**Course title – credits:** Advanced Invertebrate Zoology, aka Metazoan Parasitology – BIOL557 - 3 credits

**Meeting day and time:** MWF 9-950 am

**Required Reading:**
Chapters will be assigned for each group of parasites. See explanation on page 3 concerning their applicability to exams.

Publications (primary literature) will be assigned and cover topics relevant to our in-class discussions. In most cases, these publications highlight some aspects of the parasite or its manifestation (disease) that we don’t cover in class, but you should know for the exam.

Pdf files of the textbook and publications will be posted to a Dropbox folder. I will send out a link to the folder and you will sign into the folder to access the files at your leisure.

**Course Description**
An introduction to the diversity of metazoans (animals) that parasitize humans, livestock, other animals (both vertebrate and invertebrate), and plants. Lectures emphasize the morphology, form and function, physiology, systematics, evolution, lifecycles and pathogenesis of several major parasitic groups.

**Learning Outcomes**
Upon completion of this course, all students should be able to

1) Define parasitism in the broadest context, from ecological, anatomical and physiological perspectives;
2) Be able to identify the major parasitic taxa and describe their anatomies;
3) Understand the lifecycles and epidemiology of representative parasitic species;
4) Recognize how the human body fights and reacts to infections at the immunological level;
5) Appreciate how invertebrate vectors respond to parasitic infections;
6) Understand how to treat infections, both at the individual level (medically) and at the community level (ecologically)
This schedule is tentative and open to change. Note that the textbook and chapters will help you to understand the material, but exam information will not come from these readings. The **mandatory reading materials are the publications**, from which some text questions will be drawn.

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<td>Phylum Arthropoda: Chelicerata: Acari</td>
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<td>TBA</td>
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EXAM STRUCTURE
Exams will be a combination of fill-in-the-blank, multiple choice, short answer, label-the-diagram, draw-the-lifecycle, diagnose the disease, and essay questions. You are required to know the taxonomy of the major groups we discuss, from the phylum level down to species, depending on the taxon. You are also responsible for knowing aspects of host digestion and immunity, the lifecycles of select species, their anatomies, and the pathologies they cause.

How to study for an exam. First, read the appropriate chapters. Most chapters are fairly short and easy to read. They will set the context for understanding your notes. In other words, by reading the chapters, they will refamiliarize you with the parasites, and put your mind in the mood to soak up the lecture information and prepare you for the exam. In general, most exam questions come directly from the notes in class, unless otherwise specified. If there are any assigned publications, read them, but in terms of coverage for the exam, I only expect you to know some of the major points of the publications. What are the major points? Depends on the paper. If it discusses a human disease, then you should know how the disease was transmitted and the pathologies and symptoms affiliated with the disease. If the paper is on a parasite that does not affect humans, then focus on parasite transmission, how it infects its host, and perhaps any associated pathologies of infection. When dealing with a publication, first read the abstract to get an overview of the paper, and then read both the Introduction and finally the Discussion. The Methods and Materials are not terribly important for exams, nor are the Results, since the significance of the results are alluded to in the Discussion. However, while I will not ask you to regurgitate the methods and results, you should at least have a very basic understanding about what the authors did and how they did (experiments, sequencing).

Plagiarism: Cheating on an exam in any fashion will result in a zero for that exam. Please see the UML’s academic dishonest policy at:
http://www.uml.edu/Catalog/Graduate/Policies/Academic-Integrity.aspx

Participation: You are expected to attend each lecture class. This is an advanced course, and we only meet three times a week, so each lecture is replete with information. If you must miss a lecture, please let me know in advance. A participation grade will be given out at the end of class. Repeated absences will be noted and affect your grade.

You must not miss a Lecture Exam. If you must miss an exam, you need to do two things: 1st, inform me ahead of time (within 24 hrs); 2nd, you must provide a legitimate excuse with a doctor’s note or other official note. Missing an exam or needing to schedule an early exam because of a vacation, etc is not a valid excuse and is not permitted.
Course Evaluation and Grading

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<tr>
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<td>1. Topic</td>
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<td>3. Draft</td>
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<td>4. Critique</td>
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<td>5. Final</td>
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Final grades are based on a strict percentage: > 93% = A, 90-92% = A-, 87-89% = B+, 83-88% = B, etc

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**GRADUATE RESEARCH PAPER (GRP)**

**Purpose:** The purpose of the research paper is to acquaint you with the symptoms, pathologies and treatments of various diseases caused by animal parasites. **Important:** The parasite you choose and the disease it causes must be due to the parasite itself and not a virus and/or bacteria it transmits.

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**The GRP will be performed in stages as we proceed through the course.**

**Jan. 29, 2016** – Email the instructor your topic of choice for the GRP. The topic must be specific and **should not** just a species name. This topic cannot change once it is chosen, so be sure there is enough literature to make a good topic. Also make sure there is substantial new literature beyond the year 2000. If you are uncertain about a topic, see the instructor before this date. A late topic may receive zero points.

**Feb. 12, 2016** – Email the instructor a list of references (minimum 10 beyond year 2000) in an attached WORD file (.doc or .docx). If the publications do not appear to pertain to your topic, you will not receive full credit. All publications should be written in the appropriate format (see below) and **not copy/pasted in different text styles, formats, sizes, etc.** Points will be deducted for inappropriate styles or copy/pasting of multiple formats/fonts.

**March 23, 2016** – the first electronic and hardcopy drafts of your paper will be turned into class. **Two** hardcopies must be turned in (one for the instructor, one for critique by another student). The draft must not be a preliminary outline or “thrown together” paper. It must contain all of the elements of the final paper but may not necessarily be complete, i.e., the critiques will evaluate this. An electronic version of the research paper must also be turned in to TURNITIN.COM on the date it is due (or before that). **The Course name is Metazoan Parasitology GRP: Class ID is 11488577: password is parasite.**

**April 6, 2016** – the critique of the GRP is due in class. The critique will have notes added directly to the paper as well as a separate sheet (to be provided) that outlines the major positives and negatives of the paper. Two copies of the critique must be turned in (one for the author, one for the instructor). **April 25, 2013** – the final paper will be turned in on Turnitin.com.

**April 22, 2016** – the final paper will be turned in on Turnitin.com. Late papers will not be accepted.
Assignment: Select an animal parasite (single animal species) that is a major pathogen of humans, livestock, pets, or has some other important medical or socioeconomic impact. The parasite must be an animal – I do not want research papers on viral, bacterial or single-celled eukaryotes (protozoans). The parasite must not be a species that we cover in lecture. If you have any questions about whether your topic is appropriate, email the instructor ahead of time.

Elements of the GRP: You are to describe the parasite (systematics, morphology, physiology, lifecycle, ecology), its pathogenesis, disease, diagnosis, and any known or up-and-coming treatments.

Organize the paper in the following fashion:

1) **Title** (be creative, but not silly, after all, this is a scientific paper)

2) **Abstract:** This should be a one paragraph summary of your paper that includes a brief description of the disease, its transmission, its treatments and its impacts.

3) **Introduction:** Basics on the importance of understanding parasites and controlling parasitic infections. Be creative and informative. Make the reader want to continue reading your paper! Be sure to mention the species that is the topic of the paper and transition the Introduction into the next topic – the Species Description.

4) **Species Description:** One or more paragraphs on the species. The description of the species should not be verbatim descriptions from the text (i.e., I do not want detailed descriptions of its reproductive tract, epidermis, etc.). Instead, provide a general description of the animal beyond what is in a paper. Use scientific sources from the primary literature and make sure to always correctly cite your sources. For example:
   a. *Trichuris trichiura*, also known as whip worm, is the metazoan parasite that causes the disease known as Trichuriasis. *T. trichiura* belongs to the phylum Nematoda and is a member of the family Trichuridae, the tenth largest family of the class Secernentea (Source, 2004). These nematodes are generally quite small, approximately 30-50 mm long, with a simple cuticle composed of interweaving collagen fibers at right angles (Fig. 1). The cuticle allows…

Notice that in the preceding example I did not list every taxonomic category the worm belongs to (e.g., order, suborder, superclass, etc), but still provided enough information for an interested reader to make them acquainted with the animal. I also used a complete sentence and did not just list the taxonomic categories, which would make for terrible sentence structure.

   b. Provide a description of the parasite’s lifecycle and make sure to mention how many hosts (intermediate, definitive, etc) are in the lifecycle. Does the parasite show high or low host specificity? How many vectors may carry the parasite, and who are they? Draw a diagram of the lifecycle if necessary.

   c. You may use images (downloads or scans) in the description. You must reference each figure within the body of the text (see above), but do not make the Figure the topic of a sentence (e.g., Figure 1 below shows a hookworm). Instead, place the Figure in parentheses. For example:
Nematodes have a very complex cuticle (see Figure 1). Each Figure must include a Figure caption that is placed below the figure. All figures must have a reference.

5) **Disease, Pathologies, and Symptoms:** Several paragraphs that describe the disease, its related pathologies and symptoms, and its epidemiology. Make sure to include all aspects of epidemiology including how it is transmitted, its ecological and geographical distribution, its prevalence, and its incidence in the population. This is also the place to discuss, in detail, the immunology of infection. What is happening inside the host body that leads to the varied symptoms?

6) **Diagnosis and Treatment:** Describe how the disease is diagnosed: ELISA, blood smears, fecal smears, etc. Are any tests more efficient than others. Once diagnosed, how is the disease treated? Describe any known cures for the disease, including available medications or surgical procedures that directly affect the parasite and/or control the symptoms. Also, mention those practices that are being used by both local peoples and scientists to control the disease itself, such as proper sanitation protocols, use of insecticides, clearing of land, etc.

7) **Socioeconomic Impacts:** One or more paragraphs that describe the socio-economic impacts of the disease. These impacts may be relatively minimal in some cases, such as social embarrassment or minor tissue damage, or they might be quite severe, including death and major economic impacts for entire countries or regions.

8) **References Cited:** Most parasitic diseases are well known enough to have a wealth of references. Therefore, 10 references is not enough to cover what you need to know. Review papers are acceptable, but you must also cite experimental and descriptive papers where appropriate. A good research paper will have a minimum of 15 references and maybe up to 20 or 30 (or more, but no need to cover everything in the literature).

**GRADING**
You will be graded in stages as portions of your GRP are turned in. Partial credit is available.

1. Topic 25 pts (emailed)
2. References 25 pts (emailed)
3. Draft 200 pts (2 hardcopies + Turnitin.com)
4. Critique 100 pts (2 hardcopies)
5. Final 200 pts (Turnitin.com only)

**Grading of the Draft and Final Papers**

1. **Style:** 50 points – proper headings for each section, presence of Figure/Tables and legends, proper style of references both in the text and in the references section.

2. **Grammar:** 50 points - includes correct spelling, punctuation, sentence structure, and the correct use of taxonomic terminology (see above).
3. **Content: 100 points** – The amount of content is dependent on the subject. Some species are better known than others, in which case I will expect greater detail.

**Grading of the Critique**

The critique is an important part of the GRP and constitutes one of your first forays into peer review. Peer review is an important part of the scientific publication process, and you as a reviewer are expected to give your full attention to the GRP. You will be provided guidelines for how to handle the review process and you will be turning in a hardcopy of the critique to both the author and the instructor. I will evaluate your criticisms to determine how closely you read the paper and the value of your critique. You will receive a grade (out of 100 pts) that reflects your attention to detail in the GRP.

Any portion of the GRP that is turned in late will receive an automatic 10% deduction. A further 10% will be deducted from the grade for each 24 hours that elapse after the original due date.
GUIDELINE FOR PROPER WRITING

Style & Writing
The paper must be double spaced and 12-point font (Times, Times New Roman, Helvetica) with 1 inch margins. You may use bold subtitles to delineate the different sections of the paper: Introduction, Species Description, Disease, etc.

Grammar
Check your grammar. This includes sentence structure and use of punctuation. Remember that semicolons separate complete thoughts (sentences) while colons are generally used to delineate a list. If you are uncertain about punctuation, look in a book or the internet for proper use.

Never use quotations. There is no need for quotations anywhere in the text. Nothing is ever written so well or in such a complex fashion that it cannot be paraphrased.

Do not use informal wording or abbreviate words. For example, do not use “don’t” in place of “do not” or “won’t” in place of “will not” – they are too informal for a scientific paper.

Figures and Tables
You may use both figures and tables in your paper. Be sure that all figures/tables are mentioned in the body of the text and are not there as extraneous material. They should be important for explaining a topic and not used as fillers. There are many ways to cite a figure/table in the body of a paper; however, the most appropriate way is to do so as if it were a reference. For example, “Hemichordates (acorn worms) have an anterior proboscis that contains a heart (Figure 1).”

Figure 1. Photograph and illustration of hemichordate anatomy (Bridges, 1999) or Webpage: http://scienceblogs.com/pharyngula/upload//hemichordate_anatomy.jpg Note that the figure has the reference (source) within it. This is acceptable for your paper.

Tables
Tables are acceptable for making comparisons among species, diseases, etc. Be sure that all Table are properly described with a legend that is placed above the table.
Important points about taxonomic names:
Recall that species are part of a larger classification system that is organized as:
Kingdom, phylum, class, order, family and genus. There are also ‘super’ categories such as
superclass, and ‘sub’ categories such as subfamily, infraorder, etc.

1. Species names: Species names are always binomens: e.g. *Homo sapiens*. The first part of the
species binomen is the genus name (Latin noun, capitalized) and the second part is the specific
epithet (Latin adjective, never capitalized). A species name always consists of both parts and is
always either italicized or underlined. When writing a species name within a section of the paper
(Abstract, Introduction, etc), your first mention of the species should always be spelled out, e.g.,
*Ascaris lumbricoides*. If the name is mentioned again, the first part of the name (genus), may be
abbreviated to a single letter plus “.” Example, *A. lumbricoides*. Note that both parts are still
italicized.

2. Non-genus or species names are never italicized or underlined.

3. A taxon should not be confused with its members. For example, the family Hominidae
(contains humans) does not possess opposable thumbs, but humans do.

Incorrect and Correct examples of taxon name use:
Incorrect: *Ascaris* has a thick cuticle.
Correct: Species of *Ascaris* have a thick cuticle.
Incorrect: The species *Ascaris lumbricoides* is a long nematode...
Correct: *Ascaris lumbricoides* is a long nematode… (saying “species” is redundant)
Incorrect: Mesozoa are ciliated worms that parasitize octopods.
Correct: Mesozoans are… or Species of Mesozoa are…

In some cases, it is appropriate to substitute a formal taxon name with one less formal to
avoid redundancy and/or spice up your writing. For example:
Platyhelminthes – platyhelminths, flatworms (common name)
Cestoda – cestodes, tapeworms (common name)
Trematoda – trematodes, flukes (common name)
Nematoda – nematodes, roundworms (common name)

You should notice that formal taxonomic names, once changed, lose capitalization. Also,
some names when made plural are spelled slightly different. For example:
Trichurida - trichurids
Plagiorchiformes – plagiorchids
Opisthorchiformes – opisthorchids

If you mention a species, genus or family name, there is no need to preface the name with the
previously mentioned taxonomic category. For example, do not state “the species *D.
medinensis*” or “the family Dracunculidae” or the “Dracunculidae family.” These are redundant.
All species names are binomens, and all family names end in “idae” so there is no need to tell the
reader which taxonomic cateogory you are referring to.
References:

Primary literature: Any journal article including review articles. You must use a minimum of 15 references. My lectures, internet websites, and textbooks do not count.

Journals
Use Google Scholar to find and download publications from campus. If the university does not have a subscription to the journal, then order the paper through Interlibrary loan. You can also search UML’s journal database which is linked to my homepage (sidebar). We have full or limited access to many journals, e.g., Annals of tropical medicine and parasitology, Experimental parasitology, Molecular and biochemical parasitology, Parasitology today, Trends in parasitology, and Veterinary parasitology.

Citing References in the text
There are different methods of citing authors within the body of the text. For example:

2. 2 Authors: “Author & Author (2000) states that…”
3. 3 or more authors: Author et al. (2000) think that nematodes…” Please note that only the first author’s name is used and that et al. is not italicized. Also, note that “et al.” is only used in the body of the text. All author names appear in the references section.
4. Some scientists consider nematodes to be … (Author 1999; Author 2004).

Always cite works in chronological order (Smith & Jones 1991; Cook et al. 1992; Anderson 1993a,b).

Examples of References style at the end of the paper
Chapter in a book

Book

Journal Articles
One author:

Two authors:

Three or more authors:
Rules on plagiarism
In the course of writing a paper on any topic, you are bound to reiterate the wording used by another student or scientist just by chance alone, after all, there are only so many ways to write a sentence. It happens. However, when whole sentences are verbatim, then chance alone cannot explain such a coincidence. This is evidence of plagiarism, which is a violation of both course and university policies. Turnitin.com detects similarities among papers and will provide originality scores to show how similar your paper is to those in its database (which is enormous). If Turnitin.com detects plagiarism in your paper, I will print out the originality scores and determine if the similarity is by chance or plagiarism. In general, a score of > 20% similarity indicates plagiarism on your part and I will take appropriate action. I may do one of the following:
1. Deduct points and (potentially) have you rewrite the appropriate sections. The amount of points I deduct is at my discretion. I may only deduct a few points if the similarities are mild, or many points (up to 50%) if the similarities are more acute.
2. If the similarities between your paper and another paper in the database are large enough to cause serious concern, you will be given a zero for the paper and not be given a chance to rewrite the paper or reaccumulate the lost points. I will also make a determination based on the extent of the plagiarism whether or not to file a formal report to the Dean of Sciences. Such a report results in a permanent mark on your transcripts and may lead to dismissal.