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Spring 2-1-2017

BIOL 435.01: Comparative Animal Physiology

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BIOL 435 (CRN 33100), Comparative Animal Physiology

Tuesday & Thursday 12:30 – 1:50 in ED 312

Instructor: Dr. Art Woods
BioResearch Building (BRB) 005
406-243-5234
art.woods@mso.umt.edu
<http://hs.umt.edu/dbs/labs/woods/>

TA: Steve Lane
BioResearch Building (BRB) 013
steven.lane@umconnect.umt.edu

Office Hours. Wednesday 1 – 2 and Thursday 9 - 10. Feel free to contact me and set up an appointment for an alternative time; email is best. Office hours for Steve Lane by appointment.

Textbook. I am not using a textbook. Rather, we will read a lot of primary literature in biology, which I will supplement by directing you to selected online readings and videos.

Course Objectives. Traditional courses in animal physiology take systems- or organs-based approaches. This course will talk about those systems but will focus primarily on just a few major problems:

- How do organisms sense and respond to changes in environmental factors?
- How is climate change affecting organisms?
- How does physiology evolve?

Within the context of those overarching question, we will discuss a wide range of physiological systems. The course will also use primary papers and data, which give more realistic views of science-as-a-process than do textbooks or summary articles.

Learning Outcomes. By the end of the semester you will be able to

1. understand and explain the core principles of comparative animal physiology;
2. understand and explain the major physiological problems faced by animals in their environments, and common solutions to those problems;
3. describe the ecological and evolutionary contexts for those solutions;
4. read, analyze, and discuss primary literature in comparative animal physiology;

5. write concise essays about primary papers in a transparent, simple style.

Course Structure & Style. In recent years, I have been lecturing less and doing more in-class discussions, activities, and demonstrations. I'm going to keep doing that this year. Each week will be devoted to answering a particular question related to the major questions presented above, and I'll generally lecture only on part of one of the two days. In the rest of the time, we'll read and discuss papers, calculate answers to quantitative problems, and do simple demonstrations and experiments in class. This style will have the consequence of putting the responsibility more on you to keep up with the readings I assign.

Course moodle page. There is one, and I'll post all electronic media from the course to it. I'll also keep my gradebook on moodle so that you'll always have access to up to date information on how you're doing in the class.

Evaluation. Points will be based on your performance on:

Midterms. Three midterms will be given during the semester (Feb 14, March 14, and April 11), each worth 100 points. 300 points total. Exams will contain both multiple-choice and short-answer formats. They will emphasize course content, information from the assigned papers, concepts we covered in our discussions, and intellectual synthesis.

Final exam. Final Exam from 8:10 – 10:00 on Wednesday, May 10th. 100 points. Cumulative; will include information from student powerpoint presentations (see below).

Paper summaries. Two 2-page summaries of scientific papers will be assigned (each worth 35 points). 70 points total. These will be assigned at roughly equal intervals throughout the semester. You will receive extensive feedback on first drafts and then will have the opportunity to turn in a second draft that will be graded.

In-class quizzes. At the beginning of 8 - 10 of the class periods, I will give short quizzes, each worth 5 points. I will drop your lowest scores, leaving 6 quizzes (total of 30 points).

Term presentation. The final 3 class periods will be devoted to short presentations on research questions. You will work in groups of 2 to pose a physiological problem and then to discuss one or more papers containing data relevant to the problem. I expect all students to be at all presentations (required!). 100 points.

Term presentations will be 15 minutes long and followed by a 5-minute question and answer period. The order of presentations will be made based on a drawing to be held in the near future. Topics for presentations are open to anything in the field of comparative physiology, BUT they must present novel information to the class (no repetition of material that I will cover). Hence you'll be required to consult with me in ensure that your topic is appropriate. I will provide more instruction on this as the date approaches.

The goals are to identify a question or subject in comparative physiology, discuss the historical record of research related to the area/question, discuss results of the latest research related to the area/question, and propose future experiments/research related to the area/question.

Grading

Grades will be assigned in the +/- system, according to the following scheme:

Grade	Percent of Total Points
A	93-100%
A-	90-92.99%
B+	87-89.99%
B	83-86.99%
B-	80-82.99%
C+	77-79.99%
C	73-76.99%
C-	70-72.99%
D+	67-69.99%
D	63-66.99%
D-	60-62.99%
F	Below 60%

Component	Points	Weighting
Exam 1	100	16.7%
Exam 2	100	16.7%
Exam 3	100	16.7%
Final exam	100	16.7%
Quizzes	30	5%
Paper summaries	70	11.7%
Term presentation	100	16.7%
Total	600	100%

Communication. UM requires that all email communication between faculty and students use umontana or mso aliases. So I will only email you at your umontana address, and I would appreciate if you would email me only *from* your umontana address. Same for communication with the TA. In addition, we're not allowed to send information about grades via email, so we'll need to discuss these issues by phone or in person.

Attendance. You are required to attend all class meetings.

Credit/No Credit. Students interested in this option should see [UM's Academic Policies](#).

Audit. [According to University policy](#), changing your grading option to audit is not allowed after the 15th day of instruction.

Incompletes. I will follow [university policy on assigning incompletes](#).

Student Conduct. All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the

University. Don't do it! The penalties can be severe. The rules are laid out in UM's [Student Conduct Code](#).

Harassment. Harassment of any kind (sexual, racial, religious, disability-based, etc.) will not be tolerated in this class. If you feel that you are being harassed, please see me. In addition, there are many resources available on campus.

Make-up Exams. Make-up exams are not considered a right, but are reserved for students who are prevented from taking an examination on the originally scheduled date due to:

1. a documented illness,
2. or documentation of participation in a University-sanctioned activity
 - A. Documentation of participation in a University-sanctioned activity requires written communication from the University of Montana Office of Academic Advising.
 - B. Student athletes must provide this documentation to Dr. Woods in the first week of classes.

You must call me at 406-243-5234 before the scheduled time of the exam in order to communicate the nature of the problem you feel precludes you from taking it. Absolutely no make-up examinations will be scheduled if you have not communicated with me before the scheduled exam. Also, note that simply informing me that you will be absent does not constitute an excused absence.

Extra Credit. Not provided; please don't ask.

Disabilities. I am committed to creating an environment of equal access for students with and without disabilities. To be fair to all students, I will adhere to the Americans with Disabilities Act and Section 504 of the Rehabilitation Act by only making accommodations based upon [guidance received from the University of Montana Disability Services for Students \(DSS\)](#). Before these accommodations can be suggested and granted, "DSS requires comprehensive documentation of a disability and its impact on learning."

In addition, I have been working to make my documents (Word, PPT) more accessible, and I will continue to update them during the semester.

Religious holidays. Absence due to religious holiday will be excused, with appropriate policies applied. Please notify me about this by February 15.

Official extracurricular activity. Absence due to official extracurricular activity will be excused, with appropriate policies applied. Please notify me about this no less than one week prior to missed class(es).

Schedule

DATE	TOPIC
1/24	Course overview, introductions, and quick look at Dr. Woods's work.
1/26	How do ectotherms and endotherms respond to temperature? Performance curves and critical thermal limits. [lecture + discussion of Huey & Kingsolver 1989]
1/31	How is climate changing, and where? Overview of climate change.
2/2	Effects of climate change on ectotherms [discussion of Deutsch et al. 2008]
2/7	How do animals integrate their local microclimates and their metabolic processes into a body temperature? Environmental biophysics.
2/9	Exercises on calculating heat balance. [discussion of Kaspari et al. 2015]
2/14	MIDTERM EXAM 1
2/16	Talk about writing well; first writing assignment passed out. Also, Macrophysiology I: global patterns of physiology. [discussion of Gaston et al. 2009]
2/21	Macrophysiology II: global patterns of water loss in insects [discussion of Addo-Bediako et al. 2001]
2/23	Jennifer Sunday visits class to discuss macrophysiology and Sunday et al. 2011
2/28	What is metabolism and how does it scale with body size? Fick's law and the scaling of respiratory variables in vertebrates. [first writing essay due]
3/2	Steve Lane: scaling of respiratory variables in Antarctic sea spiders. Discuss Lane et al. manuscript
3/7	How has physiology evolved over deep evolutionary time? The history of life on Earth, the tree of life, and the evolution of physiology.
3/9	Discussion of phylogenetics and independent contrasts.

- 3/14 **MIDTERM EXAM 2**
- 3/16 More talk about writing; second writing assignment passed out.
- March 20 - 24 **Spring Break**, no classes
- 3/28 How much is ocean pH changing and how is that affecting marine invertebrate larvae? Overview of ocean acidification.
- 3/30 Discussion of paper on ocean acidification.
- 3/28 How muscles work.
- 3/30 Discussion of constraints and tradeoffs shaping how muscle physiology evolves [discuss Lindstedt et al. 1998]. [second essay due]
- 4/4 Cardiovascular and respiratory physiology; oxygen transport in the blood
- 4/6 How has the physiology of diving mammals changed to allow them to spend so much time underwater?
- 4/11 **MIDTERM EXAM 3**
- 4/13 How has the physiology of small mammals changed to allow them to live at high altitudes? A discussion with Zac Cheviron
- 4/18 The physiology of flight.
- 4/20 Discussion of bird flight paper
- 4/25 Discussion & review.
- 4/27 Student term presentations
- 5/1 Student term presentations
- 5/3 Student term presentations
- 5/10 **Final Exam** Wednesday, 8:10 – 10:00 in normal classroom