

MIP/BZ/BSPM 462
PARASITOLOGY & VECTOR BIOLOGY
Fall 2023

Instructors

- Dr. Elizabeth Hemming-Schroeder, PhD, Department of Microbiology, Immunology and Pathology
- Dr. Ashley McGrew, DVM, PhD, DACVM (Parasitology), Department of Microbiology, Immunology and Pathology

Teaching Assistants

Andrea Russell, Department of Microbiology, Immunology and Pathology

Texts & Lab Notes (Required)

- Sullivan, John. 2009. A Color Atlas of Parasitology. University of San Francisco.
- Marquardt, Demaree and Grieve. 2000. Parasitology and Vector Biology, 2nd Edition. Harcourt /Academic press. Specific chapters available through Canvas (no purchase necessary)
- Mullen, Garry R. and Lance A. Durden. 2019. Medical and Veterinary Entomology, 3rd Edition. Elsevier Academic Press.
- Combes, Claude. 2005. The Art of Being a Parasite. University of Chicago Press.
- Class and laboratory notes for Dr. Ashley McGrew
- Class and laboratory notes for Dr. Hemming-Schroeder

Texts (Optional)

- John, Petri. 2006. Markell and Voge's Medical Parasitology, 9th Edition. Saunders/Elsevier.

Protozoology and Helminthology: Ashley McGrew

| | Points: |
|--|---------------------------|
| LECTURE EXAM #1 | 75 Points |
| LECTURE EXAM #2 | 75 Points |
| LECTURE EXAM #3 | 75 Points |
| LAB: | |
| LAB PRACTICAL | 100 Points |
| Final Project (project approval during laboratory) | 100 Points |
| Lab Notebook (submitted twice) | 30 Points (2 X 15 points) |
| Parasite Unknowns (assessment in laboratory) | 20 Points |
| Lab Procedures and Participation | 25 Points |
| Essay 1 | <u>50 Points</u> |
| | 550 TOTAL POINTS |

Parasitology Course Objectives:

- Students will be able to:
 - Accurately describe parasitic life cycles, using correct terminology and definitions, and will be able to explain how aspects of a given life cycle relate to clinical signs, pathogenesis of disease, and epidemiology
 - Explain the relationship between host and parasite using basic immunologic terms and concepts
 - Recognize important morphologic characteristics of parasites of medical and veterinary importance
 - Select and perform appropriate diagnostic tests, given a clinical scenario, and describe the basic principles and techniques used in diagnosing parasitic disease
 - Describe aspects of distribution, morphology, life cycle, pathology, clinical signs, epidemiology, treatment, and control for representative parasites from each of the major taxonomic groups
 - Identify parasite elements and recognize their diagnostic stages
- Students will also be introduced to science-based literature (e.g. *The Art of Being a Parasite*, by Claude Combes) and peer-reviewed literature, enabling them to:
 - Effectively discuss evolutionary and ecological relationships between species
 - Recognize zoonotic diseases and the impact parasites have on public health
 - Identify how parasites of human and veterinary significance impact socioeconomic trends and perspectives relating to disease control

Additional notes for the Protozoology and Helminthology portion of this course:

- The schedule below describes the intended daily focus for each lecture or laboratory session; any minor modifications that need to be made to this schedule or the course, during the semester, will be announced in lecture or lab and/or posted in Canvas.
- The daily focus listed for each laboratory session is ***in addition to*** the examination of slides, viewing of gross specimens, and diagnostic techniques that will closely mirror the material being covered in lecture that week. Daily laboratory activities are carefully planned into the allocated timeframe and students should plan to be present in laboratories for the full duration.
- Handouts may be provided to students in the lecture-portion of class, on most days. These handouts ***will not be available*** in Canvas. Portions of handouts may be purposefully left blank and completed together during lecture, used to stimulate discussion, or reinforce important concepts. Among other material, students are responsible for learning all information on the provided handouts; ***therefore, if a class is missed, it is the student's responsibility to obtain a copy of the missed material during office hours or find a classmate with whom they can meet with to discuss what was covered in class.*** It is expected that the student will seek out any missed material that was presented on the day of their absence.
- In general, up to a 10% deduction may be assigned to late assignments and projects, and turning assignments in late should be discussed with the instructor(s) in advance—partial credit may be considered at the instructor's discretion

| Date | Subject |
|----------------------|---|
| <u>Week 1</u> | |
| August 21 | Course Introduction |
| August 23 | Introduction to Parasites/Introduction to Protozoology |
| August 25 | Trypanosomatidae |
| Tues lab | Introduction/Lab safety/Lab notebook requirements/ Introduction to Final Projects |
| Thurs lab | Microscopy: <i>focusing</i> on what's important |
| <u>Week 2</u> | |
| August 28 | Diplomonadorida/Trichomonadorida |
| August 30 | Turbulinida/Eucoccidiorida |
| September 1 | Haemosporida/Piroplasmorida |
| Tues lab | Funnels, and fluke-finders, tests and techniques |
| Thurs lab | "What <i>also</i> floats in... sugar?" |
| <u>Week 3</u> | |
| September 4 | LABOR DAY—NO CLASS |
| September 6 | Eucoccidiorida (continued) |
| September 8 | Eucoccidiorida (continued) |
| Tues lab | <i>Cryptosporidium</i> sp. and <i>Giardia</i> sp.—It's not easy being <i>green</i> |
| Thurs lab | Great <i>Xpect</i>-ations: choosing diagnostic tests |
| <u>Week 4</u> | |
| September 11 | LECTURE EXAM 1: Protozoa |
| September 13 | Introduction to Trematodes/Schistosomatidae |
| September 15 | Fasciolidae |
| Tues lab | What a fluke! |
| Thurs lab | The host-parasite relationship: pathways to understanding (Lab Notebook DUE, Friday at 9:00am) |
| <u>Week 5</u> | |
| September 18 | Opisthorchidae |
| September 20 | Introduction to Cestodes |
| September 22 | Cestodes (continued) |
| Tues lab | Final Projects DUE/Final Project Presentations |
| Thurs lab | Final Project Presentations |
| <u>Week 6</u> | |
| September 25 | LECTURE EXAM 2: Cestodes and Trematodes |

Septamber 27 Introduction to Nematodes
September 29 Ancylostomatoidea/Rhabditoidea

Tues lab Final Project Presentations
Thurs lab Final Project Presentations
Unknown #1

Week 7

October 2 Ascaridoidea
October 4 Dracunculoidea/Filaroidea
October 6 Trichuroidea/Oxyuroidea

Tues lab “ζῆλον” & “νόσος *nosos*”... communicating information to the public
Unknown #2
Thurs lab Blood meals, vectors, and Knott’s: tying it together
(Lab Notebook DUE, Friday at 9:00am)

Week 8

October 9 LECTURE EXAM 3: Nematodes
October 11 The *art* of being a parasite...

Tues lab Review
October 12 (Thurs lab) LAB PRACTICAL EXAM: Protozoa and Helminths

| Medical/Veterinary Entomology - Dr. Hemming-Schroeder | | |
|---|---------------------|-------------------------|
| LAB 1 | External anatomy | 30 points |
| LAB 2 | Internal anatomy | 30 points |
| LAB 4 | Mosquito life cycle | 30 points |
| LECTURE EXAM 1 | | 75 points |
| LECTURE EXAM 2 | | 75 points |
| LAB PRACTICAL EXAM | | 125 points |
| FINAL LECTURE EXAM) | | 85 points |
| Essay Question 2 | | <u>50 points</u> |
| | | 500 points total |
| NOTE: Labs are generally due 1 week after they are assigned. 5 points are deducted for each lab period that an assignment is turned in late. | | |

Vector Biology Course Objectives

- Students will learn basic principles of entomology, natural cycles of arthropod-borne disease transmission, integrated pest management and application of these factors to reduce transmission of arthropod borne diseases
- Students in the laboratory will learn identification methods for medically-important arthropods
- Laboratory exercises aid students in learning and understanding basic arthropod anatomy, behavior, and the mosquito life cycle

Additional notes:

- Handouts may be provided to students in the lecture-portion of class, on several occasions, to facilitate in-class activities. These handouts will not be available in Canvas. Portions of handouts may be purposefully left blank and completed together during lecture, used to stimulate discussion, or reinforce important concepts. Among other material, students are responsible for learning all information on the provided handouts; therefore, if a class is missed, it is the student's responsibility to obtain a copy of the missed material during office hours or find a classmate with whom they can meet with to discuss what was covered in class. It is expected that the student will seek out any missed material that was presented on the day of their absence.

| Date | Subject |
|----------------------|--|
| Oct. 13 | History of Medical Entomology ESSAY 1 QUESTION HANDED OUT |
| <u>Week 9</u> | |
| Oct. 16 | Biology of Arthropods (Development, Molting) |
| Oct. 18 | Biology of Arthropods (Digestion, Excretion) |
| Oct. 20 | Biology of Arthropods (Respiration, Circulation) ESSAY 1 DUE (50 Points) |

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| Tuesday Lab | LAB 1: External anatomy of medically important arthropods (Grasshopper) |
| Thursday Lab | LAB 2: Internal anatomy of medically important arthropods (Cockroach) |
| <u>Week 10</u> | |
| Oct. 23 | Biology of Arthropods (Neuroendocrinology) |
| Oct. 25 | Biology of Arthropods (Reproduction) |
| Oct. 27 | Simuliidae (Blackflies), Psychodidae (Sandflies) |
| Tuesday Lab | LAB 3: Diptera: Nematoceros identification, LAB 1 DUE LAB 4a: Begin mosquito life cycle exercise |
| Thursday Lab | LAB 4b: Mosquito life cycle exercise #2 LAB 5: Mosquito Identification (larvae), LAB 2 DUE |
| <u>Week 11</u> | |
| Oct. 30 | LECTURE EXAM 1 (Arthropod morphology and physiology) |
| Nov. 1 | Ceratopogonidae (Biting Midges) / TseTse Flies |
| Nov. 3 | Pathogen Transmission by Arthropods |
| Tuesday Lab | LAB 4c: Mosquito life cycle exercise #3 LAB 5: Mosquito Identification (adults) |
| Thursday Lab | LAB 4d: Finish mosquito life cycle exercise LAB 6: Brachycerous/Cylorrhaphous fly identification |
| <u>Week 12</u> | |
| Nov. 6 | Pathogen Transmission by Arthropods |
| Nov. 8 | Mosquito surveillance and control |
| Nov. 10 | Vector Competence and Vectorial Capacity |
| Tuesday Lab | LAB 7: Arbovirus Surveillance |
| Thursday Lab | LAB 8: Venomous Arthropods, LAB 4 DUE |
| <u>Week 13</u> | |
| Nov. 13 | Fleas and flea-borne diseases |
| Nov. 15 | LECTURE EXAM 2 (Pathogen transmission and vector control) |
| Nov. 17 | Special guest star lecturer – TBD ESSAY 2 QUESTION HANDED OUT (50 points) |
| Tuesday Lab | LAB 9: Flea identification |
| Thursday Lab | LAB 10: Cockroach Identification |

November 20 – 24 FALL BREAK

Week 15

| | |
|---------|-------------------------|
| Nov. 27 | Tick Biology |
| Nov. 29 | Tick Borne Diseases |
| Dec. 1 | Triatominae and Bedbugs |

Tuesday Lab LAB 10: Tick Identification

Thursday Lab LAB 11: Identification of lice, bedbugs, triatominae

Week 16

| | |
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| Dec. 4 | Lice and louse-borne diseases |
| | ESSAY QUESTION 2 DUE |
| Dec. 6 | Mite Biology/Chiggers - Mite Borne Disease |
| Dec. 8 | Review Session |

Tuesday Lab Review Session for Lab Practical

Thursday Lab **LAB PRACTICAL EXAM**

December 11 – 15 FINAL EXAMINATIONS
FINAL LECTURE EXAM (85 points):
MONDAY, 12/11/23, 7:30 – 9:30am

Grading Rubric

89.5-100% = A
79.5-89.4% = B
69.5-79.4% = C
59.5-69.4% = D
<59.5% = F

NOTE: This class is NOT curved. You start the semester with zero points and therefore begin to earn points with the first graded assignment. There are nearly 1000 points that can be earned. You will be graded according to the total points you have earned by the end of the semester.

Be aware this is a 5-credit upper division Microbiology course that requires approximately 2 hours of study/lab time for every 1 hour of time spent in class/lab. Since we will be spending approximately 6.5 hours in class/lab per week, you should be prepared to spend about 13.5 – 14 hours per week on this class. This may include extra time spent in lab completing the assignments or reviewing material already presented.

Laboratory: You are expected to come to lab with all pre-lab assignments completed. There is substantial material covered in every lab, and you will not have time during the

lab to complete everything unless you are prepared and well organized.

Since we will be working with BSL-1 and BSL-2 organisms in the lab, you are not permitted to participate in any laboratory procedure or procure points for those assignments until you have taken the lab safety quiz and have signed the lab compliance form. Make-up labs are offered only to students with instructor-approved excuses, and make-up labs must be set up with the GTA. Any make-up lab must be completed within one week of its assignment.

Lab practical: Attendance during the scheduled lab practical for each section is required (1 exam covering parasitology, 1 exam covering medical entomology). Dates for the lab practical exams are listed in the syllabus. NO excuses for missing the lab practical exams are accepted, and there is NO make-up practical exam for either section. Because it requires approximately 16 hours of work to set up these exams, they cannot be set up for individual students. If you miss the lab practical, these points cannot be recovered.

Class attendance is mandatory on exam days, and highly recommended on a regular basis. Make-up exams will be given ONLY if you have a medical reason for missing the exam, or you have a family emergency or other extenuating circumstances. You must notify the instructor before the exam, and you must be able to provide documentation for verification. Make-up exams will not be given if no prior arrangements have been made with the instructor. Student athletes are ONLY allowed to be absent on an exam day if you are participating in a CSU sanctioned activity. It is your responsibility to inform the instructor at the beginning of the semester if you are a student athlete, and a letter on CSU letterhead from the athletic office must be handed in to the instructor delineating scheduled CSU sanctioned activities along with expected absences. The timeline for giving a make-up exam to any student athlete is at the discretion of the instructor.

Cell phones MUST be turned off and stored in your backpack while in class. This includes both lecture and examination times.

Academic Integrity & CSU Honor Pledge:

This course will adhere to the CSU Academic Integrity/Misconduct policy as found in the General Catalog and the Student Conduct Code:

<https://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity>

Academic integrity lies at the core of our common goal: to create an intellectually honest and rigorous community. Because academic integrity, and the personal and social integrity of which academic integrity is an integral part, is so central to our mission as students, teachers, scholars, and citizens, we will ask that you affirm the CSU Honor Pledge as part of completing your work in this course.

CSU Principles of Community

Inclusion: We create and nurture inclusive environments and welcome, value and affirm all members of our community, including their various identities, skills, ideas, talents and contributions.

Integrity: We are accountable for our actions and will act ethically and honestly in all our interactions.

Respect: We honor the inherent dignity of all people within an environment where we are committed to freedom of expression, critical discourse, and the advancement of knowledge.

Service: We are responsible, individually and collectively, to give of our time, talents, and resources to promote the well-being of each other and the development of our local, regional, and global communities.

Social Justice: We have the right to be treated and the responsibility to treat others with fairness and equity, the duty to challenge prejudice, and to uphold the laws, policies and procedures that promote justice in all respects.

It is our intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let us know of ways in which to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let us know so that we can work with you to make arrangements.

Information relevant to COVID-19:

All students are expected and required to report any COVID-19 symptoms to the university immediately, as well as exposures or positive tests (even home tests).

- If you suspect you have symptoms, or if you know you have been exposed to a positive person or have tested positive for COVID (even with a home test), you are required to fill out the COVID Reporter (<https://covid.colostate.edu/reporter/>)
- If you know or believe you have been exposed, including living with someone known to be COVID positive, or are symptomatic, it is important for the health of yourself and others that you complete the online COVID Reporter.
- If you do not have internet access to fill out the online COVID-19 Reporter, please call (970) 491- 4600.
- You may also report concerns in your academic or living spaces regarding COVID exposures through the COVID Reporter. You will not be penalized in any way for reporting.
- When you complete the COVID Reporter for any reason, the CSU Public Health Office is notified. Students who report symptoms or a positive antigen test through the COVID Reporter may be directed to get a PCR test through the CSU Health Network's medical services for students. For the latest information about the University's COVID resources and information, please visit the CSU COVID-19 site: <https://covid.colostate.edu/>.

Land Acknowledgement:

Colorado State University acknowledges, with respect, that the land we are on today is the traditional and ancestral homelands of the Arapaho, Cheyenne, and Ute Nations and peoples. This was also a site of trade, gathering, and healing for numerous other Native tribes. We recognize the Indigenous peoples as original stewards of this land and all the relatives within it. As these words of acknowledgment are spoken and heard, the ties Nations have to their traditional homelands are renewed and reaffirmed. CSU is founded as a land-grant institution, and we accept that our mission must encompass access to education and inclusion. And, significantly that our founding came at a dire cost to Native Nations and peoples whose land this University was built upon. This acknowledgment is the education and inclusion we must practice in recognizing our institutional history, responsibility, and commitment

Student Accommodations:

If you are a student who will need accommodations in this class, please contact me to discuss your individual needs. Any accommodation must be discussed in a timely manner. A verifying memo from The Student Disability Center may be required before any accommodation is provided. Their site is: <https://disabilitycenter.colostate.edu/>

The Student Disability Center (SDC) has the authority to verify and confirm the eligibility of students with disabilities for the majority of accommodations. While some accommodations may be provided by other departments, a student is not automatically eligible for those accommodations unless their disability can be verified and the need for the accommodation confirmed, either through SDC or through acceptable means defined by the particular department. Faculty and staff may consult with the SDC staff whenever there is doubt as to the appropriateness of an accommodative request by a student with a disability.

The goal of SDC is to normalize disability as part of the culture of diversity at Colorado State University. The characteristic of having a disability simply provides the basis of the support that is available to students. The goal is to ensure students with disabilities have the opportunity to be as successful as they have the capability to be.

Support and services are offered to student with functional limitations due to visual, hearing, learning, or mobility disabilities as well as to students who have specific physical or mental health conditions due to epilepsy, diabetes, asthma, AIDS, psychiatric diagnoses, etc. Students who are temporarily disabled are also eligible for support and assistance.

Any student who is enrolled at CSU, and who self-identifies with SDC as having a disability, is eligible for support from SDC. Specific accommodations are determined individually for each student and must be supported by appropriate documentation and/or evaluation of needs consistent with a particular type of disability. SDC reserves the right to ask for any appropriate documentation of disability in order to determine a student's eligibility for accommodations as well as in support for specific accommodative requests. The accommodative process begins once a student meets with an accommodation specialist in the SDC.