Chapters 21-26: Selected Eukaryotic Pathogens

1. Protozoan Pathogens
2. Fungal Pathogens
3. Parasitic Helminths
1. Protozoan Pathogens
Malaria (pp. 696-8)

Caused by protozoa in the genus *Plasmodium*:

- non-motile, obligate parasite
- 4 main *Plasmodium* species cause malaria:
  - *P. vivax*
    - most *common* malaria pathogen
  - *P. falciparum*
    - most *deadly* malaria pathogen
  - *P. ovale* & *P. malariae*
    - cause milder form of malaria much like *P. vivax*
Transmission:

- vector transmission through the saliva of biting (female) mosquitoes (*Anopholes*)

Signs/Symptoms:

- *Plasmodium* life cycle involves infection and destruction of RBCs
- periodic fever, chills
- anemia can be severe
- tissue damage due to capillary blockage
Diagnosis:

• in most cases diagnosis is made through the microscopic examination of a blood smear

Treatment:

• quinine is the traditional medicine for malaria
  • causes death of merozoites in RBCs

• quinine derivatives chloroquine & mefloquine are more commonly used today

Prevention:

• elimination, avoidance of mosquito vectors
• an truly effective vaccine has yet to be produced
Trichomoniasis (pp. 802-3)

*Trichomonas vaginalis*, if present in the vagina, is usually kept in check by normal microbiota:

- disturbance of the normal microbiota and a rise in the normally acidic pH can result in overgrowth of this protozoan (trichomoniasis)

**SYMPTOMS & SIGNS:**
- greenish discharge, itching & irritation

**DIAGNOSIS:** microscopic

**TREATMENT:** metronidazole
(inhibits DNA synth. in anaerobes)
Trypanosome Pathogens

“Sleeping Sickness”  \( (Trypanosoma brucei, \text{ pp. 660-61}) \)

**TRANSMISSION:** tsetse fly (West & Central Africa)

**SYMPTOMS:** chancre at bite, fever, headaches, coma

- infection of CNS, can lead to death in weeks/months

**DIAGNOSIS:** serological

**TREATMENT:** eflornithine, eliminate vector
Toxoplasmosis (pp. 695-96)

Caused by the protozoan *Toxoplasma gondii*:

**TRANSMISSION:** contact with cats; undercooked meat

**SYMPTOMS:** fetal damage during pregnancy

**DIAGNOSIS:** serological

**TREATMENT:** pyrimethamine
Leishmaniasis (pp. 698-99)

Caused by protozoa in the genus *Leishmania*:

**TRANSMISSION:** sand flies (tropics, Mediterranean)

**SYMPTOMS:** chills, sweats, weakness; potential infection of visceral organs which can be fatal

**DIAGNOSIS:** microscopic

**TREATMENT:** miltefosine, antimony compounds, both with significant side effects
Other Protozoan Pathogens

**Giardiasis** (*Giardia lamblia*, pp. 771-2)

**TRANSMISSION:** fecally contaminated water
  * e.g., drinking unboiled water when hiking, camping

**SYMPTOMS:** diarrhea, flatulence lasting up to 6 weeks
  * adheres to intestinal wall, inhibits nutrient absorption

**Amoebic Dysentery** (*Entamoeba histolytica*, pp. 773-4)

**TRANSMISSION:** fecally contaminated water

**SYMPTOMS:** dysentery (diarrhea with blood, mucus)
  * feeding on intestinal wall, damage can be lethal

**TREATMENT:** both are treated with metronidazole
The Course of Amoebiasis

A. Amoebas pass through the stomach as cysts.

B. Amoebas emerge from cysts in the terminal small intestine.

C. Amoebas form deep ulcers.

D. Some amoebas pass into the bloodstream and infect other organs.

E. Perforation of the large intestine leads to infection of the peritoneal cavity.

F. Some amoebas form cysts and pass out of the body.

G. Cysts remain alive in the environment and are transmitted in food and water.

Key:
- **Cyst**
- **Trophozoite amoeba**
2. Fungal Pathogens
Candida albicans (pp. 801-2)

Can cause vaginal infections when the normal microbiota is disturbed by antibiotics, oral contraceptives, etc; “thrush” in oral cavity

SYMPTOMS & SIGNS:
irritation & itching along with discharge

• diagnosis is made by microscopic examination

TREATMENT:
topical miconazole, nystatin; oral ketoconazole (all target ergosterol)
Dermatomycoses  (pp. 629-31)

Fungal infections of the skin, hair or nails due to species of the Ascomycote genera *Epidermophyton*, *Trichophyton* and *Microsporum*:

- “ringworm” or “jock itch”
  - thought to be due to parasitic worms in the past

TRANSMISSION: fomites such as towels, combs, etc
  - require moisture to thrive

TREATMENT: topical agents that dry, acidify the body surface, miconazole, tolnaftate, griseofulvin administered orally (inhibits microtubules, mitosis)
3. Parasitic Helminths
Flatworm Pathogens

**Tapeworms** (*Cestodes*, pg. 774-6)

**TRANSMISSION:** larvae in contaminated meat or fish
- inadequate cooking leads to infection

**SYMPTOMS & SIGNS:** minimal if present at all, little harm to the host beyond lost nutrients

**TREATMENT:** **niclosamide** (inhibits ATP production) and **praziquantel** (paralysis of flatworms)

**Schistosomiasis** (*blood fluke*, pg. 701)

**TRANSMISSION:** waterborne larvae penetrate skin
- feeds on blood in liver causing fever, abdominal sym.

**TREATMENT:** **praziquantel**
Roundworm Pathogens

Trichinellosis (*Trichinella spiralis*, pg. 776-8)

**TRANSMISSION:** eating contaminated pork or wild game (common in animals fed “garbage”)

- inadequate cooking of meat leads to infection
- prolonged freezing of meat can kill the nematode
- larvae can encyst in muscle tissue for years

**SYMPTOMS & SIGNS:** if present can include fever, gastrointestinal symptoms, swelling around the eyes

**TREATMENT:** mebendazole (blocks glucose uptake by worms) & corticosteroids (reduces inflammation)
Life Cycle of *Trichinella spiralis*

1. *Trichinella spiralis* adults develop, invade intestinal wall of pig, and produce larvae that invade muscles.

2. Section showing *T. spiralis* larvae encysted in pig's muscle tissue.

5. Meanwhile, other animals are infected by eating infected meat that has been dumped.

Undercooked pork

3. Human eats undercooked pork containing cysts.

4. In human intestine, cyst walls are removed, and *T. spiralis* adults develop. Adults produce larvae that encyst in muscles.

(a) Life cycle of *Trichinella spiralis*, the causative agent of trichinellosis

(b) *T. spiralis* adult

**Life Cycle of *Trichinella spiralis***
Filariasis (aka “elephantiasis”) (Wuchereria bancrofti, pg. 468)

TRANSMISSION: larvae transferred by mosquitoes

• live for years in lymphatic vessels, lymph nodes causing inflammation & severe damage to tissues

SYMPTOMS & SIGNS: lymphatic damage causes lymphedema, the gross swelling of lymphatic tissues

TREATMENT: ivermectin (induces paralysis of larvae) & albendazole (inhibits microtubule formation, mitosis)
Key Terms for Eukaryotic Pathogens
(Chapters 21-26)

• lymphedema
• dysentery
• dermatomycoses