

BIOLOGY 451 - COMPARATIVE PHYSIOLOGY - SYLLABUS

Meeting Times: Spring, 2020, T-Th 11:00-12:15, 107 Wilson Hall

Instructors: Dr. William M. Kier, 313 Wilson Hall, billkier@bio.unc.edu

Dr. Tyson L. Hedrick, G40a Wilson Hall, thedrick@bio.unc.edu

Kier Office Hours: 12:15-1:15 Thursday; *Hedrick Office Hours:* 2:00-3:00 Tuesday

Textbook: Hill, R.W., Wyse, G.A., and Anderson, M. (2016) *Animal Physiology*. 4th Ed. Sinauer Associates, Inc., Sunderland, MA.

Course overview:

BIOL 451 is an examination of the physiology of animals using a comparative approach. Both invertebrate and vertebrate animals are discussed in order to elucidate general principles arising from the properties of the environments in which animals exist, the physical and biochemical implications of those environments and shared evolutionary history.

Lecture topics:

Week of	Topics	Chap
January 6	course introduction, composition of air, water vapor in air	22
January 13	solubility of gases, respiration in water, gills, countercurrent exchange, boundary layers, respiration in air, mammalian lungs, air-breathing fish, bird respiration	23
January 20	insect respiration, cyclic respiration, oxygen transport in blood, respiratory pigments, oxygen dissociation curves, facilitated diffusion, carbon dioxide transport	24
January 27	pumps and channels, water compartments, circulation patterns, cardiac output, blood vessels, physics of pipe flow, blood pressure, capillaries, exercise, invertebrate circulation, clotting, feeding	25, 6
February 3	food types and mechanisms, hydrothermal springs, digestion, enzymes, wood and cellulose digestion, ruminants, nutrition, vitamins, minerals, trace elements	6,
February 10	EXAM 1 - TUESDAY, FEBRUARY 11 (30% of course grade) metabolic rate, energy storage, oxygen, diving mammals and birds	7, 26
February 17	metabolic rate and body size, size and scaling, energy cost of locomotion for running, swimming and flying, physiological time, temperature and Q_{10} , high temperature and heat death, low temperature and freezing, temperature adaptation, acclimation, acclimatization	7, 8, 9, 10
February 24	body temperature, heat, heat transfer, heat balance, temp regulation in the cold, insulation, heat exchangers, temp regulation in the heat, evaporation, torpor and hibernation, heterotherms, hot fish, hot insects	10, 11
March 2	Osmotic regulation theory and practice in marine invertebrates, osmotic regulation in marine vertebrates and freshwater animals, water balance in terrestrial animals	27, 28
March 9	SPRING BREAK	
March 16	Nitrogen regulation and excretion; theory, invertebrate animals, vertebrate animals and the mammalian kidney	28, 29

March 23	EXAM 2 - TUESDAY, MARCH 24 (30% of course grade) muscle and movement: amoeboid and microscopic locomotion, vertebrate muscle structure and function	20
March 30	vertebrate muscle excitation and contraction, muscle types, and use in locomotion and movement	20
April 6	nervous system: general theory, action potentials, cable theory model, scaling of transmission speed, myelinated and unmyelinated nerves	12
April 13	endocrine system: hormone types and modes of action, hormonal regulation of salt and water balance and of insect metamorphosis, sensory systems and mechanosensation	16
April 20	hearing, vestibular sensation, chemosensation, vision and visual sensory processing	14
	FINAL EXAM - 12:00 PM, Monday, April 27, 2020 (40% of course grade)	

Textbook and Readings:

The text for the course is Hill, R.W., Wyse, G.A., and Anderson, M. (2016) *Animal Physiology*. 4th Ed. Sinauer Associates, Inc., Sunderland, MA. The coverage in the text is up to date and complete and we hope that you will enjoy reading it. We have included general reading assignments in the weekly topic list above and will provide more detailed reading assignments each class meeting as we progress through the course. If you are accustomed to not doing the reading and relying on lecture only, please break the habit! We have found that students do much better in the course if they complete the readings before class. Such an approach allows you to get significantly more out of each lecture. In addition, the pace of the lectures is fast and it will be difficult to keep up if you have not already studied the text. If you are interested in additional information on a given topic please see us as there are some wonderful readings we can recommend for more in depth coverage of many of the topics.

Exams and Grading:

The exam dates, including the final, are included on the schedule above. The first exam will cover the first 1/3 of the course and will count for 30% of the course grade. The second exam will cover the second 1/3 of the course and will also count for 30% of the course grade. The final will count 40% of the course grade. One half of the final will cover the final 1/3 of the course and the other half of the final will be cumulative. The weighting is designed to prevent any single exam, especially the final, from carrying too much weight since anyone can have a bad day, particularly during the crowded final exam period.

The exams will be short answer, fill in the blank, short problems and multiple choice. They are designed to explore the depth of your understanding of the material and require that you do more than simply memorize. To excel, you must master the material and in many cases be able to use the information in a new context. We strongly encourage you to study in groups and discuss the material instead of working alone or merely quizzing one another. **We do not schedule make-up exams.**

Honor Code:

The Chancellor requires that you read the statement of the Honor Code below. In a perfect world, this is all that should be required. This is, alas, not a perfect world. We want to mention that after we complete the grading of the exams, we will pull a number of them at random and photocopy them. We thus will have a record of what was originally on the exam for comparison if it is handed back for regrading. We apologize if this seems mistrustful. We are confident that the vast majority of students

are honest, but we have been forced into this policy by several unpleasant Honor Code violations in the past.

Lecture and Office Hours:

Office hours are listed above. If you have a class conflict with those times please contact us by email and we will set an appointment. The lectures will start promptly at 11:00. It would be helpful if you could be on time since it is disruptive of your colleagues if you arrive late. In return, we will be prompt about finishing up lectures on time and will avoid running over. We have found that students who perform best in this course are those who do not miss class. If you absolutely cannot attend class due to an emergency, please make certain that you get the notes from someone immediately so that you can work through the material in association with the textbook. We recommend that you introduce yourself to several colleagues in the class and exchange phone numbers and email addresses. This will allow you to confirm that they will be in a particular class if you are unable to attend and can thus be assured of getting the notes from them.

As an aid to following our lectures we will put an outline on the board or projection screens at the beginning of class. We hope that this will help you to follow the lectures and to see their overall structure and goals.

Statement of Diversity:

The Department of Biology values the perspectives of individuals from all backgrounds reflecting the diversity of our students. We broadly define diversity to include race, gender identity, national origin, ethnicity, religion, social class, age, sexual orientation, political background, and physical and learning ability. We strive to make this classroom and this department an inclusive space for all students.

BIOLOGY 451 - COMPARATIVE PHYSIOLOGY - HONOR CODE STATEMENT

The *Instrument of Student Judicial Governance* was adopted in furtherance of the University's shared commitment to the pursuit of truth, and the dissemination of knowledge to succeeding generations of citizens devoted to the high ideals of personal honor and respect for the rights of others. In order to achieve these goals and ideals, and to promote a community characterized by intellectual honesty, personal integrity, and mutual respect, students and faculty are encouraged to adhere to the following principles:

All students are responsible for conducting themselves in a manner that helps enhance an environment of learning in which the rights, dignity, worth, and freedom each member of the academic community are respected. In order to ensure effective functioning of an Honor System worthy of respect in this institution, students are expected to:

- A. Conduct all academic work within the letter and spirit of the Honor Code, which prohibits the giving or receiving of unauthorized aid in all academic processes.
- B. Consult with faculty and other sources to clarify the meaning of plagiarism; to learn the recognized techniques of proper attribution of sources used in the preparation of written work; and to identify allowable resource materials or aids to be used during examination or in completion of any graded work.

- C. Sign a pledge on all graded academic work certifying that no unauthorized assistance has been received or given in the completion of the work.
- D. Comply with faculty regulations designed to reduce the possibility of cheating – such as removing unauthorized materials or aids from the room and protecting one’s own examination paper from the view of others.
- E. Maintain the confidentiality of examinations by divulging no information concerning an examination, directly or indirectly, to another student yet to write that same examination.
- F. Treat all members of the University community with respect and fairness.
- G. Report any instance in which reasonable grounds exist to believe that a student has given or received unauthorized aid in graded work or in other respects violated the Honor Code. Such report should be made to the Office of the Student Attorney General, the Office of the Dean of Students, or other appropriate officer or official of their college or school.
- H. Cooperate with the Office of the Student Attorney General and the defense counsel in the investigation and hearing of any incident of alleged violation, including giving testimony when called upon. Nothing herein shall be construed to contravene a student’s rights enumerated in Section IV.A. of this *Instrument*.

The offenses set out in Section II of the *Instrument*, not this listing of responsibilities, shall be the basis for determining chargeable offenses under the Honor Code.

The University is committed to freedom of expression. The principles set forth in this statement do not create the basis for disciplinary action and are not intended to interfere with an individual’s academic or personal freedom. Consequently, the offenses set out in Section II of this *Instrument*, not this listing of expectations, shall be the basis for determining chargeable offenses under the Honor Code. It is hoped, however, that student will voluntarily endorse these common principles in furtherance of the shared commitment to fostering a community of intellectual honesty, personal integrity, and responsible citizenship.

Excerpted from *The Instrument of Student Judicial Governance*, UNC - Chapel Hill,

<https://studentconduct.unc.edu/instrument-document>

See also: <https://studentconduct.unc.edu/>