

Human Health and Diseases

EXERCISE [PAGES 244 - 245]

Exercise | Q 1.01 | Page 244

Multiple Choice Question

Which of the following is NOT caused by unsterilized needles?

1. Elephantiasis
2. AIDS
3. Malaria
4. Hepatitis B

Solution: Elephantiasis

Exercise | Q 1.02 | Page 244

Multiple Choice Question

Opium derivative is _____.

1. Codeine
2. Caffeine
3. Heroin
4. Psilocybin

Solution: The opium derivative is Heroin.

Exercise | Q 1.03 | Page 244

Multiple Choice Question

The stimulant present in tea is _____.

1. tannin
2. cocaine
3. caffeine
4. crack

Solution: The stimulant present in tea is caffeine.

Exercise | Q 1.04 | Page 244

Multiple Choice Question

Which of the following is caused by smoking?

1. Liver cirrhosis
2. Pulmonary tuberculosis
- 3. Emphysema**
4. Malaria

Solution: Emphysema

Exercise | Q 1.05 | Page 244

Multiple Choice Question

An antibody is _____.

- 1. the molecule that binds specifically an antigen**
2. WBC which invades bacteria
3. secretion of mammalian RBC
4. the cellular component of blood

Solution: An antibody is a molecule that binds specifically an antigen.

Exercise | Q 1.06 | Page 244

Multiple Choice Question

The antiviral proteins released by a virus-infected cell are called _____.

1. histamines
- 2. interferons**
3. pyrogens
4. allergens

Solution: The antiviral proteins released by a virus-infected cell are called interferons.

Exercise | Q 1.07 | Page 244

Multiple Choice Question

Both B-cells and T-cells are derived from _____.

1. lymph nodes
2. thymus glands
3. liver
- 4. stem cells in bone marrow**

Solution: Both B-cells and T-cells are derived from stem cells in the bone marrow.

Exercise | Q 1.08 | Page 244

Multiple Choice Question

Which of the following diseases can be contracted by droplet infection?

1. Malaria
2. Chicken pox
- 3. Pneumonia**
4. Rabies

Solution: Pneumonia

Exercise | Q 1.09 | Page 244

Multiple Choice Question

A confirmatory test used for detecting HIV infection is _____.

- 1. ELISA**
2. Western blot
3. Widal test
4. Eastern blot

Solution: A confirmatory test used for detecting HIV infection is **ELISA**.

Exercise | Q 1.1 | Page 244

Multiple Choice Question

Elephantiasis is caused by _____.

- 1. *W. bancrofti***
2. *P. vivax*
3. Bedbug
4. Elephant

Solution: Elephantiasis is caused by **W. bancrofti**.

Exercise | Q 1.11 | Page 244

Multiple Choice Question

Innate immunity is provided by _____.

- 1. phagocytes**
2. antibody

3. T- Lymphocytes
4. B- Lymphocytes

Solution: Innate immunity is provided by phagocytes.

Exercise | Q 2.01 | Page 244

Very Short Answer Question

What is the source of cocaine?

Solution: Cocaine is an alkaloid obtained from the coca plant - Erythroxylum coca.

Exercise | Q 2.02 | Page 244

Very Short Answer Question

Name one disease caused by smoking?

Solution: Cancer of mouth, lips, and lungs

Exercise | Q 2.03 | Page 244

Very Short Answer Question

Which cells stimulate B-cells to form antibodies?

Solution: Helper T cells stimulate B cells to form antibodies.

Exercise | Q 2.04 | Page 244

Very Short Answer Question

What does the abbreviation AIDS stand for?

Solution: The abbreviation of AIDS stands for Acquired Immuno Deficiency Syndrome.

Exercise | Q 2.05 | Page 244

Very Short Answer Question

Name the causative agent of typhoid fever?

Solution: Salmonella typhi

Exercise | Q 2.06 | Page 244

Very Short Answer Question

What is the Rh factor?

Solution: i. Rh is the most complex of the blood group system.

- ii. Rh – factor is an antigenic protein present on the surface of the red blood cells in human beings.
- iii. It was first discovered by Landsteiner and Wiener (1940), on the surface of RBCs of Rhesus monkey, so it is called the Rh factor/ Rhesus factor (also called D antigen).
- iv. The person having Rh factor (D antigen) are called Rh-positive (Rh +ve) and those lacking D antigens are called Rh negative (Rh -ve).

Exercise | Q 2.07 | Page 244

Very Short Answer Question

What is schizont?

Solution:

Schizont is a cell formed from a trophozoite during the asexual stage of the life cycle of Plasmodium.

Exercise | Q 2.08 | Page 244

Very Short Answer Question

Name the addicting component found in tobacco.

Solution:

Nicotine is the addicting component found in tobacco.

Exercise | Q 2.09 | Page 244

Very Short Answer Question

Name the pathogen causing Malaria.

Solution: Plasmodium is the pathogen that causes malaria.

Exercise | Q 2.1 | Page 244

Very Short Answer Question

Name the vector of Filariasis.

Solution: Wuchereria bancrofti is transmitted to the human body by female Culex mosquito.

Exercise | Q 2.11 | Page 244

Very Short Answer Question

Give the name of the causative agent of ringworm.

Solution: Dermatophytes of the genera Trichophyton and Microsporum are the most common causative agents of ringworm.

Exercise | Q 2.12 | Page 244

Very Short Answer Question

Define health.

Solution: Health is defined as the state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.

Exercise | Q 3.01 | Page 244

Short Answer Question

What are acquired diseases?

Solution:

Acquired diseases develop after birth. These diseases can be subdivided into the following categories:

a. Communicable or infectious diseases: The diseases which are transmitted from an infected person to another healthy person either directly or indirectly are known as Communicable or Infectious diseases. Communicable diseases are caused by pathogens like viruses, bacteria, fungi, helminth worms, etc.

e.g. Malaria, typhoid, ascariasis, etc.

b. Non-Communicable or Non-infectious diseases: The diseases that cannot be transmitted from an infected person to another healthy one either directly or indirectly are known as Non- Communicable or Non - Infectious diseases.

e.g. Cancer, deficiency diseases, etc.

Exercise | Q 3.02 | Page 244

Short Answer Question

Differentiate between antigen and antibody

Solution:

Sr. No.	Antigen	Antibody
i.	Any foreign material which brings about an immune response in the body is called an antigen	Glycoproteins formed in the body to fight against antigen is called an antibody.

ii.	It triggers the formation of antibodies.	It is produced against antigens.
iii.	It may be a free molecule or component of the microbial cell surface.	It is extruded from the surface of plasma cells.
iv.	The structure of the antigen is variable.	The antibody is Y-shaped.

Exercise | Q 3.03 | Page 244

Short Answer Question

Name the infective stage of Plasmodium. Give any two symptoms of malaria.

Solution:

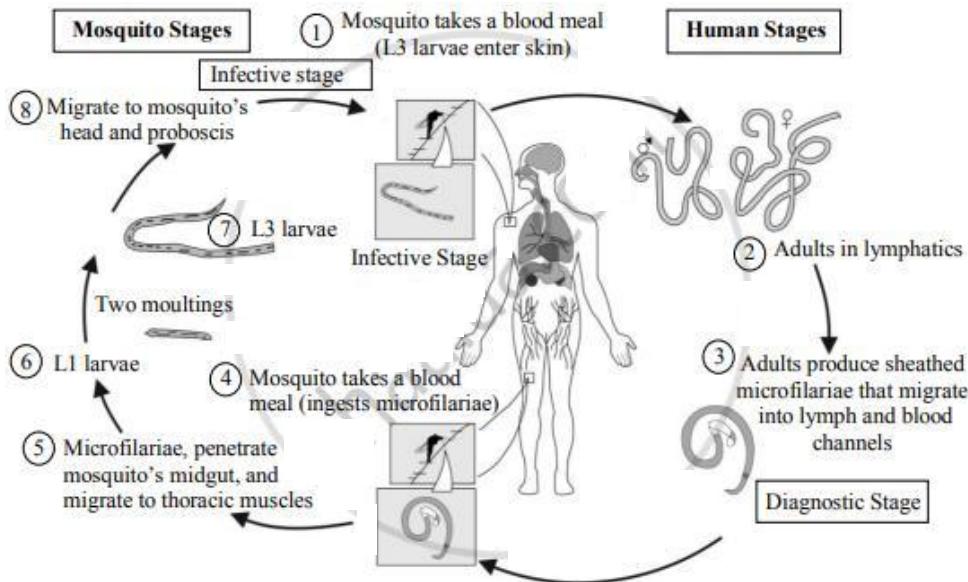
- i. For humans, **sporozoites** are the infective stage of malaria.
- ii. **Signs and symptoms of malaria:** Symptoms of malaria begin to appear about 7 to 15 days after the bite of an infective mosquito.
 - a. Initial symptoms are fever, headache, and chills.
 - b. The classical symptom of malaria is cyclic occurrence of high fever followed by sweating and sudden shivering. Such an entire episode lasts for four to six hours and recurs every two days or three days.
 - c. Vomiting and convulsions.
 - d. Arthralgia (joint pain), anemia due to rupturing of RBCs.
 - e. Haemoglobinuria, hepatomegaly (liver enlargement).
 - f. Retinal damage (eye).
 - g. Cerebral malaria (brain infection)

Exercise | Q 3.04 | Page 244

Short Answer Question

Explain the mode of infection and cause of elephantiasis.

Solution:



The life cycle of *Wuchereria bancrofti*:

- i. *Wuchereria bancrofti* has a complicated life cycle which consists of five stages.
- ii. After mating of male and female worms, the female gives birth to thousands of live microfilariae.
- iii. These microfilariae are taken up by vector insect (intermediate host), as a blood meal.
- iv. In the intermediate host, microfilariae moult and develop into 3 rd stage (infective) larvae, in the intermediate host.
- v. When the vector bites a healthy person, infectious larvae are injected in the dermis of the skin.
- vi. After about one year, the larvae moult through two more stages maturing into adult worms. Mode of transmission: *Wuchereria bancrofti* is transmitted to the human body by female Culex mosquito. The larvae escape the mosquito bodies and arrive on the human skin.

They penetrate the skin, undergo two moltings before they become adults and settle in the lymphatic system. The incubation period can be as long as 8-16 months.

Exercise | Q 3.05 | Page 244

Short Answer Question

Why is smoking a bad habit?

Solution:

- i. Smoking tobacco is the greatest risk factor for cancer mortality.

- ii. Tobacco smoke has more than 7000 chemicals and at least 250 are known to be harmful and more than 50 of them are known to cause cancer.
- iii. Tobacco smoking causes many types of cancers, including cancers of the lung, oesophagus, larynx (voice box), mouth, throat, kidney, bladder, pancreas, stomach, and cervix. Hence, for all these reasons smoking is considered a bad habit.

Exercise | Q 3.06 | Page 245

Short Answer Question

What do the abbreviations AIIMS and CMIS denote?

Solution:

- i. AMIS: Antibody-mediated immune system
- ii. CMIS: Cell-mediated immune system

Exercise | Q 3.07 | Page 245

Short Answer Question

What is a carcinogen? Name one chemical carcinogen with its target tissue.

Solution:

Factors that are known to cause cancer are called carcinogens.

	Carcinogen	Organ affected
i.	Soot	Skin, lungs
ii.	Coal tar (3, 4 benzpyrene)	Skin, lungs
iii.	Cigarette smoke (N-nitrosodimethylamine)	Lungs
iv.	Cadmium oxide	Prostate gland
v.	Aflatoxin (a metabolite of Aspergillus flavus, a mould)	Liver
vi.	2 – naphthylamine and 4 – aminobiphenyl	Urinary bladder
vii.	Mustard gas	Lungs
viii.	Nickel and chromium	Lungs
ix.	Asbestos	Lungs
x.	Diethylstilbestrol (DES)	Vagina

xi.	Vinylchloride (VC)	Liver
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Exercise | Q 3.08 | Page 245

Short Answer Question

Distinguish between active immunity and passive immunity.

Solution:

No.	Active Immunity	Passive Immunity
a.	When resistance is developed by individuals as a result of an antigenic stimulus it is called active immunity.	When ready-made antibodies are directly given to protect the body against foreign agents, immunity is called 'Passive immunity'.
b.	The types of active immunity are natural acquired active immunity and artificial acquired active immunity.	The types of passive immunity are natural acquired passive immunity and artificially acquired passive immunity.
c.	It has no side effects.	It may cause a reaction.
d.	It provides relief only after a long period.	It provides immediate relief.
e.	It is long-lasting immunity.	It is short-lived immunity.
e.g.	Polio vaccine, BCG vaccine, etc.	Rabies vaccine, maternal antibodies, etc.

Exercise | Q 4.01 | Page 245

Short Answer Question

Differentiate between B-cells and T-cells.

Solution:

No.	B-cells	T-cells
i.	B-cells mature in bone marrow	T-cells mature in the thymus gland.
ii.	They are involved in humoral immunity	They are involved in cell-mediated immunity.
iii.	B cells originate and mature in the bone marrow.	T cells originate in the bone marrow and mature in the thymus.

iv.	They occupy 20% of total lymphocytes	They occupy 80% of lymphocytes
v.	B-cells produce specific plasma cells that produce antibodies.	T-cells produce clone T-cells and can kill the infected cell.

Exercise | Q 4.02 | Page 245

Short Answer Question

What are the symptoms of malaria?

Solution:

Signs and symptoms of malaria:

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

- a. Initial symptoms are fever, headache, and chills.
- b. The classical symptom of malaria is the cyclic occurrence of high fever followed by sweating and sudden shivering. Such an entire episode lasts for four to six hours and recurs every two days or three days.
- c. Vomiting and convulsions.
- d. Arthralgia (joint pain), anemia due to rupturing of RBCs.
- e. Haemoglobinuria, hepatomegaly (liver enlargement).
- f. Retinal damage (eye).
- g. Cerebral malaria (brain infection).

Exercise | Q 4.02 | Page 245

Short Answer Question

How does malaria spread?

Solution:

Mode of transmission:

The malaria parasite life cycle involves two hosts. Plasmodium is transmitted from one person to another through an insect vector- female Anopheles mosquito.

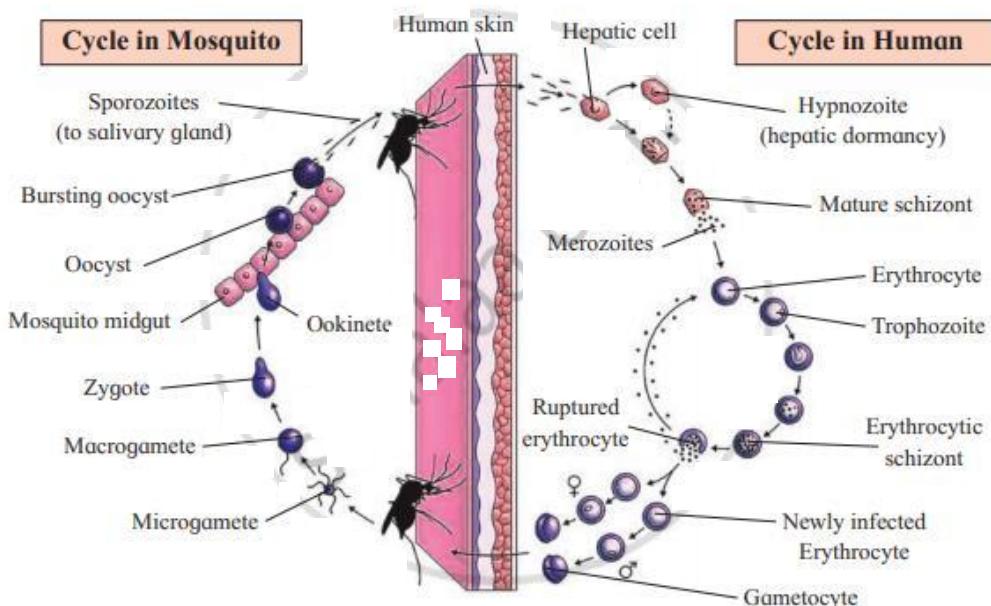
When an infected female Anopheles sucks the human blood, it may transfer sporozoites to human circulation. Sporozoites reproduce asexually through the fission (schizogony) in the liver cells or erythrocytes.

The cells formed are now called merozoites. The cells formed within erythrocytes function as gametocytes (gamogony).

Besides, it forms gametocytes within erythrocytes (gamogony). Gametocytes if taken up by female Anopheles, fertilization occurs in its gut.

A diploid zygote is formed which transforms into an oocyst. Oocyst forms a large number of haploid sporozoites through meiosis (sporogony). Sporozoites migrate to salivary glands and are ready to infect the new human hosts.

Stages in the life cycle of Plasmodium in mosquito and human



Exercise | Q 4.03 | Page 245

Short Answer Question

Write a short note on AIDS.

Solution:

Modes of transmission of AIDS:

- i. **Unsafe sexual contact:** Including oral, vaginal, and anal sex.
- ii. **Blood:** Through blood transfusions or needle sharing.
- iii. **From mother to child (Transplacental):** A pregnant woman can transmit the virus to her fetus through their shared blood circulation, or a nursing mother can transmit it to her baby from her breast milk.
- iv. Other methods of spreading the virus are rare and include accidental needle injury, artificial insemination with infected donated semen, and transplantation with infected organs.

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

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

- i. **Initial infection** with the virus and formation of antibodies, usually lasting for 2-8 weeks after the initial infection.
- ii. **Asymptomatic carrier state** in which no signs of disease, are seen. The incubation period ranges from 6 months to 10 years.
- iii. **AIDS-related complex (ARC)** with one or more of the following clinical signs; recurrent fever for longer than one month, fatigue, unexplained diarrhoea, night sweats, shortness of breath, loss of more than 10 per cent body weight, etc.
- iv. **AIDS** is the end stage of HIV infection. It is characterised by life-threatening opportunistic infections (like pneumonia, tuberculosis, Kaposi's sarcoma, etc.).

Preventive measures:

AIDS has no cure; hence prevention is the best choice. The following steps help in preventing AIDS:

- i. People, particularly those in a high – risk group, should be educated about HIV transmission.
- ii. Disposable needles and syringes should be used and disposed of properly and immediately.
- iii. Unsafe sexual habits should be changed.
- iv. High-risk groups should refrain from donating blood.
- v. Toothbrushes, razors, other articles that can become contaminated with blood should not be shared.
- vi. Before receiving blood, ensure that it has been screened for not containing HIV infections.

vii. Routine screening must be done for:

- a. Blood donors.
 - b. Organ donors (kidney, liver, lung, cornea).
 - c. Donors of semen and growth hormone.
 - d. Patients undergoing haemodialysis and females in the high-risk group who are pregnant or contemplating pregnancy.
- i. **At first, a test ELISA** (Enzyme-Linked Immunosorbent Assay) is used to detect HIV antibodies.

ii. The second confirmatory test is usually a Western Blot. It is used to eliminate any false-positive results. It is a highly specific test and it is based on detecting specific antibody to viral core protein and envelope glycoprotein.

Although AIDS has no cure, certain medicines called Antiretroviral drugs can help in reducing the viral load and prolong the life of HIV patient. e.g. TDF (Tenofovir), EFV(Efavirenz), Lamivudine (3TC), etc.

Exercise | Q 4.04 | Page 245

Short Answer Question

Give the symptoms of cancer.

Solution:

Symptoms of cancer are as follows:

- i. Cancer symptoms are quite varied and depend on where the cancer is located, where it has spread, and the size of the tumour.
- ii. Some cancers can be felt or seen through the skin – a lump on the breast or testicle can be an indicator of cancer in those locations.
- iii. Melanoma (skin cancer) is often noted by a change in a wart or mole on the skin.
- iv. Some oral cancers present as white patches inside the mouth or white spots on the tongue.
- v. Metastasis of cancer can produce additional symptoms in the newly affected area, like swollen or enlarged lymph nodes.
- vi. Vertigo, headache, seizures may be experienced if cancer spreads to the brain.
- vii. In addition, the liver may become enlarged and cause jaundice.
- viii. The bones become painful, brittle, and break easily. ix. Coughing and shortness of breath may occur if the lungs are affected due to cancer.

Exercise | Q 4.05 | Page 245

Short Answer Question

Write a note on antigens on blood cells.

Solution:

There are several known antigens on the surface of human red blood cells. These antigens give rise to different blood groups.

ABO Blood Groups:

The A, B, and O blood groups were discovered by Karl Landsteiner in 1900.

He found two antigens or agglutinogens on the surface of human red blood cells and named them as antigen A and antigen B. He also noticed the corresponding antibodies or agglutinins in the serum called 'a' and 'b'.

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

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

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

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

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

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

Rh factor: Rh – factor is an antigenic protein present on the surface of the red blood cells in human beings.

Exercise | Q 4.06 | Page 245

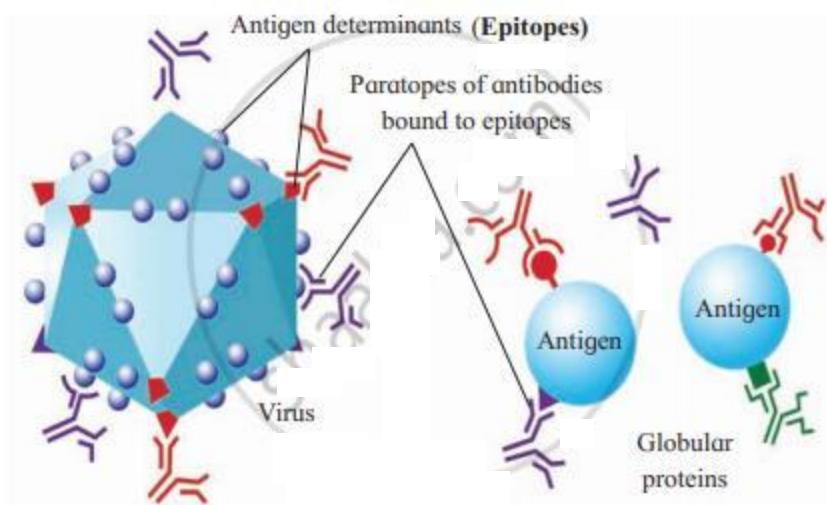
Short Answer Question

Write a note on the antigens-antibody complex.

Solution:

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

Formation of antigen-antibody complex



Exercise | Q 4.07 | Page 245

Short Answer Question

What are the various public health measures, which you would suggest as safeguard against infectious diseases?

Solution:

Some public health measures that must be taken to safeguard the population against infectious diseases are as follows:

- i. Improved access to vaccinations and contraceptives (to prevent STDs)
- ii. Facilitation of screening, counseling, and education of those at risk of infection.
- iii. Support to access to treatment
- iv. Following good hygiene practices like hand washing
- v. Infection control standard, contact, droplet, and airborne precautions
- vi. Procedures for decontamination of persons and disinfection of equipment and environment, if needed.
- vii. Quarantine of contacts (if necessary)
- viii. Prophylaxis of exposed individuals
- ix. Control of the vectors of transmission of infection
- x. Spreading awareness about the route of transmission of infected diseases
- xi. Practice good food – safety techniques
- xii. Precautionary measures while traveling to areas of known epidemics.
- xiii. Controlling spread by rodents like rats

Exercise | Q 4.08 | Page 245

Short Answer Question

How does the transmission of the following diseases take place?

Amoebiasis

Solution:

- i. **Causative organism:** Entamoeba histolytica (protozoan).
- ii. **Mode of transmission:**

- a. Amoebiasis is usually transmitted by the faeco-oral route.
- b. It can be transmitted indirectly through contact with dirty hands or objects.
- c. It is transmitted through contaminated food and water. The infection spreads through the ingestion of the cyst form of the parasite.

Exercise | Q 4.08 | Page 245

Short Answer Question

How does the transmission of the following diseases take place?

Malaria

Solution:

Mode of transmission :

The malaria parasite life cycle involves two hosts.

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

When an infected female Anopheles sucks the human blood, it may transfer sporozoites to human circulation. Sporozoites reproduce asexually through the fission (schizogony) in the liver cells or erythrocytes.

The cells formed are now called merozoites. The cells formed within erythrocytes function as gametocytes (gamogony). Besides, it forms gametocytes within erythrocytes (gamogony). Gametocytes if taken up by female Anopheles, fertilization occurs in its gut.

A diploid zygote is formed which transforms into an oocyst.

Oocyst forms a large number of haploid sporozoites through meiosis (sporogony).

Sporozoites migrate to salivary glands and are ready to infect the new human hosts.

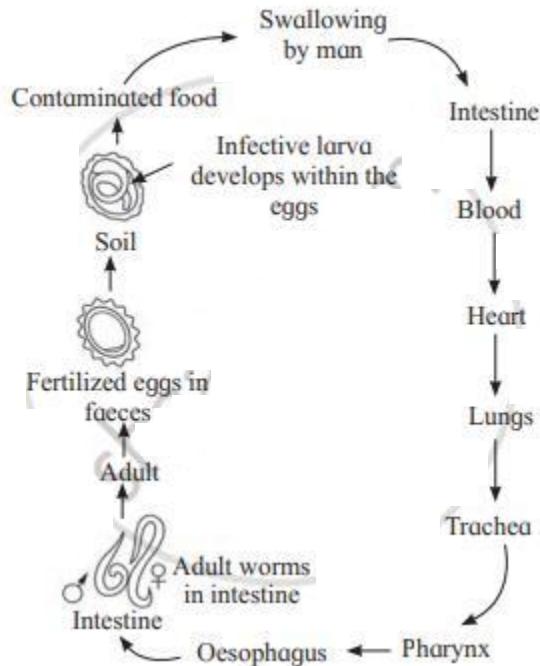
Exercise | Q 4.08 | Page 245

Short Answer Question

How does the transmission of the following diseases take place?

Ascariasis

Solution:



Life cycle of *Ascaris lumbricoides*

The life cycle of *Ascaris* involves only one host, i.e. human.

- Ascaris is present in the gastrointestinal tract and faecal matter. Adult worms live in the lumen of the small intestine.
- Ingestion of infective eggs takes place from contaminated vegetables and water is the primary route of infection.
- A female worm may produce approximately 2, 00,000 eggs per day, which are passed with the feces.
- Unfertilized eggs may be ingested but are not infective.
- Fertile eggs develop into embryos and become infective after 18 days to several weeks depending on the environmental conditions (Optimum conditions: moist, warm, shaded soil).
- After swallowing the infective eggs, the larvae hatch and are carried via circulation to lymphatics and the lungs.

vii. The larvae mature further in the lungs (10 to 14 days), penetrate the alveolar walls, ascend the respiratory tract to the throat, and are swallowed. Upon reaching the small intestine, they develop into adult worms.

viii. Two-three months are required from the ingestion of the infective eggs to oviposition by the adult female. Adult worms can live for 1 to 2 years.

ix. The eggs appear in stools after 60-70 days. In larval ascariasis, symptoms occur 4-16 days after infection.

Mode of transmission

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

Exercise | Q 4.08 | Page 245

Short Answer Question

How does the transmission of the following diseases take place?

Pneumonia

Solution:

- i. Pneumonia mostly spreads by direct person to person contact.
- ii. It can also spread via droplets released by an infected person or even by using shared clothes and utensils.

Exercise | Q 4.09 | Page 245

Short Answer Question

What measure would you take to prevent water-borne diseases?

Solution:

Waterborne diseases can be prevented in the following ways:

- i. Drink only boiled water
- ii. If not boiled, water should be chlorinated and filtered.
- iii. Practice good personal hygiene

- iv. Take food safety precautions like proper washing and cooking of food.
- v. Use disposable glass and plates wherever possible while eating food outside
- vi. Take vaccinations against preventable diseases like typhoid, hepatitis A, polio, etc.

Exercise | Q 4.1 | Page 245

Short Answer Question

Write a short note on typhoid.

Solution:

Salmonella typhi is the agent of typhoid fever.

Signs and symptoms of typhoid are as follows:

- i. Prolonged fever is as high as 1040 F.
- ii. General nausea, fatigue and headache.
- iii. Abdominal pain, constipation or diarrhoea.
- iv. Rose-coloured rash on the skin.
- v. Whitecoat on tongue, cough.
- vi. Anorexia (loss of appetite).
- vii. If not treated on time, the patient may experience breathlessness, irregular heartbeats and haemorrhage.

Modes of transmission of typhoid are as follows:

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

Typhoid fever can be confirmed by the Widal Test.

Antibiotics like Chloromycetin is a helpful treatment. Treatment of typhoid involves surgical removal of the gall bladder in severe cases.

The two vaccines for the prevention of typhoid are:

- i. Live, oral Ty21a vaccine (sold as Vivotif Berna)
- ii. Injectable Typhoid polysaccharide vaccine (sold as Typhim Vi by Sanofi Pasteur and Typherix by GlaxoSmithKline).

Exercise | Q 5 | Page 245

Match the following

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

Solution:

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

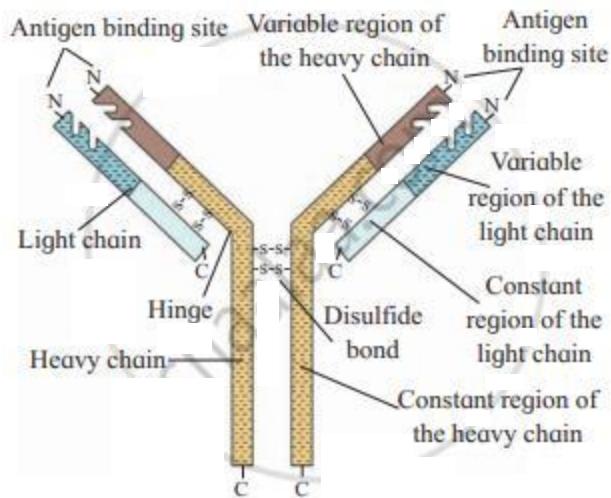
Exercise | Q 6.01 | Page 245

Long Answer Question

Describe the structure of an antibody.

Solution:

Structure of antibody



Antibodies are glycoproteins which are highly specific to specific antigens.

Antibodies are also known as Immunoglobulins (Igs), produced in response to antigenic stimulation.

Antibodies are produced by plasma cells which in turn are formed by B-lymphocytes.

The mature plasma cells produce antibodies at an extremely rapid rate i.e. about 2000 molecules per second.

Structure of antibody:

- i. The antibody is a 'Y' shaped molecule.
- ii. Each immunoglobulin molecule is made up of four polypeptide chains.
- iii. There are two heavy or H-chains and two light or L-chains.
- iv. The four polypeptide chains are held together by disulfide bonds (-S-S-) to form a 'Y' shaped structure.
- v. The region holding together arms and stem of the antibody is termed as the hinge.
- vi. Each chain of the antibody includes two distinct regions, the variable region, and the constant region.
- vii. Variable regions constitute the antigen-binding site (paratope).
- viii. This part of the antibody recognizes and binds to the specific antigen to form an antigen-antibody complex.

ix. Since most antibodies carry two antigen-binding sites, they are said to be bivalent.

Exercise | Q 6.02 | Page 245

Long Answer Question

Write a note on Vaccination.

Solution1:

- i. Administration of vaccine (i.e. inactivated pathogen or antigenic protection of particular pathogen) to protect against a particular pathogen, is called vaccination.
- ii. Normally, the body's immune system helps to protect against pathogens that cause infection.
- iii. However, some pathogens can overwhelm the immune system. This results in serious illness.
- iv. The pathogens most likely to cause illness, are the ones the body doesn't recognize and which go undetected by the immune system.
- v. Vaccination is a method in which the immune system is exposed to a safe antigenic preparation that helps it recognize and eliminate a pathogenic organism when it is encountered.
- vi. Vaccination is an important form of primary prevention, that can protect people from getting sick.
- vii. Vaccination has helped control deadly diseases like measles, polio, tetanus, and whooping cough.
- viii. The more people that are vaccinated, the more protected the individuals and the society are against diseases by a phenomenon known as herd immunity.

Solution2:

- i. Vaccination teaches the body to recognize new pathogens causing diseases.
- ii. It stimulates the body to make antibodies against antigens of pathogens.
- iii. It also primes immune cells to remember the types of antigens, allowing a faster response to the pathogen in future encounters.

- iv. Vaccines work by exposing a person to a safe version of a pathogen.
- v. The different forms of vaccines are as follows:
 - a. A protein or sugar from the pathogen.
 - b. A dead or inactivated form of a pathogen
 - c. A toxoid containing toxin produced by a pathogen.
 - d. A weakened (attenuated) pathogen. When the body responds to the vaccine, it builds an adaptive immune response. This helps to equip the body to fight off an actual infection.

Exercise | Q 6.03 | Page 245

Long Answer Question

What is cancer?

Solution:

An uncontrolled growth and multiplication of cells resulting in a harmful tumour are called cancer.

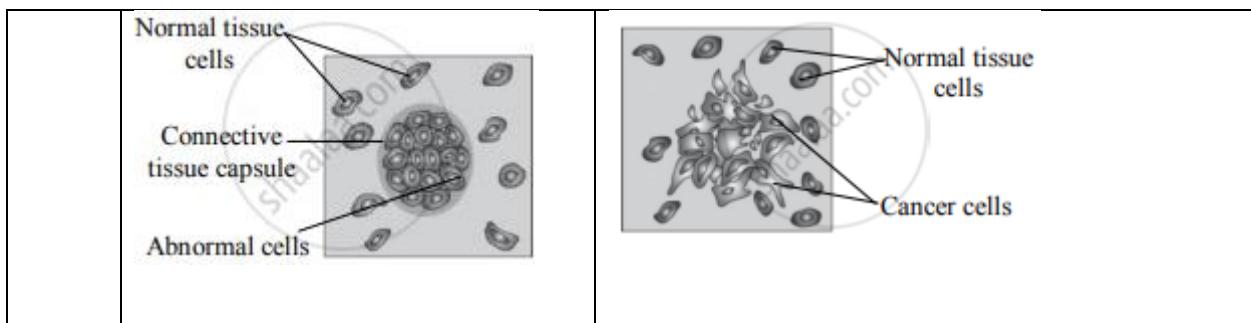
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Long Answer Question

Differentiate between a benign tumor and a malignant tumor.

Solution:

No.	Benign cancer	Malignant cancer
i.	It grows slowly	The growth rate of this tumour is rapid
ii.	The mortality rate is extremely low	The mortality rate is comparatively high
iii.	These cells remain restricted to the site of origin and do not spread to other parts of the body.	These cells spread from one organ to another via blood or lymph by metastasis
iv.	They may become malignant	They form secondary tumours
v.	They are non-malignant/ noncancerous.	They are malignant/ cancerous.



Exercise | Q 6.03 | Page 245

Long Answer Question

Name the main five types of cancer.

Solution:

The five types of cancer are:

- i. Carcinoma
- ii. Sarcoma
- iii. Lymphoma
- iv. Leukemia
- v. Adenocarcinomas

Exercise | Q 6.04 | Page 245

Long Answer Question

Describe the different types of immunity.

Solution:

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

i. Innate immunity or Inborn Immunity:

Innate immunity is the resistance to infections that an individual possesses genetically.

It is the natural (inborn) defense system of the body.

It is not affected by prior contact with microorganisms or immunization.

It is non-specific when it indicates a degree of resistance to infection in general.

Innate immunity comprises the various types of barriers that prevent the entry of foreign agents into the body.

a. Epithelial surface: The intact skin and mucous membranes (secrete mucously) covering the body, protects against invasion by a microorganism(s).

The healthy skin possesses bactericidal activity due to the presence of high concentrations of salt in drying sweat. **Sebaceous secretions** and a long chain of fatty acids have bactericidal and fungicidal properties.

The mucosa of the respiratory tract has several innate mechanisms of defense.

The nose prevents entry of microorganisms to a large extent, the inhaled particles being arrested through the hair at or near the nasal orifices.

Those foreign particles that pass the nasal orifices are held by the mucus lining the epithelium and are swept back to the pharynx where they tend to swallow or coughed out.

The cough reflex is an important defense mechanism of the respiratory tract. The mouth is constantly bathed in saliva which has an inhibitory effect on microorganisms. The acidity of gastric secretions in the stomach destroys micro-organisms.

The flushing action of urine eliminates bacteria from the urethra.

Spermine and zinc present in semen are antibacterial.

b. Antimicrobial substances in blood and tissues:

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

c. Cellular factors in innate immunity:

Natural defense against the invasion of blood and tissues by microorganisms and other foreign particles is mediated to a large extent by phagocytic cells which ingest and destroy them. Phagocytic cells are grouped as macrophages and neutrophils. These cells remove foreign particles that enter the body. A class of lymphocytes called Natural killer (NK) cells is important in non-specific defense against viral infections and tumors.

d. Fever:

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

e. Acute-phase proteins (APPs):

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

ii. Acquired immunity:

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

Acquired immunity is of two types Active and Passive.

a. Active immunity:

It is the resistance developed by individuals as a result of an antigenic stimulus (exposure to antigen).

It also is known as "Adaptive immunity". Active immunity may be natural or artificial.

1. Natural Acquired Active immunity: Immunity acquired due to infection is called natural active immunity. It is developed after the entry of pathogens in the body. It is long-lasting immunity. e.g. Person who has recovered from an attack of measles develops naturally acquired active immunity to measles, for a lifetime.

2. Artificial Acquired Active immunity: It is the resistance induced by vaccines. The vaccine is introduced into the body to stimulate the formation of antibodies by the immune system. e.g. Polio vaccine, BCG vaccine, etc. such immunity may be temporary or permanent.

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

1. Natural Acquired Passive immunity: Before birth maternal antibodies are transferred from mother to foetus through the placenta. After birth, antibodies are transferred from mother to infant through colostrum (first milk of mother) and continue throughout the period of breastfeeding. The antibodies received by the baby from the mother remain in the body for a short time. Therefore, natural acquired passive immunity is short-lived.

2. Artificially Acquired Passive immunity: This immunity is developed by injecting previously prepared antibodies using serum from humans or animals. e.g. Antibodies obtained from hyper immunised horses are injected to humans against rabies pathogens. It is short-lived.

Exercise | Q 6.05 | Page 245

Long Answer Question

Describe the ill –effects of alcoholism on health.

Solution:

Effects of Drug/ Alcohol Abuse:

i. Behavioural changes: The immediate adverse effects of drugs and alcohol abuse are manifested in the form of reckless behaviour, vandalism and violence.

ii. Coma/ Death: Excessive doses of drugs may lead to coma and death due to respiratory failure, heart failure or cerebral haemorrhage. A combination of drugs or their intake along with alcohol generally results in overdose and even deaths.

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

iv. Crimes: If an abuser is unable to get money to buy drugs/ alcohol he/she may turn to crime. At times, a drug/alcohol addict becomes the cause of mental and financial distress to his/her entire family and friends.

v. Adverse health effects/ Diseases: Those who take drugs intravenously (direct injection into the vein using a needle and syringe) are likely to acquire serious infections like HIV and hepatitis B. Use of alcohol during adolescence may also have longterm effects like loss balance, liver cirrhosis, pancreatitis. It could lead to heavy drinking in adulthood. Chronic use of drugs and alcohol damages nervous system and liver (cirrhosis). Use of drugs and alcohol during pregnancy adversely affects the foetus.

vi. Misuse in Sports: Another misuse of drugs is that certain sportspersons use drugs to enhance performance. They (mis)use narcotic analgesics, anabolic steroids, diuretics and certain hormones to increase muscle strength and bulk and to promote aggressiveness and an overall improvement in their performance.

vii. Side-effects of the use of anabolic steroids in females: Masculinization (features like males), increased aggressiveness, mood swings, depression, abnormal menstrual cycles, excessive hair growth on the face and body, enlargement of the clitoris, deepening of the voice.

viii. Side-effects of the use of anabolic steroids in males: Acne, increased aggressiveness, mood swings, depression, and reduction of the size of the testicles, decreased sperm production, kidney and liver dysfunction, breast enlargement,

premature baldness, enlargement of the prostate gland. These effects may be permanent with prolonged use.

Exercise | Q 6.06 | Page 245

Long Answer Question

In your view, what motivates youngsters to take to alcohol or drugs and how can this be avoided?

Solution:

- i. Addiction is a psychological attachment to certain effects such as euphoria and a temporary feeling of well being associated with drugs and alcohol.
- ii. These feelings drive people to take them even when these are not needed, or even when their use becomes self-destructive.
- iii. With repeated use of drugs, the tolerance level of the receptors present in our body increases.
- iv. Consequently, the receptors respond only to higher doses of drugs or alcohol leading to greater intake and addiction.

Prevention:

- i. Habits such as smoking, taking drugs, or alcohol are more likely to be taken up at a young age, more during adolescence.
- ii. It is best to identify the situations that push an adolescent towards the use of drugs or alcohol and to take remedial measures well in time. In this regard, the parents and the teachers have a special responsibility.

Exercise | Q 6.07 | Page 245

Long Answer Question

Do you think that friends can influence one to take alcohol/drugs? If yes, how may one protect himself/herself from such an influence?

Solution:

Yes, friends can influence one to take alcohol/ drugs.

One can protect oneself from such influence by the following ways:

- i. Counseling:** Seek counseling to deal with mental illness or traumas experienced. One can also attend support groups, read self – help books, and seek advice from a therapist. There are many specific national helpline numbers that can also offer help.

ii. Support: Share your fears and problems with a reliable person like a teacher or a parent who can support you and help you. This will make it easier to avoid stress and the desire to adopt an addiction.

iii. Choose friends carefully: Peer pressure is one of the main causes of addictions amongst teenagers. Hence, it is best to avoid people who you know are addicted. Carefully choose your friend circle and who you decide to confide in.

iv. Avoid starting young: Those who start drinking or using drugs at an early age (even in small amounts) are most likely to develop an addiction later in life.

v. Be aware of the consequences of addictions: Stay aware of the effects of drug and alcohol addiction on your social, physical, and mental health and prevent adverse impact on yourself by refraining from it.

vi. Develop strong bonds: Social connections can help protect you against the risk of substance use.

vii. Participate in anti-drug, tobacco, and alcohol programs: Early interventions can help a person. If you have adopted a bad habit, or feel you are on the path of addiction, admit the problem and seek timely help to prevent it from turning into an addiction.