K.T.S.P. Mandal's Hutatma Rajguru Mahavidyalaya

T.Y.B.Sc – Zoology
Parasitology

Prof. P. P. Shindekar

Introduction to Parasitology

Parasite

- Organisms which are dependent on other organism for survival.
- Receives nourishment & shelter from another organism i.e. host where it lives called parasite.
- It derives benefit from host.
- A parasite has lost its power of independent life

Host

- As an organism which harbors the parasite & provides nourishment and shelter.
- Host is injured / harmed & parasite is always benefited.
- Parasite obtain various benefits such as shelter, nutrition, reproduction, development from host.

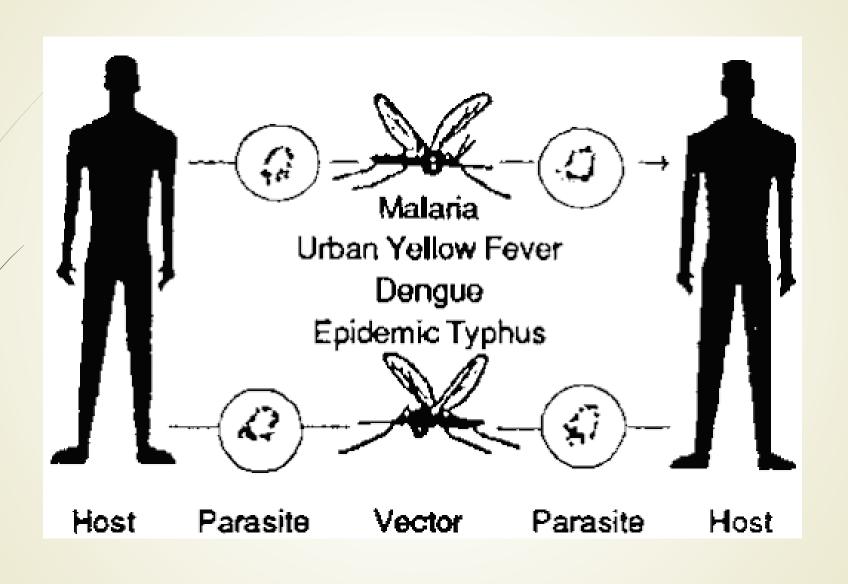
Parasitology

- Is the branch of zoology which deals with the study of parasites, their morphology, life cycle and their pathogenic effects.
- Is also called as medical parasitology

Vector

- A vector is a living organism that carries a disease causing organism to new host.
- Carriers of parasite
- Generally invertebrates Arthropod or Mollusca
- E.g., mosquito, housefly





Types of vector

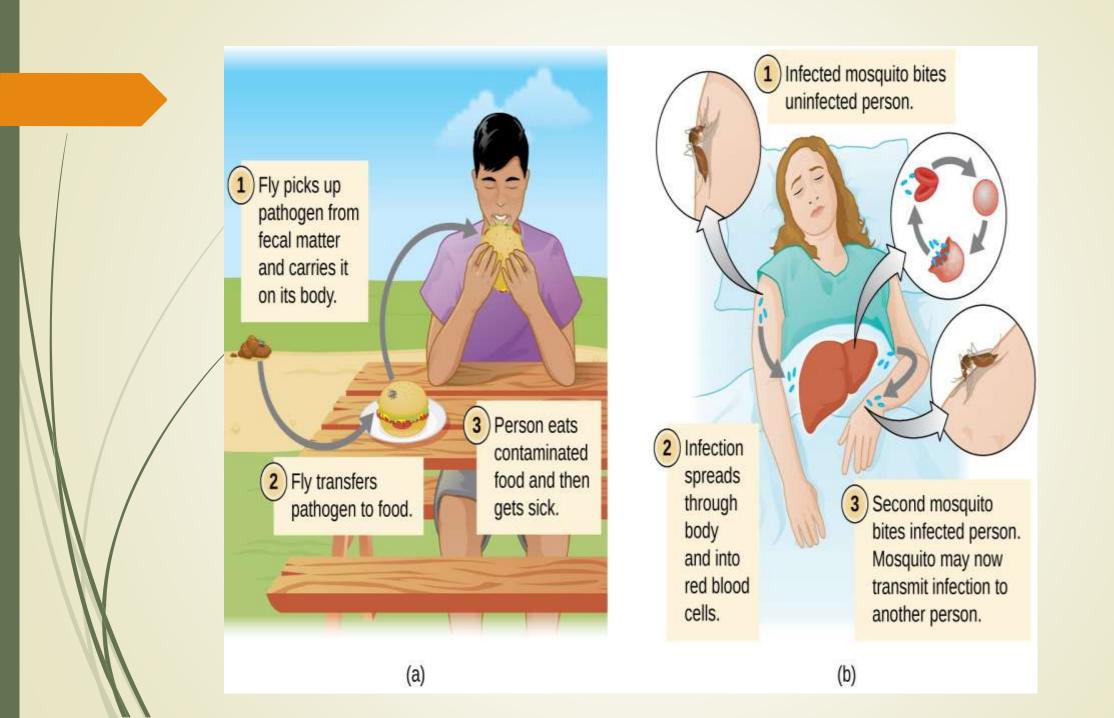
Mechanical vector Biological vector It is the vector in which the parasite It is the vector which merely transfers the infective stages of parasites without parasitic undergoes a part of the development development. before it gets transfer. Ex: Housefly and cockroach for Entameoba. Ex: Female anapheles mosquito in the case of plasmodium.

Biological vectors:

- Undergo multiplication, propagation and development inside the arthropod's body.
- Acquire pathogenic agents in act of blood feed.

Mechanical vectors:

- Transmit pathogens by way of their secretions and the contaminated external surfaces of body.
- Serve as mere contaminators.
- Pathogens do not undergo multiplication ordevelopment inside their bodies.



Host - Parasite relationship

Symbiosis/mutualism

- Both the host and parasite are dependent upon each other.
- None of them are harmed.

Commensalism

- Only the parasite derives benefit from the association without causing any infection to the host.
- It is capable of living independently.

The types of host - parasite relationship

Parasitism

- Always harm the host due to their association.
- The parasite cannot live an independent life.

Commensalism



More Examples of Mutualism

 One kind of <u>flagellate</u> lives in the guts of termites and digests the cellulose in the wood that the termites eat. <u>Without</u> the protozoa, the termites could not completely digest the cellulose.





PARASITISM

- Example: Fleas and mosquitoes feed on blood from other organisms.
 - In this type of parasitic relationship, the host needs to stay alive and it is not damaged greatly



Medical protozoology

Medical helminthology

Medical arthropodology

i.e. Medical entomology

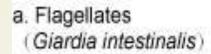
Medical Protozoology

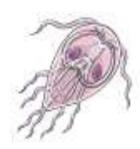
- It is the branch of science that deals with the study of protozoan parasite
- Parasitic and cause serious disease in man and domestic animals

Protozoan	Habitat	pathogeniceffect
Entamoeba histolytica	Large intestine	Dysentry
Trypanosoma brucei	Blood	Sleeping sickness
Plasmodium vivax	R.B.Cs	Malaria

Protozoa

Helminths





b. Amebae Entamoeba)



c. Sporozoa Plasmodium)



d. Ciliates Balantidium coli)







e. Nematodes (Ascaris lumbricoides)



f. Trematoda (Fasciola hepatica)



g. Cestoda (Taenia)

Medical helminthology

- It is the branch of medical science which deals with study of helminth parasite, their morphology, life cycle, pathogenic effects and control measure
- Helminth parasite are divided into two groups
- Platyhelminthes: flatworms which include cestod like Taenia & trematod like liverfluke
- 2. Nemathelminthes: roundworms like Ascaris, Filaria
- Endoparasites of gut and blood in human body and cause various disease collectively called helminthiasis

Medical entomology

- It is the branch of medical science which deals with study of harmful insects to ma and his domestic animals, their morphology, life cycle, pathogenic effects or disease caused by them.
- Insect cause disease in 2 ways
- They bring harmful effects by destroying tissues of their host
- Act as vector carriers of parasite from one host to another. Houseflies, mosquitoes, fleas, lice, flies.
- Ticks and mite

Location on the Host

Ectoparasite

- On outside surface of body of host
- Examples fleas, mosquitoes, horse flies

Endoparasite

- Live in body of host
- Examples roundworms, whipworms, heartworms

Ectoparasite	Endoparasite
(i) The parasite which live on the body surface of the host are called ectoparasite.(ii) Respiration is aerobic.	(i) The parasite which live inside the body of the host are called endoparasite.(ii) Respiration is often anaerobic.
(iii) They can be temporary, or permanent.	(iii) They are generally permanent parasites.
(iv) Example : Lice and Bed-bug.	(iv) Example : Malarial parasite and hookworm.

Endoparasite

- Parasite that live within the body of their host in locations such as alimentary canal, liver, lungs, bloodare known as endoparasite
- Types of endoparasite : depending upon their occurrence in different organs and tissues of the host
- Superficial endoparasite: live on epithelial surface of the alimentary canal e.g. Ascaris
- Visceral endoparasites: live inside tissues like blood, muscles etc
- Blood or haemoparasite: parasite like plasmodium, trypanosome live in blood cells
- 2. Lymph parasite: live in lymph vessels
- 3. Organ parasite: live in particular organ & cause damage to it
- 4. Muscle parasite
- 5. Tissue parasite

Types of Parasites

Temporary Parasite

Visits its host for a short period. Example mosquitoes and bed bugs

Permanent Parasites

Leads a parasitic life throughout the whole period of its life. Example Intestinal helminth

Facultative Parasite

Lives a parasitic life when oppurtunity arises. Example Free living Amoeba

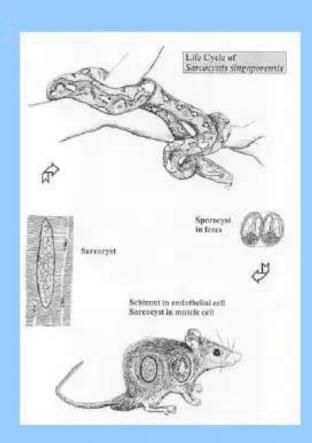
Obligatory Parasites

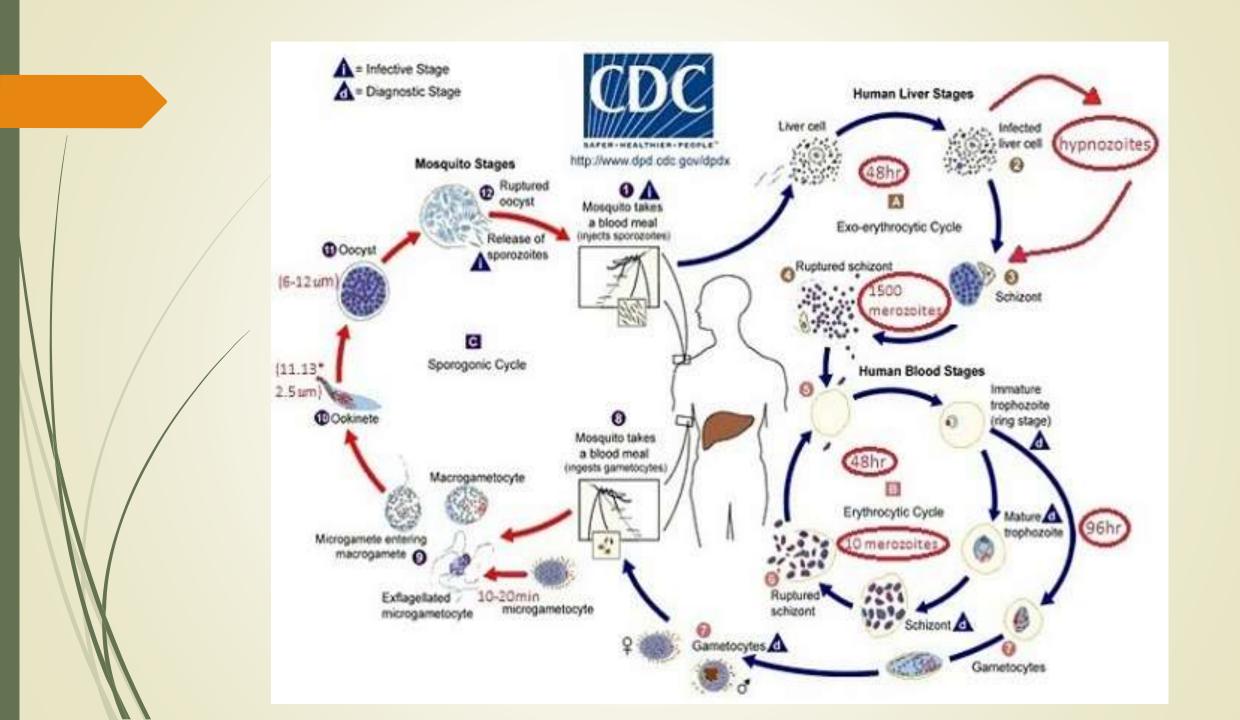
Cannot exist without a parasitic life. Example *Trypanosoma*. Wuchereria

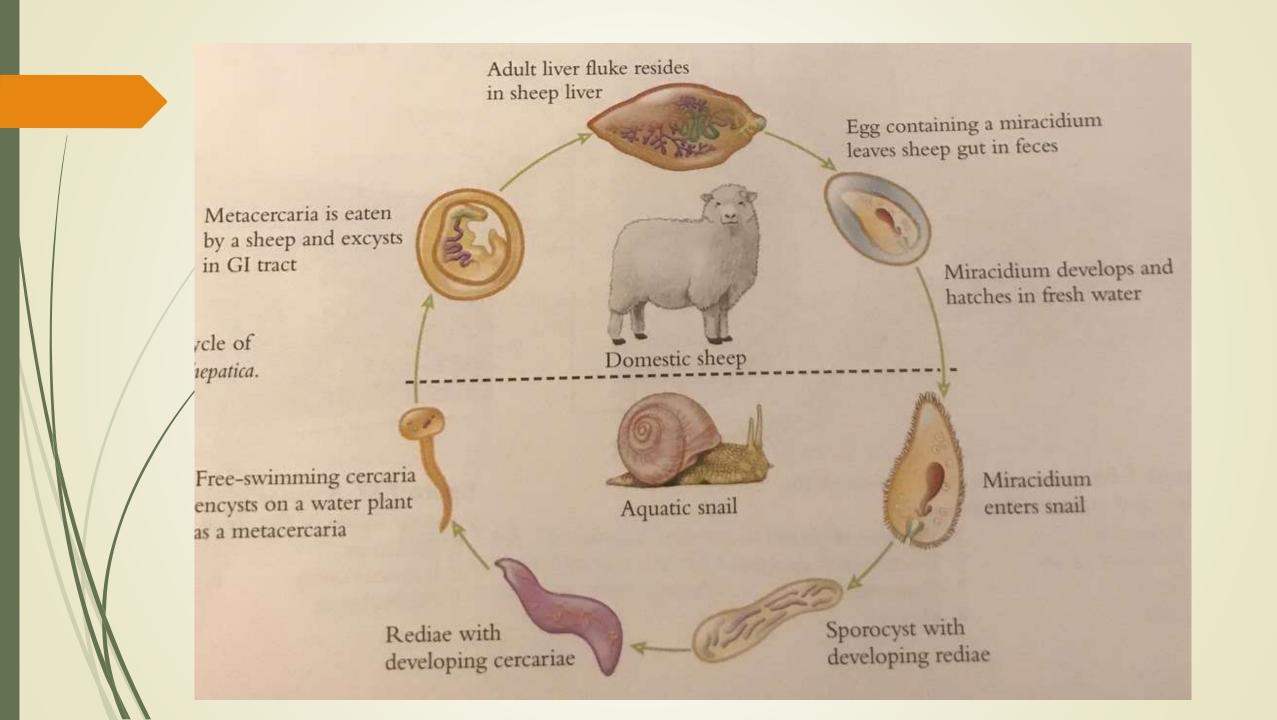
- Occasional parasite: attack on an unusual host & survive. E.g. common liver fluke of sheep occurs in dogs and cats
- Wandering or Aberrant parsites: the parasites which live in the body of host migrate to the place where they cannot live & survive. E.g. larval Ascaris
- Hyper parasite: One parasite supports the life of another parasite.
- Multiparasites or symparasite: In the body of single host when two or more species or types of parasites live simultaneously. E.g. in human host Ascaris & Entamoeba both parasite live in the intestine at same time

Types of Hosts

- Definitive Host: The host in which the parasite goes through its sexual cycle (I.e., fertilization & meiosis)
- E.g., mosquitoes serve as definitive hosts of the malaria parasite (*Plasmodium* spp.)
- E.g., snakes (~30 species) serve as definitive hosts of Sarcocystis singaporensis, a disease of mammals







Types of Hosts

- Intermediate Host: Host in which the parasite replicates but does not go through its sexual cycle
- E.g., mammals, including humans, serve as intermediate hosts of the malaria parasite (*Plasmodium* spp.)
- E.g., mammals (~30 species, including humans) serve as intermediate hosts of Sarcocystis singaporensis

S. singaporensis
has been
proposed as
biological control
of rodents pests—
apparently it can
selectively kill
them!

Types of Hosts

- Reservior Hosts: The reservoir host is the population in which a parasite resides when it isn't affecting a population that we care more about
- E.g., the rabies virus normally is passed back and forth among wild mammals (these serve as the reservoir hosts—the populations that we don't much care about)
- Occasionally, however, rabies can infect pets, and thereby us (the population we do care about)
- To prevent the latter (i) we vaccinate pets, (ii) avoid handling wild animals, and (iii) otherwise attempt to reduced the incidence of rabies in reservoir pops.

Paratenic Host

- Intermediate host that serves as a <u>transport</u>" host for parasitic larva
- Final host must eat this host for adult parasite to develop
- Examples fleas or mice for certain tapeworms

Effects of parasite on host

- 1. Traumatic: In this type of damage, the tearing of the cells and tissues occurs. Because of mechanical injuries, the normal position of cells and tissues in injured part is altered. Number of intestinal parasites cause this type of damage, especially tapeworms and hookworms damage the soft tissue of intestinal mucosa in their attachment. Tearing of mucosa membrane is common when scolex of tapeworm is embedded in it. During the migration of larvae and adult worms they damage the tissue by producing mechanical injury.
- 2. Lytic: Some parasites secrete the enzymes which are responsible for the lysis of cells or tissues of the host. For example, Entamoeba histolytica secretes a special tissue dissolving enzyme, which destroys the intestinal epithelial lining causing its necrosis. The cercaria larvae of blood fluke Schistosoma can penetrate human skin by secreting lytic enzyme and main pathway into the subcutaneous capillaries and then reach the liver.
- 3. Obstruction: An extensive infestation of intestinal round worms Ascaris lumbricoides known to produce intestinal obstruction, particularly in young children because of relative small size of the intestinal lumen. The tapeworm Taenia saginata also causes

4. Loss of nutriment: The parasites which live in the intestine get the environment where predigested food supply is rich. Therefore, they get easily the predigested food of host. For example, Ascaris lumbricoides sucks the nutritive substances from the intestine Ascaris infection causes protein and vitamin deficiency in hyperinfected children.

In the worms, protein and vitamin contents are high which indicates that they suck these nutriments from their host. Tapeworms feed by osmosis on the contents of the bowel Amino acids i.e. proteins are converted by breakdown of shed mucosa cells. The hookworms suck the blood from the intestinal mucosa by suction mechanism and much blood is lost in this process which causes anemia.

- 5. Toxic action: Most of the intestinal parasites secrete, antienzymes (antitryptic and antipeptic) in order to protect themselves from the gastric juices and digestive enzymes of host. They also help the development of malnutrition. The metabolic products of parasite are toxic to the host. These substances if absorbed by host cause irritation of the host's tissue.
- 6. Allergic: The body fluid of intestinal parasites, e.g. Ascaris may give rise to typhoid-like fever, also responsible for various allergic manifestations such as utricaria, oedema of the face, conjuctivities and irritation of upper respiratory tract. Host becomes more sensitive to the proteins and excretory products secreted by the parasite. The merozoites of plasmodium release toxins in the blood which cause malaria fever in which the patient suffers from chills, shivering and high temperature with convulsions followed by profuse sweating.

Host specificity

- One of the fundamental aspects of parasitism
- Host specificity is defined as adaptability of a species of parasite to a certain species or group of host
- Specificity is the phenomenon of parasites being confined to certain host
- Specificity is nothing but the restriction of parasite to one or more kinds of host
- In nature large variety of free living organisms are present & they are adapted to a particular environment.
- If there is change in environment existence of the organism come into danger and unable to survive.

- For example, desert animal cannot survive in extreme cold of polar regions.
- It is also true in parasitic animals because they are also adapted to a definite environment.
- Host itself is the environment for a parasite which lives in it and host adapted to that host.
- It is specific to its host

Factors of host specificity

- Suitable conditions for reaching to the host and transmission of parasite from one host to another
- Parasite should have ability to establish in a host
- Favorable conditions in the body of host for the growth &reproduction of host.
- Therefore these factor decide type of host suitable to the parasite

Host specificity can be categorized into different types

Host specificity

Structural specificity

Physiological specificity

Ecological host specificity

1. Structural host specificity

The structural or morphological adaptation of a parasite to its host is called structural or morphological host specificity.

2. Physiological specificity the physiological adaptation of a parasite to its microenvironment on or in the body of host is called physiological host specificity.

3. Ecological host specificity: the ability to infect a compatible host as the result of ecological opportunity is called ecological specificity