# CUET (UG) Biology Notes: Human Health and Disease

## 1. Introduction to Health

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

- Factors Affecting Health: 1. Genetic disorders (deficiencies acquired from parents).
  2. Infections.
  3. Lifestyle (food, water, rest, exercise, and habits).
- Pathogens: Disease-causing organisms (bacteria, viruses, fungi, protozoans, helminths). Most are parasites that harm the host by living in or on them.

## 2. Common Human Diseases

This table summarizes the highest-yield data points for competitive exams.

| Disease | Pathogen (Type) | Mode of Transmission | Key NCERT Symptoms & Tests |
|---|---|---|---|
| Typhoid | Salmonella typhi (Bacterium) | Contaminated food and water | Sustained high fever, weakness, stomach pain, constipation. Intestinal perforation in severe cases. Confirmed by Widal test. |
| Pneumonia | Streptococcus pneumoniae & Haemophilus influenzae (Bacteria) | Inhaling droplets/ aerosols from an infected person; sharing glasses | Infects the alveoli (air-filled sacs get filled with fluid). Fever, chills, cough. In severe cases, lips and fingernails turn bluish. |
| Common Cold | Rhinoviruses (Virus) | Droplets; contaminated objects (fomites) | Infects the nose and respiratory passage but NOT the lungs. Nasal congestion, sore throat, cough (lasts 3-7 days). |
| Malaria | Plasmodium (P. vivax, P. malariae, P. falciparum) (Protozoan) | Bite of female Anopheles mosquito (vector) | Rupture of RBCs releases a toxic substance called hemozoin, causing chills and high fever recurring every 3-4 days. |
| Amoebiasis | Entamoeba histolytica (Protozoan) | Contaminated food/water; Houseflies act as mechanical carriers | Amoebic dysentery. Constipation, abdominal pain, stools with excess mucus and blood clots. |
| Ascariasis | Ascaris lumbricoides (Helminth/Roundworm) | Soil, water, or plants contaminated with feces containing eggs | Internal bleeding, muscular pain, fever, anemia, and blockage of the |

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| | | | intestinal passage. |
| Filariasis | Wuchereria (W. bancrofti, W. malayi) (Helminth/Filarial worm) | Bite of female mosquito vectors | Elephantiasis. Slowly developing chronic inflammation of organs (usually lymphatic vessels of lower limbs and genital organs). |
| Ringworms | Microsporum, Trichophyton, Epidermophyton (Fungi) | Soil, or by using towels, clothes, or comb of infected individuals | Appearance of dry, scaly lesions on skin, nails, and scalp accompanied by intense itching. Heat and moisture help them grow. |

## 3. Immunity

The overall ability of the host to fight the disease-causing organisms conferred by the immune system.

### A. Innate Immunity

Non-specific defense present at the time of birth. It consists of four types of barriers:

1. Physical Barriers: Skin (main barrier) and mucus coating of the respiratory, gastrointestinal, and urogenital tracts.
2. Physiological Barriers: Acid in the stomach, saliva in the mouth, tears from eyes (prevent microbial growth).
3. Cellular Barriers: Polymorphonuclear leukocytes (PMNL-neutrophils), monocytes, and macrophages (phagocytose and destroy microbes).
4. Cytokine Barriers: Virus-infected cells secrete proteins called interferons which protect non-infected cells from further viral infection.



### B. Acquired Immunity

Pathogen-specific defense characterized by memory.

- Primary Response: Low intensity upon first encounter.
- Secondary (Anamnestic) Response: Highly intensified upon subsequent encounters due to memory cells.
- B-Lymphocytes: Produce an army of proteins called antibodies in the blood.
- T-Lymphocytes: Do not produce antibodies but help B cells produce them. Mediate Cell-Mediated Immunity (CMI), which is responsible for graft rejection (tissue matching/blood grouping is required before organ transplants).
- Antibody Structure: Represented as $H_2L_2$ (2 Light chains, 2 Heavy chains linked by disulfide bonds). Five classes: IgA, IgM, IgE, IgG, IgD.

### C. Active vs. Passive Immunity

- Active: Host produces its own antibodies (slow process). Induced by natural infection or vaccination.
- Passive: Ready-made antibodies are directly given to protect the body quickly.

- Examples: Colostrum (mother's first milk) is rich in IgA. Anti-tetanus serum, Anti-snake venom.

**D. Allergies & Auto-immunity**

- Allergies: Exaggerated response of the immune system to certain antigens (allergens). Involves IgE antibodies and release of chemicals like histamine and serotonin from mast cells. Treated with antihistamines, adrenaline, and steroids.
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- Auto-immunity: Due to genetic or unknown reasons, the body attacks self-cells (e.g., Rheumatoid arthritis).



**E. Human Immune System (Lymphoid Organs)**

- Primary Lymphoid Organs: Where immature lymphocytes differentiate into antigen-sensitive lymphocytes (Bone marrow and Thymus).
- Secondary Lymphoid Organs: Provide sites for interaction of lymphocytes with antigens (Spleen, lymph nodes, tonsils, Peyer's patches).
- MALT (Mucosa-Associated Lymphoid Tissue): Constitutes about 50% of the lymphoid tissue in the human body.

**4. AIDS (Acquired Immuno Deficiency Syndrome)**

Caused by the Human Immunodeficiency Virus (HIV), a retrovirus with an RNA genome.

- Transmission: Sexual contact, contaminated blood transfusions, sharing infected needles, and from infected mother to child through the placenta.
- Mechanism: 1. Virus enters Macrophages (acts as an "HIV factory" as viral RNA forms viral DNA via reverse transcriptase).
  2. Virus simultaneously enters Helper T-lymphocytes ($T_H$), replicates, and destroys them.
  3. The progressive decrease in $T_H$ cells leads to severe immune deficiency, making the person susceptible to ordinary infections (like Mycobacterium, Toxoplasma).
- Diagnosis: ELISA (Enzyme-Linked Immuno-Sorbent Assay). Treatment with anti-retroviral drugs is only partially effective.

5. Cancer

One of the most dreaded diseases. Cancer cells lose the property of contact inhibition (where contact with other cells inhibits their uncontrolled growth).

- Tumors: * Benign: Remain confined to their original location.
  - Malignant: Proliferating cells (neoplastic/tumor cells) grow rapidly, invading and damaging surrounding normal tissues. They exhibit metastasis (cells sloughed off enter the bloodstream and start new tumors elsewhere).
- Causes (Carcinogens): * Physical: X-rays, gamma rays, UV rays.
  - Chemical: Tobacco smoke (major cause of lung cancer).
  - Biological: Oncogenic viruses. Normal cells contain cellular oncogenes (c-onc or proto-oncogenes) which, when activated, lead to oncogenic transformation.
- Detection: Biopsy and histopathology (blood/bone marrow tests for leukemia), Radiography (X-rays), CT (Computed

Tomography - 3D internal imaging), MRI (Magnetic Resonance Imaging - uses strong magnetic fields/non-ionising radiation).

## 6. Drugs and Alcohol Abuse

Commonly abused drugs include opioids, cannabinoids, and coca alkaloids.

| Drug Category | Source & Chemical Nature | Mode of Intake & Target System | Effects on the Body |
|---|---|---|---|
| Opioids (Heroin/Smack) | Extracted from latex of poppy plant (Papaver somniferum). Chemically it is diacetylmorphine. | Snorting and injection. Binds to receptors in CNS and gastrointestinal tract. | It is a depressant and slows down body functions. |
| Cannabinoids (Marijuana, Hashish, Charas, Ganja) | Inflorescence, leaves, and resins of the hemp plant (Cannabis sativa). | Inhalation and oral ingestion. Binds to brain receptors. | Known for their effects on the cardiovascular system of the body. |
| Coca Alkaloids (Cocaine/ Crack) | Extracted from the coca plant (Erythroxylum coca), native to South America. | Sniffed/snorted. Interferes with the transport of the neurotransmitter dopamine. | Potent stimulant action on CNS, producing euphoria and increased energy. Excessive dosage causes hallucinations. |

- Tobacco: Contains nicotine (an alkaloid) which stimulates the adrenal gland to release adrenaline/nor-adrenaline. Smoking increases carbon monoxide ($CO$) content in blood and reduces the concentration of heme-bound oxygen.
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- Adolescence & Addiction: Addiction is a psychological attachment to certain effects (euphoria) associated with drugs and alcohol. Repeated use builds tolerance, leading to higher dosage requirements.
- Withdrawal Syndrome: Sudden discontinuation in regular users causes anxiety, shakiness, nausea, and sweating.
- Prevention & Control: Avoid undue peer pressure, education and counseling, seeking help from parents/peers, looking for danger signs, and seeking professional medical help.