Parasite

Introduction

- **Paraitology :**
- **Parasitism :** (chapter 21)
- **Parasite :**

is an organism baring food and shelter temporarily or permanent and living in or on another organism.

- **Kind of parasite (according to habitat)**

1. **Ectoparasites :** (chapter 21)
2. **Endoparasites :** (chapter 21)

- **Endoparasite**

- **Ectoparasite**

- **Parasites can be:**

1-Facultative parasite:

parasites able to live both free living and parasite living e.g. Strongyloides species.

2-Obligate parasite:

parasite living permanently in a host and cannot live without a host e.g. Trichomonos species.

3-Coprozoic (spurious) parasites:

foreign organisms which have been swallowed merely pass along alimentary canal of man (without establishment) to be recovered in faeces. (without affect)

HOST

- **Host :**

organism harboring the parasite species may be affected or not.

- **Classification of Hosts**

1-Definitive host or final host : (sexual development)

- Eg: man.
- (see page 358 chapter 21)

2-Intermediate host: (asexual development)

- **Eg:** Taenia>>>>>>> adult------ man
  Larva –---- cattle
- (see page 358 chapter 21)

3-Reservoir host (carrier):

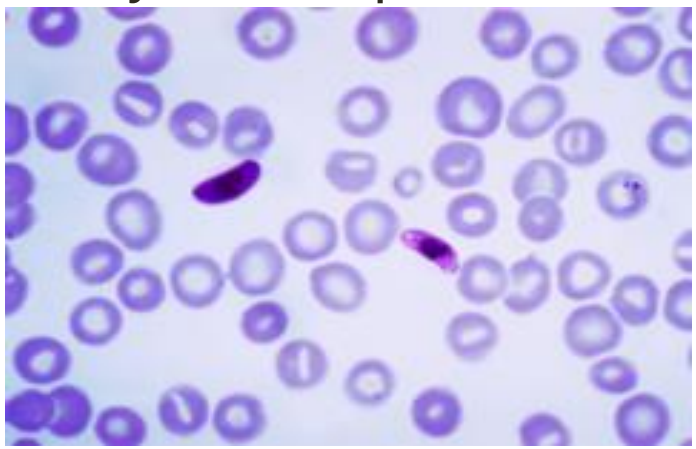
the carrier host is well adapted to the parasite and tolerates the infection but serve as source of the infection to other organisms

4-Vector:

an arthropod which carries the parasite from one host to another.

Classification of parasites

- **General classification:** animal parasites are classified according to international code taxonomy – Each parasite belong to a:
- **Kingdom**
  Phylum
  Class
  Order
  Family
  Genus
  Species



- Some have further divisions to:
  Sub – order, super family, sub – species

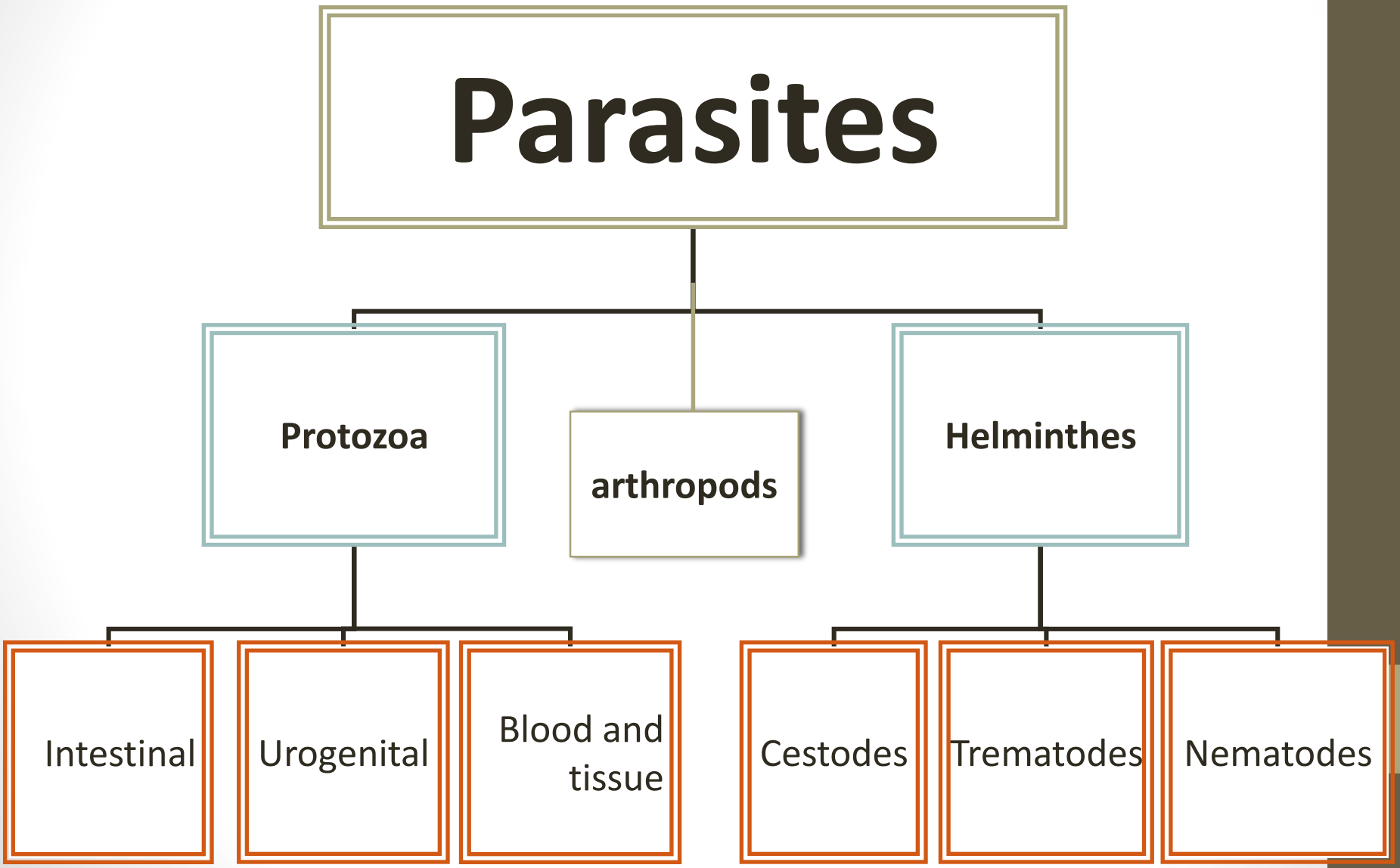
- in classification, scientific parasitic name is of 2 parts:
  Genus name and species name. Ex: *Plasmodium falciperum*
  Genus name (one word): *plasmodium*
  Species name (two words): *plasmodium falciperum*.

- Genus: means group of close related species.
- Species: means population with the same genetic characters.

Mode of parasitic infections

1) **Congenital from mother to fetus.**
2) **Sexually transmission**
3) **Ingestion of contaminated food and water or undercooked meat in which the infective stage has developed.**
4) **Penetration of the skin due to contact with infected soil or water stream.**
5) **Inhalation of dust carrying the infective stage of parasite.**
6) **Vectors: through the bite or faeces of infected vector or by swallowing the vector.**

Classification of parasites



Protozoa

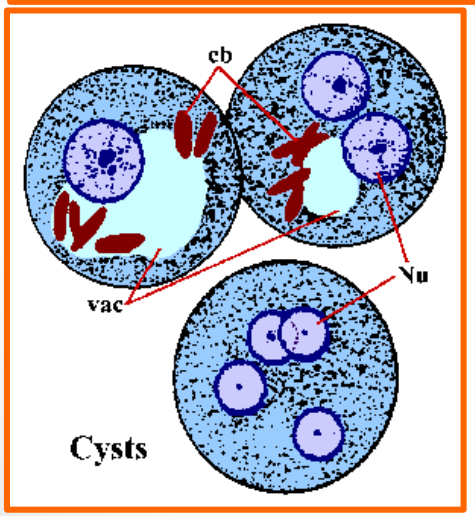
Protozoa

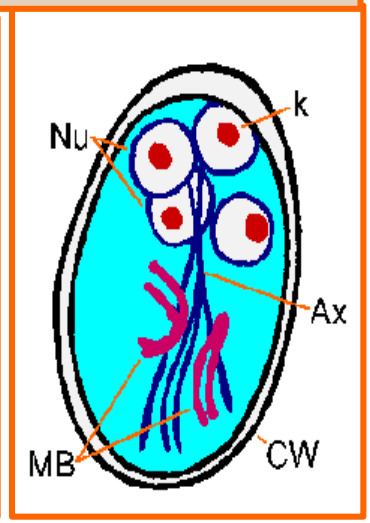
- **See page 72 chapter 5**

- **Protozoa life cycle consist of two stage :**

Cyst

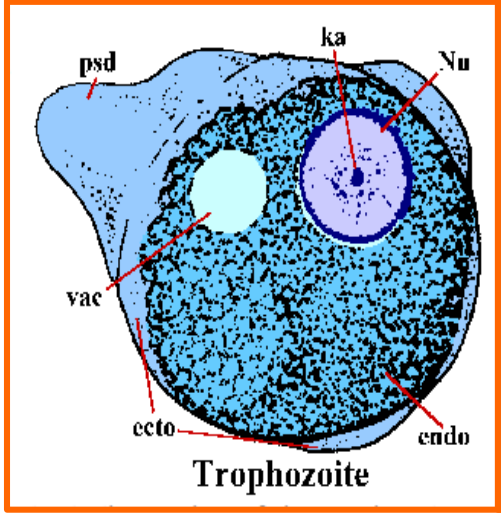
Infective stage, dormant, immotile.





Trophozoite

Vegetative stage. Can be motile.



Protozoa are classified
(according to their method of locomotion)

- **See page 73 , chapter 5 , table 5-3)**

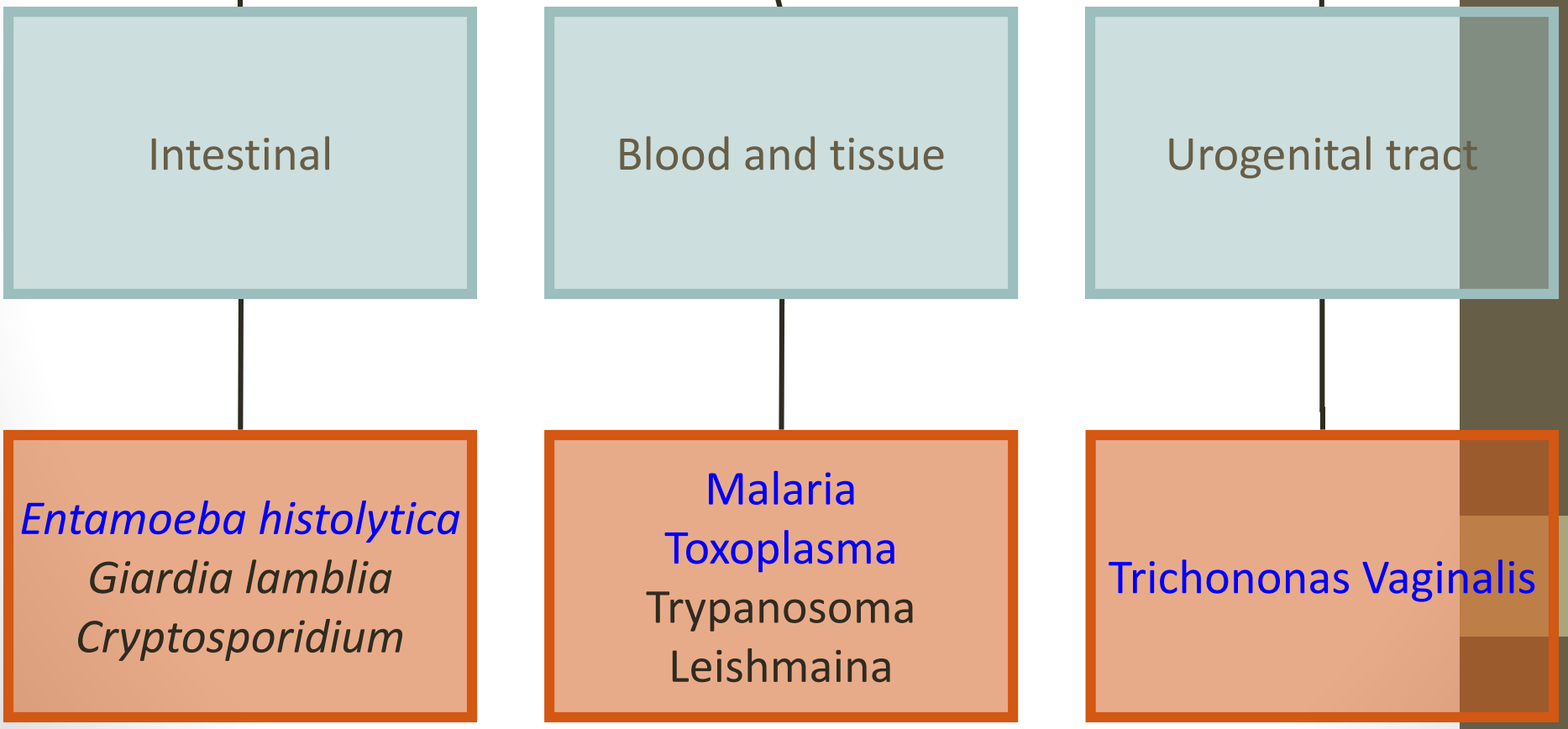
1. **Flagellates** (e.g. *Giardia lamblia*).

1. **Amoeboids** (e.g. *Entamoeba histolytica*).

2. **Sporozoans** (e.g. *Plasmodium*).

3. **Ciliates** (e.g. *Balantidium coli*).

Protozoa infection



Entamoeba histolytica

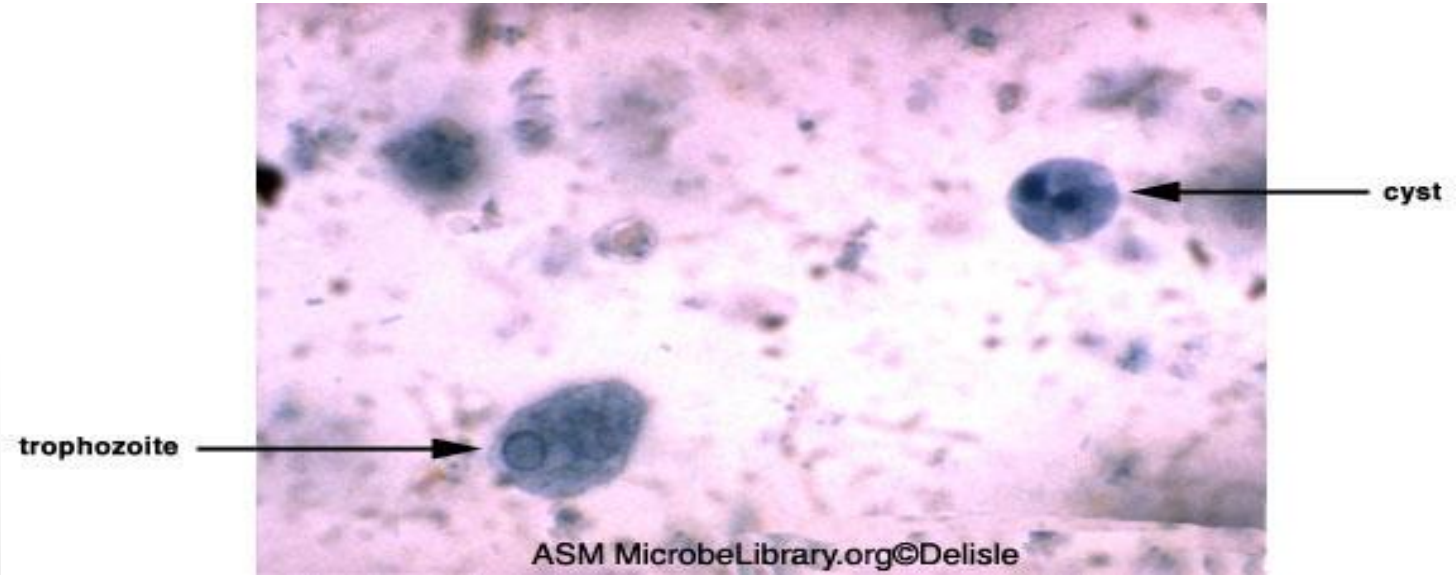
➢ Name of Disease:

- Amoebiasis (Amebic dysentery)

Dysentery
Stool with blood and mucus.

➢ Parasite:

- It possess both trophozoite and cyst forms.
- It moves by Pseudopodia (false feet)



Entamoeba histolytica

- **Geographical distribution:**
- **Word wide,** but more common in tropical and subtropical countries and in countries with poor sanitation

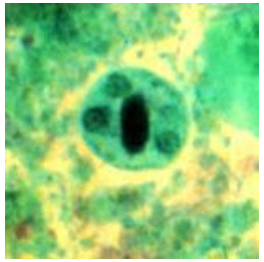
- **Habitat:**
- The lumen of the large intestine.
- **Reservoir**:
- Mainly: humans
- Rarely: dogs, pigs, monkeys

Amoebiasis

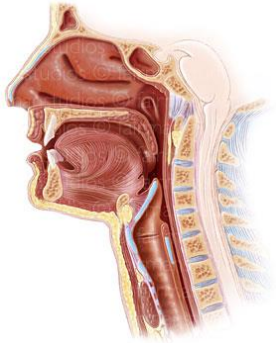
- **Mode of transmission :**

See page 362 , chapter 21 , table 21-3)

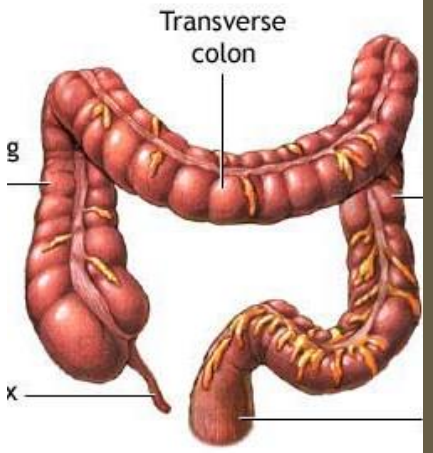
Life cycle:



Cyst: infective stage

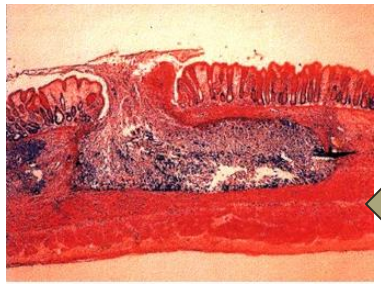


Inters mouth through contaminated food, drink, fly, or through using human stool as fertilizer



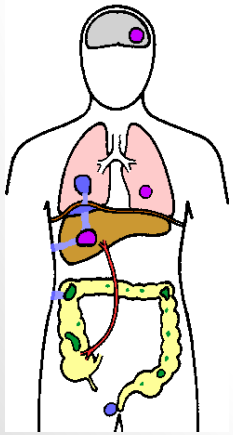
To L.I. lumen and change into trophozoite (pathogenic stage)

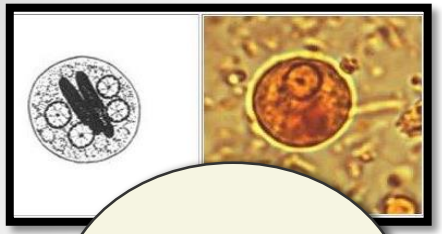
Produce lytic enzymes (capable of doing lysis and produce ulcer)



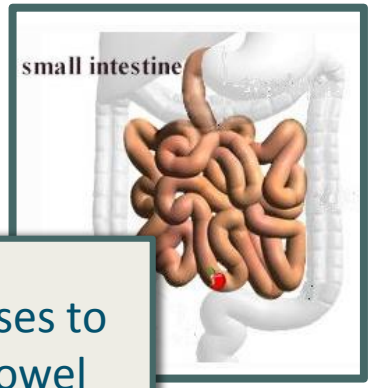
Flask shape ulcer

Can do erosion through B.V. to liver and other organs





Cyst Ingested



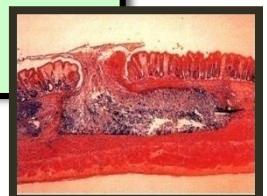
Cyst passes to small bowel

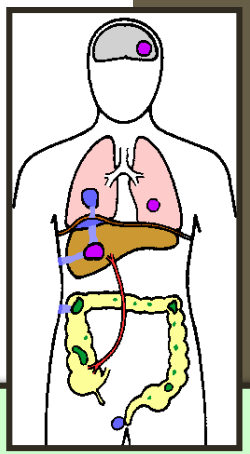
Cyst wall disintegrates and release trophozoites.

Trophozoites colonize colon.

Trophozoites form cysts that passes in feces.

Cause ulceration of colon,





Can further spread to other organ and cause abscesses (mainly liver)

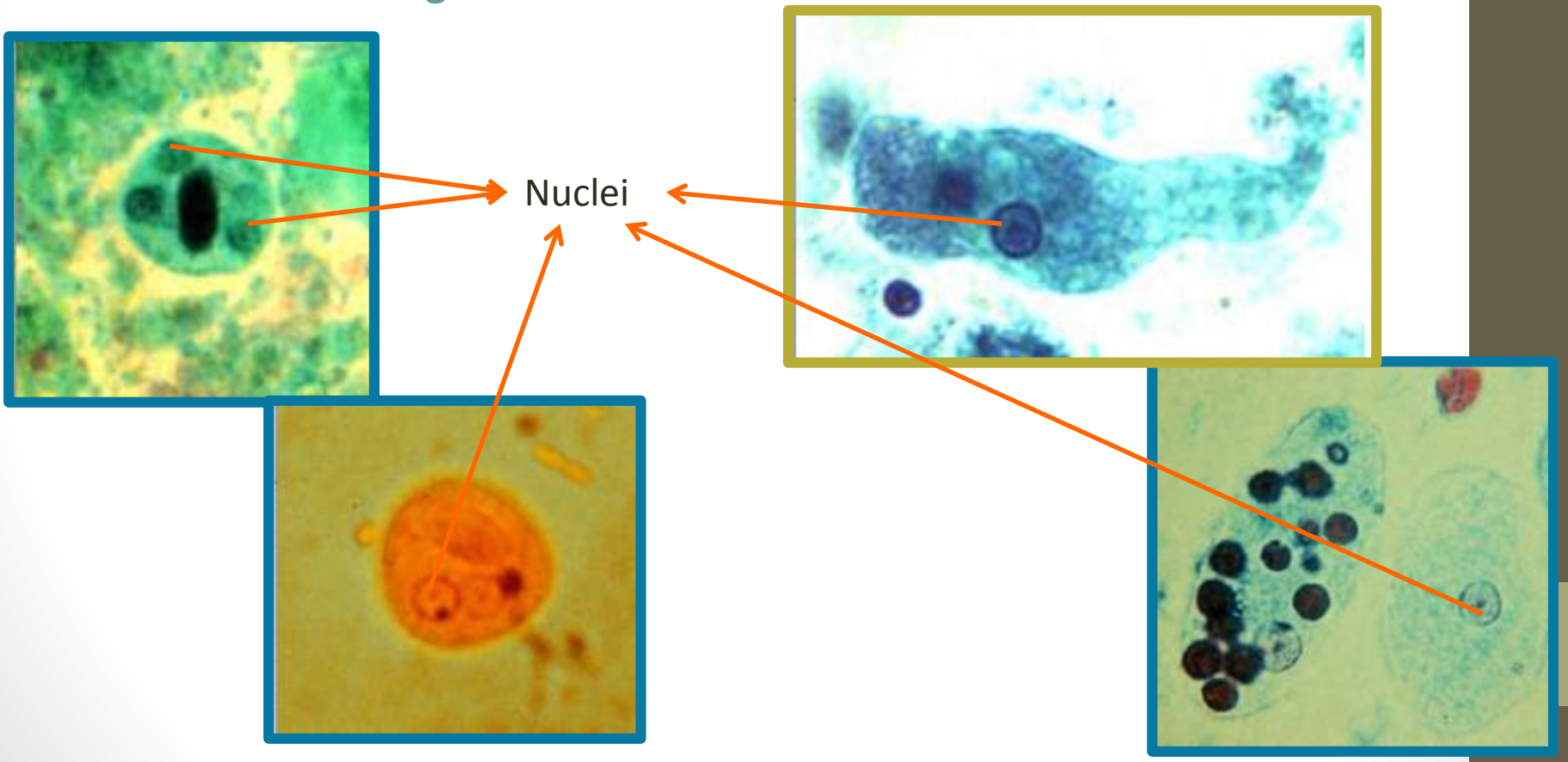
Morphology: *Entamoeba histolytica*

Cyst:

Infective stage

Trophozoite

Pathogenic stag



Clinical picture:

- Dysentery: blood+mucous diarrhea (as a result of flask shape ulcer wall invasion)
- Sever abdominal pain
- Tenesmus: sense of incomplete evacuation
  (the patient at this point should be seeking medical advice)

Complication:

A. intestinal: peritonitis, appendicitis, Hemorrhage

B. Extra intestinal:

Most commonly: liver
- hepatitis (sever right abdominal pain)
- Fever
- amoebic liver abscess (sever pathology in the liver because the inflammation spots came together) shoulder pain and Toxemic manifestations

Also in lung, skin, and brain

Plasmodium sp. (Malaria)

➢ **Name of Disease:**

- Malaria →
  - ✓ systemic infection with malaise, fever, chills, sweating, headache, and nausea.
  - ✓ The frequency with which the cycle of chills, fever and sweating is repeated is referred to as **periodicity** and depends on the particular species of plasmodium.

➢ **Parasite: four species are known to infect human**

✓ *Plasmodium falciparum*

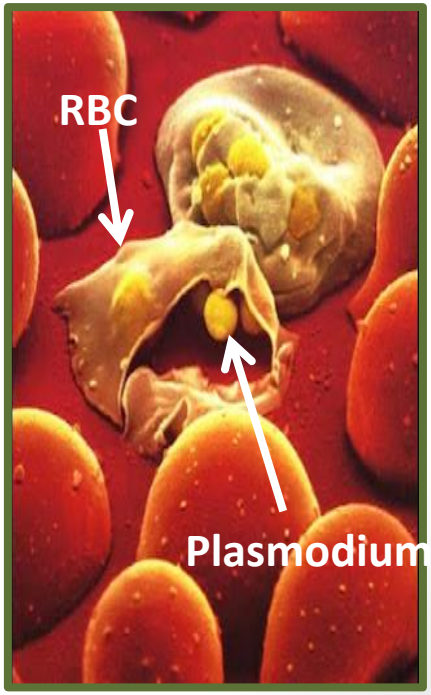
•(the most deadly and dangerous ,)

✓ *Plasmodium vivax*.

•(the most common species,)

✓ *Plasmodium ovale.*

✓ *Plasmodium malaria.*



Plasmodium sp. (Malaria)

- Approximately 300 million people worldwide are affected by malaria and between 1 and 1.5 million people die from it every year

- **Geographical distribution:**

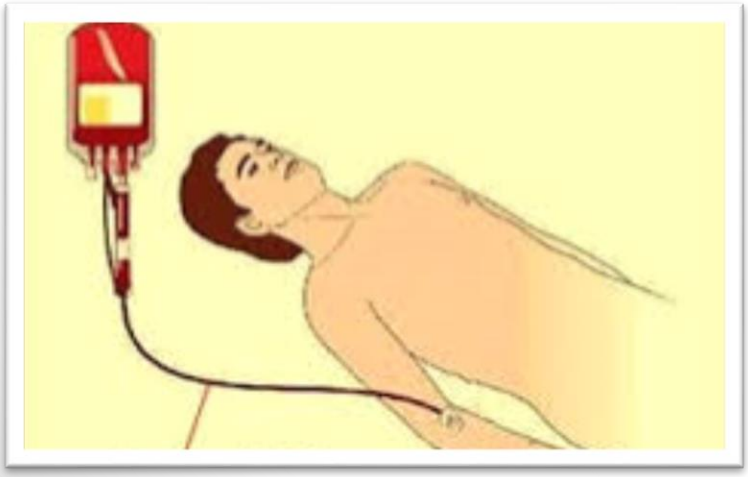
➢ Previously extremely widespread, the malaria is now mainly confined to Africa, Asia and Latin America

➢ The problems of controlling malaria in these countries are aggravated by inadequate health structures and poor socioeconomic conditions. The situation has become even more complex over the last few years with the increase in resistance to the drugs normally used to combat the parasite that causes the disease.

Plasmodium sp.

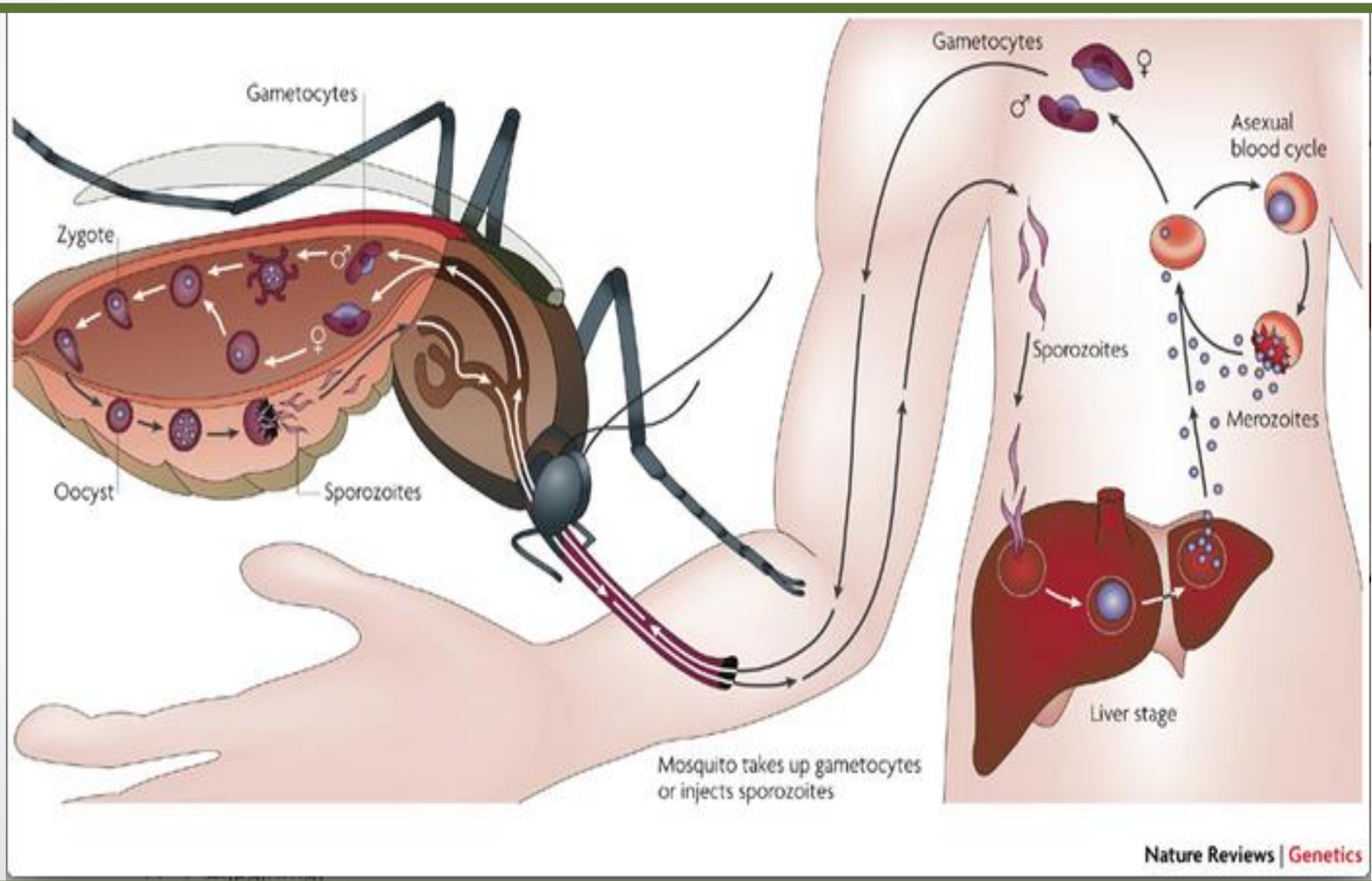
- **Mode of transmission :**

See page 366 , chapter 21 , table 21-4)



Life Cycle: *Plasmodium sp.*(

chapter 21, page 367, figure 21-7)



Plasmodium sp. (Malaria)

Pathology and clinical significance:

- When merozoits invade the blood cells, using hemoglobin as a nutrient, eventually, the infected red cells rupture, releasing merozoits that can invade other erythrocytes. If a large numbers of red cells rupture at roughly the same time, **a paroxysm** (sudden onset) of fever can result from the massive release of toxic substance.

- ***Plasmodium falciparum*** is the most dangerous species**.** ***P. malriae, P. vivax,*** **and** ***P. ovale*** cause milder form of the disease, probably because they invade either young or old red cells, but not both. This is in contrast to *P. falciparum*, which invades cells of all ages.

- ***Plasmodium falciparum*** is characterized by persistent high fever and orthostatic hypertension. Infection can lead to capillary obstruction and death if treatment is not introduced.

Toxoplama gondii

◆Name of the disease:

- Toxoplasmosis.

◆Geographical distribution:

- World wide. Approximately 50% of human Population of USA has been infected.

◆Reproduction:

✓Sexually reproduction (Definitive host) →

- In Cats, where Oocysts are
- released in feces of cat.

✓Asexual reproduction (intermediate host)→

- In worm blooded animals
- (cats, mice, humans, and birds).

Mod of Transmission

1.eating row, undercooked meat of sheep and cow containing viable trophozoits (bradyzoits)

2. swallowing food and water contaminated with infected cat feces

3.Congenital transmission, through placenta (fatal) especially when infection occurs during pregnancy

4. person to person: ex. By blood transfusion or organ transmission

Toxoplama gondii

- **Mod of Transmission :**

See page 361 , chapter 21 , table 21-2)

Clinical symptoms

- Infection of normal human hosts are common and usually asymptomatic.
- Infection in immunocompromised individuals is very sever and they my suffer relapse of the infection.
- Congenital infections can also be sever, it can result in still births, brain lesions, and they are a major cause of blindness in newborns.

Helminthes (worms)

Helminthes (worms)

- **Eukaryotic and multicellular parasites**
- **ranging from barely visible roundworms (0.3 mm) to huge tapeworms 25 meters long .**
- **helminthes grouped them into three categories:**

1. Nematodes (roundworms),
2. Trematodes (flukes)
3. Cestodes (tape- worms)

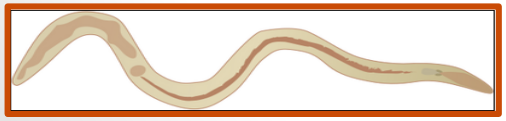
Helminthes

- live inside their host. They are worm-like organisms that live and feed off living hosts, receiving nourishment and protection while disrupting their hosts' nutrient absorption, causing weakness and disease
- Sources for human infection are contaminated food, soil, and water or infected animals,
- routes of infection are by oral intake or penetration of unbroken skin

Helminthes

Nematodes (round worms)

***Ascaris lumbricoides* (Roundworm)**



Cystods (flat worms)

Taenia saginata

Trematodes (fluks)

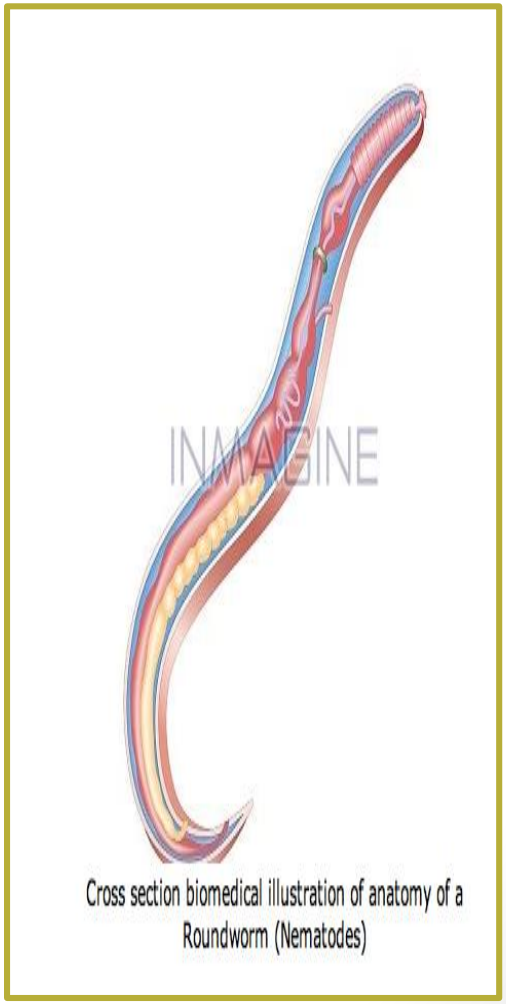
Bilharzia (Schistosomiasis)

Nematodes (Roundworms)

- elongate, cylindrical shape.
- Nonsegmented and tapered at both ends
  .
- Sexes are separate.
- the vast majority are free- living soil and freshwater worms, but around 200 are parasitic, including 50 species that affect humans.

- **Nematodes divided into:**

1. intestinal nematodes (e,g, **Ascaris lumbricoides**
2. Tissue nematodes



Cross section biomedical illustration of anatomy of a Roundworm (Nematodes)

Ascaris lumbricoides (Roundworm)

- *Ascaris lumbricoides* is the largest nematode (roundworm) parasitizing the human intestine
- 1/3 the world population is infected with this worm

- Geographical distribution:

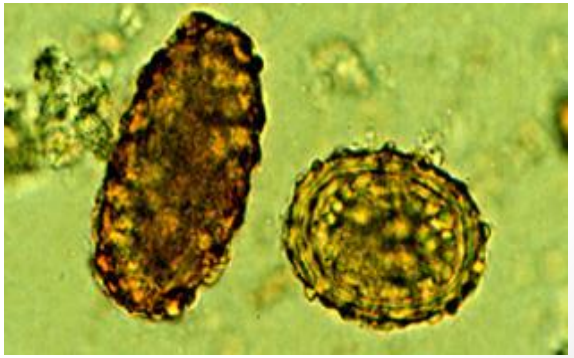
world wide, common among people with low standard of living and among children

- Morphology:

Adult: in small intestine

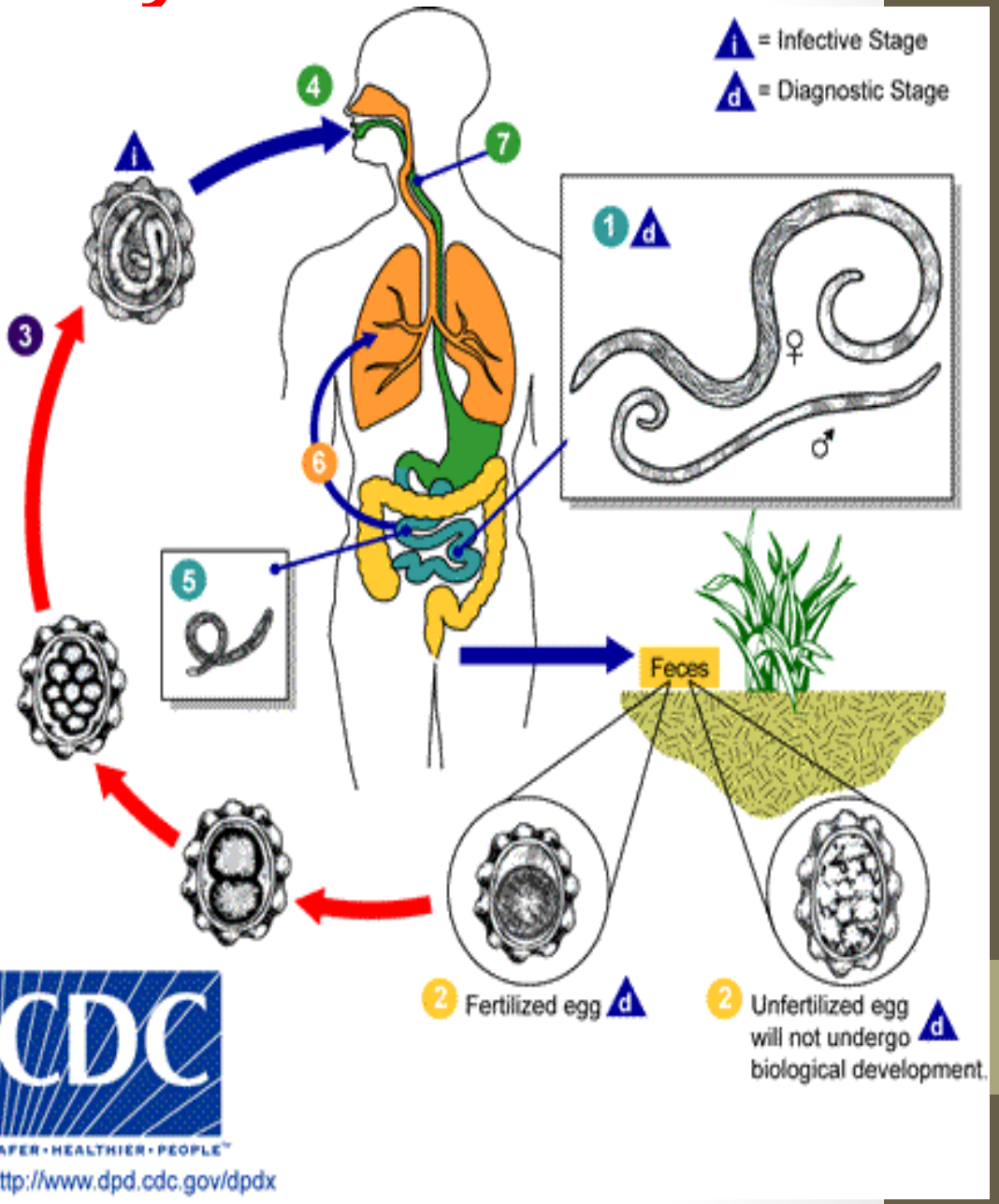
adult

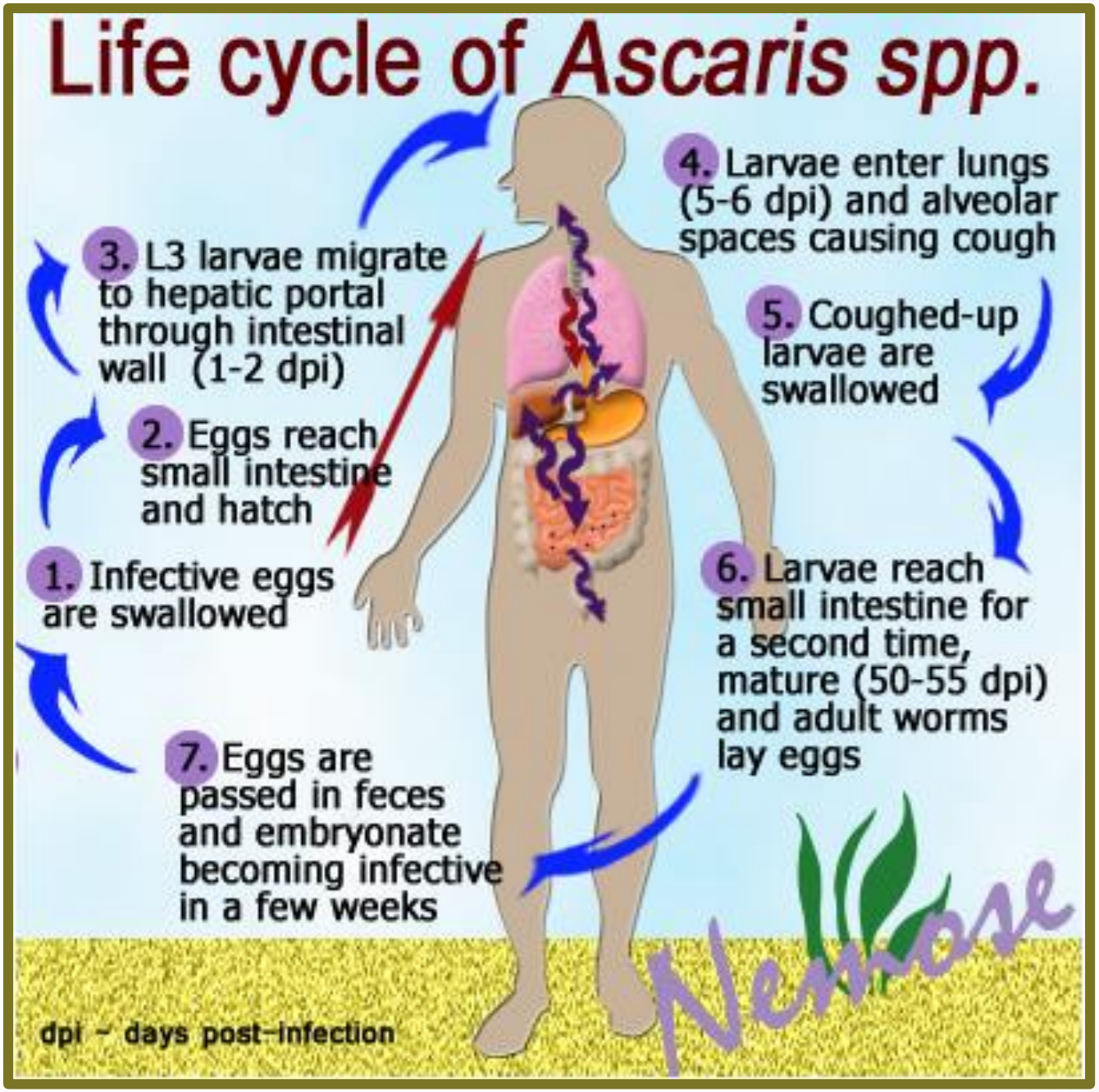
egg: infective stage



Life cycle:

- 2 phases: lung and intestinal
- Egg ingested, hatches in duodenum; larvae penetrate intestine wall, enter blood vessels and embolize through liver to lungs.
- They then migrate into airspaces, up trachea and are swallowed, taking up permanent adult residence in the small intestine; ~ 2 months from egg to mature adult
- Each female produce 200,000 eggs per day
- Adult worms can live 1 to 2 years.




Life cycle of Ascaris spp.
1. Infective eggs are swallowed
2. Eggs reach small intestine and hatch
3. L3 larvae migrate to hepatic portal through intestinal wall (1-2 dpi)
4. Larvae enter lungs (5-6 dpi) and alveolar spaces causing cough
5. Coughed-up larvae are swallowed
6. Larvae reach small intestine for a second time, mature (50-55 dpi) and adult worms lay eggs
7. Eggs are passed in feces and embryonate becoming infective in a few weeks
dpi - days post-infection
Nemrose

Clinical Symptoms:
Ascaris lumbricoides

- Lung phase
- It causes hemorrhage, inflammation, bacterial infection.
- Symptoms:
- Bloody sputum, cough , wheezing, and fever.

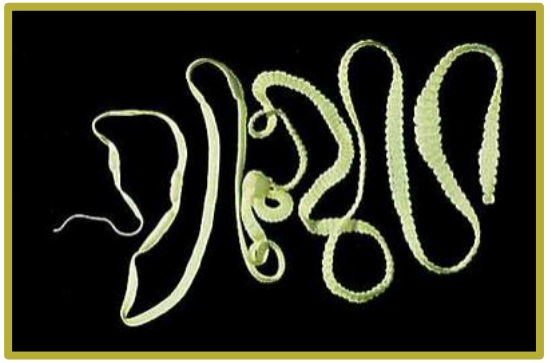
Deaths form ascariasis range from 8000 to 100,000 annually worldwide.

- Intestinal phase
- Symptoms: Related to number of worms;
    - **Small numbers:** asymptomatic.
    - **Large numbers:** Passing of worm in stool, vomit, nausea, malabsorption and abdominal pain.

- Complications:
- If untreated, can cause intestinal obstruction (blockage) and
- malnutrition.

Cestodes (tapeworms)

- Long, ribbon-like, segmented worms.
- Primarily intestinal parasites.
- Can reach 15 m in length.



- human species are :

1. *Taenia saginata (* the beef tapeworm)
2. *T. solium, (* the swine tape- worm)
3. *Diphyllobothrium latum (* the fish tapeworm)

- Name of the disease:

Teniasis.

Taenia saginata
or Beef Tape-Worms

- **Habitat:**

is the small intestine (the ileum)

- **Transmission:**

acquired in humans through the ingestion of raw or poorly cooked meat of infected cows. These cows have been infected via the ingestion of human feces containing the eggs of the parasite

Taenia saginata

- Morphology:

Adult is divided into three parts,

1- a head: round and small. It has four suction disks

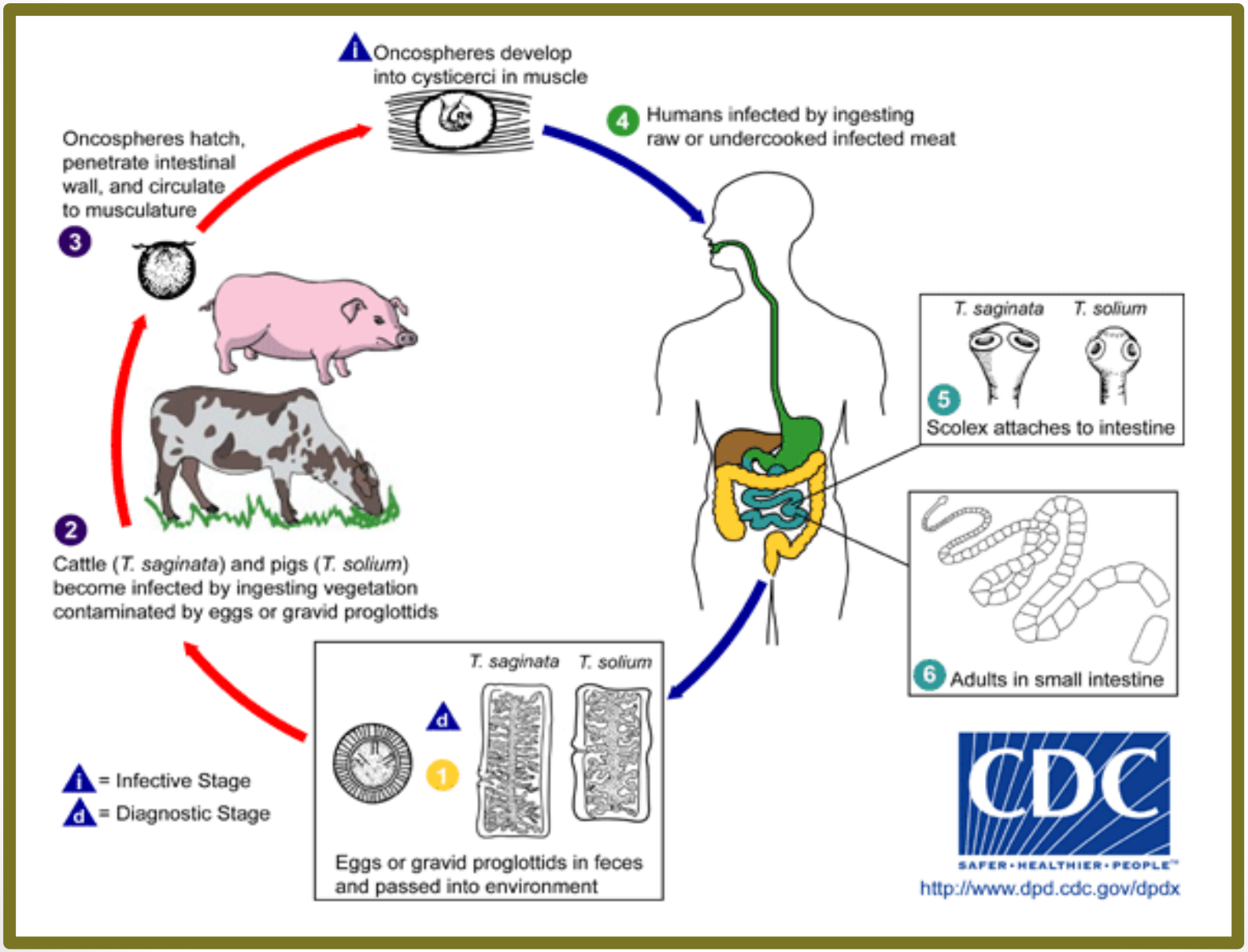
2- neck: A small, slender neck, about an inch long

3- number of segments.

Adult tapeworms and can grow up to 25 meters in the lumen of the intestine, but are usually closer to 5 meters in length

Egg present in feces

Taenia saginata: life cycle



Taenia saginata

Habitat:

- adult — in small intestine of man only **(devenitive host)**
- Egg — in feces
- larva stage — in muscle of thigh, shoulder, neck and heart of cattle only **(intermediate host)**

Clinical symptoms:

- High infection: diarrhea and consitipation
- Vomiting
- Loss of appetite
- Anemia

Trematodes (fluke)

- Small (about 1 cm) flat , leaf-like worms.
- Infest various organs of the human host (e.g. intestinal veins, urinary bladder, liver, or lung)
- All parasitic trematodes use freshwater snails as an **intermediate host.**

Schistosoma spp.

- Name of the disease:

✓ Schistosomiasis (Bilharzia)– it is a disease of the venous system.

•Transmission:

✓ By direct skin penetration, when people come in contact with contaminated water.

Currently more than

200 million

People are infected.

Schistosoma is **NOT acquired by ingestion of contaminated food**, it directly penetrates the skin of swimmers in contaminated rivers and lakes.

Bilharzia (Schistosomiasis)

- Disease of the **venous system**, acquired by people when they come in contact with contaminated water
- Adult Schistosomes take up residence in various abdominal veins, depending on the species; they are, therefore called **(Blood Flukes)**
- Very common among children

◆**Transmission:** ***Direct skin penetration***

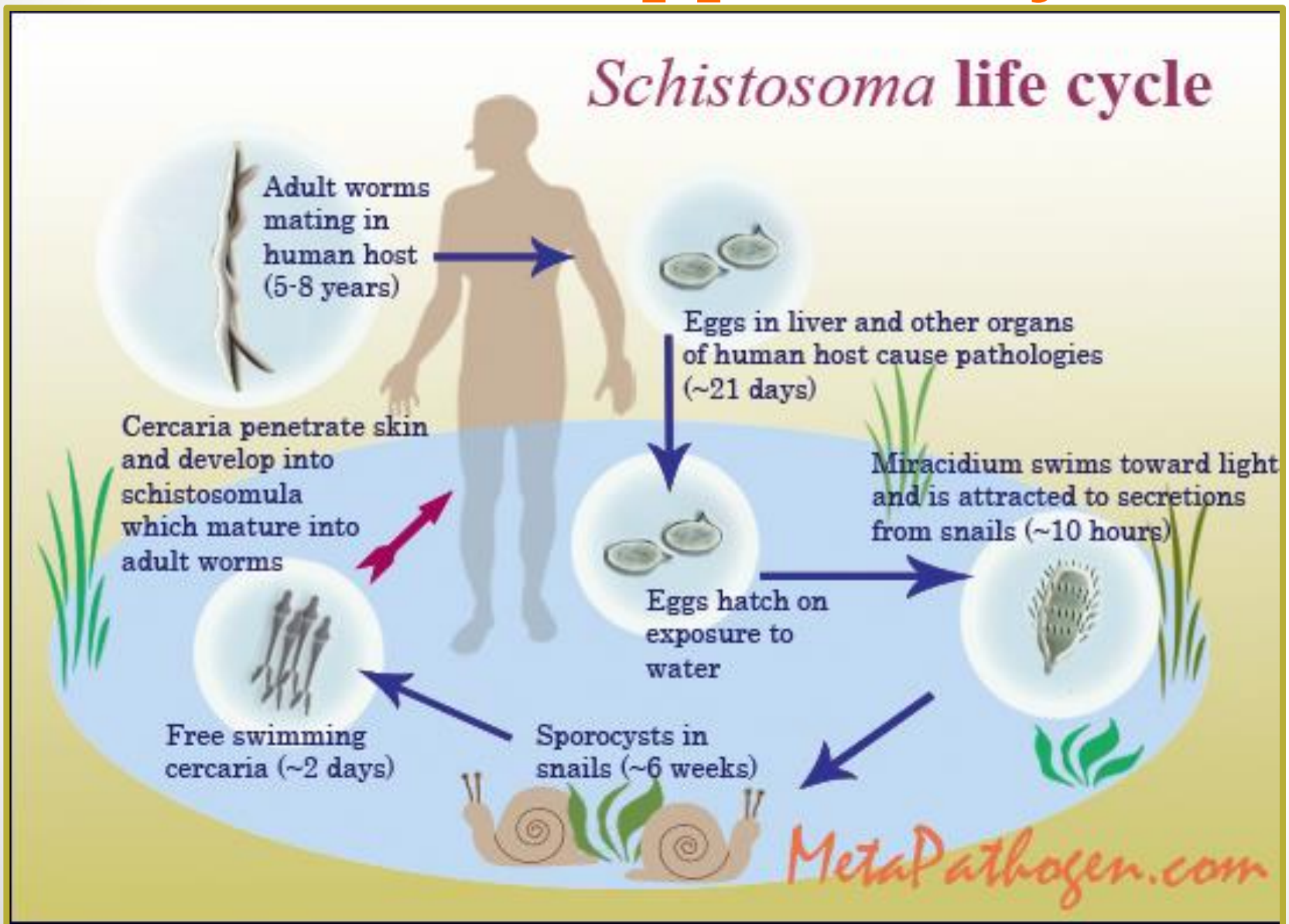
Fresh water becomes contaminated by Schistosoma eggs when infected people urinate or defecate in the water. The eggs hatch and the parasites grow and develop inside snails.

types of Schistosomiasis:

intestinal Schistosomiasis

Urinary tract Schistosomiasis

Schistosoma spp. Life Cycle



Bilharzia (*Schistosomiasis*)

- Clinical symptoms:

✓ Most people have no symptoms when they are first infected. After few days, rash or itchy skin due to hypersensitivity reaction to the parasite.

✓ within 1-2 months, other symptoms may develop including: fever, couph , urticaria, splenomegaly, diarrhea and abdominal pain.

- Chronic Schistosomiasis:

- Without treatment, schistosomiasis can persist for years.

- Symptoms:
- - Intestinal: GI bleeding, diarrhea, pain, and enlarged liver.
- - Urinary Tract: Heamaturia (blood in urine) and dysuria (painful urination).