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PHARM

Parasitology

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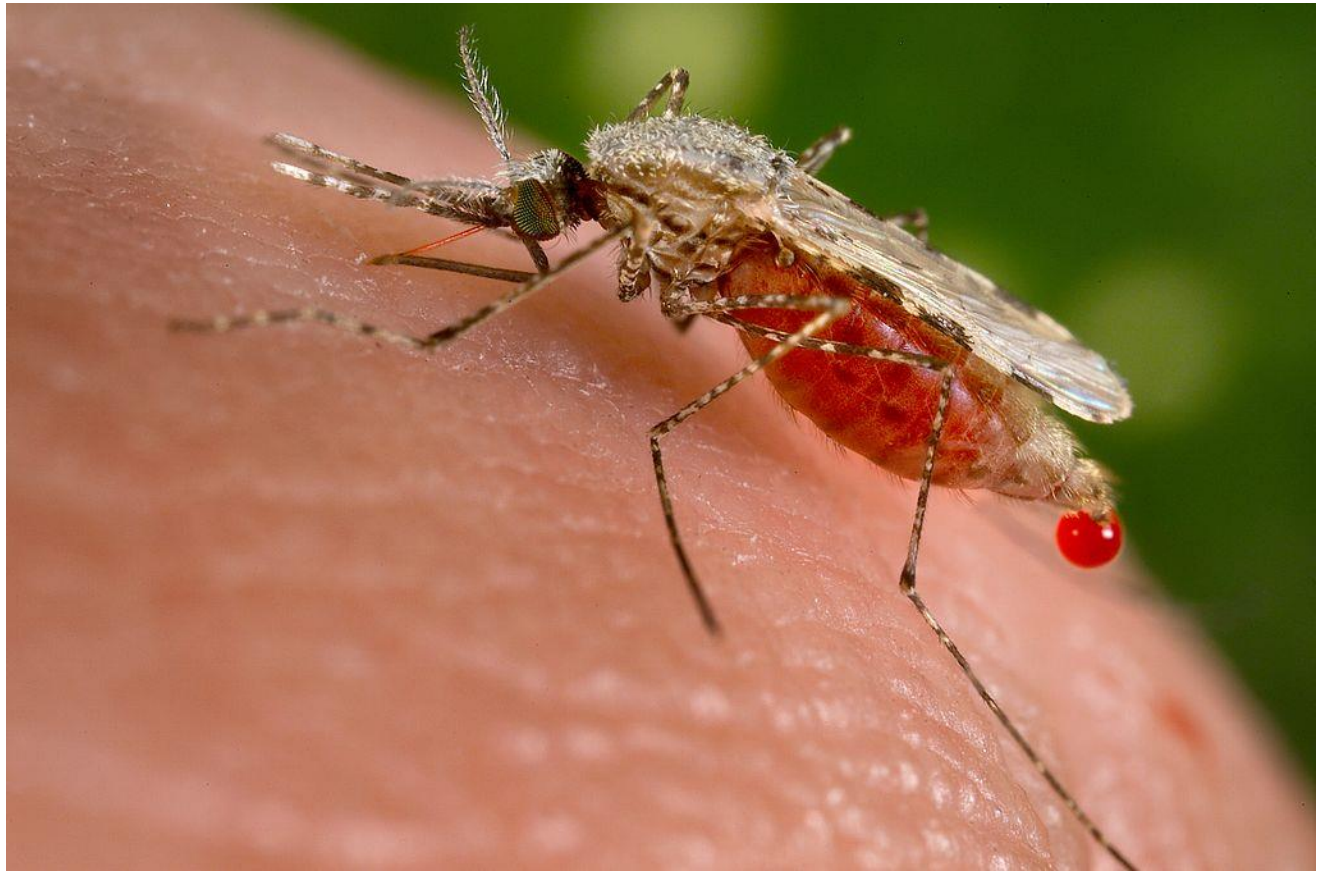


Types of microorganisms

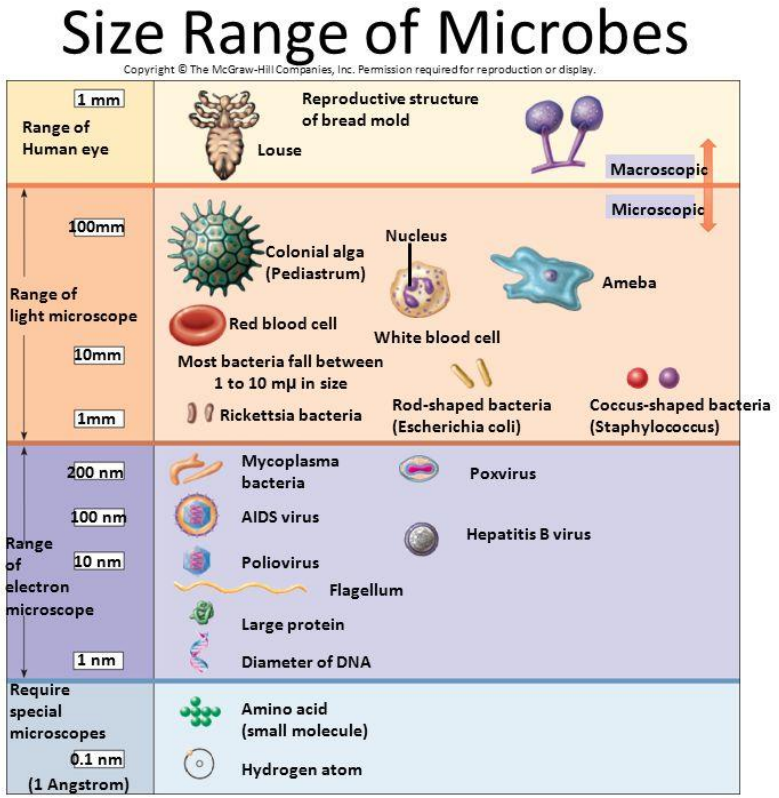
Parasites:
ecto-, endo.; eucaryots

Fungi:

Bacteria:

Viruses:

Prions:



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Definitions and main topics

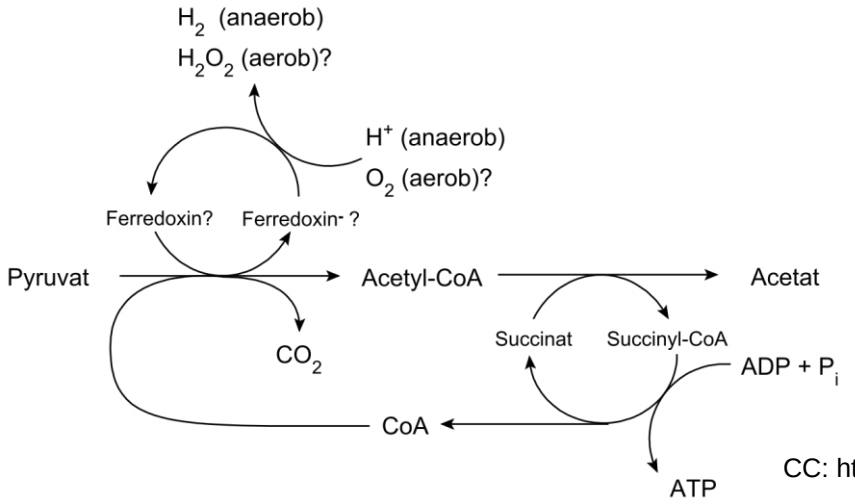
- **parasitism**
- parasite: unicellular × multicellular; ecto- × endo-
- **definitive** host: sexual development, maturity (could be insect)
- **intermediate** host: part of the cycle, invasive stages
- **vector**: intermediate host actively spreading
- **parathenic** host: no development, but still infective
- **infection × infestation**

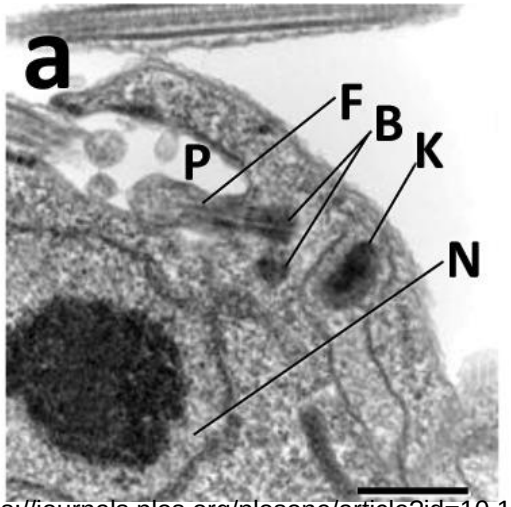
Division

1. **Protozoa**
    1. flagellate (trypasonomes, leishmania, giardia, trichomonas); ameboid protozoa; apicompl.
2. **Helminths** (parasitic worms)
    1. trematoda (flukes); cestoda (tapeworms); nematoda (roundworms)
3. **Annelida** (ringed worms)
    1. leeches
4. **Anthropods**
    1. mites; insect

Protozoa

- unicellular, eucaryotic organisms; 10 – 150 μm
- special organels: **hydrogenosome** (trichomonas; anaerobic, ATP, without DNA); **kinetoplast** (trypanosomes; part of mitoch. at basal body of flagella, maxicircles = DNA, minicircles = gRNA); **two nuceli of** ciliates





CC: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0045288

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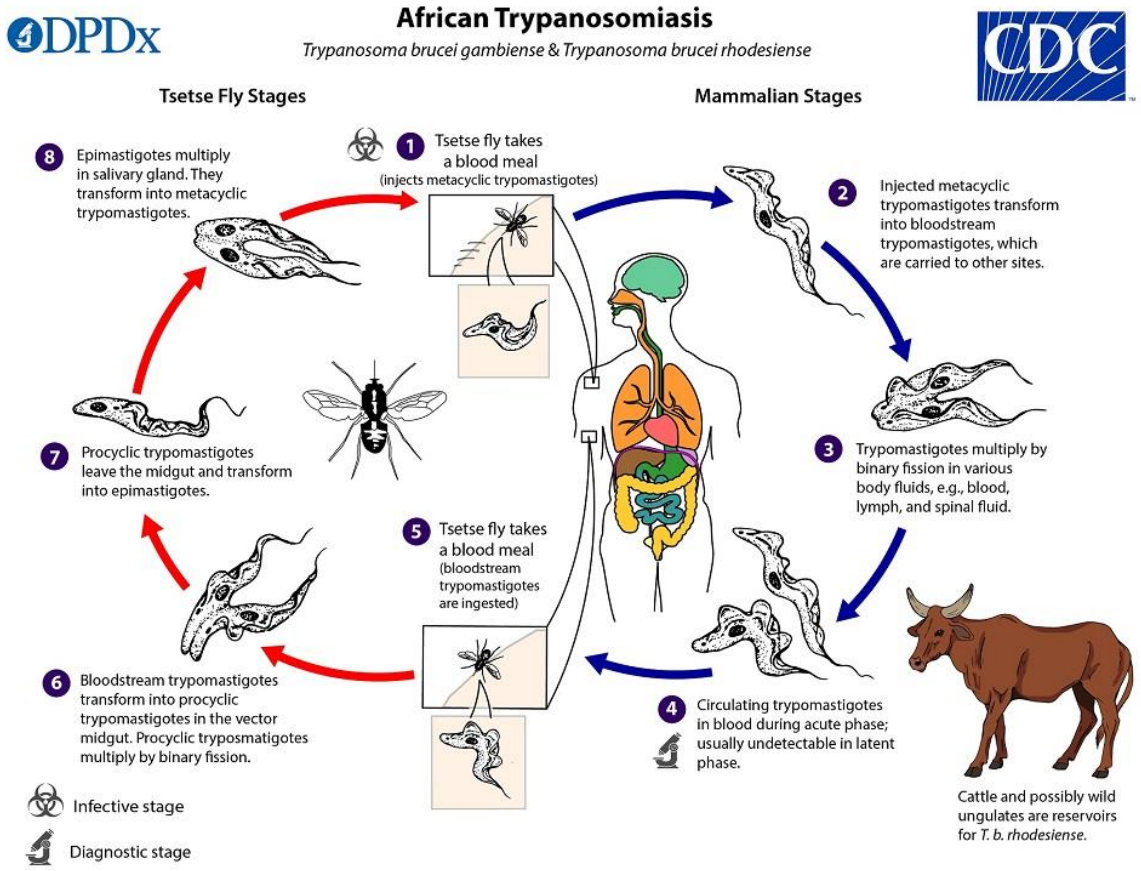
Flagellates - trypanosomes

- **african** (*T. gambiense (brucei), rhodensiense*) – cause of *sleeping sickness* (african trypanosomiasis) – sub-Saharan Africa – biting fly tse-tse (g. *Glossina*)
- Tg: West.Af. – chronic disease, slow on-set – death > 4 years
- Tr: East.Af. – acute, fast, < 9 months
- in place of bite (painful) tryp. chancre (3 cm; disappears) – lymph (nodes Winterbottom. sympt.) – blood, extracel. reprod. – typical periodic fevers

Flagellates - trypanosomes

- antigenic change– inf. of CNS (sleep disorders, letragia, coma)
- deadly without treatment – proof directly in blood or CSF – staining with Giemsa-Rom. (samples out of fever)



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Flagellates - trypanosomes

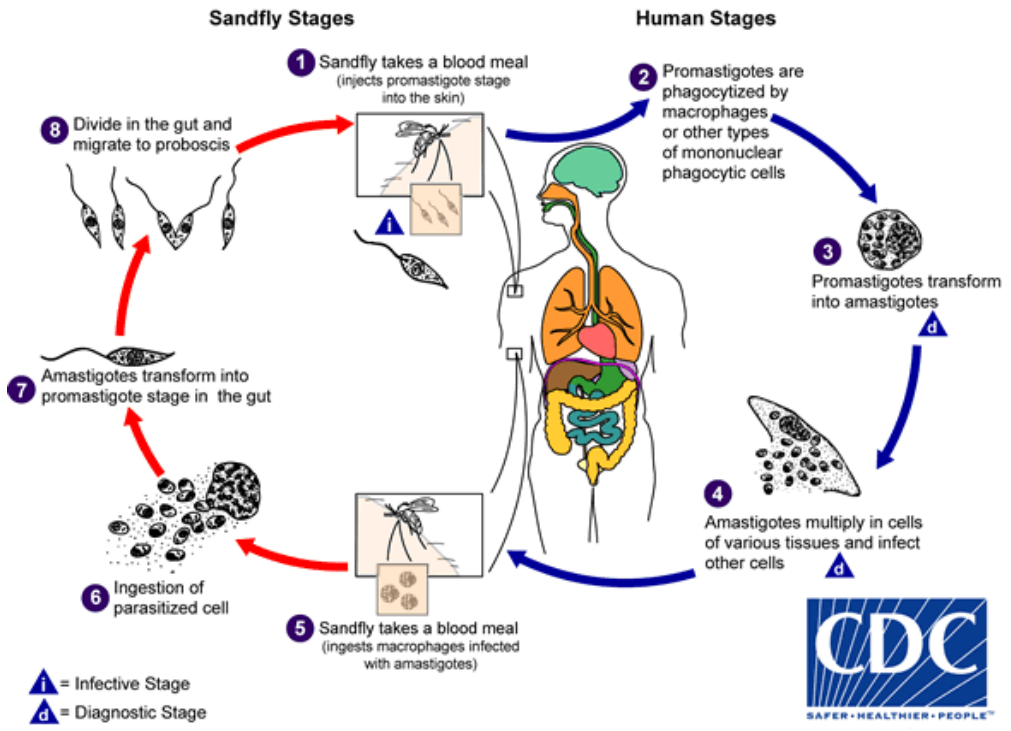
- **american** (*T. cruzi*) – cause of *Chagas disease* (american trypanosomiasis) – Latin America – kissing bug (g. *Reduviidae*) – not through bite, but in droppings and scratching (trypomastigotes) – in muscle cells (amastigotes) multiplication (10 days; local inflammation *chagoma*) – into blood and invasion in other cells (after 3 weeks, acute phase: fever, enlarged liver, invasion into CNS menigoenceph., serious) – kissing bugs need mud, reservoir in wild animals

Flagellates - leishmania

- intracel. parasites of mammals, incl. man – tropical and subtrop., excl. Australia – *cutaneous leishmaniosis*, *visceral* (kala-azar)
- vector: blood sucking sandflies g. *Phebotomus*
- probing – leishmania multipl. in lysosomes of phagcytes (flagellate extracel. forms in insect; without flag. intracel. in men)
- cutaneous form: *L. major* – wel ulcer on limbs 15 mm – crust that is healed

Flagellates - leishmania

- visceralní from: penetration from ulcer into body – fever with anemia and leucopenia (*L. donovani*) – swollen nodes and liver, dark skin
- in CZ all cases from vaccation (HR) – 1999 – 2011: 17 cases



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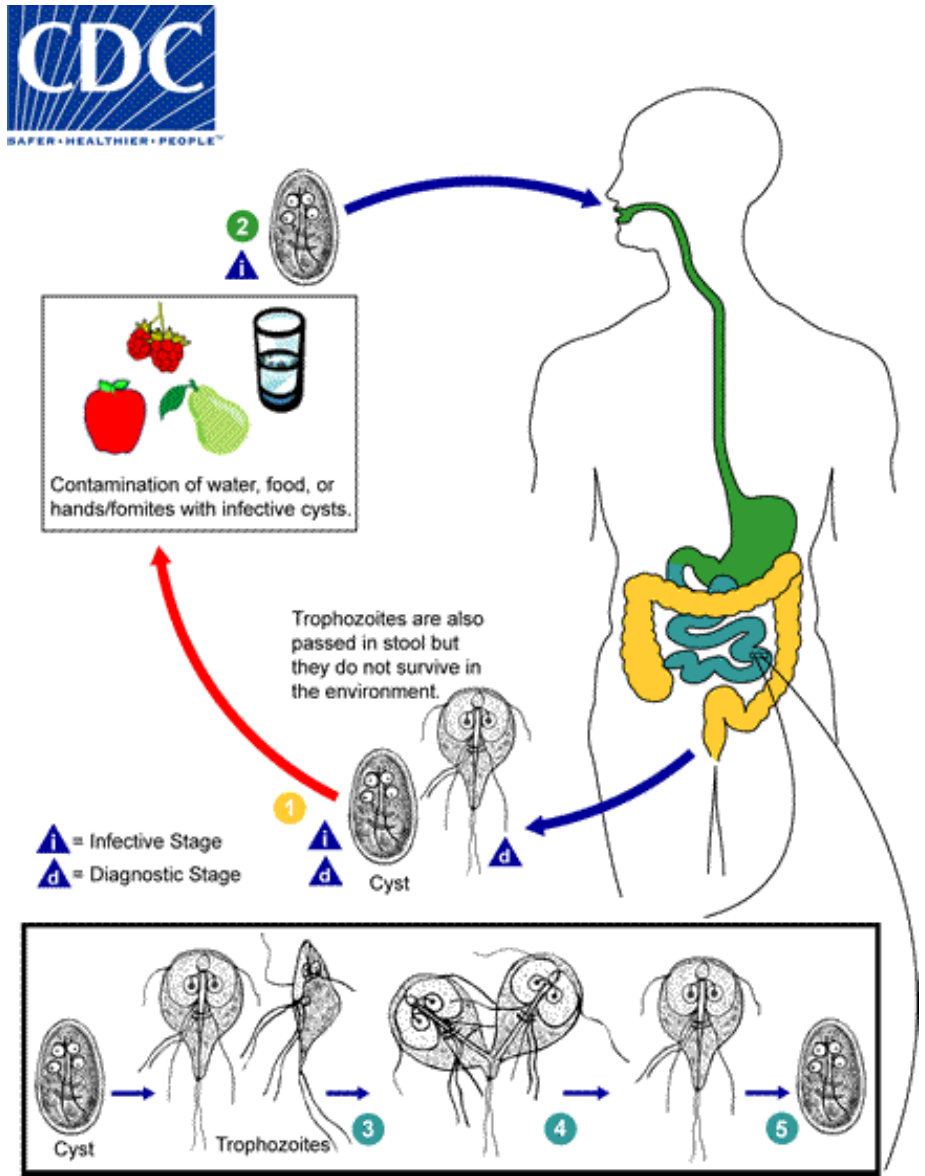
Flagellates - giardia

- *Giardia intestinalis* (*G. lamblia*): 1859 Vilém Dušan Lambl
- *giardiosis*: most common intestinal protozoal inf. v CZ (300 – 400 cases/year) – incidence ↑ with ↓ hyg. standards and cummulation of people (kindergartens)
- lives in lumen – transfer alimentary (resistant cysts in water) – diarrhea (i.t. 7 days; anthropozoonosis)
- th.: metronidazol; prevention

Flagellates - giardia



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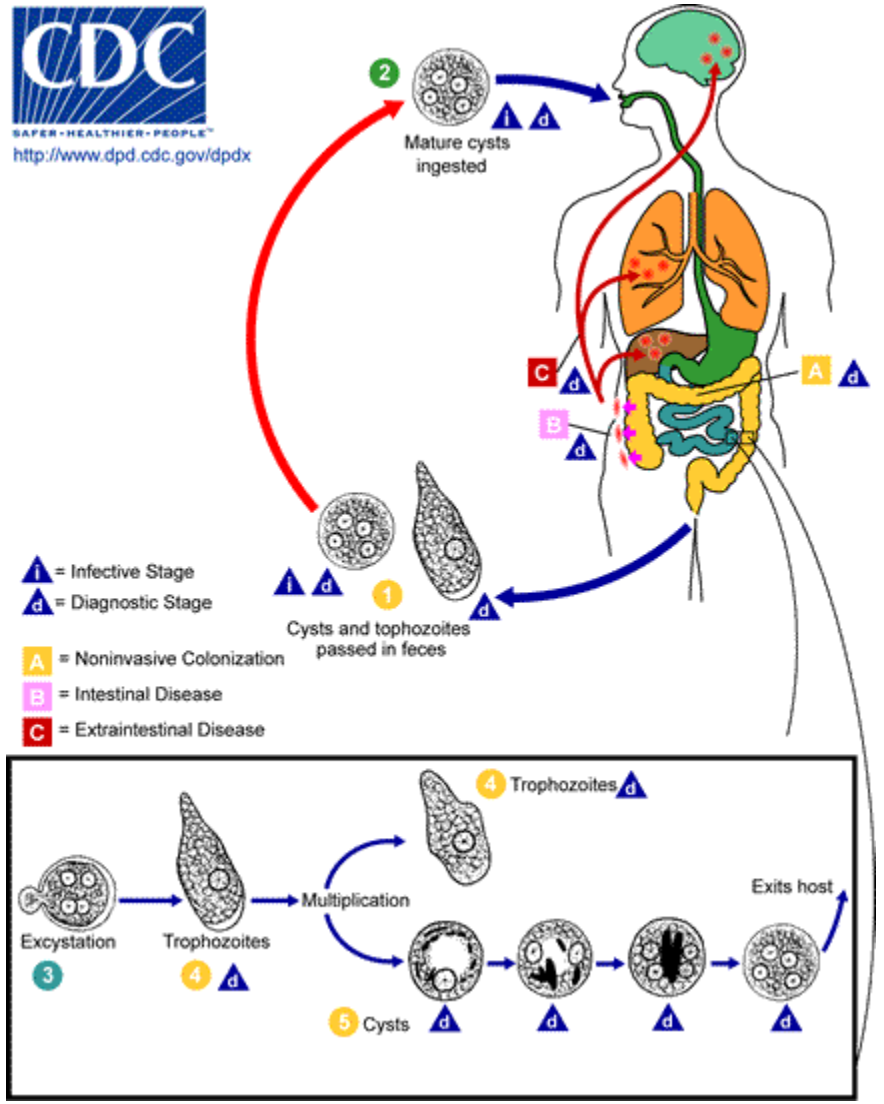
Flagellates - trichomonas

- *Trichomonas vaginalis* – 5 flagellas, no cysts, directly via trophozoits – *urogenital trichomoniasis*: STD (asympto ♂), then through discharge – through laundry not often, also thermal pools and mother – child
- i.t.: 1 – 2 weeks – vaginosis, greeninsh discharge, rotten odor, itching, uretitis – no permanent immunity – th. of all partners

Ameboid protozoa

- *Entamoeba histolytica*: in tropics and subtropics, bad hygiene – spread orofecal (cyst) – intestinal and extraint. sympt. – if not treated, may be deadly
- excystation in intestines – repl. of trophozoits and elim. of cysts (pains, diarrhea) – formation of *forma magna* – extraint. sympt: liver absces, high fever
- prevention: hygiene on travels; th. metronidazol

Ameboid protozoa



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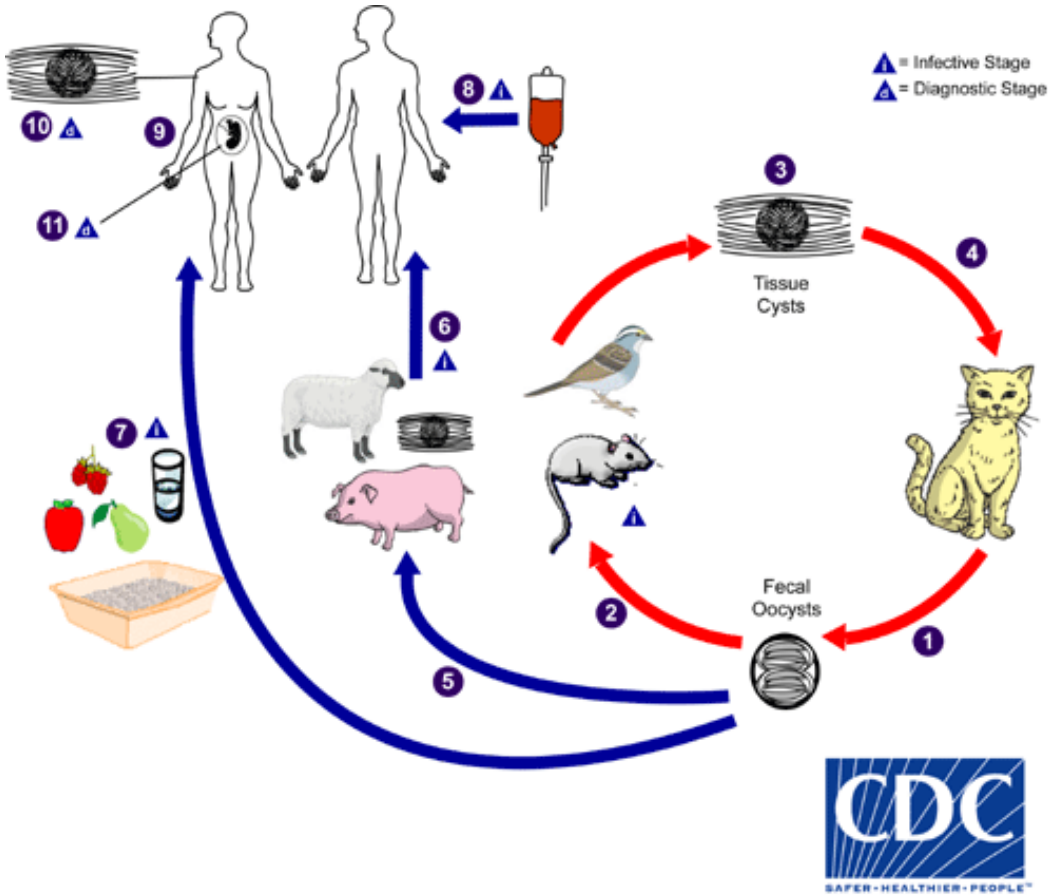
Apicomplexa

- *Toxoplasma gondi* – definitive host: cat; intermediate: rodents, cattle, men – cosmopolitan (in CZ 20% people positive antibb.) – infection alimentary (contam. with oocysts, inproper cooking – tiss. cysts), transplacental
- tachyzoit (invasive stage) – bradyzoit (tiss. cysts, brain, muscles) – oocysts (infectious stage, in cat intestine)

Apicomplexa

- toxoplasmosis: incidence1.4/100000
- good IS: 90% asympto – clin. symptomes (fever, malaise)
- imunocompr.: CNS, encephalitis
- latent: behavioral changes, slowed reactions („mouse is caught“)



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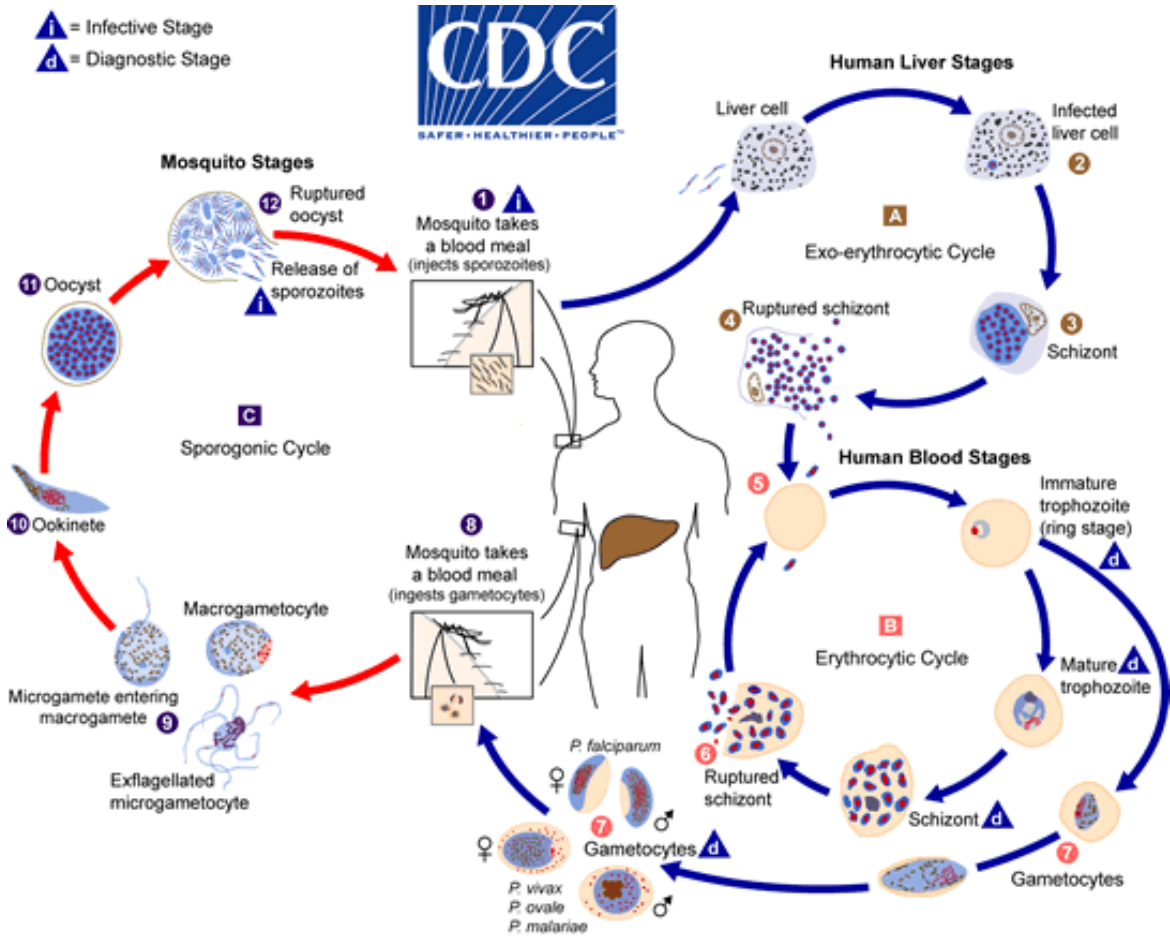
Apicomplexa

- *Plasmodium* – cause of *malaria* (females of mosquito *Anopheles*) – most sever parasitosis in the world
- tropics (between N45 – S30, upto 2000 m.) – 1,5 – 3 mil. deaths/y
- not in CZ, but endemic 1930 – 1950, 215 cases
- apical complex – invasive apparatus for IC – live mainly in blood cells – not able to living in environment

Apicomplexa - plasmodia

- sporozoits: terminal in vector, infectious for humans
- merozoits: humans
- liver phase: 10 – 14 days
- blood phase: *P. malariae* 72h; *P. falciparum, vivax, ovale* 48h



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Apicomplexa - plasmodia

- *malaria*: attack of dis. when ery are disrupted – fevers in cycles (quartan or tercian) – before that there are chills and shiver – hepatosplenomegalia
- in case of *P. falciparum* – most severe forms, lethal if not treated
- Dg.: traveller anamnesis, microscopy of blood

Helminths

- parasitic worms (*Vermes*) causing helmintosis – multicellular organisms – further divided into **flatworms** (*Platyhelminthes*; here are **flukes** *Trematoda* and **tapeworms** *Cestoda*) and **roundworms** (*Nematoda*)
- mainly endoparasites – mechanical damage, taking out the nutrients, toxic products – intestines + other organs

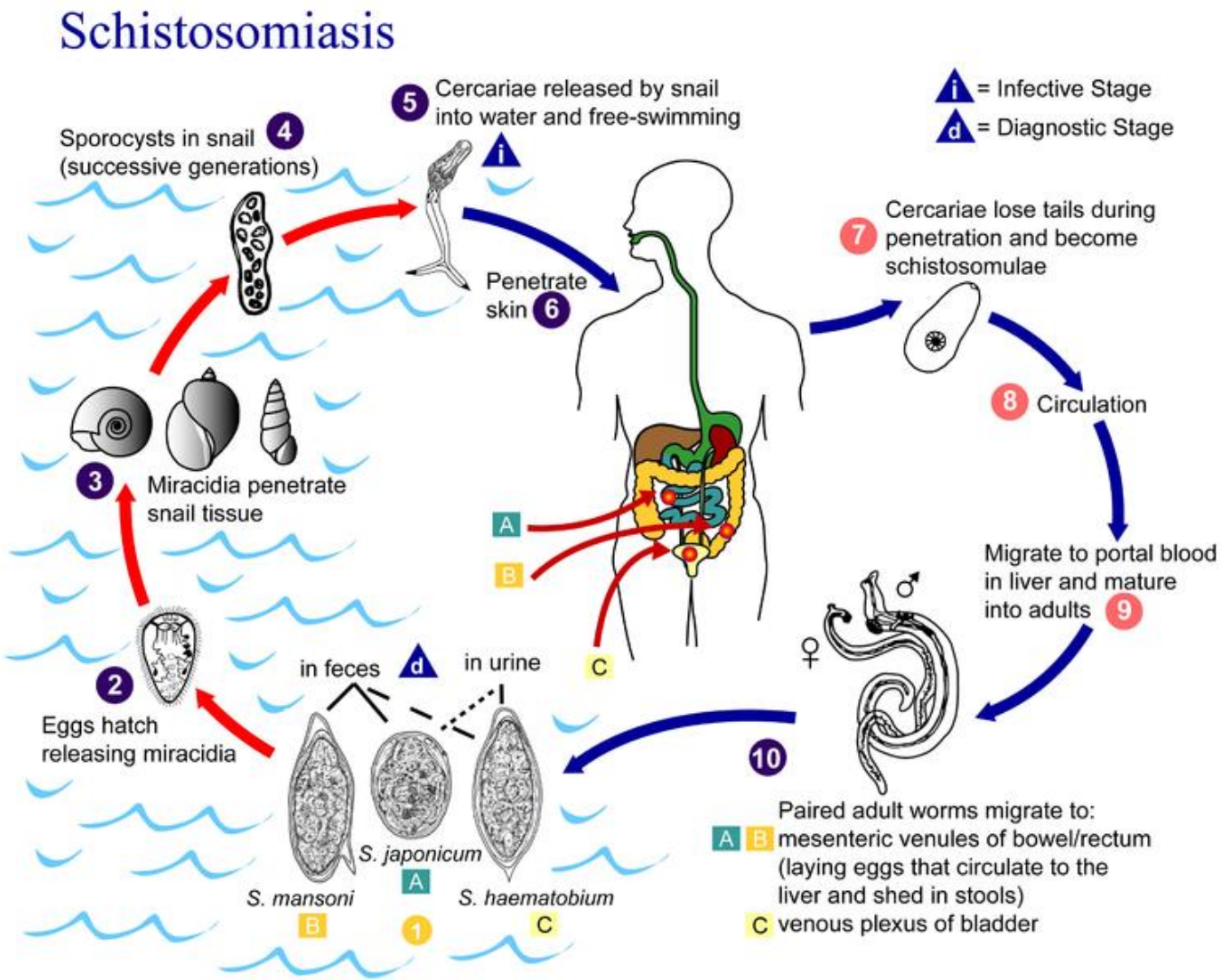
Trematoda

- *trematodosis*: severe dis. vertebrates
- mostly dorsoventral flattening – from mm to cm
- two suction caps: oral and abdominal
- complex development (1 – 3 intermediates): 1. embryogenesis (egg – larva miracidium) 2. partenogenesis (in snails) 3. maritogenesis (development into sexually mature in def. host – after ingestion of metacercariae)

Trematoda

- genus *Schisostoma* (blood flukes) – disease schisostomiasis (bilhrasiosis) – form intestinal, liver and urogen.
- *Schisostoma mansoni*: liver and colon; host human and intermediate snail – Africa, South America
- WHO – 2016: 206,5 mil. patients worldwide – bad hygiene
- it: 4- 6 weeks – itching in place of penetration – acute (fever, pains of body, diarrhea) – chronic (3 – 6 months; inflamm. rxn, hepatosplenomegalia)

Trematoda - Schisostoma



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Trematoda

- *Fasciola hepatica* – *fasciolosis* (common live fluke) – first info in 1379 – nowadays in CZ only as imported disease
- humans are infected by ingestion of metacercariae encysted on fallen fruits or grass stalks

Cestoda

- *cestodosis*: ex. cca 3000 species
- very well adapted – missing GIT, nutrition absobed osmotically through whole body surface – intestines of humans and animals
- flat body, lenght 3 – 12 m
- head (*scolex*) – segmented body (*proglotids*), inside eggs, separ.
- intermediate: animal – in muscles *cysticercus* – insufficiently heated meated

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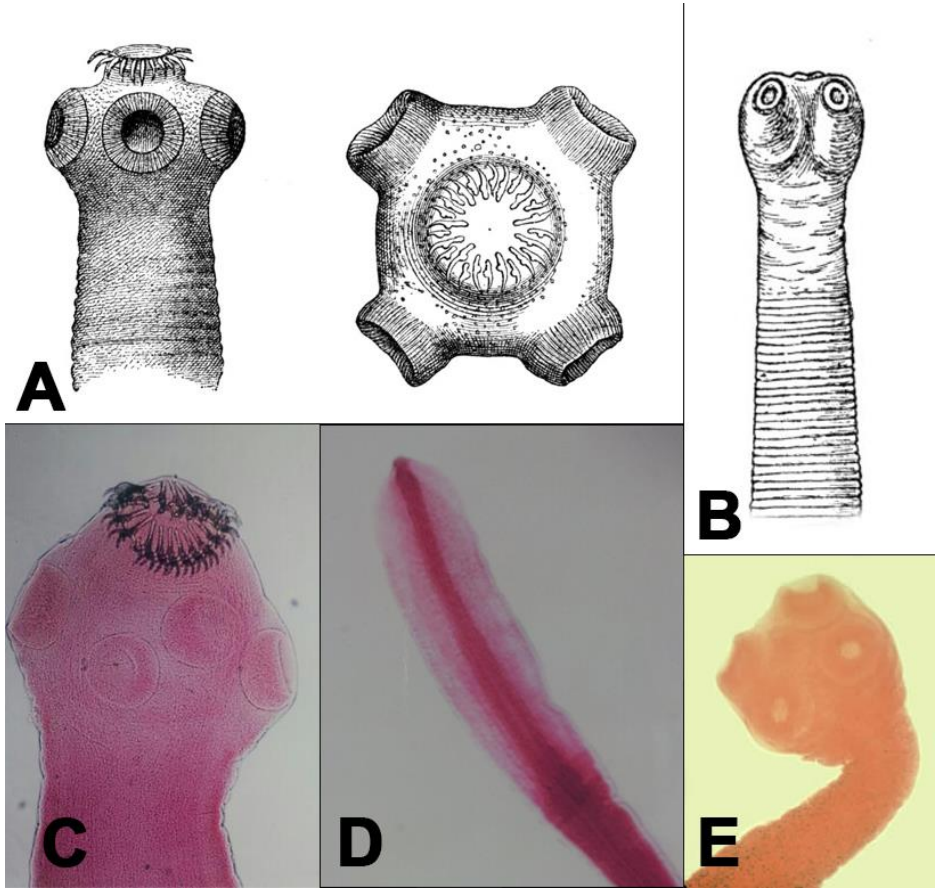
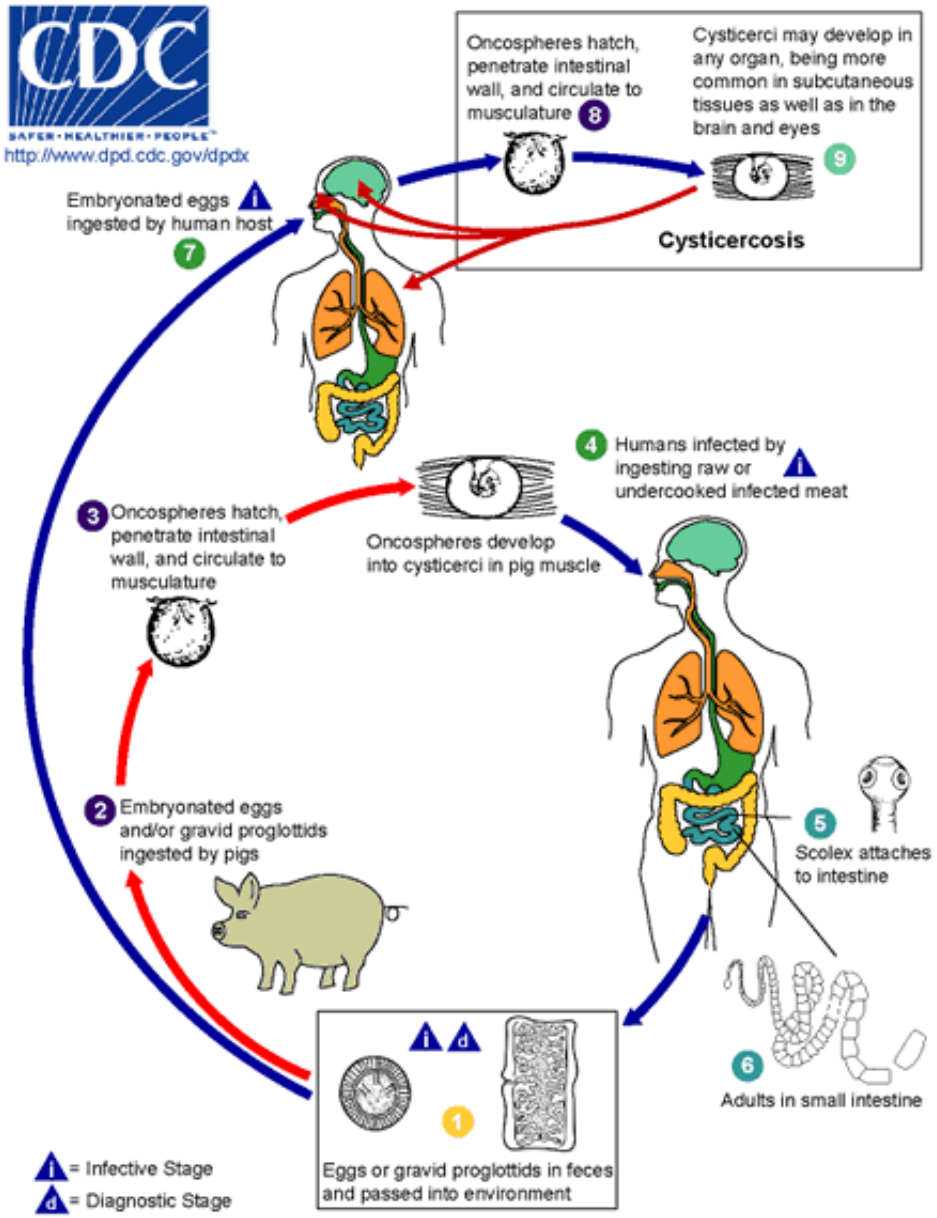
Cestoda - scolex





CC: CDC; Flukeman

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Cestoda

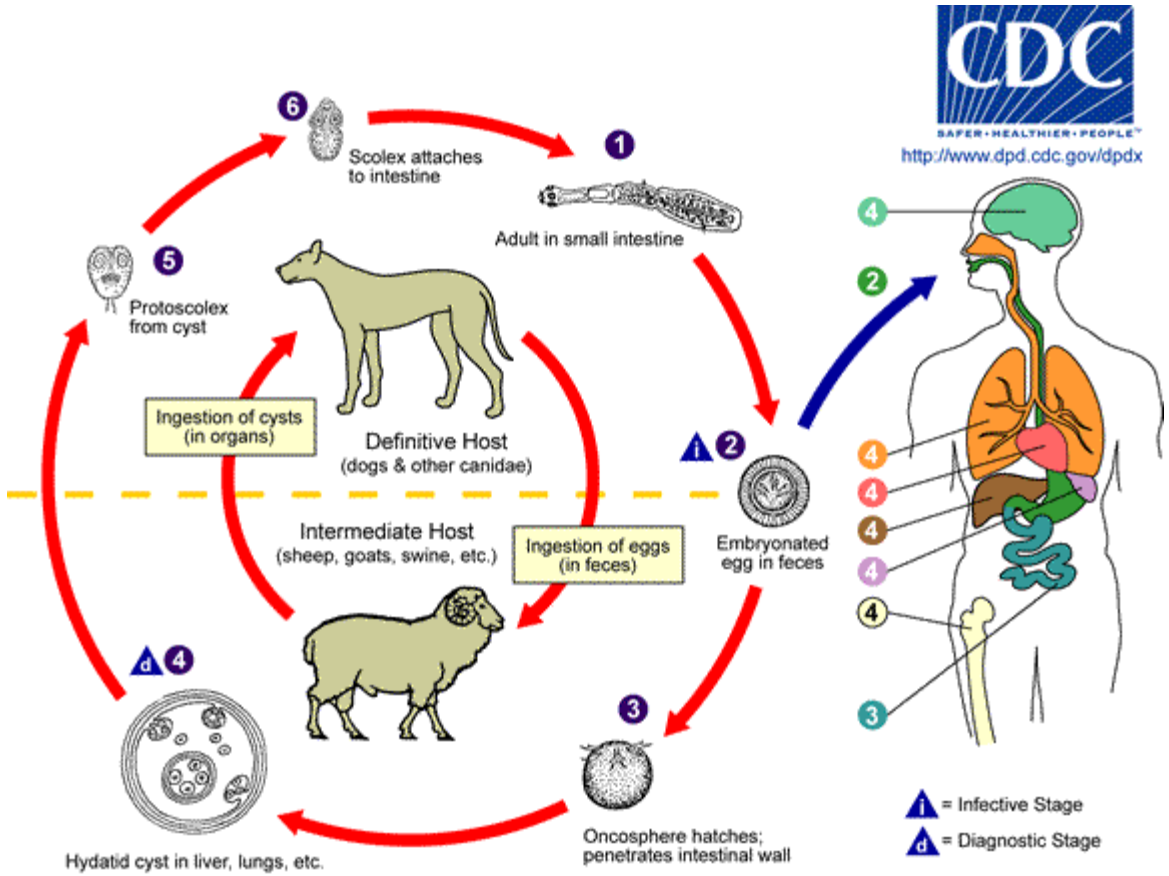
- *Taenia saginata* (beef tapeworm): cosmopolite, intermediate: cattle; definitive host: humans
- most cases in centr. and east. Africa – CZ: 2016 – 56 000 infected
- mostly asymptomatic inf.; might be GIT disturbances (stomachache, obstipation, diarrhea, lossing weight)
- Dg.: smear form anus, eggs
- only intestinal in humans (*T. solium* – contaminated water – tissue – very severe, brain, eye)

Cestoda

- *Echinococcus granulosus* (hydatid worm) – inf.: hydatosis and cystic echinococcosis – size: 2 – 10 mm – aliment.
- human **is not** definitive host (parasite is travelling)
- cosmopolite; 2 – 3 mil. infections per year (eggs are very stable, spread by feces) – areas with intensive sheep breeding
- definitive host: canine beast; intermediate: herbivores
- Dg.: serology, RTG, sono, CT – location of cysts

Cestoda -Echinococcus

- cysts grow slowly – some years without sympt. (< 5 cm)
- acc. location: stomachache, stuffiness, blood in sputum, neurolog. problems, bigger liver, jaundice, weight loss,
- in case of rupture risc of anaphyl. shock and death



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