

## BIOLOGY 14: PHYSIOLOGY WINTER 2020

### COURSE DESCRIPTION

This course focuses on 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. Topics include mechanisms underlying biological control (hormones, neurons) and coordinated body functions (reproduction, circulation, respiration, osmoregulation, digestion). The systems studied will also be considered on an integrative level, by analyzing how different organisms adapt to environmental demands and stresses (changes in ion and water balance, temperature, oxygen levels, pressure) 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.

### COURSE OBJECTIVES

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

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

### CLASS MEETING TIME AND LOCATION

Tuesday and Thursday from 10:10 - 12:00 am in Room 201 of the Life Sciences Center (LSC). Lectures are also held during some of the X-hours (Wednesday from 3:30 - 4:20 pm). Students are also required to attend a lab session once a week in LSC 204 during most weeks of the course.

### INSTRUCTORS

Robert Hill, Ph.D.  
Assistant Professor  
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Office Hour: Fridays 2-3 PM, LSC Room 133

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### LAB DIRECTOR

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### GRADUATE TEACHING ASSISTANTS

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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. Information will also be drawn from research articles and reviews, as well as from other well-regarded physiology textbooks. Copies of the recommended text and other textbooks will be on reserve in Dana Library (located on the 3rd floor of 37 Dewey Field Road).

Canvas Materials: The Canvas site for this course will include the PowerPoint slides for the lectures, as well as videotapes of the lectures (Echo360), reading materials for the lab sessions, research papers, and reviews. Laptops can be used to access the material and take notes during class.

## 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. 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 an "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: >90 (A); 86-89 (A-/B+); 80-85 (B); 76-79 (B-/C+); 70-75 (C); 66-69 (C-); 61-65 (D); <60 (E).

### Grading Policy for Exams:

- 1) After the exam has been graded and returned, a copy of the answer key will be posted on the windows to the entrance of the Bio14 lab, LSC room 204. Review this answer key and be sure to understand the errors in your exam and why you made them.
- 2) The number of points given for each answer is final. If, after reviewing your answers and comparing them to the posted answer key before the deadline (see below), you find an arithmetic error or detect an omission by the grader, you must observe the following procedures for error correction
  - a) **Do not write on the exam. Any alteration of the answers between the time when the graded papers were returned to the student and the time when the paper was submitted for re-grading constitutes a breach of the Academic Honor Principle. To deter this practice, we scan exams before grading them.**
  - b) Prepare a typed cover page with your name and HB number.
  - c) If you find an addition error, indicate on the cover page that an addition error has occurred. Specify the page and question number.
  - d) If you determine that your answer contains all of the information indicated in the key, but you did not receive full credit, simply indicate the number of the question to be re-evaluated and state in one or two short, descriptive sentences (typed) what makes your answer correct. The citation of a text page, diagram, or reference to a lecture date/number may also be helpful.
  - e) Attach the typed cover sheet to your complete exam and return it before the announced deadline to the Bio14 drop box located outside the LSC 202.
  - f) Exam Error correction requests must be hand-delivered to the **Bio14 drop box** (physical box outside of room 202 in the LSC) **before these deadlines:**

First Exam: 12:00 PM (Noon) on Tuesday, February 4, 2020

Second Exam: 12:00 PM (Noon) on Tuesday, February 25, 2020

**We will not accept questions regarding errors in grading after these deadlines.**

## 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 this during the course, please contact Dr. Hill or Dr. Maue.

Honor Principle: <http://student-affairs.dartmouth.edu/policy/academic-honor-principle>.

## **STUDENTS WITH DISABILITIES**

Students with disabilities, including invisible disabilities such as chronic illnesses and learning disabilities are encouraged to arrange for accommodations that might be helpful. Please meet with Dr. Hill privately as soon as possible, preferably during the 1st week of class, to discuss possible accommodations. In particular, students requiring disability-related academic adjustments and services must consult the Student Accessibility Services (SAS) office (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 Dr. Hill. 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 with Dr. Hill, Dr. Maue and/or SAS will remain confidential.

SAS Office: <http://www.dartmouth.edu/~accessibility/facstaff/index.html>

## **STUDENT WELLNESS**

The academic environment at Dartmouth can be challenging, the terms can be intensive, and classes are sometimes not the only demanding part of your life. There are a number of resources available on campus to support your wellness, and you are encouraged to use these resources and take care of yourself throughout the term.

These resources include:

Undergraduate Deans: <http://www.dartmouth.edu/~upperde/>

Counseling and Human Development: <http://www.dartmouth.edu/~chd/>

Student Wellness Center: <http://www.dartmouth.edu/~healthed/>

At Dartmouth, we value integrity, responsibility, and respect for the rights and interests of others, all central to our Principles of Community. We are dedicated to establishing and maintaining a safe and inclusive campus where all have equal access to the educational and employment opportunities Dartmouth offers. We strive to promote an environment of sexual respect, safety, and well-being. In its policies and standards, Dartmouth demonstrates unequivocally that sexual assault, gender-based harassment, domestic violence, dating violence, and stalking are not tolerated in our community.

The Sexual Respect Website (<https://sexual-respect.dartmouth.edu/>) provides a wealth of information on your rights and obligations with regard to sexual respect and resources that are available to all in our community. As a faculty member, we are obligated to share disclosures regarding conduct under Title IX with Dartmouth's Title IX Coordinator. Should you have any questions, please feel free to contact Dartmouth's Title IX Coordinator Kristi Clemens ([Kristi.Clemens@Dartmouth.edu](mailto:Kristi.Clemens@Dartmouth.edu)) (and deputies if appropriate).

## **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. Hill as soon as possible to discuss appropriate accommodations. All discussions will be confidential.

## **LAB EXERCISES (see Lab Syllabus for more information)**

Details about the lab activities are included in the Lab Syllabus. Students will do dissections in a number of the lab sessions. The materials for dissection are from commercial vendors and other suppliers, and include both fixed tissues (from cow, sheep, frog, pig) and live organisms (i.e. leech, cockroach). Dissection procedures and techniques will be reviewed before students begin these experiments. Students will also do an Independent Project, where they perform non-invasive, instructor-approved experiments on other students, typically monitoring work output, blood pressure, respiration rate and/or heart rate during short periods of activity or in response to other stimuli in or outside of the laboratory.

**LAB 1 (Week of Jan 6-10) Anatomy and Function of the Nervous System.** Students will dissect and compare the central nervous systems of the sheep and leech. Students will also visually compare brains of several other species as well in order to identify general structures of the brain and consider overall changes that have occurred during evolution.

**LAB 2 (Week of Jan 13-17) Sensory Physiology.** Students will dissect a cow eye and identify specific structures. They will participate in several different group activities that demonstrate comparative and other aspects of visual system function.

**LAB 3 (Week of Jan 20-24) GI Function and Metabolism.** Students will use biochemical assays to measure nutrient (ie. carbohydrate, protein, lipid) breakdown in segments of the gastrointestinal system isolated from cockroaches.

**LAB 4 (Week of Jan 27-Jan 31) Renal Anatomy and Function.** Students will dissect a pig kidney and identify structures related to its function, will do an experiment analyzing urine samples from animal models of diabetes and various forms of kidney damage.

**NO LAB (Week of Feb 3-7)** Students will complete a series of on-line Statistics Modules.

**LAB 5 (Week of Feb 10-14) Comparative Cardiac Anatomy.** Students will dissect a cow heart, and leech heart tube, and will identify structures in each as well as compare and contrast the circulatory systems in a variety of other organisms.

**LAB 6 (Week of Feb 17-21) Cardiopulmonary Anatomy.** Students will learn to use blood pressure cuffs and heart rate monitors. During this lab, students will submit the plan for their independent experiment (one per group). Each group will be responsible for determining the method by which they will test their hypothesis. All experiments must be approved by the graduate TAs and Dr. Socha prior to beginning this experiment. Students will also dissect a sheep pluck (heart, lungs, diaphragm, thyroid, trachea) to identify components of the cardiorespiratory system, including visualizing the flow of the blood through the heart, to the lungs, and back to the heart and rest of the body. Students will discuss an assigned research paper that they will have read prior to the lab.

**NO LAB (Week of Feb 24-28)** Students will collect data for their Independent Project. Student groups will test the hypothesis they developed, using changes in blood pressure and heart rate as the output. Groups will check out blood pressure cuffs and heart rate monitors for a 24-hour period and complete this lab on their own time. Students will also independently write a lab report (each student must write their own lab report, analyze the data, and come up with their own conclusions).

**NO LAB (Week of Mar 2-6)** Students are required to submit a hard copy according to standard lab report format (detailed instructions will be provided). For these reports, each person in the group must do their own analysis of the data collected by their group, do their own writing, make their own figures, and write their own discussion and conclusions. The Lab Report is due on March 5th.

## CLASS SCHEDULE

DATE	ACTIVITY / TOPIC	READING
<b>Tue - Thu</b>	Lab 1: Comparative Anatomy and Function of the Nervous System	
<b>Tue 1/7</b>	Lecture 1: Course Intro / Nervous System I -Functional Organization	15-17, 58-89, 310-353
<b>Wed 1/8</b>	X-hour Lecture 2: Nervous System II - Cellular Structure and Function	154-205
<b>Thu 1/9</b>	Lecture 3: Sensory Physiology I	256-305
<b>Tue - Thu</b>	Lab 2: Sensory Physiology	
<b>Tue 1/14</b>	Lecture 4: Sensory Physiology II	256-305
<b>Wed 1/15</b>	X-hour Lecture 5: Hormones and Endocrine Regulation	101-149
<b>Thu 1/16</b>	Lecture 6: Reproductive Physiology	670-698
<b>Tue - Thu</b>	Lab 3: GI Function and Metabolism	
<b>Tue 1/21</b>	EXAM 1	
<b>Wed 1/22</b>	X-hour: Lecture 7: GI System - Digestion and Feeding	592-631
<b>Thu 1/23</b>	Lecture 8: GI System - Metabolism	58-76
<b>Tue - Thu</b>	Lab 4: Renal Anatomy and Function	
<b>Tue 1/28</b>	Lecture 9: Renal Physiology - Ion and Water Balance	545-586
<b>Wed 1/29</b>	X-hour	
<b>Thu 1/30</b>	Lecture 10: Plant Physiology - Metabolism and Water Balance	
<b>Tue - Thu</b>	NO LAB	
<b>Tue 2/4</b>	Lecture 11: Muscle Structure and Function I	223-251
<b>Wed 2/5</b>	X-hour	
<b>Thu 2/6</b>	Lecture 12: Muscle Structure and Function II	223-251
<b>Tue - Thu</b>	Lab 5: Comparative Cardiovascular Anatomy and Function	
<b>Tue 2/11</b>	EXAM 2	
<b>Wed 2/12</b>	X-hour	
<b>Thu 2/13</b>	Lecture 13: Cardiovascular Physiology - Heart and Blood	357-411
<b>Tue - Thu</b>	Lab 6: Cardiopulmonary Anatomy and Function	
<b>Tue 2/18</b>	Lecture 14: Respiratory Physiology/Gas Exchange in Animals	442-488
<b>Wed 2/19</b>	X-hour Lecture 15: Immune System	415-439
<b>Thu 2/20</b>	Lecture 16: Integrative Physiology - Migration and Navigation	
<b>Tue - Thu</b>	Lab 7: Independent Project	
<b>Tue 2/25</b>	Lecture 17: Integrative Physiology - Exercise / Locomotion	410-411; 522-540
<b>Wed 2/26</b>	X-hour	
<b>Thu 2/27</b>	Lecture 18: Integrative Physiology - Thermoregulation	635-665
<b>Tue - Thu</b>	NO LAB	
<b>Tue 3/3</b>	Lecture 19: Integrative Physiology - Diving/High Altitude	488-495
<b>Wed 3/4</b>	X-hour Lecture 20: Integrative Physiology - Space	
<b>Thu 3/5</b>	No Class      **Independent Lab Project Reports Due by 10am**	
<b>Tues 3/10</b>	EXAM 3 (11:30 am - 1:30 pm)	