

CUET · BIOLOGY · CLASS XII · CODE 304

Human Health and Disease

CUET unit: Biology and Human Welfare → Human Health and Disease

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Snapshot

- Defines health as a state of complete physical, mental and social well-being — not merely absence of disease — and groups diseases into infectious and non-infectious categories.
- Surveys common human diseases caused by bacteria (typhoid, pneumonia), viruses (common cold), protozoans (malaria, amoebiasis), helminths (ascariasis, filariasis) and fungi (ringworms), together with their pathogens, symptoms and routes of transmission.
- Explains innate immunity (four barriers) and acquired immunity (humoral B-cell and cell-mediated T-cell responses), antibody structure (H₂L₂), active vs passive immunity and vaccination.
- Covers two major non-infectious threats — AIDS (HIV retrovirus, reverse transcriptase, ELISA, anti-retroviral drugs) and cancer (benign vs malignant, metastasis, oncogenes, biopsy, radiotherapy/chemotherapy/immunotherapy).
- Closes with drugs and alcohol abuse — opioids, cannabinoids, coca alkaloids, tobacco — their sources, effects, addiction/dependence and prevention strategies for adolescents. This chapter is a high-yield CUET unit and questions are virtually guaranteed every year.

Detailed Notes

2.1 Core concepts

- **Health** is a state of complete physical, mental and social well-being; it depends on (i) genetic disorders, (ii) infections, and (iii) lifestyle including food, water, rest and exercise (NCERT §7 intro, p. 129–130).
- Diseases are grouped into **infectious** (easily transmitted person-to-person) and **non-infectious**; AIDS is a fatal infectious disease and cancer is the major non-infectious killer (NCERT §7 intro, p. 130).
- **Typhoid** is caused by **Salmonella typhi**, enters via contaminated food/water, gives sustained 39–40°C fever, weakness, stomach pain, constipation, headache; confirmed by **Widal test**. **Mary Mallon** ("Typhoid Mary") was a famous carrier (NCERT §7.1, p. 130–131).
- **Pneumonia** is caused by **Streptococcus pneumoniae** and **Haemophilus influenzae**; alveoli fill with fluid; symptoms include fever, chills, cough, headache and gray/bluish

lips & nails in severe cases; spreads through droplets or shared utensils (NCERT §7.1, p. 131).

- **Common cold** is caused by **Rhino viruses**, infecting the nose and respiratory passage **but not the lungs**; symptoms last 3–7 days (NCERT §7.1, p. 131).
- **Malaria** is caused by *Plasmodium* (*P. vivax*, *P. malaria*, *P. falciparum*); **malignant malaria** by *P. falciparum* is the most serious. Sporozoites enter via female *Anopheles* bite, multiply in liver, then attack RBCs; rupture releases the toxin **haemozoin** causing chill and fever every 3–4 days. Malarial parasite needs two hosts — human and mosquito (NCERT §7.1, p. 131, Fig. 7.1).
- **Amoebiasis (amoebic dysentery)** is caused by *Entamoeba histolytica* in the large intestine; **houseflies** act as mechanical carriers; symptoms include constipation, abdominal pain, stools with mucous and blood clots (NCERT §7.1, p. 132–133).
- **Ascariasis** is caused by *Ascaris* (roundworm); symptoms include internal bleeding, muscular pain, fever, anemia and intestinal blockage; acquired through contaminated water/vegetables/fruits (NCERT §7.1, p. 133).
- **Filariasis (elephantiasis)** is caused by *Wuchereria* (*W. bancrofti* and *W. malayi*); chronic inflammation of lymphatic vessels of the lower limbs; transmitted by female mosquito vectors (NCERT §7.1, p. 133, Fig. 7.2).
- **Ringworms** are caused by fungi of genera *Microsporum*, *Trichophyton* and *Epidermophyton*; produce dry scaly itchy lesions; thrive in skin folds; acquired from soil, towels, clothes, combs (NCERT §7.1, p. 133, Fig. 7.3).
- For vector-borne diseases (malaria, filariasis) control of vectors is paramount; recent **Aedes mosquito** outbreaks have caused dengue and chikungunya in India (NCERT §7.1, p. 134).
- **Innate immunity** is non-specific, present at birth, with four barriers — **physical** (skin, mucus), **physiological** (acid in stomach, saliva, tears), **cellular** (neutrophils, monocytes, NK cells, macrophages) and **cytokine** (interferons from virus-infected cells) (NCERT §7.2.1, p. 134–135).
- **Acquired immunity** is pathogen-specific and has memory: **primary response** is low-intensity on first exposure, **secondary/anamnestic response** is highly intensified (NCERT §7.2.2, p. 135).
- B-lymphocytes produce **antibodies**; T-lymphocytes help B-cells and also mediate **cell-mediated immunity (CMI)**. Each antibody is **H2L2** — two heavy + two light peptide chains. Types: **IgA, IgD, IgE, IgG, IgM**. Antibody-mediated response = **humoral immune response** (NCERT §7.2.2, p. 135–136, Fig. 7.4).
- CMI is responsible for **graft rejection** — the body distinguishes 'self' from 'non-self' (NCERT §7.2.2, p. 136).
- **Active immunity** = host produces antibodies after exposure to antigen (slow); **passive immunity** = ready-made antibodies given. Examples: **colostrum** (IgA-rich,

mother's first milk) and antibodies via placenta during pregnancy (NCERT §7.2.3, p. 136).

- **Vaccination** uses inactivated/weakened pathogen or antigenic proteins to create memory B and T-cells. **Passive immunisation** uses preformed antibodies (tetanus antitoxin, snake antivenom). **Recombinant DNA technology** produces vaccines like the **hepatitis B vaccine from yeast** (NCERT §7.2.4, p. 136).
- **Allergy** = exaggerated immune response to environmental antigens (allergens like dust mites, pollens, animal dander). Antibodies are **IgE**; chemicals released are **histamine and serotonin** from mast cells; treated with anti-histamine, adrenalin, steroids (NCERT §7.2.5, p. 137).
- **Auto-immune disease** — body attacks its own cells; example **rheumatoid arthritis** (NCERT §7.2.6, p. 137).
- **Primary lymphoid organs**: bone marrow and thymus (lymphocyte maturation). **Secondary lymphoid organs**: spleen, lymph nodes, tonsils, Peyer's patches, appendix. **MALT** = mucosa-associated lymphoid tissue, ~50% of body's lymphoid tissue (NCERT §7.2.7, p. 137–138, Fig. 7.5).
- **AIDS** (Acquired Immuno Deficiency Syndrome) was first reported in **1981**; caused by **HIV**, a **retrovirus** with an envelope enclosing an **RNA genome**. Transmission: sexual contact, contaminated blood, shared infected needles, infected mother to child via placenta. Time lag between infection and symptoms = 5–10 years (NCERT §7.3, p. 138–139, Fig. 7.6).
- HIV enters macrophages; **reverse transcriptase** converts viral RNA into viral DNA, which integrates into host DNA. HIV then attacks **helper T-lymphocytes (TH)**, progressively decreasing their number; patient becomes immuno-deficient. Diagnostic test = **ELISA (enzyme linked immuno-sorbent assay)**. Treatment with anti-retroviral drugs only prolongs life (NCERT §7.3, p. 140).
- Prevention efforts include **NACO** (National AIDS Control Organisation), safe blood, disposable needles, condoms, safe sex (NCERT §7.3, p. 140).
- **Cancer**: cancer cells have lost **contact inhibition**; masses are called **tumors**. **Benign tumors** stay confined; **malignant tumors** (neoplastic cells) divide rapidly, invade nearby tissues, starve normal cells and undergo **metastasis** — spread via blood to start tumors elsewhere (NCERT §7.4, p. 141).
- **Carcinogens** cause cancer — ionising radiations (X-rays, gamma rays), non-ionising (UV) cause DNA damage; chemical carcinogens in tobacco smoke cause lung cancer. **Oncogenic viruses** carry **viral oncogenes**; normal cells contain **cellular oncogenes (c-onc) / proto-oncogenes** which on activation cause oncogenic transformation (NCERT §7.4, p. 141).
- Cancer detection uses **biopsy and histopathology**, blood/bone marrow tests for leukemias, **radiography, CT, MRI**, antibodies against cancer-specific antigens, and molecular biology for inherited susceptibility (NCERT §7.4, p. 141–142).

- Cancer treatment: **surgery, radiotherapy, chemotherapy, immunotherapy**. Biological response modifiers like **α -interferon** activate the immune system to destroy the tumor (NCERT §7.4, p. 142).
- **Opioids** bind to opioid receptors in CNS and gastrointestinal tract. **Heroin (smack)** = diacetylmorphine, made by acetylation of morphine from latex of opium poppy **Papaver somniferum**; taken by snorting/injection; depressant (NCERT §7.5, p. 142–143, Fig. 7.7–7.8).
- **Cannabinoids** interact with cannabinoid receptors mainly in the brain; obtained from inflorescences of **Cannabis sativa**; flower tops, leaves and resin produce **marijuana, hashish, charas and ganja**; affect cardiovascular system; taken by inhalation/oral ingestion (NCERT §7.5, p. 143, Fig. 7.9–7.10).
- **Cocaine (coke/crack)** is a coca alkaloid from **Erythroxylum coca** (South America); interferes with neurotransmitter **dopamine** transport; potent CNS stimulant; excessive doses cause hallucinations. Other hallucinogenic plants: **Atropa belladonna** and **Datura** (NCERT §7.5, p. 143, Fig. 7.11).
- **Tobacco** contains **nicotine**, an alkaloid; stimulates adrenal gland to release adrenaline and nor-adrenaline (raising BP, heart rate); linked to lung/bladder/throat cancer, bronchitis, emphysema, coronary heart disease; smoking raises CO in blood, reducing haem-bound oxygen (NCERT §7.5, p. 144).
- **Addiction** is psychological attachment to drug-induced euphoria; **dependence** leads to a **withdrawal syndrome** (anxiety, shakiness, nausea, sweating) on stopping (NCERT §7.5.2, p. 145).
- Intravenous drug abuse spreads AIDS and Hepatitis B through shared needles; chronic alcohol use causes liver **cirrhosis**; misuse of anabolic steroids by sportspersons causes masculinisation in females and acne, mood swings, testicular shrinkage in males (NCERT §7.5.3, p. 146).
- Prevention measures: avoid undue peer pressure, education and counselling, seeking help from parents/peers, looking for danger signs, professional/medical help via psychologists and de-addiction programmes (NCERT §7.5.4, p. 146–147).

2.2 Definitions to memorise

Term	Definition	Page
Health	A state of complete physical, mental and social well-being	130
Pathogen	Disease-causing organism (bacteria, virus, fungus, protozoan, helminth, etc.)	130
Widal test	Diagnostic test to confirm typhoid fever	131
Haemozoin	Toxin released on RBC rupture during malaria; causes chill and high fever	131
Vector		131

Term	Definition	Page
	Transmitting agent (e.g., female <i>Anopheles</i> mosquito for malaria)	
Innate immunity	Non-specific defence present at birth via four barriers	134
Cytokine barriers	Interferons secreted by virus-infected cells that protect adjacent cells	135
Primary response	Low-intensity acquired immune response on first pathogen encounter	135
Secondary (anamnestic) response	Highly intensified response on subsequent encounter	135
Antibody (H ₂ L ₂)	Y-shaped protein with two heavy + two light peptide chains	135
Humoral immune response	Antibody-mediated immunity carried out by B-lymphocytes	135
Cell-mediated immunity (CMI)	T-lymphocyte-mediated immunity; responsible for graft rejection	135
Active immunity	Host produces own antibodies after antigen exposure	136
Passive immunity	Ready-made antibodies given; e.g., colostrum (IgA)	136
Colostrum	Yellowish first milk rich in IgA antibodies	136
Allergy	Exaggerated immune response (IgE) to environmental allergens	137
Auto-immune disease	Body attacks self-cells; e.g., rheumatoid arthritis	137
MALT	Mucosa-associated lymphoid tissue; ~50% of body's lymphoid tissue	138
Retrovirus	Virus with an RNA genome enclosed in envelope; HIV is one	138
Reverse transcriptase	Enzyme converting viral RNA into viral DNA in host	140
ELISA	Enzyme linked immuno-sorbent assay — diagnostic test for AIDS	140
Contact inhibition	Property of normal cells to stop dividing on contact; lost in cancer	141
Metastasis	Spread of malignant tumor cells via blood to distant sites	141
Carcinogens	Physical/chemical/biological agents that cause cancer	141
Proto-oncogenes	Normal cellular genes (c-onc) that can cause cancer when activated	141
Addiction	Psychological attachment to euphoria from drug/alcohol use	145

Term	Definition	Page
Withdrawal syndrome	Anxiety, shakiness, nausea, sweating on stopping drug/ alcohol	145
Cirrhosis	Liver damage from chronic alcohol/drug use	146

2.3 Diagrams / processes to remember

- **Figure 7.1 — Life cycle of Plasmodium** (p. 132): sporozoites injected by *Anopheles* → liver cell asexual reproduction → RBC infection and rupture → gametocytes taken up by female mosquito → fertilisation in mosquito gut → sporozoites migrate to salivary glands.
- **Figure 7.2 — Elephantiasis** (p. 133): inflammation of lower limb due to *Wuchereria* in lymphatic vessels.
- **Figure 7.3 — Ringworm lesion** on skin (p. 133).
- **Figure 7.4 — Antibody structure** (p. 135): Y-shaped, two antigen-binding sites at N-terminus, two **light chains** and two **heavy chains**; represented as H₂L₂.
- **Figure 7.5 — Lymph nodes / lymphoid organs** in human body (p. 138).
- **Figure 7.6 — Replication of retrovirus (HIV)** (p. 139): viral RNA core → enters cell → viral DNA produced by reverse transcriptase → integrates into host genome → new viral RNA → new viruses released.
- **Figure 7.7 — Chemical structure of morphine** (p. 142).
- **Figure 7.8 — Opium poppy** *Papaver somniferum* (p. 142).
- **Figure 7.9 — Cannabinoid skeletal structure** and **Figure 7.10 — Leaves of Cannabis sativa** (p. 143).
- **Figure 7.11 — Datura flowering branch** (p. 143).

2.4 Common confusions / NTA trap points

- *Aedes* is the vector for **dengue and chikungunya**, NOT for amoebiasis (amoebiasis uses **houseflies** as mechanical carriers) and NOT for malaria (which uses **female Anopheles**).
- Common cold infects the **nose and respiratory passage but NOT the lungs** — students often wrongly mark "lungs".
- Antibody is **H₂L₂** (two heavy + two light chains), not H₄ or L₄.
- The mother's gift of **colostrum (IgA-rich)** is **passive** immunity, not active.
- **Reverse transcriptase** is found in HIV (a retrovirus) and makes **DNA from RNA**, not the other way.
- *Plasmodium falciparum* causes **malignant malaria** — most fatal species; do not confuse with *P. vivax* (most common, less severe).

- **Primary** lymphoid organs = bone marrow + thymus; **secondary** = spleen, lymph nodes, tonsils, Peyer's patches, appendix. Students mix the two.
- **Hepatitis B vaccine** is made from **yeast** (recombinant DNA), not from inactivated virus in the NCERT context.
- **Heroin (smack)** = diacetylmorphine made from **morphine** of *Papaver somniferum*; **cocaine** is from *Erythroxylum coca*. These often get swapped.

Practice MCQs

Q1. The Widal test is used to confirm which of the following diseases?

- A. Malaria
- B. Pneumonia
- C. Typhoid
- D. Amoebiasis

Q2. Which of the following pairs of bacteria is responsible for pneumonia in humans?

- A. *Salmonella typhi* and *Haemophilus influenzae*
- B. *Streptococcus pneumoniae* and *Haemophilus influenzae*
- C. *Streptococcus pneumoniae* and *Salmonella typhi*
- D. *Mycobacterium* and *Streptococcus pneumoniae*

Q3. Which species of *Plasmodium* causes the most serious, malignant form of malaria?

- A. *Plasmodium vivax*
- B. *Plasmodium malariae*
- C. *Plasmodium falciparum*
- D. *Plasmodium ovale*

 **12 more MCQs + answer key**

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PYQ Alignment

This chapter is one of the most reliably tested units in CUET (UG) Biology — pathogen-disease pairings (typhoid–*Salmonella typhi*, malaria–*Plasmodium falciparum*, filariasis–*Wuchereria*, ringworm fungi), antibody structure (H2L2), innate immunity barriers, active vs passive immunity (colostrum), HIV biology (retrovirus, reverse transcriptase, ELISA, helper T-cell), cancer terminology (metastasis, contact inhibition, proto-oncogenes) and drug sources (*Papaver somniferum*, *Cannabis sativa*, *Erythroxylum coca*) feature almost every year as direct recall, match-the-following or assertion–reason questions.

CUET 2025 — Actual PYQs from this chapter

Q.2 (CUET 2025) Antibody molecule has:

- A) Two peptide chains
- B) Three peptide chains
- C) Four peptide chains
- D) One polypeptide chain

Tests: aligns with §2 (health & disease) **Answer:** Not in extracted key — verify against official NTA key

Q.4 (CUET 2025) Match List-I (Disease) with List-II (Characteristic symptoms). List-I List-II (A) Malaria (i) Inflammation of lower limb (B) Filariasis (ii) Cycles of fever (C) Ringworms (iii) Blood clots and excess mucus in stools (D) Amoebiasis (iv) Scaly lesions on nails

- A) [option not extracted — see source]
- B) [option not extracted — see source]
- C) [option not extracted — see source]
- D) [option not extracted — see source]

Tests: aligns with §2 (common human diseases — symptoms) **Answer:** Not in extracted key — verify against official NTA key

Q.8 (CUET 2025) Which type of innate immunity is exhibited by interferons secreted by virus-infected cells?

- A) Physical barriers
- B) Cytokine barriers
- C) Physiological barriers
- D) Cellular barriers

Tests: aligns with §2 (health & disease) **Answer:** Not in extracted key — verify against official NTA key

Q.17 (CUET 2025) Which of the following is incorrect regarding drug abuse?

- A) Cannabinoids affect cardiovascular system
- B) Heroin extracted from *Papaver somniferum*
- C) Nicotine is a sedative and pain killer
- D) Excess dosage of coca alkaloid causes hallucinations

Tests: aligns with §2 (health & disease) **Answer:** Not in extracted key — verify against official NTA key

CUET 2024 — Actual PYQs from this chapter

Q.19 (CUET 2024) Identify incorrect statements about diseases: (A) Typhoid severe cases cause intestinal perforation (B) Common cold caused by Rhinovirus (C) Pneumonia causes bluish lips and nails (D) Pneumonia caused by *Salmonella* (E) Typhoid confirmed by Widal test

- A) [option not extracted — see source]
- B) [option not extracted — see source]
- C) [option not extracted — see source]
- D) [option not extracted — see source]

Tests: aligns with §2 (health & disease) **Answer:** Not in extracted key — verify against official NTA key

Q.20 (CUET 2024) Match types of immune barriers with examples. Cytokine, Physical, Cellular, Physiological barriers.

- A) [option not extracted — see source]
- B) [option not extracted — see source]
- C) [option not extracted — see source]
- D) [option not extracted — see source]

Tests: aligns with §2 (health & disease) **Answer:** Not in extracted key — verify against official NTA key

Q.21 (CUET 2024) Smack is chemically: 1. Diacetyl morphine 2. Cocaine 3. Benzodiazepine 4. Amphetamine 22. Antibodies are secreted by: 1. T-cells 2. B-cells 3. Alpha cells 4. Beta cells 23. In sewage treatment, flocs are: 1. Solids settling during sedimentation 2. Supernatant above sludge 3. Mass of bacteria with fungal filaments 4. Anaerobic bacteria 24. Match products with microorganisms. Statin, Clot buster, Swiss cheese, Cyclosporin-A. 25. Beetle used as biocontrol agent for aphids:

- A) *Trichoderma*
- B) Dragonflies
- C) Ladybird
- D) Silverfish

Tests: aligns with §2 (drugs of abuse — chemistry of smack) **Answer:** Not in extracted key — verify against official NTA key

CUET 2023 — Actual PYQs from this chapter

Q.18 (CUET 2023) Match List-I with List-II List-I (A) Lymphoid organ (B) Cancer (C) HIV (D) Typhoid List-II (I) ELISA (II) Widal test (III) Bone marrow and thymus (IV) Carcinogens

- A) A-IV, B-II, C-I, D-III
- B) A-III, B-IV, C-I, D-II
- C) A-II, B-III, C-IV, D-I
- D) A-I, B-III, C-II, D-IV

Tests: aligns with §2 (health & disease) **Answer:** Not in extracted key — verify against official NTA key

Q.19 (CUET 2023) The statements not true for allergy are: (A) Allergy is due to chemicals like histamine and serotonin. (B) Allergens are substances which cause allergy. (C) Antibodies produced are IgA type. (D) Adrenaline and steroids quickly enhance symptoms.

- A) C and D only
- B) A and C only
- C) A and B only
- D) B and D only

Tests: aligns with §2 (health & disease) **Answer:** Not in extracted key — verify against official NTA key

Q.20 (CUET 2023) Match causal agent with disease (A) Salmonella typhi (B) Streptococcus pneumoniae (C) Rhino virus (D) Plasmodium (I) Typhoid (II) Pneumonia (III) Common cold (IV) Malaria

- A) A-I, B-II, C-III, D-IV
- B) A-III, B-I, C-IV, D-II
- C) A-II, B-III, C-IV, D-I
- D) A-IV, B-III, C-I, D-II

Tests: aligns with §2 (health & disease) **Answer:** Not in extracted key — verify against official NTA key