

Vertebrate Physiology (ECOL 437) Syllabus, spring 2009

Introduction

Welcome to Vertebrate Physiology. Our focus will be on the basic principles of vertebrate physiology and special attention will be directed towards physiological homeostasis maintained by interactions of complex organ systems. Our discussions will be grounded in an explicit evolutionary and ecological context. We hope that this will be an enjoyable and informative semester. Vertebrate physiology is a writing-emphasis course, meaning at least half of the course grade will come in the form of written work. Prerequisites include the ECOL 181-182 sequence and one semester of organic chemistry (or concurrent enrollment). Prior courses in ecology, evolution, genetics, physics, and biochemistry would be helpful, but are not mandatory. Without some of the courses listed above you may need to work a bit harder to “catch up.” Please talk to the instructors if you have concerns about your previous background.

Course Objectives

1. Learn basic principles of physiology
2. Understand homeostasis and anhomeostasis
3. Understand important implications of ecto vs. endothermy
4. Understand predictive power of phylogenetic relationships
5. Understand potential formative role of past and present environmental conditions
6. Understand major subject areas of vertebrate physiology
7. Understand how the intact animal and its life history require a synthesis of the major subject areas of vertebrate physiology
8. Understand how physiologists study the field, test hypotheses, and generate knowledge
9. Become versed in a subset of the scientific literature
10. Be able to critically evaluate a scientific paper
11. Generate a feasible research proposal, communicated in written and oral form

Major Topics

- A. Nervous system function
- B. Muscle stimulation, recruitment, and contraction
- C. Endocrine function
- D. Respiration from epithelial to intracellular, including ventilation and circulation
- E. Water balance, ionic regulation, & relevant organs
- F. Metabolism and energy balance across representative vertebrate groups

Meeting Times (Please attend the discussion/lab section in which you are enrolled)

Lecture: MWF in BIO W 210 (<http://iiewww.ccit.arizona.edu/uamap/staticLarge/88.html>) 1000-1050h

Discussion/Lab: in CBS/KOFFL 411 (<http://iiewww.ccit.arizona.edu/uamap/staticLarge/KOFFL.html>)

Sect. 1 Wed. 1300-1450h OR Sect. 2 Wed. 1500-1650h

Instructors

Kevin E. Bonine, Ph.D., kebonine@u.arizona.edu

Office Hours: BSE 113, Mon 1:10 -2:00 pm, Wed 11:10-noon, and by appointment.

Tel: 626-0092, Home: 751-1349 (please call before 9pm or after 7am)

Graduate Teaching Assistant: **Kevin Oh**, koh@email.arizona.edu

Office Hour: 11am-noon Thursdays in BSW302, and by appointment.

Course Materials

The required text is available at the UA bookstore.

Animal Physiology 2nd Edition, Richard W. Hill, Gordon A. Wyse, and Margaret Anderson 2008, Sinauer, ISBN: 978-0-87893-317-4, casebound [a copy of the 1st edition of your text (2004) and another 2002 text (Eckert 5th edition) will be on reserve in the Science Library]

Other readings will be made available electronically on course website or on electronic reserve in library. Please check 437 course website regularly for updates, changes, and/or additions.

Web Site

We will maintain a course website (http://eebweb.arizona.edu/eeb_course_websites.htm) with readings, assignments, schedules, announcements, etc. Appropriate powerpoint lectures will likely be posted to the website the day after they are given. Check 437 website for updates.

Course Work

Lecture Exams (three midterms @ 100 pts each, cumulative final 200 pts)	500
Research Proposal (topic, rough draft, peer review, final submission)	175
End-of-Semester Review Panel	25
Lab/Discussion Grade (participation, quizzes, assignments, etc.)	<u>300</u>
Total Points	1000

Grading

We expect top-notch, senior-level work in this class. Most of you will have to work hard to earn the grade you want. Unless you have a strong physiology background you will not be able to sit back and expect to do well; rather, you should ask questions, come to lecture having read the relevant material, ask Kevin Oh to cover difficult material again in lab/discussion, and *take advantage of our office hours*. A quote from a former student:

Going into my senior year, I thought I knew how to get the "A" with the minimum effort; how to "play the game". It was after a few weeks in your class then I was asked to work my butt off and actually take an active role in my personal education process, I remembered why I was there in the first place...I was inspired to take my personal learning to a new level, and to discover a passion I have for the study of physiology-and science in general.

Please re-familiarize yourself with policies against plagiarism, etc., within the UA Student Code of Academic Integrity: <http://dos.web.arizona.edu/uapolicies/>

Students caught cheating may be penalized by failing the relevant assignment or exam, failing the course, or being expelled.

Assignments are due *no later than the beginning of lecture* on the due date, unless otherwise noted. Late assignments will be penalized 10% for each day they are late (this includes being late to lecture on the due date). There will be no 'make up' exams or 'extra credit'. We realize that you have lives (cars do break down, people die, stuff happens). In exceptional cases, and if arrangements are made in advance, we will consider your unique situation.

Grades will generally be distributed as follows (any potential curving of final grades will not "hurt" you, but can only help you):

≥ 90%	A
80-89%	B
70-79%	C
60-69%	D
≤ 59%	F

Keep in mind the following, adapted from J.M. Williams (1993, Clarifying grade expectations, *The Teaching Professor* 7(7):1):

The "A" Student--An Outstanding Student

* Attendance: "A" students have virtually perfect attendance. Their commitment to the class resembles that of the instructor.

* Preparation: "A" students are prepared for class. They always read the assignment. Their attention to detail is such that they occasionally catch the instructor in a mistake.

* Attitude: "A" students have a winning attitude. They have both the determination and the self-discipline necessary for success. They are curious and they show initiative. They do things they have not been told to do.

* Talent: "A" students have something special. It may be exceptional intelligence and insight. It may be unusual creativity, organizational skills, commitment--or a combination thereof. These gifts are evident to the instructor and usually to the other students as well.

* Results: "A" students make high grades on assignments--usually the highest in the class. Their work is a pleasure to grade.

Students with Disabilities:

If you anticipate the need for reasonable accommodations to meet the requirements of this course, you must register with the Disability Resource Center (<http://drc.arizona.edu/>; Disability Resource Center 1224 East Lowell Street Tucson, Arizona 85721, Phone: (520) 621-3268 V/TTY Fax: (520) 621-9423, E-mail: uadrc@email.arizona.edu) and request that the DRC send the instructor official notification of your accommodation **by the beginning of the 3rd week** of class. Please plan to meet with us by appointment or during office hours to discuss accommodations and how the course requirements and activities may impact your ability to fully participate. All related discussions will remain confidential.

Attendance

You are expected to attend each lecture and each discussion/laboratory session prepared and **ready to contribute**. Lecture and lab quizzes may be used to motivate your attendance and participation if necessary. All holidays or special events observed by organized religions will be honored for those students who indicate affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored.

Class meeting suggestions:

In addition to paying attention and turning off electronic devices such as iPod and cell phone, please consider employing these suggestions (borrowed from Guy McPherson) during class discussions:

1. Listen carefully to others before speaking
2. Challenge and refute ideas, not people
3. Focus on the best ideas, not on being the best, or "winning"
4. Before adding your own contribution, practice listening by trying to formulate in your own words the point that the previous speaker made
5. Speak whenever you wish (without interrupting!) even though your ideas may seem incomplete
6. Avoid disrupting the flow of thought by waiting until the present topic reaches its natural end before introducing a new issue
7. If you wish to introduce a new topic, warn the group that what you are about to say will address a new topic and that you are willing to wait to introduce it until people are finished commenting on the current topic
8. Give encouragement and approval to others

Please be aware of the UA policies against threatening behavior by students:

<http://policy.web.arizona.edu/~policy/threaten.shtml>

Course Work Details

Lecture Exams

There will be three midterm examinations and a fourth, final examination. The final will be cumulative. Topics covered in the formal lecture period, in discussion/lab, by guest speakers, and in the assigned readings will be fair game. Format will be mixed and may include: matching, fill-in, multiple choice, short answer, and essay. We may occasionally have some portion of an exam as a take-home essay. Be prepared to synthesize ideas, rather than just regurgitate information. There will be no make-up exams.

Research Proposal

The research proposal (see separate handout) will be your opportunity to research a topic of interest to you that is appropriate for a vertebrate physiology course with emphasis on physiological systems and organism-level function in non-human vertebrates. You will be expected to synthesize relevant information from the primary literature (containing peer-reviewed, original research results) in a well-written proposal. You will be graded in four stages: research question and annotated references (**20 pts.**), first draft (**45 pts.**), peer review/edit (**40 pts.**), and final submission (**70 pts.**). You will also be required to visit one of us to discuss your proposal in office hours (participation points [see below] will be awarded for this office visit) sometime between submission of your initial research question and the beginning of spring break. More details will be forthcoming.

Funding Panel

After you submit your final research proposal, you will be part of a panel to assess the worthiness of all proposals for funding. Part of your role will involve briefly presenting someone else's proposal to the rest of the funding panel. The quality and effectiveness of your effort and participation will be worth up to **25** points. Those few proposals selected for funding will earn the author bonus points. More details will be forthcoming.

Discussion/Lab Participation

Your participation in discussion/lab will be graded. Your participation consists of attendance, preparedness (Have you read the material? Did you retain enough to do well on a short quiz? Did you take notes on your reading?), and contribution to appropriate discussion of the physiological topics at hand. To motivate your weekly preparation we will either 1) give you a short quiz on your assigned readings or 2) collect your reading 'journal' entries for that week. More details on format will be provided. Occasionally we will do short labs or problem sets and these may include a short, graded write-up as well. Once during the semester each student will come to lab prepared to lead the discussion on that day's topic. This means you will have read the assigned material and also found other relevant scientific literature that expands on the material for that lab/discussion period and relevant lectures. Bring a copy of one abstract from a related paper for the instructors. Again, more details and sign-ups forthcoming. Occasional quizzes in *lecture* will contribute toward the 300 points available in lab.

Short Seminar Write-Up (25 points of the lab/discussion grade)

During the semester you will write up a one to two page (typed and double spaced) summary of a seminar/scientific talk. Your seminar/talk attendance on campus should be relevant to this course and appropriately scientific. We will provide suggestions of appropriate seminars as the semester progresses. **This short write-up is due no later than end of April.** Please contact the instructors if you have questions about the appropriateness of a specific talk you are considering attending. The longer you wait to ask about appropriate seminars the less helpful (and patient) we can be.

In your write-up please address the following as best you can: What was the question being studied? What methods (be very brief) were used to collect relevant data? What were the relevant data? What conclusions did the presenter come to with respect to their initial question? Do you agree? Why or why not?

Any concerns about scores on assignments and exams must be addressed within one week of the graded work being returned to you.

The information contained in the course syllabus, other than the grade and attendance policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.

	DAY	DATE 2009	TOPIC	READING (from Hill et al. text 2 nd ed. unless noted)
	WEEK 1			
1	WED	14 January	Introduction, syllabus	Ch 1
	WED	14 January LAB	Introduction, brief field trip, assignments, sign-ups, etc.	See course website
2	FRI	16 January	Membranes and Biological Compounds	Ch 2
	WEEK 2			
	MON	19 January	MLK HOLIDAY	
3	WED	21 January	Solute Transport and Water	Ch 4
	WED	21 January LAB	Physiology in Context, Evolution/Development Exercise	Lienhard et al. 2002 Ness and Williams 1998
4	FRI	23 January	Solute Transport and Water	Ch 4
	WEEK 3			
5	MON	26 January	Neurons	Ch 11
6	WED	28 January	Neurons	Ch 11
	WED	28 January LAB	Cotransporters and Ion Gradients Nernst and Goldman Exercises	Bisbal & Specker 1991
7	FRI	30 January	Synapses	Ch 12
	WEEK 4			
8	MON	02 February	Synapses	Slowinski article, Ch 12
9	WED	04 February	Sensory Processes	Ch 13
	WED	04 February LAB	Specialized Senses Plan Receptor Field Experiment	Catania 2002, Barinaga 1999, Malakoff 1999
10	FRI	06 February	Sensory Processes	Ch 13
	WEEK 5			
11	MON	09 February	Sensory Processes	Ch 13
12	WED	11 February	Nervous System Organization, Biological Clocks	Ch 14
	WED	11 February LAB	Touch Receptor Field Experiment and Report Prepare for 1 st Midterm	---
13	FRI	13 February	EXAM ONE (covers info. through Ch 13 and lab Feb 11 th)	---
	WEEK 6			
14	MON	16 February	Endocrine and Neuroendocrine Function	Ch 15
15	WED	18 February	Endocrine and Neuroendocrine Function	Ch 15

	WED	18 February LAB	Hormones	Ulmann et al. 1990 Wingfield & Kitaysky 2002 Mendes 2002 OR Hayes et al. 2002
16	FRI	20 February	Reproduction	Ch 16
	WEEK 7			
17	MON	23 February	Reproduction	Ch 16
18	WED	25 February	Control of Movement	Ch 18
	WED	25 February LAB	Muscle Muscle Experiment	Volk 2004 (http://www.thinkmuscle.com/ARTICLES/volk/myostatin.htm) Bonine et al. 2001
19	FRI	27 February	Muscle	Ch 19
	WEEK 8			
20	MON	02 March	Muscle	Ch 19; Sprackland 2005
21	WED	04 March	Muscle etc.	Ch 19, 20
	WED	04 March LAB	Locomotion and Movement, Comparative Functional Anatomy in Amphibians	Dickinson et al. 2000
22	FRI	06 March	Oxygen & Carbon Dioxide	Ch 21
	WEEK 9			
23	MON	09 March	Organismal Respiration	Ch 22
24	WED	11 March	Gas Transport	Ch 23
	WED	11 March LAB	Comparative Aquatic Respiration Lab Review Gas Transport Prepare for 2nd Midterm	---
25	FRI	13 March	EXAM TWO (covers material since first midterm)	---
		14-22 March	SPRING BREAK (think about vertebrate physiology as you relax, exercise, imbibe, etc.)	
	WEEK 10			
26	MON	23 March	Respiratory Control: Jason Pilarski, Guest?	Ch 22
27	WED	25 March	Circulation & Heart Function	Ch 24
	WED	25 March LAB	Respiration Lab Heart Anatomy	Zapol 1987 Eisenberg 1998
28	FRI	27 March	Circulation & Heart Function; Diving	Ch 24, 25
	WEEK 11			
29	MON	30 March	Ionic and Osmotic Balance	Ch 26

30	WED	01 April	Water and Salt Physiology in the Environment	Ch 27
	WED	01 April LAB	Circulation Lab	Lillywhite 1988
31	FRI	03 April	Water and Salt Physiology in the Environment	Ch 27
	WEEK 12			
32	MON	06 April	Kidney Function	Ch 28
33	WED	08 April	Kidneys; Arid Environments	Ch 28, 29
	WED	08 April LAB	Kidney + Excretion Lab Review Kidney Function	NIDDK site (http://www.kidney.niddk.nih.gov/KidDisases/pubs/yourkidneys/) McClanahan et al. 1994
34	FRI	10 April	Bird Osmoregulation: Eldon Braun, Guest?	TBA
	WEEK 13			
35	MON	13 April	Feeding, Nutrition, Digestion	Ch 5
36	WED	15 April	Digestion; Metabolism	Ch 5, 6
	WED	15 April LAB	Research Proposal Workshop Prepare for 3 rd Exam	---
37	FRI	17 April	Aerobic & Anaerobic Metabolism	Ch 7
	WEEK 14			
38	MON	20 April	EXAM THREE (covers material since second midterm through Wed 15 April)	---
39	WED	22 April	Energetics	Ch 8
	WED	22 April LAB	Nutrition and Metabolism	Mc Williams et al. 2004
40	FRI	24 April	Thermal Physiology	Ch 9
	WEEK 15			
41	MON	27 April	Thermal Physiology	Ch 9
42	WED	29 April	Bird Physiology: Kevin Oh, Guest	TBA
	WED	29 April LAB	Funding Panel	---
43	FRI	01 May	Thermal Physiology, Ectothermy & Endothermy	Ch 9
	WEEK 16			
44	MON	04 May	Environmental Challenges & Thermal Physiology	Ch 10
45	WED	06 May	Wrap Up	TBA
	WED	06 May LAB	Funding Panel	---
	WED	13 May (11am-1pm)	CUMULATIVE FINAL EXAM (held in regular lecture room)	