




Immuno-Parasitology



protozoa



helminths



arthropods


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PROTOZOA


65,000 species
(31,250 extant + 33,750 extinct)

flagellates




6,900 species
5,100 free-living
1,800 parasitic

amoebae




11,550 species
11,300 free-living
250 parasitic

sporozoa



5,600 species
all parasitic

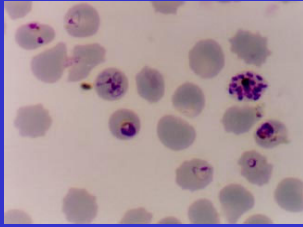
ciliates



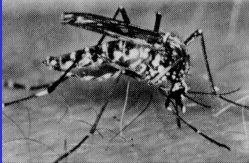
7,200 species
4,700 free-living
2,500 parasitic

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Plasmodium spp. (malaria)



zoitae-schizonts



mosquitoes

salivarian transmission

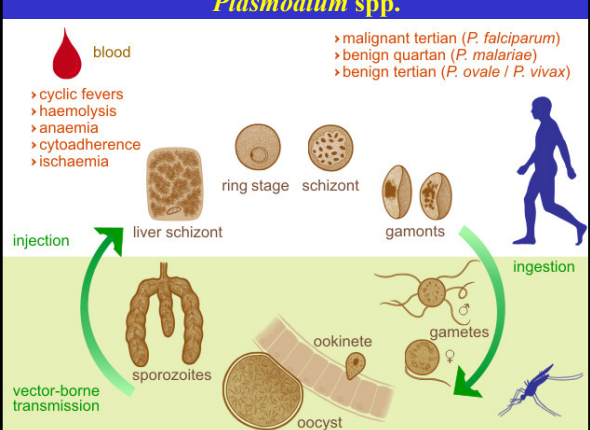
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Plasmodium spp.

blood

- > cyclic fevers
- > haemolysis
- > anaemia
- > cytoadherence
- > ischaemia

- > malignant tertian (*P. falciparum*)
- > benign quartan (*P. malariae*)
- > benign tertian (*P. ovale* / *P. vivax*)



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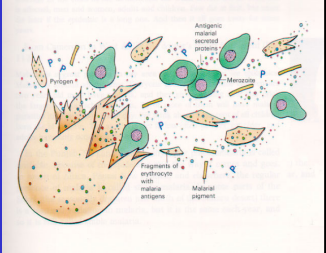
MALARIA

species	<i>P. falciparum</i>	<i>P. malariae</i>	<i>P. ovale</i>	<i>P. vivax</i>
malaria	malignant tertian	benign quartan	benign tertian	benign tertian
erythrocyte cycle	48 hrs	72 hrs	48 hrs	48 hrs
exoerythrocyte cycle	9 days	14-15 days	9 days	8 days
gametocytes	crescent	ovoid	ovoid	ovoid
frequency	~40%	~10%	<1%	~50%
distribution	worldwide in 'tropics'	scattered in 'tropics'	tropical Africa	worldwide in 'tropics'
	recrudescence persistent erythrocytic forms		relapsing persistent exoerythrocytic forms	

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Haemolysis

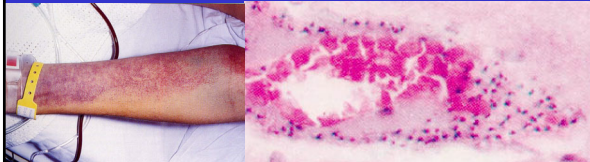
- schizogony culminates in erythrocyte lysis
- cyclical fevers (paroxysms) synchronized with haemolysis (quartan 72 hrs, tertian 48 hrs)
- results in anaemia
- exacerbated by erythrophagocytosis by spleen
- haemozoin pigment deposition



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Sequestration

- mediated by stickiness = cytoadherence
- infected RBC with knob-like protrusions coated with parasite proteins
- attach to endothelial receptors
- clog microcirculation



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Cumulative effect

- haemolytic anaemia
- exacerbated by erythrophagocytosis
- haemozoin pigment accumulation
- endothelial cytoadherence
- RBC rosetting
- all contributing to tissue anoxia through compromised function and reduced flow
 - cell pathology → anaemia → anoxia
 - vessel pathology → ischaemia → anoxia

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Immunoparasitology (malaria)

Parasite

- intracellular (hepatocytes/erythrocytes)
- immuno-diagnosis (antibody, antigen, DNA)

Host immunity

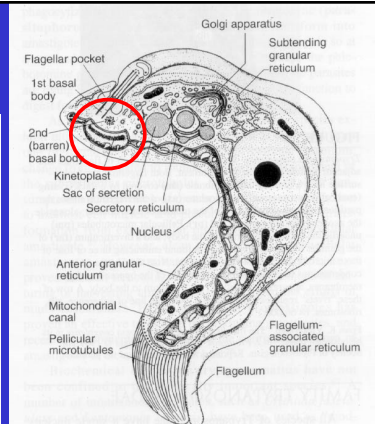
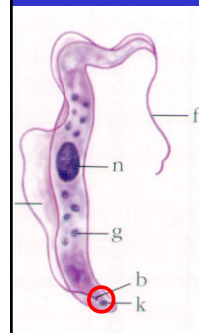
- protection (against disease)
 - cell-mediated responses (T cells)
 - antibody responses (B cells)
- vaccination (some under trial)
 - anti-infection, anti-disease, anti-transmission

Problems

- immuno-evasion (strip surface coat)
- species/strain specificity

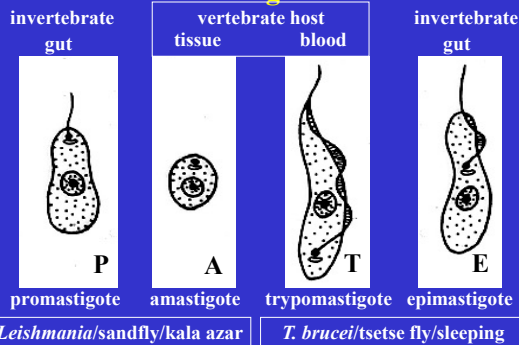
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Kinetoplast extranuclear DNA



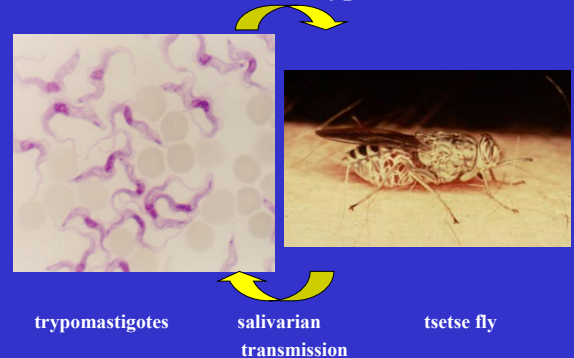
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Mastigotes

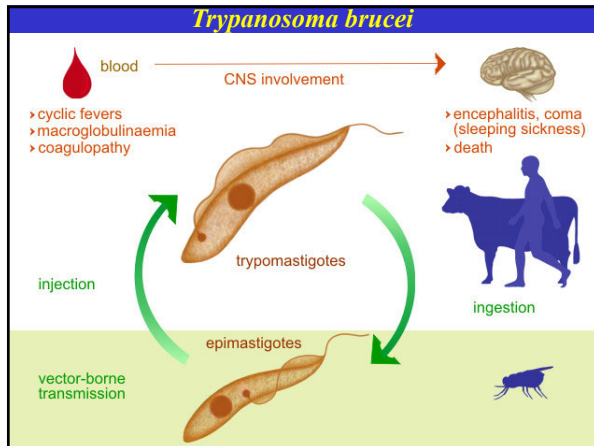


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Trypanosoma brucei Old World/African trypanosomiasis



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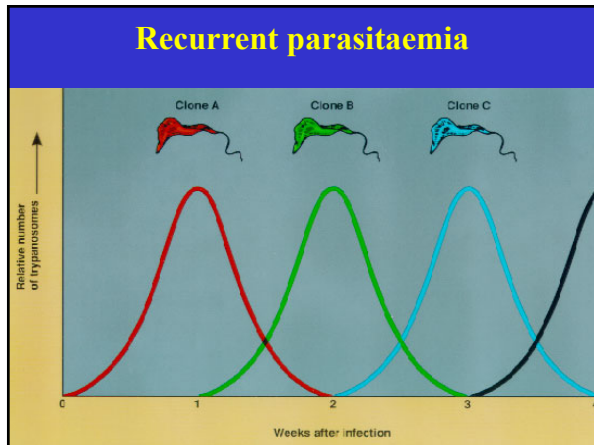


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Sleeping sickness

- trypanosomes multiply in plasma and interstitial fluid
- cyclic fevers due to parasite destruction
- antigenic variation results in macroglobulinaemia
- microvascular damage
- coagulopathy
- perivascular inflammation
- penetrate blood-brain barrier
- encephalitis
- coma

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Immunoparasitology (sleeping sickness)

Parasite

- extracellular (blood)
- immuno-diagnosis (antibody, antigen, DNA)

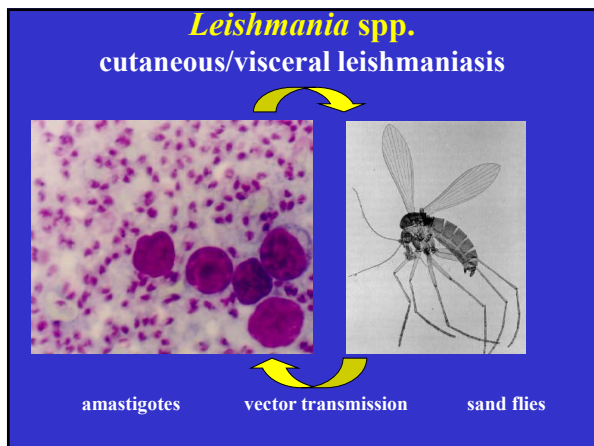
Host immunity

- limited protection
 - despite strong antibody responses (B cells)
- vaccination (none yet)
 - anti-disease (polyvalent), anti-infection

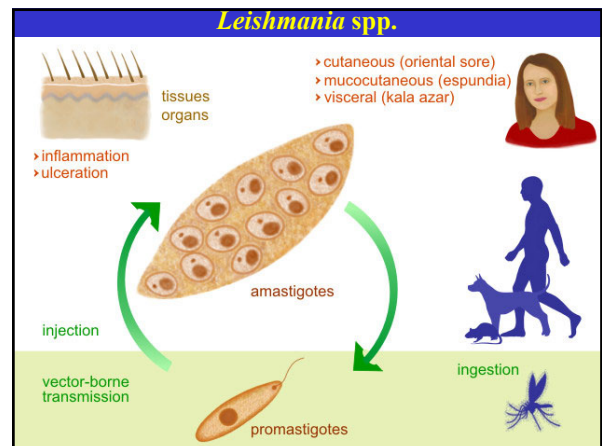
Problems

- immuno-evasion (antigenic variation)
- species/strain specificity

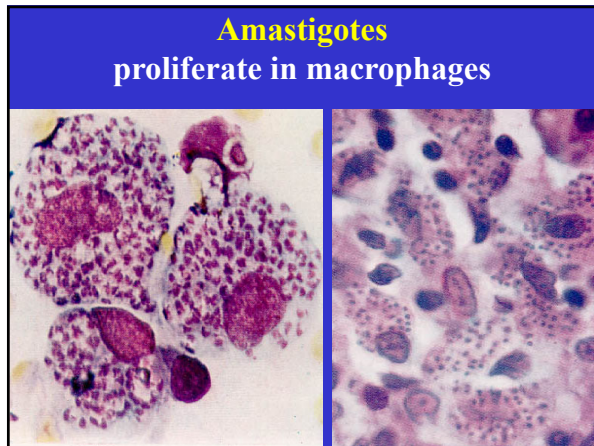
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Leishmaniasis

Three types of clinical disease

- cutaneous/oriental sore (*L. tropica/mexicana*)
skin lesions, sores, ulceration
- mucocutaneous/espundia (*L. braziliensis*)
destructive nasopharyngeal lesions
- visceral/kala azar (*L. donovani*)
hepatosplenomegaly, oedema, anaemia

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Immunoparasitology (leishmaniasis)

Parasite

- intracellular amastigotes (phagocytes)
- immuno-diagnosis (antibody, antigen, DNA)

Host immunity

- protection (against cutaneous lesions)
 - cell-mediated responses (T cells)
 - antibody responses (B cells)
- vaccination (none yet)
 - anti-disease

Problems

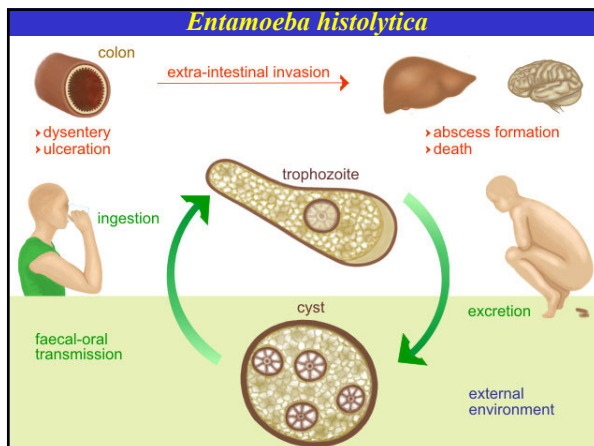
- immuno-evasion (hide in effector cells)
- species/strain specificity

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Entamoeba histolytica

trophozoite faecal-oral cyst

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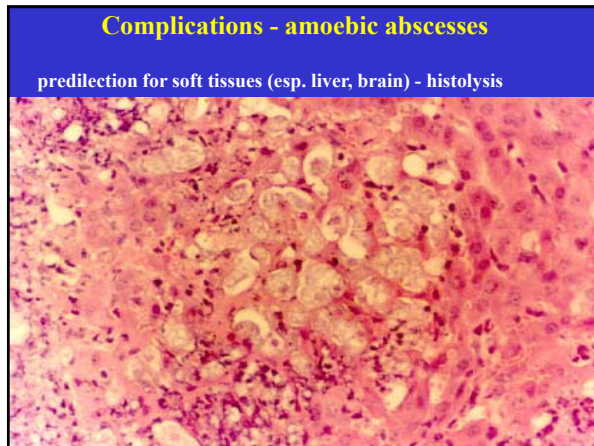
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Amoebic dysentery

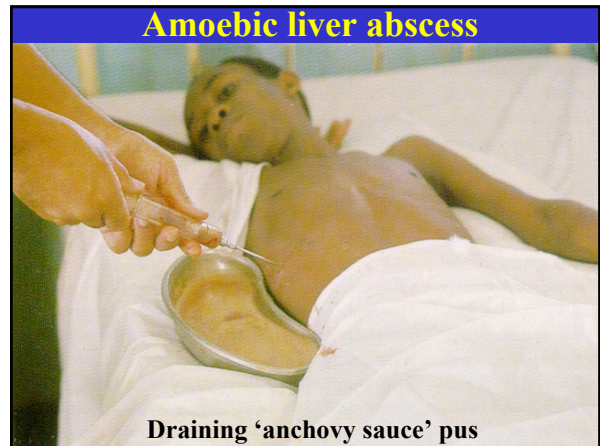
extremely variable presentation

- asymptomatic (vast majority)
- intestinal disease
 - mucosal penetration
 - ulceration (caecum, appendix, ascending colon)
 - colitis (colicky abdominal pain, tenesmus)
 - dysentery (diarrhoea, blood-tinged mucus)
 - weight loss, dehydration

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Immunoparasitology (amoebic dysentery)

Parasite

- extracellular (but can eat host cells)
- immuno-diagnosis (antibody, antigen, DNA)

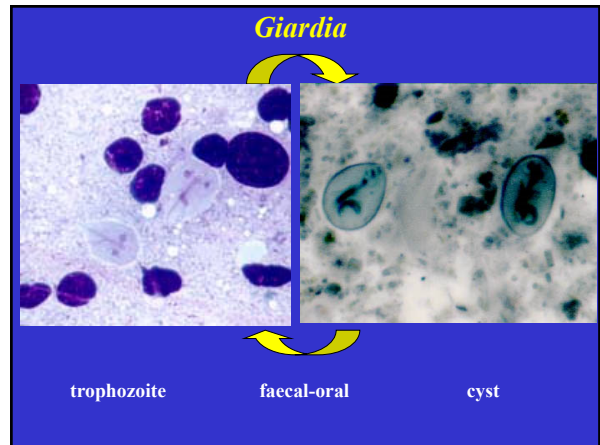
Host immunity

- protection (against disease)
 - mucosal immunity (T and B cells)
 - encapsulation (abscess)
- vaccination (none yet)
 - anti-disease

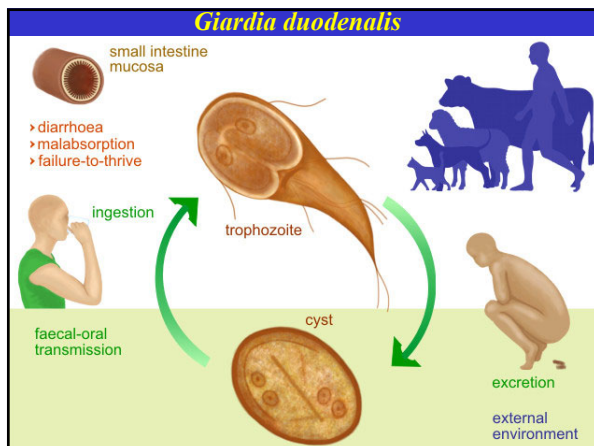
Problems

- immuno-evasion (amoebae are phagocytic)
- species/strain specificity

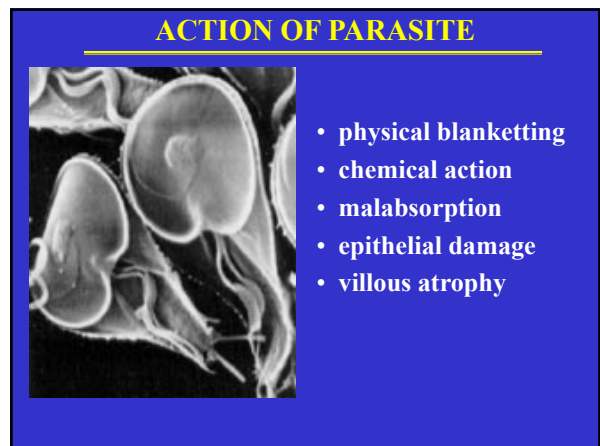
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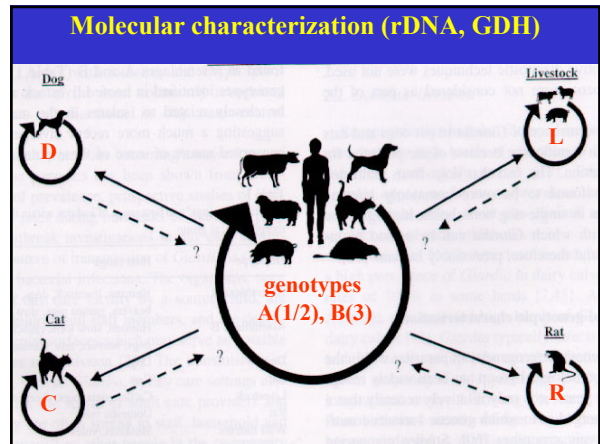
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EFFECT ON HOST



- diarrhoea
- dehydration
- steatorrhea
- weight loss
- retarded growth
- failure-to-thrive

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Immunoparasitology (giardiasis)

Parasite

- extracellular (gut lumen)
- immuno-diagnosis (antibody, antigen, DNA)

Host immunity

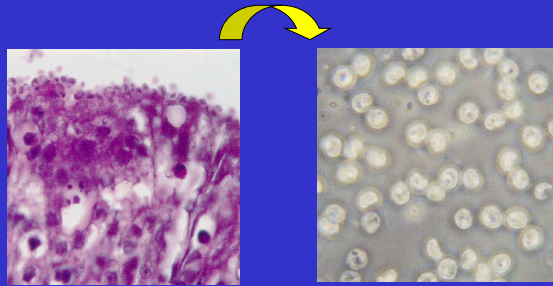
- strong protection (against disease)
 - mucosal immunity (T and B cells)
- vaccination (none yet)
 - anti-disease

Problems

- immuno-evasion (hide in lumen)
- species/strain specificity

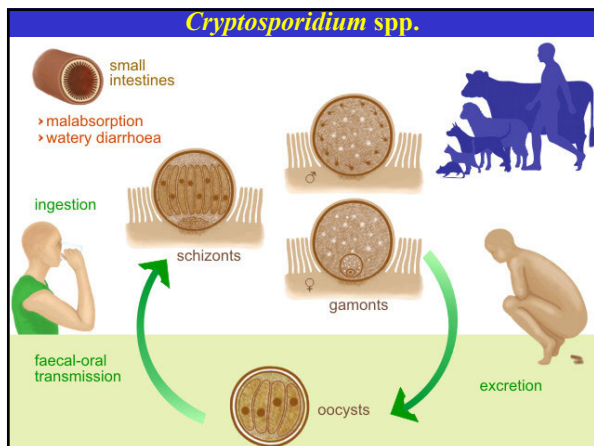
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Enteric coccidia - *Cryptosporidium parvum*

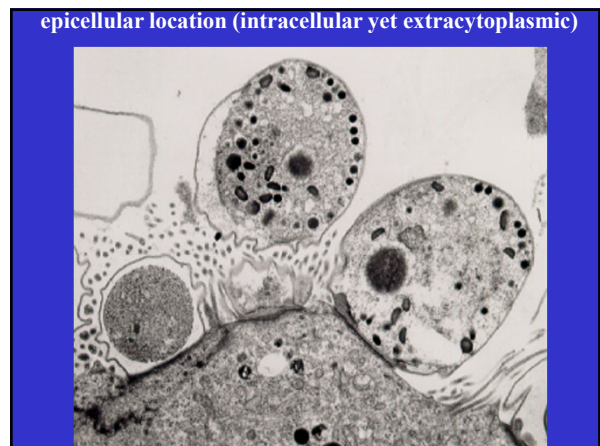


endogenous stages faecal-oral exogenous oocyst

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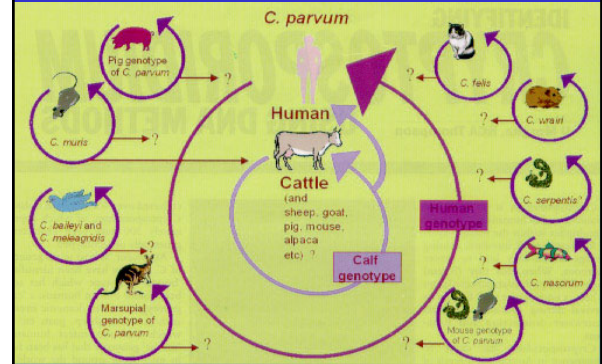
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Pathogenesis

- villus atrophy
- microvillus destruction
- impaired glucose and electrolyte transport
- impaired carbohydrate and protein digestion
- malabsorptive and maldigestive disease
- pernicious cycle (cyclic merogony)
- auto-infection (chronic infections)

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Genotypes



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Immunoparasitology (cryptosporidiosis)

Parasite

- intracellular but extracytoplasmic (enterocytes)
- immuno-diagnosis (antibody, antigen, DNA)

Host immunity

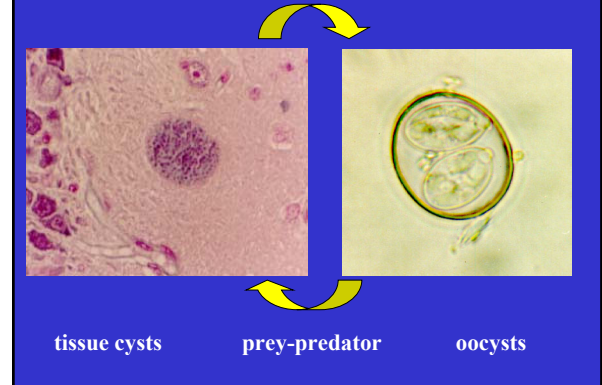
- strong protection (against disease)
 - colostral immunity (antibodies)
 - mucosal immunity (T and B cells)
- vaccination (none yet)
 - anti-infection, anti-disease, anti-transmission

Problems

- immuno-evasion (parasitophorous vacuoles)
- species/strain specificity

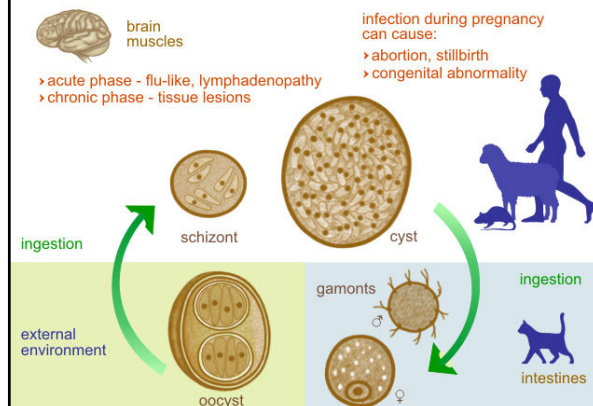
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Toxoplasma gondii

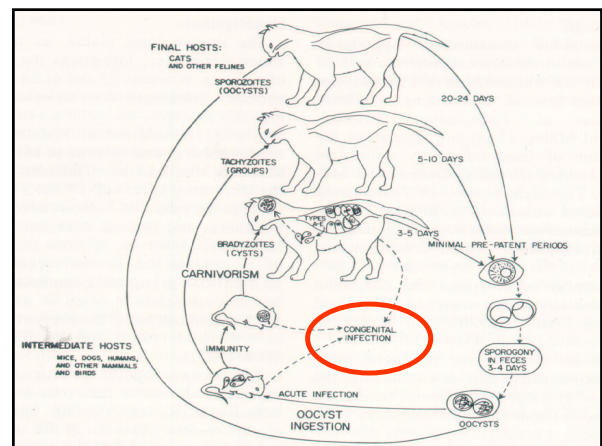


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Toxoplasma gondii



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Consequences

infection during pregnancy



1st trimester - abortion

2nd trimester - stillbirth

3rd trimester - congenital abnormalities (cerebral calcification, retinochoroiditis, hydrocephalus, microcephaly)

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Toxoplasma

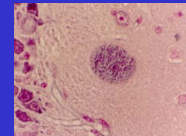
Infections acquired

- oocyst ingestion
- transplacental
- transmammary

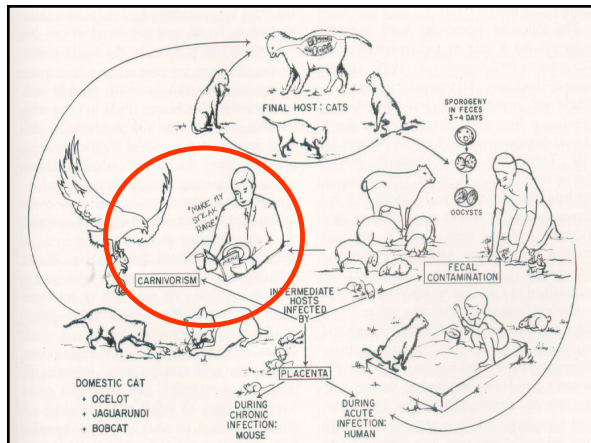


Still does not explain high incidence

- epidemiology suggests ascension through food chain



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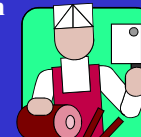
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Carnivorism

Cooking

- ingestion of cysts in raw/rare meat (tartare, smallgoods)
- bradyzoites resistant to pepsin
- revert to tachyzoites
- multiply and spread
- cyst formation

- heat denaturation
- meat red due to blood
- haemoglobin browns around 65°C
- organisms dead



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Immunoparasitology (toxoplasmosis)

Parasite

- intracellular (macrophages, muscles/nerves)
- immuno-diagnosis (antibody, antigen, DNA)

Host immunity

- strong protection (against disease)
 - concomitant immunity (T and B cells)
- vaccination (several under trial)
 - anti-disease

Problems

- immunosuppression (reactivation of latent infections)
- immuno-evasion (hide in effector cells, cyst formation)
- species/strain specificity

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