Vertebrate Physiology (ECOL 437)  
Syllabus (tentative), fall 2005

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 differences in 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
9. Become versed in a subset of the scientific literature
10. Be able to critically evaluate a scientific paper
11. Be able to communicate synthetic research project in written and oral form

Topics
A. Nervous system function
B. Muscle stimulation, recruitment, and contraction
C. Endocrine function
D. Respiration from epithelium 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: Tues. and Thurs. in Social Sciences Room 206, 0930–1045h
Discussion/Lab: in CBS/KOFFL 410 Sect. 2 Wed. 0900-1050h
OR Sect. 1 Wed. 1400-1550h

Instructors
Kevin E. Bonine, Ph.D., kebonine@u.arizona.edu
Office Hours: BSE 1D (in the basement), times TBA, and by appointment.
Tel: 626-0092, Home: 751-1349 (please call before 9pm or after 6am)

Teaching Assistant: Kristen Potter, kap15@email.arizona.edu
Office Hours: TBA, and by appointment
Course Materials
The required text is available at Antigone Books (411 N. 4th Ave, 520-792-3715, antigonebooks.com).

*Animal Physiology, Richard W. Hill, Gordon A. Wyse, and Margaret Anderson*
April 2004, Sinauer, 769 pages, 539 illustrations
ISBN: 0-87893-315-8, $104.95?, casebound

Other readings will be made available electronically on course website or on electronic reserve in library.

Web Site
We will maintain a course website ([http://eebweb.arizona.edu/eeb_course_websites.htm](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.

Course Work
Lecture Exams (three midterms @ 100 pts each, final 150 pts) 450
Term Paper (topic, rough draft, peer review, final submission) 200
Oral Presentation (and handout for peers) 50
Lab/Discussion Grade (participation, quizzes, assignments, etc.) 300

Total Points 1000

Grading
We expect top-notch, senior-level work in this class. Most of you will have to work hard to earn a decent grade. 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 Kristen 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://studpubs.web.arizona.edu/policies/cacaint.htm](http://studpubs.web.arizona.edu/policies/cacaint.htm)

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):

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>≥ 90%</td>
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<tr>
<td>B</td>
<td>80-89%</td>
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<tr>
<td>C</td>
<td>70-79%</td>
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<tr>
<td>D</td>
<td>60-69%</td>
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<tr>
<td>F</td>
<td>≤ 59%</td>
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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 (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 text reading 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.

Term Paper
The term paper (about 12+ pages) 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. You will be expected to synthesize relevant information from the primary literature (containing original research results) in a well-written paper. You will be graded in four stages: topic and annotated references (25 pts.), first draft (50 pts.), peer review/edit (50 pts.), and final submission (75 pts.). More details will be forthcoming.
Oral Presentation
After you finish your term paper, you will have the opportunity to tell your classmates about the information you compiled. This presentation will consist of a ten minute oral powerpoint presentation accompanied by a useful handout (1 piece of paper only) that will allow your peers to recall the important points from your presentation and follow up with the relevant scientific literature. 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?), and contribution to appropriate discussion of the physiological topics at hand. 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 talk for 5-10 minutes about an interesting article that expands on the material for that lab/discussion period and the relevant lectures. Bring a copy of the paper abstract for the instructors. Again, more details and sign-ups forthcoming.

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 10 November. Please contact the instructors if you have questions about the appropriateness of a specific talk you are considering attending.

In your write-up please address the following as best you can: What was the hypothesis (or hypotheses) being tested? Can you describe any errors in the speaker’s logic or methods? What was the conclusion of the talk with respect to the hypothesis? Do you agree with the speaker’s findings? How might you improve upon the research reported in the talk?

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.
## Tentative Lecture Schedule

(30 lecture meetings, 15 lab meetings)

<table>
<thead>
<tr>
<th>Lect</th>
<th>DATE</th>
<th>TOPIC and (READING in Hill et al., 2004)</th>
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<tbody>
<tr>
<td>1</td>
<td>AUG 23</td>
<td>Introduction to course and to vertebrate physiology (CH1)</td>
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<tr>
<td>D1</td>
<td>AUG 24</td>
<td>Introduction to primary literature, readings, other assignments, term paper, oral presentation; sign up for lab presentation</td>
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<tr>
<td>2</td>
<td>AUG 25</td>
<td>Overview of membranes and biological compounds (CH2)</td>
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<tr>
<td>3</td>
<td>AUG 30</td>
<td>Overview of solute transport and water (CH3)</td>
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<tr>
<td>D2</td>
<td>AUG 31</td>
<td>Physiology in context: Lienhard et al. 1992, Nesse and Williams 1998 (evolution exercise)</td>
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<tr>
<td>4</td>
<td>SEP  1</td>
<td>Introduction to the Nervous System (CH10)</td>
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<tr>
<td>5</td>
<td>SEP  6</td>
<td>Neurons (CH11)</td>
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<tr>
<td>D3</td>
<td>SEP  7</td>
<td>Cotransporters, Ion Concentrations; Pelis et al. 2001 (Nernst and Goldman equations)</td>
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<tr>
<td>6</td>
<td>SEP  8</td>
<td>Neurons (CH11), Synapses (CH12)</td>
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<tr>
<td>7</td>
<td>SEP  13</td>
<td>Synapses (CH12), Sensory Processes (CH13)</td>
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<tr>
<td>D4</td>
<td>SEP  14</td>
<td>Specialized senses; Catania 2002, Barinaga 1999, Malakoff 1999 (plan touch receptor-fields experiment)</td>
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<tr>
<td>8</td>
<td>SEP  15</td>
<td>Sensory Processes (CH13), K. Potter – guest lecture</td>
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<td>9</td>
<td>SEP  20</td>
<td>Endocrine and Neuroendocrine Function (CH14)</td>
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<tr>
<td>D5</td>
<td>SEP  21</td>
<td>(touch receptor-fields experiment), exam 1 preparation</td>
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<tr>
<td>E1</td>
<td>SEP  22</td>
<td>Midterm Lecture EXAM 1 (Intro+Nervous System) covers lectures 1-8, (CH1-3, 10-13) and relevant discussions</td>
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<tr>
<td>11</td>
<td>SEP  27</td>
<td>Endocrine and Neuroendocrine Function (CH14), Reproduction (CH15)</td>
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<tr>
<td>D6</td>
<td>SEP  28</td>
<td>Exam 1 return, discuss term papers Hormones; Ulmann et al. 1990, DeNardo and Sinervo 1994</td>
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<tr>
<td>P1</td>
<td>SEP  29</td>
<td>Navigation (CH16) Term Paper Topic and Annotated Reference (5) List Due</td>
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<tr>
<td>12</td>
<td>OCT  4</td>
<td>Muscles and movement (CH17+18)</td>
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<tr>
<td>D7</td>
<td>OCT  5</td>
<td>Locomotion and movement; Wilson et al. 2002, Dickinson et al. 2000 (muscle/movement/dissection lab)</td>
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<tr>
<td>14</td>
<td>OCT  6</td>
<td>Muscles and movement (CH17+18)</td>
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<tr>
<td>15</td>
<td>OCT  11</td>
<td>More muscle (CH17-19)</td>
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<tr>
<td>D8</td>
<td>OCT  12</td>
<td>Muscle, Lance Armstrong, lizard locomotion; Coyle 2005, Bonine et al. 2001</td>
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<tr>
<td>P2</td>
<td>OCT  13</td>
<td>Oxygen and Carbon Dioxide, External Respiration (CH20+21)</td>
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Term Paper First Draft Due (can also be turned in on 18 October with no penalty)

17 OCT 18 Gas transport in the body, Circulation (CH22+23)

D9 OCT 19 Circulation; Lillywhite 1988; Zapol 1987
prepare for exam 2

E2 18 OCT 20 Midterm Lecture EXAM 2 (Endocrine, Navigation, Muscle;
covers lectures 9-15 and related discussions; CH14-19)

19 OCT 25 Oxygen and Carbon Dioxide Wrap-Up (CH20-24);

D10 OCT 26 Blood chemistry and buffering; Jackson et al. 2000
discuss term papers, return exams
(heart, pulse, BP, circulation lab)

20 OCT 27 Water and Salt (CH25+26)

21 NOV 1 Kidneys and Excretion (CH27)

D11 NOV 2 Kidney and Excretion/Urine lab

22 NOV 3 Kidneys and Excretion (CH27)

23 NOV 8 Ionic and osmotic balance, kidney function (CH25-28); Eldon Braun - guest?
P3 D12 NOV 9 Term Paper Peer Review/Edit (bring draft for peers with codename)
(Powerpoint tutorial?)

24 NOV 10 Nutrition, Feeding, Digestion (CH4)

25 NOV 15 Energy metabolism (CH5)

D13 NOV 16 Drought effects; Henen et al. 1998, prepare for exam 3
(drierite, water loss with bullfrog and desert tortoise?)

E3 26 NOV 17 Midterm Lecture EXAM 3 (O2, CO2, Circulation, Water, Salt, Kidneys)
covers lectures 16-23 and related discussions; CH20-28)

27 NOV 22 ATP production (CH6)

No lab NOV 23 Work on term papers, no formal lab meeting

Yum yum NOV 24 Thanksgiving (no lecture)

28 NOV 29 Energetics of Activity (CH7)

D14 NOV 30 Physiology and altered environments; Mendes 2002, Hayes et al. 2002

P4 29 DEC 1 Environmental challenges; heat (CH8), Environmental challenges; cold (CH9);
Term Paper Final Draft Due

30 DEC 6 Wrap up
(Please get your powerpoint file to KEB by 1600h)

OP D15 DEC 7 Student Oral Presentations

FE FE DEC 15 FINAL EXAM (Thursday, 0800–1000h; cumulative, more detailed emphasis on
material since 3rd midterm)
Reading List   ECOL 437   Vertebrate Physiology   Fall 2005   K.E. Bonine

Reading assignments may change slightly as the semester progresses.

31 Aug.

07 Sept.

14 Sept.

28 Sept.

05 Oct.

12 Oct.

19 Oct.

26 Oct.

02 Nov.
TBA

16 Nov.

30 Nov.