

Animal Physiological Ecology (11:216:360)
Fall 2023
Tuesday & Thursday, 2:00 – 3:20 PM, RAB-206
FINAL EXAM: TUESDAY, DECEMBER 19, 12-3PM

Instructor: Dr. Henry John-Alder, ENR156, 14 College Farm Road, Cook Campus
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Office Hours: By appointment.

This course will consist of in-person lectures and will use CANVAS as its course support system.

Students must comply with Rutgers community safety practices
(<https://coronavirus.rutgers.edu/health-and-safety/community-safety-practices/#masks>).

Course Description: Animal Physiological Ecology (216:360) is a course about “how animals work” – how they maintain themselves, grow, and reproduce – in the face of environmental challenges. It is a course about the physiological processes that are shared by many or all species, and the processes unique to each species. We are living in an ever-warming world, and the importance of a basic understanding of physiological ecology is becoming increasingly self-evident.

Animal Physiological Ecology is a physiology course taught from an ecological and evolutionary perspective. Perhaps a better title would be “Ecological and Evolutionary Animal Physiology”. The course is organized around environmental features and challenges, including food and energy, temperature, water, and oxygen. Within these themes, the course covers the physiological topics of 1) feeding, nutrition, and digestion; 2) energy balance and thermoregulation; 3) osmoregulation, ion regulation, and volume regulation; 4) respiration and circulation; 5) movement, integration, and sensory processes. These topics will be discussed in an ecological, evolutionary, and comparative context, with an holistic emphasis on how the whole organism “works”. The course will address molecular and cellular mechanisms, but it will mainly emphasize the organismal, ecological, and evolutionary significance of physiological function.

The course is open to sophomores through seniors, but it should be viewed as an upper-level course most appropriate for juniors and seniors. The presentation of the course assumes that students recall and understand basic biological principles, including enzyme function, active and passive transport across membranes, osmosis, energy transduction, metabolic pathways (e.g., glycolysis, Krebs tricarboxylic acid cycle, electron transport). Many of these basic principles are reviewed in detail in the first five chapters of the textbook (*Animal Physiology*, see below), and you should read those chapters carefully. In addition, Campbell’s *Biology* textbook is an excellent source to review basic biological information. Supporting information can be found at <http://www.course-notes.org/Biology/Outlines>.

Biology in general and physiology in particular are quantitative sciences. You will get lots of practice reading and interpreting graphs in this course. Some basic knowledge of mathematics, chemistry and physics will be helpful.

Learning Goals: In brief, after successfully completing Animal Physiological Ecology, students will have the knowledge base:

- 1) To understand that nothing in biology makes sense outside the context of evolution; that evolution is the organizing principle – the fabric – of biology.
- 2) To describe how organisms exist through the regulated, dynamic exchange of matter and energy with the environment.
- 3) To understand some of the many ways in which global warming is presenting new and even unprecedented challenges to living organisms.
- 4) To describe the diversity of physiological mechanisms used by organisms to regulate exchanges with the environment and cope with environmental challenges.
- 4) To describe the breadth of the discipline of physiology and the importance of integrating physiology with ecology and behavior, and with structural, cellular, and molecular biology;
- 6) To describe the functional diversity of life, with a particular focus on physiological functions that allow animals to live and thrive in environments ranging from hot, wet and tropical to cold, arid, and polar; from terrestrial to aquatic, from marine to freshwater, from normoxic to hypoxic to anoxic;

Required Textbook:

Hill, Cavanaugh, and Anderson, 2022. *Animal Physiology*, 5th edition (Sinauer). (The 2nd, 3rd, and 4th editions of this text are acceptable alternatives for most topics.)

The textbook is an outstanding source of information and references, and I strongly suggest that you get a copy for yourself. The course will cover many (but not all) sections of the book in detail. In some cases, supplemental readings will be posted as PDF files on the class Sakai site.

Without any doubt, you will improve your likelihood of getting the grade you want by reading pertinent sections and thinking about information presented in the textbook. The textbook includes some chapters and some sections of chapters that will not be covered directly in lectures. These sections will not be covered on exams. I will try to provide specific pages pertinent to lectures as the semester unfolds.

Evaluation: Evaluation will be based on three multiple-choice examinations and ten 10-point quizzes. Quizzes will be administered online via Canvas. Two hourly examinations will be given during scheduled class periods during the semester, and the partially comprehensive **final examination will be on Tuesday, December 19 from 12:00 to 3:00 PM; MARK YOUR CALENDARS NOW.**

The hourly exams will each consist of 50 multiple choice questions, valued at 2 points apiece for a total of 100 points. The final exam will consist of 75 questions (150 points), 50 of which (100 points) will cover material discussed after the second mid-term exam and 25 of which (50 points) will cover material discussed for the 1st and 2nd exams.

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Grading Scale: Final grades will be based on a total of 450 points. At a minimum, you must earn 225 points to earn a passing grade. I intend to assign letter grades on a strict percentage basis, where cutoffs are A = 90%, B+ = 87%, B = 80%, C+ = 77%, C = 70%, D = 50%, and F < 50%. However, grades will be curved if necessary to compensate for the overall performance of the class.

Course Policies and Procedures:

The best way to ensure that you earn the highest possible grade is to *attend* all lectures, *read* pertinent sections of the textbook, and *think and talk* about the information that is covered. The more thoughtful and repetitive you are in reading, reviewing, and talking about the information covered, the better you will remember it. It is helpful to take notes during the lectures, re-write your notes with guidance from pertinent readings as soon as possible after the lectures, read all pertinent sections of the textbook and supplemental readings, and write an outline of all required and pertinent sections of the textbook and supplemental readings. It is helpful to discuss the lecture material with other students in the class, or to explain what you learned to a friend or family member. But most of all, it is important to *think* about the information that is covered, and then think about it again and again. *People remember what they think about. The more you think about things, the more you remember about them. Thinking is the key to success in this and every course.*

Lecture Notes and PowerPoint slides: Lectures will be delivered in person in RAB-206 on Tuesdays and Thursdays 2:00 – 3:20 PM. You will do your best by attending lectures regularly. Lecture slides and other supporting content will be posted in modules on CANVAS.

Absence from exams: All exams will be administered at their regularly scheduled times. You must notify me ahead of time if you will have to miss a regularly scheduled exam due to an official university function. Absence from an exam due to illness or other family emergency will be evaluated on a case-by-case basis and will normally require written documentation of the reason for the absence.

DIVERSITY STATEMENT: It is my intention that students of all backgrounds will be well served by this course. I will work to create an environment of inclusion which respects and affirms the inherent dignity, value, and uniqueness of all individuals, communities and perspectives. We are lucky to have a diverse university. Diverse voices and life experiences enhance the learning process, and I welcome students to share their personal experiences. I will not tolerate disrespectful language or behavior against any individual or group. If you feel as though you have been disrespected or treated unfairly by the instructor or any other individual please let me know. You may speak with the instructor in person, over email or report anonymously via the Office of Academic Programs. In addition, you may also report bias to the Rutgers Diversity and Inclusion initiative using this link: <http://inclusion.rutgers.edu/report-bias-incident/>.

Lecture Schedule, Topics, and Readings

The lecture schedule is subject to change and adjustment as the semester progresses.

DATE	TOPIC	READINGS*
September 5	Introduction; Course logistics; Discussion: What does “physiological ecology” mean? What is one particularly fascinating animal to you with regard to its physiological ecology? How is your personal physiological ecology characterized: daily, weekly, and annually?	<i>Animal Physiology</i> : Inside front cover
September 7, 12	Scope and nature of physiology	Chapter 1; Chapter 2; Chapter 3 pages 71-79
September 14, 19	Food and Energy	Chapters 6 – 9 Review: Ch. 2 pages 39-43; Ch. 5 pages 101-123
September 21, 26	Thermal Relations	Chapter 10; Also Figure 2.3 and related text on page 37
Sept. 28, Oct. 3	Integration of Food, Energy, and Temperature	Chapter 11
THURS OCTOBER 5	FIRST MID-TERM EXAMINATION	EXAM WILL BE ADMINISTERED ON CANVAS DURING CLASS MEETING PERIOD
October 10, 12, 17, 19	Water, salts, and excretion: osmoregulation, ion regulation, volume regulation, nitrogen balance	Chapters 27 – 30 Review: Ch. 5
October 24, 26, 31 November 2, 7	O ₂ and CO ₂ ; Internal transport	Chapters 22-26
THURS NOVEMBER 9	SECOND MID-TERM EXAMINATION	EXAM WILL BE ADMINISTERED ON CANVAS DURING CLASS MEETING PERIOD
November 14, 16, 21, 28, 30	Integrating and sensory systems; Movement and muscle	Chapters 12-14
December 5, 7, 12	Muscle and movement	Chapters 19-21
DECEMBER 19	FINAL EXAMINATION	12:00 to 3:00 PM
*Readings are from <i>Animal Physiology</i> by Hill, Cavanaugh, and Anderson unless designated otherwise		