BIO 386: Comparative Physiology
Spring 2016
Course meeting (MWF: 12:30 – 1:20 pm & M: 2:30 – 5:30 pm)

Lecture Instructor:
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Office Hours (Nobel 221F): M,W,Th: 10:30 – 11:30 am
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I am here to help you succeed through your academic endeavor. Please let me know if you have any concerns, need clarifications, or are unsure of the study strategy. Please ask questions during and after class, stop by during office hours, or send me an email to set up a time to meet. I check and respond to emails during normal 'business' hours (M-F 8:00 am – 5:00 pm; I may not respond in a timely manner if contacted outside of these hours). However, please know that I prefer not to answer questions about the learning materials by e-mail or other "message" technologies. It will be far more effective in promoting your understanding and clarifying your confusions by discussing in person for three minutes than going over tens of emails. My office hours are dedicated to meet with you. Please plan to take advantages of those hours.

Course Location: Lecture – Nobel 305
Lab – Nobel 226

Lecture Textbook: *Animal physiology*, **3rd edition** by Hill, Wyse, and Anderson (Sinauer)

Recommended: *Writing Papers in Biological Sciences,* 5th edition by McMillan (Bedford/St. Martin's)

Online Resources:

This course will rely on the **Moodle** course management system (2016 s-bio-386-Kawarasaki) for distributing and posting course materials. Use your email username and password to log in.

Course Description:

'Nothing in biology makes sense except in the light of evolution.' ~Theodosius Dobzhansky

Animal physiology deals with the fundamental question of how animals function – survive and reproduce – in their environments. Animals are diverse in their physiological adaptations. Thus, the focus of this course is not only to learn how specific structures (e.g. heart or kidney) work within an animal, but also to compare and contrast those different adaptations in various types of animals. This comparative approach is a particularly exciting and powerful way to explore the field of physiology; not only does it allow us to discover the underlying principles that govern physiological processes across various taxa, but also encourages us to contemplate on the evolutionary origins of certain mechanisms.

Also, it is worth reminding that comprehensive understanding of physiology requires examination of adaptations at various levels of the biological organization – from molecular to organismal. Thus, integration of the information introduced in the four-course core curriculum of the Biology program at Gustavus will be emphasized in this course.

Course-Specific Learning Outcomes:

1. Students will demonstrate understanding of the diversity in physiological adaptations exhibited by various members of the animal kingdom by;
    a. Describing functions of different organs and organ systems
    b. Explaining underlying biochemical and cellular processes for various physiological adaptations
    c. Evaluating how specific adaptations are critical for survival of animals within their environments
    d. Comparing and contrasting various strategies/mechanisms that different types of animals exhibit to deal with similar environmental challenges.
    e. Synthesizing an evolutionary perspective on the origin of certain physiological mechanisms

2. Students will apply their understanding of experimental research into practice by;
    a. Identifying a research question
    b. Formulating a testable hypothesis that is related to the research question
    c. Designing an experiment that critically addresses the hypothesis
    d. Applying appropriate statistical testing on data to evaluate the hypothesis
    e. Producing figures and/or tables to summarize findings in the style appropriate for scientific manuscripts
    f. Interpreting results to draw a conclusion and their meaning in a broader context

3. Students will demonstrate their ability to effectively communicate biological information by;
    a. Writing of summaries and reports for laboratory activities
    b. Construction of a research poster in the quality appropriate for professional meetings
    c. Orally presenting their research findings at a poster symposium

These outcomes will be achieved by;

- Participating in lectures and class activities
- Discussion of selected readings
- Actively engaging in laboratory activities
- Identifying, developing, and executing an independent research project related to physiology
- Sharing and discussing research finding to classmates and other students at Gustavus

Please refer to the document titled "The Big Picture: How Your Experience in BIO386 (Comparative Physiology) Meets the Departmental and Institutional Learning Outcomes" for more information about how this course is aimed to contribute to your overall educational experience at Gustavus in general.

Course Format:

Lecture:

You are expected to attend and actively participate in all lectures. I will give assignments and make announcements in class. Assignments are due at the beginning of the lecture period unless otherwise stated. If you are absent, you cannot earn points associated with lecture activities. It is important that you complete the suggested readings before class. Questions from you are always welcome during lectures. Exchanges of ideas are the critical (and fun) component of our collaborative learning and they often lead to the development of more exciting and dynamic perspectives on the topic we are covering.

Laboratory:

You are expected to participate in all labs. Laboratories give you an opportunity to explore various physiological concepts in a hands-on manner. Labs are also designed to help you practice the process of designing experiments, analyzing and interpreting data, and writing reports. Some of the lab periods will be dedicated for you to work on your independent project. However, you must expect to put time outside of the scheduled three hours per week for your project. You can be granted access to the lab outside of lab hours, but please be sure to keep the lab **CLEAN**.

Missing lecture and/or Lab: Physical experiences that obtained during labs of upper-level biology courses are integral to your education development, and therefore, may not be made up by alternative assignments. Please contact the instructor at the earliest possible opportunity if you have a legitimate excuse to miss a lab. However, please note that, even with an excused absence, full make-up of points will not be guaranteed.

Course Assessment:

Lecture exams:

Three lecture exams and one final exam will be given. The exam questions will be of a variety of formats; question may include matching, multiple-choice, true-false, labeling and drawing diagrams, fill-in-the-blank, short-answer, and essay. You are expected to take exams on the days they are scheduled. Please *mark exams on your calendar*. An alternative date will be set to accommodate only individuals with an acceptable **academic excuse**, but you must contact me at least 1 week in advance. A rehearsal, athletic practice, vacation or a job are not acceptable reasons for missing an exam. The format of the make-up exam will be at my discretion.

Lab reports and notebook:

For lab activities and your independent project, you are expected to keep a neat record of procedures and measurements in a single notebook (a binder is also accepted). Also, for every Lab (1 – 7; see schedule), you are expected to submit **a typed summary and conclusion(s)** (bullet point lists are fine). The conclusions are **due at the beginning of the first lecture** during the following week; please check the schedule. For the selected Labs (3 – 5), you will also have the opportunity to practice writing *Materials and Methods* and *Results* of the activity, in addition to the summary and conclusion. Of your attempts in writing these reports, the best two grades will contribute toward your final grade.

Independent research project:

You will design and execute an independent research project related to physiology and present the results in the form of a scientific poster. You may work as a group of two for this project. The proposal/introduction with associated literatures cited will be due earlier in the semester. Please note that while the poster will be completed as a group, **this first write-up will be submitted and subsequently graded independently.** Each student is also required to keep a lab notebook for his or her procedures, observations, and data recording. The lab notebook will be graded independently for its clarity and comprehensiveness, although substantial overlaps in data with group members are expected. Please check the schedule for various due dates.

Point breakdown:

1) Three lecture exams (50 pts. each)	50 points X 3	=	150 points
2) One final exam (80 pts.)	80 points X 1	=	80 points
3) Independent group project (poster)	50 points X 1	=	50 points
4) Independent group project (presentation)	10 points X 1	=	10 points
4) Independent group project first write-up (individual)	25 points X 1	=	25 points
5) Lab conclusions (for all labs)	10 points X 7	=	70 points
6) Lab reports (best two grades will be counted)	20 points X 2	=	40 points
	TOTAL	**=**	**425 points**

Questions about your exams or assignments:

Please come see me with questions about your exams and assignments after you have waited 24 hours from when the material was returned to you. This will give you time to consult your notes and text, and reflect on the question. If you request a re-assessment of any question, write down your rationale for why you believe I should reconsider your answer and include it with your original exam or homework assignment. I reserve the right to re-grade your entire assignment. You have seven days to look over your assignment and contact me about re-grades.

Course Grade:

The letter grade that you earn for this course is a function of the total number of points you accumulate during the semester. The laboratory is considered an extension of lecture and therefore, the course grading will be combined (in other words, you will receive the same grade for both lecture and the lab). Letter grades are assigned based on a standard college scale. Exam scores are not assigned by a "standard curve," so everyone in the course can earn an A. **No extra credit** will be available for this course, just do the assigned work and do it well and you will be fine.

Grade	Percent	Grade	Percent	Grade	Percent	Grade	Percent
A	93-100	B	83-86	C	73-76	D	60-64
A-	90-92	B-	80-82	C-	70-72	F	Below 59
B+	87-89	C+	77-79	D+	65-69		

MANAGING AT GUSTAVUS:

Academic Integrity

Before you came to GAC, you agreed to abide by the academic honesty policy. For a refresher of the Honor Code see http://gustavus.edu/general_catalog/current/acainfo. Cheating on exams and homework (both seeking answers and allowing others to use your work) and plagiarism will not be tolerated. Plagiarism is the use of someone else's words, ideas, data, or work without giving them full credit. *Plagiarism includes lifting material from web sites, using language similar to the source even if you give credit (i.e. paraphrase that is too similar to the source), or using a classmates homework.* Take notes in your own words to avoid plagiarism and be careful about what you "cut and paste." "It is still plagiarism if you use an author's key phrase or sentence structure in a way that implies they are your own, even if you cite the source. Instead, enclose the original wording in quotations and cite the source. Better yet, put the whole passage in your own words" (McMillan 1998). Cite sources in a conventional biology format (see McMillan 1998). If you violate the Honor Code, I will discuss the issue with you and the Provost and you will earn a zero for the assignment. If you repeat an offense a second time, you will fail the course.

Resources for students whose first language is not English
Support for English Language Learners (ELL) and Multilingual students is available through the College's ELL Support specialist, Sarah Santos (ssantos@gustavus.edu or x7197; in the library 203A). She can meet individually with you to consult about academic tasks and to help find other means of support. You may also find it helpful to contact The Writing Center (232 Confer) which has peer tutors on staff. For further information about ELL, contact the Academic Support Center (204 Johnson Student Union).

Resources for Students with Disabilities
Gustavus Adolphus College is committed to ensuring the full participation of all students in its programs. If you have a documented disability (or you think you have a disability of any nature) and, as a result, need reasonable academic accommodation to participate in class, take tests or benefit from the College's services, then you should speak with the Disability Services Coordinator Kelly Karstad (kkarstad@gustavus.edu or x6286) for a confidential discussion of your needs and appropriate plans. Course requirements cannot be waived, but reasonable accommodations may be provided based on disability documentation and course outcomes. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact Disability Services as early as possible. Disability Services (*https://gustavus.edu/advising/disability/*) is located in the Academic Support Center (204 Johnson Student Union).

Date	Day	Lecture Topic	Hill et al.	Due dates
Feb. 8	M	Introduction; What is physiology?	Ch. 1	
Feb. 10	W	Introduction; What is physiology?	Ch. 1	
Feb. 12	F	Molecular and cellular physiology	Ch. 2	
Feb. 15	M	Transport of solutes and water	Ch. 5	Lab 1. Summary and conclusion due (Individual)
Feb. 17	W	"Omics" approach to physiology/Phenotypic plasticity	Skim Ch. 3 and 4	
Feb. 19	F	Energy metabolism	Ch. 7	
Feb. 24	M	Metabolism and scaling	Ch. 7 & 8	Lab 2. Summary and conclusion due (Individual)
Feb. 24	W	Aerobic and anaerobic metabolisms	Ch. 8 & 9	
Feb. 26	F	**Exam 1**		
Feb. 29	M	Thermal relations	Ch. 10	Lab 3. Summary and conclusion due (Individual)
Mar. 2	W	Thermal relations	Ch. 10 & 11	
Mar. 4	F	Adaptations to high and low temperatures	Ch. 10 & 11	
Mar. 7	M	Nervous system physiology	Ch. 12	
Mar. 9	W	Nervous system physiology	Ch. 12 & 13	
Mar. 11	F	Nervous system physiology	Ch. 13 &14	
Mar. 14	M	Nervous system physiology	Ch. 14 & 15	Lab 4. Reports and conclusion due (Individual)
Mar. 16	W	Endocrine physiology	Ch. 16	
Mar. 18	F	Endocrine physiology	Ch. 16	
Mar. 21	M	Endocrine physiology and Review	Ch. 16	Lab 5. Reports and conclusion due (Individual)
Mar. 23	W	**Exam 2**		Must receive approval for the project (Group)
Mar. 25 - Apr. 3		***No class – Spring Break/Easter Recess***		
Apr. 4	W	Muscle physiology	Ch. 20	
Apr. 6	W	Muscle physiology	Ch. 20	
Apr. 8	F	Muscle physiology	Ch. 25	
Apr. 11	M	Muscle physiology	Ch. 25 and 24	First write-up for independent project DUE (Individual)
Apr. 13	W	Cardiovascular physiology	Ch. 24	
Apr. 15	F	Cardiovascular physiology		
Apr. 18	M	Cardiovascular physiology		Lab 6. Conclusion due (Individual)
Apr. 20	W	Respiratory physiology	Ch. 22	
Apr. 22	F	Respiratory physiology	Ch. 22 and 23	
Apr. 25	M	Respiratory physiology	Ch. 23	Lab 7. Conclusion due (Individual)
Apr. 27	W	***May Day: Class begins at 12:50 pm***	Ch. 23	
Apr. 29	F	Water and salt physiology	Ch. 26	
May 2	M	Water and salt physiology		
May 4	W	**Exam 3 (Up to respiratory physiology)**	Ch. 27	
May 6	F	Water and salt physiology	Ch. 27 and 28	
May 9	M	Water and salt physiology	Ch. 28	
May 11	W	Renal physiology	Ch. 29	Poster due for printing (Group)
May 13	F	Renal physiology	Ch. 29	
May 16	M	Desert physiology	Ch. 30	Poster presentation
May 18	W	Desert physiology/digestive physiology	Ch. 30 and Ch. 6	
May 20	F	***Semi-cumulative Final exam from 8:00 - 10:00 am***		

Spring 2016 **Tentative Schedule for BIO386 Comparative Physiology LAB**

Date	Day	LAB Topic
Feb. 8	M	Lab 1: Osmolality and tonicity of solutions
Feb. 15	M	Lab 2: Homeostasis in the blood glucose level*; Statistical & graphical analyses of data; Introduction to the independent project
Feb. 22	M	Lab 3: Scaling and the effect of temperature on metabolic rate*
Feb. 29	M	TBD
Mar. 7	M	Lab 4: Stress tolerance*
Mar. 14	M	Lab 5: Animal locomotion*
Mar. 21	M	*Independent project topic/hypotheses DUE (Each group meeting with the instructor)*
Mar. 28	M	***No class (Spring Break)***
Apr. 4	M	*Refined hypotheses/experimental design DUE (Each group meeting with the instructor)*
Apr. 11	M	Lab 6: Frog gastrocnemius muscle
Apr. 18	M	Lab 7: Turtle cardiac muscle
Apr. 25	M	*Group projects*
May 2	M	*Group projects*
May 9	M	Poster preparation
May 16	M	Poster presentation

Labs denoted with asterisk (*) are candidates for Materials and Methods and Result writing exercise