. Vitiligo causes white patches on skin also characterised as autoimmune disorder. Psoriasis is a skin disease that causes itchy or sore patches of thick red skin and is also autoimmune whereas Alzheimer's disease is due to deficiency of neurotransmitter acetylcholine.

(22) **(D).** Colostrum, the yellowish fluid secreted by the mother during initial days of lactation is very essential to impart immunity to the new born infant because it contains Immunoglobulin A. It will impart naturally acquired passive immunity to the newborn.

(23) **(B).** Heroin, commonly called smack and is chemically diacetylmorphine which is synthesized by acetylation of morphine.

(24) **(D).** *Salmonella typhi* is the causative agent. Confirmatory test = Widal test, it's based on antigen antibody reaction.