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ديدان طفيلية

المرحلة الرابعة

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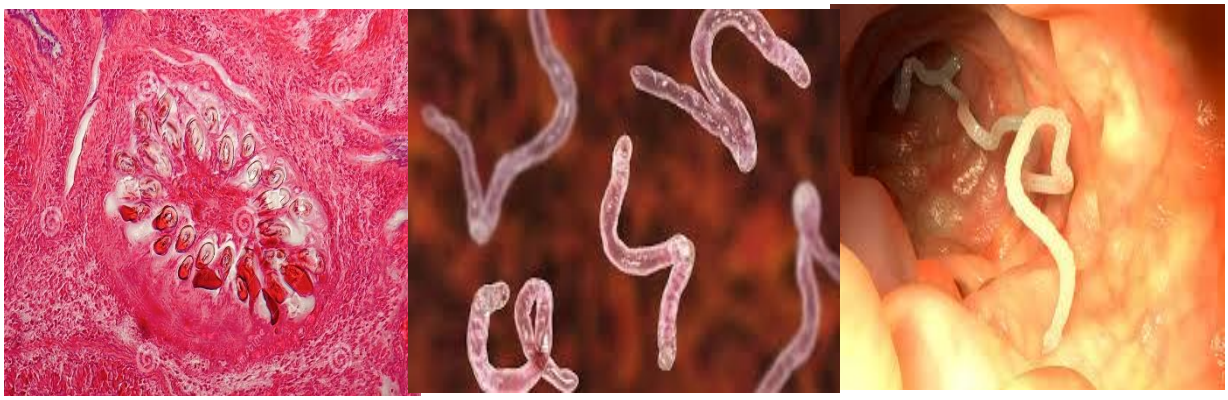

4th Year, Department of biological Science, Madent Alelem University College,1st Semester 2020 Helminthology

-What is Helminthology ?

Helminthology definition is - a branch of zoology concerned with helminths; especially, the study of parasitic worms which cause infectious to human/ animal and the disease they produce. the first part of the word (helmins), belongs to the Greek language which means "worm". Helminthes are studied in microbiology because they cause infectious diseases and most are diagnosed by microscopic examination of eggs or larvae(main infective stages of worms).

-Nomenclature and Taxonomy OF Parasites and

According to the binomial nomenclature as suggested by **Linnaeus**, each parasite has two names: a **genus** and **a species name**. These names are either derived from names of their discoverers, **Greek or Latin** words of the **geographical** area where they are **found, habitat** of the **parasite**, **or hosts** in which parasites are found and its **size and shape**.

All parasites are classified under **the following taxonomic units**—the kingdom, subkingdom, phylum, subphylum, super class, class, subclass, order, suborder, super family, family, genus and species. The generic name of the parasite always begins with an initial capital letter and species name with an initial small letter, **e.g., *Entamoeba histolytica.***

Some Key word and their definitions:

-Parasites

They are living organisms, which depend on a living host for their nourishment and survival. They multiply or undergo development in the host.

Parasite which causes harm to its host is called **Pathogenic parasite.** Parasite which benefits from the host without causing any harm to the host is called **Non-pathogenic parasite and the relations process are (commensal التعايشand Symbiosis التكافل).**Parasites can also be **classified as**:

1- **Ectoparasite*:*** Ectoparasites inhabit only the body surface of the host without penetrating the tissue for example lice القمل ,ticks القرادand mites العث **Fig 1**.

2-Endoparasite : They live within the body of the host (e.g., *Leishmania*) **Fig 1**. Invasion by the endoparasite is called as **infection.**

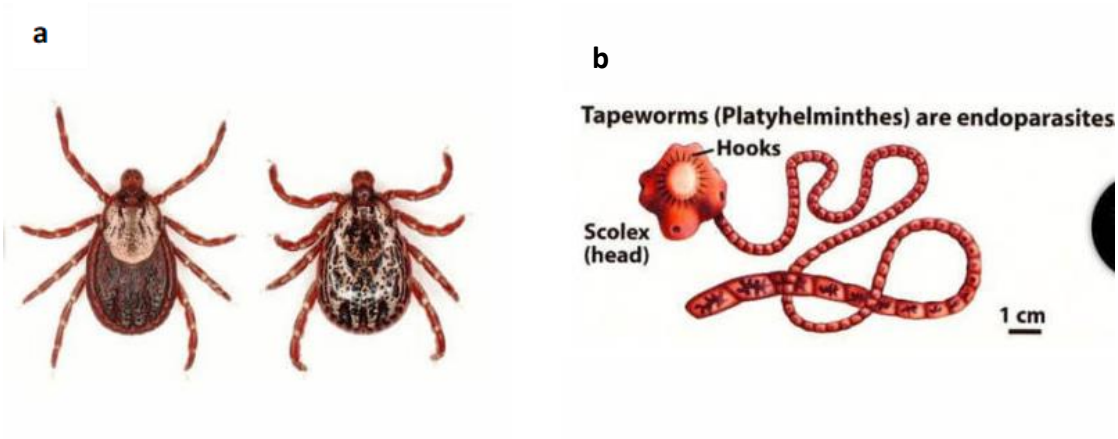

Fig 1. Ectoparasite (Lice) and Endoparasite (tapeworm)

The endoparasites are of following types:

A) Obligate parasite: They cannot exist without a parasitic life in the host (e.g.,*Plasmodium* species).

B) Facultative parasite: They can live a parasitic life or free-living life, when the opportunity arises (e.g., *Acanthamoeba*)

C) Accidental parasite: They infect an unusual host (e.g., *Echinococcus granulosus* infect humans accidentally).

D) Aberrant parasite or wandering parasite: They infect a host where they cannot live or develop further (e.g., *Toxocara* in humans).

Host

Host is defined as an organism, which harbors the parasite and provides nourishment and shelter.

Hosts may be of the following types:

A) Definitive (final) host مضيف نهائي: The host in which the adult parasites replicate sexually (e.g., anopheles species), is called as definative host. Th e definitive hosts may be human or nonhuman living things

B) Intermediate host مضيف مؤقت : Th e host in which the parasite under goes asexual multiplication is called as intermediate host. (e.g., in malaria parasite life cycle, humans are the intermediate hosts).

- Intermediate hosts are essential for the **completion of the life cycle** for some parasites.

-Some parasites require **two intermediate hosts** to complete their different larval stages. These are known as the **first and second intermediate** hosts respectively (e.g., Amphibian snails are the first intermediate host and aquatic plants are the second inter mediate host for *Fasciola hepatica*)

C) Reservoir host مضيف خازن : It is a host, which harbours the parasites and serves as an important source of infection to other susceptible hosts. (e.g., dog is the reservoir host for cystic echinococcosis).

D) Accidental host مضيف عرضي : A host in which the parasite cannot successfully develops (e.g. *Toxocara canis* in humans). However, while a dead end for the parasite this can still cause disease. (e.g. *Toxocara canis* in humans).

Vector الناقل : A living carrier (usually an insect) that transports a pathogenic parasite from one host to another. A classical example is the mosquito which injects malaria parasites with its salivainto humans during a blood meal.

Incubation Period فتره الحضانه : The period between infection and the appearance of symptoms.

Disease مرض : Th e disease is the clinical manifestation of the infection, which shows the active presence, and replication of the parasite causing damage to the host. It may be mild, severe and fulminant and in some cases may even cause death of the host.

Helminthes: are multicellular eukaryotic animals that generally possess digestive, circulatory, nervous, excretory, and reproductive systems. Some are free-living in soil and water. Helminthes infect more than one-third of the world

population. Helminthes infections differ from bacterial or protozoan infections **because** the worms do not usually increase in number in the host.

How we study Helminthes?

Helminthes are studied in microbiology **Fig 2**.
-Because they cause infectious diseases and most are diagnosed by microscopic examination of eggs or larvae.
- Eggs may have striations (lines), a spine, or an operculum (hatch by which the larva leaves).
-Helminthes infect more than one-third of the world population.

- Helminthes infections differ from bacterial or protozoan infections **because** the worms do not usually increase in number in the host

Helminthes do harm their hosts in the following ways:

Symptoms اعراض are many and varied and are dependent upon the type of worm with which the victim is infected

A. Mechanical damage same as

B. Eating host tissues, or completing for vitamins.

Below are some symptoms:

1- By causing **irritation**, as in ***Fasciola*** ***ديدان متورقه***.

2- By **absorbing** the food intended for the host, as in **tapeworms** **ديدان شريطيه** .

3- By **sucking** blood or lymph, as in **hookworms** **ديدان شصيه** .

4- By **feeding** on the tissues of the host, as in ***Ascaris*** ***الاسكارس***.

5- By causing **mechanical obstruction** and pressure, as in **microfilaria**.

6- By causing the **growth of nodules and tumors** and by perforating vessels, as i***n Wuchereria bancrofti*** (تسبب داء الفيل) فخرية بنكروفتية .

7- By causing wounds through the site of infection, as in *Ascaris* or by reducing the resistance of the host to other infections, as in lungworm.

8- By secreting toxins or harmful substances, *e.g.* anti-coagulants secreted by hookworms, anti-digestive enzymes secreted by intestinal worms.

9- By transmitting casual agents of infectious disease, such as bacteria, viruses, blood protozoa and spirochaetes **Fig 2**.

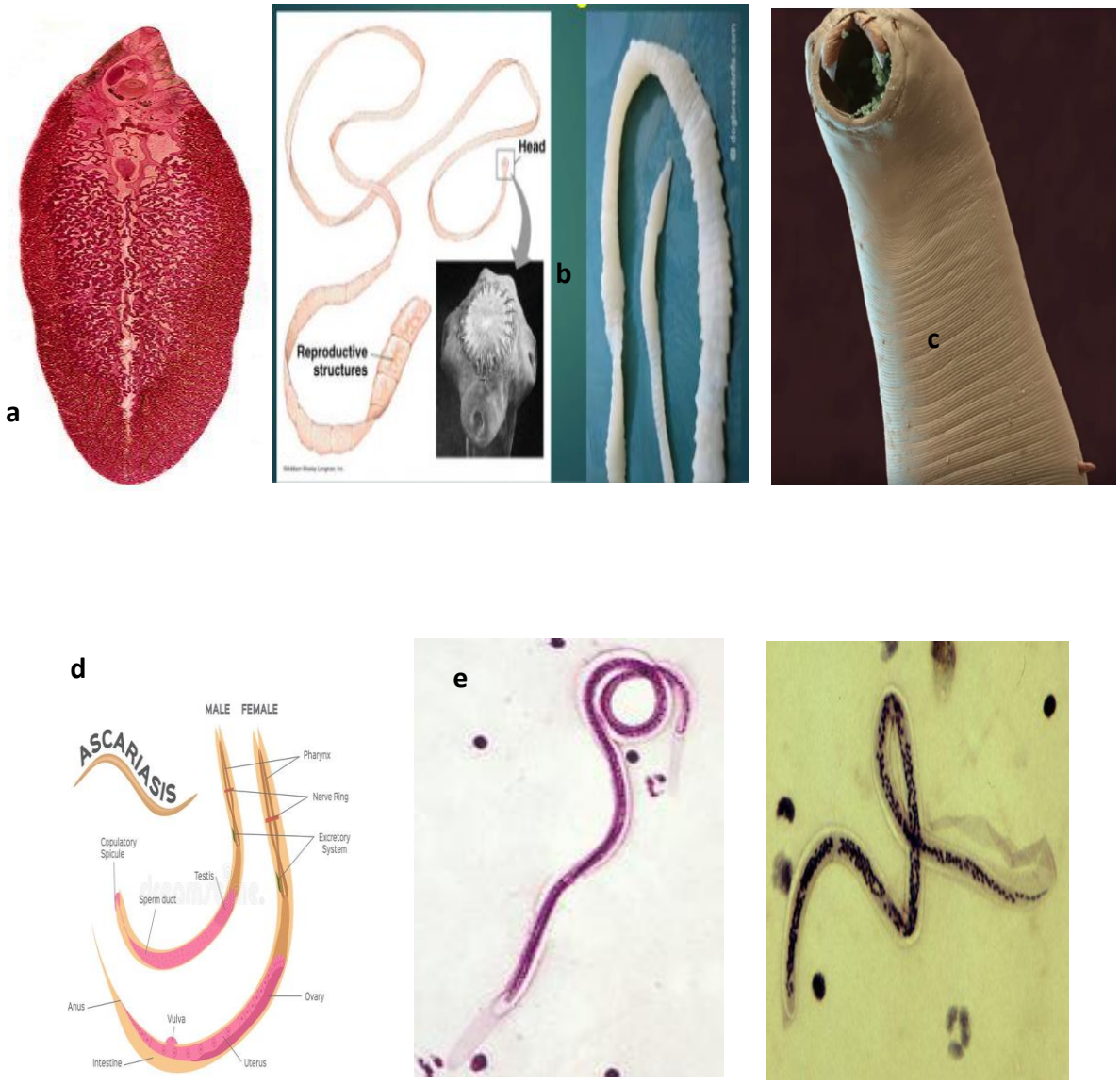

Fig 2. (a) *Fasciola*., (b) Tapeworm, (c) Hockworm, (d) Ascaris, (e) Microfilaria, (f) *Wuchereria bancrofti*

Life cycle

- Parasitic helminthes are highly modified compared to free-living helminthes. They often lack sense organs such as eyes, and may even lack a digestive system.

- Their reproductive system, however is often complex, which ensures infection of new hosts. Some flukes can produce 25,000 eggs per day.

Life cycle of Helminthes

- Monocious (hermaphroditic): Male and female reproductive system in one animal

- Diecious:Separate male and female [Egg → Larva(e) → adult]

- Helminthes eggs have tough resistant walls to protect the embryo while it develops. Mature eggs hatch to release larvae either within a host or into the external environment. **The four main modes of transmission (Fig 3)** by which the larvae infect new hosts are as following:

1- **Faecal-oral transmission** of eggs or larvae passed in the faeces of one host and ingested with food/water by another

2- **Transdermal** transmission of infective larvae in the soil (geo-helminths) actively penetrating the skin and migrating through the tissues to the gut where adults develop and produce eggs that are voided in host faeces (e.g. larval hookworms).

3- **vector-borne transmission** of larval stages taken up by blood-sucking arthropods or undergoing amplification in aquatic molluscs (*Schistosoma*)

4- **Predator-prey transmission** of encysted larvae within prey animals (vertebrate or invertebrate) being eaten by predators where adult worms develop and produce eggs **(***Taenia* cysticerci in beef and pork being eaten by humans).

5- **Oneself (autoinfection)** as in *Enterobius vermicularis.*

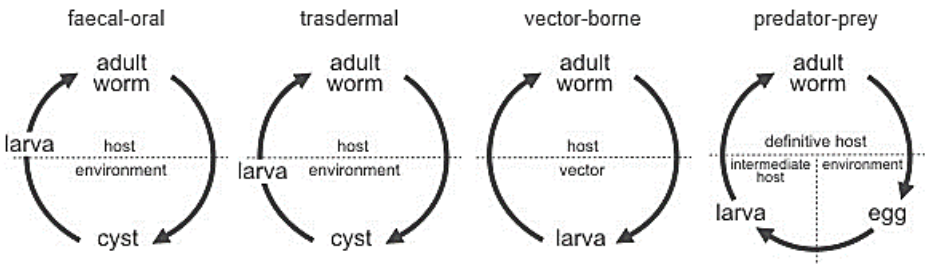

Fig 3. The four main modes of transmission

Intermediate host

- The host that contains the **larval stages** called intermediate host.

- Some parasites have a different host **for each larval stage**, these called **intermediate hosts**

- **Humans** can serve as the **intermediate** host for the **dog tapeworm**.

Cyst كيس : A general **term** for a dormant stage of the life cycle when an organism is enclosed in a protective wall which is called cyst wall. Encysted stages are usually infective for another host **Fig 4**.

- The **larva encysts** as a hydatid cyst in a variety of tissues including the **lungs or liver and even the brain Fig 4**.

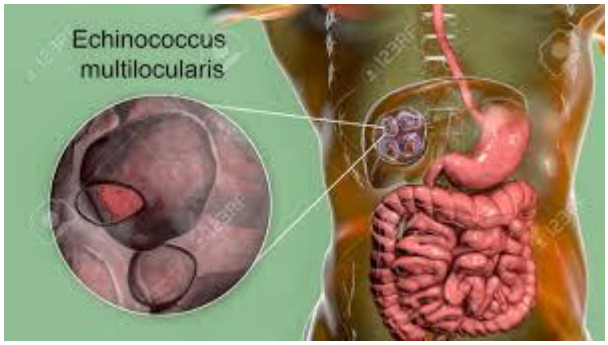

Fig 4. ***Echinococcus multilocularis*** **in Human (Cyst)**

Definitive host:

The host that contains the adult stages (reproductive mature) of a parasite called **Definitive host**

- Humans can serve as the definitive host for beef, pork, and fish tapeworms. Infective stages:

- **Infective stages** either eggs or larvae.

- The eggs of some parasitic round worms (pin worm) are infective for humans.

- The adults are found in the large intestine. From there, the female pinworm migrates to the anus to deposit her eggs on the perianal skin.

- The eggs can be ingested by the host or by another person exposed through contaminated clothing or bedding and immediately cause infection.

- Other parasites are infective for mammals in the larval stage, such as Larvae of filarial worms.

Types of Parasitic Helminthes

Three major assemblages of parasitic helminths are recognized: the Nemathelminthes (nematodes) and the Platyhelminthes (flatworms), the latter being subdivided into the Cestoda (tapeworms) and the Trematoda (flukes)**Fig 5**.

1- Nematodes (roundworms) have long thin unsegmented tube-like bodies with anterior mouths and longitudinal digestive tracts. They have a fluid-filled internal body cavity (pseudocoelum) Adult worms form separate sexes with well-developed reproductive systems.

2- Cestodes (tapeworms) have long flat Tape-like bodies with a single anterior holdfast organ (scolex) and numerous segments. They do not have a gut and all nutrients are taken up through the tegument. They do not have a body cavity (acoelomate) and are flattened to facilitate perfusion to all tissues. All tapeworms are hermaphroditic and each segment contains both male and female organs.

3- Trematodes (flukes) have small flat leaf-like bodies with oral and ventral suckers and a blind sac-like gut. They do not have a body cavity (acoelomate) and are dorsoventrally flattened with bilateral symmetry. Most species are hermaphroditic (individuals with male and female reproductive systems) although some blood flukes form separate male and female adults.

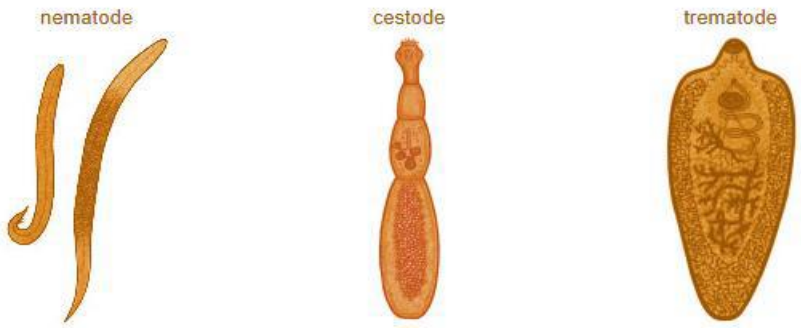

Fig 5. Types of Parasitic Helminthes