Parasitic Diseases

Human Pathogenic Protozoans

“First Animal”

- Amoebas
  - Move by pseudopods
  - Cyst → trophozoite
- Flagellates
  - Move by flagella
  - Cyst → trophozoite
- Ciliates
  - Move by cilia
- Sporozoans
  - Do not have motility structures

Generalized Protozoa Life Cycle

- Cyst
  - Protective form of the organism
  - Passed into the environment
- Reproduction
  - Asexually = binary fission; schizogeny
  - Sexually = gametes
- Trophozoite
  - Motile
  - replicate

Kingdom Protista

- Phylum : Protozoa
  - Flagellates
    - Trichomonas
    - Giardia
    - Trypanosoma
    - Leishmania
  - Amoebae
    - Entamoeba
    - Naegleria
    - Acanthoamoeba
- Phylum Apicomplexa
  - Coccidia
    - Eimera, Isospora
    - Toxoplasma
    - Cryptosporidium
    - Plasmodium
  - Piroplasmasina
    - Babesia
- Phylum Ciliophora
  - Balantidium

New Taxonomy

- Alveolates
- Amoebae
- Euglenozoa
- Archaezoa

Alvelolates

- Ciliates
  - 2 nuclei
- Apicomplexans
  - Pathogenic
  - Intracellular organelles as apical complex
- Dinoflagellates
  - Plankton
  - Some produce neurotoxins

Archaezoa

- Lack several organelles
  - Mitochondria
  - Golgi apparatus
  - peroxisomes
- Examples
  - Diplomonadida
    - Giardia
    - Microsporidia
  - Parabasala

Euglenozoa

- Euglenoids
  - Characteristics of plants and animals
    - Phototrophic
    - Chloroplasts
    - Flagella + cytoplasm for movement
    - Lack cell walls
- Kinetoplastids
  - Mitochondrial DNA is kinetoplast

Amoebae

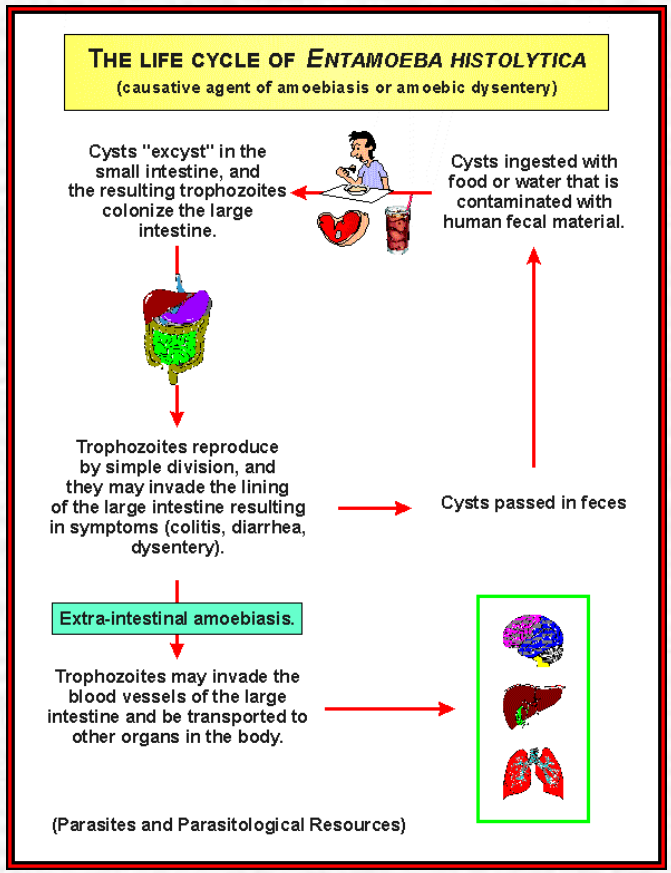
- Lack mitochondria
- Pseudopods
- Binary fission

AMOEBA

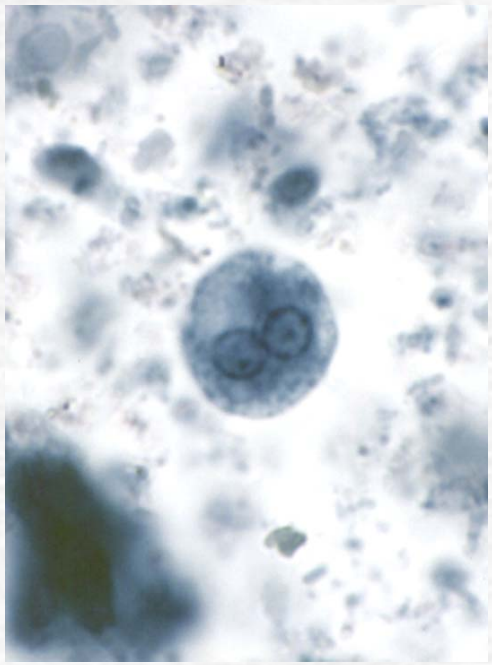
- Entamoeba histolytica
- Acanthoamoeba castillanii
  - Free living, opportunistic
  - Corneal ulceration
- Naegleria fowleri
  - Free living, opportunistic
  - CNS → fatal meningitis

Entamoeba histolytica

- Amoebic dysentery
- Humans are DH
- Contaminated water
- Cysts
- Trophozoites in lining of SI, colon
- Clinical syndrome
  - Mucosal necrosis
  - Liver abscesses
- DX: Id cysts
- TX: Metronidizole

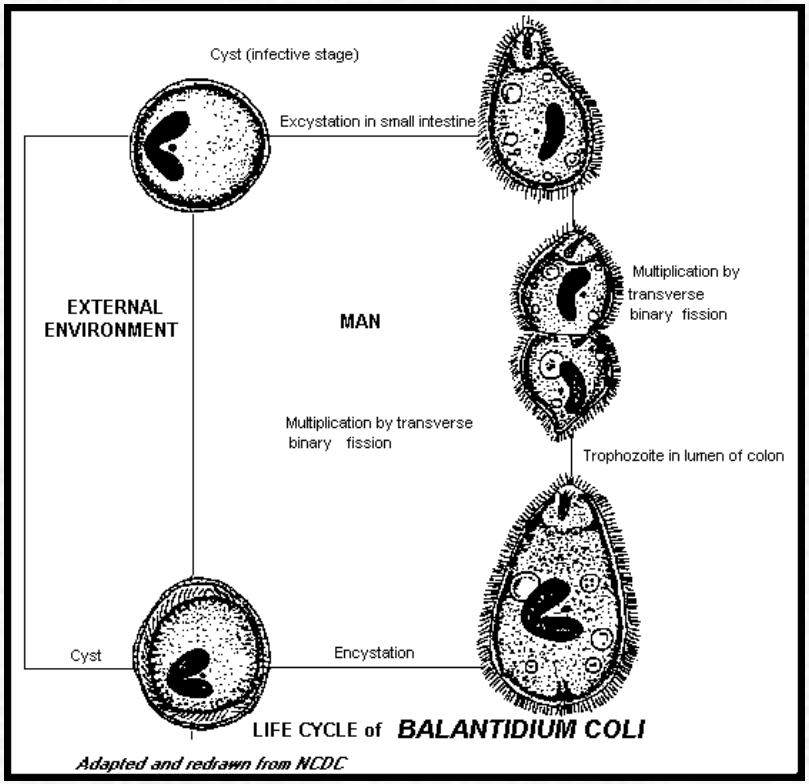


Entamoeba histolytica



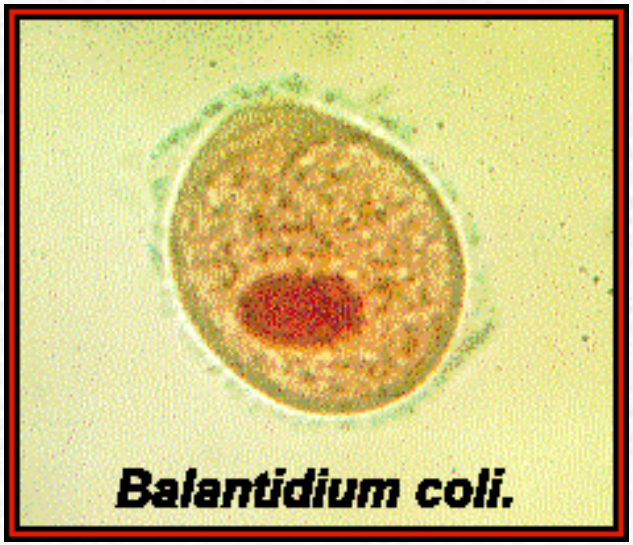
cyst

Ciliates

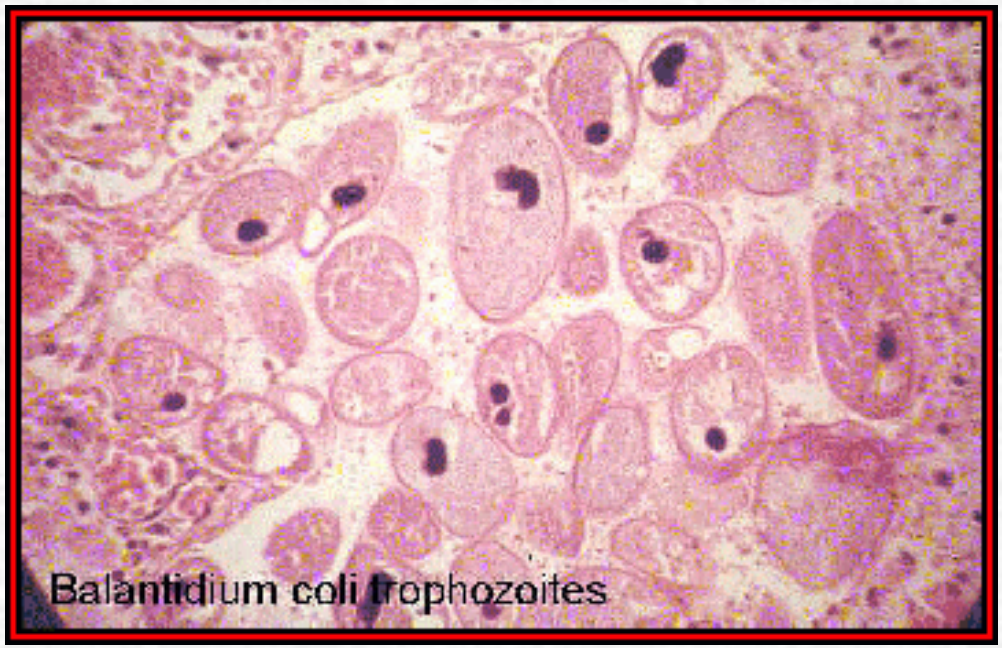


- *Balantidium coli*
  - Zoonotic (pigs_
  - Similar to E. histolytica
  - Trophozoites
    - Invade intestinal mucosa
    - Severe diarrhea
  - DX: Id organism
  - TX: Tetracycline
  - Prevention: Hygiene

Balantidium coli



trophozoite



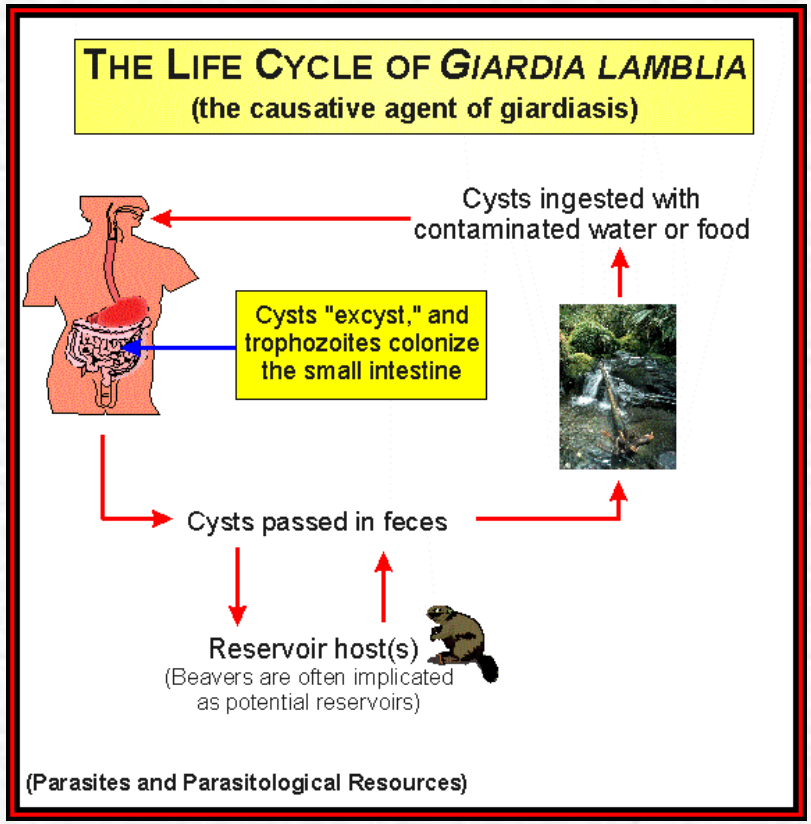
Trophozoites in intestinal lining

FLAGELLATES

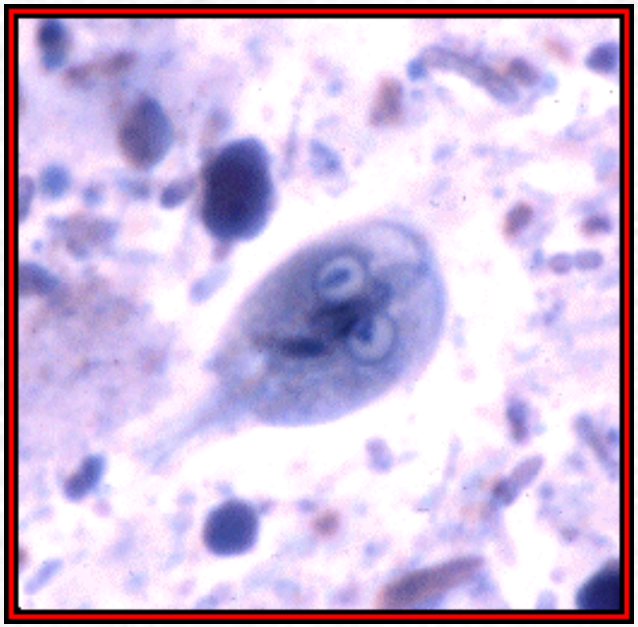
- Giardia
- Trichomonas
- Trypanosoma species
  - African
  - American
- Leishmania species
  - Cutaneous
  - Visceral

Giardia lamblia

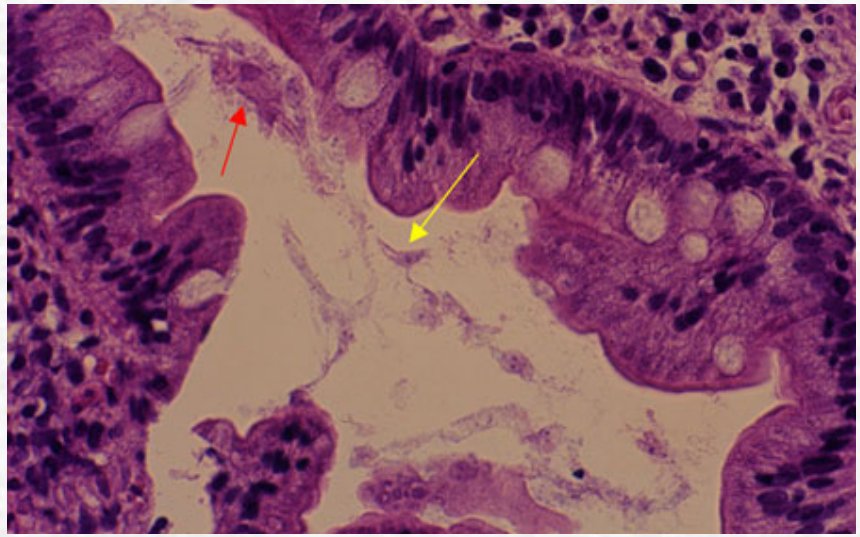
- 5 flagella for motility
- Cyst ingestion
- Trophozoite excyst
  - Motile due to acid
  - Attach to mucosa
  - Absorbs nutrients
- Clinical Signs
  - Diarrhea, Nausea
  - Malabsorption
- DX: Id organism
- TX: Metronidizole
- Prevention: Sanitation



Giardia

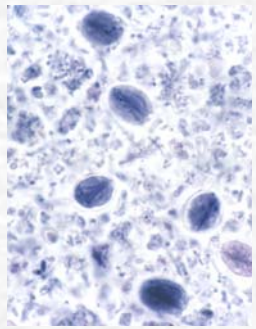


trophozoite

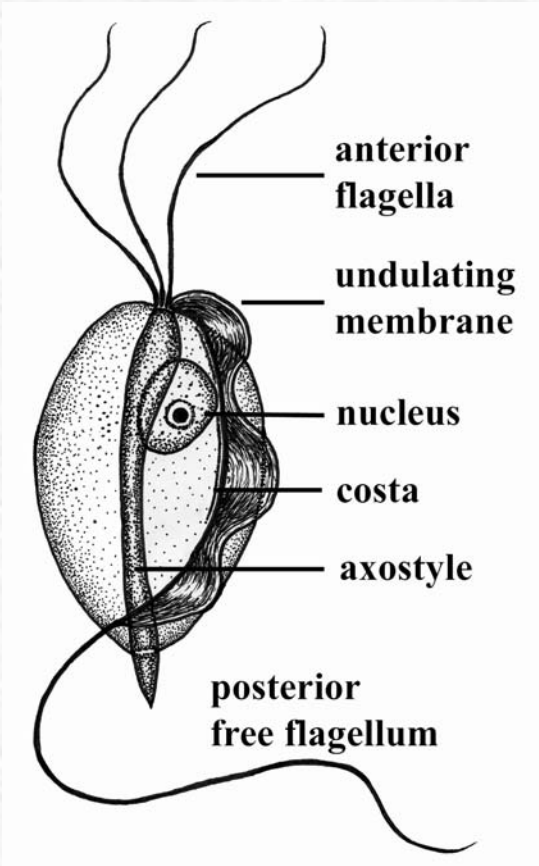


Trophozoite in GI

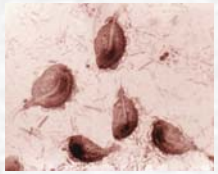
cyst



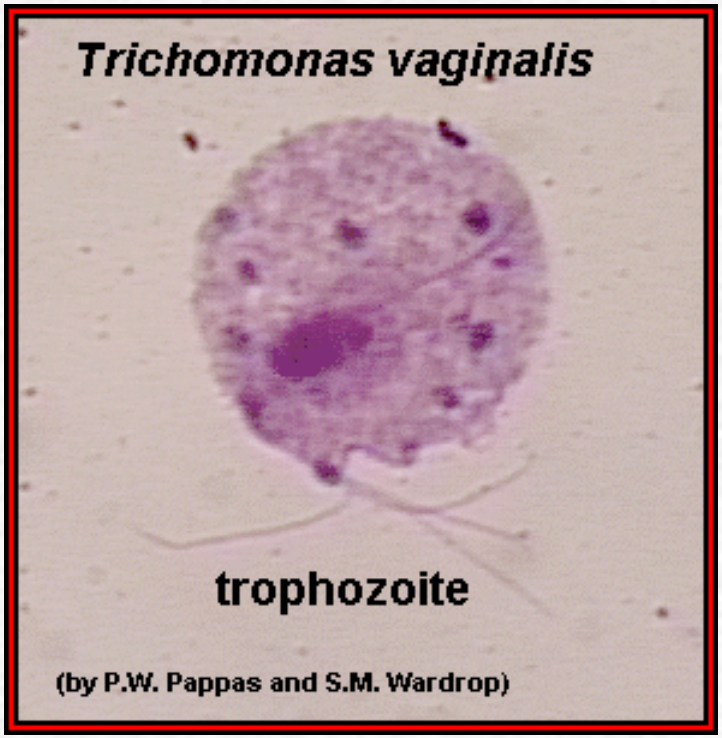
Trichomonas vaginalis

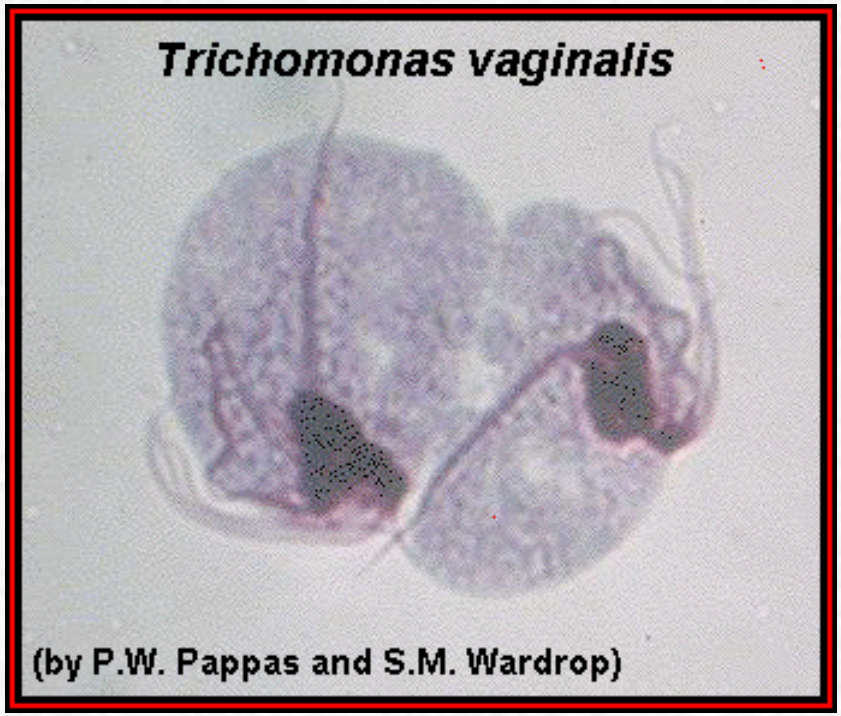


- STD
- Female
  - Vaginitis: discharge
- Male
  - Urethritis: burning
- Trophozoite only
- DX: Id organism
- TX: Metronidizole
- Prevention: Safe sex

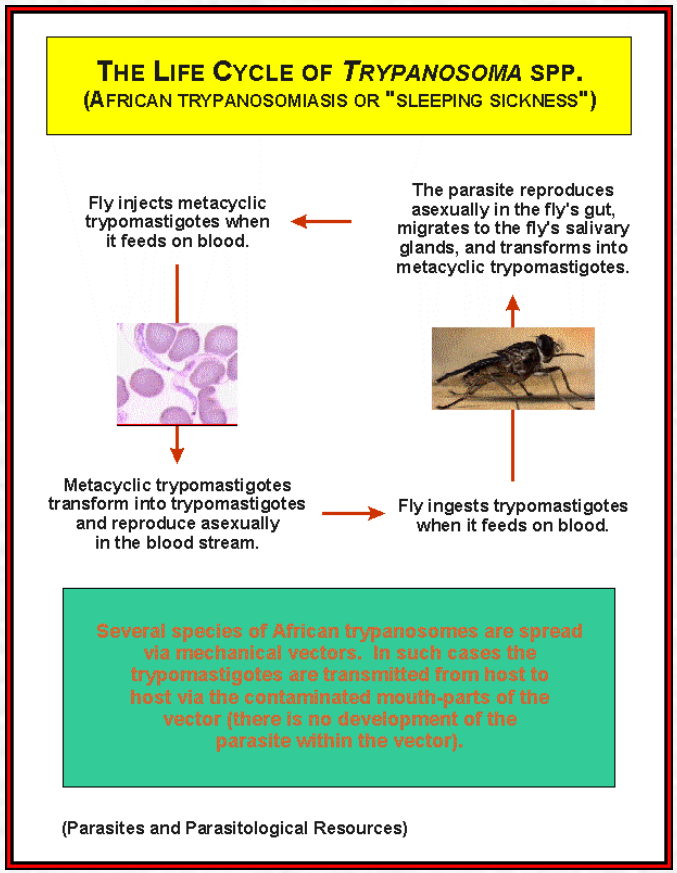


Trichomonas



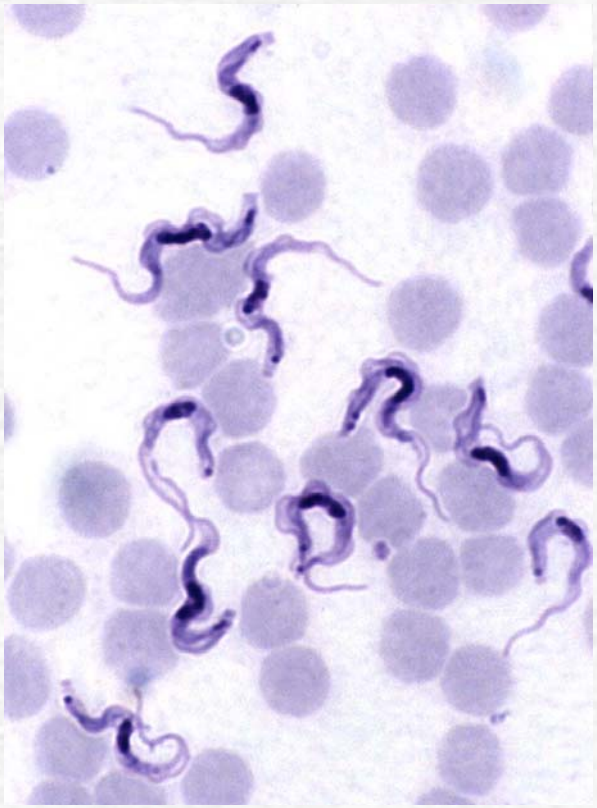


Trypanosoma brucei



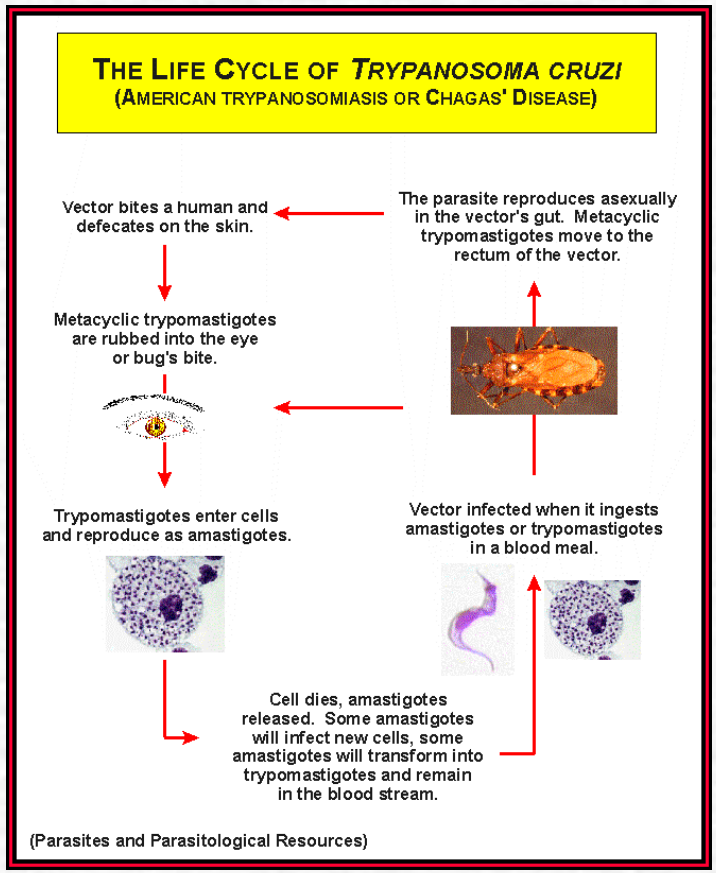
- African Sleeping Sickness
- Arthropod vector (Tsetse fly)
- Animal reservoir = Zoonotic
- Trypanosomes
  - Picked up in blood
  - Development in fly
    - Gut
    - Salivary gland
  - Chancre at site of bite
- Clinical Signs
  - Fever, malaise
  - CNS → coma

Trypanosoma trophozoites

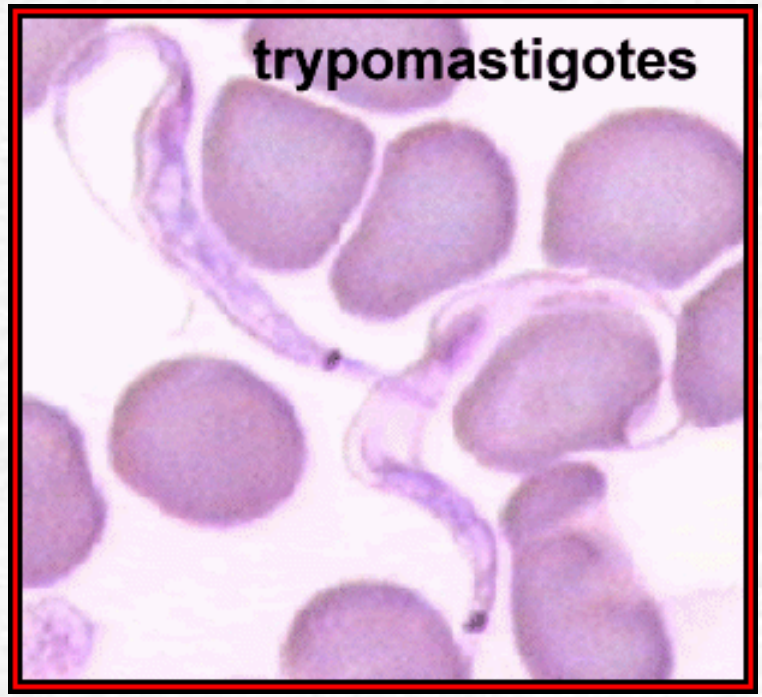


Trypanosoma cruzi

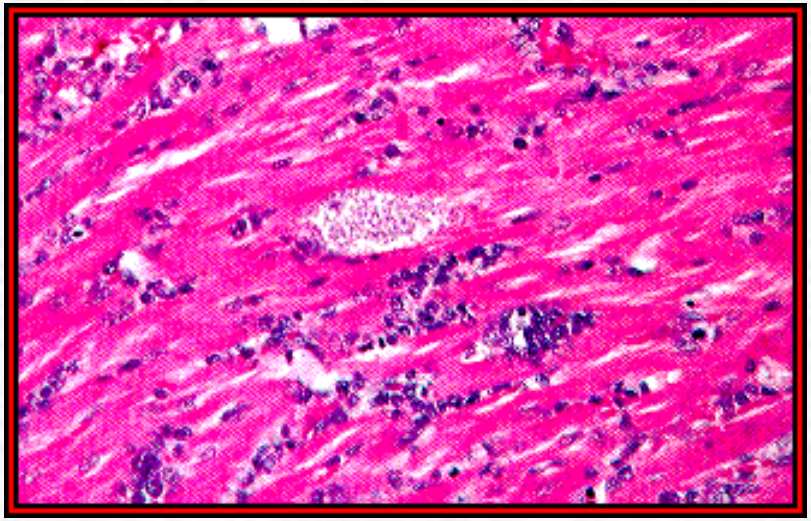
- Chagas Disease
- Animal reservoir = Zoonotic
- Vector = Triatomid bug
- Trypansome
  - Multiply in bug gut
  - Metacyclic form in feces
  - Organsim circulates in blood
  - Amastigotes in new cells
  - Trypomastigotes in blood
- Clinical Course
  - Nervous: Megaesophagus, mega colon
  - Cardiac: arrythmia, dilation
  - GI: pseudocyst in lining



T. cruzi



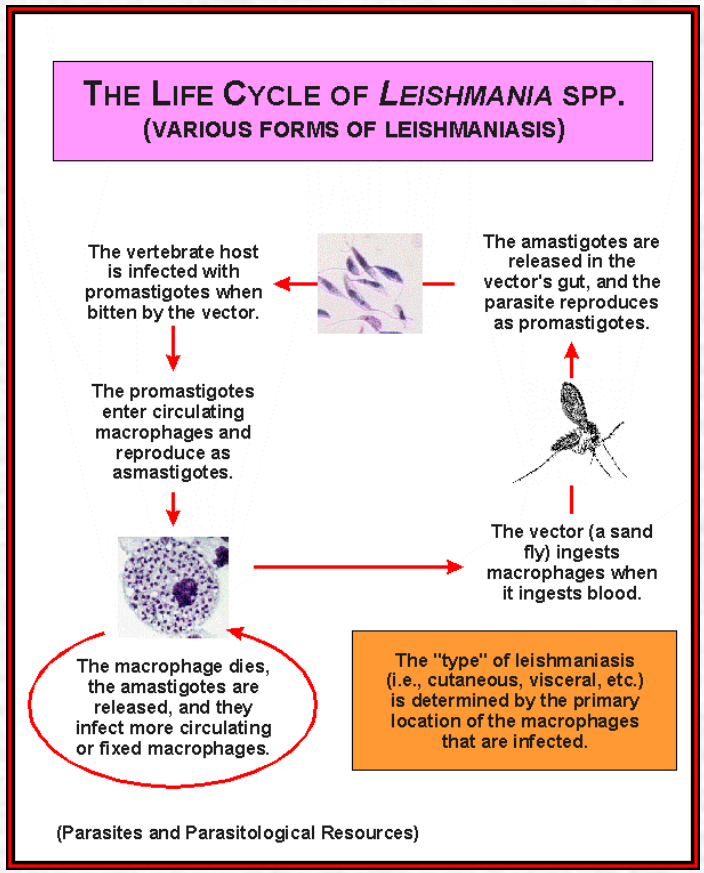
Chagas Disease



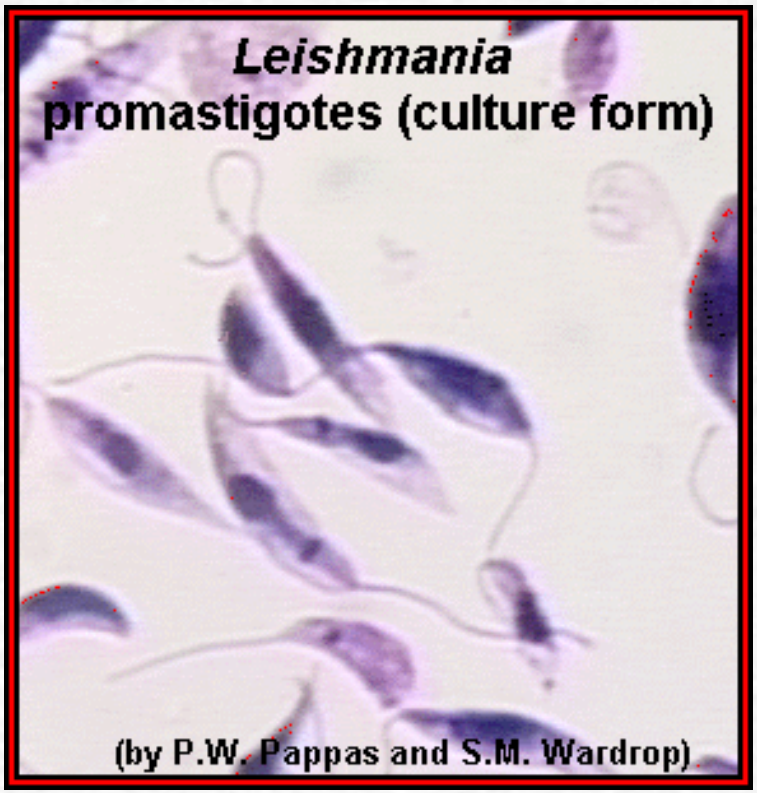
T. cruzi in heart muscle

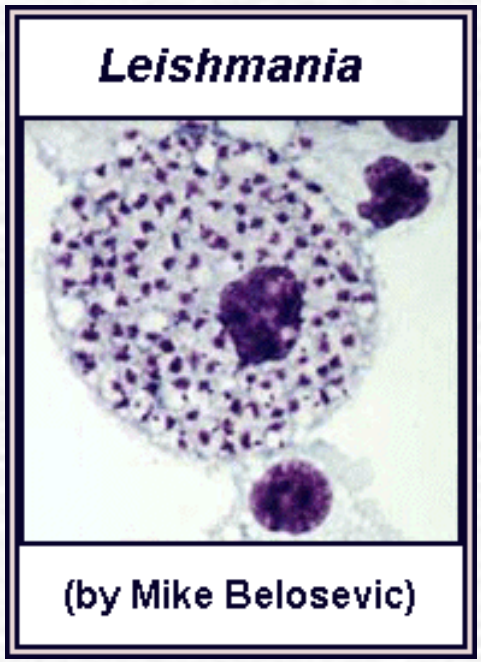
Leishmania species

- Cutaneous
  - Localized open sore
  - Can spread locally
- Visceral
  - Systemic
  - Macrophage location
- Animal reservoir = Zoonotic
- Vector: Sand flies
- Promastigotes inoculated
  - Ingested by macrophages
  - Multiply
- Amastigotes
  - Released and redigested
  - Picked up by fly
  - Multiply in gut



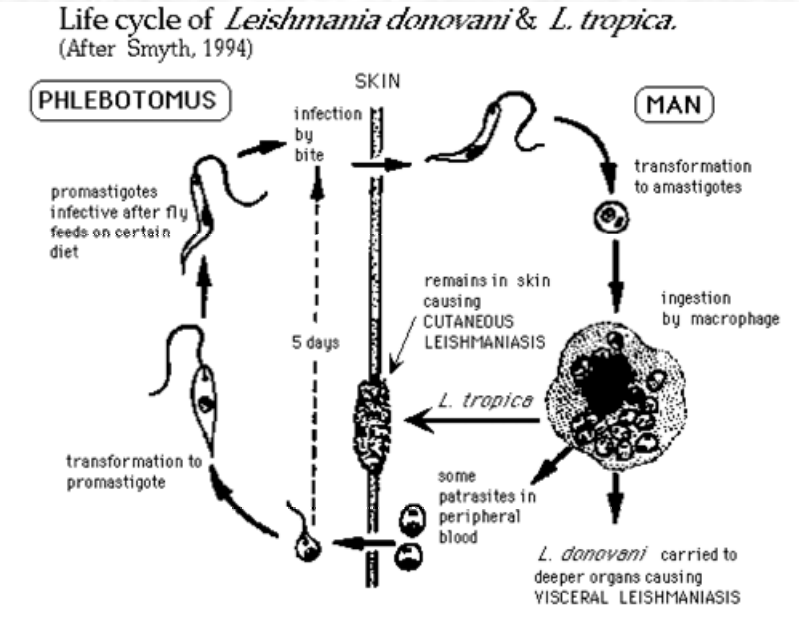
Leishmania





Amastigotes infecting macrophages

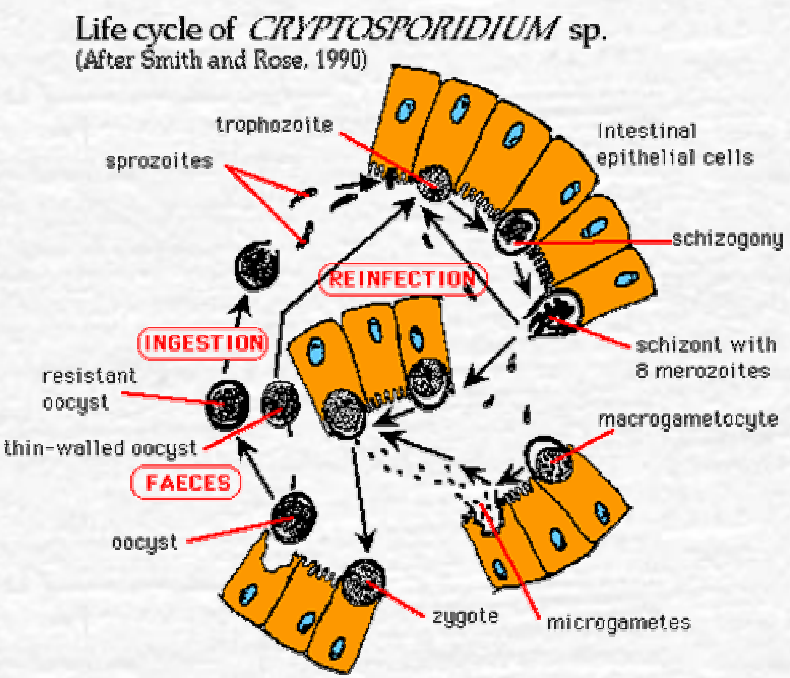
Leishmaniasis



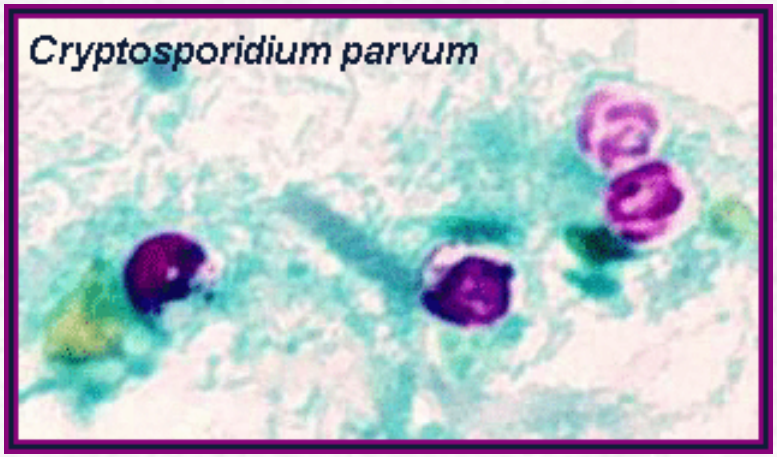
APICLOMPLEXA

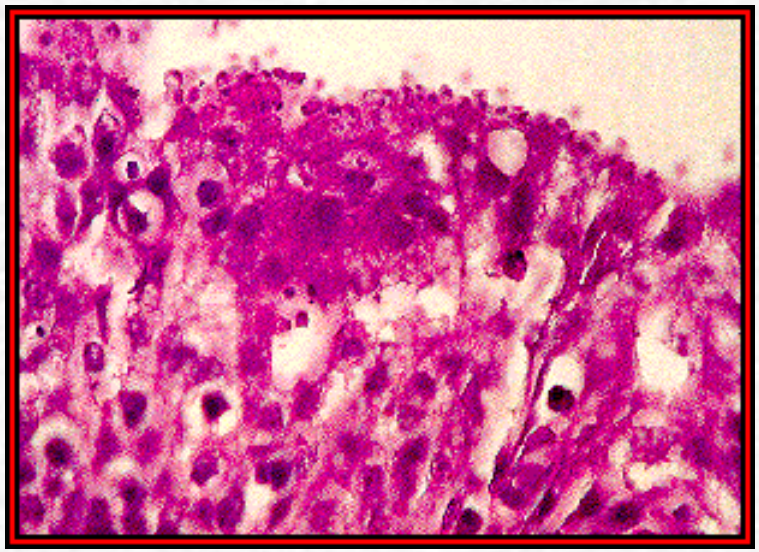
- Cryptosporidium
- Plasmodium
- Toxoplasma
- Coccidia
- Babesia

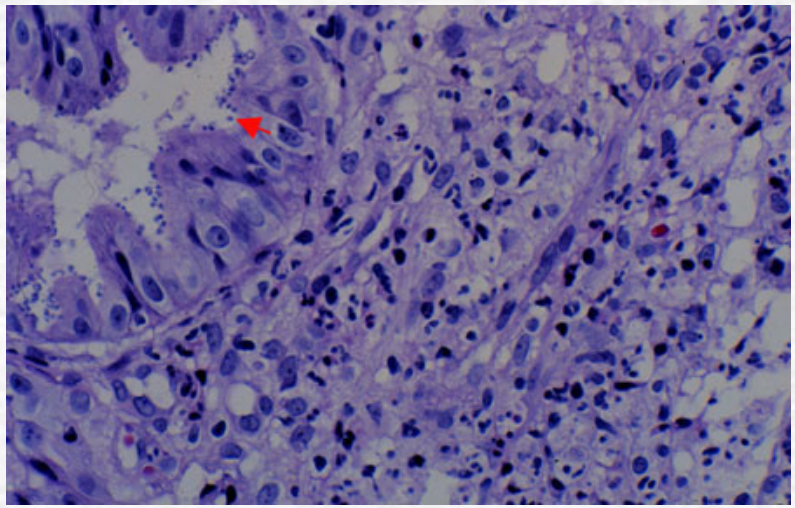
Cryptosporidium parvum



- Animal reservoir = zoonotic
- Fecal contaminated water
- Oocysts ingested
- Sporozoites
  - Invade intestinal cells
  - Asexual reproduction
    - Gametes (oocyst)
    - Oocysts in feces
- Clinical Syndrome
  - Diarrhea
    - Self limiting in children
    - Severe if immunocompromised
- Dx: Oocysts
- TX: Antiprotozoal



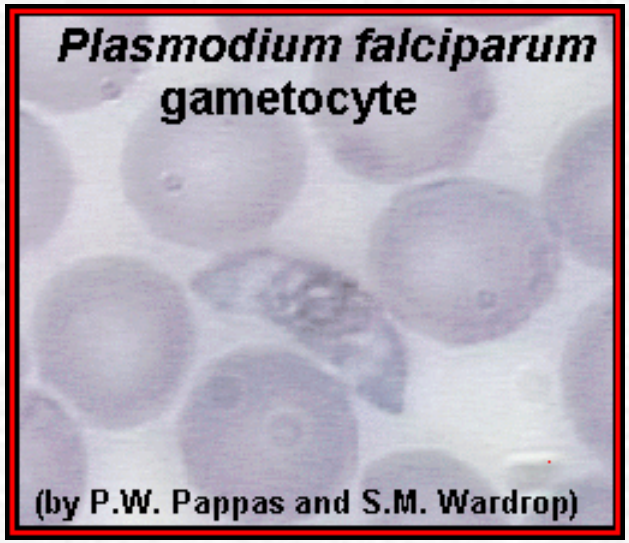


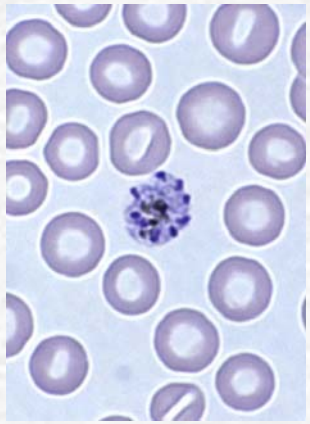


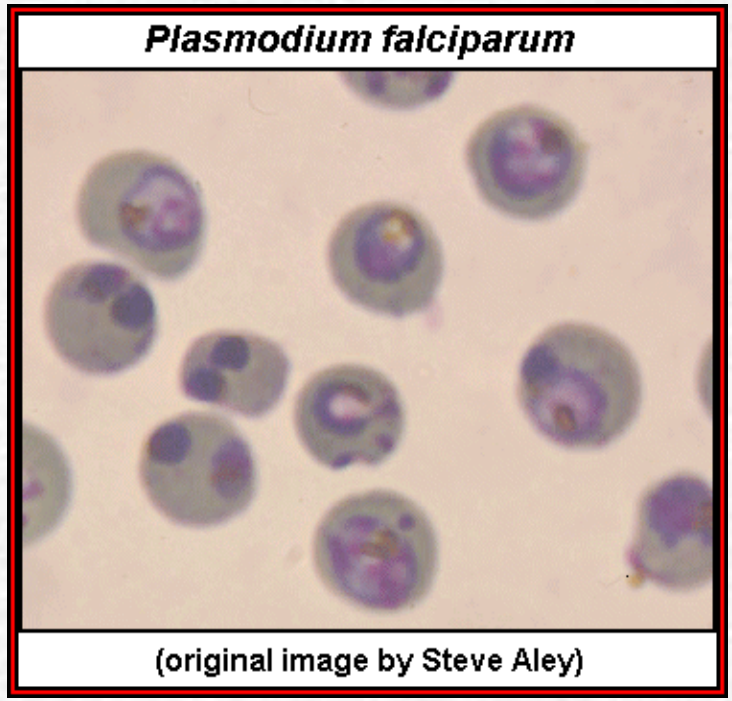
Intestinal infections

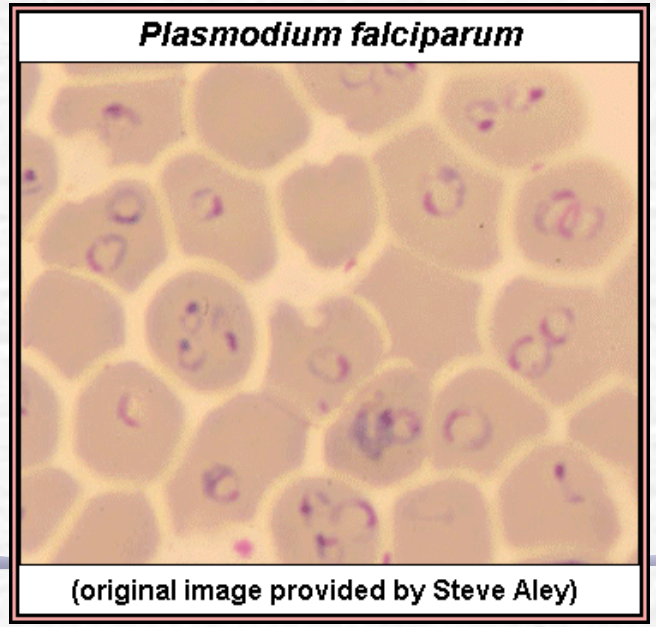
Plasmodium species

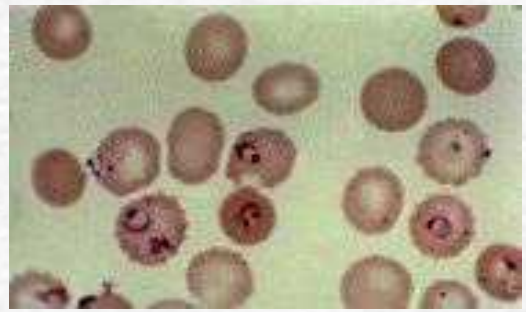
- Malaria
- Vector: Anopheline Mosquitoes
  - Gametocytes → zygote
  - Oocyst in gut
  - Sporozoites in salivary glands
- Humans = DH
  - Sporozoites in liver
  - Schizonts develop
  - Merozoites in RBC → gametocytes
- Clinical Course
  - Invasion, Rupture, Reinvasion
  - Fever, Chills
  - Anemia
  - Free Hgb → Renal Failure, death
- DX: Symptoms, Id blood
- TX: antimalarial drugs


Plasmodium falciparum
gametocyte
(by P.W. Pappas and S.M. Wardrop)

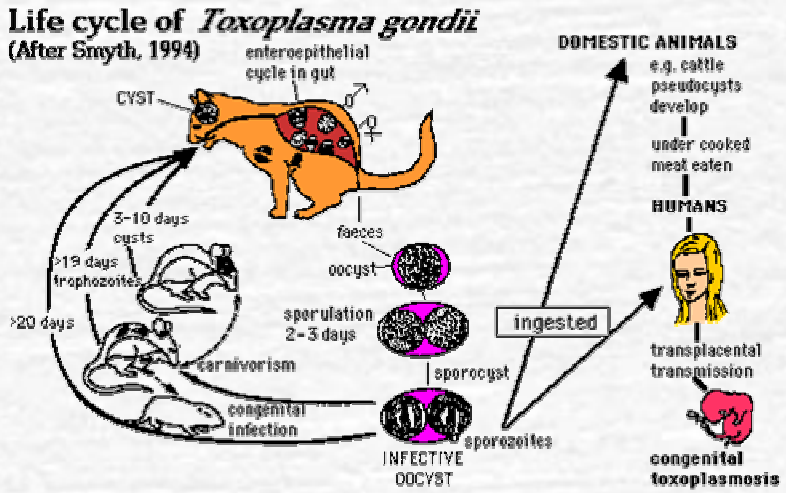



Plasmodium falciparum
(original image by Steve Aley)


Plasmodium falciparum
(original image provided by Steve Aley)

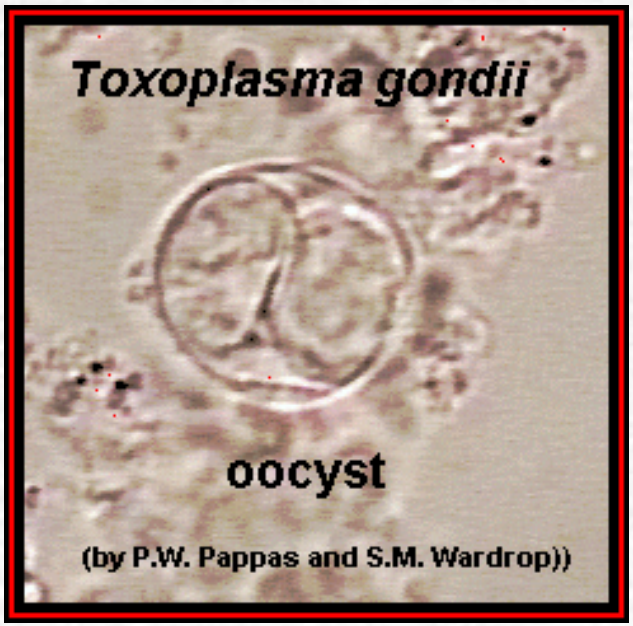


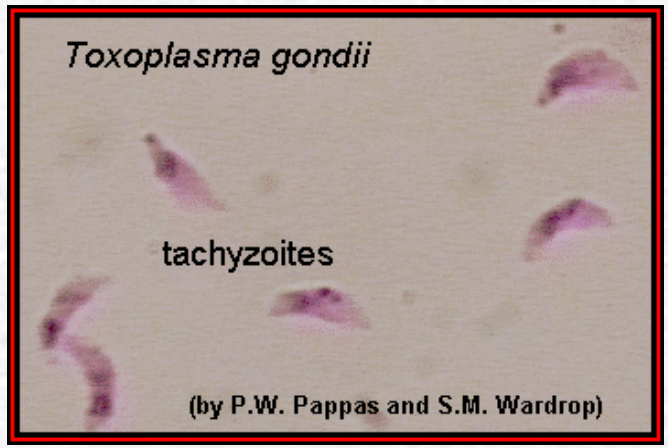
Toxoplasma gondii



- Toxoplasmosis
- Zoonotic
- Feline = DH; intestinal phase
- Oocysts
  - Feces
  - Release sporozoites→ replicate
  - Tachyzoites form
    - Encyst in brain, muscle
    - Develop bradyzoites
- Clinical Course
  - Asymptomatic
  - Fetus: miscarriage, handicap
  - AIDS: brain cysts, inflammation
- Dx: Ab titer, biopsy
- TX: TMPS

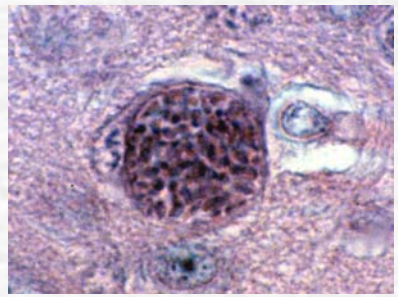
Toxoplasmosis





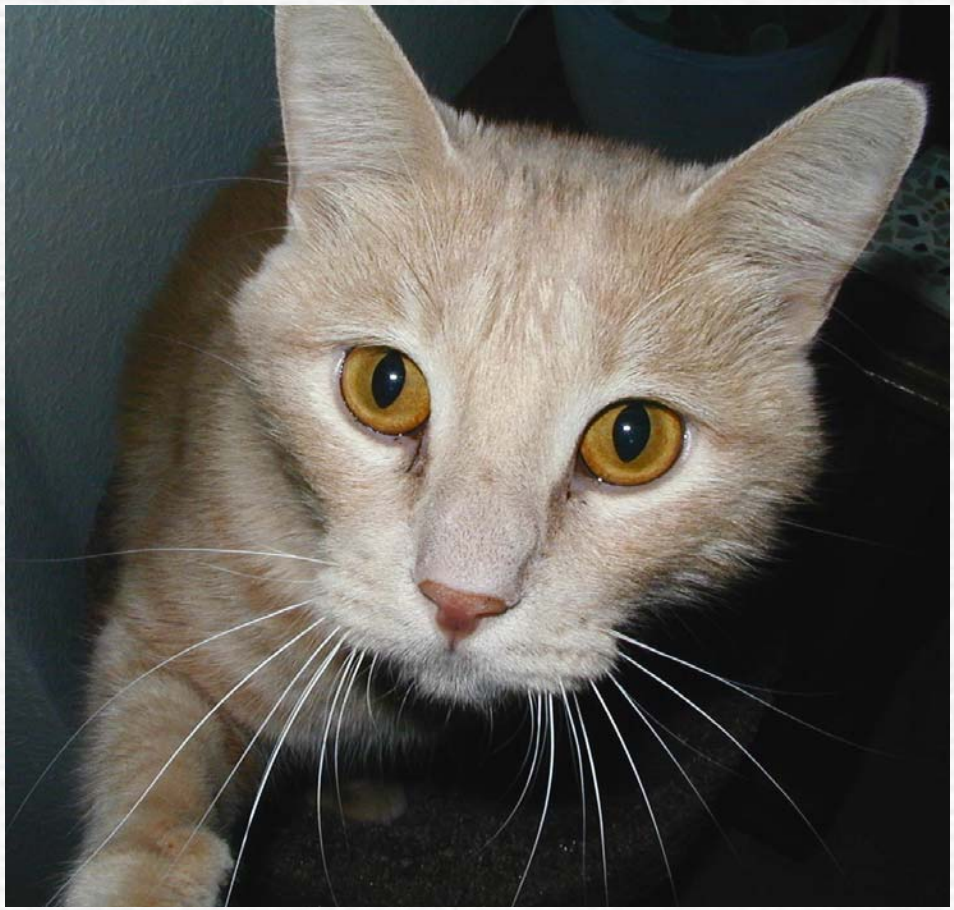
tachyzoite

oocyst



Bradyzoite cyst in brain

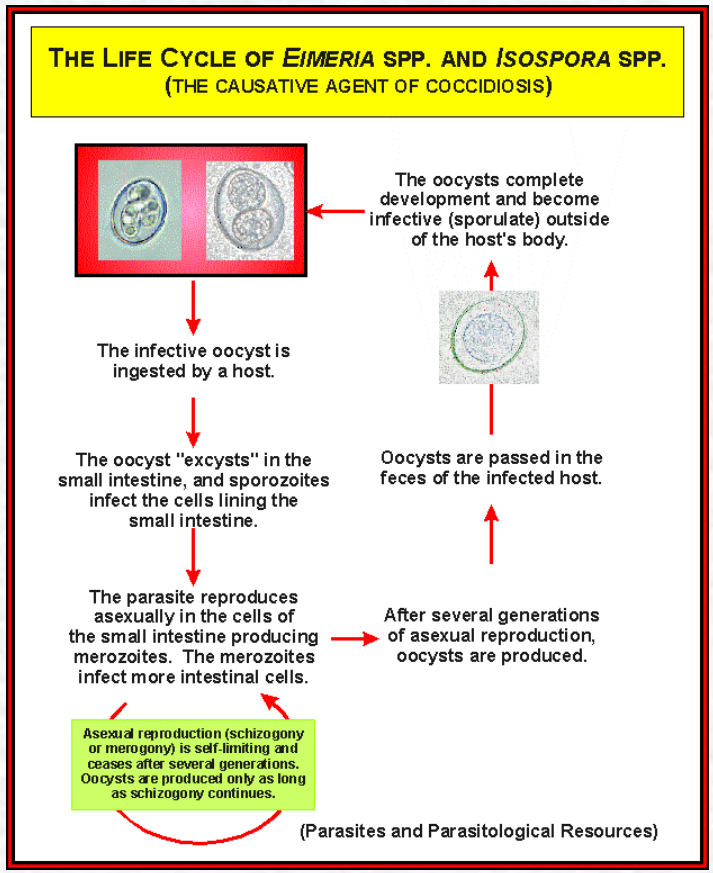
Don’t look at me…



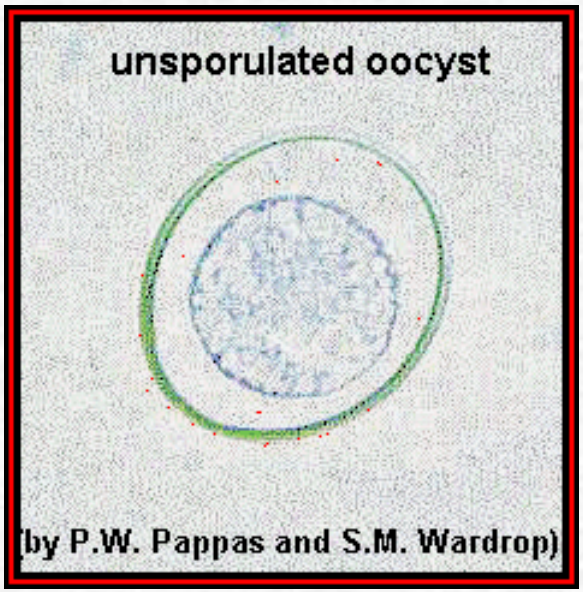
I’m parasite free!

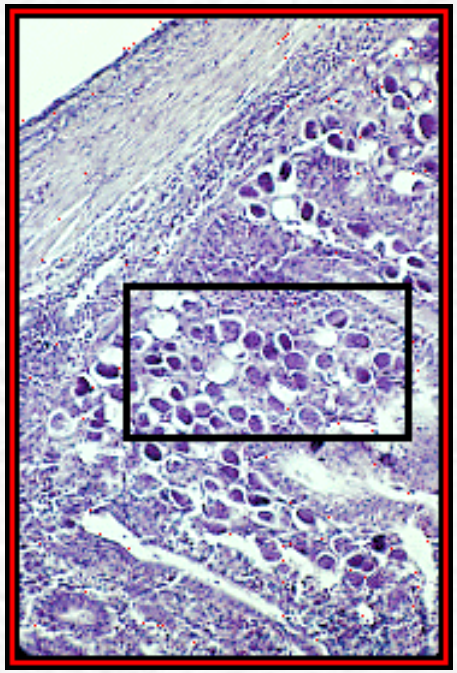
Coccidiosis

- Number of species
- Oocysts
  - Ingested
  - Sporozoites
    - Liberated
    - Asexual reproduction
  - Merozoites-> reinfect
  - Gametocytes produced
    - Gametes → zygote
    - oocyst
- Clinical Disease
  - GI mucosal damage
  - Diarrhea
- DX: Oocysts in feces
- TX: TMPS



Coccidia





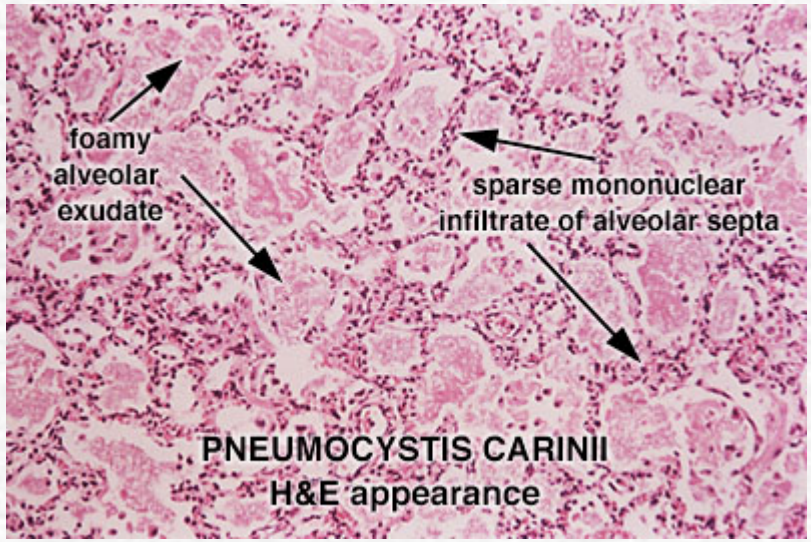
Eimeria in tissue

Babesia bigemina

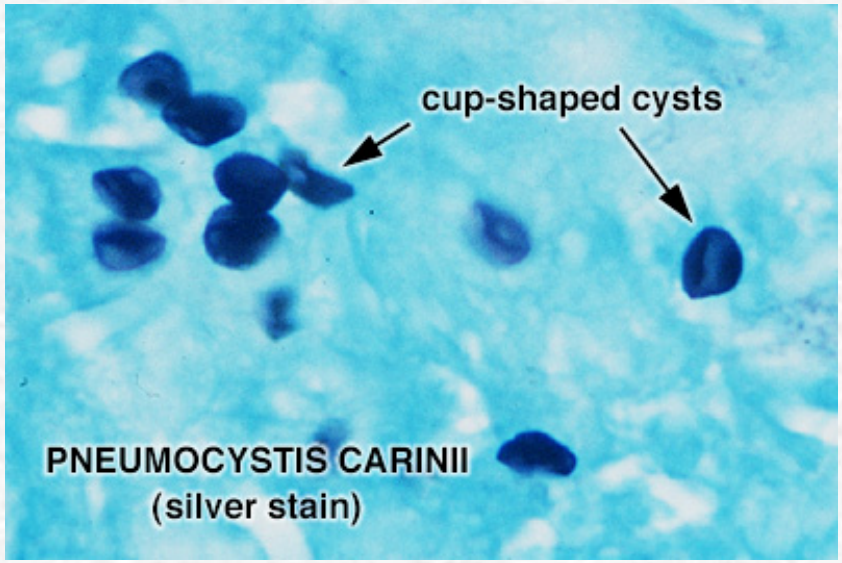
- Piroplasm organism
- Vector: hard Tick
- Host: Mammal RBCs
- Splenectimized humans
- Clinical Syndrome
  - Anemia due to destruction
  - Fever, aches
  - Jaundice
  - Kidney Failure
- DX: Id organism in RBC
- TX: Ab

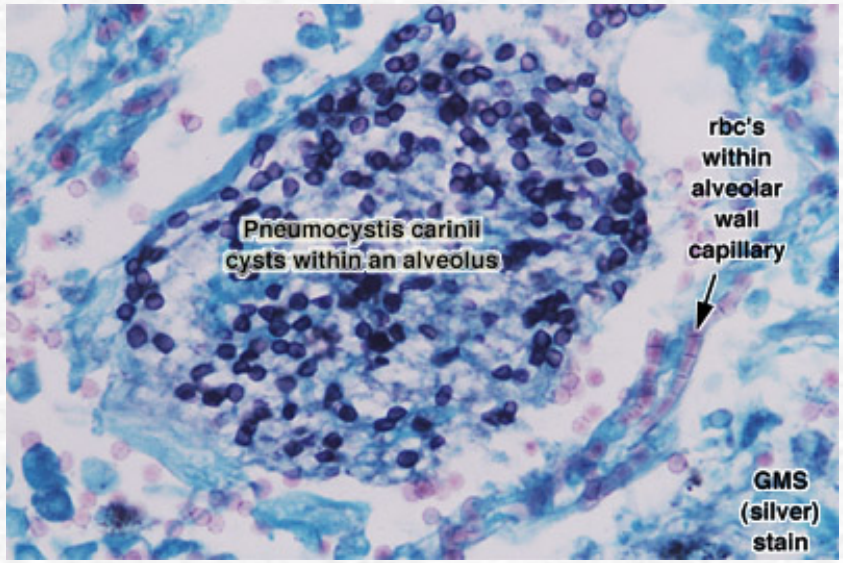
Pneumocystis jiroveci

- Formally P. carinii
- Protozoan vs Fungal
- Source: Human Respiratory
- Transmission @ early age
- Clinical Course
  - Cysts in alveolar wall
  - Ruptures → bodies released
  - Trophozoites develop
    - Sexual repro = cysts
    - Asexual repro = fission
  - Pneumonia
- DX: Id cysts
- TX: TMPS



PCP


cup-shaped cysts
PNEUMOCYSTIS CARINII
(silver stain)


Pneumocystis carinii
cysts within an alveolus
rbc's
within
alveolar
wall
capillary
GMS
(silver)
stain

Protozoal Drug Treatments

- Metronidizole
  - Nicks in DNA
- Antimalarials
  - Chloroquine, Amodiaquine, Mefloquine
    - Eradicate erythrocytic asexual stages
  - Primaquine
    - Eradicates exoerythrocytic stages
- TMPS
  - Inhibits metabolites related to Folic acid synthesis

Parasite Prevention Summary

- Wash hands
- Drink clean water
- Cook meat and fish
- Wash vegetables & fruit
- Wear shoes
- Control Vectors
- Prevention first
- DX before TX
- Follow up / change TX

Questions?