Study Guide (revised)
EEB 4274- Exam I (Fall, 2011)

Note: In addition to the topics outlined below, for each species we have treated in detail, be able to identify the life-cycle stage infective to each host as well as whether a species represents a zoonotic infection in humans, and the disease (if any) caused by the species in its host(s).

Introduction to parasitism: features of parasitism; types of symbiosis and how parasitism differs from mutualism & commensalism; definition of a parasite; definition of parasitism; terminology associated with types of parasites: i.e., ectoparasite, endoparasite, mesoparasite, hyperparasite, etc., facultative vs. obligate parasite, etc.; differences between a parasite and a parasitoid; terminology associated with categories of hosts: i.e., definitive host, intermediate host, paratenic host, reservoir host, etc.; understand concepts of: zoonosis, etiological agent, epidemiology, prevalence and intensity of infection, pathogen, pathogenicity, monoxenous, heteroxenous, epidemiology, etiological agent, epidemic, pandemic, epizootic.

Introduction to parasitic protozoa: general features of parasitic protozoans (single celled, increase rapidly within host, etc.); 2 groups based on site in host, etc.

Phylum Retortamonada: general features; typical life-cycle including association with host/s of each life-cycle stage; Order Diplomonadida: general features; diversity of *Giardia* spp., *Giardia duodenalis*: morphology, life-cycle, host(s), reservoirs, site in host, disease caused and 3 sources of pathogenicity, diagnosis of infection, symptoms, treatment.

Phylum Chromista: general features of *Opalina*: life-cycle, hosts, site in host, pathogenicity(?)

Phylum Ciliophora: general and unique features (macro and micronuclei, etc.), mode of locomotion; *Balantidium coli*: morphology, life-cycle, host(s), site occupied within host (1º & 2º infection), disease caused and its pathogenicity, diagnosis of infection, treatment; *Ichthyopthirius multifilis*: morphology, life-cycle, host(s), site occupied within host, disease caused, pathogenicity, diagnosis of infection, treatment.

Phylum "Rhizopoda": general features, mode of locomotion, general life-cycle; characteristics useful for distinguishing among species- why it is particularly important to do so in this "phylum"; treatment; is phylum monophyletic? **Class "Lobosea"**: 6 species (in 3 genera) in humans and whether they are pathogenic or not (i.e. parasitic or commensal); *Entamoeba histolytica*- morphology of trophozoite and cyst, life-cycle, host(s), site occupied within host (1º & 2º infection), disease caused, pathogenicity, diagnosis of infection (1º & 2º infection), treatment; for other species in humans: morphology/distinguishing characteristics, pathogenicity (if any); site in host, diagnosis. **Class "Heterolobosea"**: general features; *Naegleria fowleri*: morphology, life-cycle and how human infection is acquired, host(s), site occupied within host, disease caused, pathogenicity, diagnosis of infection, treatment(?); obligate or facultative parasite? Member of other class: *Acanthamoeba polyphaga*: possible sources of infection, site occupied within host; pathogenicity.

Phylum Parabasalia: general features. **Order Trichomonadida**: general features (undulating membrane, costa, axostyle, etc); know the 4 species in humans (i.e., including *Dientamoeba fragilis*), their morphology, life-cycle, site occupied in host, transmission, disease caused (if any) and pathogenicity (if any), diagnosis, treatment (if necessary); know 1 species that is pathogenic in cattle: morphology, life-cycle, site occupied in host, disease caused, pathogenicity, diagnosis, treatment, problems with cryopreservation and transmission of trophozoites.

Phylum Microsporidia: general features, site and types of hosts (entire phylum parasitic); *Nosema apis*: morphology, hosts, stage infective to host, site occupied within host, disease caused, pathogenicity, diagnosis of infection.

Phylum Euglenozoa-**Class Kinetoplasta**: general features, kinetosome vs. kinetoplast. What are they? **Order Trypanosomatida**: 4 major body forms (amastigote, promastigote, etc.) be able to illustrate and label parts of each (kinetoplast, flagellum, free flagellum, undulating membrane, nucleus, etc.), know which form(s) is/are found in which trypanosome species (and subspecies if relevant); *Trypanosoma*- named for which body form? Distinguish between anterior and posterior station species (what are the criteria? examples of each); *Trypanosoma brucei* complex: names of 3 subspecies, life-cycle, body forms, hosts (intermediate, definitive and reservoir), site occupied within hosts, disease caused, pathogenicity, diagnosis of infection, treatment and approximate geography of each. Be able to illustrate the life-cycle of *T. b. rhodesiense*. Control of trypanosomes: problems with vaccine development (i.e., describe VAT system), drugs, eliminate flies, eliminate reservoirs, etc. *Trypanosoma cruzi*- morphology, life-cycle, hosts (intermediate, definitive and reservoir), site occupied within hosts, disease caused, pathogenicity (acute and chronic phases of Chagas' disease), diagnosis of infection, treatment (explanation for why treatment is difficult), geography. *Leishmania*- (trypomastigotes lacking), general life-cycle and host associations of Old vs. New World

species. Be able to illustrate life-cycle of *L. tropica*; for each of 5 species important to humans know: hosts (intermediate, definitive and reservoir), site(s) occupied within hosts, disease caused, pathogenicity (including post kala-azar for *L. donovani*), diagnosis of infection, approximate geography of each; treatment of *Leishmania* infections, new developments using drugs bound to foreign particles, etc.

Phylum Apicomplexa: general features, understand and be able to illustrate organelles of apical complex. Know 3 distinct reproductive processes found among apicomplexans (i.e., merogony/schizogony, sporogony, gametogony), which represent sexual and which represent asexual modes of reproduction? beginning stages and products of each process; understand how 3 processes relate to one another in a typical generalized life-cycle (illustrate).

Class Aconoidasida- general features; **Order Haemosporida**- general features, including hosts and sites in which 3 reproductive processes occur; *Plasmodium*- general features, 4 species of importance to humans and the % of malaria cases globally for which each is responsible, generalizations about life-cycles and hosts, mosquito (*Anopheles*) as intermediate vs. definitive host; life-cycle of *Plasmodium vivax*, be able to illustrate; describe fact that infections are not self-limiting, cyclical production of gametocytes and consequences for transmission. Describe/distinguish between paroxysm, relapse and recrudescence, know species responsible for each. For 4 species of *Plasmodium* in humans: morphology of various life-cycle stages, life-cycle, hosts, sites occupied within hosts, disease caused and its associated pathogenicity, diagnosis of infection, treatment. Describe 3 mechanisms of resistance: individual resistance to *P. vivax*, individual resistance to *P. falciparum*, protective immunity. Strategies of malaria control: elimination of vector (destroy mosquito breeding sites, introduction of *Gambusia*, etc.); development of vaccines (problems associated with this strategy). Treatment: of humans with drugs (infected vs. uninfected individuals), other haemosporidan genera: *Leucocytozoon*- typical hosts (intermediate and definitive), sites occupied within hosts, *L. simondi* as an example (hosts, pathogenicity, etc.). *Haemoproteus*- typical hosts (intermediate and definitive), sites occupied within hosts, *H. columbae* as an example (hosts, pathogenicity, etc); member of other order: *Babesia bigemina*- hosts, disease caused, pathogenicity, diagnosis of infection, treatment; Babesia *microti*- hosts, geography, pathogenicity; association with island of Nantucket.

Class Conoidasida- general features; **Subclass Coccidiasina**- general features; 7 genera important to humans: whether they are each monoxenous or heteroxenous, oocyst morphology, etc.; *Eimeria*- estimated incredible diversity, infections self-limiting (what does this mean; contrast to Haemosporida); each species is host, site and tissue specific, general name for diseases caused; draw and label typical oocyst of *Eimeria*; be able to illustrate life-cycle of *Eimeria tenella*; describe why infections often result in loss of millions of host cells; protective immunity to *E. tenella*, disease caused and its pathogenicity, diagnosis of infection, treatment. *Isospora*- monoxenous, oocyst morphology, diagnosis of infection, *Isopora belli* in humans, symptoms, pathology; *Cyclospora*- oocyst morphology, monoxenous; *Cyclospora cayatensis* in humans, symptoms, pathology; *Toxoplasma gondii*- heteroxenous, oocyst morphology, morphology of various life-cycle stages, be able to illustrate life-cycle (understand terminology of life stages: zoitocysts, bradyzoites, etc.), typical definitive and intermediate hosts, sites occupied within hosts, disease caused and its pathogenicity (towards foetus, adults, etc.), prevention of infection, diagnosis of infection, protective immunity. *Sarcocysti*s- oocyst morphology, heteroxenous (typically carnivore and herbivore), *Sarcocystis suihominis*- hosts, how humans acquire infection. *Neospora caninum*- oocyst morphology, hosts, symptoms, pathogenicity, diagnosis of infection. *Cryptosporidium*- oocyst morphology, host specificity, disease(s) caused; *Cryptosporidium parvum*- in humans, sites in hosts, symptoms, pathogenicity; as a zoonotic infection, important reservoir hosts. **Subclass Gregarinasina**- general features; host associations, reproductive process lacking (schizogony); acephaline gregarines: general features, e.g. *Monocystis lumbrici*- life-cycle (be able to illustrate); cephaline gregarines: general features (body divided by septum, etc.), terminology associated with morphology (protomerite, etc.), explanation for common association with mandibulate arthropods; define and be able to illustrate syzygy.