

**Louisiana State University: Department of Biological Sciences**  
**BIOL 4800 Comparative Animal Physiology**  
**COURSE SYLLABUS**  
Fall Session 2010

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**Lecture Times:** Monday, Wednesday, Friday, T.B.D. (3 lectures/week)

**Lecture Place:** T.B.D.

**Course Content:**

This course will cover advanced principles of comparative animal physiology, with an emphasis on the responses of non-adapted animals to changes in the environment, and will compare these responses to animals adapted to those environments. The study of animal physiology is interested in the function of animals, from the interaction of organ systems, down to the action of individual molecules. We will examine the adaptations that some animals have developed at these different levels of biological organization to allow them to tolerate environmental extremes. Typical stressors that we will cover include salinity, water limitation, hypoxia, altitude, depth, temperature extremes, exercise, and pollution. Many of these environmental stressors are relevant to the Gulf Coast region, and we will discuss issues of local relevance whenever possible to illustrate how the environmental stressors, including anthropogenic disturbances, are likely to adversely impact on local animal populations. The physiological systems that will be discussed include gas exchange, circulation, osmoregulation, metabolism, thermoregulation, and the endocrine, and neural control of these systems. The course will also touch briefly on behavioral components for surviving and/or adapting to environmental extremes. A recent study highlighted the decline in public interest in environmental issues despite the wide array of global concerns facing us today. Solutions to these problems will require a great deal of research and innovation, but also a public that is knowledgeable of the problems and receptive to addressing these challenges.

**Course design:**

The course will be multi-faceted consisting of approximately 4.5 hours of formal in-class lecture and 1.5 hours of out-of-class service-learning (S-L) requirements per every two weeks. In addition, approximately 10-20% of the time allotted for lectures will involve some degree of reflection on either lecture material or on the experiences of the students during their S-L requirements. Formal lectures will provide students with a strong theoretical basis for how animals cope with diverse environmental stressors. This knowledge will be further enhanced through the independent review of the primary scientific literature. Students will be expected to

reflect on data from conflicting studies, and to evaluate the validity of these findings based on available information. Small in-class or take home assignments will be routinely given that will form the basis of class discussions.

### **Service-Learning Component:**

Service-Learning is defined as:...a course-based, credit-bearing educational experience in which students (a) participate in an organized service activity that meets identified community needs and (b) reflect on the service activity in such a way as to gain further understanding of course content, a broader appreciation of the discipline, and an enhanced sense of civic responsibility (from Bringle & Hatcher, 1995). Students will need to engage members of the community in meaningful and purposeful discussion of the effects of environmental perturbations on animal function.

As a BIOL 4800 student, you will collaborate with members of two separate K-12 science classes to identify and review research material, and to discuss the impact of a specific environmental issue to the people and biota of Louisiana. In the 2<sup>nd</sup> week of this course, individual groups of 3-4 BIOL 4800 students will be assigned to each of the K-12 groups. These combined BIOL 4800/K-12 groups will meet bi-weekly to reflect on environmental issues that are relevant to the local community, Louisiana, the U.S., and the world, and then present their lists to the entire classrooms. From these consolidated lists, each group will be assigned a specific topic, which will form the basis of their additional research and discussions.

Students will utilize various resources including, but not limited to, news paper articles, the internet, and television programs to obtain a wide breadth of knowledge on the topic. As the project progresses, BIOL 4800 and K-12 students will meet during predetermined S-L timeslots to critically evaluate information and to assign a list of bi-weekly tasks. BIOL 4800 students will be required to investigate the topic in greater detail by reviewing at least 5 manuscripts from the primary literature. The undergraduate students will be responsible for summarizing this material with the K-12 students, and comparing this information with that obtained by the K-12 students during their research. Each group will develop a unified view of the underlying science, how the problem arose, and potential solutions if any. Students will also reflect on animal species at risk in Louisiana and propose mechanisms for best alleviating the problem. As an example, students may research the problem of salt water intrusion into coastal wetlands, and outline its effects on Louisiana fisheries. In these discussions students might investigate current engineering efforts to divert large volumes of fresh water into these coast marshes, and reflect on the pros and cons of these measures. K-12 students, in collaboration with the BIOL 4800 students, will present their findings in a series of poster presentations, which they will deliver at the Annual Ocean Commotion assembly the Louisiana Sea Grant College Program. This one-day event attracts approximately 3,000 area students from the K-8 age groups. The BIOL 4800 student will also submit a short report in the format of a newspaper article on their own research in these same topics. After several revisions involving the K-12 students and teachers, a select number of

the top articles will be submitted to one of the local newspapers (Advocate; Baton Rouge) for potential publication in one their science features. This S-L program is meant to enhance the scientific literacy of K-12 students and their teachers, as well as members from the LSU community.

### Course Mechanics:

- All Powerpoint slides for the lectures, and any assigned readings, will be posted on Moodle before the start of class. You can access Moodle from your PAWS account. Although every attempt will be made to post course notes before lecture, do not expect to find the notes on Moodle until the night before a lecture. These notes are no substitute for coming to lecture!
- If you use an email account other than your PAWS account, please make sure that your PAWS mail is forwarded to that account. **All class correspondence from me will go to your PAWS account. Additional, notices will be provided on Moodle.**
- If you have questions regarding any of the course material, please drop by during office hours or make an appointment. Questions by e-mail or phone will be answered very briefly. (Trust me, what can take 45 minutes to explain via email can usually be done in 10 minutes face to face.)

### Learning Objectives:

- Understand the physiological mechanisms allowing animals to tolerate diverse environmental stressors.
- Comprehend and critically evaluate scientific reports/studies related to different aspects of comparative animal physiology.
- Develop both written and verbal communication skills that will allow you to successfully communicate scientific concepts to other individuals.
- Analyze problems and plan and organize activities that address community needs.
- Create meaningful partnerships with community members in real-world learning environments.
- Demonstrate an ability to have a direct and positive impact on society.

In consultation with the Instructor and/or the community partner, you may be required to:

- Plan, organize, and coordinate preliminary visits with community members in order to access needs.
- Create an outline of activities- What roles will everyone play? What types of activities will be performed?
- Develop a schedule or timeline of events- When will the activities begin? In what location will the activities be performed?
- Define the target audience.
- Gather information and resources that best allow information to be conveyed to the community member.
- Execute the project- Is the target audience paying attention and reacting? You may need to adjust your activities to reach established goals?

- Define measurable outcomes by which learning can be assessed.
- Final assessment of the effectiveness of the program- conduct follow-up and gather information that provides guidance for future projects. The final assessment will entail a small report of three double-spaced pages, and should include a) summary of the activities and b) discussion of what you learned about i) comparative physiology, ii) your community, and iii) yourself.

The quality of the service-learning activity will be evaluated based on for performance of the activity and for the quality of your report and reflection on the service.

**Course Textbook:**

**Animal Physiology, Hill, Wyse, Anderson- 2<sup>nd</sup> Edition, 2008.**

Sinauer Associates, Inc. Publishers ISBN 978-0-87893-317-4

Papers will be assigned at a later date.

**Policy for seeing students (Office hours):**

Office Hour: 4:45-5:45 p.m. on Tuesday and Thursday; 10-11:00 a.m. on Friday; or by appointment

Office hours are the best time to meet with me to discuss any aspect of the course. However, my policy is to make myself available to you whenever I am in my office. Please feel free to drop in and visit me in the Life Sciences Building (Room 216) if you have any questions requiring clarification. With that said, I may ask you to return at another time if I am unable to talk to you at that particular moment. Alternatively, you can contact me by e-mail with a list of times you are available so that we can arrange a specific appointment. If you do come see me unannounced, most likely I will only be able to answer quick questions.

**Grading Policy:**

**Your final grade in the course will be determined by the following components.**

<b>Component</b>	<b>Points Allotted</b>
Midterm exam #1-	15 points
Midterm exam #2-	15 points
Final exam-	20 points
Quizzes	5 points
In-class reflection/Discussion	10 points

Out-of-class discussion*	10 points
Final Poster Presentation*	15 points
Final Report*	10 points

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100 points total

\* All members of the group will be given the same final grade for these components.

The points of every component will be totaled together to give a final number of points for the course, which will be used to calculate a final percentage. This percentage will be converted to a final letter grade as based on the following scale.

A	86-100%
B	73-85.9%
C	62-72.9%
D	50-61.9%
F	<u>below 50%</u>

### Course Component Descriptions:

- **Midterm examinations** will consist of short-essay and short-answer questions. Midterm exam #1 will be administered on ## and cover material from ##. Midterm exam #2 will be administered on ## and cover material from ##.
- **The final examination** will be comprehensive covering material from the entire course. The exam will consist of a mixture of short answer, short-essay and long-essay questions. The final examination has been scheduled by the Registrar's Office for Saturday, ## between the hours of ##. A student who has missed a final examination because of illness or domestic affliction or who is obliged to be absent from a final examination for some other compelling reason (including religious convictions) may apply for a deferred final examination. This should be done with 48 hours, or at the earliest time if in the case of illness.
- **Quizzes**- On approximately every 2<sup>nd</sup> class, a surprise quiz will be given at the start of class on the assigned reading for that day. The quizzes will be given within the first 5 minutes of class, so it is imperative that students arrive to the class on time.
- **In-class Reflection and Discussion**- Reflection is "an intentional consideration of an experience in light of particular learning objectives."
- **Reflective essays**: After each meeting with the K-12 students and teachers, each BIOL 4800 student will be required to develop a "reflective" essay (1-2 pages) providing a synopsis of the bi-weekly meetings at the school. Students

will be randomly chosen to discuss their reflective essays, providing stimulus for further discussion.

- **In-class discussion:** Students will be given peer reviewed manuscripts to discuss in class.
- **Out-of-class Discussion:** Each student will spend upwards of 8-10 hours immersed in discussions with the K-12 students and their teachers. These discussions are essential for establishing a working relationship with the client, providing them with a common knowledge of specific environmental issues and methods for scientific dissemination of information.
- **Final Poster Presentation:** Each group of BIOL 4800 and K-12 students will be expected to develop a poster presentation to be displayed at the Annual Ocean Commotion event.
- **Final Report:** Each group of BIOL 4800 students will provide a final report, including a summary of their S-L experience, how it achieved the learning objectives of the course, and what improvements could be made to enhance the learning experience. This final report should develop strong summary statements clearly outlining conclusions, if any, to the sets of assignments.

**More details of each assignment will be provided later in the course.**

## Lecture Schedule (Tentative):

<b>Class Date(s)</b>	<b>Topics Covered</b>
Aug. 23, 25	<u>Introduction to course; Fundamentals of Physiology</u> Why study comparative physiology. Levels of biological organization, homeostasis of the internal milieu, time frames, evolutionary processes <i>Chapt. 1</i>
Aug. 27, 30	<u>Membranes and enzyme kinetics: comparative aspects of cellular physiology</u> <i>Membrane structure and composition; characterization of membrane transport; membrane potential and its function; passive properties of cells; Elements of metabolism; Enzyme kinetics. Chapt. 2 (pp.29-56)</i>
Sept. 1, 8, 10	<u>Aerobic and anaerobic forms of metabolism</u> <i>Energy metabolism and metabolic rates: Chapt. 5 (pp. 136-145), Mechanisms of ATP production, metabolism during oxygen deficiency, metabolism during exercise. Chapt. 6</i>
Sept. 13, 15, 22	Physiological responses to temperature <i>Basis for heat transfer with the environment, biochemical, physiological and behavioral effects of temperature, Strategies in thermal biology (endothermy versus ectothermy), Adaptations to extreme environments such as freeze tolerance: Chapt. 8</i>
Sept. 24	Midterm examination #1
Sept. 27, 29, Oct. 4, 6, 8, 11, 13	<u>Circulation and respiration</u> <i>Properties of gases in the environment (Chapt. 20); Design and evolution of respiratory surfaces: Chapt. 21 (pp. 541-559) and circulatory systems (Chapt. 23, pp. 626-640); control of ventilation (pp. 559-575); Gas transport in blood and at gas-exchange surfaces, regulation of pH (Chapt. 22)</i>
Oct. 18, 20	Adaptations in marine mammals to a diving lifestyle <i>Circulatory adjustments, oxygen storage capacity, metabolism, aerobic dive limit): Chapt. 24.</i>
Oct. 22	Fall Holiday
Oct. 25, 27, Nov. 1, 3, 8, 10, 12	Solute, water and nitrogen balance <i>Properties of water, movement of water and solutes across membranes, solute regulation in freshwater and seawater vertebrates, nitrogenous waste excretion in animals: Chapt. 25, 26, 27</i>
Nov. 15	Midterm examination #2
Nov. 24-26	Thanksgiving holiday- No Class
T.B.A.	Final Examination ( <i>Comprehensive</i> ) 2-hour in class exam
<b>Service-Learning Components</b>	
Sept. 3, 17, Oct. 1, 15, 29, Nov. 5	Out-of-class meetings with K-12 students
Sept. 20, Oct. 4, 18, Nov. 1, 8	In-class written reflections due (at the start of class)
Nov. 19	Ocean Commotion- Posters due
Dec. 1, 3	Final class reflections
Dec. 3	Final Report Due (at the start of class)