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. 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, and biochemistry would be helpful, but are not mandatory. Please talk to the instructors if you have concerns about your previous background.

Meeting Times
Lecture: Tues. and Thurs. in Haury 129 8:00–9:15
Discussion/Lab: in CBS/KOFL 411
   Sect. 1 Wed. 9:00-10:50
   OR Sect. 2 Wed. 14:00-15:50
Please attend the discussion/lab section in which you are enrolled.

Instructors
Kevin E. Bonine, Ph.D.
offce: BSE 1D (in the basement)
Office Hours: BSE 1D Wed. 1300-1400h, Thurs. 1400-1500h, and by appointment.
Tel: 626-0092, Home: 751-1349 (please call before 9pm or after 6am)
kebonine@u.arizona.edu

Teaching Assistant: Nate Swenson
Office Hours: TBA
email: swenson@email.arizona.edu

Course Materials
The text is available at the University Bookstore.
Other readings on course website or on electronic reserve in library.

Web Site
We will maintain a course website (http://eebweb.arizona.edu/Links/Classes.html) with announcements etc. Appropriate powerpoint lectures will likely be posted to the website the day after they are given. This site is still under construction as of 22 August 2004 but should be up soon.

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.) 250
Short Article/Seminar Write-Ups (three @ 33.33 pts each) 100
Total Points 1050
Grading
Assignments are due no later than the beginning of lecture on the due date. Late assignments will be penalized 10% for each day they are late (and this includes being late to lecture). 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):

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
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<tbody>
<tr>
<td>≥ 90%</td>
<td>A</td>
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<tr>
<td>80-89%</td>
<td>B</td>
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<tr>
<td>70-79%</td>
<td>C</td>
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<tr>
<td>60-69%</td>
<td>D</td>
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<tr>
<td>≤ 59%</td>
<td>F</td>
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Any student with a documented disability who feels they may need academic adjustments or accommodation is requested to speak with the instructor by the 2nd week of class. All related discussions will remain confidential. Students should contact the S.A.L.T. Center for Learning Disabilities (Old Main, Room 135; 621-1242) or the Center for Disability Related Resources (2nd and Cherry; 621-3268) prior to discussions with the instructor. These offices will verify the need for special services.

Attendance
You are expected to attend each lecture and each discussion/laboratory session prepared and ready to contribute. Lecture quizzes may be used to motivate your attendance and participation if necessary.

Class meeting suggestions:
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

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. More details will be forthcoming.

Discussion/Lab Participation
Your participation in discussion 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 forthcoming.

Short Seminar/Article Write-Ups (2x33.3 points)
During the semester you will write up a one or two page (typed and double spaced) summary of a seminar and a talk (one of each). 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. The paper summary should be about a peer-reviewed article published in the primary literature (turn in a copy of the abstract of the article with your assignment) relevant to this course. One short write-up is due no later than 02 November, the other is due no later than our last lecture (07 December). Again, the topic must be physiological and appropriately scientific. Please contact the instructors if you have questions about the appropriateness of a specific talk you are considering attending or paper you are considering reviewing.

In the above write-ups please be sure to address the following: What was the hypothesis (or hypotheses) being tested? Are there biases evident in the article or talk? Can you describe any errors in the author's/speaker's logic or methods? What was the conclusion of the article with respect to the hypothesis? Do you agree with the author's/speaker's findings? In an ideal world (e.g., unlimited funding and time) how would you suggest improvements to the research reported in this article?

Early in the semester (due 08 September in lab) you will write up a 2-page (typed and double-spaced) article summary on one of your assigned readings (33.3 pts.). More details forthcoming.
Tentative Lecture Schedule  
(29 lecture meetings, 16 lab meetings)

<table>
<thead>
<tr>
<th>Lect</th>
<th>DATE</th>
<th>TOPIC and (READING in Randall et al., 2002)</th>
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<tbody>
<tr>
<td>1</td>
<td>AUG 24</td>
<td>Introduction to course and to vertebrate physiology (CH1) Overview of Krogh, hypotheses, methods, physiological state (CH2)</td>
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<tr>
<td>D1</td>
<td>AUG 25</td>
<td>Introduction to primary literature, readings, article summary, term paper, oral presentation</td>
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<tr>
<td>2</td>
<td>AUG 26</td>
<td>Overview of solutions, biological molecules, etc. (CH3) Overview of membranes, channels, transporters, gradients (CH4)</td>
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<tr>
<td>3</td>
<td>AUG 31</td>
<td>Continue CH4, begin Physical basis of neuronal function (CH5)</td>
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<tr>
<td>D2</td>
<td>SEP  1</td>
<td>Put it in context: Lienhard et al. 1992, Nesse and Williams 1998, (evolution exercise)</td>
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<td>4</td>
<td>SEP  2</td>
<td>Neuronal function, neuronal communication (CH5, 6)</td>
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<tr>
<td>5</td>
<td>SEP  7</td>
<td>Neuronal communication, sensing the environment (CH6, 7)</td>
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<tr>
<td>SW</td>
<td>SEP  8</td>
<td>Cotransporter, Ion Concentrations; Pelis et al. 2001 (2-page write-up due)</td>
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<tr>
<td>6</td>
<td>SEP  9</td>
<td>Sensing the environment, organization and evol. of the nervous system (CH7, 8)</td>
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<tr>
<td>7</td>
<td>SEP 14</td>
<td>Organization and evolution of the nervous system (CH8) (Cindy Rankin?)</td>
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<tr>
<td>D4</td>
<td>SEP 15</td>
<td>Specialized senses; Catania 2002, Barinaga 1999, Malakoff 1999, (plan touch receptor fields experiment)</td>
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<tr>
<td>P1</td>
<td>SEP 16</td>
<td>Term Paper Topic and Annotated Reference (5) List Due Wrap up nervous function (CH5-8)</td>
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<td>9</td>
<td>SEP 21</td>
<td>Glands and hormones (CH9)</td>
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<tr>
<td>D5</td>
<td>SEP 22</td>
<td>(touch receptor fields experiment) exam 1 preparation</td>
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<tr>
<td>E1</td>
<td>SEP 23</td>
<td>Midterm Lecture EXAM 1 (covers lectures 1-8 and relevant discussions; CH1-8)</td>
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<tr>
<td>10</td>
<td>SEP 28</td>
<td>Glands and hormones (CH9)</td>
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<tr>
<td>D6</td>
<td>SEP 29</td>
<td>Exam 1 return, discuss term papers Hormones; Ulmann et al. 1990, DeNardo and Sinervo 1994</td>
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<tr>
<td>12</td>
<td>SEP 30</td>
<td>Muscles and movement (CH10)</td>
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<tr>
<td>13</td>
<td>OCT  5</td>
<td>Muscles and movement (CH10)</td>
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<tr>
<td>D7</td>
<td>OCT  6</td>
<td>Locomotion and movement; Wilson et al. 2002, Dickinson et al. 2000 (muscle/movement/dissection lab)</td>
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<td>14</td>
<td>OCT  7</td>
<td>Muscles and movement (CH10) guest?</td>
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<tr>
<td>15</td>
<td>OCT 12</td>
<td>Behavior initiation, patterns, control (CH11)</td>
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<tr>
<td>D8</td>
<td>OCT 13</td>
<td>Behavioral control; Marler et al. 1999, Smith and John-Alder 1999</td>
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<tr>
<td>P2</td>
<td>OCT 14</td>
<td>Integration of physiological systems – circulation (CH12); Term Paper First Draft Due</td>
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<tr>
<td>17</td>
<td>OCT 19</td>
<td>Integration of physiological systems – circulation (CH12)</td>
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D9 OCT 20  Circulation; Lillywhite 1988; prepare for exam 2 (pulse, BP, circulation lab)
E2 18 OCT 21  Midterm Lecture EXAM 2 (covers lectures 9-15 and related discussions; CH9-11)
19 OCT 26  Gas exchange, acid-base balance (CH13);
D10 OCT 27  Blood chemistry and buffering; Jackson et al. 2000
discuss term papers, return exams (heart function)
20 OCT 28  Gas exchange, acid-base balance (CH13)

SW 21 NOV 2  Ionic and osmotic balance, kidney function (CH14)
Short Write-Up #1 Due
D11 NOV 3  The depths; Zapol 1987 (vertebrate response to head submersion)

P2 22 NOV 4  Ionic and osmotic balance, kidney function (CH14); Term Paper Draft for Peers
P3 23 NOV 9  Ionic and osmotic balance, kidney function (CH14); Eldon Braun
Term Paper Peer Review/Edit Due
D12 NOV 10 Drought effects; Henen et al. 1998, prepare for exam 3
(drierite, water loss with bullfrog and desert tortoise)
VD NOV 11  Veterans Day- no class

24 NOV 16  Energy acquisition, digestion, metabolism (CH15)

E3 D13 NOV 17  Midterm Lecture EXAM 3 (covers lectures 16-23 and related discussions CH12-14)
25 NOV 18  Energy acquisition, digestion, metabolism (CH15)
26 NOV 23  Energy expenditure (CH16)
D14 NOV 24  (metabolic rate lab)

Yum yum NOV 25  Thanksgiving (no lecture)
27 NOV 30  Energy expenditure (CH16)

D15 DEC 1  Ramifications of altered environments; Mendes 2002, Hayes et al. 2002

P4 28 DEC 2  Environmental challenges (CH17); Term Paper Final Draft Due

SW 29 DEC 7  Environmental challenges (CH17), Short Write-Up #2 Due
(This would be a good day to get your powerpoint file to us)

OP D16 DEC 8  Student Oral Presentations

FE FE DEC 16  FINAL EXAM  (Thursday, 8:00–10:00; cumulative, more detailed emphasis on
material since 3rd midterm)

Reading assignments may change slightly as the semester progresses.
Reading List  ECOL 437  Vertebrate Physiology  Fall 2004  K.E. Bonine

01 Sept.

08 Sept. (write up 2 page summary of this article and bring to lab)

15 Sept.

29 Sept.

06 Oct.

13 Oct.

20 Oct.

27 Oct.

03 Nov.

10 Nov.

01 Dec.