Slide 1

Eukaryotes: Protists and Helminths

Lecture 15

Slide 2

Learning Outcomes

- Protizoans
  - Alveolates
    - Plasmodium
  - Ciliates
  - Excavates
  - Euglenids
    - Parabasalids and Diplomonads
      - Giardia and Trichomonas
  - Kinetoplastids
  - Trypanosoma
  - Amoebas
- Helminths
  - Flukes and Tapeworms

Slide 3

Protozoa

- Single celled heterotrophic or mixotrophic
- Aquire food via ingestion
- Fungi absorb nutrient after breakdown outside of cells
- Paraphyletic
- May represent several groups with little evolutionary kinship
- Classification confusing and ever-changing

Slide 4

Non-algal Protozoa

- Unicellular
- Chemoheterotrophs
- Vegetative form is a trophozoite
- Asexual reproduction by
  - fission,
  - budding, or
  - schizogony
- Sexual reproduction by conjugation
- Some produce cysts

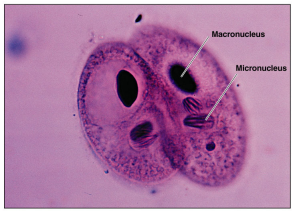
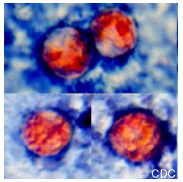


Figure 12.16

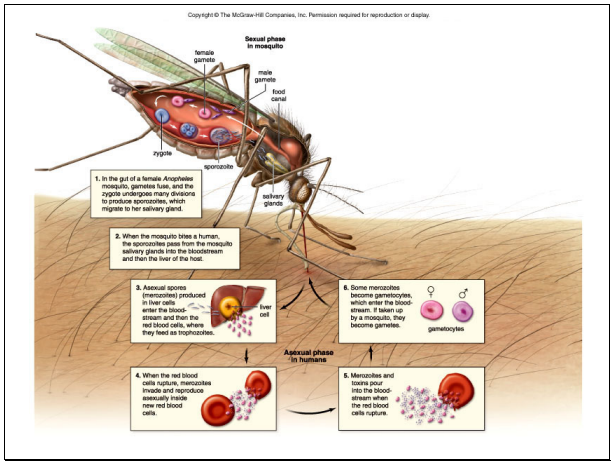
Slide 5

Apicomplexa

- Within Alveolate Supergroup
- Nonmotile
- Possess relict plastid (chloroplast)
- Intracellular parasites
- Apical complex punctures host cells
- Complex life cycles
- *Cryptosporidium*
- *Cyclospora*



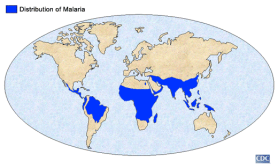
Slide 6



Slide 7

Malaria

- 300 to 500 million cases per year worldwide
- 2 to 4 million deaths
- 4 forms
- *Plasmodium vivax*
- *P. ovale*
- *P. malariae*
- *P. falciparum*
  - 50% mortality



Slide 8

Ciliates

- Within Alveolate Supergroup
- Move by cilia
- Large complex cells
- Outer pellicle
- Cytostome or gullet
- Anal pore
- Contractile vacuole
  - Export water the enters via osmosis
- Micronuclueus
  - Copied and transferred during conjugation
- *Paramecium*
- Ubiquitous in pond water

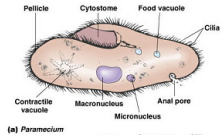
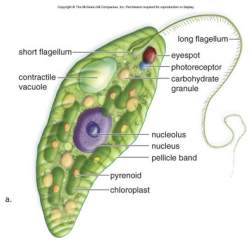


Figure 12.20

Slide 9

Excavates

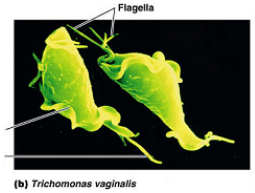
- Possess long Zooflagella
- (formerly known as flagellates)
- Mitochondria atypical or absent
- Deep (excavated) oral grooves
- Euglenids
- Some genera heterotrophic lacking chloroplasts
- Some photosynthetic
- Chloroplast triple membrane
- Secondary endosymbiosis of green alga
- *Euglena*
- Eyespot



Slide 10

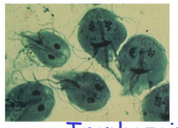
Parabasalids

- Lack mitochondria
- Fermenters
- *Trichomonas vaginalis*
- no cyst stage
- Trophozoite transmitted via direct contact
- Incidence 5 million cases per year USA
- 50% cases asymptomatic
- Prefer conditions of lower vaginal acidity

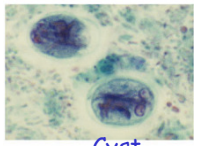


Diplomonads

- (Archaezoa)
- Two nuclei
- Two sets of flagella
- No functional mitochondria
  - Fermenter
- *Giardia lamblia*
- Forms Cysts
- Permits survival in inhospitable conditions
- Aid in transmission
- Fecal-Oral from contaminated freshwater



(c) *Giardi lamblia* Trophozoite



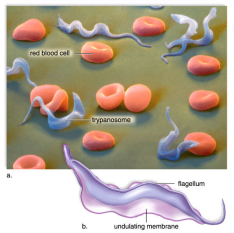
(d) Giardialamblia cyst Cyst

Figure 12.17b-d

Kinetoplastids

- (Euglenozoa)
- Sexual reproduction absent
- Chemoheterotrophs
- Hemoflagellates (blood parasites)
- Reproduce in vector via schizogony
  - *Trypanosoma brucei gambiense*
  - African Sleeping Sickness
  - transmitted by tsetse fly
  - *T. cruzii*
  - Chagas' disease
  - South America
  - Transmitted via kissing bug

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



Amoebozoans

- Move by pseudopods
- Aquatic
- *Amoeba proteus*
  - Predator of bacteria
  - Common in soil, ponds
- *Entamoeba histolytica*
  - Amoebic dysentry
  - Fecal-oral route via cysts
- Acanthamoeba
  - Grow in water
  - Infect cornea
  - Keratitis
  - Associated with unsanitary contact lens use

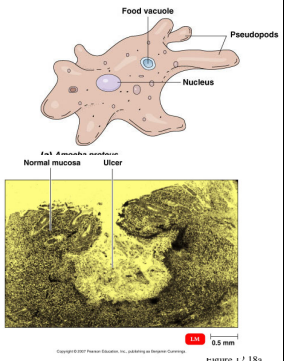


Figure 12.18a

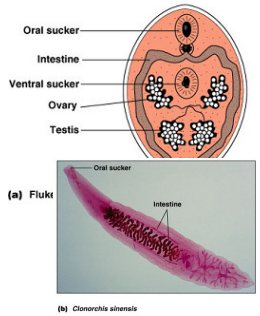
Helminths

- Parasitic worms and flukes
- Multicellular animals
- Chemoheterotrophs
- Kingdom Animalia
- Phylum: Platyhelminthes (flatworms)
  - Class: Trematodes (flukes)
  - Class: Cestodes (tapeworms)
- Phylum: Nematoda (roundworms)

Slide 15

Trematode Anatomy

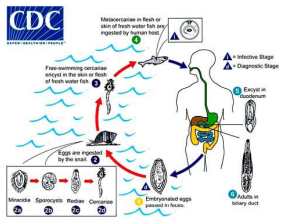
- Flukes
- Protective tegument resistant to host digestive juices
- Two suckers used for attachment
- Absorb nutrients from host bodily fluids across cuticle
- Incomplete digestive system
- hermaphrodites



Slide 16

Asian Liver Fluke

- *Clonorchis sinensis*
- Eggs shed in feces
- Eggs ingested by intermediate host 1 (aquatic snail)
- Larval stages;
  - miracidium, sporocyst, Rediae in snail
- Free swimming cercaria burrow into fish (intermediate host 2)
- Metacercariae ingested by human in undercooked fish
- Asian Liver fluke cannot spread in US because intermediate host (snail) is absent



Slide 17

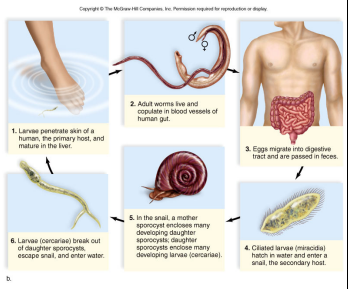
Schistosoma

- *Shistosoma sp.*
- Blood flukes
- Adults 15-20 mm
- Female inhabits groove in male
- Symptoms result from continually shed eggs lodging in host tissue
- Granulomas
  - Local damage to tissue caused by immune response
- 20 million severe infections
- 200,00 deaths annually
- Second only to malaria in socio-economic and public health importance

Slide 18

Transmission of Schistosoma

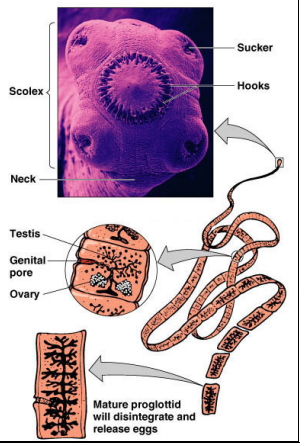
- Adult flukes lay eggs in human host
- Eggs in feces contaminate water
- Free swimming larvae hatch
- Larvae penetrate snail (intermediate host)
- Cercariae leave snail and penetrate human (definitive host) foot
- Adults mature in human intestinal blood vessels



Slide 19

Cestodes

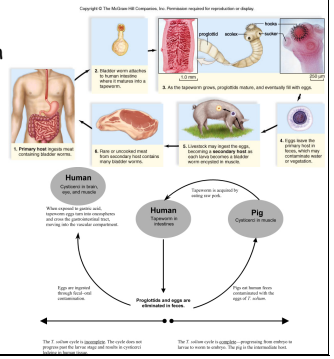
- Tapeworms
- Few mm to 20m
- Scolex hooks and suckers – attaches to intestinal musoca
- Lack digestive system – absorb nutrients digested by host
- Proglottids contain reproductive organs
- Egg cases shed in feces



Slide 20

Tapeworm Infections

- *Taenia solium* Pork Tapeworm
- Transmitted as larvae cysticerci in undercooked meat
- Cysticerci may develop in humans if eggs are consumed
- Diagnosed by observing proglottids and eggs in feces
- Treatment with praziquantel
- Neurocysticercosis may require surgery



Nematodes: Trichinella

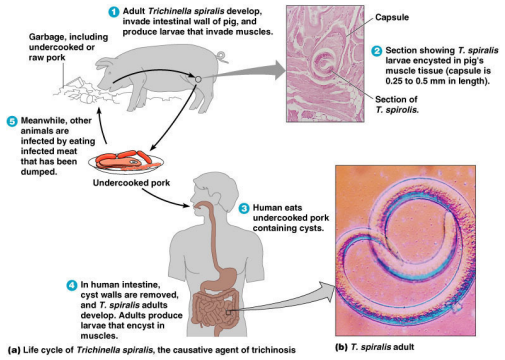
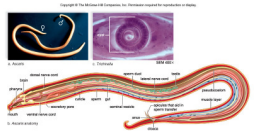


Figure 25.26

Ascariasis

- Ascaris lumbricoides
- One of the most common intestinal parasites of humans
- Males 15-30cm
- Females 20-50cm
- Capable of producing 200,000 eggs daily
- Fecal-oral transmission
- Eggs hatch in intestines
- Juvenile migrate to heart and lungs via blood vessels
- Larvae travel up trachea before being swallowed



Slide 23

Filarialiasis

- Filarial worm
- *Wuchereria bancrofti.*
- Restricted to tropical Africa
- Mosquitoes intermediate host
  - *Culex, Aedes, Anopheles*
- Transmitted to humans via bite
- Adults reside in lymphatic vessels
- Impede collection of fluid
- Swelling of limbs due to accumulation of fluid
- Elephantitis

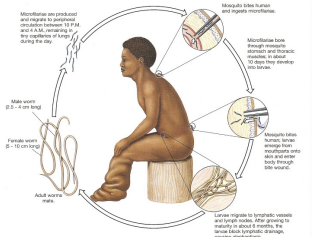


Figure 11.19 The life cycle of the roundworm Wuchereria bancrofti. This roundworm produces microfilariae and causes elephantiasis (a chronic edema; see Figure 23.4), especially of the legs and scrotum.

Slide 24

Guinea Worm

- *Dranunculus medinensis*
- Larvae ingested by copepods in freshwater
  - Develop into juveniles
- Copepod digested releasing living worm
  - Worm burrows through duodenum
  - Mate
  - Male dies
- Females mature
- 1 year growing to 50cm
- migrates to feet
- Sheds eggs into water

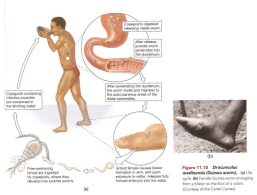


Figure 11.20 *Dracunculus medinensis* (Guinea worm). (a) Life cycle. (b) Female Guinea worm emerging from a blister on the foot of a victim. (Courtesy of the Carter Center)