

BIOLOGY

Chapter 8: Human Health and Disease



HUMAN HEALTH AND DISEASE

Health:

In simple terms, Health can be defined as free from all diseases and infections. According to the World Health Organization (WHO), health is not only the absence of disease or illness. It is a state of an active and energetic condition including the physical, mental, and social well-being. A balanced diet and regular exercise play an important role in maintaining a good health of an individual.

There are many factors which affect health, such as:

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

To maintain a good health, an individual should include a healthy and balanced diet, maintain personal hygiene along with regular exercise and other physical activities. Everyone should be aware of the different types of diseases and their effects.

Diseases:

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

Infectious diseases:

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

Non-infectious diseases:

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

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

Life Cycle of Plasmodium:

The malarial infection starts when an infected female anopheles mosquito bites a healthy human. Thus, injects the plasmodium parasites into the bloodstream in the form of sporozoites.

The sporozoites travel quickly into the human liver with the help of the bloodstream and there they asexually divide into the liver cells for 7 to 10 days. In this period no symptoms are produced in the human body.

After the multiplication of the sporozoites, converted into merozoites and they are released from the liver cells in the vesicles. They travel through the heart and arrive in the lungs where they settle down in the lung capillaries.

The disintegration of the vesicles allows merozoites to enter the blood phase of their development.

The merozoites enter the red blood cells in the bloodstream and there they multiply until the cell burst. Then they start to enter more red blood cells. These repeated cycles of parasites cause fever each time when the parasites break the red blood cells and then invade the blood cells.

Some blood cells which are infected leave the asexual multiplication cycle and instead of replicating, merozoites develop into the sexual form of the parasite known as gametocytes.

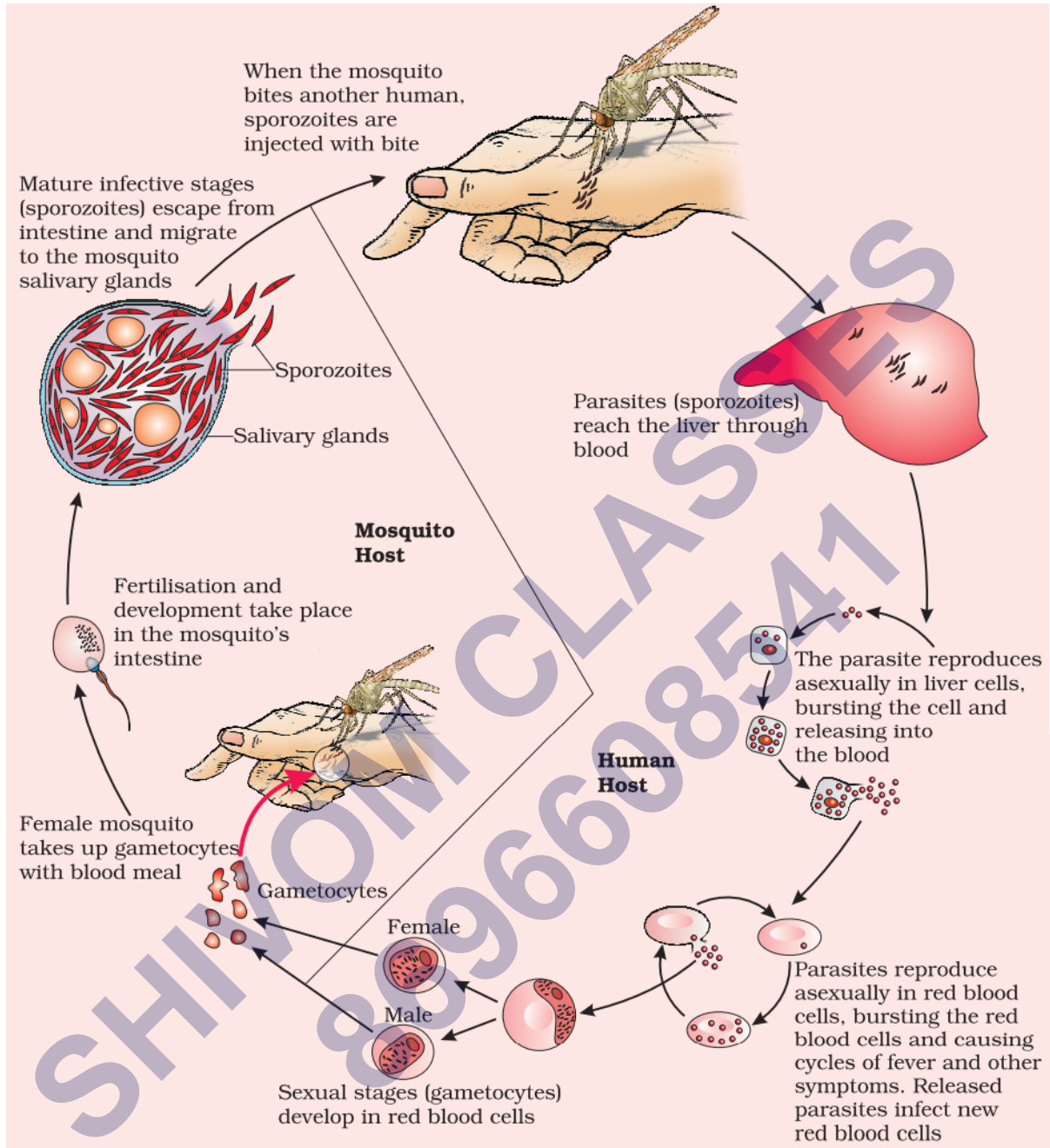
When again the mosquito bites an infected person the gametocytes enter into the mosquito body, where they further develop into mature sex cells called gametes.

The female gametes develop into ookinetes and remain in the midgut wall of the mosquito where they form oocysts on the exterior surface.

Inside the oocyst, many active sporozoites are present. When the oocyst, breaks down, a large number of sporozoites are released into the body cavity and they travel to the mosquito's salivary gland.

This led to the cycle of human infection starts again when the mosquito bites another person.

Hence, the primary host is the mosquito, and the secondary host is the human.



Immunity:

Immunity is the ability of a person to fight against diseases which can be achieved through the presence of antibodies in the person's system.

Immunity is of two types:

Innate immunity

Acquired immunity

Innate Immunity:

The immunity which is present since the time of birth and is a non-specific type of immunity is called innate immunity. The entry of pathogens is restricted with this immunity with the help of certain barriers.

Innate immunity consists of four types of barriers. These are:

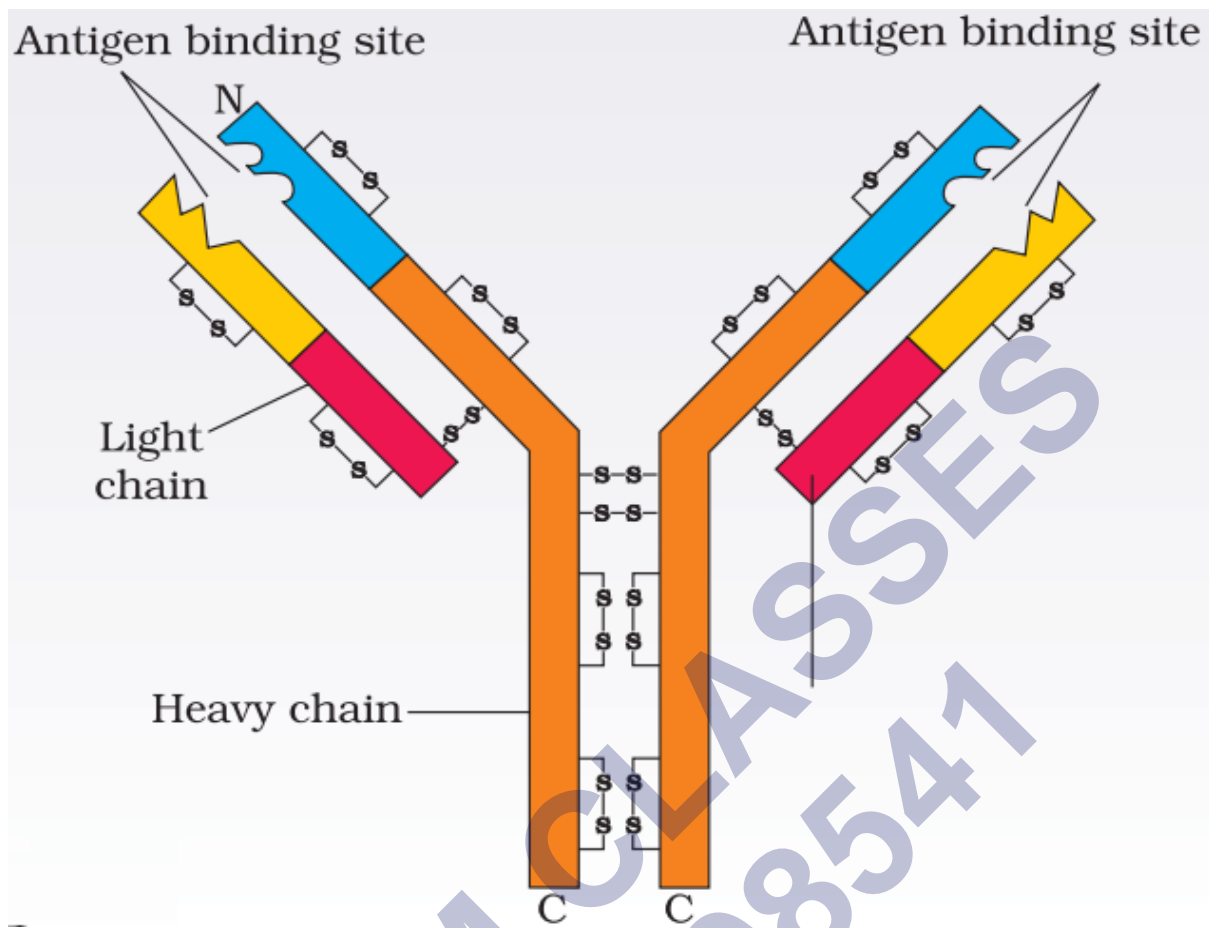
- i. **Physical barriers:** e.g., Skin, gastrointestinal, mucus coating of the epithelium lining the respiratory, and urogenital tracts.
- ii. **Physiological barriers:** Acid in the stomach, tears from eyes, saliva in the mouth.
- iii. **Cellular barriers:** Certain types of leukocytes (WBC) of our body can phagocytose and destroy microbes. For example, the polymorpho-nuclear leukocytes (PMNL-neutrophils), natural killer (type of lymphocytes) in the blood, monocytes, as well as macrophages in tissues.
- iv. **Cytokine barriers:** The cells that are infected by the virus will produce proteins called interferons that help in protecting the other non-infected cells from getting a viral infection.

Acquired Immunity:

Acquired immunity is developed during one's life and is pathogen-specific. When the person develops an infection or a disease due to their exposure to the pathogen and the person's body becomes immune to the disease which is caused due to the development of the immune response in the body is called active immunity which is acquired naturally or secondary or anamnestic response. The lymphocytes B and T lymphocytes are the types of lymphocytes that help in the primary and secondary responses. The function of B lymphocytes is to recognize foreign substances and get attached to them whereas the T lymphocyte's function is to remember the antigens and also recognize them and respond against them and help B-lymphocytes to produce antibodies.

Antibody Structure:

Antibodies are 'Y' shaped pretentious structures, which are made up of four polypeptide chains. Two heavy polypeptide chains and two light chains constitute the antibody and help in performing various functions. It is represented as H_2L_2 . The different types of antibodies in our bodies are IgA, IgG, IgE, and IgM.



Humoral Immune Response:

People who are administered preformed antibodies get passive immunity. It is the transfer of active humoral immunity through these readymade antibodies present in the blood (body humor).

Cell-mediated immunity:

It defends against intracellular pathogens and cancer by binding to antigens and lysing the infected cells or cancer cells that do not involve antibodies instead release phagocytes, antigen-specific cytotoxic T-lymphocytes, and various cytokines in response to an antigen. This helps the body to differentiate between 'self' and 'non-self'.

Active and Passive Immunity:

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

Colostrum:

The yellowish fluid colostrum secreted by mother during the initial days of lactation has

abundant antibodies (IgA) to protect the infant. The foetus also receives some antibodies from their mother, through the placenta during pregnancy. These are some examples of passive immunity.

Vaccination and Immunization:

Vaccination is based on the memory of the immune system. When an antigenic material is injected into a healthy person, it generates antibodies and memory cells as primary immune response. The vaccine is a suspension of inactivated pathogens or antigenic proteins of a pathogen that is taken orally or injected to provide immunity for that pathogen. During the infection B and T lymphocytes will get activated and forms a large number of antibodies after recognizing the antigen a.

In cases of snakebites, the injection which is given to the patients, contain preformed antibodies against the snake venom. This type of immunization is called passive immunization.

People who are administered preformed antibodies get passive immunity. It is the transfer of active humoral immunity through these readymade antibodies. This process is done when the person needs antibodies in a short span.

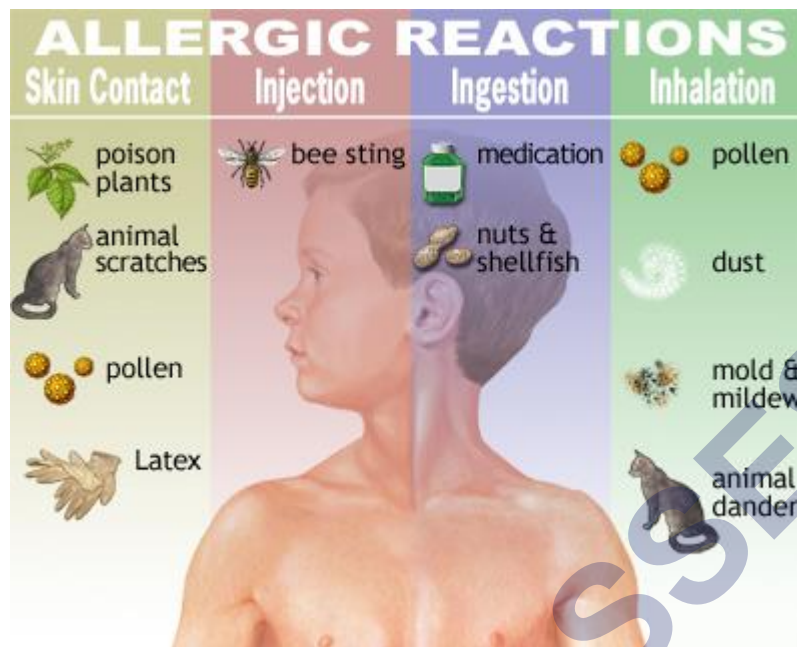
Newer techniques like recombinant DNA technology are used in the production of several vaccines and the vaccines produced will be having fewer side effects. It also helps in the production of antigenic polypeptides in bacteria and yeast.

Allergies:

Allergies are also known as allergic diseases. They are the number of conditions which is caused by hypersensitivity of the immune system to various typically harmless substances present in the environment. When the immune system reacts to a foreign substance like pollen, or bee venom, or a food that does not cause a reaction in most people then allergies occur. The antibodies produced to these are of IgE type.

Common examples of allergens are outdoor pollutants including ozone and diesel exhaust, indoor pollutants such as tobacco smoke and nitrogen dioxide, microbial products, mites in dust, pollens, animal dander, etc.

Symptoms of allergic reactions include sneezing, running nose, watery eyes, and difficulty in breathing. Due to the production of histamine and serotonin in the mast cells, allergies are caused while drugs like anti-histamines, adrenalin, and steroids are taken to reduce the symptoms of allergy.



Autoimmunity:

Autoimmunity is the ability of the human immune system to differentiate between the antigens that are foreign to the body and the antigen wlt is observed in some cases that due to certain genetic and reasons the body attacks its own cells leading to damage and this is called auto-immune disease. Example -Rheumatoid arthritis.

Immune System in the Body:

- It consists of Lymphoid organs, tissues, cells, and antibodies.
- The immune system functions as follows:
- It helps in differentiating between self and non-self.
- It protects the body against non-self or foreign antigens.
- It is based upon the production of memory cells and reacts according to the antigens present previously.
- It is involved in allergic reactions.
- It is important in auto-immune diseases.
- It is important in organ transplant and graft rejection.

Lymphoid organs:

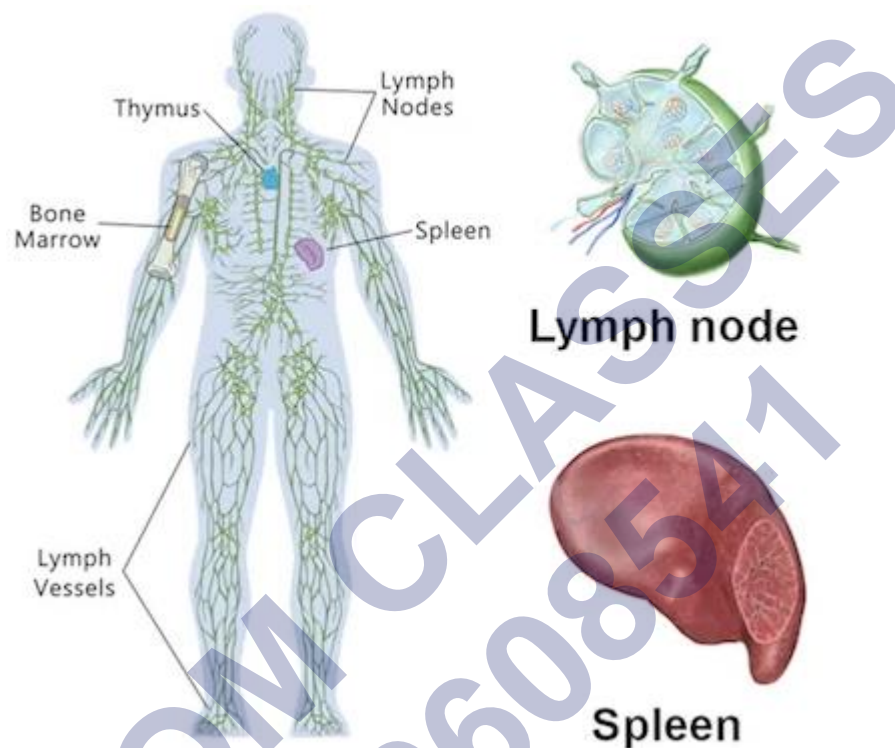
Lymphoid organs are the organs where origin and maturation and proliferation of lymphocytes occur. Primary lymphoid organs include bone marrow and thymus.

Both bone-marrow and thymus provide micro-environments for the development and maturation of T-lymphocytes. The spleen is a large bean shaped organ. It mainly contains lymphocytes and phagocytes.

After maturation lymphocytes migrate to secondary lymphoid organ like spleen, lymph

nodes, tonsils, peyer's patches of small intestine and appendix. They provide the sites for interaction lymphocyte with antigens.

There is lymphoid tissue also located within the lining of respiratory, digestive and urogenital tract called mucosal associated lymphoid tissue (MALT). It constitutes 50% of lymphoid tissues in human body.



AIDS (Acquired Immuno Deficiency Syndrome):

HIV-AIDS is acquired immunodeficiency syndrome, caused by the Human Immunodeficiency Virus, and interferes with the body's ability to fight infection. This virus is transmitted through contact with the infected blood, semen, or vaginal fluids. AIDS was first reported in 1981 and in approximately the last twenty-five years, it has spread all over the world killing more than 25 million persons.

Flu-like symptoms appear within a few weeks of infections such as fever, fatigue, and sore throat.

Then disease becomes asymptomatic until it progresses into AIDS. weight loss, fever or night sweats, fatigue, and recurrent infections are the symptoms of AIDS.

Till now, no cure is available for AIDS but antiretroviral regimens can slow the progress of the disease as well as prevent secondary infections and complications.

Causative Agent: It is caused by Human Immunodeficiency and is a member of a group of viruses called a retrovirus. Their genome is RNA which is enclosed in an envelope and they also consist of the reverse transcriptase gene.

Transmission of HIV-infection:

Sexual contact with an infected person: individuals who have multiple sexual partners.

By transfusion of contaminated blood and blood products: Individuals who require repeated blood transfusions (certain cancers, anemia, and thalassemia).

By sharing infected needles as in the case of intravenous drug abusers: drug addicts who take drugs intravenously.

From infected mother to her child through the placenta: children born to an HIV infected mother. HIV/ AIDS does not spread through mere touch or physical contact. It primarily spreads through sexual contact but also through infected blood from shared intravenous needles and so on. This incubation period may vary from a few months to many years (usually 5-10 years).

HIV Affects the Body:

When the virus enters the person's body then it will infect the macrophages. Then with the help of reverse transcriptase enzyme, the viral genome RNA replicates and forms viral DNA. This viral DNA will go into the host cell and then these infected cells will produce virus particles. Thus, macrophage will produce viruses. Simultaneously, the HIV virus will enter the helper T cells and produce the virus progeny in the blood which will attack other helper T lymphocytes. This cycle continues until the number of T lymphocytes decreases in the infected person. This leads to the person suffering from several diseases that include infections and diseases such as those caused by bacteria especially Mycobacterium, viruses, fungi, and even parasites like Toxoplasma. Thus the patient becomes immunodeficient leading to a very weak immune system.

Detection: The detection of AIDS can be done by Enzyme-linked immunosorbent assay (ELISA): It is a biochemical test that helps in detecting the presence of an antibody or an antigen in a sample. To confirm the results of the ELISA test a Western Blot test is also done.

Treatment: The treatment of AIDS is done by using anti-retroviral drugs which increases the lifespan of a person by it cannot prevent death.

Prevention and Control Methods:

- Making blood transfusions safe from HIV.
- To ensure not to use the same needles that are already used.
- Free distribution of condoms.
- Controlling drug abuse.
- Advocating safe sex.
- Promoting regular check-ups for HIV in susceptible populations.

Role of Society in preventing the spread of this disease:

- Sympathy for HIV/ AIDS patients.
- To make people aware of AIDS so as to prevent it from spreading.
- Cooperation between the society and the medical facility to prevent the spread of this disease. Disclosure about the HIV status to prevent further spread to more people.

Cancer:

Cell growth is highly controlled and coordinated in our body but when this is controlled, mechanisms breakdown it will result in the differentiation of cells uncontrollably which will result in the growth of cancer cells leading to uncontrollable growth. These cancerous cells will divide continuously leaving the formation of mature cells called tumors.

Tumors are of Two Types:

Benign tumor is one that is differentiated and capsulated. Benign tumors generally have a slower rate of growth and normally remain limited and do not spread to other parts of the body causing less damage.

Malignant tumors They develop when cells grow uncontrollably. If the cells still grow and spread, the disease can become life-threatening. Malignant tumors can grow quickly and spread to other parts of the body during a process called metastasis.

Causes of Cancer:

The normal cells are transformed into cancerous cells through physical, chemical, or biological agents. These agents are called carcinogens.

Common Carcinogens:

Ionizing radiations: X-rays and gamma rays.

Non-ionizing radiations: UV Both ionizing and non-ionizing radiations cause DNA damage that causes neoplastic transformation.

The chemical carcinogens are the major cause of lung cancer that is present in tobacco smoke.

Oncogenic viruses consist of genes called viral oncogenes that are cancer-causing viruses. In normal cells, several genes are identified called cellular oncogenes(c-onc), or proto-oncogenes that can be activated under certain conditions thus resulting in the oncogenic transformation of the cells.

Cancer Detection and Diagnosis:

When cancer is detected early then the disease can be treated successfully. Cancer detection is based on:

Biopsy: In this process, a small suspected tissue is taken and is then stained called Histopathological studies of the tissue (thin sections are examined under the microscope).

Blood and bone marrow tests: To detect leukemia and to measure the increased cell counts.

Radiography: (use of X-rays),

CT (computed tomography): To generate the three-dimensional structure of an organ through X-rays.

MRI (magnetic resonance imaging): It is the use of strong magnetic fields and non-ionizing radiations that are used to detect the changes in the living tissues.

Antibodies against cancer-specific antigens: Used for detection of certain cancers.

Techniques of molecular biology: It is used to detect various types of cancers and also in the identification of genes that help in preventing cancers. Those individuals in which these are detected are advised to stop the use of carcinogens that are harmful to them like tobacco and smoking in the case of lung cancer.

Treatment of Cancer:

Treatment of cancer can be done by one or a combination of different approaches. The common approaches for the treatment of cancer are surgery, radiation therapy, chemotherapy, and immunotherapy.

In radiotherapy, the tumor cells are irradiated lethally while the normal cells surrounding them are taken care of.

There are several drugs that are used to kill cancerous cells called chemotherapeutics which may be specific for particular tumors. These drugs will show certain side effects that include the side effects like hair loss, anemia, etc.

The majority of the cancers are treated by a combination of all the above methods.

The Tumor cells can be detected by the immune system with the help of certain substances called biological response modifiers. They are substances such as α -interferon that destroy the tumor by activating the immune system.

Drugs and Alcohol Abuse:

Commonly abused drugs include opioids, cannabinoids and coca alkaloids obtained from flowering plants and a few from fungi.

Opioids are the drugs which bind to specific opioids receptors present in our central nervous system and gastrointestinal tract. Heroin commonly called smack is chemically diacetylmorphine, which is a white, odorless, bitter crystalline compound. It is extracted from the latex of poppy plant (*Papaversomniferum*). Generally taken by snorting and injection, heroin is a depressant and slows down body functions.

Cannabinoids are a group of chemicals which interact with cannabinoid receptors present in the brain. Natural cannabinoids are obtained from the inflorescence of the plant *cannabis sativa*. They include marijuana, hashish, charas and ganja. They generally taken by inhalation and oral ingestion; these are known for their effects on cardiovascular system of the body.

Coca alkaloid or cocaine is obtained from coca plant *Erythroxyton coca*, native to South America. It interferes with the transport of the neuro-transmitter dopamine. Cocaine, commonly called coke or crack is usually snorted. It has a potent stimulating action on central nervous system, producing a sense of euphoria and increased energy.

Adolescence and Drug abuse:

- Adolescence is the period during which the child becomes matured.
- It is between 12 – 18 years of age.

Causes of drug abuse:

- Curiosity
- Adventure
- Excitement
- Experimentation
- Stress or pressure to excel in examination

Effects of drug/ alcohol abuse:

- Reckless behavior
- Malicious mischief
- Violence
- Drop in academic performance
- Depression, isolation, aggressiveness, etc.

Dependence is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drug/ alcohol is abruptly discontinued that includes anxiety, shakiness, nausea and sweating.

Prevention and Control:

Avoid undue peer pressure: Every child has his/ her own choice and personality, which should be respected, and nurtured child should not be pushed unduly to perform beyond his/ her threshold limits.

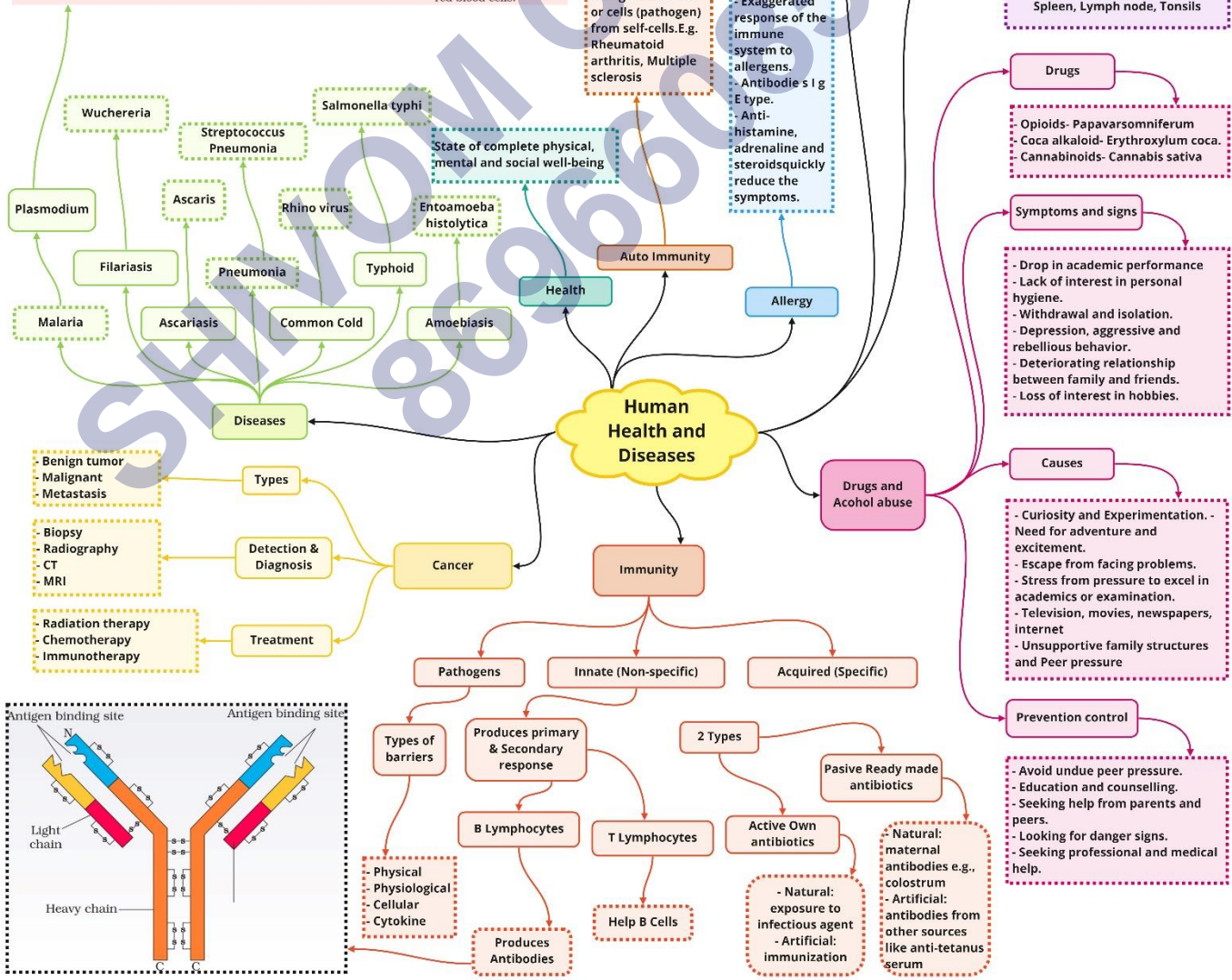
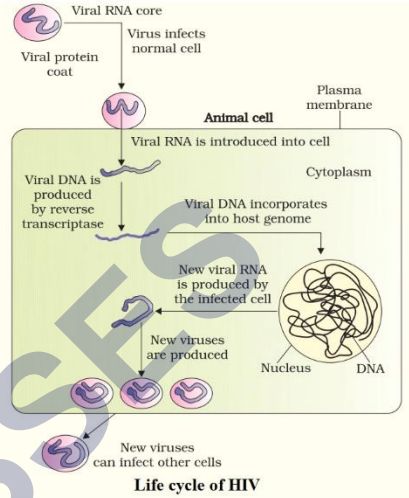
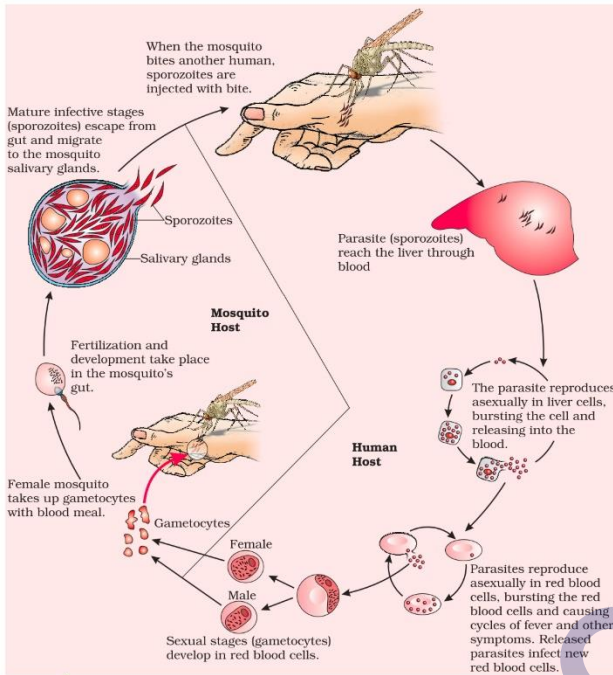
Education and counselling: Educating and counselling him/ her to face problems and stresses, and to accept disappointments and failures as a part of life.

Seeking help from parents and peers: Help from parents and peers should be sought immediately. Besides getting proper advice to sort out their problems, this would help young to vent their feelings of anxiety and guilt.

Looking for danger signs: Alert parents and teachers need to look for and identify the danger signs discussed above. This would help in initiating proper remedial steps or treatment.

Seeking professional and medical help: A lot of help is available in the form of highly qualified psychologists, psychiatrists, and de-addiction and rehabilitation the problem completely and lead a perfectly normal and healthy life.

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Important Questions

➤ Multiple Choice Questions:

1. The term 'Health' is defined in many ways. The most accurate definition of the health would be:
 - (a) Health is the state of body and mind in a balanced condition
 - (b) Health is the reflection of a smiling face
 - (c) Health is a state of complete physical, mental and social well-being
 - (d) Health is the symbol of economic prosperity.
2. The organisms which cause diseases in plants and animals are called:
 - (a) pathogens
 - (b) vectors
 - (c) insects
 - (d) worms.
3. The chemical test that is used for diagnosis of typhoid is:
 - (a) ELISA Test
 - (b) ESR Test
 - (c) PCR Test
 - (d) Widal Test.
4. 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) Smallpox.
 - (a) i and ii
 - (b) ii and iii
 - (c) iii and iv
 - (d) ii and iv
5. 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.
6. The disease chikungunya is transmitted by:
 - (a) Houseflies
 - (b) Aedes mosquitoes

- (c) Cockroach
(d) Female Anopheles.
7. Many diseases can be diagnosed by observing the symptoms in the patient. Which group of symptoms are indicative of pneumonia?
- (a) Difficulty in respiration, fever, chills, cough, headache
(b) Constipation, abdominal pain, cramps, blood clots
(c) Nasal congestion and discharge, cough, sore throat, headache
(d) High fever, weakness, stomach pain, loss of appetite and constipation.
8. Which type of immune response is responsible for the rejection of tissues/ organs in the patient's body post-transplantation?
- (a) auto-immune response
(b) humoral immune response
(c) physiological immune response
(d) cell-mediated immune response.
9. In malignant tumours, the cells proliferate, grow rapidly and move to other parts of the body to form new tumours. This stage of disease is called:
- (a) metagenesis
(b) metastasis
(c) teratogenesis
(d) mitosis.
10. When an apparently healthy person is diagnosed as unhealthy by a psychiatrist, the reason could be that:
- (a) the patient was not efficient at his work
(b) the patient was not economically prosperous
(c) the patient shows behavioural and social maladjustment
(d) he does not take interest in sports.
11. 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
12. 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.

13. 'Smack' is a drug obtained from the:

- (a) latex of *Papaver somniferum*
- (b) leaves of *Cannabis sativa*
- (c) flowers of *Datura*
- (d) fruits of *Erythroxylon coca*.

14. The substance produced by a cell in viral infection that can protect other cells from further infection is:

- (a) serotonin
- (b) colostrum
- (c) interferon
- (d) histamine.

15. 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.

➤ Very Short Question:

1. Name the diagnostic test which confirms typhoid.
2. Name the two major groups of cells required to attain specific immunity.
3. You have heard of many incidences of Chickengunya in our country. Name the vector of the disease.
4. Breast fed babies are more immune to diseases than the bottle fed babies. Why?
5. Name the pathogen which causes malignant malaria.
6. Which microorganism is used to produce hepatitis B Vaccine?
7. What is the reason of shivering in malarial patient?
8. When is a tumour referred to as malignant?
9. Why does an AIDS patient suffer from many infections?
10. Name two curable sexually transmitted diseases?

➤ Short Questions:

1. Where are B-cells and T-cells formed? How do they differ from each other?
2. Given below are the pathogens and the diseases caused by them. Which out of these pairs is not correct matching pair and why?
 - (a) Wuchereria – Filariasis
 - (b) Microsporium – Ringworm
 - (c) Salmonella – Common Cold
 - (d) Plasmodium – Malaria
3. What would happen to the immune system, if thymus gland is removed from the body of a person?
4. Lymph nodes are secondary lymphoid orgDescribe the role of lymph nodes in our immune response.
5. What is the role of histamine in inflammatory response? Name few drugs which reduce the symptoms of allergy.
6. What do you mean withdrawal Symptoms? What are its characteristics?
7. Enumerate the two properties of cancer cells that distinguish them from normal cell.
8. What are allergens? How do they cause inflammatory response inside human body?

➤ Long Questions:

1. (i) How and at what stage does Plasmodium enter a human body?
 (ii) With the help of a flow chart only shows the stages of asexual reproduction in the life cycle of the parasite in the infected human.
 (iii) Why does the victim show symptoms of high fever?
2. What is Immune system? Mention the two types of the immune system.
3. Medically it is advised to all young mothers that breastfeeding is the best for their newborn babies. Do you agree? Give reasons in support of your answer.

➤ Assertion and Reason Questions:

1. For question, two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
 - a) Both assertion and reason are true, and reason is the correct explanation of assertion.
 - b) Both assertion and reason are true, but reason is not the correct explanation of assertion.

- c) Assertion is true, but reason is false.
- d) Both assertion and reason are false.

Assertion : Proto-oncogenes are cellular genes required for normal growth.

Reason: Under normal conditions, they could lead to the oncogenic transformation of the cell.

2. For question, two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- a) Both assertion and reason are true, and reason is the correct explanation of assertion.
- b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
- c) Assertion is true, but reason is false.
- d) Both assertion and reason are false.

Assertion : Cornea is considered as an immunologically privileged site

Reason: A transplanted cornea is rarely rejected.

➤ Case Study Questions:

1. Read the following and answer any four questions from (i) to (v) given below:

A group of teenagers was involved in drug abuse. 'They used syringes and needles to inject drugs. 'They indulged in this habit when they became adults. Administration of drug through needles became a piece of cake for them. Raj was the most active drug abuser amongst them and used to take drugs in high profile parties. In a span of time he started losing weight and suffered persistent diarrhoea. He developed constant low grade fever and used to catch opportunistic infection. When he consulted a doctor, he got himself tested for HIV in his blood and finally diagnosed with AIDS.

Based on the above information, answer the following questions.

(i) Select the incorrect statement.

- a) AIDS is a disorder of cell mediated immune system of the body.
- b) AIDS is caused by Human Immunodeficiency virus.
- c) AIDS infections were detected in India for the first time in prostitutes of Chennai, Tamil Nadu in 1986.
- d) December 10 is recalled as World AIDS Day.

(ii) How do you think Raj got AIDS infection?

- a) Through transfusion of HIV infected blood
- b) Sexual intercourse with an infected partner

- c) Sharing towel with infected friend
- d) Use of contaminated needles and syringes to inject drugs

(iii) How AIDS can be diagnosed?

- a) ELISA test
- b) Ames test
- c) Pap's test
- d) Widal test

(iv) How can AIDS be prevented?

- a) Blood tests of blood donor before transfusion to check for the presence of AIDS virus.
- b) Use of disposable needles and syringes for injecting medicines and vaccination
- c) Having protected sex by use of condoms
- d) All of these

(v) Select the correct statement for AIDS virus.

- a) It is rhomboid in shape with a diameter of 10-15 cm.
- b) Its genome consists of ds DNA.
- c) It consists of reverse transcriptase enzyme.
- d) Its envelope consists of lipid bilayer and three protein coats.

2. Read the following and answer any four questions from (i) to (v) given below:

Siddharth is a chain smoker. He got into this habit in early adolescence due to peer pressure and gradually got addicted to this habit. Its now almost 20 years he is into the habit of smoking. Since few months he is experiencing pain in chest, shortness of breath, wheezing and chronic cough with phlegm. He seeked advice of a medical practitioner who diagnosed him with lung cancer. Based on the above information, answer the following questions.

(i) What do you think is the possible carcinogen responsible for Siddharth's lung cancer?

- a) Nitrosamines
- b) Benzo(a)pyrene
- c) Hydrazine
- d) All of these

(ii) How is lung cancer diagnosed?

- a) Computerised tomography scan
- b) Sputum cytolog
- c) Biopsy of lung tissue
- d) All of these

(iii) From which of the following type of cancer is Siddharth suffering from?

- a) Sarcoma

- b) Carcinoma
- c) Lymphoma
- d) Leukemia

(iv) Select the correct statement.

- a) Surgery, radiotherapy and chemotherapy can be used to treat lung cancer.
- b) Chemotherapy involves the exposure of cancerous parts to X rays which destroy rapidly growing cancer cells.
- c) Surgical removal of lung cancer tissue is suggested at advanced stage 4.
- d) Monoclonal antibodies can effectively treat lung cancer and can cure it completely.

(v) **Assertion:** Lung cancer if not treated at an early stage can spread to other initial organs of the body.

Reason: Cancer cell have uncontrolled proliferation and ability to invade new sites (metastasis).

- a) Both assertion and reason are true and reason is the correct explanation of assertion.
- b) Both assertion and reason are true but reason is not the correct explanation of assertion.
- c) Assertion is true but reason is false.
- d) Both assertion and reason are false

✓ **Answer Key-**

➤ Multiple Choice Answers:

1. (c) Health is a state of complete physical, mental and social well-being
2. (a) pathogens
3. (d) Widal Test.
4. (d) ii and iv
5. (c) Salivary glands of mosquito
6. (b) Aedes mosquitoes
7. (a) Difficulty in respiration, fever, chills, cough, headache
8. (d) cell-mediated immune response.
9. (b) metastasis
10. (c) the patient shows behavioural and social maladjustment
11. (b) ii and iv

12. (c) Shaking hands with infected persons
13. (a) latex of *Papaver somniferum*
14. (c) interferon
15. (d) cell-mediated immune response.

➤ Very Short Answers:

1. Widal test
2. B-lymphocytes and T-lymphocytes.
3. *Aedes* mosquitoes.
4. The mother's milk consists of antibodies (Ig A) such antibodies are not available to bottle fed babies.
5. *Plasmodium falciparum*.
6. Yeast.
7. After sporozoite infection, when RBC ruptures, a toxic substance haemozoin is released which cause chilling and high fever.
8. A tumour is said to be malignant when grows rapidly, invade & damage the surrounding normal tissues.
9. Because in AIDS patient, immune system greatly weakens & cannot fight against any infection.
10. Gonorrhoea & Syphilis

➤ Short Answer:

1. B-cells and T-cells are formed in bone marrow. B-cells produce antibodies but T-cells do not produce antibodies but help B-cells to produce them.
2. *Salmonella* : Common cold is not a matching pair.
3. T-lymphocytes are developed and matured in thymus gland, Immune system will become weak on removal of thymus gland.
4. Lymph nodes provide the sites for interaction of lymphocytes with the antigen. When the microorganisms enter the lymph nodes, lymphocytes present there are activated and cause the immune response.
5. Histamine acts as allergy-mediator which cause blood vessels to dilate. It is released by mast cells. Antihistamine steroids and adrenaline quickly reduce the symptoms of allergy.
6. Withdrawal symptoms refers to the characteristic unpleasant symptoms by body of a drug addict if regular dose of drug is abruptly discontinued. These include anxiety, shakiness, sweating, restlessness, depression, muscular cramps etc.

7. Ans.

(i) Ancontrolled proliferation of cells without any differentiation

(ii) Ability of these cells to invade other tissues called metastasis.

8. The substance which causes the hypersensitive reaction of the immune system is called an allergen. dust, pollen grains etc. These allergens are actually weak antigens. First exposure to allergen does not cause allergy but consequent exposure, allergen combines with Ig E on mast cell. That causes cells to burst & release Histamines which cause inflammatory response.

➤ Long Answer:

1. (i) Sporozoite stage enters human body along with saliva of female anophel mosquito as ii bites to suck blood.

(ii) Asexual phases of the life history of plasmodium in the body of a human

(iii) When the parasite attacks red blood cells, it leads to its rupture with the release of haemozoin, which is a toxin. As the haemozoin is released into blood, symptoms (high fever) of malaria appear.

2. The system which protects our body from pathogens and other foreign invaders is called the immune system. It is of two types.

i. Innate

ii. Acquired

Innate immunity is non-specific and is present by birth. It includes physical barriers, physiological barriers, cellular and cytokinin barriers.

Acquired immunity is pathogen-specific and is obtained with experience. It is of two types- Humoral and cell-mediated.

3. Yes, I do agree with the fact that breastfeeding is the best for newborn babies.

Mammary glands start producing milk at the end of pregnancy. The milk produced during the initial few days of lactation is called colostrum which contains several antibodies. It helps in developing resistance for newborn baby against diseases. It helps the baby fight off viruses and bacteria. Thus breast milk is packed with a disease-fighting substance that protects newborn babies from illness. Breast milk also naturally contains many of the vitamins and minerals that a newborn requires. It is easily digested as well. There is no constipation, diarrhoea and upset stomach.

➤ Assertion and Reason Answers:

1. (c) Assertion is true, but reason is false.

Explanation:

Proto-oncogenes are cellular genes required for normal growth. If they are muted or overexpressed, they may become oncogenes that contribute to the malignant transformation of the cell.

2. (a) Both assertion and reason are true, and reason is the correct explanation of assertion.

Explanation:

Some transplanted tissues do not stimulate an immune response. For example, a transplanted cornea is rarely rejected because lymphocytes do not circulate into the anterior chamber of the eye, that's why this site is considered as immunologically privileged site.

➤ **Case Study Answers:**

1.

(i) (d) December 10 is recalled as World AIDS Day.

Explanation:

Every year, December 1 is designated as World AIDS Day.

(ii) (d) Use of contaminated needles and syringes to inject drugs

(iii)(a) ELISA test

Explanation:

ELISA test, also called EIA for enzyme immunoassay is used to detect HIV antibody. It checks for certain proteins that the body makes in response to HIV.

(iv)(d) All of these

(v) (c) It consists of reverse transcriptase enzyme.

Explanation:

HIV is spherical with a diameter of 90-120 nm. Its genome consists of single stranded RNA. The envelope consists of a lipid bilayer derived from host cell membrane and projection knob like glycoproteins. It contains two protein coats.

2.

(i) (d) All of these

Explanation:

Carcinogen in tobacco smoke include polynuclear aromatic hydrocarbons, $\beta\beta$ naphthylamine, benzo (a) pyrene, nitrosamines, hydrazine, etc.

(ii) (d) All of these

Explanation:

A CT scan can reveal small lesion in lungs. Examination of sputum under microscope reveals the presence of lung cancer cells. A sample of lung tissue is obtained through some invasive procedure and careful analysis of cancer cells is done in lab to reveal the type of lung cancer.

(iii) (b) Carcinoma

(iv) (a) Surgery, radiotherapy and chemotherapy can be used to treat lung cancer.

Explanation:

Chemotherapy involves administration of certain anticancer drugs which kill cancer cells. Monoclonal antibodies coupled to appropriate radioisotopes can detect cancer specific antigens and hence cancer.

(v) (a) Both assertion and reason are true and reason is the correct explanation of assertion.

Explanation:

Cancer cells have lost the ability of contact inhibition and so proliferate in an uncontrolled manner. They detach from their source organ and invade fresh sites, this is called metastasis.

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