

Infection

The lodgment and multiplication of organism in the tissue of the host .

Classification of infection

1. **Primary infection** : - Initial infection with organism in the host .
2. **Reinfection** : - Subsequent infection by the same organism in the host .
3. **Secondary infection** : - In the host whose resistance is lowered by preexisting infection disease , anew organism may set up as infection .
4. **Focal infection** : - It is a condition due to infection at localized sites like appendix and tonsil .
5. **Cross infection** : - The patient suffering from a disease and new infection is set up from another host or from external source .
6. **Nosocomial infection** : - Cross infection occurring in hospital .
7. **Subclinical infection** : - When a patient clinical affects are not apparent .

Source of infection

1. **Human** : - is himself a common source of infection from a patient or carrier .
2. **Animals** : - Infectious diseases transmitted from animals to human are called zoonosis may be bacterial (e.g. plague from rat), viral (e.g. rabies from dogs) , protozoa (e.g leishmaniasis from dogs), helminthes (e.g. hydatid cyst from dogs), fungal from cats and dogs .
3. **Insects** : - The disease caused by insects are called arthropod borne disease .Insects like mosquitoes , flees ,lice that transmit infection are called vector.Transmission may be mechanical (transmission of dysentery or typhoid bacilli by house fly) these are called mechanical vector. They are called biological vector if pathogens multiplies in the body of vector e.g. Anopheles mosquito in malaria.
4. **Some vector** may act as reservoir host(e.g. ticks in relapsing fever and spotted fever).
5. **Soil** : - Soil may be serve as some of parasitic infection like round worm and hook worm. Spores of tetanus bacilli remain viable in soil for a long time.
6. **Water** : - Vibrio cholera , infective hepatitis virus .
7. **Food** :- Contaminated food may be source of infection.(food poisoning by staphylococcus).

Methods of transmission of infection

1. **Contact** : - Syphilis , gonorrhoea , trachoma .
2. **Inhalation** : - Influenza , tuberculosis , small pox , measles ,mumps .
3. **Infection** : - Cholera (water) food poisoning (food) dysentery (hand borne) .

4. **Inoculation** : - Tetanus , (infection) rabies (dog), arbovirus (insects) , serum hepatitis (injection) .
5. **Insects** : - Act as mechanical vector (dysentery and typhoid by house fly) or biological vector (malaria) of infectious disease .
6. **Congenital** : - Congenital syphilis , Toxoplasma .
7. **Laboratory infection** : - Infection may be transmitted during procedure like injection , catheterization.

Respiratory system infection

Lower respiratory tract infection (Consist of three types):

1. Trachea
2. Bronchiole
3. Lung

Upper respiratory tract infection Sputum (Consist of types):

1. Tonsillitis.
2. Throat.
3. Nose.
4. Nose sinuses
5. Larynx

It is mucous that is coughed up from the lower airways .In medicine, sputum samples are usually used for microbiological investigation of respiratory tract

Culture media which used :

1. MacConkey agar.
2. Blood agar.

Types of bacteria which cause respiratory tract infection:

1. Staphylococcus.
2. Streptococcus.
3. Corynebacteria.
4. Neisseria.
5. Pnemonea.
6. Haemophillus.

Food poisoning

Food poisoning is illness that results due to the consumption of food or drink which is contaminated with pathogenic bacteria, viruses, parasites, toxins (endotoxin or exotoxin) or chemicals. Most people recover without the need for treatment. In most cases, the food that causes the illness has been contaminated by bacteria, such as salmonella or Escherichia coli, or a virus, such as the

norovirus. The contamination of food can occur at any point beginning from growing, till processing and shipping of the product. Improper cooking of the food may also be the cause for contamination other cause can be when pathogens are transferred from one surface to another especially in case of ready-to-eat foods or raw foods. Since these foods are not cooked before consumption, pathogens are not destroyed and ingesting them may lead to food poisoning. This is called cross-contamination. Thus the contamination of food may occur at any stage in the process from food production to consumption

Symptoms

- Feeling unwell
- Vomiting
- Diarrhea
- Stomach cramps
- Abdominal pain
- Loss of appetite
- High temperature of 38C
- Muscle pain
- Chills

Causes

Food borne illness are usually infectious or toxic in nature and caused by bacteria ,viruses, parasites or chemical substances entering the body through contaminated food or water arise from improper handling, preparation or storage of food.

Most common organisms that cause food poisoning:

1. Bacteria

- Campylobacter jejuni*
- Clostridium perfringens*
- Salmonella species (S. typhi)*.
- Escherichia coli (E. coli)*

2. Viruses.
3. Fungal (mycotoxin)
4. Parasites.

Diagnosis

Generally detailed history including signs, symptoms and details of food intake are used to diagnose for the food poisoning. Symptoms may include pain in the abdomen, nausea, vomiting, diarrhoea, fever and signs and symptoms of dehydration (body does not have as much water and fluids as it should)

Stool test: Sometimes stool test is done for detecting bacteria or parasites.

General properties of microbes causing food poisoning :

Types of microorganism time	Periode time	Disease
1.Salmonella day	(6- 36) hours	(1- 6)
2-Staphylococcus areuse . hours	(2- 6) hours	(6 – 24)
3-Clostridium walchii hours	(8- 24) hours	(24-48)
4-Clostridium botulinum	(12-46)hours	(1 – 3)days
5-Vibrio parahaemolytica	(2- 48) h.	(2- 5) days
6-E. coli	(12- 72) h.	(1-7) day

Viruses

Virus are unicellular ultramicroscopic particles , containing either RNA or DNA , reproducing inside living cells .

Characters :-

1. Do not possess cellular organization .
2. Contain one type of nucleic acid either RNA or DNA never both.
3. Lack enzymes necessary for protein and nucleic acid synthesis .

4. They multiply by complex process inside living cell called replication not by binary fission .
5. They are unaffected by antimicrobial or antibiotic .
6. They are sensitive for Interferon , which is chemical substances give resistance to the immunity system .

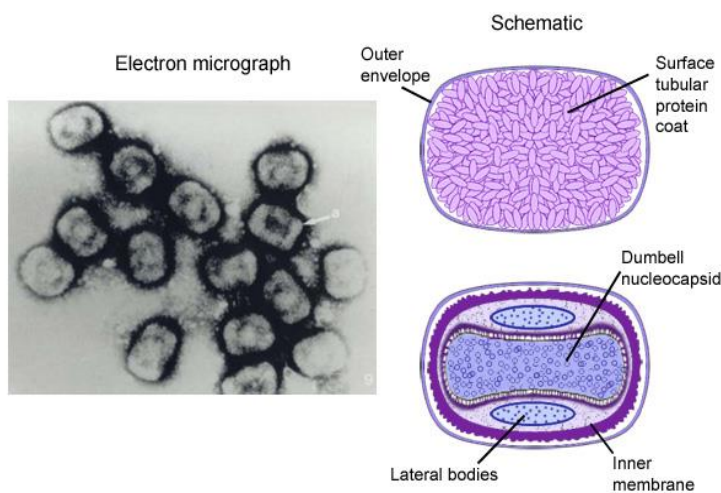
Morphology :-

size :-

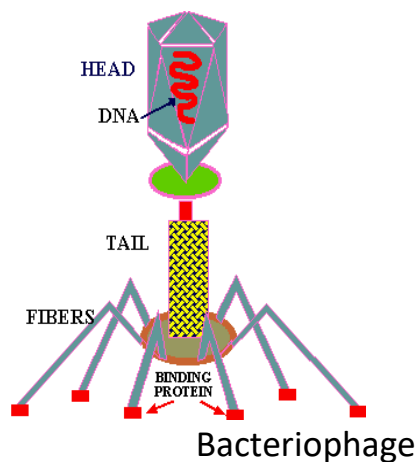
Viruses are very widely in size . The largest virus among them is Pox viruses measuring about 300 nanomicroin . The smallest viruses are foot and mouth virus measuring about 20 nanomicroin.

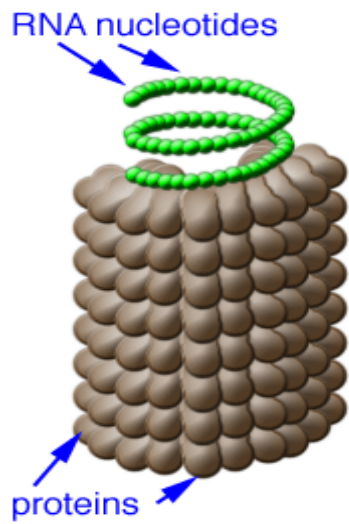
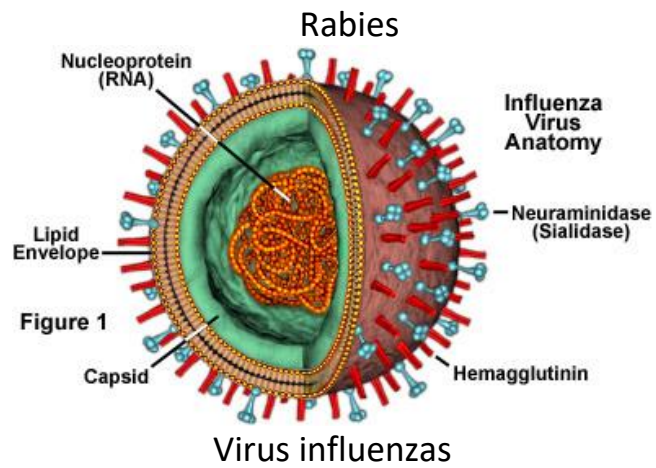
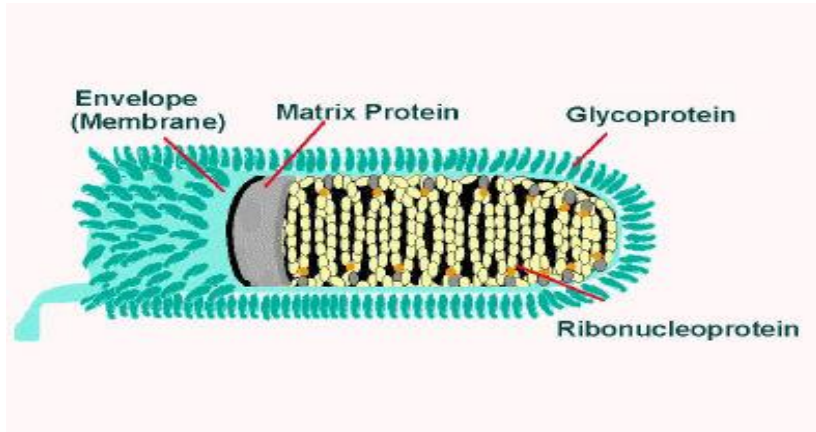
shape :-

Viruses are also widely in shape , some have characteristic shape like , Rabies virus have bullet shape , Pox virus have brick shape . Tobacco mosaic virus have rod shape , Influenza virus have spherical shape , Bacteriophage have head , neck and tail .



Pox virus





Tobacco virus

Structure :-

Virus have central Core of nucleic acid which is either RNA or DNA but never both. Nucleic acid is covered by protein coat called Capsid which is composed of number of subunits called nucleocapsid. Virion may be enveloped or non enveloped. Protein subunits may be seen as projecting on the surface of the envelop these are called Peplomers.

Some viral diseases

1. Influenza virus .
2. Mumps virus .
3. Small pox virus .
4. Measles virus .
5. Poliomyelitis virus .
6. Adies virus .

Parasitology

Parasitology :-

Is the science which deals with study of parasites.

Parasite : Is the organism that live in or on other organism (host) & depend on its host for obtain food, shelter or both. The parasite is smaller in size than its host & from different genus

Host: Is the organism that harbors the parasite & provides it with food.

(Types of parasites)

1. Obligatory parasite: Is that parasite which completely adapted to parasitic life & can not exist as free living.

2. Facultative parasite: Is that parasite which can live as a parasite or able to be free living.

3. Accidental parasite: Is that parasite which normally occur or live in certain host & exceptionally (accidentally) found in wrong host.

4. Permanent parasite: Is that parasite which live for all or the great part of its parasitic life in the host.

5. Temporary parasite: that parasite which visit the host only for food (eat & run).

6. Endoparasite: Is that parasite which lives inside the body of the host.

7. Ectoparasite: Is that parasite which lives outside the body of the host (on the surface).

(Kinds of hosts)

Some parasites require only one host to complete their life cycle, but other parasites require more than one host to complete their life cycle.

1. Final (definitive) host: Is the host which harbors the adult or the sexually mature reproducing stage of the parasite.

2. Intermediate host: It is the host which harbors any immature (developmental) forms of the parasite. Some parasites require more than one intermediate host to complete their life cycle.

3. Reservoir host: It is the animal host which harbors the infective stage of the parasite that can be transmitted to human.

Parasite - host relationship

1. Parasitism: An obligatory association between two different organisms (parasite & host) in which one of them (parasite) is benefit & the other (host) is harmfully affected such as pathogenic parasites.

2. Commensalism: Is a relation between two organisms in which one of them (the parasite) is benefit & the other (the host) is unaffected such as non pathogenic parasites.

3. Mutualism:- Is the association between two organisms (parasite & host) in which both are benefit such as some flagellates in the gut of termite.

Scientific name: -consist of two words, the first is the name of genus (start with a capital letter) & the second is the name of species (start with a small letter) & both are underlined.

Common name : - A general name refers to shape or place ex:(tape worm, pin worm)

Geographical distribution : - The geographical areas in which the parasite is endemic or found.

Habitat : - Is the organ (place)in which the parasite found or live in the body of its host.

Infective stage: Is the stage of the parasite which can infect the human or the host.

Mode of infection: Is the process by means the infective stage of the parasite invade (enters or infected) the human body.

Auto-Infection : - It is a self infection of the host with the parasite.

Retro – infection : It is a form of auto infection in which the larvae hatches near the anus and migrate back to the large intestine to develop in to adult.

Life cycle : - It is the different developmental stages of the parasite to complete one generation. life cycle starts with a certain stage & ends at the same stage. ex: ova → larvae → adult.

a. Direct Life cycle :- In which the parasite require only one host to complete its life cycle ex: *Entamoeba histolytica*.

b. Indirect Life cycle: In which the parasite require more than one host to completed its life cycle ex: *Leishmania tropica*

Phylum: Protozoa

General features of Protozoa:

1. Microscopic unicellular organisms of varied size & shape.
2. Body consist of a mass of protoplasm surrounded with membranous wall.
3. Usually have one or more nuclei with karyosome.
4. Reproduction is mostly asexually by simple fission (some have sexually reproduction by sporogony).
5. Some can forming resistant infective cysts.
6. Some are pathogenic parasites to human.
7. Some transmitted directly (have no intermediate host) & some require insect vector (intermediate host) for transmission to human.

((Classification of Protozoa))

Protozoa classified in to 4 classes (according to their locomotion organs):

A.

A. Class: Rhizopoda (Sarcodina)

General features of parasitic Rhizopoda (Sarcodina):

- * Irregular shape.
- * Usually habitat in the intestine.
- * Multiply asexually by simple binary fission.
- * They are require only final host (no intermediate host).
- * Move by pseudopodia ex: *Entamoeba histolytica* & *Entamoeba coli*.
- * Mostly forming cyst stage.

B. Class: Ciliatae

General features of parasitic ciliatae:

- * Usually habitat in the large intestine, & Usually forming cyst stage
- * Multiply asexually by simple binary fission.
- * They are requiring only one host (no intermediate host).
- * Move by cilia ex: *Balantidium coli*.

C. Class: Flagellatea((Zoomastigophora)

General features of parasitic Flagellatea:

- * Multiply asexually by simple longitudinal fission.
- * Move by flagella.
- * Human parasitic flagellates are divided in to 3 groups due to their habitat these groups are :
 - Intestinal flagellates:** ex: *Giardia lamblia*.
 - Atrial flagellates:** Usually habitat in the genital tract & mouth, have only trophozoite (no cyst stage) ex: *Trichomonas vaginalis*.
 - Blood & tissue flagellates:** ex: *Lieshmania tropica*.

D. Class Sporozoa (Telosporea)

General features of parasitic Sporozoa:

- * Habitat in blood & tissues.
- * Require intermediate host.
- * No locomotion organs.
- * Multiply sexually by sporogony & asexually by schizogony
ex: *Plasmodium vivax* & *Ttoxoplasma gondii*.

(Intestinal Protozoa)

1. *Entamoeba histolytica*

Phylum: Protozoa. **Class:** Rhizopoda (Sarcodina)

Disease: cause Amoebic dysentery & some time cause amoebic liver abscess.

Habitat: Lumen of large intestine, may be invade mucosa & sub mucosa of intestinal wall & some time go to the liver.

Host: Final host: **Human & Monkeys**. Intermediate host: **no**.

Infective Stage: Mature cyst with four (4) nuclei.

Mode of infection: Oral route by ingestion the mature cysts with contaminated food or water.

Diagnostic sample: stool.

Diagnostic stage: Trophozoite and cyst.

Treatment: Flagyl (metronidazol) 800 mg (3 times daily) for 5-10 day.

Morphology: There are two morphological stages.

a. Trophozoite stage:

* Also called uncystic, vegetative stage & it has active movement in fresh stool.

* Irregular shape, it is change due to activity of pseudopodia.

* Size about 20 micron.

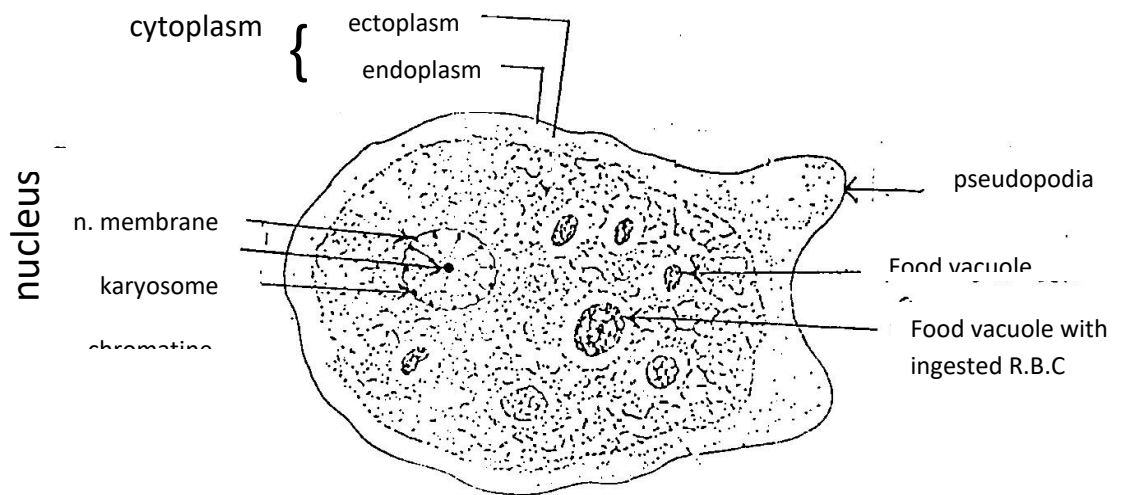
* Cytoplasm is differentiated in to two layers (ectoplasm & endoplasm).

* Have one rounded nucleus with small central karyosome & fine regular distributed

chromatin granules on the peripheral

* Have one or more thin finger like ectoplasmic structure called pseudopodium.

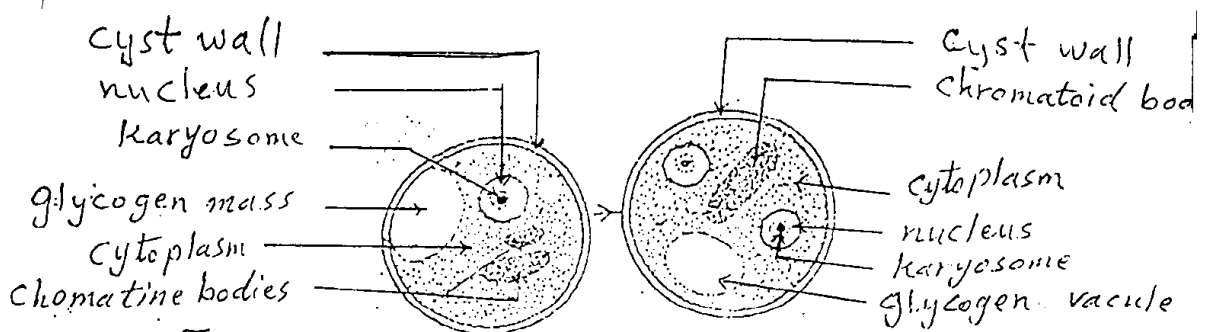
* Have many food vacuoles which contain bacteria & some times ingested R.B.Cs.



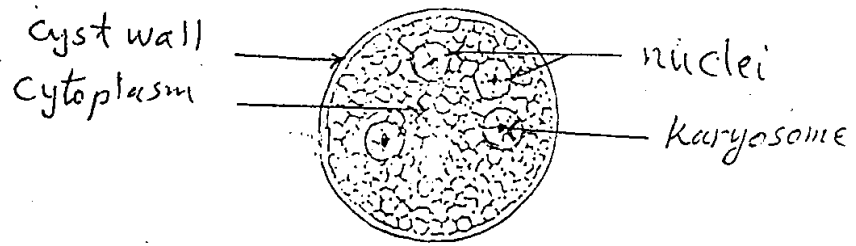
Entamoeba histolytica

b. Cyst

- * Sph
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Entamoeba histolytica



Entamoeba histolytica

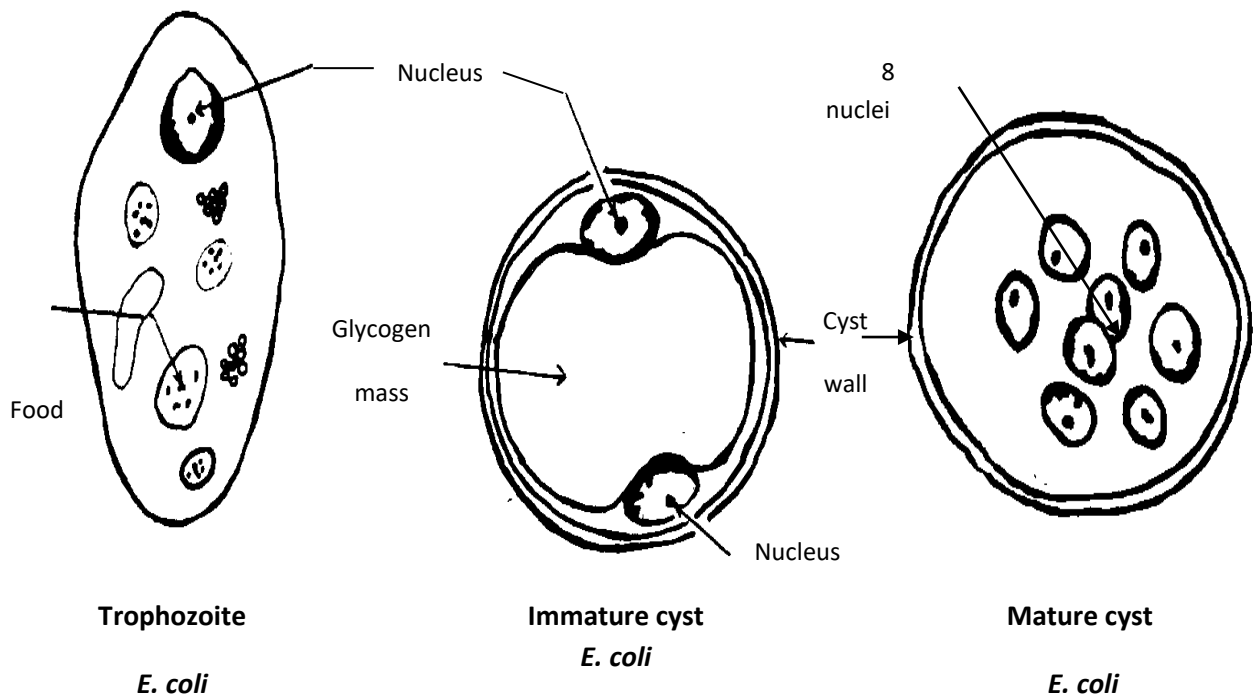
(Mature cyst)

2. *Entamoeba coli*

It is similar to *Entamoeba histolytica* with exception of the following differences:

(Differences between *Entamoeba histolytica* & *Entamoeba coli*)

trophozoite	<i>Entamoeba histolytica</i>	<i>Entamoeba coli</i>
Disease	amoebiasis (Amoebic dysentery or amoebic liver abscess)	non pathogenic
Size	10-40 micron	10-30 micron
Cytoplasm	Cytoplasm clearly differentiated from endoplasm	Not clearly differentiation from endoplasm
Food vacuole	contain RBC in acute case	contain bacteria, yeast & other particles without RBC
Karyosome	small & central in the nucleus	large & not central karyosome
Cyst	<i>Entamoeba histolytica</i>	<i>Entamoeba coli</i>
Diameter	12 Micron	17 Micron
Nuclei in mature cyst	nuclei	nuclei
Chromatin	chromatin bodies from 1- 4 & cigar- shape	chromatin bodies from 10-15 & splinter shape



4. *Giardia lamblia*

Phylum: protozoa. **Class:** flagellatae.

Disease: Giardiasis

Habitat: In the upper part of small intestinal (duodenum).

Host: final host :human especially children. Intermediate host: (no).

Infective stage: mature cyst with 4 nuclei.

Mode of infection: orally by ingestion mature cyst with contaminated food & water.

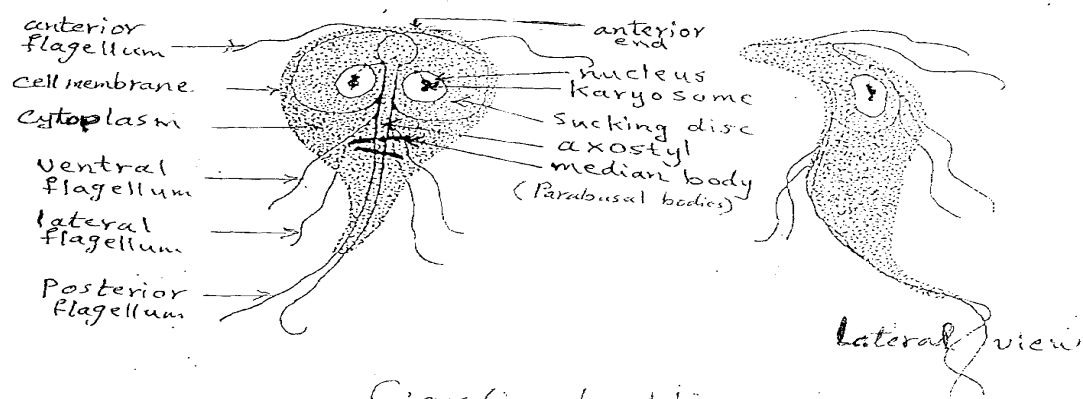
Diagnostic sample: stool.

Diagnostic stag: trophozoite & cyst stage.

Morphology: have two stages

a. Trophozoite:

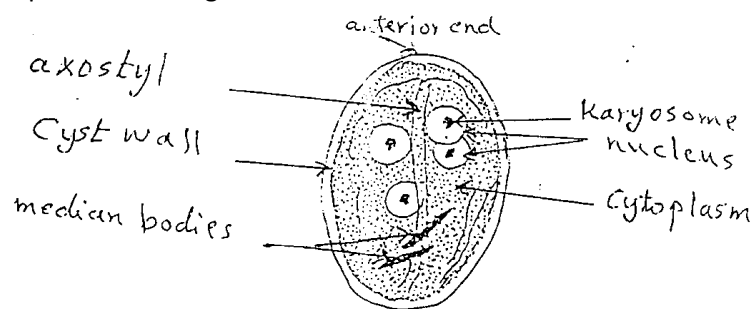
- * Bilaterally symmetrical.
- * Size is 15×12 micron.
- * Pear shape (rounded anteriorly & tapering posteriorly).
- * Have 2 oval sucking (adhesive) discs at the anterior part of the ventral surface.
- * Have 2 nuclei each with large central karyosome.
- * Have 2 longitudinal axostyles & 2 median bodies (deeply staining boxes).
- * Have 8 flagella (4 pairs).
- * Movement: rapid, jerky, twisting motion (falling leaf movement).
- * Found only in diarrheic stool (in acute stage).



Giardia lamblia
 ((Trophozoite stage))

b. Cyst :

- * Mostly oval shape.
- * Size 9-12 micron with 2 layers.
- * Have defined double wall.
- * Have 2-4 nuclei at anterior end.
- * Axostyle & parabasal body & other structures may be seen.
- * Found in formed stool & in liquid stool in large number.



Giardia lamblia
 ((Cyst stage))

(Genital tract Flagellates)

Trichomoas vaginalis

Phylum: protozoa

Class: flagellatae

Disease: Trichomoniasis.

Habitat: Vagina of female & urethra of male.

Host: final host: human.

Intermediate host: No.

Infective stage: Trophozoite.

Mode of infection: directly by sexual contact (the male carrier the disease from infected female to healthy female).

Diagnosis stage: Trophozoite.

Diagnostic sample: In female: Vaginal discharge or vaginal swab or urine.

In male: Urethra discharge or urine.

Treatment: Flagyl (metronidazol):

For female: 1) **250 mg** → 3 times daily (orally) → for 10 days.

2) **500 mg** → vaginal suppository → 1 daily → for 10 days.

For male: **250 mg** → 2 times daily (orally) → for 10 days.

Morphology:

* Have only trophozoite & have no cyst stage.

* Oval or pear shape.

* Size: 15-30 micron.

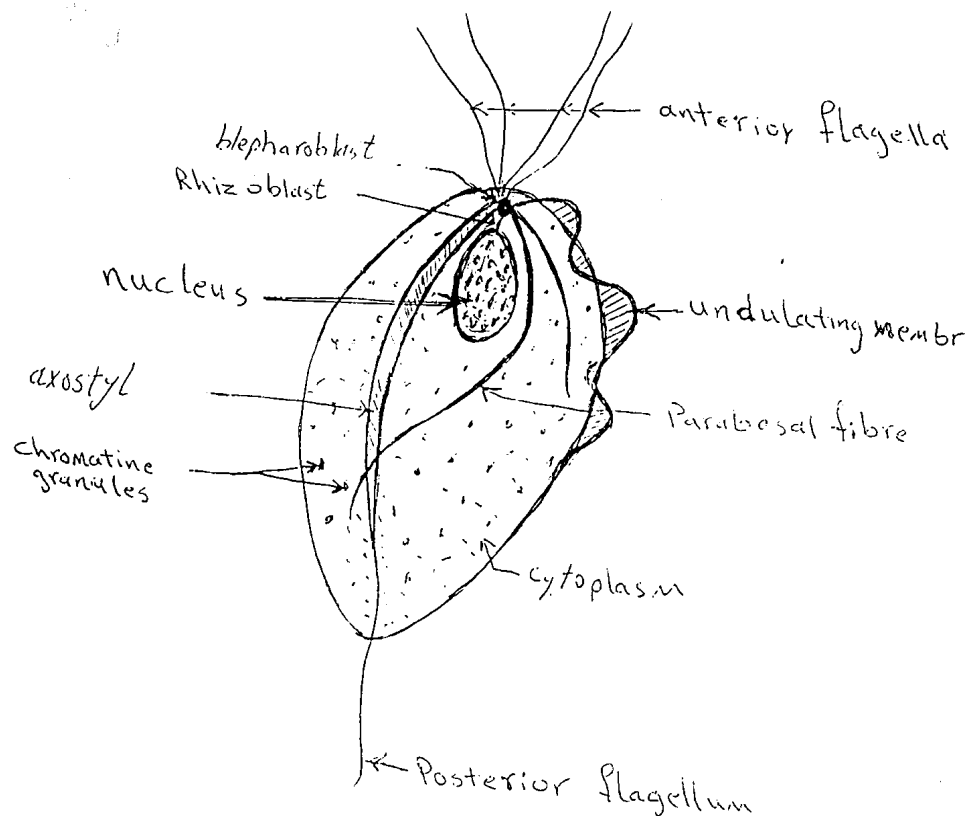
* Have 4 equal anterior flagella & 1 posterior flagellum.

* Have 1 large oval nucleus with equal distributed of chromatin.

* Have longitudinal axostyle.

* Have short undulating membrane.

* Rotating movement.



Trichomonas vaginalis
((trophozoite))

(BLOOD & Tissue Flagellates)

Parasitic

flagellates that inhabit in blood & tissue of human including:

a. Genus: Leishmania.

b. Genus: Trypanosoma.

a. Genus: *Leishmania*

There are 3 species of leishmania that can infected man these are:

1. *Leishmania tropica*
2. *Leishmania donovani*
3. *Leishmania braziliensis*

Phylum: protozoa.

Class: flagellates.

Disease:

1. *Leishmania tropica*: Cause cutaneous leishmaniasis (oriental sore or Baghdad boil).
2. *Leishmania donovani*: Cause visceral leishmaniasis (kala azar or black fever).
3. *Leishmania braziliensis*: Cause muco-cutaneous leishmaniasis (espundia).

Habitat:

1. *L. tropica*: In blood & skin tissue.
2. *L. donovani*: blood & tissue. Monocyte of reticulo-endothelial system (viscera ex: spleen, liver, lymph nodes, bone marrow, lymph nodes).
3. *L. braziliensis*: blood & tissue of mucous-membranes of nose,throat,ear,mouth

Hosts:

Final host: human and some vertebrates.

Intermediate host: female of sand fly (genus Phlebotomus).

Infective stage:

Promastigote stage (Leptomonas form)in salivary glands of sand fly.

Mode of infection:

Through the skin by means of biting of infected (insect vector) female sand fly.

Diagnostic sample:

1. *L. tropica* : blood & scraping from the skin lesion.
2. *L. donovani*: blood & tissue of reticulo-endothelial system.
3. *L. braziliensis*: blood & tissue of mucous-membrane.

Diagnostic stage:

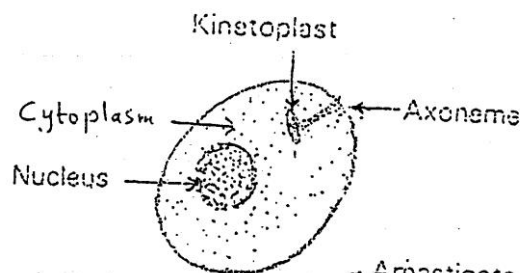
Amastigote stage (Leishmanial form).

Treatment: Pentostam.

Morphology: All leishmania parasites are similar morphologically.

a. Amastigote stage (leishmanial form): Found in man & some mammals.

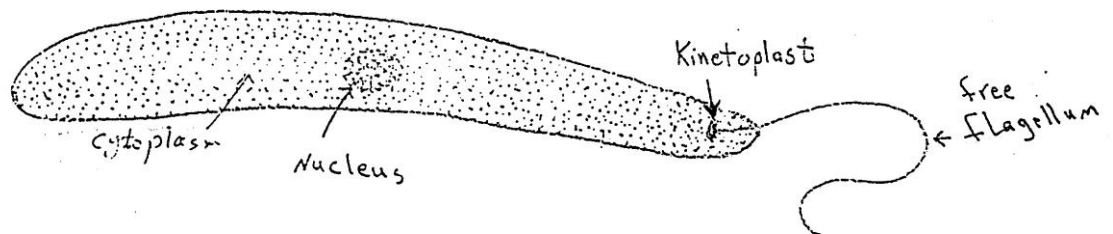
- * Body is oval or spherical shape.
- * Size (2-5 micron) \approx $\frac{1}{2}$ size of R.B.C.
- * Nucleus is rounded or oval usually position in the posterior half of the body.
- * Kinetoplast of variable size (smaller than the nucleus) rod shaped or rounded, located at the anterior end of the body.
- * No undulating membrane.
- * No free flagellum .



b. Promastigote stage (leptotrichous)

- * Body is elongated shape
- * Nucleus in the middle.
- * Kinetoplast located near the anterior end.
- * No undulating membrane.
- * Free flagellum is present.

Leishmania spp. ((Amastigote stage))



(Parasitic Sporozoa)

a. Genus: Plasmodium Clinically there are 4 species of plasmodium parasites that can infect man and cause malaria, these are:

1. *Plasmodium vivax*
2. *Plasmodium falciparum*.
3. *Plasmodium malariae*.
4. *Plasmodium ovale*.

Phylum: protozoa.

Class: sporozoa.

Disease:

1. *Plasmodium vivax*: cause benign tertian malaria.
2. *Plasmodium falciparum* : cause malignant tertian malaria
3. *Plasmodium malariae*: cause quartan malaria.
4. *Plasmodium ovale*: mild tertian malaria.

Habitat:

In R. B. C. (Red Blood Cells).

Hosts:

Final host: female Anopheline mosquito (it is the insect vector).

Intermediate host: human and some vertebrates

Infective stage:

Sporozoite.

Mode of infection:

Through the skin by biting of infected female Anopheline mosquito.

Diagnostic sample:

Blood

Diagnostic stage:

All Erythrocytic stages (Ring, amoebic, schizont and gametocytes).

Treatment:

Chloroquine.

Morphological stages of Erythrocytic cycle of plasmodium :**1. *Plasmodium vivax*:**

- * The parasitized erythrocytes become enlarged, pale (deficient in Hb).
- * The infected RBC contain fine dots (schuffner's dots)
- * Primarily invade reticulocytes (young red cells).
 - * Single infection (one parasite infect the R.B.C)
 - * All stages can be seen in the peripheral blood.

a. Trophozoite:**i. Ring stage: (early or young trophozoite)**

* Delicate ring usually with one nucleus on one side (signet-ring appearance).

* The size of the ring is large nearly equals (1/3-1/2) diameter of the RBC.

* Usually one ring (parasite) infects the RBC.

ii. Amoeboid stage: (late or old trophozoite)

* Is very pleomorphic, as the trophozoite grows it become irregular, finely pigmented plasmodium organism.

* That shows marked amoeboid activity, many pseudopodial processes are usually seen.

* It fills over 1/2 the size of the enlarged RBC.

* The pigment in the developing trophozoite is fine, light brown & scattered.

b. Schizont:

* Fills over 1/2 the RBC.

* Its nucleus divide (once the nucleus divide it is called schizont).

* The parasite losses its activity & contains accumulations of pigment in the cytoplasm.

* The maximum size of the schizont in about 8-10 micron undergoes segmentation, this occurs around 48 hours.

* The pigment accumulate eccentrically & the divided nucleus with portion of

the cytoplasm form number of round or oval cells called Erythrocytic Merozoites which are about 1.5 -2 micron in diameter.

* In *P. vivax* each mature schizont contain more than 14-24 merozoite.

c. gametocytes:

* they are round or oval, nearly fill the erythrocyte.

* The microgametocyte (♂gametocyte) has a pink diffuse nucleus & pale blue cytoplasm.

*The macrogametocyte(♀gametocyte) with darker blue cytoplasm & compact

nucleus, often located at the periphery at the parasite.

2. Plasmodium falciparum:

* The parasitized RBC is not enlarged with coarse stippling (Maurer's clefts or dots).

* Multiple infection of the RBC is a common characteristic.

* It can invade all the red cell (of all ages).

* Only the ring forms & gametocytes are ordinary seen in peripheral blood.

a. Trophozoite:

i. Ring stage (early or young trophozoite):

* Small ring in size (1/5 the RBC diameter).

* It may contain double chromatin dots (nuclei).

* Multiple infection is common. May adheres to the RBC surface from the in side.

ii. Old (late) trophozoite:

* Compact & rounded (not amoeboid).

* Pigment is coarse & black in few clumps.

* (Usually not seen in peripheral blood).

b. Schizont:

- * Resemble (similar) to that of *P. vivax* but not seen or very rare in peripheral blood (in blood of deep tissues).
- * Mature schizont usually contain more than (18-32) merozoite.

c. Gametocytes:

- * Crescent in shape, stretching the corpuscular covering (elliptical).
- * When fully developed they have a characteristic **banana shape**, they so called crescent.

3. Plasmodium Malariae:

- * Infected RBC is not enlarged & no dots.
- * Primarily invade old RBC.
- * All the forms of development can be seen in peripheral blood.

a. Trophozoite:

i. Ring stage (early Trophozoite):

- * The size of the ring is large nearly equals $\approx 1/3$ the size of RBC.
- * Usually with one chromatin granules (nucleus).
- * The ring is thick.
- * Usually one parasite infect the RBC.

ii. Old or late trophozoite (band form):

- * May assume band shape.
- * It contains abundant coarse granules of dark brown or black pigment.

b. Schizont:

- * Mature schizont almost fills the unenlarged RBC, resemble a rosette having a central compact mass of black pigment surrounded by less than 12.
- * Mature schizont usually contain **8-10** merozoite.

c. Gametocytes:

- * Are similar to those of *P. vivax* but are smaller & contain less pigment.

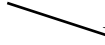

Pathogenicity & symptoms of malaria:

- * Fever, sweating , chill.
- * Anemia: in chronic stage of malaria
 - * The main clinical features in a typical case of malaria are paroxysms of fever which appear at regular intervals.
 - * Each paroxysm shows a succession of **3** stages:

1. Hot stage(fever): lasting for **1- 4** hours.
2. Sweating stage: lasting for **1-2** hours.
3. Cold stage(chill): lasting for 30 minutes to **1** hour.
 - * paroxysm occurs due to the sudden liberation of merozoites into the blood stream
 - * Anemia & other symptoms occur at the chronic stages of the disease.
 - * In *Plasmodium falciparum* the disease may be developed to Black Water Fever.

Laboratory diagnosis of malaria:

Peripheral Blood → blood film

1. Thin blood film : stain by leishman. 
 2. Thick blood film: stain by geimsa. 
- Microscopic examination
for erythrocytic stages

Notes:

- * Thin blood film: for differentiating species & stages.
- * Thick blood film: chance of detecting malarial parasites is larger.
- * Blood film should be done repeatedly
- * Misdiagnosis & difficulties in diagnosing malaria.
 1. Dirty slide.
 2. Stain (not filtered).
 3. old specimen.
 4. If the patient is severely anemic.
 5. If the patient is on treatment

Serological diagnosis:

- * ELISA & RIA (Radio Immune Assay).
- * Only in survey & in checking blood from blood donors.

Mode of infection: Oral route by ingestion of cysticercus with undercooked meet of infected cattle.

Habitat : a.) Adults inhabit in the small intestine of man only .

b.) Eggs passes in human feaces, either individually or within the separated gravid segments .

c.) Larvae (cysticercus) in the muscles of cattle .

Morphological characters :

1)The long of adult worm measure from 3 up to 25 meters usually 7-10 meters in length with a maximum breadth about 1.4 Cm .

2) Scolex is pyriform (quadrate) measured about 2 mm in diameter , contain 4 suckers & have a short rostellum with no hooks .

3) Strobila is creamy white–yellowish in color , contain 1000 – 2000 segment .

4) Genital pores are at the lateral margin & irregularly alternated .

5) Immature segments are small & wider then length .

6) Mature segments are nearly square & each one contain complete well developed set of both male & female reproductive organs .

7) Gravid segments are longer than wide measuring about 2 x 1.4 Cm & have a fully developed uterus consist of a longitudinal stem with 15 – 20 lateral compound branches on each side filled with egg. The other reproductive organs are degenerate

8) The larval form is called cysticercus bovis which in pea-size about 0.5 – 1 Cm, milky white color, bladder filled with fluid & contain only one scolex in side. cysticercus is developed in the voluntary muscles of cattle & complete development within 2–3 months after ingestion,then it becomes infective to man

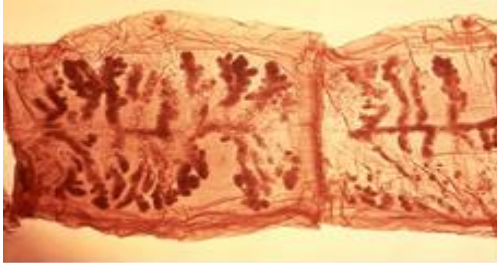
9) **Fertilized egg:** is usually spherical, brownish color, measure about 30 – 40 m. in diameter. Contain a small Oncophere (Hexacanth embryo) about 14 m. in diameter which enclosed within a thick brown radially striated layer called embryophore. The egg covered with a delicate soft egg shell . Between the embryophore & the egg shell there is an albuminous material (yolk) .

hexacanthembryo



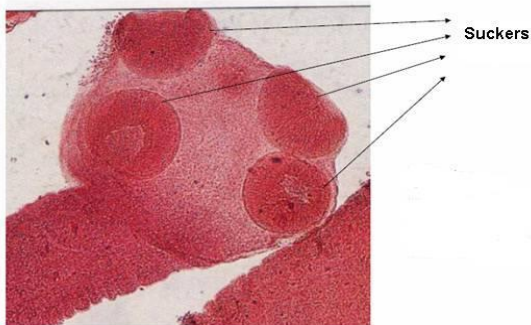


Mature



Proglotid segment

Scolex of *Taenia saginata*



Pathogenicity :

Adult worms are usually cause no symptoms , or trifling symptoms , these may be abdominal disturbance & discomfort , hungry feeling , indigestion with diarrhea or constipation , lost of weight & eosinophilia .

Diagnosis : (Stool examination)

- 1) By detection of the ova microscopically .
- 2) By finding the gravid segments in feaces . (For specific diagnosis , press the gravid segment ((after boiling to kill the eggs)) between tow slides & held up to the light for examined ((by necked eye or by hand lens)) the number of the lateral uterine branches , they are 15 – 20 branch in T. saginata while in T. solium they are 7 – 13 branch)

Cysticercosis :

It is the infection of man with cysticercus. Sometimes man serves as intermediate host for T. solium (very rarely in T. saginata), Human cysticercosis occurs when man ingesting the ova & develops in his tissues into cysticercus (auto-infection sometimes occurs). After the ingestion of ova ,oncosphere hatches in the intestine of man & penetrates into the intestinal wall to held by blood or lymph & settle down in the subcutaneous tissue, the muscles, brain, & eye , then development takes place into cysticercus .

Symptoms of cysticercosis depends upon the location & number of cysticerci .

It is very dangerous when localized in the brain or eye .

In the tissue it may be calcified & die .

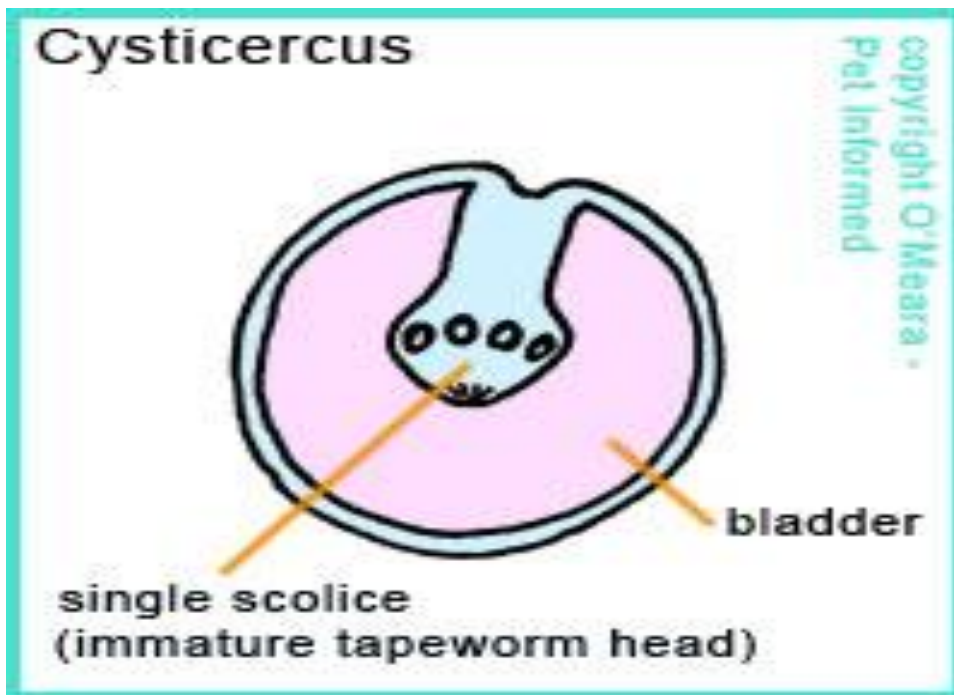
Diagnosis of cysticercosis is by X-ray in case of calcification of cysts, or by biopsy in case of subcutaneous nodules , or by serological tests (IHA , ELISA) .

2.((*Taenia solium*))

It is similar to T. saginata , except in the following differences :

Differences between T. solium & T. saginata

<i>T. solium</i>	<i>saginata</i>
Common name : pork tape worm Cellulosa tape worm	beef tape worm or Bovine tape worm
Disease : Taeniasis or pork tape worm infection.	taeniasis or beef tape worm infection.
Infective stage to man : cysticercus cellulosa , some times ova .	cysticercus bovis , infection with ova very rare .
Intermediate host : pigs , some times man	cattle , very rare man
Adult length : usually (2 – 4) meters .	Adult length : usually (7 – 10) meters
Proboscis : contain (800 – 1000) segments	contain (1000 – 2000) segments.
Testicular branches : (7 – 13) branches .	(5 – 20) branches
Proximal suckers : contain 4 suckers , long rostellum with 2 crown of hooks	contain 4 suckers , long rostellum without hooks
Larvae : called cysticercus cellulosa in muscles of pigs	called cysticercus bovis in muscles of cattle .
Cysticercosis : commonly occurs	very rarely occurs



((Schistosomes))

1. Schistosomes are diecious (sexes are separated) .
2. Adults inhabit in the portal vein and its radicals .
3. Schistosomes eggs are not operculated, but they have spine
4. They have no redial stage larvae .
5. Cercaria (with forcked tail) is the infective stage to man .
6. Human infection take place by means of the direct penetration of cercaria through the skin .
7. Males are shorter and broader than females .
8. Males and females have two suckers (oral and ventral suckers) .
9. The two branches of the intestine, after the primary bifurcation, they are re-unite again some distance behind the ventral sucker to forming a single canal which ends blindly at the posterior end of the body .

10. The lateral margins of the males are folded (incurved) behind the ventral sucker toward the ventral surface forming a gynaecophoric canal in which the females carried during copulation, this canal extend to the posterior end of the males .
11. Testis vary in number from (4-8), and they are lies behind the ventral sucker .
12. Copulatory organs in males such as cirrus are absent .
13. Females have slender (filiform) bodies .
14. Uterus with comparatively contains few eggs .

There are three important species of Schistosomes which can infected man :

- 1 . *Schistosoma haematobium* .
2. *Schistosoma mansoni* .
3. *Schistosoma japonicum* .

((*Schistosoma haematobium*))

Class : Trematoda

Disease: Urinary schistosomiasis, vesical schistosomiasis, schistosomal haematuria .

Definitive host: Man .

Intermediate host: Snail (*Bulinus* spp.)

Infective stage: Cercaria (with forcked tail) .

Mode of infection: By penetration of Cercaria directly through the skin .

Diagnostic stage: Ova (with terminal spine) in urine .

Habitat : **a.)** Adult: In the portal vein and it's radicals, especially in the vesical plexus of man.

b.) Eggs : Passes out in urine and very rarely in feaces .

c.) Larval stage : In the tissues of snail *Bulinus* spp.

Morphology :

Males:

- * Measures about 1 - 1.5 cm in length and about 1 – 1.3 mm in width .
- * Have small oral sucker and larger ventral sucker .
- * Have a gynaecophoric canal.

* Cuticle on the dorsal surface is covered with small tubercles and a minute spines .

* Number of testis are 4 – 5 and lies dorsally just behind the ventral sucker .

Females:

* Body is cylindrical (thread – like) in shape .

* Measures about 2 cm in length and about 0 . 25 mm in breadth .

* Cuticle is smooth (with out tubercles) .

* Ovary is small elongated organ situated in the posterior half of the body .

* Uterus contain 20 – 30 egg, and it is opened in to the genital pore.

* Vitelline gland occupies the posterior fourth of the body .

Eggs:

It is transparent, light yellowish brown in color, compact, elongated, spindles, at one pole it is bear a terminal spine and it is contain inside the shell a ciliated larvae (meracidium).(Egg is the diagnostic stage) .

Pathogenicity:

* The earliest symptoms are due to the entering of the cercaria, Irritation of the

skin in the position of penetration, this disappear after 2 – 3 days .

* Some days later there may be an allergic and rash, cough, eosinophilia .

* After about one month later, toxic symptoms may be shown consisting loss of

appetite, headache, malaise, generalized pain in back and in extremities, fever and abdominal, liver, spleen enlargement .

* After several months a painless passage of a small amount of blood (haematuria)

at the end of urination due to the extrusion of the eggs through the bladder wall,

this may continue for month or more, burning sensation at the time of urination,

and increased desire to urinate .

* In chronic cases some eggs may calcified in the bladder wall or in other urinary

organs, this leading to abscess . inflammation and then fibrosis may be develops in

these positions .

* Some times malignant of the bladder wall may be occurs .

Diagnosis:

Urine examination:

☺ To finding the ova with terminal spine (occasionally ova is found in feaces) .

☺ The best examination is done for the last part of the urine after exercise and this urine is centerfugated or sedimentated , then the deposit is examined microscopically for eggs .

☺ The bloody urine gives good results .

Serological diagnosis: such as :

☺ C.H.R : Cercarian Hullen Reaction. (skin test) .

☺ F.A.T : Fluorescent Antibody Test .

Biopsy of tissues: for detection of eggs .

((*Schistosoma mansoni*))

Class :Trematoda

Disease : Intestinal schistosomiasis .

Definitive host : Man .

Intermediate host : Snail Biomphalaria spp.

Infective stage : Same to that of *schistosoma haematobium* .

Mode of infection : Same to that of *schistosoma haematobium* .

Diagnostic stage : Ova (with lateral spine) in feaces .

Habitat : a.) Adult: In the inferior mesentric veins .

b .) Eggs : passes out in feaces and very rarely in urine .

c .) Larval stages : In the tissues of the snail Biomphalaria spp.

Morphological characters:

Males: similar to that of *Schistosoma haematobium* except in the following

differences :

1. Smaller in size .
2. The cuticle on the dorsal surface covered with larger tubercles .
3. Number of testis 5 – 8 and they are in cluster .

Females: similar to that of *Schistosoma haematobium*_ except :

1. Smaller in size .
2. The ovary is located in the anterior half of the body .
3. The uterus contains 3 – 4 eggs .

Eggs:

Similar to eggs of *Schistosoma haematobium*, but they are regularly oval, measures

about 170 μ in length and 60 μ in width, and they have a large lateral spine .

Life cycle:

Same as in the life cycle of *Schistosoma haematobium* in general,

except : the eggs are usually passed in feaces, and the snail is Biomphalaria .

Pathogenicity: Intestinal symptoms .

Diagnosis : ☺ Stool examination to find the eggs in feaces , rarely in urine .

☺ By biopsy from rectal tissues for detection of eggs .

☺ Serological diagnosis as in *S. haematabium* .

((*Schistosoma japonicum*))

Class :Trematoda.

Disease : Oriental schistosomiasis .

Definitive host : Man .

Intermediate host : Snail Onchomelania spp.

Infective stage : Same as in schistosoma haematobium.

Mode of infection : Same as in schistosoma haematobium.

Diagnostic stage : Ova (rounded with minute lateral spine) in feaces .

Habitat : a.) Adult: In the superior mesentric veins .

b.) Eggs : passes in feaces only .

c .) Larval stages : In the tissues of the snail *Onchomelania* spp.

Morphological characters:

Males: similar to other species except in the following differences :

1. The cuticle is smooth with out tubercles
2. Number of testis are 6 – 8 .

Females: similar to other species except :

1. Ovary located in the middle of the body .
2. The uterus contains 50 – 100 eggs .

Eggs:

Are nearly rounded , measures about 90 μ in length and 70 μ in width , and they

have a minute lateral spine near one pole to the side, and are passed in feaces only **Life cycle:**

Similar to that of *Schistosoma mansoni* .

Pathogenicity:

Generally resembles that of *Schistosoma mansoni*, but the disease tends to be more

acute and more serious because of the greater number of eggs deposited in the tissues

Diagnosis:

- ☺ Stool examination to find the eggs in feaces , rarely in urine .
- ☺ By biopsy of rectal tissues for detection of eggs .
- ☺ Serological diagnosis as in *S. haematabium* .