Common Diseases in Humans

What is Health?

- Health is the state of complete physical, mental, and social well being.
- Health increases productivity and ensures longevity.

Ways to Ensure Good Health

- Balanced diet
- Personal hygiene
- Exercise
- Awareness about prevention and control of diseases
- Proper waste disposal and control of vectors
- Vaccination

Why do Diseases Occur?

- Genetic reasons – Innate deficiencies and inheritable defects
- Infections
- Sedentary life style – Junk food, consumption of alcohols/drugs, lack of exercise

Pathogenic Diseases

- Pathogens are the parasites that enter the human body through various means, then multiply, and interfere with normal vital activities.

Bacterial Diseases

- **Typhoid**
  - Pathogen – *Salmonella typhi*
  - Spreads through – Contaminated food and water
  - Site of infection – Small intestine
  - Symptoms – High fever, stomach pain, headache, loss of appetite, constipation, and intestinal perforations in severe cases
  - Confirmatory test – Widal test
- **Pneumonia**
  - Pathogens – *Streptococcus pneumoniae* and *Haemophilus influenzae*

- Spreads through – Droplets/aerosols released from infected person, sharing of glasses or utensils
- Site of infection – Alveoli (gets filled with fluid, difficulty in breathing)
- Symptoms – Fever, chills, cough, headache, lips and nails become grey in severe cases

Viral Diseases

- **Common cold**
  - Pathogen – Rhino viruses
  - Site of infection – Nose and respiratory passage
  - Spreads through – Droplets released from coughing or sneezing, or contaminated objects
  - Symptoms – Nasal congestion and discharge, sore throat, cough, headache, tiredness

Protozoan Diseases

- **Malaria**
  - Pathogen – *Plasmodium* sps. (*P.vivax, P. falciparum, P. malaria*)
  - Vector – Female *Anopheles* mosquito
  - Symptoms – High grade fever, chills
- **Amoebiasis**
  - Pathogen – *Entamoeba histolytica*
  - Vector – Housefly
  - Site of infection – Large intestine
  - Symptoms – Constipation, abdominal pain, cramps, stools with mucous, and blood clots

Fungal Diseases

- **Ringworms**
  - Pathogens – Genera *Microsporum*, *Trichophyton*, and *Epidermophyton*
  - Spreads through – Towels, clothes, comb (Fungus is acquired from soil)

- Symptoms – Appearance of dry, scaly lesions on various body parts with intense itching

Diseases Caused by Worms

- **Ascariasis**
  - Pathogen – Round worm, *Ascaris*
  - Spreads through – Water, vegetables, fruits contaminated by faeces of infected person
  - Symptoms – Internal bleeding, muscular pain, fever, anaemia, blockage of intestinal passage

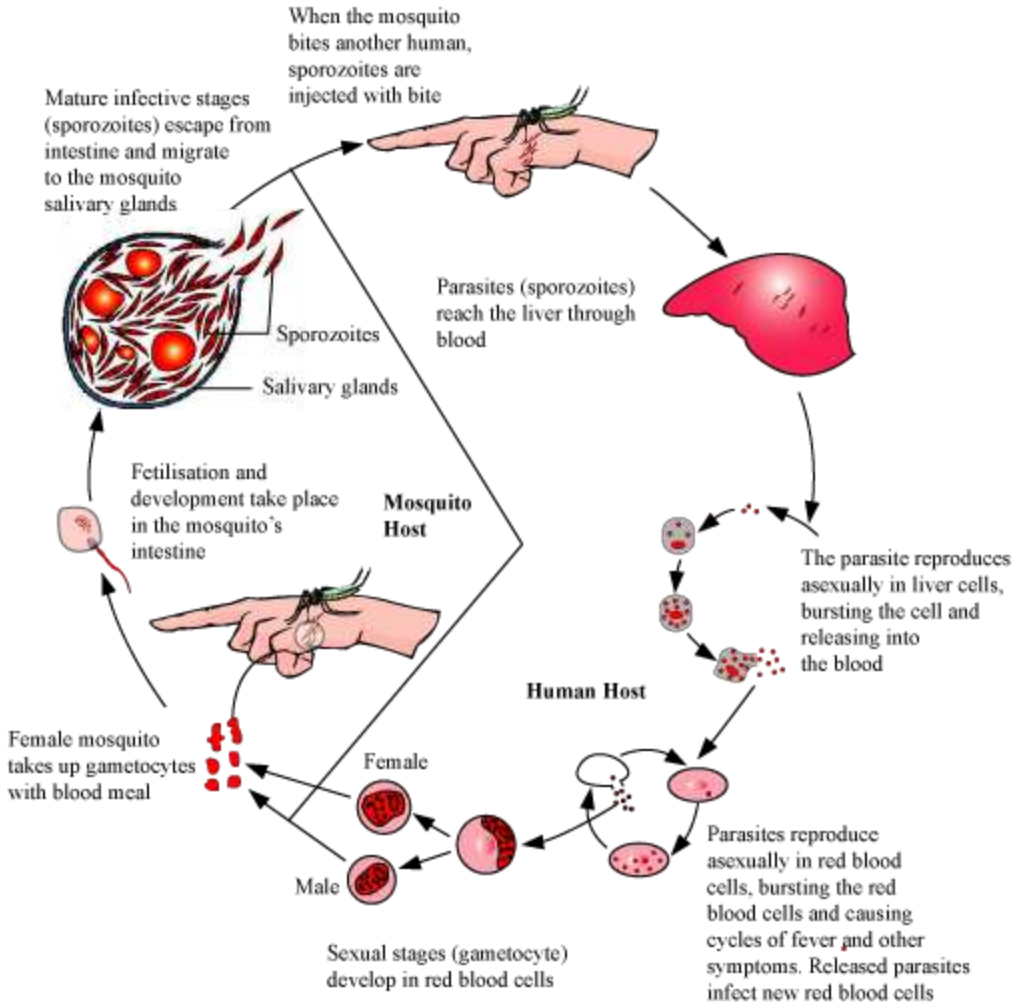
- **Elephantiasis (filariasis)**
  - Pathogen – *Wuchereria* (*W.malayi* and *W.bancrofti*)
  - Spreads through – Bite of female mosquito vector
  - Symptom – Chronic inflammation of the organs, usually the lymphatic vessels of lower limb

Life Cycle of *Plasmodium*

- *Plasmodium* requires two hosts to complete its life cycle.
- When female *Anopheles* mosquito bites a healthy human being, it releases *Plasmodium*, which lives in its body as sporozoite (infectious form).
- The parasites multiply (asexual reproduction) in the liver cells and finally burst the liver cells. Sporozoites are released in blood.
- Parasites enter RBCs and further multiply (asexual reproduction) here and finally burst RBCs also.
- Bursting of RBCs is accompanied by release of a toxic substance called haemozoin (associated with fever and chills).
- In the RBCs, only sporozoites change into gametocytes (sexual stage). Gametocytes multiply.
- When the diseased person is bitten by a female *Anopheles* mosquito, gametocytes are introduced into the mosquito.
- Gametocytes fertilise and develop inside the intestine of mosquito to

form sporozoites.

- Sporozoites are stored in the salivary glands of mosquito and are released into the healthy person who is bitten by this mosquito.



Immunity

What is immunity?

- The ability of body to fight the disease-causing organisms is called immunity.

Types of immunity

- Immunity is of two types – innate immunity and acquired immunity.
- **Innate immunity** – It is present from the time of birth. It is non-specific. It consists of 4 kinds of barriers.

    - Physical barriers – Skin and mucus coating of respiratory, gastrointestinal, and urogenital tract prevent entry of microbes into body.
    - Physiological barriers – Acid in stomach, saliva in mouth, tears from eyes
    - Cellular barriers – Blood has leukocytes such as polymorpho nuclear leukocytes, monocytes, etc. and tissue has macrophages which phagocytose the microbes.
    - Cytokine barriers – Special proteins called interferons are secreted by virus-infected cells that prevent the further spread of viral infection.
- **Acquired immunity** – It is acquired, which means that it is produced in response to an encounter with a pathogen based on memory. It is pathogen specific.
    - When a pathogen for the first time infects a person, low intensity immune response is generated (primary response).
    - When the same pathogen attacks again, intensified immune response in generated, thereby preventing the occurrence of disease (secondary response).
    - Acquired immunity involves two types of cells – B-lymphocytes and T- lymphocytes.
    - B-lymphocytes – Secrete proteins called antibodies in response to pathogens **Antibodies** are specialized proteins with 4 peptide chains (2 light and 2 heavy), hence denoted as H_2L_2. IgA IgM, IgE, etc. are examples of some of the antibodies. They generate **humoral immune response** (found in blood).
    - T-lymphocytes – They help B-cells to produce antibodies. They generate **cell -mediated immune response**. This response helps the body to differentiate between 'self' and 'non-self' as occurs in case of graft rejection.

Difference between active immunity and passive immunity

- Active Immunity

    - This is the naturally acquired immunity produced in the host body in response to an antigen.
    - Immunization and body naturally getting immune to a microbe that had caused infection previously are examples of active immunity.
- Passive immunity
    - When ready-made antibodies are provided to an individual to protect against foreign agents
    - Colostrums present in mother's milk contain IgA. Also, the foetus gets antibodies from mother through placenta.

How does vaccination help?

- Vaccines are nothing but inactivated pathogens.
- These inactivated pathogens when introduced in the body produce a primary immune response and antibodies are produced against the pathogen.
- Memory B and T-cells are produced.
- Now when the pathogen again attacks the person, memory B and T-cells generate a massive immune response and the pathogen is killed.

Problems of immune system

- **Allergies**
    - Exaggerated immune response to certain antigens present in environment
    - Allergens – Substances in response to which allergy is produced E.g., dust, pollen, etc.
    - Antibodies involved – IgE type
    - During allergic reactions, chemicals such as histamines and serotonins are released.
    - Symptoms – Sneezing, watery eyes, difficulty in breathing, etc.
    - Allergy test – Patient is injected with small doses of allergens to monitor his response.
    - Antihistamines, adrenalins, and steroids may be given so that

the symptoms of allergy subside.

- **Autoimmunity**
  - In autoimmunity, body generates immune response against its own cells.
  - Reasons – Genetic and other unknown reasons
  - Example – Rheumatoid arthritis is an autoimmune disease.

Human immune system

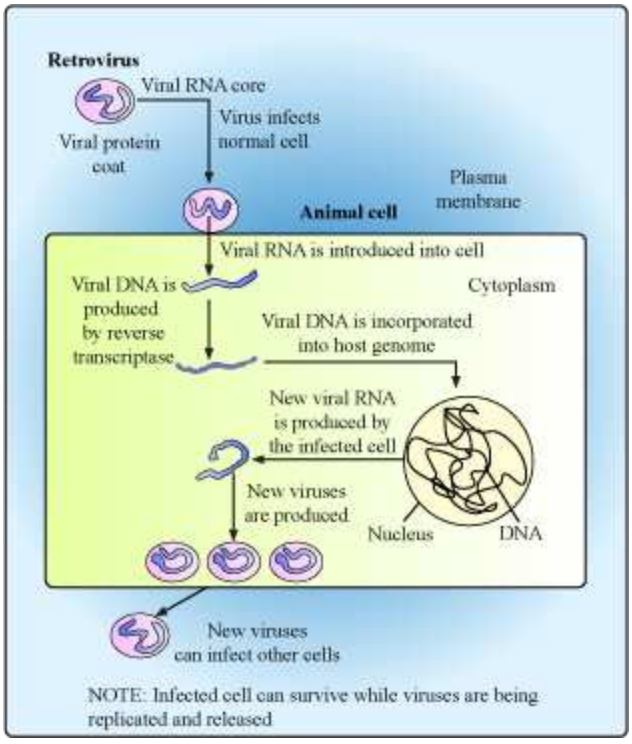
- Lymphoid organs are of two types – primary lymphoid organs and secondary lymphoid organs.
- Primary lymphoid organs consist of bone marrow and thymus. Here, immature lymphocytes are differentiated to form antigen-sensitive lymphocytes.
  - Bone marrow – Here, all blood cells including lymphocytes are produced.
  - Thymus – It is responsible for maturation of T-lymphocytes. This lobed organ is situated near the heart and keeps on reducing in size as the age increases.

- Secondary lymphoid organs – Lymphocytes migrate here after attaining maturity. It includes spleen, lymph nodes tonsils, Peyer's patches, and appendix.
  - Spleen – Large bean-shaped organ containing lymphocytes and phagocytes, which acts as a filter for blood
  - Lymph nodes – Located at different points throughout the immune system, they trap the antigens present in lymph or tissue fluid, and these antigens cause activation of lymphocytes and generation of immune response.
- MALT (Mucosal-associated lymphoid tissue) – Lines major tracts (respiratory, digestive, urogenital, etc); constitutes 50% of lymphoid tissue in body

AIDS & Cancer

AIDS (Acquired Immuno Deficiency Syndrome)

- Caused by HIV (Human Immunodeficiency Virus) [HIV is a retrovirus (RNA virus)]
- **Transmission of HIV occurs through:**
    - Sexual contact with infected person
    - Sharing infected needles (as in case of intravenous drug abusers)
    - Transfusion of contaminated blood
    - Infected mother to child through placenta
- Time lag between infection and appearance of symptoms – Few months to many years (5-10 years)
- **How does AIDS infection spread?**
    - Virus enters the body of a person and enters macrophages.
    - Here, virus replicates (viral RNA reverse transcribes to viral DNA, which gets incorporated into hosts DNA and subsequently new viral particles are produced).



- Macrophages become a virtual HIV factory.
- Thereafter, HIV enters helper T-lymphocytes, replicates, and produces progenies.
- As the progenies are released, they attack other T-lymphocytes.
- Therefore, T-lymphocytes start decreasing in number and immune response of the person becomes weak.
- Even infections which could be overcome easily start aggravating.

- **Diagnosis of AIDS –** By ELISA (Enzyme Linked Immuno Sorbent Assay)
- **Treatment –** No permanent cure; antiretroviral therapies can prolong the life of patient
- **Prevention of AIDS**
  - Ensuring use of disposable syringes
  - Screeningblood from blood banks
  - Advocating safe sex
  - NACO (National AIDS Control Organization) and many NGOs are doing a lot to create awareness among people.

Cancer

- The process of development of cancer is called **oncogenic transformation.**
- Normal cells have the property of contact inhibition (stoppage of growth on coming in contact with other cells), but cancer cells lose this property.
- As a result, cancer cells divide continuously to give rise to mass of cells (tumours).
- Tumours are of 2 types – benign and malignant.
- Benign tumours – Remain confined to their original location and do not spread
- Malignant tumours– These exhibit **metastasis** i.e., the cells sloughed from such tumours reach distant sites and wherever they reach, new tumour is formed.
- Malignant tumours actually represent cancer. The cells actively divide, grow, and starve the normal cells of vital nutrients.
- **Causes of cancer**
    - **Carcinogens –** Physical, chemical, and biological agents that cause cancer Example - ionizing radiations (X-rays and gamma rays), non-ionizing radiations (UV)
    - **Oncogenic (cancer-causing) viruses** – They have viral oncogenes (cancer-causing genes).
    - Sometimes normal genes in our body called proto-oncogenes get converted into cellular oncogenes that cause cancer.
- **Diagnosing cancer**
    - Biopsy and histopathological studies
    - **Biopsy** – Suspected tissue is cut into thin sections and examined microscopically
    - **Radiography**, CT scan (computed tomography), and MRI (Magnetic resonance imaging) are techniques of diagnosing cancers.
    - **C T Scan** – 3-D imaging of internals of an organ is generated by X-rays.
    - **MRI Scan** – Pathological and physiological changes in a living

tissue are detected by using magnetic fields and non-ionising radiations.
    - Immunological and molecular biological diagnostic techniques can all be used to detect cancers.
    - Identifying certain genes, which make an individual susceptible to cancers, can help to prevent cancers.
- **Treatment of cancer**
    - **Radiotherapy** – Tumour cells are irradiated to death. Also, proper care is taken for protecting surrounding normal tissues.
    - **Chemotherapy** – Drugs specific for particular tumours are used to kill cancer cells. They have side effects such as hair loss, anaemia, etc.
    - **Immunotherapy**– Biological response modifiers such as α-interferons are used. They activate the immune system of patient and helps in destroying the tumour.

Commonly Abused Drugs

Opioids (Heroin)

- Source: Acetylation of morphine extracted from the latex of poppy plants (*Papaver somniferum*)
- Consumed by: Snorting or injection
- Properties: White, bitter and odourless
- Mode of action: Binds to opioid receptors present in the CNS and GI tract
- Effect: It is a depressant; slows down body functions

Cannabinoids

- Source: Inflorescences of the plant *Cannabis sativa*
- Consumed by: Inhalation or oral ingestion
- Mode of action: Binds to cannabinoid receptors present in the brain
- Effect: Affects the cardiovascular system

Cocaine

- Source: Coca plant *Erythroxylum coca*, found in South America
- Consumed by: Snorting
- Mode of action: Interference with transfer of neurotransmitter, dopamine
- Effect: Stimulates the CNS, producing a sense of euphoria and increased energy; excessive dosages cause hallucination

Drugs Normally Used as Medicines

- Drugs like barbiturates, amphetamines, benzodiazepines, LSD (Lysergic acid diethyl amides) are used as medicines to help patients with mental illness and insomnia.
- Morphine: It is a pain killer which is used for patients who have undergone surgery, but it is also abused.

Nicotine

- Present in tobacco, which is smoked, chewed or snuffed
- Mode of action: Stimulates the adrenal gland to release adrenaline and nor-adrenaline
- Effect: Increases blood pressure and heart rate

Ill Effects of Smoking

- Increased risk of diseases like bronchitis, emphysema, coronary heart disease, gastric ulcer and cancer (throat, lung and urinary bladder)
- Increased carbon monoxide levels in blood, leading to oxygen deficiency

Alcohol / Drug Abuse

Causes of alcohol/ Drug Abuse

- Alcohol / drug abuse normally starts in adolescence (period between 12-18 yrs – transition phase between childhood and adulthood).
- Many adolescents are motivated towards drugs/ alcohol due to curiosity and experimentation.
- Peer pressure, academic stress, unstable family structure further incline youth towards alcohol/ drug abuse.

- Perception of consuming alcohol / drug being cool and progressive and use of alcohol/drug in television, movies, etc. further promote this habit.

Alcohol/ Drug Addiction

- When a person uses alcohol/ drug repeatedly, he becomes addicted.
- Addiction refers to psychological attachment to certain effects such as euphoria and temporary feeling of well-being associated with use of alcohol or drugs.
- In addiction, tolerance level of receptors present in our body increases towards the drug.
- This drives the person to use them even when they are not required or when they tend to harm his health / family life.
- Subsequently, the user runs into a vicious circle of addiction and subsequent dependence.
- Dependence leads to manifestation of withdrawal syndrome on discontinuation of use.
- Withdrawal syndrome – Anxiety, nausea, sweating, shakiness, and sometimes may be lethal

Effects of Alcohol/ Drug Abuse

- Immediate effect – Vandalism, violence, and reckless behaviour
- Drop in academic performance, lack of interest in personal hygiene, rebellious behaviour, and change in eating and sleeping patterns, weight and appetite fluctuations
- Mental, psychological, and financial loss not only to the user, but also to his family
- Those who take drugs intravenously have a high risk of acquiring deadly diseases such as AIDS and hepatitis B.
- Damage to nervous system and liver (cirrhosis)
- Use of anabolic steroids by sportsperson have adverse effects:
    - In females – Increase of masculinity, aggressiveness, depression, abnormal menstrual cycle, facial hair growth, enlargement of clitoris, and deepening of voice

    - In males – Acne, aggressiveness, depression, reduction in size of testicles, decreased sperm production, enlargement of prostate gland, breast enlargement, premature baldness
- Ultimately, prolonged use of alcohol/drugs leads to coma and death.

Preventing Alcohol/ Drug Abuse

- It is better to prevent the inclination of an individual towards alcohol/ drugs right from adolescence. Some of the ways of prevention are:
    - Avoid peer pressure – Understand the unique personality and capabilities of a child
    - Education and counselling – A child must be taught to accept success and failure equally. Especially during adolescence, he must be inclined towards constructive activities such as music, yoga, sports, reading based on his interest.
    - Help from parents and peers – This includes proper guidance, advice, and trust to overcome problems such as stress and guilt.
    - Identifying danger signals – If any sign of symptom of alcohol / drug abuse is seen in the adolescent by family or friends, then it should not be ignored because prevention is better than cure.
- Seeking medical help – Psychologists and rehabilitation programs surely help an addict. Medical help should be sought to prevent further damage.