Micro Exam #4 Review

* Ciliophora aka ciliates
  + Their motility/movement is done through cilia (organ of motility)
  + They receive nutrition by permeation or through ingestion by gullet
    - Food enters the cytosome (mouth of ciliate) where it is then turned into a food vacuole which is then dissolved by enzymes
  + They can live in a high salt environment b/c they have a contractile vacuole
    - The contractile vacuole regulates cell fluids
  + Ciliophora reproduce through binary fission (asexual) but they are also the most primitive eukaryote showing sexual characteristics through sharing of nuclei
    - They undergo conjugation which is the exchange of genetic information b/w 2 organisms
    - Once the genetic information is shared through conjugation the bacteria then asexually reproduce through binary fission
  + Balantidium Coli
    - This can be deadly to children/infants
    - It is the only ciliate that parasitizes humans
    - It causes dysentery
    - Diagnosis is done by finding cysts, pseudocysts, or trophozoites in feces
    - Treatment is done with metronidazole or tetracycline
* Apicomplexa
  + They were earlier known as sporozoan
  + They are immobile as adults and form many spore-like structures
  + These parasites have a sexual cycle with distinct male and female gametes
  + Apicomplexa usually have a complex life cycle and are usually found in the lymph and blood
  + Enzymes present in groups (complexes) of organelles at the tips (apices) of their cells digest their way into host cells, giving the group the name Apicomplexa
* Apicomplexan Parasites
  + Plasmodium: Malaria Mal=Bad and aria= air so it means bad air
    - Plasmodium which is the Malaria parasite is one of the most severe parasitic diseases. It is also an amoeboid intracellular parasite.
    - It is endemic in tropical areas and causes very heavy economic loss
    - Malaria causes about 500,000,000 cases a year and about 3 million deaths per year in the world
    - Quinine (a cinchona bark product) is the treatment and prevention for infection, but resistant strains are rapidly developing
    - US army personnel, Immigrants or blood transfusion are the main ways infection occurs in the united states
    - People who have the sickle cell gene for example, west African blacks and many African Americans are protected from malaria because plasmodium cannot grow in sickled cells and the spleen destroys these cells
    - Ross received the Nobel prize in1902 for his work on malaria
    - Disease symptoms are closely related to the plasmodial life cycle
      * High fever and chills and sweats (hyperhydrosis) are caused by the rupture of Erythrocytes (RBC’s)
      * Asynchrony is now established with a 48-72 hour cycle of fever and chills as merozoites form and rupture RBC’s and re-infect.
    - Malaria has a complex life cycle involving humans and female anopheles mosquito
    - Plasmodium itself begins its life cycle in an infected human then it starts to mature in the female anopheles mosquito and later fully matures (causing infection) in a human host once again.
      * Plasmodium enters its sexual reproductive phase in an infected human and produces male or female (indistinguishable) gametocytes. When a mosquito takes a blood meal from an infected human, it also takes in the gametocytes which become ookinetes in the mosquito. The ookinetes are zygotes that penetrate the visceral side of the mosquito gut. Once they have penetrated the stomach wall the ookinetes become sporozoites which then travel to the mosquito’s salivary gland.
      * The parasites, which are present as sporozoites in the salivary glands of an infected mosquito are transmitted to humans through the mosquito’s bite at this point the sporozoites go from the mosquito’s saliva to being blood born b/c the sporozoites have entered the human blood stream.
      * The sporozoites now migrate to/attack the liver where they become merozoites. This part of the plasmodial life cycle in liver cells is called pre-erythrocytic schizogony
      * After about 10 days the merozoites emerge into the blood and invade red blood cells (RBC’s) where they now become trophozoites. The trophozoites reproduce asexually, producing many more merozoites which are released into the blood by rupture of red blood cells. The RBC’s rupturing is what causes disease symptoms.
        + This part of the plasmodial life cycle in the RBC’s/Erythrocytes is known as Erythrocytic Schizogony
    - P. Falciprum
      * This is the most deadly malarial strain
      * It agglutinates (clumping) blood cells causing blood vessel blockage which leads to ischemia
      * It is also causes black water fever which is fatal
        + Black water fever produces tarry black urine due to the breakdown of hemoglobin
        + It also causes jaundice and kidney damage
  + Toxoplasmosis
    - The species is Toxoplasma Gondii and it invades many warm blooded animals
    - Humans usually become infected through contact with the oocysts in the feces and urine of domestic cats
      * It can also be transmitted through cows, sheep, and birds
    - Toxoplasmosis is also congenitally transmitted from the mother to the baby through the placenta. The severity of the infection to the fetus depends on the tox factor which is the factor for determining congenital defects (birth defects). A very high tox factor arrests embryonic development
      * Infection in the fetus can lead to death , brain damage, blindness (retinchoroiditis) , and mental retardation due to destruction by feeding trophozoites
      * It can also lead to an abnormally small head, disorders of movement, still birth, spontaneous abortion, encephalitis, accumulation of CSF and skin problems
    - Most symptoms are age dependent and are typhoid like causing fever and weakness
    - Today toxoplasmosis is a major problem with AIDS patients causing anemia and jaundice in them
    - Toxoplasma is also linked to schizophrenia, over 50% of schizophrenics and their mothers test positive for toxoplasmosis
    - Diagnosis is done in a few ways, either by finding parasite in the blood or CSF, or Immunofluorescence, or Sabin Feldman Dye Test
    - Treatment is done with Pyrimethamine and Trisulfapyridine
    - Prevention is accomplished by having pregnant women avoid contact with raw meat or cat feces because the oocysts become sporocysts which become airborne and inhaled.
    - The life cycle of Toxoplasma has 3 types of life stages trophozoites in blood, tissue cysts in beef tissue, and sporocysts/oocysts in cat urine and feces. Toxoplasma undergoes sexual reproduction only in cats. The life cycle begins in two ways leading to 2 infection routes.
      * The first is by having a cat consume raw meat or contaminated soil where the parasite now undergoes sexual reproduction and oocysts are formed.
        + Now oocysts in cat urine and feces further mature into sporocysts in a litter box, sandbox, or soil.
        + Next a pregnant women is exposed to sporocysts and becomes infected leading to infection in the fetus b/c Toxoplasma crosses the placenta. This leads to either death or congenital defect in the newborn depending on the tox factor.
      * The second way is that infected raw meat, rodents, birds, and contaminated soil contain Toxoplasma trophozoites and or cysts. This route affects humans and cats directly. In cats the parasite undergoes sexual reproduction then goes on to infect humans.
        + In humans this route can cause severe CNS damage or seizures, or death in immunocompromised patients (AIDS)
        + It also can infect pregnant women leading to fetal issues death or defects.
  + Babesiosis
    - The species is Babesia Bigemina
      * This Babesiosis affects cattle and is transmitted by ticks
    - B. Microti
      * This species causes Babesiosis infections in humans
      * It is transmitted by bites from infected ticks where once the parasite is in the blood stream it invades and multiplies in red blood cells
      * Symptoms usually begin with sudden high fever, headache, and muscle pain
      * Anemia and Jaundice can occur as red blood cells are destroyed
      * In a splenectomized (spleen removed) patient Babesiosis is deadly
      * Diagnosis is made from blood smears
      * Treatment is Chloroquinine and the best prevention is to prevent tick bite
  + Cryptosporidium- Cryptosporidiosis
    - The species is C. Parvum is an encysted parasite meaning its life cycle is in a cyst until it bursts to infect a human host
    - It is water born and in 1993 in Milwaukee C. Parvum infected and made 400,000 people sick
    - Symptoms are watery stools/diarrhea, dehydration and may lose 17 liters of fluid with up 20 bowel movements per day
    - It is deadly in immunocompromised patients mainly AIDS patients
    - There is no good treatment
  + Cyclospora Cayentanensis
    - It was 1st recognized in 1996 and is carried by infected Guatemalan raspberries
    - It is transmitted through oral-fecal route and causes flulike symptoms, watery diarrhea, anorexia, and abdominal pain
* Fungi: Is a kingdom of biology and is a biological system
  + Mycology: is the study of fungi
  + Mycoses: are fungal diseases
  + The body of a fungus is called a thallus and the thallus of most multicellular fungi consist of a mycelium a filamentous tube like structure, and a loosely organized mass of threadlike structures called hyphae
  + Hyphal cells of most fungi have one or two nuclei and can be either septate or coenocytic
  + Some fungi exhibit dimorphism (ability to alter structure depending on environment) and a haplontic life cycle (haploid)
  + Sexual reproduction occurs in several ways, in one way haploid gametes unite, and their cytoplasm fuse in a process called plasmogamy, however if the nuclei fail to unite a dikaryotic cell is formed. Eventually the nuclei fuse in a process called karyogamy which produces a zygote
  + There are 3 major groups of fungi based on morphology
    - Molds: filamentous hyphae multicellular
    - Yeasts: unicellular with blastospores (buds)
    - Mushrooms: multicellular and 3 dimensional
  + There are 4 major phylums or classes of fungi
    - Zygomycota aka Phycomycota/phycomycetes
    - Ascomycota aka Ascomycetes (Ascospores produced)
    - Basidiomycota aka Basidiomycetes (basidiospores formed)
    - Deuteromycota aka Deuteromycetes/Fungi Imperfecti
  + There are many different types of spores produced by various fungi
    - Arthrospores (Arthroconidium), Blastospores (B-Conidia), Chlamydospores (Chlamydoconidium), Conidiospores all of these are produced asexually
    - Sporangiospores, Ascospores, Basidiospores are produced sexually
  + Some important differences between fungi and bacteria

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| Property | Fungi | Bacteria |
| Cell structure | Eukaryotic | Prokaryotic |
| Diameter of representative species | >5 um | < 2 um |
| Cell wall composition | Contains chitin, mannan, and other polysaccharides | Contains murein |
| Cytoplasmic membranes | Sterols present | Lack sterols (except for Mycoplasmae) |
| Cytoplasmic contents | Includes mitochondria, endoplasmic reticulum, Cytoplasmic streaming | Lack mitochondria, endoplasmic reticulum, no Cytoplasmic streaming |
| Nucleus | True nucleus with nuclear membrane: chromosomes in pairs | Nuclear body equivalent to a single chromosome, without nuclear membrane |
| Mode of reproduction | Either sexual or asexual, with spore formation | Binary Fission |

Laboratory procedures Used to Identify Fungi of Medical Importance

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| Procedure | Advantage |
| Wet mount of tissue or mucus-containing specimens in 10% KOH | Strong alkali degrades tissue and mucus and permits visualization of fungi |
| Wet mount of portions teased from fungal colonies and mounted in lactophenol blue | Permits observation of fungal morphology and presence of spores |
| Fixed slides stained with periodic-acid-Schiff (PAS) or methenamine silver stains | Both PAS and silver stain fungal cell walls to give good contrast with background in tissue sections or other clinical materials |
| Sabouraud’s glucose agar for culture; incubation at room temperature (RT) for up to 6 weeks, or at 37˚C for days | Low pH of the medium and RT incubation favor growth of fungi over bacteria, antibiotics may also be added to discourage bacterial growth |

Asexual Spores

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| Spore Type | Site and Type of Formation | Single or multicellular | Shape | Resistance to Environment | Example of Genera |
| Arthroconidium  (arthrospore) | Fragmentation of hyphae  Asexual | Single | Cylindrical to round | Usually none | Coccidoide  Geotrichum  Trichophyton |
| Blastoconidium  (blastospores) (buds) | Formed on main cell  Asexual | Single  Buds on yeast cell | Round to oval | Usually none | Candida  Saccharomyces |
| Chlamydoconidium  (Chlamydospore) | Enlargement of terminal Hyphal cells  Asexual | Singe  Buds on yeast cell | Considerable variation but usually round | thick-walled cells show unusual resistance to drying and heat | Candida  Mucor |
| Conidium  Conidiospores columella | Borne on specialized Hyphal branches, conidiophores  Formed in linear order | Single are Microconidia and multicellular are  Macroconidia | Round to oval microconidia  And  Long and Tapering  Macroconidia | Usually none in microconidia  None in Macroconidia either | Aspergillus  Cephalosporium  Penicillium  Alternaria  Microsporum  Trichophyton |
| Phialospore (modified Conidium) | Borne on specialized Hyphal branches, conidiophores phialides | Single | Round to oval | None | Phialophora |
| Sporangiospore  (sexual) | Formed with sacs, sporangia at end of Hyphal cells | Single | Round | None | Absidia  Mucor, Rhizopus |
| Zoospore | Formed within sacs, sporangia, at end of Hyphal branches | Single, Flagellated | Round | None | Saprolegnia |

Properties of Fungi Based on Sexual spore formation

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| Phylum | Common Name | Characteristics | Examples |
| Zygomycota | Bread molds  Sporangiospores | Display Conjugation, sporangiospores are both sexual and asexual | Rhizopus and other bread molds |
| Ascomycota | Sac fungi  Ascospores | Produce asci and acospores during sexual reproduction | Neurospora, Penicillium, Saccharomyces, and other yeasts; Candida, Trichophyton, and several other human pathogens |
| Basidiomycota | Club fungi  Basidiospores | Produce basidia and basidiospores, are special sex spores | Amanita and other mushrooms; Claviceps (which produces ergot); Cryptococcus (Filobasidiella) |
| Deuteromycota | Fungi Imperfecti  No sexual spores | Sexual stage nonexistent or unknown | Soil organisms; various human pathogens |

Fungi Associated with Respiratory Disease

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| Respiratory Disease | Fungus Species | Possible Treatment |
| Aspergillosis, Asthma, Bronchiectasis, rhinitis | Aspergillus fumigatus | Amphotericin “B”, Ketoconazole |
| Bronchopulmonary candidiasis | Candida Albicans | Amphotericin “B”,  flucytosine |
| Chronic pneumonitis | Filobasidiella Neoformans | Amphotericin “B”,  Flucytosine |
| Coccidiomycosis  aka San JoaquinValley fever | Coccidioides Immitis | For disseminated form Amphotericin “B” |
| Geotrichosis | Geotrichum candidum | Potassium iodide (orally),  Sodium Iodide (intravenously) |
| Histoplasmosis  aka Darling’s Disease | Histoplasma capsulatum | Amphotericin “B”,  Surgical removal of oral lesions |
| North American Blastomycosis (Gilchrist’s Disease) | Blastomyces dermatidis | Amphotericin “B”,  Hydroxystilbamidine,  Surgical procedures together w/ chemotherapy |
| Sporotrichosis of the lungs (rare) | Sporotrichum schenckii | Amphotericin “B”, |

* AIDS associated Pneumonia
  + Pneumocystis Jeroveci which was earlier known as Pneumocystis Carinii
* Clinical Aspects of Fungi
  + Thymus gland
    - Gives immunity through thymosin hormone which is responsible for T-cell maturation.
    - Thymus gland function decreases with age
  + Mycoses: Fungal Diseases
    - Predisposing factors are extensive chemotherapy (particularly the use of immunosuppressive drugs), damage to cell mediated immunity, very young or very old, cancer and cancer treatment, obesity, pregnancy, most infections are opportunistic (Candida is a good example)
    - Antifungal drugs are most often used to treat mycoses and grisefulvin is the backbone of treating fungal infections
      * Grisefulvin is the same organism that produces penicillin
  + Superficial Infections
    - These affect skin, hair, nails, and mucous membranes
    - Infections are called a Dermatophytoses/Dermatomycoses
    - Causative organisms are Tineas or ringworms, T. Corporis (body), T. Cruris (Groin or jock itch), T. Ungium (Nails), T. Capitis (Scalp), T. Barbae (Beard), T. Manuum (Hands), T. Pedis (Feet), T. Nigra (Palm and Sole), T. Versicolor (Branny scaling of skin on face), Black Piedra (P. Hortae), White Piedra (Trichosporon Cutaneum)
  + Intermediate Mycoses
    - These affect subcutaneous tissue, deeper than superficial but not as deep as deep seated mycoses.
    - All intermediate mycoses causing agents can cause superficial mycoses as well
    - Sporothrix Schenkii
      * Lesion first appears as a nodular mass at the site of a minor wound
      * Then causes a chronic granulomatous pus fill lesion and sometimes it disseminated to lungs and other organs. People who work with plants or soil should cover wounds to prevent infection
      * Is common in Midwestern united states especially Mississippi valley
      * Cutaneous and lymphatic forms can be treated w/ Potassium Iodide
      * Disseminated infections are Treated with Amphotericin B
    - Blastomyces Dermatidis: Blastomycosis
      * Same symptoms and treatment as Sporothrix Schenkii listed above
      * Enters body through the lungs through direct inhalation of spores or wounds
    - Candida Albicans
      * This is a major opportunistic agent and some strains of candida can be sexually transmitted
      * Cannery workers whose hands are in water for longs periods sometimes develop skin and nail lesions
      * The only prevention is to prevent debilitating conditions
      * Candidiasis is the most common nosocomial fungal infection, it is seen in patients with diseases such as tuberculosis, leukemia, and AIDS
      * It can cause infections that range from trivial to deadly
        + Trivial infections are oral thrush, perleche (corner of the mouth candidiasis), moniliasis, vaginitis (high sugar, oral contraceptives), Nails
        + Deadly or more serious candidiasis involves lungs, kidneys, blood, heart, brain(tumor)
      * Diagnosis is made by finding budding cells in skin lesions, sputum or exudates also confirm diagnosis
    - Aspergillus Fumigatus: causes Aspergillosis
      * It initially invades wounds, burns, the cornea, or external ear, where it thrives in earwax and can ulcerate the ear drum
      * Diagnosis is made by finding characteristic Hyphal fragments in tissue biopsies
      * This is a more serious infection and is known as farmers lung, it can cause a fungus ball (aspergilloma) which causes death by asphyxiation
      * Exposure is usually inevitable so prevention mainly depends on host defenses.
    - Zygomycoses
      * Caused by Rhizopus (bread molds) and is difficult to treat
      * It is especially dangerous to people with untreated diabetes (diabetes mellitus)
      * It invades lungs, CNS, eye and can be rapidly fatal
    - Madura Foot: Allescheria boydii
      * The maduromycosis (Madura foot) is caused by the fungus madurella but some bacteria like nocardia actinomyces and streptomyces are involved in infection
      * Infection may cause the need for amputation because if untreated organisms invade muscle and bone
  + Deep Seated Mycoses
    - These infections involve blood, brain, and protected organs
    - Amphotericin “B” is a life saving drug for deep seated mycoses
    - Coccidioides Immitis
      * It is known as San Joaquin Valley Fever
      * It is transmitted through dust particles laden with fungal spores
      * It is always infectious and out of 90% of people exposed fewer than 1% have infection disseminate to lung, meninges, and bones
      * Infection is more common in blacks than whites
      * infection is usually self limiting and the best treatment is Amphotericin “B”
    - Histoplasmosis
      * Caused by the species Histoplasma Capsulatum and is also known as Darling’s Disease
      * It is a dimorphic fungi b/c it changes depending on environment.
        + In humans it is in the yeast form but outside a host it can grow as a mold
      * This is most common in the Mississippi and Ohio valley, and more particularly sources of infection are chicken houses and caves which contain bat guano
      * Infection shows granulomatous lesions in lungs and disseminated to other areas of the body, and patients often have tuberculosis (TB) at the same time
      * Amphotericin “B” is the most effective treatment
    - Pneumocystis Jiroveci
      * It was earlier known as P, Carinii
      * Causes opportunistic pneumonia in AIDS patients
      * It is the secondary infection that kills more AIDS patients than any other
      * It can cause a extrapulmonary condition
      * Combination therapy with Trimethoprim and Sulfamethoxazole or Pentamidine is required to treat infection
    - Cryptococcosis
      * This is caused by Filobasidiella Neoformans and was previously known as C. Neoformans
      * Infection invades meninges and brain
      * It is carried by birds and there is increasing incidence in AIDS patients
      * Amphotericin “B” treats infection
* Poisonous Mushrooms
  + Toxins are Ergotamine and Aflatoxins
  + Basidiomycota are mushrooms that bear special sex spores known as basidiospores

Nematodes- Smart Parasites

* Round worms
  + Round tapering, elongated with no appendages
  + Thick undigestible covering
  + Multiplies in massive numbers, but most die and few survive. This can cause serious (sometimes deadly) disease.
  + Round worms are often ingested with food and sometimes they penetrate the host.
  + Both adults and larval forms are capable of serious diseases.
  + Adults as disease agents-often ingested with food
    - Trichnella Spiralis-Trichinosis-tricina worm
      * Almost all adults have antibodies. They enter as ingested larvae in poorly cooked pork and also some game animals’ meat and in horse meat in France.
      * In the GI tract larva develops into adults then mate and male dies. Female prodes (has more larva?) then dies. The larvae migrate through the blood and lymph vessels to the liver, heart, lungs and other tissues. They form cysts in eye, tongue, and diaphragm, and remain alive for years causing tissue damage. Depending on the location they cause diarrhea, muscular pain, nervous disorders, eosinophilia, and respiratory complications and death can occur.
    - Ascaris Lumbricoides: Ascariasis
      * Food and water infected with eggs
      * Larvae penetrate intestinal wall and get into blood and lymph. They move through the lungs to end up in GI tract.
      * Can cause 1) ascaris pneumonitis, 2) malnutrition, intestinal blockage constipation and perforation (peritonitis following perforations is fatal), and 3) wandering larvae cause abscesses in liver and other organs.
      * Dracunculus Medinensis
    - Entrobius Vermicularis-Pinworm infections, oxyuriasis
      * Humans are the only known hosts.
      * More than 200 million world wide cases and about 18 million in the USA.
      * Attached to the large intestines. At night the female adults laden with eggs migrate out of anus to lay eggs and return to large intestines (retrofection). The eggs are then transmitted by bed sheets, clothes, finger nails (from scratching your ass in your sleep) and inhalation of airborne eggs. Causes itching in mouth and esophagus.
      * Scotch tape test. Do I need to explain? Ok put some scotch tape by your anus hole at night and wait. You should see your ass buddies in the morning hanging out on the tape. Pets?
      * Treatment is piperazine- can cause convulsions in children
    - Ancylostoma Doudenale-Old World Hookworm
      * Ground itch (bacterial infection of penetration site)
      * Eggs are released in feces in soil and mature there. They burrow through feet and legs and become blood borne. They migrate to the heart and respiratory system (lungs). Coughed up and swallowed in to stomach and then to GI tract, where larvae mature in to adults.
      * Damage is done in the lungs and lining of the small intestines causing debilitating abdominal pain. Patients are lazy (weakness and fatigue).
    - Nector Americanus-New World Hookworm
      * Similar to Ancylostoma Doudenale
      * Cutaneous larva migrans (creeping eruptions) of the skin-caused by A. Canium, a dog hookworm.
      * Treatment is Thiabendazole
* Larvae as disease agents-these often have mosquitoes as host and vectors
  + - Filiria-Filiriasis-Wuchereria Bancrofti, Brugia Malayi
      * 100 million cases in the world
      * Adult worms grow in lymphatics and block them causing inflammation, fever, etc.
      * During the day they are in deep vessels and during the night they migrate to the peripheral blood vessels.
      * Culex, aedes and anopheles (mosquitoes) serve as alternate hosts.
      * Elephantiasis can result if left untreated.
      * Treated with diethylcarbomiazine and metronidazole
      * Use bandages to prevent massive swelling.
    - Loa Loa
    - Onchocerca Vulvulus-River blindness (Volvulus is how it is spelled everywhere else)
      * Transmitted by the black fly.
      * When they die the can cause tissue damage (eye).
      * Treatment to kill the parasite causes more complications (Ivermectin)
      * Causes heartworms infections in animals
    - Dracunculus Medinensis-Guinea Worms
      * Transmitted by fleas from dogs, cats and several wild animals.
      * Blisters form then erupt and nasty worms emerge. This takes 30-100 days.
      * Crippling joints.
    - Trichuris Trichura-Whipworm
      * Transmitted by human feces and children’s dirty hands
      * Treatment Mebendazole- can cause fetus damage if given to pregnant women
    - Strongyloides Stercolis-Thread worms
      * Parthenogenesis-production of eggs w/o fertilization - no males identified.

**Life Cycle of Trichinella Spiralis-Trichinosis**

Pig eats garbage with bug in it. This little piggy goes to the market and is served to you a little pink inside. Little do you know there is an encysted worm lurking in the pink of your meat. You eat it because you were stupid and didn’t send it back to be cooked more. You ingest little cyst and it and the pork travel through the GI tract. Your stomach dissolves cyst cover and releases the worm. Worms get a room and make babies called larvae. Larvae are released by females into lacteals and vessels. Larvae then find a good spot to make there new home in your muscle and then they encyst. Unless you are sent to the market you will not end up on someone’s plate!

**Life Cycle of the roundworm Wuchereria bancrofti**

A mosquito bites your friend who has roundworm. The mosquito ingests the microfilariae. The mosquito flies around living its live for lets say 10 days. In those 10 days the microfilariae travel through the stomach and thoracic muscles of the mosquito and develop into larvae. When you are sitting on a log watching the sunset in the west minding your own business a mosquito bites you. The larvae now emerge through the mosquito’s mouth and onto your skin. Then the sneaky little things enter the wound left by the mosquito and migrate to lymphatic vessels. I know your wondering, how do they know which rode to take to get to the lymphatic vessels…I don’t know either. So you’re hanging out for 6 months while these larvae are growing to maturity and block up your lymphatic drainage causing elephantiasis. The adult worms find a little romantic place to foul around and one thing leads to another and have little bebies (Professor Guy would say it this way) called microfilariae. These migrate to peripheral circulation between 10pm and 4pm and hide out in the capillaries of the lungs during the day.

**The Life Cycle of Dracunculus Medinensis- Guinea worm**

These little buggers like to swim around in the warm African, Asian and S. American water. They are swimming in their larvae state when a nice copepod gets hungry and eats the larvae. The larvae then mature to a juvenile worm. When some unexpecting person like you drinks the water out of the river and gets a few copepods in there too. The copepods are then ingested and then digested this releases visible worms. The worms find the nearest duodenum to penetrate and molts. It then heads to the subcutaneous areas where it wants to make your life a living HELL (usually in the distal limbs). Gravid (pregnant) females causes blister formation in the skin. They wait there until its time for another drink or you go for a swim. The worms release fully formed embryos into the water.

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| **Organism** | **Disease** | **Host Range** | **Location of Adult Forms in body** | **Geographical Distribution** | **Possible Treatment** |
| Ancylostoma duodenale | Old World hookworm | Primarily Humans | Duodenum and jejunum | Chiefly Africa, Europe, the Orient | Bephenium hydroxymaphthoate |
| Ascaris lumbricoides | Ascariasis | Humans, other vertebrates | Small intestine | Worldwide | Thiabendazole, piperazine compounds |
| Brugia Malayi  *Insects transmit Aedes, culex, & anophlene (mosquitoes) Scrotal Sac* | Malayan filariasis | Humans, other primates, cats | Lymphatics | Far East | Microfilmariae: diethylcarbamazine (hetrazan), piperazine  Adult worms: Suramine alone or with Hetrazan. Surgery & related procedures Corticosteroids |
| Dracunculus medinensis | Dracunculiasis guinea worm | Humans, dogs, cats, several wild animals | Skin, CT | Certain areas of Africa & Asia, rarely in S. America | Nitrothiazole, appropriate antibiotics for 2nd infection |
| Enterobius vermicularis | Enterobiasis, oxyuriasis (pin- or seatworm) | Humans, especially children | Large quantities in cecum and appendix. Females especially in rectum | Widespread | Warm tap H20, enemas, piperazine, Pyrvinium Pamoate (Povan), Thiabendazole |
| Loa Loa | Loiasis or eye worm | Humans, monkeys | CT, eyes | Central & West Africa | diethylcarbamazine |
| Necator americanus | New World or American hookworm | Humans | Small intestine | Generally S. US, Central & S. America | Tetrachloroethylene |
| Onchocerca volvulus | Onchocerciasis | Humans | Skin, subcutaneous CT, eyes | Africa, tropical America | Combo of diethylcarbamazine & Suramine |
| Strongyloides stercoarlis | Strongyloidiasis | Humans, dogs, cats | Intestinal mucosa, lungs | Worldwide, but more commonly in tropical areas | Thiabendazole |
| Trichinella spiralis | Trichinosis | Humans, rats, rabbits, dogs, wolves | Small intestine | Worldwide, but more common in areas where pork is eaten | Thiabendazole (for larvae migration) Corticosteroids |
| Trichuris trichiura | Whipworm | Humans | Caecum | Worldwide | Thiabendazole |
| Wuchereria bancrofti | Brancoft’s filariasis (elephantiasis) | Humans | lymphatics | Australia, E. Europe, Near East, Orient, Central & South America, Mediterranean & Central Africa | Corticosteroids |