

HUMAN HEALTH AND DISEASES

Introduction:

- Health is a state of complete physical, mental and social well-being. It is affected by genetic disorders, infections, change in lifestyles, etc.

Disease:

- It is a condition characterized by malfunctioning of one or more organs or systems of the body. It is broadly divided into infectious (transmitted from one person to another via pathogens) and non-infectious (cannot be transmitted) diseases.
- Pathogens are the disease-causing organisms such as bacteria, viruses, fungi, protozoans, helminths, etc. that cause harm to the body.

Common Human Infectious Diseases:

DISEASES CAUSED BY BACTERIA				
Name of disease /test	Causal organisms	Mode of Transmission	Symptoms	Effects
Typhoid / Widal test	Salmonella typhi	Contaminated food and water	Sustained high fever, weakness, stomach pain,	



REVISE

HUMAN HEALTH AND DISEASES

Pneumonia	Streptococcus pneumoniae and Haemophilus influenzae	Inhaling the droplets/aerosols from an infected person	Fever, chills, cough and headache.	Alveoli get filled with fluid leading to severe problems in respiration.
-----------	---	--	------------------------------------	--

DISEASES CAUSED BY VIRUSES

Common cold	Rhino viruses	Inhaling the droplets from cough or sneezes of an infected person	Nasal congestion and discharge, sore throat, cough and headache.	Infect the nose and respiratory passage.
Dengue fever	Flavivirus	By the bite of Aedes aegypti mosquito	High fever, severe front headache, joint pain, nausea, vomiting.	



HUMAN HEALTH AND DISEASES

Chikungunya	Chikungunya virus	By the bite of Aedes aegypti mosquito	Sudden onset of fever, crippling joint pains, lymphadenopathy, etc.	
DISEASES CAUSED BY PROTOZOA				
Malaria	Plasmodium (P. vivax, P. malariae, P. falciparum and P. ovale)	Through the vector female Anopheles mosquito	Shaking chills and high fever recurring 3 to 4 days.	Parasite multiply within liver cells and then attack the RBCs.
Amoebiasis or Amoebic dysentery	Entamoeba histolytica	Through houseflies which act as mechanical carriers	Constipation, abdominal pain, cramps, stool with mucous and blood clot.	Infect the large intestine.



HUMAN HEALTH AND DISEASES

DISEASES CAUSED BY HELMINTHS

Ascariasis	Ascaris lumbricoides	By consumption of contaminated water and food	Internal bleeding, muscular pain, fever, anemia etc.	
Elephantiasis or filariasis	Wuchereria bancrofti and W. malayi	By the bite of vector female Culex mosquito	Inflammation in the lower limbs and genital organs.	Lymphatic vessels of lower limbs get blocked, genital organs get deformed

DISEASES CAUSED BY FUNGUS

Ring worms	Microsporum, Trichophyton and Epidermophyton	By using towels, clothes, etc. of infected individuals	Appearance of dry, scaly lesions on various part of body.	Infects the skin, nail and scalp.
------------	--	--	---	-----------------------------------

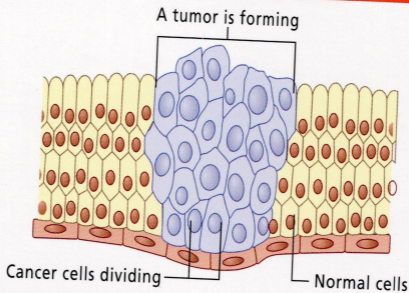


HUMAN HEALTH AND DISEASES

Cancer:

- It is an abnormal and uncontrolled proliferation of cells resulting in the formation of tumors or neoplasm.
- Cancerous cells lost the property of contact inhibition (contact with other cells inhibits their uncontrolled growth).
- Tumors can be of two types, Benign tumour which confined to a particular location and does not spread and Malignant tumour which shows metastasis (cells divides and transported through blood or lymph to distant body parts and forms new tumors there).
- Transformation of normal cells into cancerous cells are induced by carcinogens such as X-rays, UV rays, tobacco smoke, oncogenic viruses, cellular or proto oncogenes (present in inactivated form in normal cells).
- Cancer can be detected and diagnosed by several techniques like biopsy, radiography, computed tomography and magnetic resonance imaging, monoclonal antibodies, etc.
- Cancers can be treated by combination of surgery, radiation therapy, chemotherapy and immunotherapy.





Vaccination and Immunisation:

- In active immunisation/vaccination, a preparation of vaccine (antigenic proteins of pathogen or inactivated/weakened pathogen) is introduced into the body. It results in the development of antibodies which neutralizes the antigens during actual infection.
- The vaccines also generate memory B and T-cells that recognize the pathogen quickly and produce intensified immune response. e.g., Polio vaccine.
- In passive immunisation, direct injection of pre-formed antibodies or antitoxin is given. It is required for immediate immune response. e.g., Immunization against Tetanus, snake venom etc.



HUMAN HEALTH AND DISEASES

- Vaccines are produced using DNA recombinant technology also. e.g., Hepatitis B vaccine produced from Yeast.

Allergies:

- It is the hypersensitive response of the immune system to certain allergens such as pollens, dust, mites, etc. The antibodies produced due to these are IgE types.
- Allergy occurs due to the secretion of chemicals like histamine and serotonin from the mast cells. It is treated with drugs like anti-histamine, adrenaline and steroids.

Adolescence-Drugs and Alcohol Abuse:

- Adolescence is a period between 12-18 years of age which leads to mental and psychological development of an individual.
- Drug or alcohol abuse is the consumption of drugs and alcohol in high amount for the purposes other than medicinal use. It disturbs the physical, physiological or psychological functions of the body.
- Reasons for drug and alcohol addiction are curiosity, adventure, excitement, experimentation, depression and stress or pressure to excel in examination.
- The immediate effects of drug and alcohol abuse are reckless behavior, vandalism, violence, drop in academic



HUMAN HEALTH AND DISEASES

performance, aggressiveness, depression, isolation, respiratory and heart failure, etc.

- Far-reaching implications are habit of stealing, higher risk of infections like AIDS and Hepatitis B, liver cirrhosis, etc.
- In order to enhance the muscle strength, bulk, aggressiveness and performance, certain sportspersons (mis)use narcotic analgesics, anabolic steroids, diuretics.
- In females, these anabolic steroids lead to masculinisation, aggressiveness, abnormal menstrual cycles, etc. Whereas, in males it leads to acne, mood swings, reduction in size of testicles and sperm production, etc.

Addiction and Dependence:

- Addiction is a psychological attachment of people to certain effects such as euphoria and a temporary feeling of well-being associated with drugs and alcohol.
- Dependence is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drugs/alcohol is abruptly discontinued. This results in anxiety, shakiness, nausea and sweating, which are relieved when use is resumed again.
- Drug and alcohol abuse can be prevented by avoiding undue peer pressure, education and counselling, seeking helps from parents and peers, seeking professional and medical help, etc.





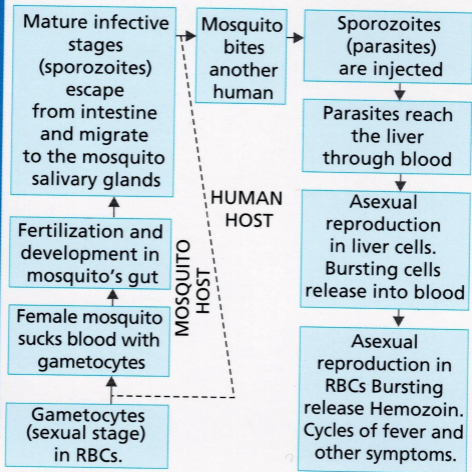
MEMORISE

HUMAN HEALTH AND DISEASES

Unit - VIII: Biology in Human Welfare

Life Cycle of *Plasmodium*:

- The life cycle of *Plasmodium* requires two hosts, i.e., female *Anopheles* mosquito (primary host) and Human (secondary host) to complete its life cycle.



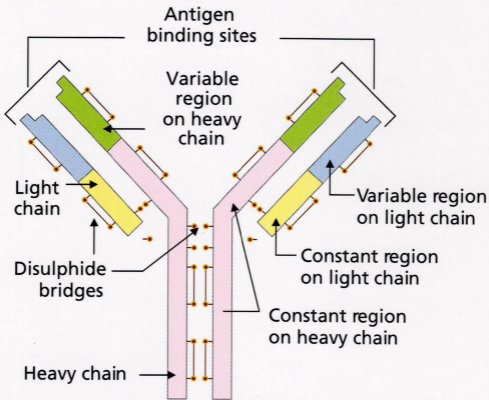
HUMAN HEALTH AND DISEASES

Immunity:

- It is the ability of the body to protect, defend and fight against disease causing pathogens.
- It is of two types, **innate** immunity (non-specific and present at the time of birth) and **acquired** immunity (pathogen specific and developed during lifetime).
- Innate immunity achieved by the provision of four types of **barriers**, i.e., physical (e.g., skin), physiological (e.g., gastric HCL), cellular (e.g., PMNL) and cytokine (e.g., interferons).
- **Acquired** immunity is characterized by memory and after encountering a pathogen, body produces **primary** (low intensity) and **secondary/anamnestic** (high intensity) **response**.
- These primary and secondary responses occur with the help of B-lymphocytes (produce antibodies and show **humoral immune response**) and T-lymphocytes (help B-cells to produce antibodies and show **cell-mediated immunity**).
- Cell-mediated immunity helps the body to differentiate between 'self' and 'non-self' and also responsible for the **graft rejection**.
- Antibodies are also called as immunoglobulins (IgA, IgM, IgE, and IgG) that are produced when an antigen attacks the body. Its structure is represented as $H_2 L_2$.



HUMAN HEALTH AND DISEASES



Structure of an antibody

- Acquired immunity is of two types, **active** (slow, long lasting and produced when a host is exposed to antigens) and **passive** (fast, short-term and produced when ready-made antibodies are directly given to the body).
- Examples of active immunity- developed by infectious organisms (natural), deliberately injecting the microbes/





MEMORISE

HUMAN HEALTH AND DISEASES

antigens either through immunization/vaccination (artificial).

- Examples of natural passive immunity- colostrum (have IgA antibodies), from mother to foetus through placenta (have IgG antibodies). Example of artificial passive immunity is Anti-tetanus serum.
- In autoimmunity, the immune system goes off track and starts attacking self-cells which leads to **autoimmune diseases** such as Rheumatoid arthritis, Hashimoto's disease, etc.

Lymphoid Organs:

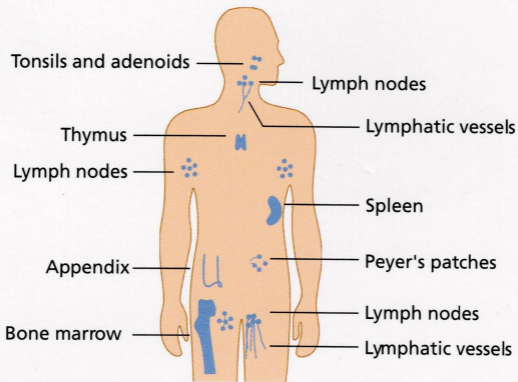
- In these organs lymphocytes originate and/or mature and proliferate. These can be classified as primary and secondary lymphoid organs.
- In primary lymphoid organs, lymphocytes get matured and differentiate into antigen-sensitive lymphocytes. **Example: Bone marrow** (site of B-lymphocytes maturation) and **Thymus** (site of T-lymphocytes maturation).
- In secondary lymphoid organs, lymphocytes fight with antigens. **Example:** Spleen (removes worn-out RBCs and microorganisms from blood), lymph nodes (trap the microorganisms or other antigens from lymph), Mucosal Associated Lymphoid Tissues (present within the lining of the major tracts).





HUMAN HEALTH AND DISEASES

THE IMMUNE SYSTEM - LYMPHOID ORGANS



Acquired Immuno Deficiency Syndrome (Aids):

- AIDS is the deficiency of immune system, acquired during the lifetime of an individual. It is caused by **Human Immunodeficiency Virus (HIV)**, a retrovirus having RNA genome.

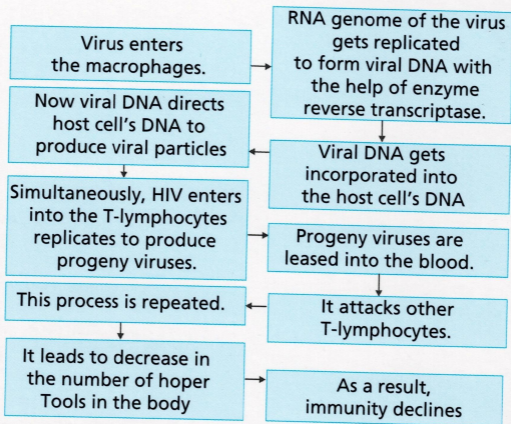




MEMORISE

HUMAN HEALTH AND DISEASES

- The life cycle of HIV includes the following steps:



- It is generally transmitted through sexual contact with infected person, blood transfusion with contaminated blood and its products, through the share of infected needles, from the infected mother to her child through the placenta.



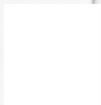


HUMAN HEALTH AND DISEASES

- Diagnostic test for AIDS is Enzyme Linked Immuno-Sorbent Assay (**ELISA**), PCR test, Western Blotting, etc.
- AIDS can be treated with the use of **anti-retroviral drugs**, but these are partially effective only and cannot prevent death.
- AIDS can be prevented by the use of disposable needles and syringes, controlling drug abuse, making blood (from blood banks) safe from HIV, discouraging unsafe sex.

Drugs:

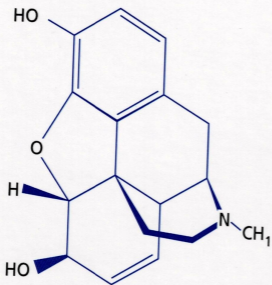
- **Opioids** bind to specific opioid receptors present in CNS and gastrointestinal tract. Some famous opioids are:
 - **Morphine** is extracted from latex of *Papaver somniferum* (poppy plant). It is a sedative and painkiller. Used during surgery.
 - **Heroin** (*smack* or diacetylmorphine) is prepared by acetylation of morphine. It is taken by snorting and injection and acts as depressant and slows down body functions.





MEMORISE

HUMAN HEALTH AND DISEASES



Chemical structure of morphine

Opium poppy

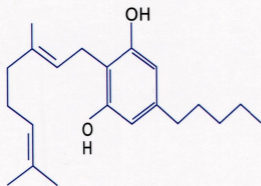
- **Cannabinoids** interact with cannabinoid receptors in the brain. Naturally it is obtained from inflorescences of *Cannabis sativa*. Its flower tops, leaves and resin are used to make marijuana, hashish, charas and ganja.
- These drugs are abused by sportspersons, generally taken by inhalation and oral ingestion and affects cardiovascular system.





MEMORISE

HUMAN HEALTH AND DISEASES



Skeletal structure of
cannabinoid molecule



Leaves of *Cannabis sativa*

- **Coca alkaloid or cocaine** is obtained from *Erythroxylum coca* plant. It interferes with transport of neurotransmitter dopamine.
 - It is usually snorted and stimulates CNS. This drug produces euphoria and high level of energy but excessive dosage causes hallucinations.
- **Hallucinogens** are obtained from *Atropa belladonna* and *Datura* plants. Lysergic Acid Diethylamide (LSD) is a powerful hallucinogen which is obtained from the fungus *Claviceps purpurea*.





MEMORISE

HUMAN HEALTH AND DISEASES

- Drugs like barbiturates, amphetamines, benzodiazepines, etc. are used as medicines to treat mental illnesses like depression and insomnia.

Tobacco:

- It is obtained from tobacco plant and can be smoked, chewed or used as a snuff. It contains nicotine which stimulates adrenal gland to release adrenaline and nor-adrenaline hormones, causes high blood pressure and heart rate.
- Consumption of tobacco increases the risk of cancer and smoking it increases the CO content in blood and reduces oxyhaemoglobin. This causes O₂ deficiency in the body.



HUMAN HEALTH AND DISEASES

- The diagnostic test that confirms typhoid in humans is:
 - ELISA
 - Widal
 - MRI
 - Amniocentesis
- The principle of vaccination is based on the property of:
 - Specificity
 - Diversity
 - Memory
 - Discrimination between 'self' and 'non-self'
- 'Pathogens' are:
 - Substances produced against any disease causative organism
 - Chemical substances produced by the host cells to kill the parasite animal
 - Disease spreading factors
 - Cells which kill the parasites
- Haemozoin can be classified as a _____.
 - precursor of haemoglobin
 - toxin released from *Streptococcus* infected cells
 - toxin released from *Plasmodium* infected cells
 - toxin released from *Haemophilus* infected cells





TEST

HUMAN HEALTH AND DISEASES

Solutions:

1. Option (b) is correct.

The diagnostic test that confirms typhoid in humans is Widal. This test is named after its inventor, Georges-Fernand Widal.

2. Option (c) is correct.

When a preparation of vaccine (antigenic proteins of pathogen or inactivated/weakened pathogen) is introduced into the body, it develops antibodies and activates the plasma and memory cells. When the same antigen attacks the person in future, the memory cells recognize the antigen and promote phagocytosis.

3. Option (c) is correct.

Pathogens are the disease spreading or disease-causing organisms such as bacteria, viruses, fungi, protozoans, helminths, etc. that cause harm to the body.

4. Option (c) is correct.

Haemozoin is a toxin released by the ruptured RBC's when infected by the *Plasmodium*. This toxin leads to shivering, high fever and chills like symptoms in the *Plasmodium* infected person.



TEST

HUMAN HEALTH AND DISEASES

5. Hallucinogens can be obtained from _____.
 - (a) *Atropa belladonna*
 - (b) *Datura*
 - (c) *Claviceps purpurea*
 - (d) All of the above
6. Ringworm in humans is caused by _____.
 - (a) Viruses
 - (b) Bacteria
 - (c) Fungi
 - (d) Nematodes
7. Use of anti-histamines and steroids give a quick relief from _____.
 - (a) headache
 - (b) allergy
 - (c) nausea
 - (d) cough
8. A certain patient is suspected to be suffering from Acquired Immuno Deficiency Syndrome. Which diagnostic technique will you recommend for its detection?
 - (a) MRI
 - (b) Ultra sound
 - (c) WIDAL
 - (d) ELISA



TEST

HUMAN HEALTH AND DISEASES

Solutions:

5. **Option (d) is correct.**

Hallucinogens are psychedelic drugs which can be obtained from plants like *Atropa belladonna* and *Datura*. Lysergic Acid Diethylamide (LSD) is a powerful hallucinogen that is obtained from the fungus *Claviceps purpurea*.

6. **Option (c) is correct.**

Ringworm in humans is caused by fungi. The main symptoms of this disease are dry, scaly lesions on various parts of the body which are accompanied by intense itching.

7. **Option (b) is correct.**

Allergy is the hypersensitive response of the immune system to certain allergens. It occurs due to the secretion of chemicals like histamine and serotonin from the mast cells. It is treated with drugs like anti-histamine, adrenaline and steroids.

8. **Option (d) is correct.**

Diagnostic test for AIDS is Enzyme Linked Immuno-Sorbent Assay (ELISA). On the other hand, cancer can be detected and diagnosed by Magnetic Resonance Imaging (MRI).

