

BIOLOGY 14: PHYSIOLOGY

WINTER 2013

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 help organisms survive environmental changes. It will cover topics in human, animal, and plant physiology, often in the context of comparative physiology, and will also include select examples of pathophysiology. This includes biological control systems (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 a variety of environmental demands and stresses (water balance, temperature regulation, 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.

CLASS MEETING TIME AND LOCATION

The class meets Tuesday and Thursday from 10:00 - 11:50 am in room 100 (Oopik Auditorium) of the Life Sciences Center (LSC) for lectures. Lectures are also held during approximately half of the X hours (Wednesdays from 3:00 – 4:00 pm). Students are also required to attend a lab session once a week in the LSC (Room 204) during most weeks of the course.

INSTRUCTOR

Robert A. Maue, Ph.D.

Professor

Department of Physiology & Neurobiology

Department of Biochemistry

Dartmouth Medical School

Adjunct Professor

Department of Biological Sciences

Dept of Psychological Brain Sciences

Dartmouth College

Office Hours:

Mon (1-2 pm)

LSC 133

Wed (3-4 pm)

LSC 133

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LAB DIRECTOR

Carmen Truncoso Brindeiro, Ph.D.

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Office Hours:

Tue (1-2 pm) Thur (1-2 pm)

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GRADUATE TEACHING ASSISTANTS

Ms. Aya Shibuya

Ms. Jessica Rostad

Ms. Ruth Sinnamon

Office Hours:

Tue (9-10am) Fri (9-10am) LSC 133

Tue (12-1pm) Thur (12-1 pm) LSC 133

Wed (2-3pm) Fri (11-12pm) LSC 133

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, 2nd edition, 2008. 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 the Dana library.

On-line: Study aids (incl. practice quizzes) developed from the textbook are found at: http://wps.aw.com/bc_moyes_animalphys_2/76/19516/4996309.cw/index.html

Blackboard Materials: The Blackboard site for this course will include the Powerpoint slides of the lectures, as well reading materials for the laboratory sessions and select research papers and reviews.

EVALUATION

Three "in class", written exams will be given (the last exam is NOT cumulative), each worth 100 points, and this will account for 75% of the grade. There is a lab report (35 points) for the independent lab project and lab notebook grades for each of the other 6 lab sessions (10-11 points per session). Thus, 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 definitely 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 overall difficulty of the exams. *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).

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. Maue.

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. Maue as soon as possible, preferably during the 1st week of class, to discuss possible accommodations. All discussions will be confidential, although the Academic Skills Center may be consulted to verify any disability.

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. Maue as soon as possible to discuss appropriate accommodations. All discussions will be confidential.

CLASS SCHEDULE

DATE	ACTIVITY / TOPIC	READING
Tu 1/8	Lecture 1: Course Intro / Overview Cell Structure/Function	10-16; 22-56 64-84;198-210
Wed 1/9	X-Hour	
Th 1/10	Lecture 2: Nervous System I: Functional Organization	306-338
Mon/Th	Lab 1: Comparative Anatomy and Function of the Central Nervous System	
Tu 1/15	Lecture 3: Nervous System II: Cellular Structure and Function	146-191
Wed 1/16	X-Hour	
Th 1/17	Lecture 4: Nervous System III: Sensory Systems	250-300
Mon/Th	Lab 2: Sensory Physiology: Visual System Anatomy and Function	
Tu 1/22	Lecture 5: Hormones and Endocrine Regulation	92-133
Wed 1/23	X- Hour	
Th 1/24	Lecture 6: Reproductive Physiology	662-692
Mon/Th	Lab 3: Metabolism and GI Function	
Tu 1/29	EXAM I	
Wed 1/30	Lecture 7: GI System: Digestion and Feeding	526-567
Th 1/31	Lecture 8: GI System: Metabolism	57-63; 126-130; 253-262
Mon/Th	Lab 4: Comparative Renal Anatomy and Function	
Tu 2/5	Lecture 9: Renal Physiology - Ion and Water Balance	470-518
Wed 2/6	X-Hour	
Th 2/7	Lecture 10: Plant Physiology: Metabolism and Water Balance	

Mon/Th	NO LAB	
Tu 2/12	Lecture 11: Muscle I	
Wed 2/13	X-Hour	
Th 2/14	Lecture 12: Muscle II	212-242
Mon/Th	Lab 5: Comparative Cardiovascular Anatomy and Function	
Tu 2/19	EXAM II	
Wed 2/20	X-Hour	
Th 2/21	Lecture 13: Cardiovascular Physiology: Heart and Blood	350-400
Mon/Th	Lab 6: Cardiopulmonary Anatomy and Function	
Tu 2/26	Lecture 14: Respiratory Physiology/Gas Exchange in Animals	410-459
Wed 2/27	X-Hour	
Th 2/28	Lecture 15: Integrative Physiology: Exercise / Locomotion	401-402; 574-617
Mon/Th	Lab 7: Independent Project	
Tu 3/5	Lecture 16: Integrative Physiology: Thermoregulation	624-656
Wed 3/6	Lecture 17: Integrative Physiology: Migration and Navigation	
Th 3/7	Lecture 18: Integrative Physiology: Diving/High Altitude/Space	462-464
Mon/Th	NO LAB	
Tu 3/12	No Class **Independent Lab Project Reports Due by 10:00 am**	
Wed 3/13	X-Hour	
Th 3/14	EXAM III 8:00 am – 11:00 am	

LAB EXERCISES

Students will do dissections in a number of the lab sessions. In some cases the materials for dissection (from cow, sheep, frog) are obtained from Carolina Biological Supplies, while in others the organisms used (ie. leech, fish, cockroach) are obtained from other suppliers. Dissection procedures and techniques will be reviewed before students begin these experiments. For the Independent lab, students will be performing experiments on other students, 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. All of these independent experiments must be non-invasive.

Lab 1 (Week of Jan 14). Anatomy and Function of the Central Nervous System

Students will dissect and compare the central nervous systems of the sheep, leech, pig, and mouse, and identify general structures of the brain.

Lab 2 (Week of Jan 21) Sensory Physiology: Visual System Anatomy and Function

Students will dissect a cow eye and identify specific structures. They will obtain an estimate of the frequency response of their photoreceptors, and use specialized goggles to demonstrate aspects of visual system function. Students will discuss an assigned research paper about vision that they will have read prior to coming to the lab.

Lab 3 (Week of Jan 28) GI Function: Digestion

During this lab, students will measure nutrient (carbohydrate, protein) breakdown in segments of the cockroach gastrointestinal system.

Lab 4 (Week of Feb 4) Renal Anatomy and Function

Students will dissect a sheep kidney and identify structures related to its function. They will isolate tubules from goldfish kidney, and measure transport of molecules across the tubules. They will also discuss a research paper relevant to renal function.

No Lab (Week of Feb 11)

Lab 5 (Week of Feb 18) Comparative Cardiac Anatomy

Students will dissect a cow heart, frog heart, and leech, and will identify structures and compare and contrast the hearts and circulatory systems in these three organisms.

Lab 6 (Week of Feb 25) 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).

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.

Lab 7 (Week of Mar 4) Independent Project

For this lab, student groups will develop a hypothesis to test using changes in blood pressure and heart rate as the output. Each group will be responsible for determining the method by which they will test their hypothesis. All experiments must be approved

by the graduate TA prior to beginning this experiment. Groups will check out blood pressure cuffs and heart rate monitors for a 24 hr period and be completing 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). (*Lab Report: 35 pts – **this report is due by 10 am on March 12***)

LAB REPORT

For the report, students are required to submit a hard copy according to standard lab report format. The reports should be double spaced with a font size of 12. For these reports, each person or group supplies their data to a central data file (usually Excel) but they must analyze all of the group data individually.