Ch 7 · Human Health & Disease

अध्याय 7 · मानव स्वास्थ्य तथा रोग

Class 12 Biology · NCERT based · English + हिंदी · ✍️ revision notes

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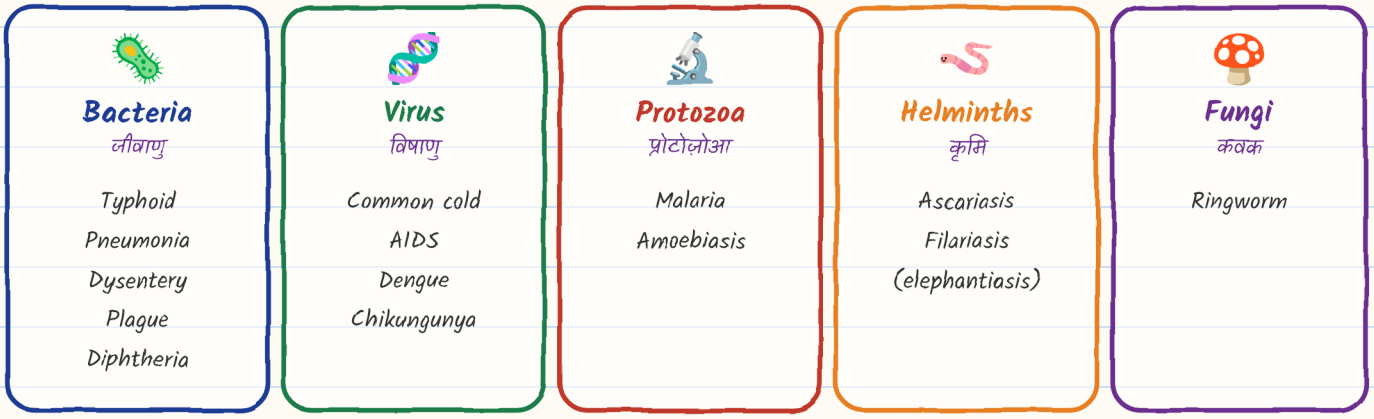
1. Health & Common Diseases / स्वास्थ्य व सामान्य रोग

Health (स्वास्थ्य) = a state of complete physical, mental and social well-being – not just absence of disease.

स्वास्थ्य का अर्थ है पूर्ण शारीरिक, मानसिक एवं सामाजिक खुशहाली की अवस्था।

- Health is affected by: ① **genetic disorders** – inherited from parents; ② **infections**; ③ **life style** – food & water, rest & exercise, habits.
- Old belief: "good humour" theory (Hippocrates & Indian Ayurveda) – health = balance of "humours". **William Harvey** discovered blood circulation & disproved the "good humour" hypothesis (showed normal body temperature with a thermometer).
- **Infectious diseases** (संक्रामक) – easily transmitted from one person to another (e.g. AIDS). **Non-infectious** – not transmitted (e.g. cancer – major cause of death).
- **Pathogens** (रोगजनक) = disease-causing organisms: bacteria, viruses, fungi, protozoans, helminths.

Common human diseases by pathogen · रोगजनक के अनुसार रोग



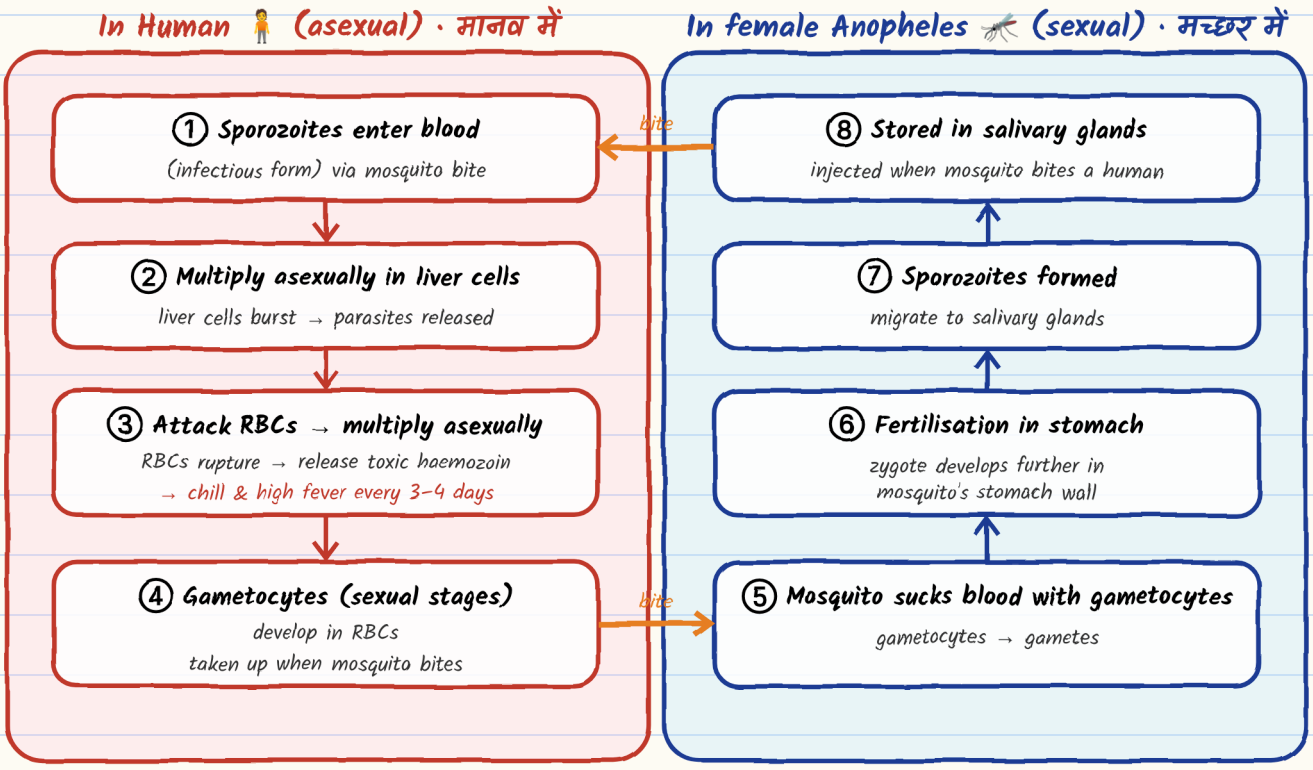
Infographic: Classification of common diseases

Disease	Pathogen	Organ / Spread	Symptoms
Typhoid टाइफाइड	*Salmonella typhi* (bacterium)	Enters **small intestine** via contaminated food & water; migrates to other organs through blood	Sustained high fever (**39–40 °C**), weakness, stomach pain, constipation, headache, loss of appetite. Severe: **intestinal perforation** & death. Confirmed by **Widal test**.
Pneumonia न्यूमोनिया	*Streptococcus pneumoniae* & *Haemophilus influenzae*	Infects **alveoli** of lungs → filled with fluid. Spread by inhaling **droplets/aerosols**, sharing glasses & utensils	Fever, chills, cough, headache. Severe: **lips & finger nails grey to bluish** colour.
Common cold सामान्य जुकाम	**Rhinoviruses**	Nose & respiratory passage, **not lungs**. Droplets; contaminated objects (pens, books, cups, doorknobs, keyboard, mouse)	Nasal congestion & discharge, sore throat, hoarseness, cough, headache, tiredness; lasts **3–7 days**.
Malaria मलेरिया	*Plasmodium* (*P. vivax, P. malariae, P. falciparum*)	Liver & RBCs; vector: **female *Anopheles***	Chill & high fever recurring every **3–4 days** (due to **haemozoin**).
Amoebiasis (amoebic dysentery) अमीबता	*Entamoeba histolytica*	**Large intestine**; **houseflies** = mechanical carriers; contaminated food & water	Constipation, abdominal pain & cramps, stools with excess **mucous & blood clots**.
Ascariasis ऐस्कैरिसता	*Ascaris* (common round worm)	**Intestine**; eggs in faeces contaminate soil, water, plants; via contaminated water, vegetables, fruits	Internal bleeding, muscular pain, fever, anaemia, **blockage of intestinal passage**.
Filariasis / Elephantiasis फ़ीलपाँव	*Wuchereria* (*W. bancrofti, W. malayi*)	**Lymphatic vessels of lower limbs**; vector: **female mosquito** (*Culex*)	Chronic inflammation, gross deformities of limbs & **genital organs**.
Ringworm दाद	*Microsporum, Trichophyton, Epidermophyton* (fungi)	Skin, nails, scalp; from soil or sharing towels, clothes, comb. **Heat & moisture** help growth (groin, between toes)	Dry, scaly lesions; **intense itching**.

📌 **Exam Tip:** **Mary Mallon** ("Typhoid Mary") – a cook who was a **typhoid carrier**; continued to spread typhoid for several years through the food she prepared.

P. falciparum causes **malignant malaria** – the most serious, can even be fatal.

2. Malaria – Life Cycle of Plasmodium / प्लाज्मोडियम का जीवन चक्र



Infographic: Life cycle of malarial parasite · मलेरिया परजीवी का जीवन चक्र

- *Plasmodium* needs **two hosts**: human (**intermediate host**, asexual) & female *Anopheles* (**definitive host**, sexual) to complete life cycle.
- Infectious form = sporozoites. Fever is due to haemozoin (toxic substance) released on rupture of RBCs.
- Female *Anopheles* = **vector** (transmitting agent).

3. Prevention & Control of Diseases / रोगों से बचाव व नियंत्रण

Measure	Examples
Personal hygiene	Keep body clean; consume clean drinking water, food, vegetables, fruits
Public hygiene	Proper disposal of waste & excreta; periodic cleaning & disinfection of water reservoirs, pools, cesspools, tanks; standard practices in public catering
Air-borne diseases (pneumonia, cold)	Avoid close contact with infected persons or their belongings
Vector-borne (malaria, filariasis, dengue, chikungunya)	Control/eliminate vectors & breeding places: avoid stagnation of water; regular cleaning of household coolers; use of **mosquito nets**; introduce larvivorous fish like *Gambusia* in ponds (feeds on mosquito larvae); spray insecticides in ditches, drainage, swamps; doors & windows with **wire mesh**

📌 **Remember:** **Dengue & Chikungunya** – transmitted by *Aedes* mosquitoes. **Malaria** – *Anopheles*. **Filariasis** – *Culex*.

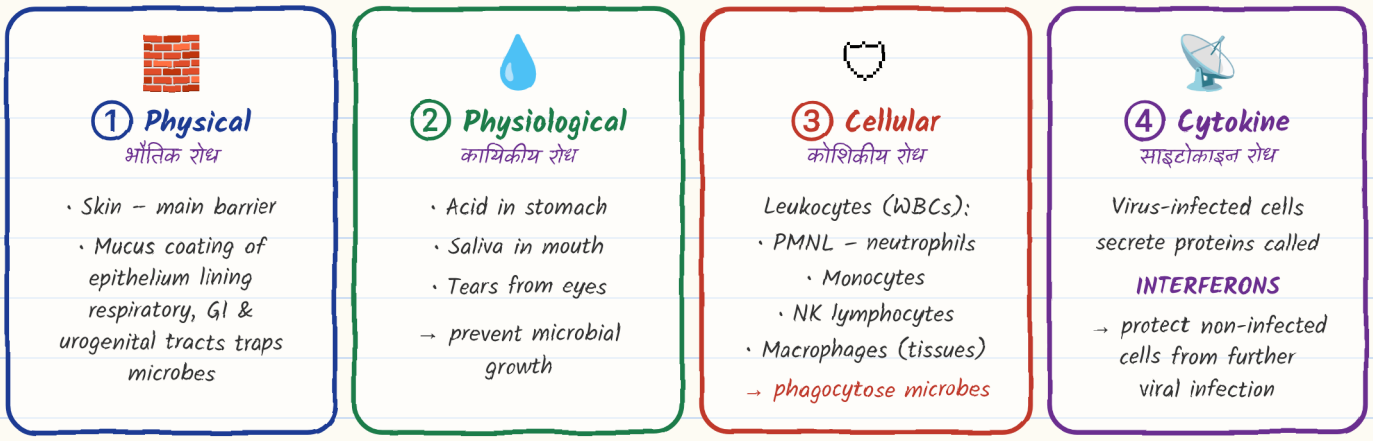
Vaccines & immunisation programmes have **eradicated smallpox** & controlled polio, diphtheria, pneumonia & tetanus. Antibiotics & drugs helped treat infectious diseases.

4. Immunity / प्रतिरक्षा

Immunity = overall ability of the host to **fight disease-causing organisms**, conferred by the immune system. Two types: **innate** & **acquired**.

(a) Innate immunity सहज प्रतिरक्षा

Non-specific type of defence, **present at the time of birth**. Provided by 4 types of barriers to entry of foreign agents:



Infographic: 4 barriers of innate immunity · सहज प्रतिरक्षा के 4 रोध

PMNL = polymorpho-nuclear leukocytes; NK = natural killer cells.

(b) Acquired immunity उपार्जित प्रतिरक्षा

- **Pathogen-specific**; characterised by memory.
- First encounter with a pathogen → **primary response** of **low intensity**. Subsequent encounter with same pathogen → highly intensified **secondary (anamnestic) response** – because body remembers the first encounter.
- Primary & secondary responses are carried out with the help of two special types of lymphocytes in blood: B-lymphocytes & T-lymphocytes.

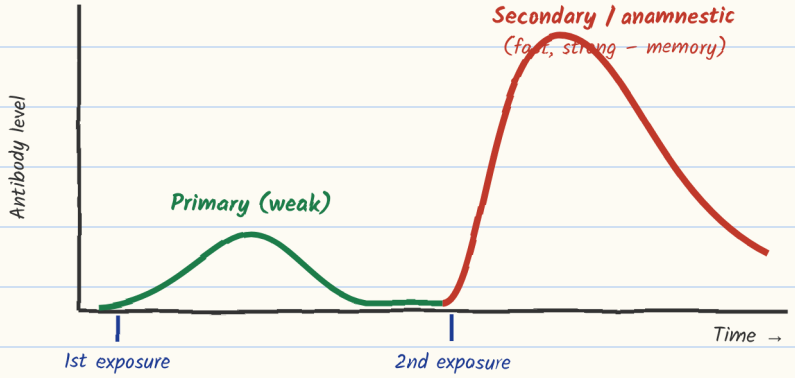


Fig: Primary vs secondary immune response

Antibody structure प्रतिरक्षी की संरचना

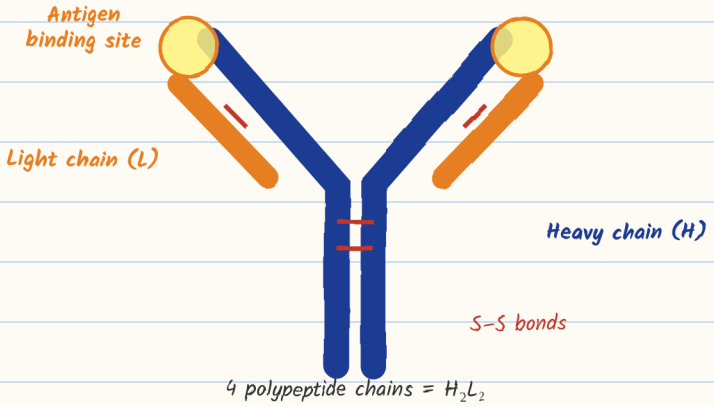


Fig: Structure of an antibody molecule · प्रतिरक्षी अणु

- **B-lymphocytes** produce an army of proteins in response to pathogens into our blood to fight them = antibodies (प्रतिरक्षी).
- **T-cells** themselves don't secrete antibodies but **help B-cells** produce them.
- Each antibody has 4 peptide chains – **2 small light** chains & **2 longer heavy** chains → represented as H_2L_2.
- Types: IgA, IgM, IgE, IgG.
- Antibodies are found in blood → this response is called humoral immune response (तरल प्रतिरक्षा अनुक्रिया).
- Second type – mediated by **T-lymphocytes** = cell-mediated immune response (CMI) (कोशिका माध्यित).

📌 **Graft rejection (CMI):** When organs like heart, eye, liver, kidney fail, transplantation is the only remedy. Grafts from just any source (animal/human) can't be done – they get **rejected** sooner or later. **Tissue matching & blood group matching** are essential; even after this, patient takes **immuno-suppressants** all his/her life. Body can differentiate **'self' and 'nonself'**, and **CMI is responsible for graft rejection**.

(c) Active & Passive immunity सक्रिय व निष्क्रिय प्रतिरक्षा

Active immunity (सक्रिय)	Passive immunity (निष्क्रिय)
Host body **produces its own antibodies** on exposure to antigens (living/dead microbes or other proteins)	**Ready-made antibodies** are directly given to protect the body
Slow – takes time to give full effective response	**Quick**, immediate protection
Long-lasting; has memory	Short-lived
e.g. natural infection; **vaccination** (deliberate injection of microbes)	e.g. **colostrum** – yellowish fluid secreted by mother in initial days of lactation, has abundant IgA; foetus receives IgG through **placenta**; anti-tetanus, antivenom injections

5. Vaccination, Allergies & Autoimmunity / टीकाकरण, एलर्जी व स्व-प्रतिरक्षा

(a) Vaccination & immunisation टीकाकरण व प्रतिरक्षीकरण

- Based on the property of "memory" of the immune system.
- A preparation of antigenic proteins of pathogen or **inactivated/weakened pathogen** (vaccine) is introduced → generates antibodies that neutralise pathogenic agents during actual infection.
- Vaccines also generate **memory B & T-cells** that recognise the pathogen quickly on subsequent exposure → overwhelm invaders with massive production of antibodies.
- **Preformed antibodies** for quick response, e.g. **tetanus** – anti-tetanus serum; **snake bite** – injection containing antibodies against snake venom (antivenom) = passive immunisation.
- **Recombinant DNA technology** allows production of antigenic polypeptides of pathogen in bacteria or yeast → large-scale production of vaccines. e.g. hepatitis B vaccine produced from yeast.

(b) Allergies एलर्जी

- **Allergy** = exaggerated response of the immune system to certain antigens present in the environment.
- **Allergens** (एलर्जन): mites in dust, pollens, animal dander, etc.
- Antibodies produced are of IgE type.
- Caused due to release of chemicals like histamine & serotonin from **mast cells**.
- Symptoms: **sneezing, watery eyes, running nose, difficulty in breathing**.
- Determination: patient exposed to or injected with very small doses of possible allergens → reactions studied.
- Treatment: **anti-histamine, adrenalin & steroids** quickly reduce symptoms.
- Modern-day life style → lowering of immunity & more sensitivity to allergens; more children in metro cities suffer from allergies & **asthma** (due to sensitivity to environment & protected environment early in life).

(c) Auto-immunity स्व-प्रतिरक्षा

- Higher vertebrates can distinguish foreign molecules & foreign organisms (memory-based acquired immunity).
- Sometimes, due to genetic & other unknown reasons, body **attacks self-cells** → damage to body = auto-immune disease.
- e.g. Rheumatoid arthritis.

6. Immune System in the Body / शरीर में प्रतिरक्षा तंत्र

Human immune system = **lymphoid organs, tissues, cells** and soluble molecules like **antibodies**. Recognises foreign antigens, responds & remembers; also important in **allergic reactions, auto-immune diseases & organ transplantation**.

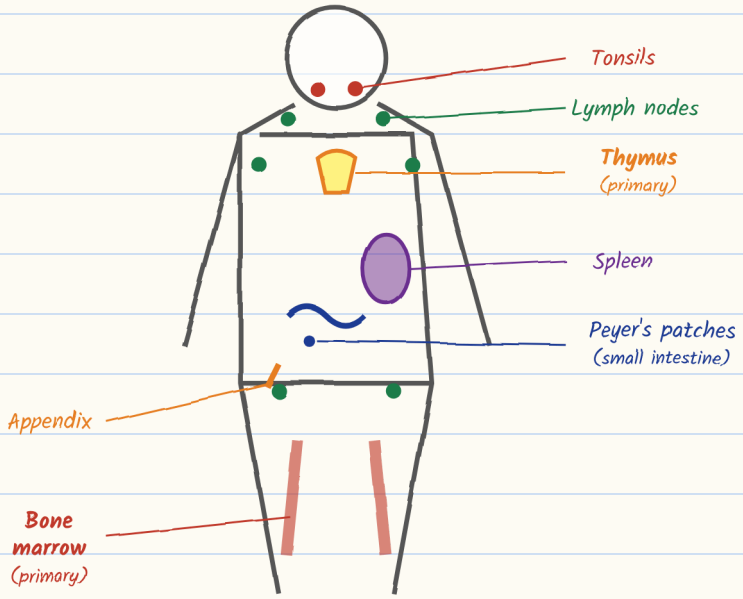


Fig: Lymphoid organs in human body (schematic) · लसीकाभ अंग

Primary lymphoid organs (प्राथमिक)	Secondary lymphoid organs (द्वितीयक)
Bone marrow & **thymus**	**Spleen, lymph nodes, tonsils, Peyer's patches** of small intestine, **appendix**
Immature lymphocytes differentiate into **antigen-sensitive lymphocytes**	After maturation, lymphocytes migrate here; site of **interaction of lymphocytes with antigen** → proliferate to become effector cells

- **Bone marrow** – main lymphoid organ where **all blood cells including lymphocytes** are produced.
- **Thymus** – lobed organ near heart, beneath breastbone; quite large at birth, gradually reduces in size with age; by puberty attains a very small size. Both bone marrow & thymus provide micro-environment for development & maturation of **T-lymphocytes**.
- **Spleen** – large bean-shaped organ; mainly contains **lymphocytes & phagocytes**; acts as a **filter of blood** by trapping blood-borne micro-organisms; also a large **reservoir of erythrocytes**.
- **Lymph nodes** – small solid structures at different points along lymphatic system; trap micro-organisms/antigens in lymph & tissue fluid → activate lymphocytes → immune response.
- MALT (mucosa associated lymphoid tissue) – located within lining of major tracts (respiratory, digestive, urogenital); constitutes about **50% of lymphoid tissue** in human body.

7. AIDS / एड्स

- **AIDS** = Acquired Immuno Deficiency Syndrome – deficiency of immune system, acquired during lifetime (not congenital); **syndrome** = group of symptoms.
- First reported in 1981; spread all over the world.

- Caused by **HIV** (Human Immuno-deficiency Virus) – member of retroviruses – has an envelope enclosing **RNA genome**.

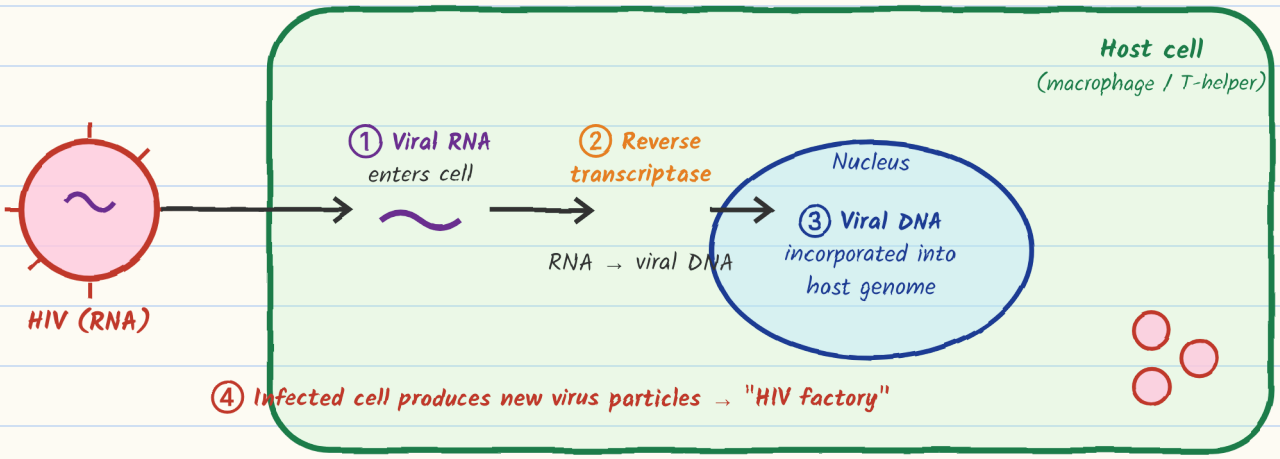
Transmission संचरण

1. **Sexual contact** with infected person.
2. **Transfusion** of contaminated blood & blood products.
3. **Sharing infected needles** (intravenous drug abusers).
4. From infected **mother to her child through placenta**.

High-risk people: individuals with **multiple sexual partners**, **drug addicts** who take drugs intravenously, individuals who require **repeated blood transfusions**, **children born to HIV-infected mother**.

📌 **Myth buster:** HIV/AIDS is **not spread by mere touch** or physical contact; spreads only through **body fluids**. Time-lag between infection & appearance of AIDS symptoms (incubation) = a few months to many years (usually 5–10 years).

Replication of retrovirus (HIV) · एचआईवी का प्रतिकृतीयन



Infographic: How HIV multiplies in host cells

Mechanism of action क्रियाविधि

1. After entering the body, virus enters macrophages → RNA genome replicates to form viral DNA with the help of enzyme reverse transcriptase.
2. Viral DNA gets incorporated into **host cell's DNA** → directs infected cells to produce virus particles.
3. Macrophages continue to produce virus → act like an HIV factory.
4. Simultaneously, HIV enters helper T-lymphocytes (T_H), replicates & produces progeny viruses, which attack other helper T-lymphocytes.
5. Repeated → **progressive decrease in number of helper T-lymphocytes**.

6. Person suffers from bouts of fever, diarrhoea & weight loss. Due to decrease in T-lymphocytes, person starts suffering from infections that could otherwise have been overcome – especially *Mycobacterium*, viruses, fungi & even parasites like *Toxoplasma*.
7. Patient becomes so **immuno-deficient** that he/she is unable to protect against these infections.

- **Diagnosis**: widely used test = ELISA (Enzyme Linked Immuno-Sorbent Assay).
- **Treatment**: **anti-retroviral drugs** – only partially effective; can only prolong life, can't prevent death (inevitable).

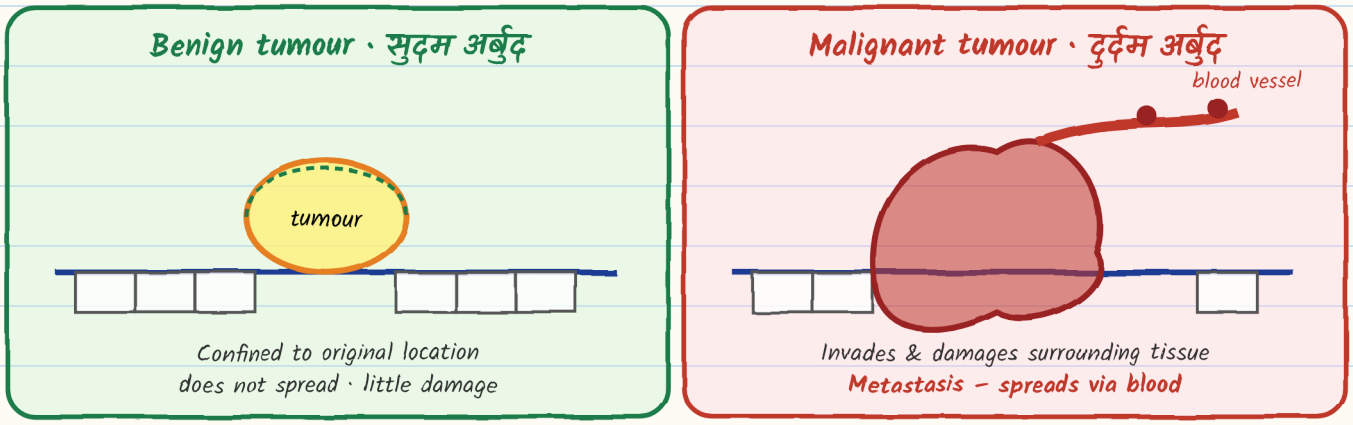
Prevention of AIDS एड्स से बचाव

"**Prevention is the best option**" – AIDS has no cure.

- In India, NACO (National AIDS Control Organisation) & other NGOs educate people about AIDS. WHO has started a number of programmes.
- Making blood (from blood banks) **safe from HIV**.
- Use of only **disposable needles & syringes** in public & private hospitals & clinics.
- **Free distribution of condoms**; controlling drug abuse; advocating safe sex; promoting regular check-ups for HIV in susceptible populations.
- Infection with HIV or having AIDS is something that should **not be hidden** – infected person should not be treated as social outcast; society needs to discuss it openly.

8. Cancer / कैंसर

- One of the most dreaded diseases; major cause of death all over the globe. In India, more than a million people suffer from cancer & large numbers die annually.
- In our body, cell growth & differentiation is highly controlled & regulated. In cancer cells, these regulatory mechanisms break down.
- Normal cells show contact inhibition (संस्पर्श संदमन) – contact with other cells inhibits their uncontrolled growth. **Cancer cells have lost this property** → continue to divide → masses of cells = **tumours** (अर्बुद).



Infographic: Benign vs malignant tumour & metastasis

Benign tumour	Malignant tumour
Normally remain **confined** to original location	Mass of proliferating cells = **neoplastic / tumour cells**; grow very rapidly, **invade & damage** surrounding normal tissues
Do not spread	Starve normal cells by competing for vital nutrients; cells slough off & reach distant sites through blood → new tumours = metastasis (मेटास्टेसिस)
Cause little damage	Most feared property

Causes of cancer – Carcinogens कैंसरजन

Transformation of normal cells into cancerous neoplastic cells is induced by physical, chemical or biological agents = carcinogens.

Type	Examples
Physical	**Ionising radiations** – X-rays, gamma rays; **non-ionising** – UV rays → DNA damage
Chemical	Present in **tobacco smoke** → major cause of **lung cancer**
Biological	Cancer-causing viruses = **oncogenic viruses** with genes called viral oncogenes

Several genes in normal cells, when activated under certain conditions, lead to oncogenic transformation = cellular oncogenes (c-onc) or **proto-oncogenes** (आद्य-अर्बुदजीन).

Detection & Diagnosis पहचान व निदान

- Early detection is essential – allows successful treatment in many cases.
- **Biopsy** & histopathological studies of tissue; **blood & bone marrow tests** for increased cell counts (in **leukaemias**).
- **Radiography** (X-rays), **CT** (computed tomography – uses X-rays to generate **3-D image** of internal organs), **MRI** (magnetic resonance imaging – uses **strong magnetic fields & non-ionising radiations** to accurately detect pathological & physiological changes in living tissue).
- **Antibodies against cancer-specific antigens**.

- **Molecular biology** techniques – detect genes in individuals with inherited susceptibility → advised to avoid exposure to particular carcinogens (e.g. tobacco smoke for lung cancer).

Treatment उपचार

Surgery
remove tumour

Radiation therapy
tumour cells irradiated lethally, protecting normal tissue

Chemotherapy
drugs kill cancer cells; side effects – **hair loss, anaemia**

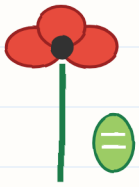
Immunotherapy
biological response modifiers – α-interferon activates immune system

Most cancers are treated by a combination of surgery, radiotherapy & chemotherapy. Tumour cells avoid detection & destruction by immune system → patients given **α-interferon** to help destroy the tumour.

9. Drugs & Alcohol Abuse / ड्रग्स व एल्कोहल कुप्रयोग

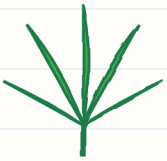
Drugs commonly abused: **opioids, cannabinoids & coca alkaloids** – mostly obtained from **flowering plants**; some from fungi.

Opioids



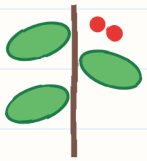
Papaver somniferum (poppy) – latex
Heroin (smack)
diacetylmorphine
Opioid receptors – CNS & gastrointestinal tract
Depressant; slows body

Cannabinoids



Cannabis sativa
inflorescences, leaves, resin
Marijuana, hashish, charas, ganja
Cannabinoid receptors in brain; inhaled / oral
Affects cardiovascular system

Coca alkaloid



Erythroxylum coca
(native to South America)
Cocaine (coke, crack)
Interferes with transport of neurotransmitter dopamine
Stimulates CNS → euphoria
Excess → hallucinations

Infographic: Commonly abused drugs – source & action · स्रोत व प्रभाव

- **Heroin** = diacetylmorphine – white, odourless, bitter crystalline compound; obtained by **acetylation of morphine**, which is extracted from latex of poppy plant *Papaver somniferum*. Taken by **snorting & injection**; a **depressant**, slows down body functions.
- **Cannabinoids** – chemicals interacting with **cannabinoid receptors** mainly in brain. Natural ones from inflorescences of *Cannabis sativa*. These days also abused by some sportspersons.

- **Cocaine** – coca alkaloid from *Erythroxylum coca*; usually **snorted**; potent stimulating action on CNS → sense of euphoria & increased energy; excessive dosage → **hallucinations**.
- Other plants with hallucinogenic properties: *Atropa belladonna* & *Datura*.
- Drugs normally used as medicines for mental illnesses (depression, insomnia) but often abused: **barbiturates, amphetamines, benzodiazepines**, **LSD** (lysergic acid diethyl amides).
- **Morphine** – very effective **sedative & painkiller**; very useful in patients who have undergone surgery.

Tobacco तंबाकू

- Used for more than 400 years; smoked, chewed or used as snuff.
- Contains a large number of chemicals including *nicotine – an alkaloid*.
- Nicotine stimulates **adrenal gland** to release **adrenaline & nor-adrenaline** into blood → both **raise blood pressure & increase heart rate**.
- Smoking → increased incidence of cancers of **lung, urinary bladder & throat**, bronchitis, **emphysema**, coronary heart disease, gastric ulcer.
- Smoking increases **carbon monoxide (CO)** content in blood and reduces concentration of haem-bound oxygen → **oxygen deficiency** in body.
- **Tobacco chewing** → increased risk of **cancer of oral cavity**.
- Cigarette packets carry a **statutory warning** that smoking is injurious to health.

Adolescence & drug/alcohol abuse किशोरावस्था

Adolescence = 'period' & 'process' during which a child becomes mature in terms of attitudes & beliefs for effective participation in society; period between *12–18 years* of age. A very vulnerable phase of mental & psychological development.

Reasons for starting drugs/alcohol: **curiosity**, need for adventure & excitement, **experimentation**; stress from pressure to excel in academics/exams; perception that it is "cool" or progressive (TV, movies, newspapers, internet promote this); **unstable or unsupportive family structures** & **peer pressure**.

Addiction & dependence व्यसन व निर्भरता

- **Addiction** = psychological attachment to certain effects – such as euphoria & temporary feeling of well-being – associated with drugs & alcohol. Drives people to take them even when not needed or when use becomes self-destructive.
- With repeated use, **tolerance level** of receptors increases → receptors respond only to higher doses → greater intake → addiction.
- **Dependence** = tendency of the body to manifest a characteristic & unpleasant *withdrawal syndrome* if regular dose is abruptly discontinued: **anxiety, shakiness, nausea & sweating** –

relieved when use is resumed. In some cases withdrawal symptoms can be severe & even life-threatening → needs medical supervision.

Effects of drug/alcohol abuse दुष्प्रभाव

- **Immediate**: reckless behaviour, vandalism & violence.
- **Excessive doses** → **coma & death** due to respiratory failure, heart failure or cerebral haemorrhage. Combination of drugs or with alcohol → overdosing & even deaths.
- **Warning signs** in youth: drop in academic performance, unexplained absence from school/college, lack of interest in personal hygiene, withdrawal, isolation, depression, fatigue, aggressive & rebellious behaviour, deteriorating relationships with family & friends, loss of interest in hobbies, change in sleeping & eating habits, fluctuations in weight & appetite.
- Those taking drugs **intravenously** → serious infections like AIDS & hepatitis B (transmitted through sharing of infected needles & syringes).
- **Chronic alcohol use** → damages **nervous system & liver (cirrhosis)**.
- Use of drugs & alcohol during **pregnancy** adversely affects the **foetus**.

Misuse of anabolic steroids by sportspersons (खिलाड़ियों द्वारा)	
In females	**In males**
Masculinisation (male-like features), increased aggressiveness, mood swings, depression, abnormal menstrual cycles, excessive hair growth on face & body, enlargement of clitoris, deepening of voice	Acne, increased aggressiveness, mood swings, depression, reduction of size of testicles, decreased sperm production, potential for kidney & liver dysfunction, breast enlargement, premature baldness, enlargement of prostate gland
In **adolescent** males or females: severe facial & body acne, **premature closure of growth centres of long bones** → stunted growth	

Prevention & control बचाव व नियंत्रण

"**Prevention is better than cure**" – habits of smoking, drugs or alcohol are more likely to be taken up at a young age.

1. **Avoid undue peer pressure** – every child has own choice & personality; don't push child unduly to perform beyond threshold limits.
2. **Education & counselling** – face problems & stresses, accept disappointments & failures as part of life; channelise energy into healthy pursuits like sports, reading, music, yoga & extracurricular activities.
3. **Seeking help from parents & peers** – helps to share feelings of anxiety & guilt.
4. **Looking for danger signs** – alert parents & teachers should look for & identify danger signs.

5. **Seeking professional & medical help** – highly qualified psychologists, psychiatrists, de-addiction & rehabilitation programmes.

⚡ Quick Revision / त्वरित पुनरावृत्ति

Keyword	Remember
Widal test	Typhoid
ELISA	AIDS / HIV
Haemozoin	Malaria fever (toxin)
Sporozoites	Infectious form of Plasmodium
Gambusia	Fish eating mosquito larvae
Aedes / Anopheles / Culex	Dengue & chikungunya / malaria / filariasis
Interferons	Cytokine barrier; α-interferon in cancer immunotherapy
H_2L_2	Antibody structure
IgA / IgG / IgE	Colostrum / placenta / allergy
Histamine & serotonin	Released from mast cells in allergy
Rheumatoid arthritis	Auto-immune disease
Bone marrow & thymus	Primary lymphoid organs
MALT	~50% of lymphoid tissue
HIV	Retrovirus; macrophages = HIV factory; attacks T_H cells
NACO	National AIDS Control Organisation
Contact inhibition	Lost in cancer cells
Metastasis	Spread of malignant tumour cells via blood
Heroin	Diacetylmorphine – acetylation of morphine
Nicotine	Adrenaline & nor-adrenaline → ↑ BP, ↑ heart rate

⭐ Exam Corner / परीक्षा उपयोगी प्रश्न

1-Mark Questions 1M

Q1. Name the test used to confirm typhoid. / टाइफाइड की पुष्टि हेतु परीक्षण?

→ Widal test.

Q2. Which form of Plasmodium is infectious to humans?

→ Sporozoites.

Q3. Name the toxic substance responsible for malarial fever.

→ Haemozoin.

Q4. Which antibody is present in colostrum?

→ IgA.

Q5. Name the cells that act as "HIV factory".

→ Macrophages.

Q6. Name the chemicals released by mast cells during allergy.

→ Histamine and serotonin.

Q7. Give the chemical name of heroin.

→ Diacetylmorphine.

Q8. What property do cancer cells lose?

→ Contact inhibition.

2/3-Mark Questions 2–3M

Q9. List the four barriers of innate immunity with one example each.

→ Physical (skin, mucus), physiological (stomach acid, saliva, tears), cellular (neutrophils, macrophages, NK cells), cytokine (interferons).

Q10. Differentiate active and passive immunity with examples.

→ Own antibodies, slow, long-lasting (vaccination) vs ready-made antibodies, quick, short-lived (colostrum, antivenom).

Q11. Draw and label the structure of an antibody.

→ Y-shape, 2 heavy + 2 light chains (H_2L_2), antigen-binding sites, S–S bonds.

Q12. Why are transplanted organs often rejected? How is it prevented?

→ Cell-mediated immunity (T-cells) recognise graft as 'non-self'; need tissue & blood group matching + immuno-suppressants.

Q13. Differentiate benign and malignant tumours. What is metastasis?

→ Confined vs invasive; metastasis = spread of tumour cells via blood to distant sites forming new tumours.

Q14. How does smoking cause oxygen deficiency in the body?

→ Increases CO in blood → reduces haem-bound O_2.

Q15. Name the primary and secondary lymphoid organs. Why is thymus important?

→ Bone marrow, thymus / spleen, lymph nodes, tonsils, Peyer's patches, appendix, MALT; thymus helps T-lymphocyte maturation, large at birth, shrinks with age.

Q16. Write the source and effect of cocaine and cannabinoids.

→ Erythroxylum coca – dopamine transport, CNS stimulant; Cannabis sativa – cannabinoid receptors, affects cardiovascular system.

5-Mark Questions SM ★★★

Q17. Describe the life cycle of Plasmodium with a labelled diagram.

→ Sporozoites → liver → RBCs (haemozoin, fever) → gametocytes → mosquito stomach (fertilisation) → sporozoites in salivary glands.

Q18. Explain how HIV multiplies and causes AIDS. Suggest preventive measures.

→ Macrophages, reverse transcriptase, viral DNA in host genome, T_H cells decrease → immunodeficiency; ELISA; NACO, safe blood, disposable needles, condoms.

Q19. What are carcinogens? Describe the methods of detection and treatment of cancer.

→ Physical, chemical, biological; biopsy, blood/bone marrow tests, X-ray, CT, MRI, antibodies, molecular biology; surgery, radiation, chemotherapy, immunotherapy (α-interferon).

Q20. Why is adolescence a vulnerable phase? List the effects of drug/alcohol abuse and measures to prevent it.

→ Curiosity, peer pressure; effects (warning signs, AIDS, liver cirrhosis, steroids); 5 preventive measures.

✏ **Diagrams to practise / अभ्यास हेतु चित्र:**

1. Life cycle of Plasmodium ⭐
2. Structure of antibody molecule ⭐
3. Replication of retrovirus (HIV) ⭐
4. Lymphoid organs (schematic)
5. Skeletal structure of morphine / cannabinoid molecule (recognise)
6. Opium poppy, Cannabis leaves, Datura flower

🎯 **Last-minute tips:** For every disease write **pathogen (in italics) + organ + symptom + mode of spread** · Match vectors correctly (*Anopheles*/*Aedes*/*Culex*) · Remember which Ig is where (A–colostrum, G–placenta, E–allergy) · In drug questions, always give **plant source + receptor/action**.

~ All the best! / शुभकामनाएँ! ~