

JSR IAS ACADEMY

BIOLOGY

Human Diseases

Communicable diseases

முயற்சி - பயிற்சி - தேர்ச்சி

The World Health Organization [WHO] defines health as 'a state of complete physical, mental and social wellbeing and not merely absence of diseases'.

“HEALTH IS WEALTH”

Diseases can be broadly grouped into infectious and non infectious types.

Infectious diseases or Communicable diseases

Diseases which are transmitted from one person to another are called infectious diseases or communicable diseases.

Such disease causing organisms are called **pathogens** and are transmitted through air, water, food, physical contact and vectors.

Non-infectious diseases or Non communicable diseases

Non-infectious diseases are not transmitted from an infected person to a healthy person.

In origin they may be

- genetic (**cystic fibrosis**),
- nutritional (vitamin deficiency diseases)
- degenerative (arthritis, heart attack, stroke).

Infectious diseases or Communicable diseases

Bacterial diseases

S. No	Diseases	Causative agent	Site of infection	Mode of transmission	Symptoms
1	Shigellosis (Bacillary dysentery)	<i>Shigella sp.</i>	Intestine	Food and water contaminated by faeces / faecal oral route	Abdominal pain, dehydration, blood and mucus in the stools
2	Bubonic plague (Black death)	<i>Yersinia pestis</i>	Lymph nodes	Rat flea vector- <i>Xenopsylla cheopis</i>	Fever, headache, and swollen lymph nodes
3	Diphtheria	<i>Corynebacterium diphtheriae</i>	Larynx, skin, nasal and genital passage	Droplet infection	Fever, sore throat, hoarseness and difficulty in breathing
4	Cholera	<i>Vibrio cholerae</i>	Intestine	Contaminated food and water/ faecal oral route	Severe diarrhoea and dehydration
5	Tetanus (Lock jaw)	<i>Clostridium tetani</i>	Spasm of muscles	Through wound infection	Rigidity of jaw muscle, increased heart beat rate and spasm of the muscles of the jaw and face
6	Typhoid (Enteric fever)	<i>Salmonella typhi</i>	Intestine	Through contaminated food and water	Headache, abdominal discomfort, fever and diarrhoea
7	Pneumonia	<i>Streptococcus pneumoniae</i>	Lungs	Droplet infection	Fever, cough, painful breathing and brown sputum
8	Tuberculosis	<i>Mycobacterium tuberculosis</i>	Lungs	Droplet infection	Thick mucopurulent nasal discharge

- 1829 **C.G. Ehrenberg** coined the term Bacterium
- Bacteria were first discovered by a Dutch scientist, **Anton van Leeuwenhoek** in 1676 and were called “animalcules”
- only a few bacteria are associated with human diseases and are called **pathogenic** bacteria.

Tuberculosis:

Prevention and treatment

- BCG vaccination,
- Regular medication like DOT

Typhoid:

- high fever up to 1040 F.
- Widal test
- Typhoid fever can be confirmed by **Widal** test.
- Bt toxin from **Bacillus thuringiensis** finds application in raising insect resistant crops (Bt Crops).

Table 1.10: Human diseases caused by Bacteria

S.No	Name of the disease	Name of the pathogen
1.	Cholera	<i>Vibrio cholerae</i>
2.	Typhoid	<i>Salmonella typhi</i>
3.	Tuberculosis	<i>Mycobacterium tuberculosis</i>
4.	Leprosy	<i>Mycobacterium leprae</i>
5.	Pneumonia	<i>Diplococcus pneumoniae</i>
6.	Plague	<i>Yersinia pestis</i>
7.	Diphtheria	<i>Corynebacterium diphtheriae</i>
8.	Tetanus	<i>Clostridium tetani</i>
9.	Food poisoning	<i>Clostridium botulinum</i>
10.	Syphilis	<i>Treponema pallidum</i>

Viral diseases

- 1796 **Edward Jenner** used vaccination for **small pox**

- 1886 **Adolf Mayer** demonstrated the infectious nature of Tobacco mosaic virus using sap of mosaic leaves
- 1892 **Dimitry Ivanowsky** proved that viruses are smaller than bacteria
- 1898 **M.W. Beijerinck** defined the infectious agent in tobacco leaves as ‘Contagium vivum fluidum’
- 1915 **F.W.Twort** identified Viral infection in Bacteria
- 1917 **d’Herelle** coined the term ‘Bacteriophage’

Generally viruses are of three types based on shape and symmetry

- Cuboid symmetry** –
Example: Adenovirus, Herpes virus.
- Helical symmetry** –
Example: Influenza virus, TMV.
- Complex or Atypical** –
Example: Bacteriophage, Vaccinia virus.

Viral diseases are generally grouped into four types on the basis of the symptoms produced in the body organs.

- Pneumotropic diseases (respiratory tract infected by influenza)
- Dermotropic diseases (skin and subcutaneous tissues affected by chicken pox and measles)
- Viscerotropic diseases (blood and visceral organs affected by yellow fever and dengue fever)
- Neurotropic diseases (central nervous system affected by rabies and polio).

Hepatitis:

- diseases caused by Hepatitis virus **A, B, C, D, E**.
- Its mode of transmission is Contaminated water, sharing of needles and blood transfusion.
- The symptoms of hepatitis is loss of appetite, (Anorexia), vomiting, eyes and urine in yellow color.

Chickenpox:

- Chickenpox (chicken pox), also known as **varicella**, is a highly contagious infection caused by the **varicella zoster virus**.
- This disease spreads through air and contact with an infected person.
- Its symptoms is appearance of rashes on the whole body, fever, headache and tiredness.

Rabies:

- Which is transmitted by the bite of the infected **dog, rabbit, monkey, cat etc.**
- The **virus present in the saliva** of dog enters the brain via neurons.
- The symptoms of rabies is **hydrophobia** (extreme fear for water), fever for 2 – 12 weeks and exaggerations in behavior.



Swine flu was first recognised in the 1919 pandemic and still circulates as a seasonal flu virus. Swine flu is caused by the H1N1 virus strain. Symptoms include fever, cough, sore throat, chills, weakness and body aches. Children, pregnant women and the elderly are at risk from severe infection.

S. No	Diseases	Causative agent	Site of infection	Mode of transmission	Symptoms
1	Common cold	<i>Rhino viruses</i>	Respiratory tract	Droplet infection	Nasal congestion and discharge, sore throat, cough and headache
2	Mumps	<i>Mumps virus (RNA virus)</i> <i>Paramyxo virus</i>	Salivary glands	Saliva and droplet infection	Enlargement of the parotid glands
3	Measles	<i>Rubella virus (RNA virus)</i> , <i>Paramyxo virus</i>	Skin and respiratory tract	Droplet infection	Sore throat, running nose, cough and fever. reddish rashes on the skin, neck and ears.
4	Viral hepatitis	<i>Hepatitis - B virus</i>	Liver	Parenteral route, blood transfusion	Liver damage, jaundice, nausea, yellowish eyes, fever and pain in the abdomen
5	Chicken pox	<i>Varicella -Zoster virus (DNA Virus)</i>	Respiratory tract, skin and nervous system	Droplet infection and direct contact	Mild fever with itchy skin, rash and blisters
6	Poliomyelitis	<i>Polio virus (RNA virus)</i>	Intestine, brain, spinal cord	Droplet infection through faecal oral route	Fever, muscular stiffness and weakness, paralysis and respiratory failure
7	Dengue fever (Break bone fever)	<i>Dengue virus or Flavi virus (DENV 1-4 virus)</i>	Skin and blood	Mosquito vector <i>Aedes aegypti</i>	Severe flu like illness with a sudden onset of fever and painful headache, muscle and joint pain.
8	Chikungunya	<i>Alpha virus (Toga virus)</i>	Nervous system	Mosquito vector <i>Aedes aegypti</i>	Fever and joint pain, headache and joint swelling

1. Common cold
2. Hepatitis B
3. Cancer
4. SARS(Severe Acute Respiratory Syndrome)
5. AIDS(Acquired Immuno Deficiency Syndrome)
6. Rabies
7. Mumps
8. Polio
9. Chikungunya
10. Small Pox
11. Chicken pox
12. Measles

Nipah virus is a zoonotic virus (transmitted from animals to humans) and also transmitted through contaminated food. In infected people, it causes a range of illness from asymptomatic infection to acute respiratory illness and fatal encephalitis.



- Infective stage of this parasite is the trophozoite
- which penetrates the walls of the host intestine (colon) and secretes histolytic enzymes
- causing ulceration, bleeding, abdominal pain and stools with excess mucus.

Symptoms of amoebiasis

- diarrhoea
- dysentery with blood
- mucus in the stool.

African sleeping

sickness is caused by **Trypanosoma** species.

Trypanosoma is generally transmitted by the blood sucking **Tsetse flies**.

Three species of Trypanosoma cause sleeping sickness in man.

- T. gambiense is transmitted by Glossina palpalis (Tsetse fly) and causes Gambian or Central African sleeping sickness
- T. rhodesiense is transmitted by Glossina morsitans causing Rhodesian or East African sleeping sickness.
- T. cruzi is transmitted by a bug called Triatoma megista and causes Chagas disease or American trypanosomiasis

Kala – Azar

- Kala – azar or visceral leishmaniasis is caused by **Leishmania donovani**,
- which is transmitted by the vector **Phlebotomus** (sand fly).
- Infection may occur in the endothelial cells, bone marrow, liver, lymph glands and blood vessels of the spleen.

Symptoms

- weight loss,
- anaemia, fever,
- enlargement of spleen and liver.

Protozoan diseases

About **15 genera of protozoans** live as parasites within the human body and cause diseases.

Amoebiasis

- Amoebiasis also called amoebic dysentery or amoebic colitis is caused by **Entamoeba histolytica**,

Malaria

Malaria is caused by different **types of Plasmodium** species such as

- P. vivax,
- P. ovale,
- P. malariae and
- P. falciparum

Plasmodium lives in the **RBC** of human in its mature condition it is called as **trophozoite**.

It is transmitted from one person to another by the bite of the infected female **Anopheles mosquito**.

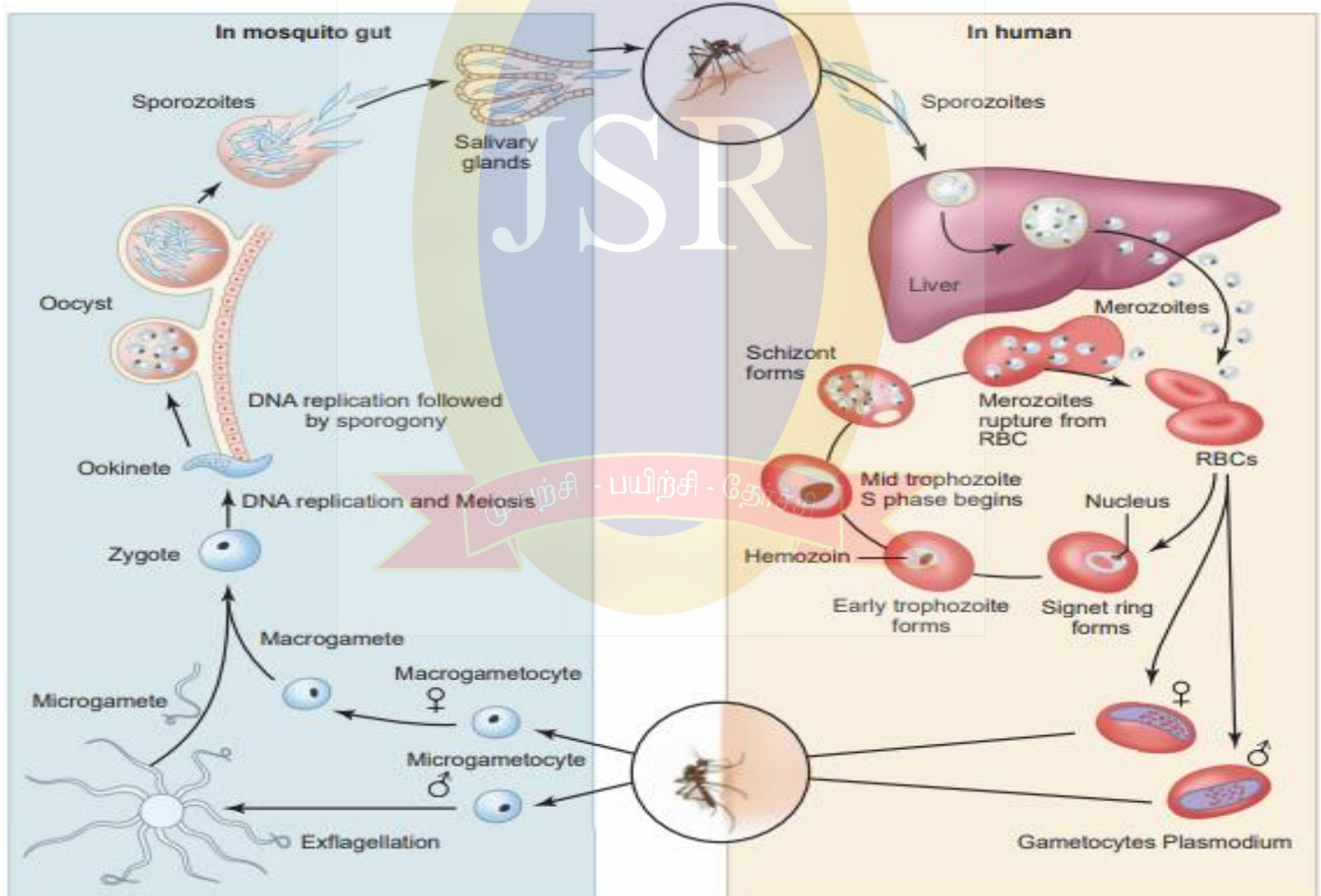
Life cycle of Plasmodium

Plasmodium vivax is a digenic parasite, involving two hosts,

- man as the secondary host
- female Anopheles mosquito as the primary host.

The life cycle of Plasmodium involves three phases namely

- schizogony(merozoite)
- gamogony (oocyte)
- sporogony (sporozoite)



- The parasite first enters the human blood stream through the bite of an infected female Anopheles mosquito. As it feeds, the mosquito injects the saliva containing the sporozoites.
- The sporozoite within the blood stream immediately enters the hepatic cells of the liver.
- Further in the liver they undergo multiple asexual fission (schizogony) and produce merozoites.

- After being released from liver cells, the merozoites penetrate the RBC's.
- Inside the RBC, the merozoite begins to develop as unicellular trophozoites. The trophozoite grows in size and a central vacuole develops pushing them to one side of cytoplasm and becomes the signet ring stage. The trophozoite nucleus then divides asexually to produce the schizont.

- The large schizont shows yellowish - brown pigmented granules called Schuffners granules.
- The schizont divides and produces mononucleated merozoites..
- This erythrocytic stage is cyclic and repeats itself approximately every 48 to 72 hours or longer depending on the species of Plasmodium involved.
- The sudden release of merozoites triggers an attack on the RBCs.
- When these are ingested by a mosquito, they develop into male and female gametes respectively.
- In the mosquito's gut, the infected erythrocytes lyse and male and female gametes fertilize to form a diploid zygote called ookinete.

SI No	Types of Malaria	Causative agent	Duration of Erythrocytic cycle
1	Tertian, benign tertian or vivax malaria	<i>P. vivax</i>	48 hours
2	Quartan malaria	<i>P. malariae</i>	72 hours
3	Mild tertian malaria	<i>P. ovale</i>	48 hours
4	Malignant tertian or quotidian malaria	<i>P. falciparum</i>	36 – 48 hours

- The ookinete migrates to the mosquito's gut wall and develop into an oocyte.
- The oocyte undergoes meiosis by a process called sporogony to form sporozoites. These sporozoites migrate to the salivary glands of the mosquito.
- The cycle is now completed and when the mosquito bites another human host, the sporozoites are injected and the cycle begins a new.
- The pathological changes caused by malaria, affects not only the erythrocytes but also the spleen and other visceral organs. Incubation period of malaria is about 12 days.
- The early symptoms of malaria are headache, nausea and muscular pain.
- The classic symptoms first develop with the synchronized release of merozoites, **haemozoin** toxin
- Fever and chills are caused partly by malarial toxins that induce macrophages to release tumour necrosis factor (TNF- α) and interleukin.
- The best protection against malaria is to **avoid being bitten by mosquito.**
- In the 1950's the World Health Organisation (WHO) introduced the Malaria eradication programme.
- This programme was not successful due to the resistance of Plasmodium to the drugs used to treat it and resistance of mosquito's to DDT and other insecticides.

DO YOU KNOW?

Malaria vaccine is used to prevent malaria. The only approved vaccine as of 2015 is RTS,S(Mosquirix). It requires four injections and has relatively low efficacy (26–50%). Due to this low efficacy, WHO does not recommend the use of RTS,S vaccine in babies between 6 and 12 weeks of age.

Prevention

- Mosquito's lay their eggs in water. Larvae hatch and develop in water but breathe air by moving to the surface.
- Oil can be sprayed over the water surface, to make it impossible for mosquito larvae and pupae to breathe.
- Ponds, drainage ditches and other permanent bodies of water can be stocked with fishes such as **Gambusia** which feed on mosquito larvae.
- Preparations containing **Bacillus thuringiensis** can be sprayed to kill the mosquito larvae since it is not toxic to other forms of life.

Fungal diseases

Dermatomycosis

infection caused by fungi belonging to the genera

- Trichophyton,
- Microsporum
- Epidermophyton.

Ringworm

Appearance of dry, scaly lesions on the skin, nails and scalp are the main symptoms of the disease.

Heat and moisture help these fungi to grow and makes them to thrive in skin folds such as those in the **groin** or between the **toes**.



Ringworms of the feet is known as **Athlete's foot** caused by **Tinea pedis**



Ringworms are generally acquired from soil or by using clothes, towels and comb used by infected persons.

Human diseases		
1.	Athlete's foot	<i>Epidermophyton floccosum</i>
2.	Candidiasis	<i>Candida albicans</i>
3.	Coccidioidomycosis	<i>Coccidioides immitis</i>
4.	Aspergillosis	<i>Aspergillus fumigatus</i>

Helminthic diseases

Helminthes are mostly endoparasitic in the gut and blood of human beings and cause diseases called helminthiasis.

The two most prevalent helminthic diseases are

- Ascariasis
- Filariasis.

Ascariasis

- Ascariasis is a disease caused by the intestinal endoparasite *Ascaris lumbricoides* commonly called the **round worms**
- The symptoms of the disease are abdominal pain, vomiting, headache, anaemia, irritability and diarrhoea.
- It may also cause enteritis, hepatitis and bronchitis.

Filariasis

Filariasis is caused by **Wuchereria bancrofti**, commonly called **filarial worm**.

It is found in the **lymph vessels** and **lymph nodes** of man.

The life cycle is completed in two hosts,

- **man**
- **female Culex mosquito**

The female filarial worm gives rise to juveniles called microfilariae larvae.

the obstruction of lymph vessels causes elephantiasis or filariasis of the limbs, scrotum and mammary glands



Common human diseases

Bacterial diseases

- Dysentery
- Plague
- Diphtheria
- Cholera
- Typhoid
- Pneumonia

Viral diseases

- Common cold
- Mumps
- Measles
- Viral hepatitis
- Dengue fever
- Chikungunya
- Chicken pox
- Poliomyelitis

Fungal diseases

- Candidiasis
- Athlete's foot

Protozoan diseases

- Malaria
- Amoebiasis
- African sleeping sickness
- Kala-azar

Helminthic diseases

- Ascariasis
- Filariasis

Vaccine

BCG - Tuberculosis Vaccine

DPT – Vaccine (Triple antigen)

- Diphtheria (Corynebacterium - causing difficulty in breathing),
- Pertussis (whooping cough),
- Tetanus (An acute and serious infection of the central nervous system caused by bacterial infection of open wounds)

MMR –

- Mumps (Viral disease) ,
- Measles (viral disease marked by distinct red spots followed by a rash; occurs primarily in children),
- Rubella (viral disease that is a milder form of measles lasting three or four days; can be damaging to a foetus during the first trimester)

DT - (Dual antigen)

- Diphtheria,
- Tetanus

TT - (bacterial toxin)

- Tetanus,
- Toxoid

DO YOU KNOW?

Vaccino therapy is the method of use of vaccine for treatment of disease. Dr. Edward Jenner prepared first vaccine for small pox in 1796. Polio vaccine was developed by Dr. Jonas Salk (vaccine consists of inactivated microorganism) and Dr. Albert Sabin (live attenuated oral polio vaccine). Louis Pasteur (1885) discovered vaccine against rabies, anthrax and cholera. BCG vaccine was developed by Calmette and Guerin against tuberculosis in France in the year 1908.