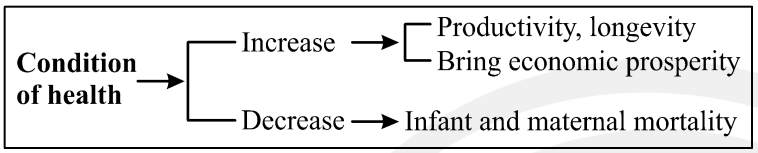
Human Health and Disease

Health

Health is not simply 'absence of disease' or 'physical fitness'.

Factors affecting health:

Mental state, genetic disorders, infections and life style (habits, rest and exercise)



Disease

It is state of the body when functioning of one or more organ systems is adversely affected, characterized by various signs and symptoms

Types of diseases		
Parameters	**Non-infectious**	**Infectious**
Transmission from one person to another	No	Yes
Example	Cancer	AIDS

Pathogens: Disease causing organisms:

- **Most parasites are pathogens** living in (or on) the host, multiply and interfere with normal vital activities resulting in morphological and functional damage.
- Gut pathogens can survive harsh pH & digestive enzymes.

Vector: Transmits disease from one organism to another

e.g., female *Aedes* mosquito is the vector for dengue and chikungunya while, *Anopheles* spreads malaria.

Table: Classification of diseases on the basis of transmission

Mode of transmission	Bacterial	Viral	Protozoan	Helminthic
Air (droplet/aerosol) or object borne (pens, knobs etc.)	Pneumonia, diphtheria	Common cold, Smallpox	–	–
Direct contact	Tetanus	Smallpox	–	–
Contaminated food and water	Typhoid, dysentery	Polio	Amoebiasis	Ascariasis
Insect vector/vector borne	Plague	Chikungunya, Dengue	Malaria	Filariasis
Body fluids	Syphilis	AIDS	Trichomoniasis	–

Bacterial Diseases

Disease	Pathogen	Organ affected	Common symptoms
Typhoid	*Salmonella typhi* **Diagnostic test: Widal test**	Small intestine and other organs by migrating through blood	**Sustained high fever (39–40°C)** ❖ **Stomach pain** ❖ **Weakness** ❖ **Constipation** ❖ **Headache** ❖ **Loss of appetite** **In severe cases, intestinal perforation and death may occur.**
Pneumonia	***Streptococcus pneumoniae, Haemophilus influenzae***	**Alveoli of lungs**	❖ **Problem in respiration due to fluid filled alveoli** ❖ **Fever, chills, cough, headache** **In severe cases, lips and finger nails may turn gray to bluish**

Viral Diseases

Disease	Pathogen	Organ affected	Symptoms
Common cold	Rhino virus	❖ Nose and respiratory ❖ passage ❖ Common cold does not infect lungs	❖ Nasal congestion and discharge ❖ Sore throat ❖ Hoarseness, cough ❖ Headache, tiredness ❖ symptoms usually lasts for 3-7 days

Helminthic Diseases

Disease	Pathogen	Organ/structure affected	Symptoms
Ascariasis	*Ascaris* **(Roundworm)**	Intestine	Internal bleeding, fever, muscular pain, anemia, **blockage of intestinal passage**
Elephantiasis / Filariasis	*Wuchereria bancrofti* *W. malayi* **(Filarial worm)**	Lymphatic vessels	**Chronic inflammation** of organs in which they live for many years resulting in gross deformities e.g., limbs, genital organs etc.

Fungal Diseases

Disease	Pathogen	Body parts affected	Symptoms
Ringworm	*Microsporum*, *Trichophyton*, *Epidermophyton*	Skin, nails & scalp	Dry, scaly lesions Intense itching

Protozoan Diseases

Disease	Pathogen	Area affected	Symptoms
Amoebiasis/ Amoebic dysentery	*Entamoeba histolytica*	Large intestine	❖ Constipation ❖ Abdominal pain ❖ Cramps ❖ Stool with excess mucous and blood clots
Malaria	*Plasmodium* ❖ *P. vivax* ❖ *P. malariae* ❖ *P. falciparum* ❖ *P. ovale*	RBCs	❖ Chills ❖ High fever recurring every 3-4 days ❖ If left untreated, it can be fatal

Aids/Acquired Immuno Deficiency Syndrome

- t is the deficiency of immune system, acquired during the lifetime of an individual.
- It is non congenital and fatal infectious disease. It is caused by HIV (Human immuno deficiency virus).

Table: Enveloped virus enclosing 2 single stranded RNA genome

Life cycle		Mode of transmission	High Risk Individuals
Entry of virus in body ↓		Sexual contact	Multiple sexual partners
		Placenta	HIV infected mother to foetus
		Blood transfusion	Repeated blood transfusion
		Infected needles	Drug addicts **(intravenous)**
	Entry into body cells **(Macrophages, helper T-cells)**		

There is progressive decrease in number of helper T-cells.

Initial symptoms: Fever, diarrhoea, weight loss.

Later the immune-deficient patient is prone to infections especially those due to *Mycobacterium,* viruses, fungi, *Toxoplasma*, etc.

There is always a time-lag between infection and appearance of AIDS symptoms. This may vary from a few months to many years (usually 5-10 years).

Diagnostic Test: ELISA (Enzyme Linked Immuno-Sorbent Assay)
Treatment: Anti-retroviral drugs, can only prolong life but cannot prevent death.

Cancer

A dreaded non-infectious disease; major cause of death all across the globe.

Parameters	Normal cells	Cancerous cells/ Neoplastic cells
Cell growth and differentiation	Highly controlled and regulated	Uncontrolled & nonregulated
Contact inhibition	**Present**, virtue of which contact with other cells inhibits their growth	**Lost**, so these cells keep on dividing and form mass of cells called **Tumor/ Neoplasm**

Types of Tumor

Parameters	Benign	Malignant tumor/cancer
Location	Confined to original place	Grow rapidly and spread to other parts
Damage	Little damage	Invade and damage other cells starving normal cells by competing for vital nutrients
Metastasis	**No**	**Yes**, cells sloughed from such tumors reach distant sites through blood and start new tumor called **metastasis (most feared property).**

Tumor cells have ability to avoid detection and destruction by immune system.

Approaches for treatment:

Surgery

Radiotherapy: Tumor cells irradiated lethally

Chemotherapy: Side effects like hair loss, anemia

Immunotherapy: a-**interferons** (Biological response modifiers) activate immune system and helps in destroying the tumor.

Immunity

The ability of the host to fight the disease causing organisms, conferred by the immune system is called **immunity**.

Parameters	Types	
	Innate	Acquired
Observed	Time of birth	After birth
Exposure to infection	Not required	Required
Defense	Non specific	Specific
Memory record	No	Yes

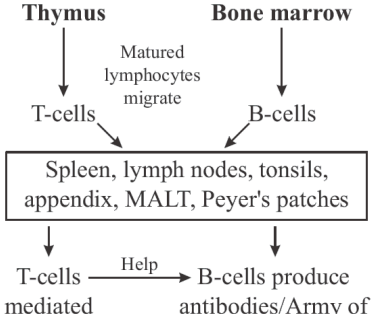
Lymphoid Organs

The human immune system consists of lymphoid organs, tissues, cells and soluble molecules like antibodies. This response is carried out by two special types of lymphocytes present in our blood i.e., **B** and **T-lymphocytes**.

IMMUNE RESPONSE

Primary lymphoid organs

Secondary lymphoid organs



Type	Primary	Secondary/Anamnestic
Exposure to pathogens	First time	**Subsequent times**
Intensity	**Low** → **High**	
	Based on memory of first encounter	

Responses are carried out by B and T lymphocytes.

- **Each antibody has 4 peptide chains (H_2L_2):** 2 long heavy chains and 2 short light chains. They are called immunoglobulins (lg). The different types of immunoglobulins are:
  lgA, lgM, lgE, lgG, IgD
- T-lymphocytes are responsible for graft rejection.

Vaccination and Immunisation

Types of immunity		
Antibodies	**Active** Produced within the host body	**Passive** Ready-made/preformed antibodies are directly given
Time taken for full/ effective response	Longer	Shorter
Memory cells	Yes	No
Examples	Natural infection → Antibody production in host **Vaccination** Deliberate injection of living / dead microbes /proteins	Mother $\xrightarrow[(\text{lg G})]{\text{Placenta}}$ Foetus Mother $\xrightarrow[(\text{lg A})]{\text{Colostrum}}$ Infant

- Recombinant **DNA technology** has allowed the large scale production of antigenic polypeptides of pathogen in **bacteria/yeast**.
- Hence, greater availability for immunization, e.g., **hepatitis B vaccine produced from yeast**.

Allergies

Exaggerated response of immune system to certain antigens present in the environment.

Allergens	**Substances to which exaggerated immune response is produced e.g., pollens, mites in dust, animal dander, etc.**
Antibodies	**lgE type**
Symptoms	Sneezing, watery eyes, running nose, difficulty in breathing

Chemical released	**Histamine** and **serotonin** from mast cells
Diagnosis	Patient is exposed to or injected with very small doses of possible allergens and reactions studied.
Treatment	Anti-histamine, adrenaline and steroids quickly reduce the symptoms of allergy

Drug Abuse

Chemical when taken for a purpose other than medicinal use or in amounts/frequency that impairs one's physical, physiological or psychological functions and constitutes drug abuse.

Source-Majorly from flowering plants and some from fungi.

Drug	Receptors	Source	Intake	Examples	Action and anything specific
Opioids	CNS, GIT	Latex of poppy plant, *Papaver somniferum*	Snorting, injection	❖ Morphine ❖ Heroin/Smack (Diacetylmorphine)	❖ **Effective sedative and pain killer** ❖ **Useful in patients undergone surgery** ❖ **Depressant and slows down body functions** ❖ **Odourless, white, bitter crystalline compound**
Cannabinoids	Principally in brain	Inflorescence, flower tops, leaves and resin of cannabis plant	Inhalation, oral ingestion	❖ Charas ❖ Hashish ❖ Ganja ❖ Marijuana	❖ **Effects on cardiovascular system of the body** ❖ **Also being abused by some sportspersons**
Stimulants	CNS	Coca plant *Erythroxylum coca* (Native of South America)	Snorting	❖ Cocaine/coka alkaloid ❖ Commonly called (coke/crack)	❖ **Interferes with transport of neurotransmitter dopamine** ❖ **Potent stimulating action on CNS, producing sense of euphoria and increased energy** ❖ **Excessive dosage causes hallucinations**
Hallucinogens		*Atropa belladona, Datura*	–	–	❖ **Have been used for hundreds of years in folkmedicine, religious ceremonies and rituals all over the globe**

Other drugs		**Synthetic**		**Barbiturates, Benzodiazepines, Amphetamines**	❖ **Help patients cope with mental illnesses like depression and insomnia**

- Chronic use of drugs and alcohol damages nervous system and liver (Cirrhosis)

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