BIOLOGY 14: PHYSIOLOGY
Fall 2018

COURSE DESCRIPTION

This course examines the structure and function of cells, tissues, organs, and organ systems, and how combinations of these generate homeostatic mechanisms and adaptive responses that allow organisms to survive environmental changes. It will cover topics in human, animal, and plant physiology, often using a comparative approach, and will also include select examples of pathophysiology. The systems studied will also be considered on an integrative level, by analyzing how different organisms adapt to a variety of environmental demands and stresses (ion and water balance, temperature regulation, changes in O2 availability) and move through their environment (navigation, locomotion, exercise). Lectures are supplemented by lab sessions that include dissection, experimentation, and discussion of primary research articles, and serve as an introduction to physiological techniques, animal models, and scientific investigation.

LEARNING OUTCOMES

By the end of this course, students should be able to:

- Demonstrate a fundamental understanding of how the human body works and how we are similar to or different from other animals.
- Apply this knowledge to make logical inferences about pathological conditions or evolutionary adaptations in humans and animals.
- Describe how the scientific method is used to gain physiological knowledge, including the roles of hypotheses, predictions, experimental design, and statistical analyses.
- Critically read and evaluate the primary literature in the field of physiology and discuss this literature with peers and scholars.
- Design and execute physiological experiments.
- Write a scientific paper.

CLASS MEETING TIME AND LOCATION

Tuesday and Thursday from 10:10 am – 12:00 pm in room 200 of the Life Sciences Center (LSC). Lectures are also held during most of the X hours (Wednesday from 3:30 – 4:20 pm). Students are required to attend a lab session once a week in LSC 204 during most weeks of the course. See the class schedule at the end of the syllabus for specific dates.

INSTRUCTOR

Hannah ter Hofstede, Ph.D.
Assistant Professor
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Dartmouth College
Email: Hannah.ter.Hofstede@Dartmouth.edu
Office Hours: Tue 3:30-4:30, Wed 9-10, Thu 12-2
All office hours are held in LSC 352

GRADUATE TEACHING ASSISTANTS

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LAB DIRECTOR

Amanda Socha, Ph.D. (Office: LSC 332)
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COURSE MATERIALS / RESOURCES

Textbook: The recommended textbook for the course is *Principles of Animal Physiology* by Christopher D. Moyes and Patricia M. Schulte, Pearson Benjamin Cummings, 3rd edition, 2016. Copies of the recommended textbooks will be on reserve in Dana library (the new location is on the 3rd floor of 37 Dewey Field Road). Students are responsible for all material covered in lectures and labs, and the textbook functions as an alternative source of information to understand lab and lecture material.
Canvas Materials: The Canvas site for this course will include the Powerpoint slides of the lectures, as well as reading materials for the laboratory sessions and select research papers. Echo 360 videos of the lectures will be posted approximately 24 hours after each lecture

EVALUATION

Three "in class", written exams will be given (the last exam is NOT cumulative), each worth 100 points, and together these account for 75% of the overall grade. Exams will cover material from both lectures and labs. The lab grade will be determined by quizzes, short answer assignments and lab reports worth 5-25 points per lab and a final independent lab report based on a group project worth 35 points. Altogether, the lab activities account for 25% of the final grade.

Grades will be determined by the percentage of the total points possible (400), and not on a curve (the entire class could receive an A, an E, or anything in between). While 90% or above will be A or A- and more than 60% will be required to pass the course, the grades associated with the remainder of the scores may be adjusted slightly depending upon the distribution of the class. *Typical (but not necessarily final)* percentages and corresponding grades are: ≥93 (A); 90-92 (A-); 87-89 (B+); 83-86 (B); 80-82 (B-); 77-79 (C+); 70-76 (C); 66-69 (C-); 61-65 (D); ≤60 (E).

HONOR PRINCIPLE

During this course, it is expected that students will abide by the Honor Principle. The Dartmouth College Student Handbook (page iii) states "Fundamental to the principle of independent learning are the requirements of honesty and integrity in the performance of academic assignments, both in the classroom and outside. Dartmouth operates on the principle of academic honor, without proctoring of examinations. Students who submit work which is not their own or who commit other acts of academic dishonesty forfeit the opportunity to continue at Dartmouth." If you have any questions or concerns regarding the honor principle during the course, please contact Dr. ter Hofstede.

STUDENTS WITH DISABILITIES

Students with disabilities who may need disability-related academic adjustments and services for this course are encouraged to see Prof. ter Hofstede privately as early in the term as possible. Students requiring disability-related academic adjustments and services must consult the Student Accessibility Services office (Student.Accessibility.Services@Dartmouth.edu, Carson Hall, Suite 125, 646-9900). Once SAS has authorized services, students must show the originally signed SAS Services and Consent Form and/or a letter on SAS letterhead to their professor. As a first step, if students have questions about whether they qualify to receive academic adjustments and services, they should contact the SAS office. All inquiries and discussions will remain confidential.

STUDENTS' RELIGIOUS OBSERVANCES

Some students may wish to take part in religious observances that occur during the academic term. If you have a religious observance that conflicts with your participation in the course, please contact Dr. ter Hofstede as soon as possible to discuss appropriate accommodations. All discussions will be confidential.

CLASS SCHEDULE

DATE	TOPIC	TEXT READINGS
Tue - Thu	**NO LAB**	
Wed 9/12	No class	p. 2-19, p. 38-90, p. 118-130, p. 209-216
Thu 9/13	Course Introduction / Molecules and Cells	
Tue - Thu	Lab 1: Central Nervous System Anatomy and Function	
Tue 9/18	Nervous System: Functional Organization	Chapter 8
Wed 9/19	Nervous System: Cell Structure and Function I	Chapter 5
Thu 9/20	Nervous System: Cell Structure and Function II	Chapter 5
Tue - Thu	Lab 2: Visual System Anatomy and Function	
Tue 9/25	Nervous System: Sensory Systems I	Chapter 7
Wed 9/26	Nervous System: Sensory Systems II	Chapter 7
Thu 9/27	Endocrine System	Chapter 4
Tue - Thu	**NO LAB**	
Tue 10/2	**EXAM I**	
Wed 10/3	Muscle I	Chapter 6
Thu 10/4	Muscle II	Chapter 6
Tue - Thu	Lab 3: Cardiovascular Anatomy and Function	
Tue 10/9	Cardiovascular Physiology I	Chapter 9
Wed 10/10	Physiological experiments: design, statistics, interpretation	
Thu 10/11	Cardiovascular Physiology II	Chapter 9
Tue - Thu	Lab 4: Cardiopulmonary Anatomy and Function	
Tue 10/16	Respiratory Physiology	Chapter 11
Wed 10/17	Low O_2 Environments	
Thu 10/18	Exercise / Locomotion	Chapter 12
Tue - Thu	**NO LAB:** collect data for independent project	
Tue 10/23	**EXAM II**	
Wed 10/24	Gastrointestinal (GI) System I	Chapter 14
Thu 10/25	Gastrointestinal (GI) System II	Chapter 14
Tue - Thu	Lab 5: GI Function: Digestion	
Tue 10/30	Reproduction	Chapter 16
Wed 10/31	Immune System	Chapter 10
Thu 11/1	Ion and Water Balance	Chapter 13

CLASS SCHEDULE (con't)

DATE	TOPIC	TEXT READINGS
Tue - Thu	Lab 6: Ion and Water Balance	
Tue 11/6	Plant Physiology	
Wed 11/7	Independent Lab Report Instructions / individual help	
Thu 11/8	Ecological Physiology: guest lecturer Prof. Matt Ayres	
Tue - Thu	**NO LAB**	
Tue 11/13	Thermoregulation	Chapter 15
	Independent Lab Project Reports Due by 10:00 a.m.	
Mon 11/19	**EXAM III: 3:00-5:00 pm**	

LAB EXERCISES

LAB 1 (Week of 9/17) Central Nervous System Anatomy and Function. Students will 1) dissect and compare the central nervous systems of the sheep and leech, 2) visually compare brains of several species including pig, chicken, mouse, and frog to identify general structures of the brain, and 3) submit an assignment based on the lab activities ***(5 points)***.

LAB 2 (Week of 9/24) Visual System Anatomy and Function. Students will 1) ***prior to lab***, read an original research paper on visual physiology, 2) ***at the start of lab***, take a quiz demonstrating understanding of the paper ***(5 points)***, 3) participate in a discussion about the research paper, 4) dissect a cow eye and identify specific structures, 5) conduct an experiment investigating the ability of insect eyes to encode light.

NO LAB (Week of 10/1)

LAB 3 (Week of 10/8) Cardiovascular Anatomy and Function. Students will 1) ***prior to lab***, complete a statistics module about experimental design, hypothesis testing and data visualization ***(10 points)***, 2) ***at the start of lab,*** submit a lab report on the insect eye experiment from lab 2 ***(10 points)***, 3) dissect a cow heart to identify structures and understand the flow of blood through the heart, 4) make observations of a dissected frog and frog heart, 5) conduct an experiment investigating the influence of music on heart rate, and 6) form groups for the independent project and design an experiment that tests a hypothesis about blood pressure and heart rate in human volunteers (project outline due next week).

LAB 4 (Week of 10/15) Cardiopulmonary Anatomy and Function / Independent Project. Students will 1) ***at noon the day before their lab***, submit the independent project outline for feedback and approval by the TA and Dr. Socha ***(5 points)***, 2) ***at the start of lab,*** submit a lab report on the music and heart rate experiment conducted during lab 3 ***(20 points)***, 3) dissect a sheep pluck (heart, lungs, diaphragm, thyroid, trachea) to identify components of the cardiopulmonary system and learn about the flow of the blood through these structures, 4) learn to use blood pressure cuffs and heart rate monitors for the independent project, and 5) finalize independent project design with the TA and Dr. Socha.

NO LAB (Week of 10/22). Starting on Tuesday of this week, groups can check out blood pressure cuffs and heart rate monitors for data collection for their independent projects. Data collection, analysis and writing of the independent report will be completed on the student's own time. Data collection for the projects will be done in groups, but each student must analyze the data independently of others, come up with their own conclusions, and write their own report. All students in a group must participate in all data collection. Failure to participate fully in data collection will result in 7 points (20%) off from the grade for the written independent project.

LAB 5 (Week of 10/29) GI Function: Digestion. Students will 1) use biochemical assays to measure nutrient (carbohydrate, protein) breakdown in segments of the gastrointestinal system isolated from cockroaches, and 2) submit an assignment based on the lab activities ***(5 points)***.

LAB 6 (Week of 11/5) Ion and Water Balance. Students will 1) ***prior to lab***, read an original research paper on renal physiology, 2) ***at the start of lab***, take a quiz demonstrating understanding of the paper ***(5 points)***, 3) participate in a discussion about the research paper, 4) dissect a pig kidney and identify structures related to its function, and 5) test mammalian urine samples to diagnose potential conditions, 6) submit an assignment based on the lab experiment ***(5 points)***.

No Lab (Week of 11/12) ***Lab Report (30 points): due by 10:00 am on 11/13/18.*** Students are required to submit their project online before the deadline. The project must meet all the requirements of the standard lab report format (detailed instructions to be provided).

Lab exercises that are not handed in to your TA by the end of lab period will receive a grade of zero. Late penalty for the independent project: 0.35 points (1% of total available points) off per hour after the deadline.