MDT MODULE

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by:

Para Family

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INDEX

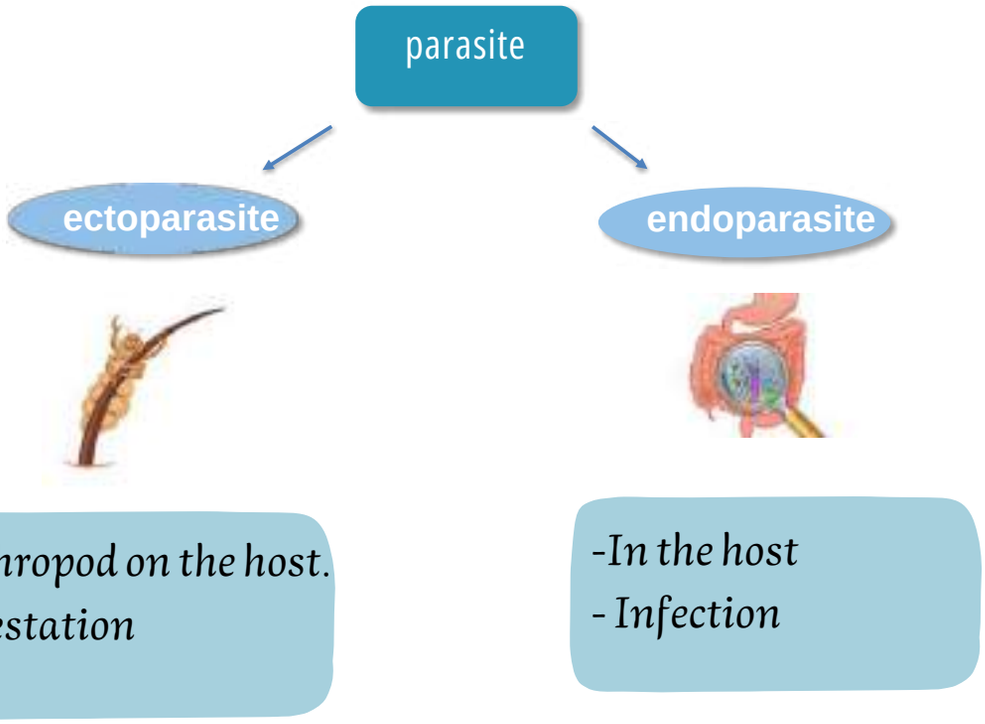
Introduction to Medical Parasitology

Parasite: An organism living temporarily or permanently in or on another larger organism (Host) in order to have shelter and /or nutrition.

Parasitology: A science that deals with an organism (Parasite) that lives in or on another organism.

Medical Parasitology: The study of parasites that is capable of causing disease in man.

host: An organism which harbors the parasite.



Infestation: establishment of arthropods (ectoparasite) upon or within a host.

Infection: Invasion of the body by any pathogenic organism "except" arthropods.

Parasite

1- Obligate parasite

✓ completely dependent upon its host

✓ can't lead a free life

2- Facultative parasite

✓ *free-living*

✓ *parasitic existance.*

3- Permanent parasite: remains all or most of its life in or on its host

4- Temporary parasite: free-living but seeks its host from time to time for food

5-Opportunistic parasites:

Parasites cause mild disease in immunologically healthy individuals, but they cause severe disease in immuno-deficient hosts. e.g., Toxcoplasma gondii

Host: An organism which harbors the parasite.
host + parasite = host parasite relationship

Types of Hosts

Definitive host	Intermediate host	Reservoir host	Carrier host
a host which harbors the adult stage, Or sexually mature stage of a parasite and fertilization takes place in it.	a host harboring larval stage Or sexually immature of a parasite ,and in which no fertilization takes place.	The animal that holds the same species of parasites as man, -source of infection to man - ensures continuity of parasite life cycle.	a host harboring a parasite But exhibiting no clinical signs or symptoms.

Vector: Any arthropod which transports a parasite From an infected to non-infected hos

Biological vectors → **Vectors that are necessary to complete the life cycle of a Parasite.**

Mechanical Vectors → **It is a passive carrier of parasites, not essential in the life Cycle.**

SOME IMPORTANT RELATED DEFINITIONS

- Zoonosis: ***Diseases of animals that are transmittable to man.***
- Habitat: ***The tissue or organ in which the adult stage of parasite exists in the host.***

• *Infective Stage*:
✓*The stage of parasite that can transmit infection to DH and*
✓ *it is capable of entering the host and*
✓ *continue development within the host.*

• *Diagnostic Stage*:
✓*it is the stage of a parasite that can be detected in stool, blood, urine, sputum, CSF or other human body secretions*

• *Prepatent (Biological) Incubation Period:*
It is time elapsing between initial infection with the parasite and demonstration of the parasites or their stages in excreta, blood, aspirate and other diagnostic material.

• *Clinical Incubation Period*:
It is the interval between exposure to infection and the appearance of earliest manifestation.

• *Autoinfection*:
A situation where the infected individual acts as a source of infection to himself.

HOST PARASITE RELATIONSHIP

Once the infecting organism is introduced into the body of the host, it Reacts in different ways and their relation will be one of the following Types:

1-*Mutualism*: Both organisms in asociate are benefited.

2-*Commensalism*: one organism lives at expense of another which is not affected.

3-*Parasitism*: The squelae of parasitism could be one of the following:

Carrier state	Disease state	Parasite destruction
- perfect host parasite relationship where tissue destruction by a parasite is balanced with the host's tissue repair. - the parasite and the host live harmoniously(they are at equilibrium).	-Parasite dominates the upper hand -It can result either from: - lower resistance of the host - higher pathogenicity of the parasite.	Occurs when the host takes the upper hand

Basic Concepts in Medical Parasitology

In medical parasitology, each of the medically important parasites are discussed through:

- morphology
- geographical distribution
- means of infection
- life cycle
- host/parasite relationship
- pathology
- clinical manifestations of infection
- diagnosis
- treatment
- preventive/control measures of parasites

Morphology:

This is especially important in diagnosis of infection and differentiation between pathogenic and non-pathogenic organisms.

Geographical distribution:

Once we are clear about the geographical distribution and conditions favoring survival in relation to different parasites, effective preventive and control measures can more easily be done.

Mode of Transmission: It provides important information relevant to prevention &control.

Direct mode

parasite doesn't require biological vector or intermediate host

Indirect Mode

parasite requires biological vectors or Intermediate hosts

- Ingestion by mouth
- Sexual
- Inhalation during respiration
- Blood transfusion
- Direct skin penetration
- autoinfection
- Congenital (transplacental)
- Trans-mammary (breast milk)

LIFE CYCLE OF PARASITES:

- *Life cycle can either be :*
  - Simple *when only one host is involved*
  - Complex:*involving one or more intermediate hosts.*

- *A parasite's life cycle could be classified into two common phases:*

1) INSIDE THE HUMAN BODY:

✓ *It provides an understanding of the symptomatology and pathology of the parasite.*
✓ *It is essential for selection of method of diagnosis and tratment.*

2) OUTSIDE OF THE HUMAN BODY:

It provides information relevant to epidemiology, prevention, and control.

علم الاوبئة

Effects of parasites on hosts

- *A Parasite can affect the host in a number of ways such as:*

1) Consumption *of the nutritive elements of the host. e.g., Diphyllobothrium latum*
selectively remove vitamin B12.
2) Obstruction *of passages e.g., Ascaris may cause intestinal obstruction.*
3) Bleeding *e.g. Schistosomes eggs.*
4) Destruction *of tissues: e.g. Leishmania donovani.*
5) Compression *of organs, e.g. Hydatid cysts in liver, brain cause pressure.*
6) Opening pathway to secondary infections *e.g. Ulcer formed as a result of Dracunculus medinensis infection exposes to Bacterial, Viral infection.*
7) Transmission *of pathogens to man, e.g., lice transmitting Rickettsia.*
8) Predisposition to malignancy *e.g., Infection with bilharziasis predisposes to malignancy.*

9) *Immunological reactions that may cause:*

- *Inflammation and fibrosis. e.g., liver or urinary tract fibrosis after deposition of the ova of schistosomes.*
- *Allergy development, e.g., bite of arthropod causing itching*
- *Anaphylactic shock e.g., due to rupture of Echinococcus granulosus cyst.*
- *Destruction of tissues. e.g., blood cells destruction in malignant malaria.*
- *Protection from reinfection e.g., Leishmania*

HOST SUSCEPTIBILITY FACTORS

- Not all parasitic infection causes disease of clinical significance.
- Both host and parasitic factors are involved.
- Host factors include:

- Genetic constitution
- Level of immunity
- Intensity and frequency of infections
- Presence of co-existing disease or conditions which reduces immunity e.g. AIDs
- Sex
- Malnutrition
- Life style and occupation

Parasite Factors include:

- Strain of the parasite and adaptation to human host.
- Parasite load.
- Site occupied in the body.
- Metabolic process of the parasite, particularly the nature of any waste Products or toxins produced by the parasite during its growth and Reproduction.

PREVENTION AND CONTROL OF PARASITIC INFECTION:

• *Preventive measures designed to break the transmission cycle are important to successful parasitic eradication.*

Such measures include:

- Reduction of the source of infection by Chemotherapy.
- Sanitary control of drinking water and food.
- Proper waste disposal.
- Control the vector population
- Protective clothing that would prevent vectors bite.
- Good personal hygiene.
- Avoidance of unprotected sexual practices
- Vaccination : as in malaria (under trials)

Classification of Parasites Nomenclature:

- Animal parasites are classified according to the "International Code of Zoological Nomenclature".
- Each parasite belongs to a phylum, class, order, family, genus and species.
- the first name is that of the genus to which the organism belongs (*Capital Letter*) and the second is that of the species (*small letter*).

eg. *Ascaris lumbricoides*.

-Taxonomic classification of medically important parasites of man belong to the kingdom of Animalia and most parasites are members of *4 phyla:*

- Phylum Protozoa ⇨ unicellular parasites
- Phylum Platyhelminthes ⇨ flat worms

- Phylum Nemathelminthes ⇨ round worms

- Phylum Arthropoda ⇨ body has exoskeleton, segmented and attached to appendages

Trematodes

General characters of Trematoda:

A) Adult form:

- usually flat dorso-ventrally, elongated, leaf-shaped, unsegmented, Bilaterally symmetrical.
- There is no body cavity.
- The alimentary system consists of the mouth surrounded by the oral sucker, muscular pharynx, esophagus and intestine. The Intestine bifurcates to form 2 blinded caeca (**no anus**), that reunite in some species.
- cuticle (tegument) covered with spines (help in fixation)
- Organs of fixation in the form of suckers:

- oral sucker: at the anterior end surrounding the mouth.
- ventral sucker: blind on the ventral surface posterior to the oral sucker.
- genital sucker: sometimes present

- Genital system:
  - Trematodes are hermaphrodites (The adult worm contains male and female genital organs) except blood flukes (Schistosomes)

B) Larval forms:

The various larval forms of trematodes are miracidium, sporocyst, redia, cercaria and metacercaria

Cercaria	encysted metacercaria
Cercaria is tailed larva > 1mm in length -schistosomes cercaria has a forked (split) tail. -hermaphroditic trematodes have not forked tail(unsplit) Some hermaphroditic cercariae have fins on the tail (lophocercous).	Only in hermaphroditic trematodes: cercaria shed its tail and becomes enclosed by a thick membrane (cyst). It is usually < 5mm
	

C) Egg:

The eggs of trematodes are usually oval and operculated except for schistosomes, which are spined

Heterophyes

Schistosoma mansoni

CLASSIFICATION OF FLUKES ACCORDING TO HABITAT:

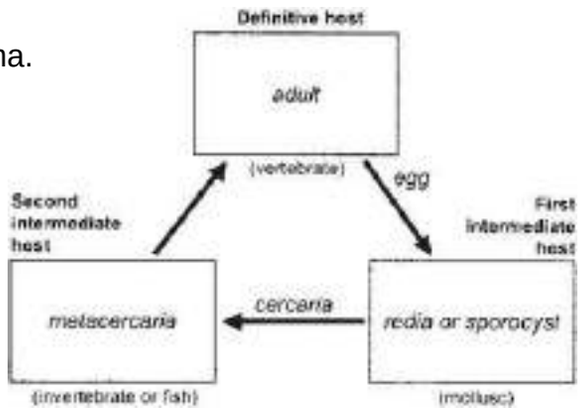
INTESTINAL FLUKES → Heterophyes heterophyes

LIVER FLUKES → Facsiola gigantica and F. hepatica

LUNG FLUKES → Paragonimus (not found in Egypt)

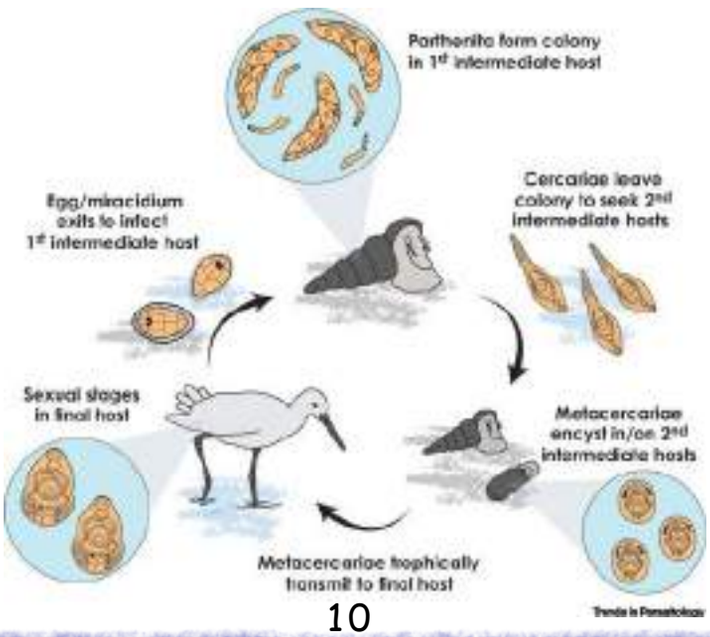
BLOOD FLUKES → Schistosoma.

GENERAL LIFE CYCLE OF CLASS TREMATODA



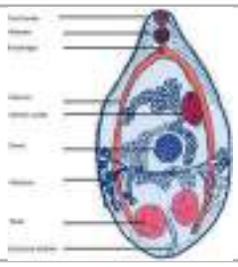
- All medically important trematodes are:

- Oviparous.
- Requires definitive host (vertebrate) and intermediate host (snail).
  Some trematodes may require two intermediate hosts, the first is snail and the second is fish.
- The eggs must reach water source either fresh or brackish according to species.

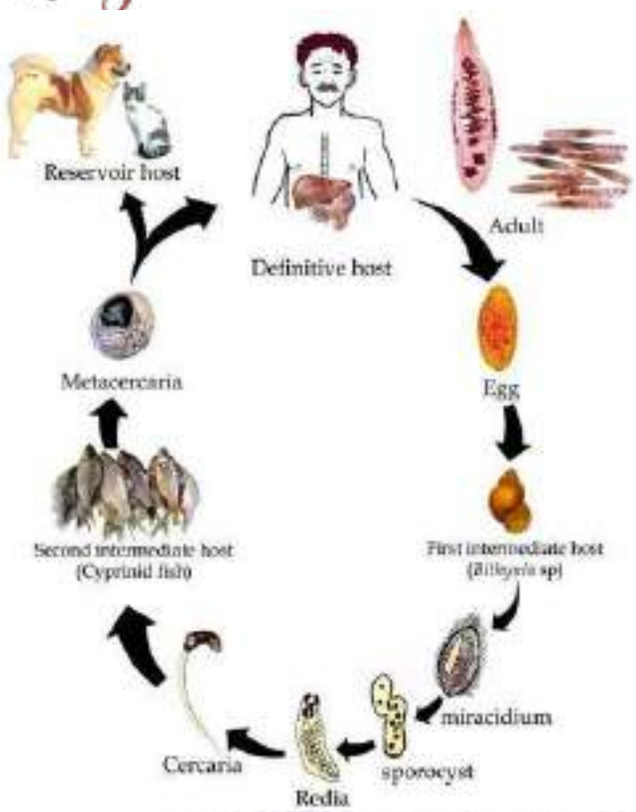


Heterophyes heterophyes

- **Disease:** Heterophyiasis; Heterophyidiasis
- **Geographical distribution:** Egypt, Iran and Far East
- **Morphology:**

ADULT	EGG	CERCARIA
-The worm is pyriform in shape -1.3 x 0.5 mm in size. -There is a genital sucker posterolateral to ventral sucker	**Shape:** oval, operculated with a slight shoulder at the rim of operculum and a knob at the posterior pole, **Size:** 30 x 15um **Color:** light brown **Content:** contains fully mature miracidium at oviposition	It has a membrane on the not forked tail
		

Life cycle



DH = definitive host

IH = intermediate host

IS = infective stage

MOI = mode of infection

- **Habitat** → small intestine (adult attached to mucosa between the villi)
- **DH** → Man and fish-eating animals (reservoir hosts).
- **IH** → **Two** intermediate host are required.
  - 1st:brackish water snails, Pirenella in Egypt.
  - 2nd :fish, chiefly Mugil and Tilapia in Egypt.
- **IS** → encysted Metacercaria on fish.
- **MOI** → Ingestion of raw or undercooked fish /eating under salted fish (less than ten days)

- **Pathology**

There is no appreciable injury to the intestine, except in heavy infection, irritation of the intestinal mucosa may be found and ulceration of The intestinal wall with eosinophilia but no anemia.

- **Clinical picture**

o In light infection, thre is no complaint.
o In heavy infection, there may be abdominal pain, mucous diarrhea,
o Rarely, the eggs of the flukes move into the heart (egg embolism), fatal valvular and myocardial damage may occur.

- **Diagnosis**

By finding the eggs in the feces

- **Treatment**

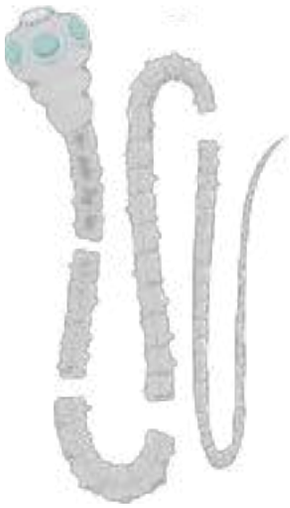
Praziquantel *is the drug of choice*

- **Prevention**

1) Health education:
1. proper cooking of fish,
2. abstinence defecation in water
3. proper salting of fish (It should not be consumed before 10 days).
2) Snail control.

سَلَامٌ عَلَيْكُم بِمَا صَبَرْتُمْ
فَنِعْمَ عُقْبَى الدَّارِ

Cestodes (Tapeworms)



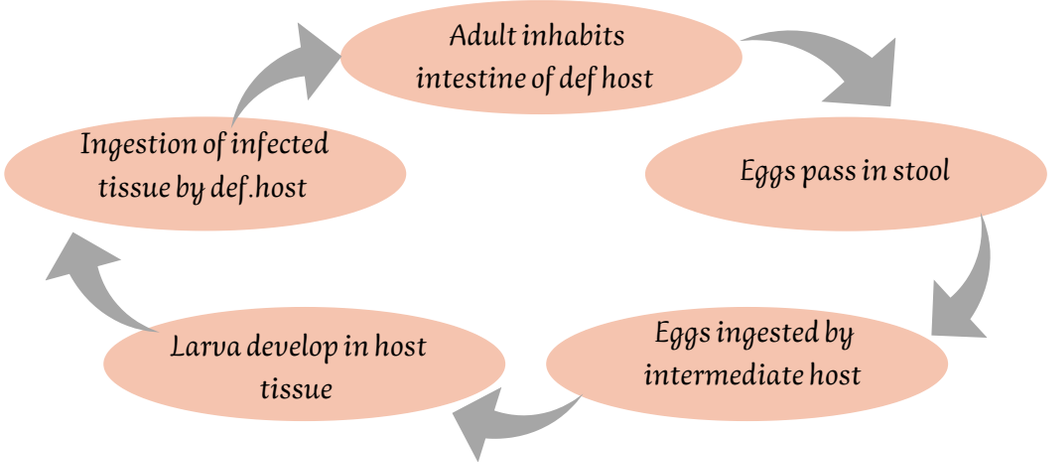
• General features

- Cestodes have tape-like, dorsoventrally flattened, segmented bodies.
- Tapeworms are hermaphrodites (mature segment contains both male and female).
- The digestive system is either absent or rudimentary.
- They are oviparous.
- They possess scolex, neck, and proglottids (segments).
- The scolex is the point of attachment between the host and the parasite. It may be equipped with suckers, hooks, or grooves, which aid in the attachment process.
- The proglottids near the neck, are immature segments, behind them are the mature segments, and at the hind end, are the gravid segments.

• Classification

Intestinal cestodes (Man acts as definitive host)	Tissue cestodes (Man acts as intermediate host)
✦ Diphyllobothrium latum (fish tapeworm).	⟹ Spargana of Diphyllobothrium spp.
✦ Taenia solium (pork tapeworm)	⟹ Cysticercus of Taenia solium
✦ Taenia saginata (beef tapeworm)	⟹ Coenurus of Multiceps spp.
✦ Hymenolepis nana (dwarf tapeworm)	⟹ Cysticercoid of Hymenolepis nana.
✦ Hymenolepis diminuta	⟹ Hydatid cyst of Echinococcus spp
✦ Dipylidium caninum	

Life cycle

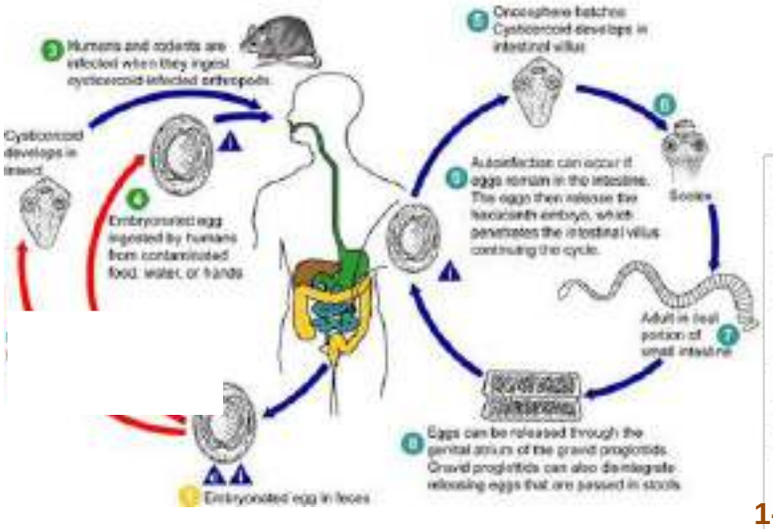


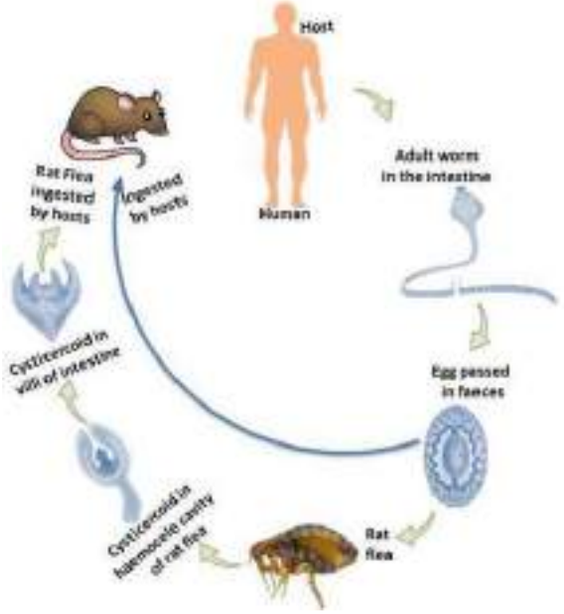
Hymenolepis nana (Dwarf Tapeworm)

- **Disease:** dwarf tapeworm infection, hymenolepiasis nana
- **Geographical distribution:** cosmopolitan
  world wide
- **Morphology:**

ADULT	EGGS	CYSTICERCOID (LARVAL FORM)
7 to 50 mm in length. Consist of about 200 proglottids. The scolex has 4 suckers and retractile rostellum armed with a single circle of hooks.	30 X 50 microns Exhibit polar filaments laying between the eggshell and the hexacanth embryo (oncosphere).	Bladder like structure. It has tail like appendage

Life cycle





- **Habitat:** In the upper two thirds of the ileum.
- **DH:** Man and occasionally rodents. → كحوارض
- **IH:** Man and occasionally beetles, larva of fleas and cockroaches.
- **IS:** Eggs &Cysticercoid larva
- **MOI:**

1-Direct route: Ingestion of eggs via fecal-oral route or with contaminated food.

2-Autoinfection :

-External autoinfection (patient hand contaminated with eggs from his own stool)

-Internal autoinfection (eggs release their embryo, which penetrates the villus continuing infective cycle without passage to external environment)

3-Indirect route : Accidental ingestion of an infected insects containing cysticercoid

Clinical picture:

- Infection is usually asymptomatic and self-limiting.
- In children, moderate parasite burden may cause mild abdominal disturbances as abdominal pain with or without diarrhea, anorexia, vomiting and dizziness.

Diagnosis:

- Finding eggs in the feces

Treatment:

- **Pranziquantel** is the most effective treatment.
- **Niclosamide** is a 2nd choice.

Prevention:

- Improving hygienic habits of children and environmental sanitation.
- Treatment of infected persons.
- Rodent and insect control should be undertaken

Hymenolepis diminuta

Morphology:

Adult:	Egg:
✓ Ranges from is 10-60 cm in length. ✓ scolex is club shaped and has a rudimentary apical unarmed rostellum and four small suckers.	The egg is 60x70µm and differs from that of H. nana in the absence of polar filaments on the inner membrane

Life cycle

The life cycle is very similar to that of H. nana except for two points:

- The eggs of H. diminuta are not infectious for the definitive host including human (i.e, no direct life cycle)
- The insect intermediate host is obligatory (i.e, indirect life cycle is mandatory)

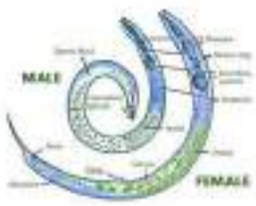
Clinical picture

Most infections are asymptomatic, but patients may present with mild nausea, anorexia, abdominal pains and diarrhea

Diagnosis and Treatment : As H. nana

N.B. No autoinfection in H.diminuta, so no need to take the niclosamide for 7 days.

Nematoda (Round worms)



GENERAL FEATURES:

Nematodes (Greek name means thread), are long, thin thread like worms with a thick cuticle.

- Elongated worm, cylindrical, unsegmented and tapering at both ends.
- Variable in size, measure <1 cm to about 100cm.
- Cross-section of the worm shows a cavity within which lie the different organs
- Sex separate and male is smaller than female and its posterior end is curved ventrally

Classification:

A)INTESTINAL NEMATODES

(nematodes living in the intestine)

Small intestine:

- Ascaris lumbricoides
- Ancylostoma duodenale
- Necator americanus
- Strongioloides stercoralis
- Trichinella spiralis

Large intestine:

- Entrobius vermicularis
- Trichuris trichura

B)TISSUE NEMATODES

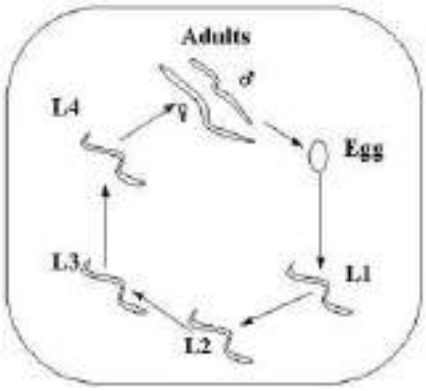
(nematodes living in lymphatic and subcutaneous tissue)

Adult forms

- Wuchereria bancrofti
- Borgia malayi
- Loa loa
- Onchocerca volvulus
- Dracunculus medinensis

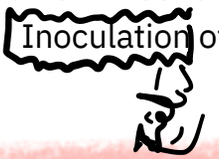
Larval forms

- Toxocara spp.
- Trichinella spiralis



GENERAL LIFE CYCLE OF NEMATODES:

- In most species, sexual reproduction by adult nematodes occurs Within an infected definitive host
- Eggs are laid by the female and Pass from the host into the external environment
- Emberyonated eggs Either become infectious or they hatch giving larva which Passes Through developmental stages (Egg → Larva1 → L2 → L3 → L4 → adult)
- Human infection occurs either by ingestion of eggs or by Inoculation of larva into human body.



Enterobius vermicularis (Oxyuris)

Common names: Pin worm, seat worm, thread worm

Disease:

Enterobiasis | oxyuriasis | Pinworm disease | seat worm disease

Geographicaldistribution : Cosmopolitan

Morphology:

ADULT

- worm is covered with striated cuticle
- has 2 anterior cuticular Wings like expansions (alae)
- 2 lateral thickenings along the length of the worm
- Double bulbed esophagus.



Female:

- 10 mm in length
- posterior end is straight with long Pointed tail.

Male:

- 5 mm in length,
- the posterior end is curved ventrally.

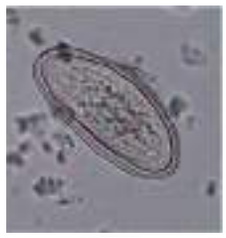
EGG

Shape: plano-convex

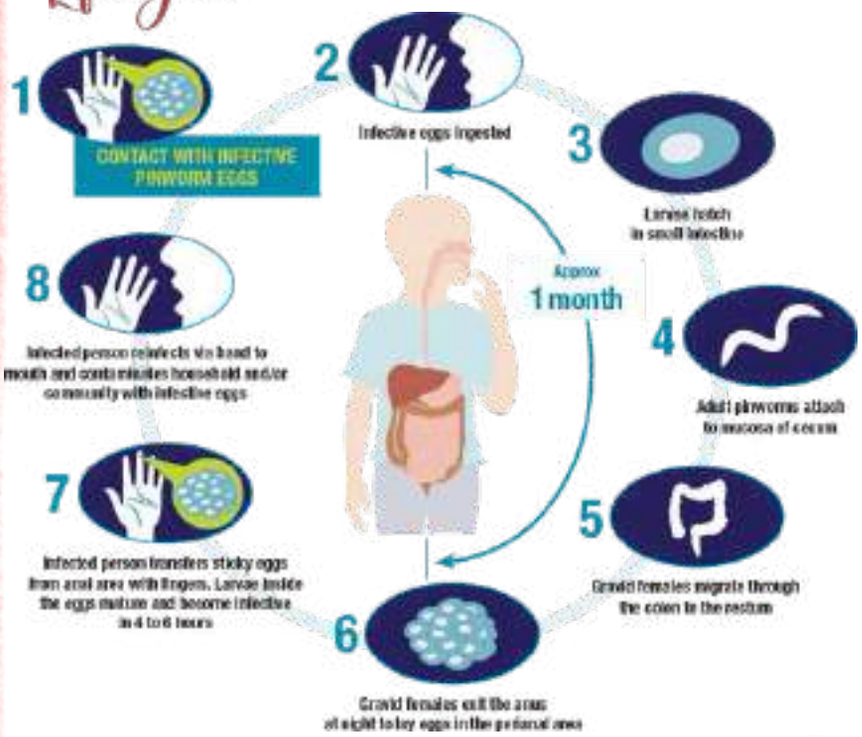
Size: 20x50 µm

Content: full-developed larva.egg

- shell has 2 layers covered by a third outer thin albuminous translucent



Life cycle:



- **Habitat** → large intestine
- **DH** → man is the only host
- **IS** → embryonated egg
- **MOI**
  - direct from person to person by feco-oral route
  - Inhalation & swallowing eggs via contaminated blankets or sheets
  - external Autoinfection

Pathology:

- The worm produces intense irritation and pruritus of the perineal area (pruritis ani).

Clinical picture:

Intestinal infection:

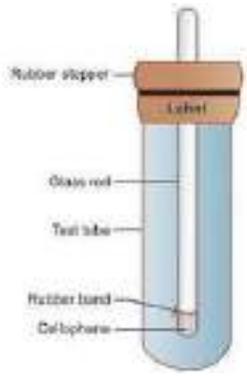
- the most common symptom is nocturnal anal Pruritus. These symptoms can lead to insominia, irritability, anorexia and Weight loss in children Scratching can lead to perianal eczema and
- Secondary bacterial infection.

Non-intestinal infection:

- In women, migration of the adult female worms May produce vaginitis, endometritis, or salpingitis.
- In children and Adolescents, entrobiasis is one of the most important causes of enuresis & recurrent urinary tract infection

Diagnosis:

1- Swabbing the perianal region:



- Detection of eggs in perianal swab is the most frequent method of diagnosis.
- Less commonly, detection of eggs or adult female in stool or urine.
- Eggs are rarely found in feces (5%)
- better obtained by swabs early in the morning before defection.

✦ The scotch adhesive tape swab:

A strip of sticky scotch tape is applied to the perianal region and then spread on a slide

✦ National institute of health swab (N.I.H.):

A cellophane paper is folded and tied at the tip of a glass rod inserted in a test tube tightly covered. The cellophane end is applied to the perianal region, then removed and spread on a slide.

2- Visualizing the adult female in perianal area or in stool.

Treatment:

- All members of the house must be treated at the same time.
- Mebendazole (Vermox),
- Mercurial ointment (white precipitate ointment):
  -It is applied to perianal region especially by night
  -It relieves itching, kills females and prevents dispersal of eggs.

A second dose should be given after 2 weeks to prevent autoinfection

Prevention:

- Personal cleanliness is essential:
  - Fingernails should be cut short
  - Hands should be washed thoroughly after using the toilet and before meals
  - anal region should be washed on rising
- Application of ointment to perianal region will prevent the dispersal of eggs.
- Infected children should wear tight-fitting cotton pants.
- Use a shower bath and not bathtub.
- Night clothes and bed sheets should be carefully handled and sundered.
- Protection of food from dust and from hands of infected individuals.
- Mothers should be informed that it is a self-limited and that kindergarten and playschool for the young are fertile sources of Enterobius.

Loa loa

Disease:

- Loiasis
- Eye worm disease
- Calabar swelling disease

Geographic distribution: Tropical Africa

Morphology:

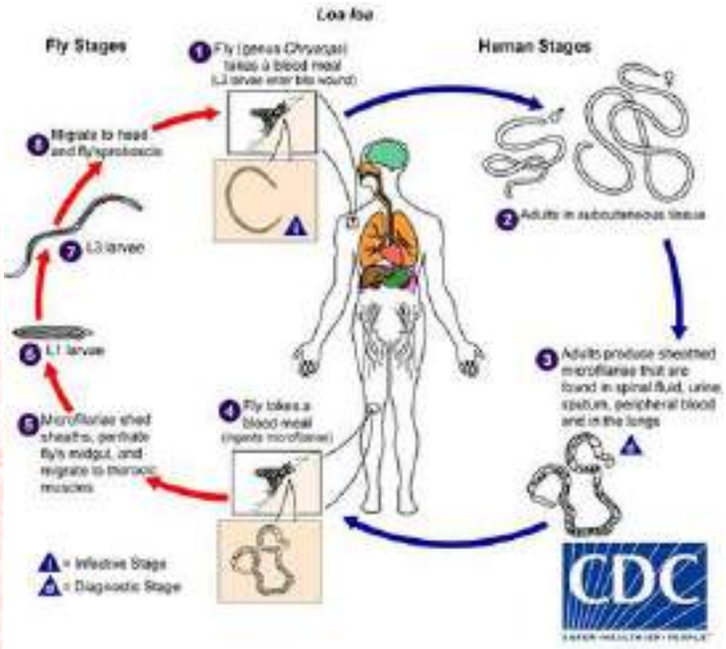
ADULT

- **Thread like**
- **Cylindrical worms**
- **Female 6 cm**
- **male 3 cm in length**

MICROFILARIA

- **250×8micron**
- **Sheathed**
- **Tail is kinky curved &full of nuclei**

Life cycle :



- **Habitat:** subconscious and muscular tissue
- **Definitive host:** man
- **Vector :** Chrysops (human biting mango flies)
- **Infective stage :** L3 larva in proboscis of Chrysops
- **Mode of infection:** bite of the fly, larva migrate and enter skin through puncture wound

◇ Pathology:

- It's due to allergic inflammatory response against the worm antigens

◇ Clinical picture:

Calabar swelling (fugitive swelling)

- It disappears in few days and reappear elsewhere .
- It is Subcutaneous swelling
- Not tender Up to 3cm
- It may be itching

Eye worm disease

- Occurs when worm is seen crossing eye
- Eye worm can cause :
- Eye congestion
- itching
- Pain
- light sensitivity

◇ Diagnosis:

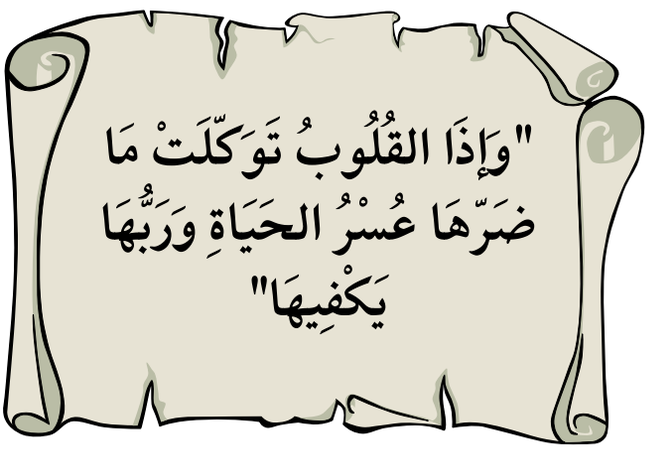
- Diagnosis rests on appearance of manifestation in endemic area
- Detection of microfilaria in peripheral blood 《microfilariae strictly diurnal, appearing in the peripheral blood only between 8 AM and 8PM.》
- Presence of antifilarial antibodies is highly suggestive in endemic area.
- The adult worm can be demonstrated by:- Removal from the skin or conjunctiva
- High eosinophils count is suggestive in endemic area

Treatment:

- Diethylcarbamazine (DEC)
- the drug of choice as it is active against the adult and microfilariae
- removal of the adult

Prevention:

- DEC in a dose of 300mg once weekly for adults is effective in preventing Loa loa infection.
- Mass treatment: Ivermectin with DEC, as skin microfilariae density reduced to zero within one month and increased to only about 2 to 10% by 12 months after treatment. Ivermectin is taken as a single dose of 200µg per kg.
- Individual protection from vector flies can be achieved by use of insect repellents and light-colored clothing.



Introduction to Protozoa

Definition:

Protozoan is:

- Unicellular organism (so not animal)
- True nucleus (nucleus surrounded with nuclear membrane)
- Has specialised membranous organells (eukaryote)
- Has no cell wall (so it's not plant, algae or fungi)
- Feeds on organic compounds (so it's not plant or algae)

Classification of subkingdom protozoa :

- Phylum: sarcomastigophra (amoeba and flagellates)
- Phylum : Apicomplex
- Phylum: ciliophora
- Plylum: Microspora

Amoebas: able to form temporary cytoplasmic extensions called pseudopodia, or false feet, which use to move

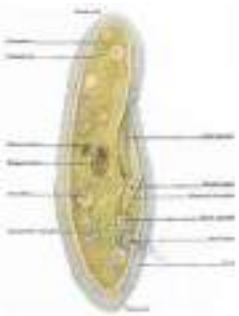
Flagellate: Possess one to many flagella for locomotion and sensation

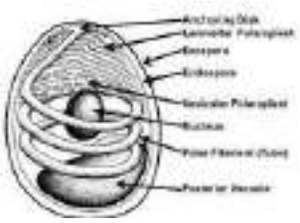
Apicomplexans: they invade host cells via apical complex associated with anterior and present in some developmental stages

Ciliates: have hair-like organelles called cilia, which are identical to eukaryotic flagella, but are shorter and much larger number, with a different undulating pattern than flagella.

Microsporidia:

a)Have polar tube or polar filament used to infiltrate host cells.
b)They're obliterate
c)spore-forming
d)intracellular parasites.





Introduction to Protozoa
Entamoeba histolytica

Life cycle:

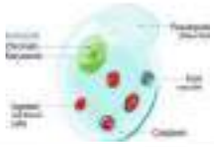
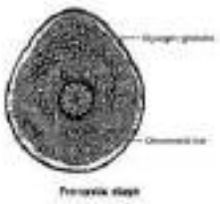
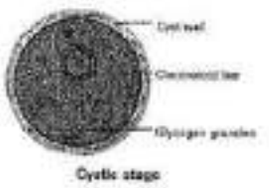
- Trophozoites:
  - The active feeding and growing stage of the protozoa.
  - It derives nutrition from the environment by diffusion, pinocytosis and phagocytosis
- Cyst stage, is the stage by with protozoa is transmitted from one host to another
- Single Host: Some protozoa like intestinal flagellates and ciliates require only one host within which they multiply asexually in trophic stage and transfer from one host to anothe by the cystic form.
- Two hosts: In some protozoa like Plasmodium, asexual method of reproduction occurs in one host (man) and sexual method of reproduction in another host (mosquito).

Entamoeba histolytica

Disease : Amoebiasis, amoebic dysentery

Geographical distribution : cosmopolitan, mainly in tropical and subtropical areas

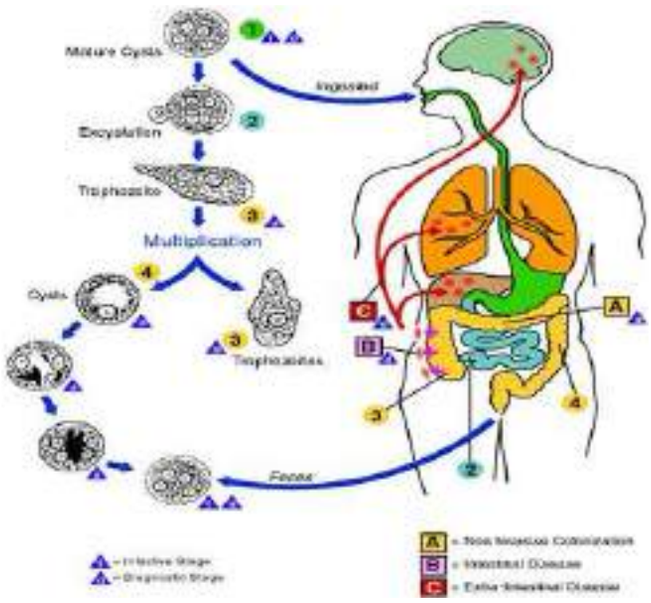
Morphology:

TROPHOZOITE	PRECYST	CYST
Acts as active **motile** feeding reproducing stage. measures (15-60 µm)in diameter (usually 18-30 µm) and typically produces one large pseudopodium at a time. **Cytoplasm**:) ecto/endoplasm(contains food vacuoles that enclose the host's erythrocytes, leucocytes, and fragments of epithelial cells, and bacteria. **Nucleus :** -3.7µm -spherical and has central, small karyosome and fine peripheral chromatin dots. 	trophozoite withdrews its pseudopodia and becomes rounded and devoid of food inclusions 	10-18 µm uninucleated divides twice by mitotic division to form 4 nucleated cyst (infective Stage) Uninucleate cyst ↓ Binucleate cyst ↓ Mature quadrinucleate cyst 

Introduction to Protozoa
Entamoeba histolytica

Life cycle:

The life cycle takes place inside a single final host (man).

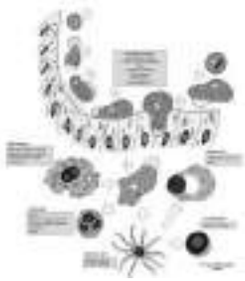


- **Habitat** ⟶ The parasite lives in the large intestinal lumen mainly caecum and may invade other tissues,reaching the circulation leading to extra-intestinal lesions.
- **Infective stage** ⟶ Four nucleated cyst in contaminated food.
- **Mode of infection** ⟶ Ingestion of infective stage.

Pathology:

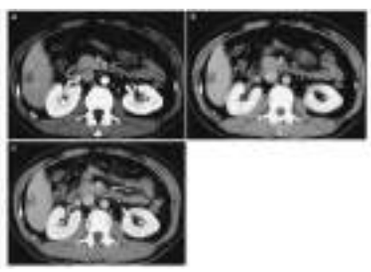
a) Intestinal amoebiasis: -

- Invasion of the intestinal wall leads to formation of several flask-Shaped ulcers in the colon as primary lesions.



b) Extraintestinal amoebiasis:

- The lesions are secondary to the primary large intestinal lesions
- may result in hepatic, pulmonary or cerebral or renal.....ect (amoebic abscess).



Clinical manifestations:

Intestinal amoebias:

- Asymptomatic ⟶ cyst passers about 75%, the Parasites live commensals in the intestinal lumen
- Symptomatic ⟶

Introduction to Protozoa
Entamoeba histolytica

Non-dysentric amoebiasis (chronic amoebiasis)	Dysenteric Amoebiasis (Acute amoebiasis)
Symptoms range from mild to intense and long lasting	This found in 5% of infected cases
There is diarrhea, abdominal cramps, nausea, anorexia	It starts with abdominal discomfort and loose fecal and progresses to diarrhea
There is no visible blood in stool	The number of stools increases (up to 10 to 20 /day)
The diarrhea is alternating with constipation	little fecal material is present, but blood, mucus, and nits of necrotic tissue become increasingly evident
If not treated, chronic amoebiasis may pass to frank dysentry	As progresses, there's fever, colic, vomiting and abdominal tenderness

Exrtaintestinal amoebiasis:

• Amoebic hepatic, pulmonary, cerebral and renal abscesses that are difficult to be suspected clinically but diagnosed serologically and radiologically (using X-ray,CT and/or MRI)

Diagnosis:

1) Diagnosis of intestinal Amoebiasis

- **Stool examination:** Entamoeba cyst is found in formed stool, trophozoite in diarrhoeic stool. Both forms may be found in soft stool
- **Culture:** culture on specific media may be used to increase the number of predicted positive cases
- **Sigmoidoscopy and biopsy:** Characteristic amoebic ulcer is found in severe cases
- **Serology:** Many tests are available, but their use for diagnosis of tissue invasion. Asymptomatic cysts carriers have negative serological tests, unless tests are positive from previous invasive amoebiasis

2) Diagnosis of Extraintestinal Amoebiasis

- **Serology:** More than 90 %of patients have positive serologic titers.
- **Radiology:** May be suggestive specially in hepatic amoebic abscess.
- **Detecting the parasite :** Aspiration of the lesion in selected cases may be of help.

Treatment:

- Metronidazole and Tinidazole are both effective against intestinal and Extraintestinal diseases

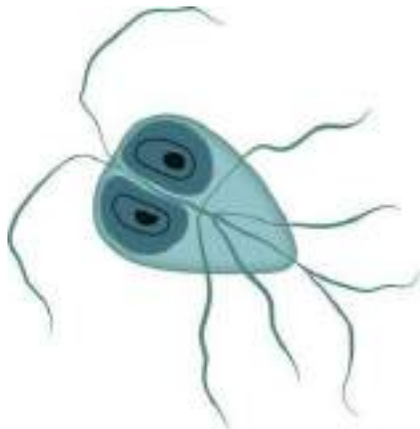
Control and prevention:

- Food sanitation, sanitary waste disposal and safe water supply
- Treatment of infected cases
- Food handler examination Health education

cutaneous leishmaniasis

➢ What is leishmaniasis?

Is a disease caused by protozoan parasites that belong to the genus leishmania.
Disease transmitted by the bite of creatine species by sand fly.



➢ Types of leishmania?

1- Cutaneous Leishmania.
2- Visceral Leishmania.
3- Mucosal Leishmania.

Parasites and geographical distribution:

A) Old world leishmaniasis:

- L. tropica minor :
  - widely distributed in Middle East, India, Mediterranean countries.
  - Infections are anthropophilic.
- L. tropica major :
  - found in North and sub-Saharan Africa, Middle East, south and central Asia.
  - Infections are zoonotic.
- L. aethiopica:
  - found in Yemen, and the highlands of Ethiopia and Kenya.
  - Infections are zoonotic with sporadic human cases.

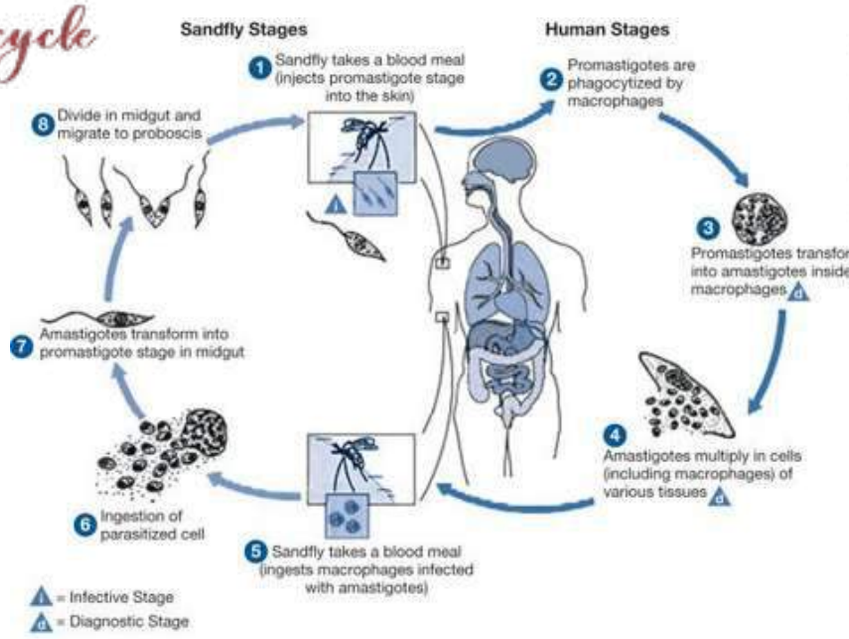
B) New world leishmaniasis:

- L. mixecana complex:
  L.brasiliena complex:
- _____
  - found in forests of Central and South Americas.
  - Infections are zoonotic.

Morphology:

AMASTIGOTE	PROMASTIGOTE
The only intracellular form of Leishmania spherical or ovoid 2-3 um in diameter has 2 nuclei, a large nucleus and kinetoplast (parabasal body and blepharoplast). There is no free flagellum.	Spindle-shaped 14 x 3 um has 2 nuclei, has central nucleus and an anterior kinetoplast arising from the blepharoplast a free flagellum. No undulating membrane. This form is found only in vector or culture media.

Life cycle



- Habitat → RES of skin ,macrophages
- D.H → Human, some mammals
- Vector/I.H → Sandfly (biological host)
- IS → promastigote
- MOI → penetration of skin by sandfly bite

The promastigotes are taken up by macrophages and develop into amastigotes. The amastigotes multiply and are taken by a female sandfly vector when it sucks a blood meal. The amastigotes become promastigotes in the midgut of the sandfly. The promastigotes multiply and fill the gut of the insect vector within 4–7 days.

Pathology:

Simple cutaneous leishmaniasis

Acute

- Wet
- Rural
- Papule (large uneuen ulcer or multiple lesions)
- Self healing Within 3-6 months

Chronic

- dry
- urban
- dry painless nodule or ,ulcer
- self-healing after 1-2 years often leaving disfiguring scar

Leishmaniasis recidivans:

- relapsing form due to delayed type-hypersensitivity immune reaction.
- multiple unhealing lesions Surrounding the primary healed lesion

Mucocutaneous leishmaniasis (Espundia):

- This form of the disease is rare
- has the same pathology of simple cutaneous leishmaniasis, but the lesions extend to affect the mucous membranes of the mouth, nose, pharynx, and larynx.
- There is destruction of the soft tissue and liquefaction of the cartilage, with considerable disfigurement.

Diffuse Cutaneous Leishmaniasis:

- This is a rarer serious condition.
- It is characterized by the formation of numerous raised (but not ulcerating) papules and nodules that spread to cover large areas of the body.
- This form is seen only in patient who do not develop a
- cell mediated immune response, so that the lesions do not ulcerate.
- Unlike localized cutaneous leishmaniasis, patients with diffuse cutaneous leishmaniasis seldom recover without treatment.

Diagnosis

- By the clinical picture.
- Detection of the organisms (amastigote forms) in the exudates taken from the indurated edge of the ulcers (for skin lesions) and stained by Leishmania stain.
- Culture the exudate on N.N.N medium and examine for promastigotes.
- Montenegro test (leishmania skin test): The test is positive in case of cutaneous and mucocutaneous leishmaniases, but is negative in case of diffuse cutaneous leishmaniasis.
  The test turns positive after healing of diffuse cutaneous leishmaniasis.
- Indirect methods (Serological tests): ELISA and IFAT tests are available to detect either antigen and or antibodies.
- Polymerase chain reaction (PCR) to diagnose the infection by of DNA.

Treatment

- Lesions in simple cutaneous leishmaniasis will generally heal spontaneously, this self- healing process does confer immunity to the individual within the immediate endemic
  area; therefore, it may be beneficial not to treat the disease unless there is the possibility of a disfiguring scar.
- Treatment options for cutaneous leishmaniasis include cryotherapy, heat, surgical excision of lesions, and local and systemic chemotherapy.
  Many drugs are used alternatively in treatment of cutaneous leishmaniasis. The response to therapy will vary according to the species and type of the disease.
- The two commonly used pentavalent antimonial drugs are:

- Sodium stibogluconate (Pentostam).
- Meglumine antimonate (Glucantine).
- Amphotericin B (Fungizone).
- Pentamidine.

Prevention and Control:

- Avoid insect bites
- Control of insect vectors
- Protection of lesion from insect bites
- Treatment and health education

Clinically Relevant Arthropods

CLASSIFICATION OF ARTHROPODS:

kingdom. → *Animalia*
phyum. → *Arthropoda*

Class Insecta

- 3 segments
- 3 pairs of legs
- 2 antennae

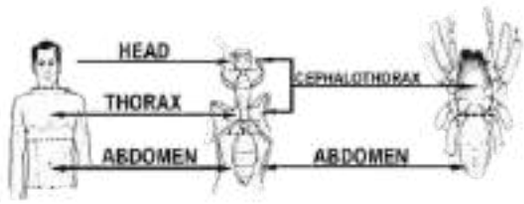
Class arachnida:

- 4 pairs of legs
- Fused body
- No antennae
- No mandible

Class crustacea:

- Cephalothorax and abdomen
- More than 4pairs of leg
- Antennae and antennules

General morphological characters of arthropods:



- They are segmented invertebrates (head-thorax- abdomen)
- They have paired articulated appendages (legs - antennae- wings)
- They have firm chitinous Exoskeleton

Life cycle of arthropods:

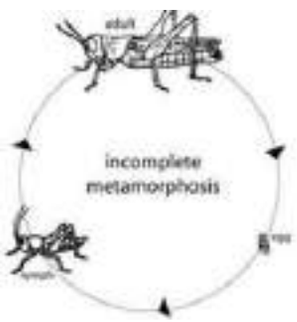
Metamorphosis is either:

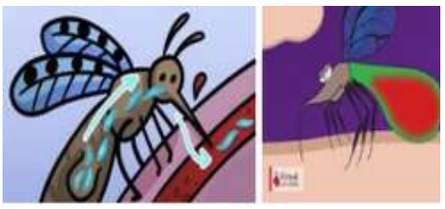
a) Incomplete metamorphosis:

- Intermediate stage differ slightly in morphology and habits from parents
- Contain 3stages (egg-nymph-adult)
- Ex.(ticks-lice-bugs)

B) Complete metamorphosis:

- Intermediate stage differ completely from parents
- Contain 4stages (egg-larva-pupa-adult)
- Ex.(mosquitoes-flies-fleas)





Mode of transmission by vectors:

Mechanical transmission:

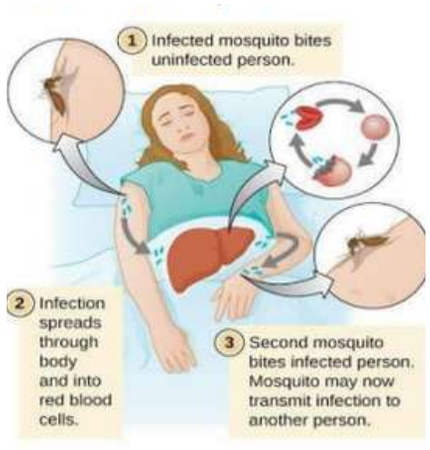
No multiplication and no development(such as Entamoeba histolytica cyst from contaminated excreta, which adhere to the body of housefly and transferred to food and drink touched by the insects

Biological transmission:

There is multiplication or development ,Vector is an essential stage in the life cycle of the parasite

Types of biological transmission:

PROPAGATIVE	CYCLO PROPAGATIVE	CYCLO DEVELOPMENTAL	TRANSOVERIAL
Multiplication without development	Multiplication and development	Development without multiplication	From parents to their of springs
Yellow fever virus in mosquitos	Leishmania in Sandfly	Filarial worms in mosquitoes	Rickettsia that cause Rocky Mountain spotted fever



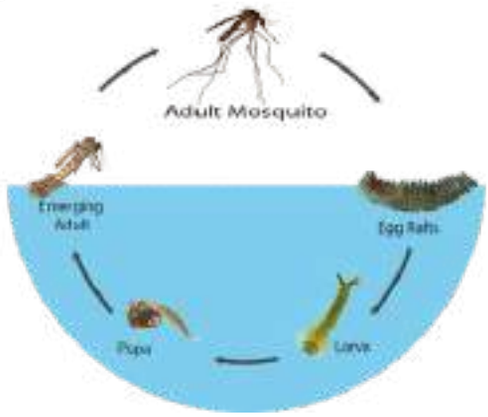
Mosquitoes

General characters of mosquitoes:

- 5:10 mm in size
- Divided into head, thorax and abdomen
- It has 2wing and long needle like mouth parts (proboscis) adapted for piercing and sucking in female and sucking only in the male.

Life cycle of mosquitoes:

- Mosquitoes undergo complete metamorphosis (egg – larva- pupa-adult)
- Fertilized female needs a blood meal for eggs to develop
- Developed eggs are laid in Stagnant water
- larval and pupal stages are aquatic stages that develop only in water
- Pupa doesn't feed but respire through respiratory trumpets
- Adult comes from pupa



Important Egyptian mosquitoes:

- Anophelines mosquitoes:transmit malaria parasite
- Culex mosquitoes:Culex pipiensis the commonest mosquito found in Egypt transmit Filaria and some viral diseases (dengue fever and rift valley fever)
- Aedes mosquitoes: Aedes aegypti came from Sudan and Saudi Arabia , transmit some viral diseases As dengue fever and rift valley fever

- ✓ Cases increases in last 5 years.
- ✓ 5 millions cases between january and november 2023 & 5,500 deaths.

In Egypt:

- ✓ Red Sea governorate in 2017
- ✓ Assiut in 2015.
- ✓ New case in Qena 2023.

Control of arthropods:

a)Physical control:

B)Biological control:

C)chemical control:

a)Physical control:

- This is achieved by destruction of breeding grounds, so the environment becomes unsuitable for mosquitoes.
- Examples:

- Proper disposal of sewage, garbage, manure and elimination of stagnant water.
- Use of wire screens, for windows and doors, bed nets, protective clothing covering all the body and repellents.

B)Biological control:

- Use of specific viruses, bacteria, protozoa, fungi which are pathogenic to various morphological forms of arthropods.
- Use of Gambusia fish that feed on larvae of mosquitoes.
- Barbell fish and Gambusia fish have been successfully used for control of Cyclops.

C)chemical control:

- Use of insecticides like; dichlorophenyltrichloroethane (DDT), baygon and pyrethrum flowers, and arsenical compounds.

Flies and myiasis

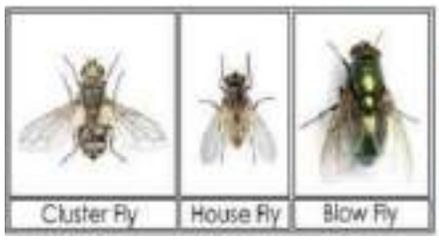
Phlebotomus spp. (Sand fly)

Geographical distribution:

Sand flies are cosmopolitan in tropical and subtropical countries.

Morphology:

It is minute hairy insect, 2-3 mm, pale in color, weak flyer with limited flight range and tends to hop.



Life cycle: complete metamorphosis.

Medical importance of sand fly

Transmission of :

- Leishmania spp.
- bacteria (Bartonella bacilliformis): Bacteria that causes Carrion's disease.

- viruses:
  - Sand fly fever (three-days fever or papatasi fever): It is a mild viral disease with short duration, fever, headache, orbital pain and leucopenia.
  - Vesicular stomatitis: Viral infection causing an influenza-like illness.
  - Harrara: It is an allergic reaction to the painful bite of sand fly resulting in local, indurated inflammatory lesion.

Flies

1-Musca domestica (House fly)
2-Stomoxys spp. (Dog fly)
3-Glossina spp. (Tsetse flies)
4-Sarcophaga and Wohlfahrtia (Flesh flies)
5-Calliphora, Lucilia and Chrysomia (Blow flies)

Medical importance of flies:

1) Mechanical transmission of some diseases:

Adult House fly may serve as a mechanical vector for:

- *Enteric infections: e.g. Vibrio cholera and Entamoeba histolytica.*
- *Non-enteric infections: e.g. tetanus and related eye disease.*
- *Trypanosoma: by Dog fly*

2) Vector of sleeping sickness: Tsetse flies

3) Myiasis: Larvae of some flies are responsible for occasional gastric, rectal intestinal genitourinary, ocular or cutaneous myiasis.

Myiasis

Definition:

Infestation of live human or animals with fly larvae which feed on host's dead or living tissue, liquid body substancesor ingested food

Classification:

1-clinical classification (cutaneous, body cavity, ophthalmic, cerebral, gastric)

2- parasitological classification:

- obligatory
- facultative
- accidental

Parasitological classification:

Obligatory myiasis	Facultative myiasis	Accidental myiasis
Required living Host for developm	Can be free living or parasite	Human body is colonised with fly species that feed on dead or decaying matter

Mode of human infestation with Diptera larvae:

a) Obligatory myiasis:

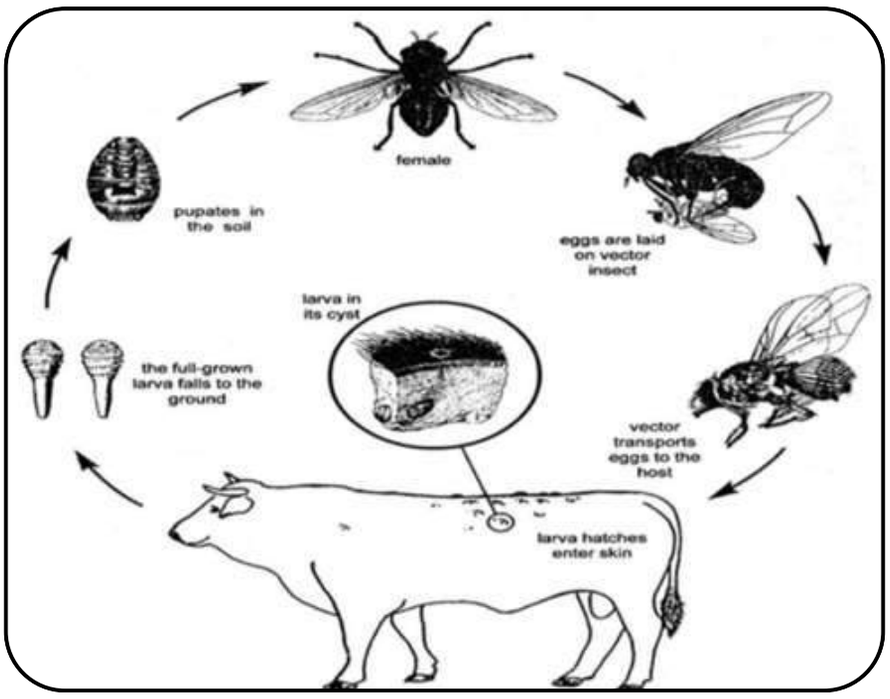
- Via phoresis: The fly female capturesablood suckingarthropod and lay eggson its abdomen.The eggs hatch during feeding from host and larvae migrate through abite wound of
- the host.(Dermatobia hominis)
- Infestation of urine contaminated soil or clothes (cordylobia)
- eggs laid on leaves, grass (Cuterebra)
- Fly eggs deposited onto existing wound (Wohlfahrtia)

b) Facultative myiasis:

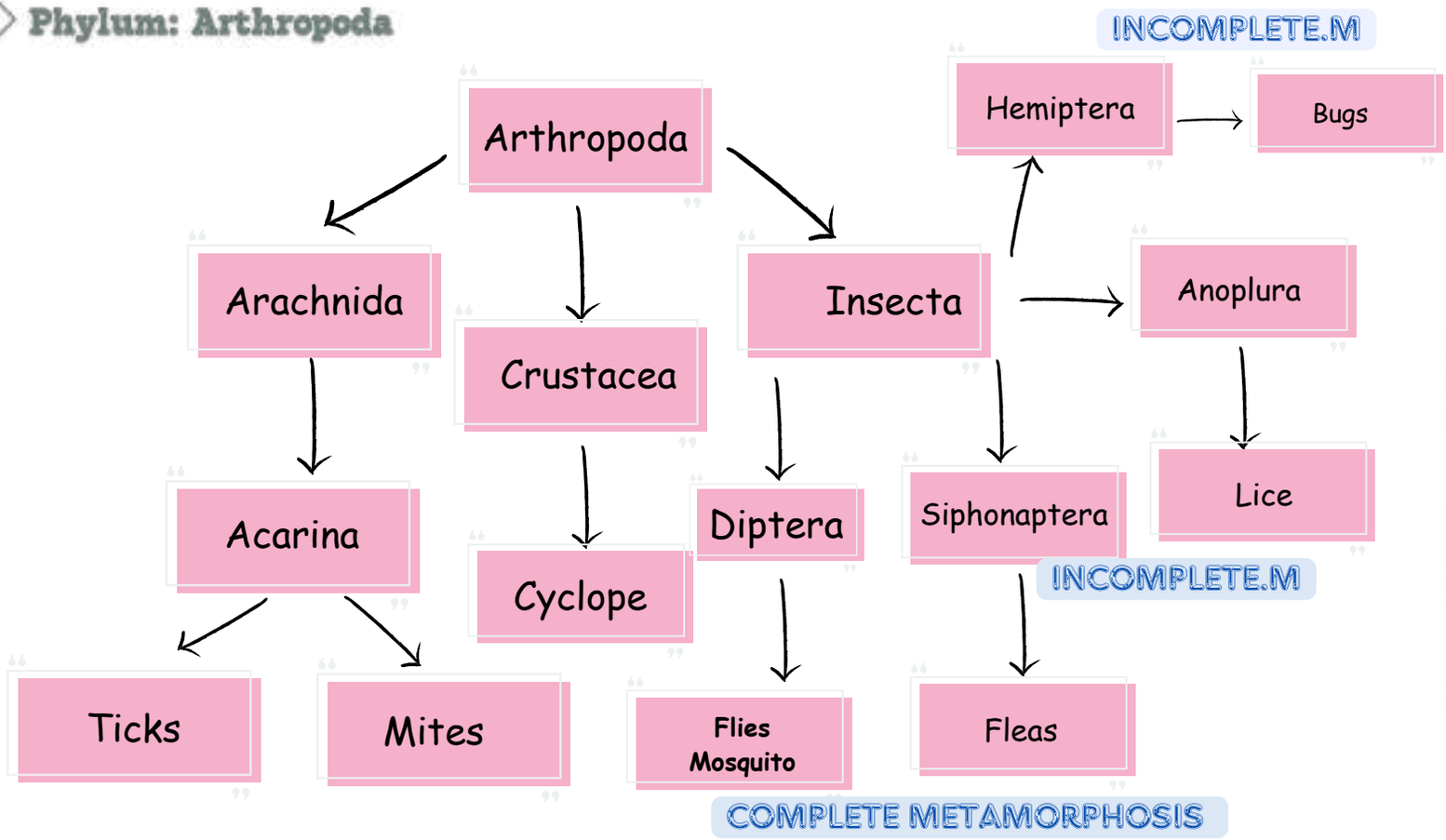
Fly eggs deposited onto existing wound (Lucillia)

c) Accidental myiasis:

infestation of unbroken skin: Eggs are laid onto the hairs of the human body (Hypoderma)



Phylum: Arthropoda



FLEAS

Complete metamorphosis

GENERAL CHARACTERS:

1-Bilaterally compressed
2-Wingless
3-Covered with stiff hair directed backwardly
4- Strong legs to help in jumping


Female comma shaped spermatheca


Male spring like aedeagus

MEDICAL IMPORTANCE OF FLEAS

1) Vector of human diseases:

a) Plague (Black death):

caused by gram negative bacillus (Yersinia pestis).. Xenopsylla cheopis (Rat flea) is the most important and efficient plague vector from rat to rat first, and on the death of the rat near human habitations, , infected fleas seek new hosts, either humans or other rats.

b) Endemic or murine typhus:

It is due to infection by Rickettsia typhi (R. mooseri).

c) Miscellaneous diseases: Fleas may act as mechanical vector of a number of bacterial and viral diseases e.g. Salmonella enteritides.

2) Intermediate hosts of animal parasites :

a) Dog tapeworm (Dipylidium Caninum)

b) Rat tapeworm (Hymenolopis diminuta) and occasionally hymenolepis nana .

3) Skin lesions:

a) Tungosis, Chigger's or Jigger disease

b) Irritating dermatitis due to flea bite.

Tungosis, Chigger's or Jigger disease

caused by Tunga penetrans (sand flea)

- A nodular lesion with subsequent ulceration due to penetration of Tunga penetrans under the skin.
- Man is infected by contact with soil infested with immature fleas.
- They burrow skin, usually between toes, soles of the feet and finger nails. As the flea feeds on tissue juice and blood, it burrows deeper, enlarges into a ball shape, and expels eggs to the outside.
- The lesion is painful and secondary bacterial infection may produce extensive ulcer.

CONTROL

- Cleanliness and sweeping of dust from floor and carpets.
- The use of flea collars for pet animals containing dichlorvos (an organo- phosphorus material with fumigant qualities).
- Dusting dogs, cats and their resting places periodically with insecticides (rotenone 1%, malathione 4% or pyrethrins 1%).
- Rodent control with anti-rodent flea measures.
- For Tunga penetrans, avoid being bare footed on dust. A spray repellent containing 10% DDT powder dusted into shoes will prevent infestation.

Bugs
Bed bugs
Winged bugs

Adult

Bed bugs have:

- Oval
- Dorsoventrally flattened
- Chestnut brown bodies
- 5 mm in length.
- Mahogany brown in colour before feeding
- Reddish brown in colour after feeding

Eggs

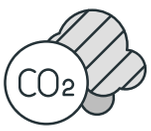
- Pear-shaped
- Whitish in colour

Nymph

It resembles the adult but smaller and sexually immature.

life cycle: incomplete metamophosis

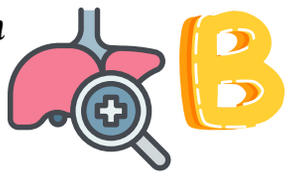
• Attracted by:
- Carbon dioxide emitted by humans during sleep
- Warmth exuded



• Do not live on host
• Feeds then withdraws to its hiding place
• Its activity is Nocturnal and can hide in beds, cracks in floors, furniture,wood and paper trash during the day

Medical importance of bed bugs

• Bed bugs bite is irritating causing insomnia.
• Bed bugs may act as a mechanical carrier but it is not a proved biologic vector of human diseases.
• Transmission of hepatitis B virus from man to man has been claimed but not definitely proven



Control

- Irritation and itching may be relieved by local lotions e.g. calamine lotion.
- Cleanliness and repair of cracks and wall paper.
- Manual collection of bugs and their destruction.
- Application of insecticides to hiding places in floor, walls, furniture and mattresses with care in using these insecticides on bedding used by infants.

TRIATOMA (WINGED BUGS)

- Kissing Bug, Assasin bug, cone–nosed bugs
- Attack face when asleep, bite is painless, spreading Trypanosoma cruzi

Medical importance

- Winged bug bites cause allergic annoying reaction.
- Vectors of Trypanosoma cruzi, the causative agent of Chaga disease (bug defecates and rubs feces into wound).

Control

- Destruction of hiding places and repair of cracks
- Household cleanliness.
- Application of insecticides.

LICE

GENERAL CHARACTERS

Adult

- Flattened dorso-ventrally.
- Wingless.
- 3 pairs of strong, short segmented legs that terminate in a single
- hook-like claw and an opposing tibial process for gripping hairs or fibers.

Nymph

resemble adult but sexally immature

Egg

SEASON: WINTER (CROWDING).

Pediculus humanus corporis (Body louse):

- The favorite location for P. h. corporis is fibers of clothing.
- It visits the skin only to feed. It is transmitted from man to man by direct contact or by clothing
- Eggs are deposited on and firmly attached to hairs of chest & axilla or fibers of clothing.
- Transmit diseases to man

Medical importance of body louse:

1)Itching: This symptom is caused by irritating saliva injected during feeding.

2) Vagabond's disease (Pediculosis): means heavy infestation with lice that occurs among poor, crowded unclean people.

3)Vector of diseases:

a-Epidemic typhus: the causative organism, Rickettsia prowazeki,

b-Epidemic relapsing fever or louse-borne relapsing fever : The spirochete Borrelia recurrentis;

c-Trench fever or five days fever: caused by Rickettsia quintana,

Pediculus humanus capitus (head louse)

- Its favorite location is the hairs in the back of the head.
- It is easily transmitted from man to another by brushes, combs and hats. It is most prevalent in school children also found in hairs of elderly and senile individuals unable to care for themselves.

Medical importance of head louse:

- Irritating itch especially on the back of the head which is sometimes accompanied by secondary infection
- .Head louse has never been incriminated in disease transmission

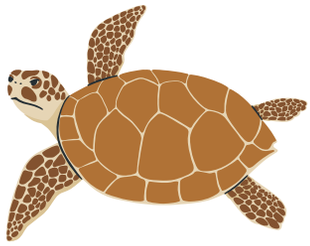
Phthirus pubis (crab louse , pubic louse):

- The favorite locations for Phthirus pubis are pubic,perianal, axillary, chest and body hair, as well as eyelashes elashes and eyebrows. Rarely found on the scalp.

- It is transmitted by sexual relation and less frequently through toilet seats, clothing, or bedding.

Phthirus pubis differs from other lice:-

- By its characteristic location on the body.
- It is very small, 2 mm in length, oblong turtle shape.



Medical importance of pubic louse:

- Irritating itch accompanied by secondary bacterial infection.
- Infestation of eyelashes with secondary infection may lead to conjunctivitis and keratitis.
- The crab louse, like the head louse have never been incriminated in disease transmission.

Ticks

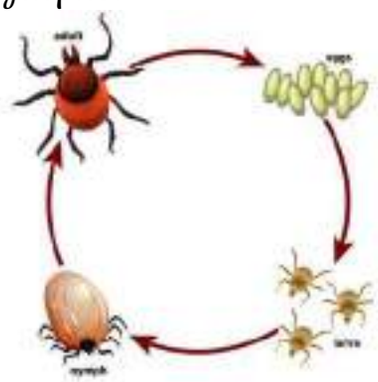
GENERAL CHARACTERS

- Body is globular, divided into cephalothorax (head and thorax fused) and abdomen.
- No antennae or wings.
- 4 pairs of legs in adults and 3 pairs in larvae.
- Sexes are separate and they multiply by incomplete metamorphosis.

LIFE CYCLE

Incomplete metamorphosis

1- eggs laid by the female.
2- larvae hatch , feed on blood then drop on the ground, moulting into nymphs.
3- nymphs feed on blood feed and moult into adults.
4- adults feed on blood and life cycle takes 1-2 years.



MEDICAL IMPORTANCE OF HARD TICKS

1)Dermatosis (Tick bite reaction):
Tick bite may result in local inflammation, swelling, ulcerations and itching.
2)Otoacariosis:
Infestation of the ear canal by ticks causes a serious irritation to the host, some times accompanied b
infection.

3)*Vector of diseases:*

Some viruses, bacteria causing Lyme disease

Protozoa: babesia

Rickettsia: Q fever

4)*Tick paralysis*

Tick paralysis

Etiology: due to tick bite. Children are the usual victims of tick

Clinical manifestations:

The illness is characterized by fatigue, irritability, distal paresthesias, leg weakness with reduced tendon reflexes, ataxia and lethargy. Unless the tick is removed, quadriplegia and respiratory failure may result

Diagnosis: The presence of a tick with sudden appearance of limb weakness and/or repiratory impairment is diagnostic.

Treatment: The case fatality rate without treatment can be 10%. Removal of Removal of the tick induces a miraculous recovery within 48 hours.

MEDICAL IMPORTANCE OF SOFT TICKS

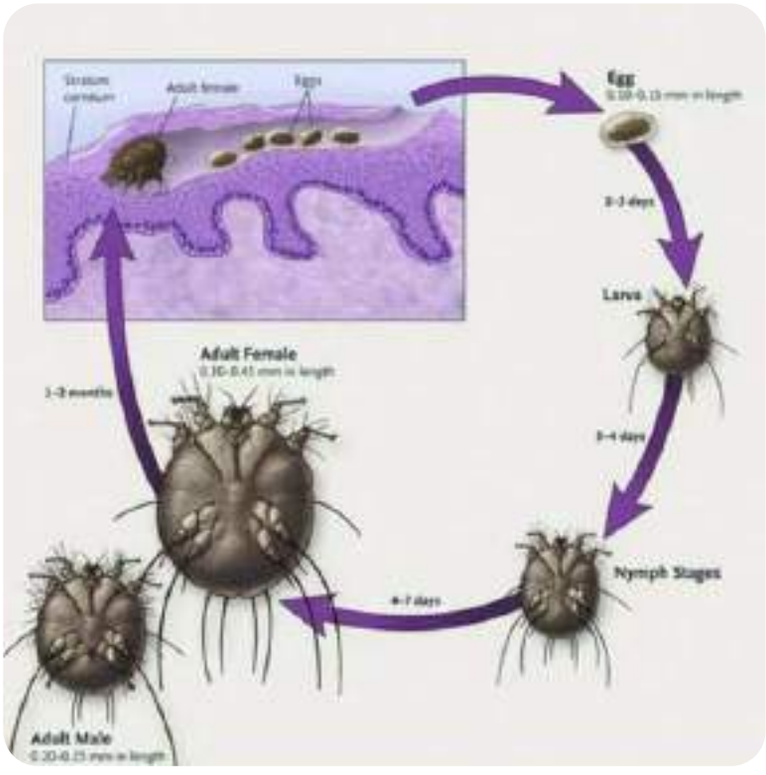
- *Anaemia, dermatosis, tick paralysis and otoacariosis: As in hard ticks.*
- *Vector of diseases: Diseases are transmitted either by bite or by coxal fluid.*
- *Q fever or Queens land fever caused by Ricketsia burnetti*
- *Endemic relapsing fever caused by Borrelia duttoni*

TREATMENT AND CONTROL

Ticks should be removed from the skin by gentle traction after applying ether or alcohol.
• Controlling their rodent hosts and destroying their habitats.
• The infested grounds, houses and animals are sprayed with insecticides.

SCABIES

Etiology: Infestation with the human scabies mite (Sarcoptes scabiei).
Geographical distribution: Worldwide.
Mode of infestation: By direct contact with infected persons or with their clothing or bedding



The female scabies mite burrows skin, leaving behind eggs and highly antigenic feces within a track as a tortuous line
- Nocturnal itching begins within a month of the first infestation, but may begin within a day in previously exposed individuals.

Erythematous papules and vesicles first appear on thin and wrinkled skin as between fingers and toes, axilla, genitals and spread to the arms, trunk and buttocks.

Pathology and manifestations:

Crusted or norwagian scabies: it is s a generalized dermatitis with extesive scaling and crusting that may occur in immunodeficient individuales

Diagnosis:

Scabies can be easily diagnosed by scraping affected skin regions with a scalpel coated with mineral oil. The scrapings in oil may be transferred to a slide and examined microscopically for 300-400 µm mites or the smaller black fecal granules.

Treatment:

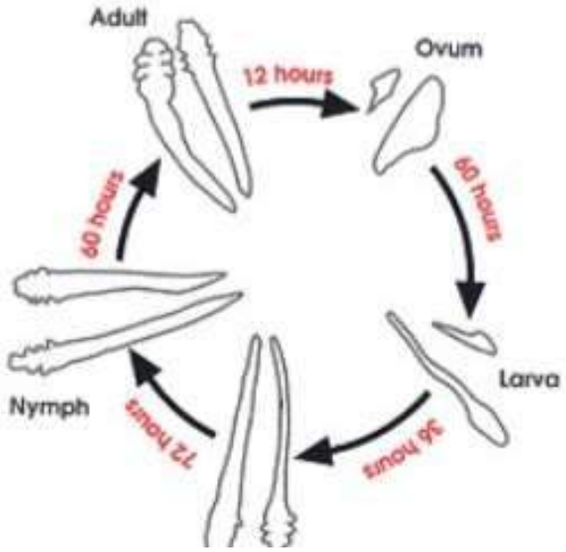
- Scabies may be treated by 5% permethrin cream / lindane
- The use of permethrin first and lindane only if that fails.
- Lindane can be neurotoxic to children and small adults.

DEMODEX MITES

Demodex folliculorum lives in hair follicles of the facial region
Demodex brevis inhabits the sebaceous glands especially of forehead, nose & eyelids of humans.

- It is a worm like parasite
- 0.3 mm in length
- With short capitulum, long tapering striated abdomen and 4 pairs of short legs attached to the anterior half of the body.
- There are two species infesting human, demodex folliculorum and Demodex brevis.

Life cycle:



Clinical manifestations:

- *These mites may penetrate the skin and lodge invarious internal organs, where they elicit a granulomatous response.*
- *Infection usually is benign, although rarely there may be loss of eyelashes or granulomatous skin eruptions.*
- *Follicle mites may be involved in introducing acne causing bacteria into skin follicles of susceptible individuals.*

Diagnosis:

Examine microscopically

Treatment :

Cleanliness and "Lindane" in an ointment

Parasitology diagnostic techniques

CURRENTLY USED DIAGNOSTIC TRENDS:

1. Direct detection and identification of the infecting organism:
a)*Naked eye vision.*
b)*microscopic examination.*
c)*Culture*
d)*Radiological imaging.*

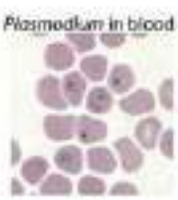
2 . Indirect identification : Serological assay(Ag and Ab detection)

3. Molecular biology assay.

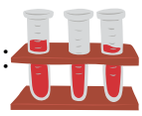
Direct detection techniques: (Principle and application)

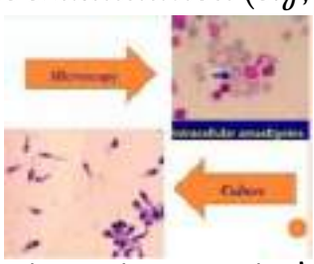
1.*Naked eye vision:*

2. *Microscopic detection of parasites diagnostic stages:*



3.*Culture followed by microscopic examination (e.g; Leishmania):*





4.*Radiological and imaging techniques in parasitology:*

1. Diagnosis of infection (confirmatory OR suggestive):
 a) Confirmatory: e.g., Ascaris
 b) Suggestive: e.g., bilharzial hepatic periportal fibrosis.
2. Study the pathological lesions. e.g., schistosomiasis.
3. Staging the course of thedisease : schistosomiasis .
4. Follow up and assessment of treatment e.g., Hydatid cyst.

Direct detection techniques : (Advantages and disadvantages)

♡ Disadvantages:

1.Diagnostic skills and equipment are needed.
2.Sensitivity(true positive rate) and Specificity(true bnegative rate) are not always optimal and depends on the microscopist.

♡ Advantages:

1. Easy
2. rapid
3. cheap
4. confirmatory.

Stool examination

Preparation of the patient:

1)Low diet residue is taken 2-3 days before analysis.
2)No drugs intake3 days before stool examination as some drugs interfere with detection of parasites.
3)No barium enema for 5-10 days before stool collection.

Collection of faecal samples:

- ❑ 3 samples of stools routinely from each patient, on alternative days . (because of Irregular release of helminthes ova and protozoan cysts)
- ❑ Stool must be examined fresh and uncontaminated by urine or water.
- ❑ If >24 hrs, it is necessary to add some preservative.
- ❑ Samples can be kept in a refrigerator at + 40 C for a short time .
- ❑ Any worms or segments passed should be placed in a separated container.

Faecal Examination Techniques

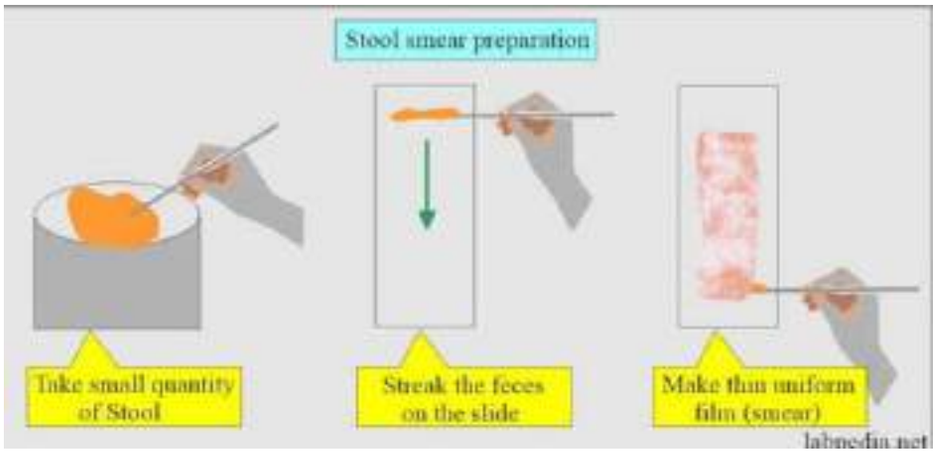
- Microscopic. Ex
  - Wet mount
  - Concentration method
    - Floatation method
    - sedimentation technique
  - Permanent stained smear
- Macroscopic ex.

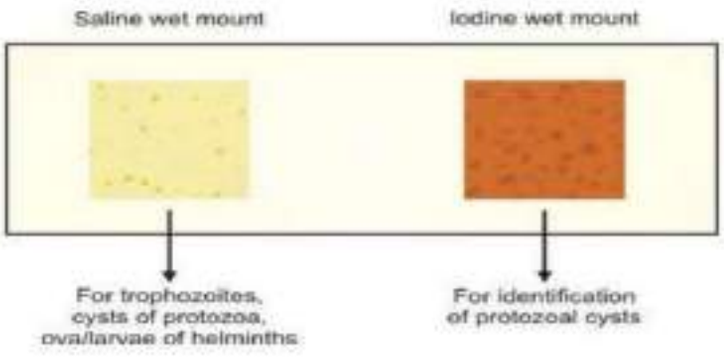
☆ Macroscopic examination:

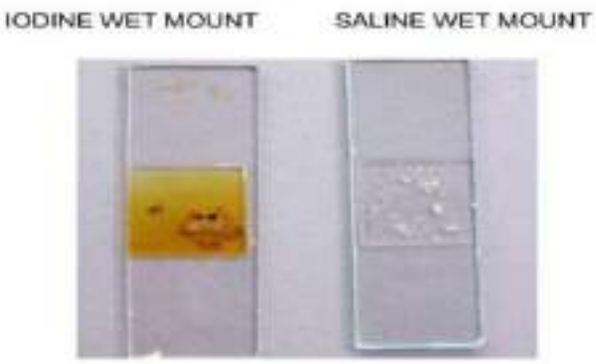
Feces should by examined for its:

1. Consistency
2. Color
3. Odor
4. Mucus
5. Precense of blood

- Adult round worms (Ascaris lumbrecoid) or segments of tapeworms may be seen in feces
- Precense of blood and mucus ➡ amoebic dysentery







☆ Permanent stained smear:

- Permanent stained smear is employed for :

1. Cytological details
2. Accurate diagnosis
3. Keeping permanent records

- Commonly used stain and methods are:

Iron – haematoxyline stain

Trichrome stain

☆ Concentration method:

When parasite is scanty in Feces, routine examination method is may fail to detect the eggs ,cysts and trophozoites in the specimen

So it is necessary to employ concentration method

Trophozoites of protozoa are destroyed by this methods:

- Floatation method
- Sedimentation method

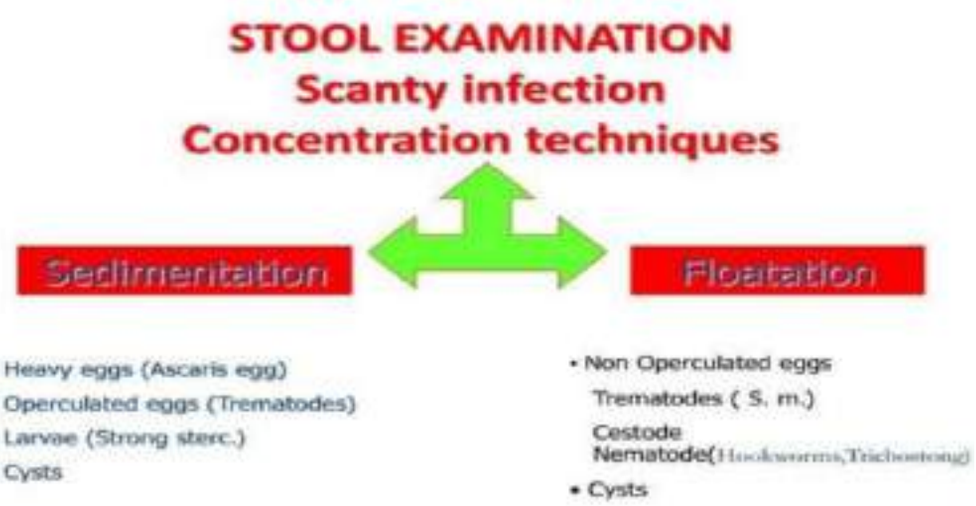
☆ Sedimentation method:

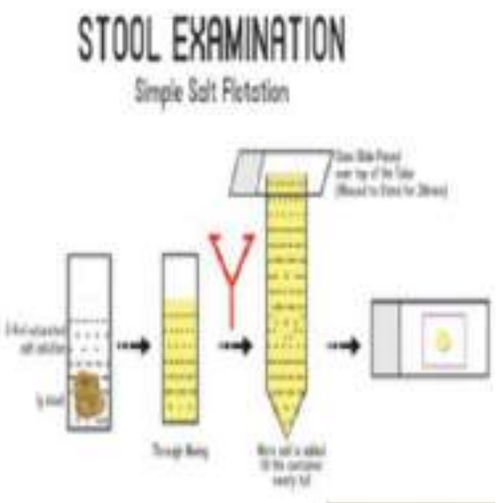
♡ **Principle**

- Use solutions of lower specific gravity than the parasitic organisms, thus concentrating the latter in the sediment.
- Recommended for general diagnostic laboratories because they are easier to perform and less prone to technical errors.

☆Floatation Method:

- Flotation techniques use solutions <u>which have higher specific gravity</u> than the Parasitic organisms to be floated so that the organisms rise to the top and the debris sinks to the bottom.





Urine examination

Macroscopic Ex.

- Color
- Odor
- Volum
- Reaction or urinary pH
- Specific gravity
- Osmolarity

Microscopic Ex.

Sedimentation

Filteration

The main aim is to find Schistosoma haematobium eggs.

- Rarely - microfilariae of Wuchereria bancrofti.
- Entrobius eggs
- Trichomonas vaginalis trophozoites.

Blood examination techniques for detection of parasites

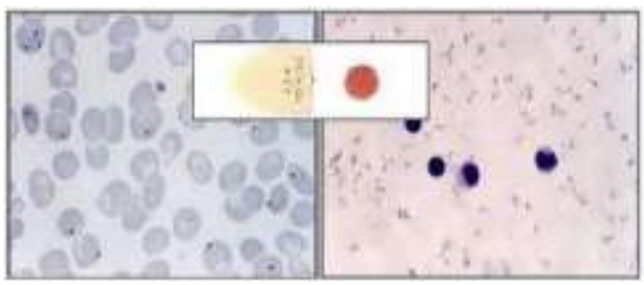
Principle: Direct detection of parasites by microscopic examination of blood film.

Indication: Diagnosis of blood parasites ; malaria, Filarial, trypanosomes, babesia and some cases of visceral leishmaniases

Procedure:

1. Thin blood film: a small drop of blood determine the malaria species.
2. Thick blood smear: a large drop of blood on a glass slide

- It is more sensitive.



Indirect Diagnostic Techniques:

1- Antibody detection assay
2-Antigen detection assay
3- Skin test

Serological assay (Antigen-antibody reaction).

Value of Immunodiagnosis of parasitic diseases:

1) To diagnose in case of difficult or impossible sampling for direct diagnosis.
2) To diagnose infection early before appearance of diagnostic stage.
3) Sensitive in cases with low parasite load.
4) Useful for survey and screening studies.
5) Blood donor screening for blood transmitted parasites.
6) To monitor the course of an infection.
7) To evaluate how protected you are against a parasite. (e.g., measure immune response after vaccination).

PROCEDURES:

1) Antibody detection assay:

A. Advantages:

- As mentioned previously in value of immunodiagnosis.
- Sensitive more than antigen detection.

Disadvantages:

- Cannot differentiate between species and subspecies.
- High cross-reaction with other genera.
- Generally ,cannot diff er between chronic and acute infection
- Cannot differentiate between species and subspecies.
- Generally, not accurate for follow up of recovery after treatment

2) Antigen detection assay:

a. Advantages:

- More specific than abs detection assay, especially with use of specific (monoclonal) antibody.
- Differentiate present infection from past infection.
- Useful in follow up of recovery after treatment.

• Disadvantages:
• Use of non-specific "polyclonal" antibodies may lead to false positive results .
• Generally less sensitive than antibody detection assay.

3) Skin tests:

a) Advantages:
• Used instead of biopsy in diagnosis of some diseases.
• Useful in assessment of cure in both visceral and diffuse cutaneous leishmaniasis.

b)Disadvantages:
• Lack of reference standards antigens and for reading of the result.
• Lack of sensitivity and specificity.
• The danger of provoking anaphylaxis.
• May induce serologically detectable antibody which could complicate subsequent serologic evaluation of a patient.
• The ethics of injecting foreign protein antigen into an individual, particularly in epidemiologic studies, has been questioned.

Types:
a) Immediate type hypersensitivity
b) Delayed-type hypersensitivity

Applications:
a)Montenegro test for Leishmaniasis (delayed type hypersensitivity).
b) Skin prick test for insect allergy (immediate type hypersensitivity

Molecular biology assay (Nucleic acid diagnostics):

1. Principle: amplification and detection of DNA or RNA
2. Procedure: PCR is currently the method of choice
3. Pros and cons:
1) Methods with highest sensitivity and excellent specificity.
2)Some false negative results due to inhibitors in sample.
3)Investment in equipment and rather expensive reagents.

IMMUNITY TO PARASITIC INFECTION

TYPES OF IMMUNITY?

1. Natural (innate) immunity
2. Acquired specific immunity:

I. Humoral immunity

II. Cell-mediated immunity

♡ MECHANISMS OF ACQUIRED SPECIFIC IMMUNITY AGAINST PARASITES:

1. Production of specific IgE antibody and/or eosinophilia:

- Helminthes infection invading host tissues e,g. Schistosomes, filaria

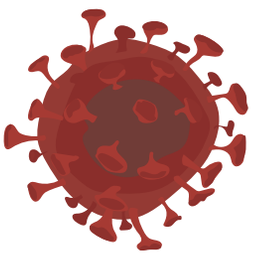
2. Induction of granulomatous responses and/or fibrosis:

– Examples:

- Schistosomes egg induces granuloma and fibrosis.
- Lymphatic filariasis results in fibrosis without granuloma.

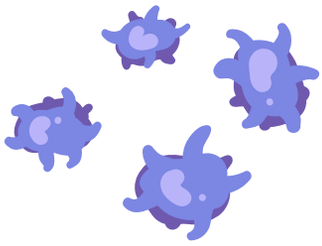
3. CD4+ helper T-cells activation and cytokines production:

- Examples:
- Leishmania, Schistosomes and Filaria,



4. Cytolytic T-lymphocytes activation (CTLs):

- Examples:
- Protozoa that replicate inside cells may stimulate specific CTLs, which are CD8+ T-lymphocytes.
- E,g. Malaria infection.



Sequelae of immune response:

Protective immune response

- Complete selt cure
- Complete protection from reinfection
- Premunition Immunity

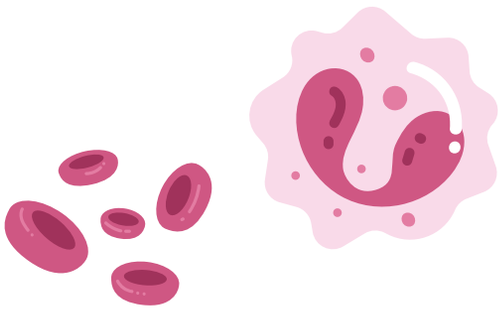
Sequelae of immune response:

Immunopathology
- Immune complexes
- Autoantibodies
- Immediate hypersensitivity response
- T-cells dependant pathology

Protective immune response:

1) Complete self cure:
e,g. primary cryptosporidiosis in immunocompetent host.

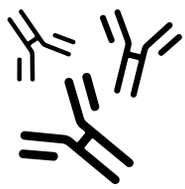
2) Complete protection from reinfection (solid immunity):
e,g. cut. Leishmaniasis after self-healing of primary infection.

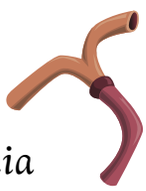


3) Premunition immunity:
e.g., Malaria and immunocompetent patient of toxoplasmosis.

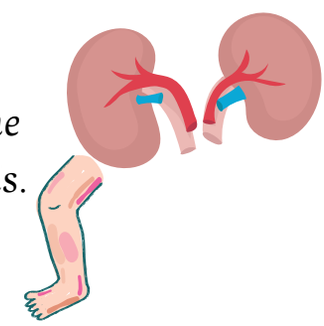
Immunopathology of Parasitic Diseases:

1) Immune complexes
2) T cell-dependent pathology
3) Immediate hypersensitivity response
4) Autoantibodies.





1) Immune complexes:
- Vasculitis in Leishmania
- Nephritis in malaria and schistosome
- Lymphangitis in lymphatic filariasis.

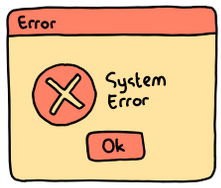


2) T cell-dependent pathology:
► Hepatic fibrosis and portal hypertension due to fibrosis associated with granuloma formation around schistosome egg.
► Lymphatic filariasis due to fibrotic reactions against filaria.

3) Immediate hypersensitivity response:
1) IgE-mediated reactions: Calabar swelling of Loa loa infection,
tropical pulmonary eosinophilia in filariasis,
2) Eosinophil-associated pathology: Endomyocardial fibrosis associated with loaiasis.

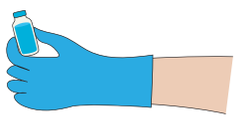
4) Autoantibodies:
e.g., schistosomiasis, malaria and onchocerciasis.

Evasion of Immune Mechanisms by Parasites



1. Hiding from immune system:
2. Antigen masking:
3. Shedding of surface antigen:
4. Antigenic variation:
5. Suppression and blockage of the host effector system:

1) Hiding from immune system:



- In intestinal lumen: e.g., Ascaris and Entrobius.
- In cyst: e.g., hydatid and Trichenilla
- In immune cells: Toxoplasma

2) Antigen masking: Some parasites acquire on its surface acoat of host proteins e.g., Schistosome larva coating with ABO Bl. group glycolipids and MHC molecules derived from the host.

3) Shedding of surface antigen: e.g., shedding of Schistosoma cercariae coat after skin penetration.

4. Antigenic variation : e.g., T. brucei surface coat antigenic variation.

THE END

PARA tables

تم بحمد الله

BY ARA FAMILY

2024-2025

Our greatest weakness lies in giving up. The most certain way to succeed is always to try just one more time.

THOMAS EDISON

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