Physiology Lab (PHSL/BMEN 3701)  
2 credits

Course Developer: Paul A. Iaizzo, Ph.D. (Surgery and Physiology)

Prerequisite: Physiology 3061

Class Meeting: Moos Tower 3-110  
Section 001, 003: Monday 1:25pm-04:25pm  
Section 002, 004: Tuesday 1:25pm-04:25pm  
Optional Lab Session: Friday 1:30-4:30 (coordinate with Megan Schmidt)

Lab Schedule  
Please refer to the schedule posted on the course website for the most updated schedule for the lab sessions. ([http://www.vhlab.umn.edu/~bmen3701/](http://www.vhlab.umn.edu/~bmen3701/))

Office Hours:  
Formal office hours will not be held. However, an additional open lab time will be scheduled on Friday afternoons from 12:30 - 3:30pm, which is available for help and/or for extra time to get labs done. If you cannot make it to your scheduled lab contact the head TA (Megan Schmidt) to schedule the make-up lab. You need to email A TA will be available from 12:30 - 1:00 pm, if no students show up the TA will leave after 1:00 pm.

Objectives:  
Provide an active learning environment to teach the basic principles of human physiology. Teach students the principles of experimental documentation in a laboratory notebook. Have the student gain an appreciation for how variable human physiology can be. Provide students with a hands-on opportunity to use commonly used physiological monitoring equipment. Promote and encourage team work and collaboration among students in the lab.

Grading:  
Attendance in all sessions is required and make-up sessions will need to be arranged by the student with a TA more than 24 hours in advance. Students who are not actively participating during lab session will not receive credit for attendance. The TA will review lab notebooks during lab sessions several times throughout the semester to provide feedback for improvement. In addition, specific written laboratory write-ups will be assigned and verification of completion of computer modules will be noted. The lab reports will be graded on a scale from 0 to 3: 3- good; 2- needs some improvement; 1: unacceptable; and 0: not turned in. If you would like to improve the grade your group receives on a report, you may rewrite it and turn it in the following week along with the previously graded report. Multiple rewrites may or may not be accepted so be sure to check with your TA before The final grade is composed of:

Attendance/Quiz/Hypothesis 35%  
Weekly Lab Report 25%
Textbook:
There is a required lab packet that can be purchased in the bookstore. There is no one textbook that is required; however, Human Physiology by Vander, Sherman and Luciano, which is required for the prerequisite course, will be used as a resource.

Suggested Reading list:
The following resources are recommended for information relevant to the laboratory lessons in the course. This is only a starting point, you should use the University Library system and the internet to find additional physiological and technical information that will assist in better understanding the test methods and the corresponding physiological response when you are writing your lab reports.


Chapter 1  

Chapter 16  

Chapter 17  

Chapter 18  


**Notebook Guidelines**

1) Put your computer #, section # (mon 001, tues 002), course # (Phsl 3063) on the cover
2) Put all lab group members’ contact info on inside cover of your lab notebook
3) The first page of the notebook should be titled “Table of Contents” and left blank to fill in during the semester. You should then number the pages. (In a real lab setting, you would want to have a notebook that has the pages pre-numbered. This is so pages cannot be taken out.) You should have a column in the table of contents to indicate which team member was the recorder for that day.
4) Use only pen to record information in notebook, not pencil.
5) Each lab member must complete two notebook entries during the semester. You should rotate the recorder each week. You should have one entry during the first half of the semester and one entry during the second half of the semester.

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**For Each Week**

1) Put the date, Lesson #, Subject, members present and what jobs they did (director, subject, recorder), and subject specs (age, weight, height, stress level, etc).
2) **Hypothesis** remember this is something that should be made beforehand and then used in your lab reports. For the lab notebook, create the best hypothesis based on the individual hypotheses of each group member.
3) **General Objectives** nothing too fancy here, for example (Lesson 5) “see how ECG changes with different activities”
4) **Special equipment** used For instance for lab 7, say pulse transducer and a set of leads. You don’t have to list everything, like the computer or MP30 unit.
5) **Methods** don’t have to go into detail. You can if you want, but bare minimum should be “(Lesson 5) took ECG readings for lying down, sitting up fast, and after exercise.” Record any deviations from the procedure here or if you have a choice of activity, for example the type of exercise your subject performed in the lab. Drawings are recommended, for example, how you set up the leads on the body. Problems with the procedure should be noted here.
6) **Results** you should make general statements of your results (trends, key results). If you used equations to derive your data, you should put them in your notebook.
7) **Discussion** you should make general comments about your results here, BUT you don’t have to answer Biopac questions since you do this in more detail in your lab reports. This should be more a discussion about problems you encountered, observations, if you felt your data is wrong or off, things that could have been better. Do not write “see lab report for details”.
8) **Conclusion** hypothesis was met? Learn anything?
9) **Meetings** if you all have a meeting to do lab reports or had to come to open lab and especially when you have to design your own experiment, you need to write this down in your lab notebook. Should include date, who attended and generally what was discussed. If didn’t have any, write “none”

Notes: (1) PLEASE WRITE NEAT AND KEEP AN ORGANIZED APPROACH (chronology, etc.) Leave some white space on the page – you will only use about half of your notebook for the semester, don’t cram everything onto 1-2 pages for a lab. (2) When you make an error, it is usually good practice to not erase it, but to put one strike through the middle of it, or if the error is an entire paragraph, to put an “x” through it. This reduces speculation that you had “doctored” your data. (3) you don’t have to, but you might find it helpful to write notes from lecture in your notebooks, especially to help you with the background section of your lab reports. (4) The lab notebook should be an aid for you when writing your lab reports.

** Notebooks should be completed during lab, not written up after the lab. Your notebook should be used to record your data and observations **as it occurs in the lab.**
Lab Report Guidelines

Cover Page: Lesson #, experiment title, group members, computer #, and lab section day

Hypothesis: LENGTH: 1-2 sentences  State your expected results. Should be as specific as possible; it is not sufficient to say that something will change. You must say whether the measurement will increase, decrease, or stay the same, etc. Your hypothesis does not have to be correct; it is a statement you make BEFORE starting the lab about what you think will happen, but should be physiologically reasonable (e.g. heart rate increases during exercise).

Specific Aims: LENGTH: 1 paragraph  State specific objectives for that experiment written in paragraph form. Do not copy directly from the lab manual.

Background: LENGTH: 1 page  Describe topics covered in the experiment, covers the basic anatomy and physiology of the system studied, and how the test method works. Define the important terms and concepts. Use your physiology textbook for background material – BIOPAC doesn’t always explain things very well. Outright copying of the manual will not be accepted.

Methods: LENGTH: 1-3 paragraphs  Describe the procedure you used to collect your data. Include the equipment and materials used, indication of electrode placement, and specify modifications (esp. type or length of exercise performed by subject). The subject profile should be in this section. This section should give enough information that your experiment could be duplicated. However, it is not necessary to write every part of your procedure down, like turning on the computer. It is alright to assume that you are writing this for a fellow physiology lab student, already familiar with the BIOPAC system. This should be written in the past tense.

Results: LENGTH: 1-2 paragraphs  State the results you obtained. You must reproduce ALL data tables from lab manual in Word, cannot attach lab manual sheets. The results should not be discussed, only stated (e.g. heart rate was found to increase after exercise). Be sure to include units in the graphs and tables and also label everything (axes, figures, tables) appropriately. Any required equations/calculated values should be included in this section.

Discussion: LENGTH: 2-3 pages. Discuss the results of your experiment. What do your results mean? Be sure to reference the relevant physiology in your discussion – what would you expect to happen based on the experimental procedure? What are some of the limitations of the study? What were some possible sources of error specific to your experiment? You must answer ALL of the questions at the end of each lesson in the Biopac manual in this section. The questions should be answered in order and written in paragraph form. Do not format as Q&A.

Conclusions: LENGTH: 1 paragraph  State the conclusions for this experiment: Was your hypothesis correct? What was the main result of the experiment? Do not repeat your discussion section here.

References: All references used should be included in their own section and must be referenced in proper format (make sure to reference the Biopac manual every time). For example:


**Reports should be double-spaced and printed on one side of the page.**
Design Your Own Experiment Guidelines and Suggestions

Suggestions for Experiments – Please talk to us if you have questions or problems.

Try to keep your projects simple. If you try to look at too many parameters, you can get into a lot of trouble. You should aim to measure 2-3 parameters (e.g. HR, BP, EEG) and a couple conditions (e.g. caffeine and no caffeine). Remember in addition to your regular lab time, there will be open labs on Fridays.

Some ideas are given below as a general level of complexity of the project. Note that these are ideas and you should modify them to something that interests you.

- Respiratory function and smoking or with caffeine
- Weight lifting and fatigue
- Force assessment (the boot that Paul Iaizzo demonstrated)
- Dive Reflex (measures changes in heart rate with temperature)
- Exercise and smoking or caffeine
- Sleep Deprivation and EEG
- Concentration and effects of temperature
- EEG and caffeine
- Visual stimuli and changes with physiology (happy face, disturbing pictures, etc.)
- Starvation and eating, changes with physiology

** Projects involving alcohol are discouraged because this is a dry campus and not all members of the lab are of legal age. Projects involving illegal or prescription substances are prohibited.

Project Proposal Presentation Guidelines/requirements

- 3 minutes maximum
- One overhead transparency (no powerpoint)
- Choose one person to speak for the group
- Present your module idea
  - Include why you are interested in investigating this
  - Your specific aims and what parameters you are going to measure. Be sure to include your experimental design. For example, if you are looking at the effect of caffeine, you would need to include the caffeine source, amount to be ingested, time of administration, subject preparation for the experiment, number of subjects (you should aim for at least 6-8 subjects), etc.
  - Your hypothesis

Turn in a sheet with your proposal (idea, why you want to do this, specific aims, parameters, and hypothesis). Include your section, computer number, group members. This presentation will be included in your final project grade.
Final Presentation Guidelines

Time limit: 7 minutes (5 minutes for presentation, 2 minutes for questions)

Format: Powerpoint Presentation

Powerpoint presentations must be emailed to the coordinating TA before 9pm the day before your presentation. This will allow the TA to make sure that everything will run correctly on the lab laptop. You will receive email confirmation from the TA. If you have lab on Monday, it is due on Sunday evening. If you have lab on Tuesday, it is due on Monday evening.

Filename:  *Your lab day*-*Your computer number*  For example:  Monday_Computer_44

The presentation should include:

1) Title slide – Project title, group members, computer number, date
2) Short background – what you found in the literature, why you are interested, what is the physiology you are trying to study (1 slide)
3) Specific Aims and Methods – what specifically you measured and how (1 slide)
4) Hypothesis – be specific and give reasons why you thought this (1 slide)
5) Results – this should be a short summary showing only important results, graphs are the easiest way to show trends and should be used whenever possible in oral presentations. On Excel-created graphs, change the default colors to avoid using yellow and turquoise and include error bars on your graphs (see a TA if you need help). (2-3 slides)
6) Discussion and Conclusions – describe physiological reasoning behind your results, describe errors and possible improvements to your study, state any conclusions you can make from your study, was your hypothesis correct? (2-3 slides)

Speakers: You can designate one or more members to speak during the presentation. All group members should go to the front of the room for attendance and to aid in answering questions from the audience. Non-presenting members can sit in the front row during the presentation until the Q&A portion.

FINAL PROJECT LAB REPORTS ARE DUE
**Final Report Guidelines**

**Cover Page:** Lesson #, experiment title, group members, computer #, and lab section day

**Hypothesis:** LENGTH: 1-2 sentences  State your expected results. Should be as specific as possible; it is not sufficient to say that something will change. You must say whether the measurement will increase, decrease, or stay the same.

**Specific Aims:** LENGTH: 1 paragraph  State specific objectives for that experiment written in paragraph form. Include test conditions and equipment used for experiment.

**Background:** LENGTH: 1 page  Describe topics covered in the experiment, covers the basic anatomy and physiology of the system studied, how the test method works, motivation for your study, and the known influence of your test condition on physiology (for example, if studying effect of caffeine, present information on the physiological systems affected by caffeine and how caffeine works to influence those systems). Define the important terms and concepts. Use your physiology textbook for background material as well as looking up journal articles using PubMed or other search engines.

**Methods:** LENGTH: 1-3 paragraphs  Describe the procedure you used to collect your data. Include the equipment and materials used, indication of electrode placement (figures are great for multi-lead set-ups), and subject profiles. This section should give enough information that your experiment could be duplicated – dosing amounts and schedules, exercise types, etc. It is alright to assume that you are writing this for a fellow physiology lab student, already familiar with the BIOPAC system. This should be written in the past tense.

**Results:** LENGTH: 1-2 paragraphs  State the results you obtained. The introductory paragraphs are given before the tables and graphs. The results should not be discussed, only stated (e.g. heart rate was found to increase after exercise). You only need to present the summarized data, you do not need to include all the raw data from your subjects. Make sure that you present the data clearly and completely. For multiple subjects, it is often best to look at % change from control to test condition, but each data set will need to be analyzed for proper presentation. Be sure to include units in the graphs and tables and also label everything (axes, figures, tables) appropriately. Any required equations/calculated values should be included.

**Discussion:**  LENGTH: 2-3 pages. Discuss the results of your experiment. What do your results mean? Be sure to reference the relevant physiology in your discussion – what would you expect to happen based on the experimental procedure? What are some of the limitations of the study? What were some possible sources of error specific to your experiment?

**Conclusions:** LENGTH: 1 paragraph  State the conclusions for this experiment: Was your hypothesis correct? What was the main result of the experiment? Do not repeat your discussion section here.

**References:** All references used should be included in their own section and must be referenced in proper format. You must have one journal article related to your project listed in the references section.

**Reports should be double-spaced and printed on one side of the page.**
**Student Conduct Code:**
The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected to adhere to Board of Regents Policy: Student Conduct Code. To review the Student Conduct Code, please see: http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf.

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

**Use of Personal Electronic Devices in the Classroom:**
Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference: http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html.

**Scholastic Dishonesty:**
You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code: http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf) If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: http://policy.umn.edu/Policies/Education/Education/INSTRUCTORRESP.html.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: http://www1.umn.edu/oscai/integrity/student/index.html. If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class—e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.
**Makeup Work for Legitimate Absences:**
Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see:
http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html.

**Appropriate Student Use of Class Notes and Course Materials:**
Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see:

**Grading and Transcripts:**
The University utilizes plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.000</td>
<td>Represents achievement that is outstanding relative to the level necessary to meet course requirements</td>
</tr>
<tr>
<td>A-</td>
<td>3.667</td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>3.333</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>3.000</td>
<td>Represents achievement that is significantly above the level necessary to meet course requirements</td>
</tr>
<tr>
<td>B-</td>
<td>2.667</td>
<td></td>
</tr>
<tr>
<td>C+</td>
<td>2.333</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>2.000</td>
<td>Represents achievement that meets the course requirements in every respect</td>
</tr>
<tr>
<td>C-</td>
<td>1.667</td>
<td></td>
</tr>
<tr>
<td>D+</td>
<td>1.333</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>1.000</td>
<td>Represents achievement that is worthy of credit even though it fails to meet fully the course requirements</td>
</tr>
<tr>
<td>S</td>
<td>Represents achievement that is satisfactory, which is equivalent to a C- or better. For additional information, please refer to:</td>
<td></td>
</tr>
</tbody>
</table>

http://policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html.

**Sexual Harassment**
"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy:
http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf
**Equity, Diversity, Equal Opportunity, and Affirmative Action:**
The University will provide equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy: http://regents.umn.edu/sites/default/files/policies/Equity_Diversity_EO_AA.pdf.

**Disability Accommodations:**
The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations. If you are registered with DS and have a current letter requesting reasonable accommodations, please contact your instructor as early in the semester as possible to discuss how the accommodations will be applied in the course. For more information, please see the DS website, https://diversity.umn.edu/disability/.

**Mental Health and Stress Management:**
As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: http://www.mentalhealth.umn.edu.

**Academic Freedom and Responsibility, for courses that involve students in research:**
Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom and conduct relevant research. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.* When conducting research, pertinent institutional approvals must be obtained and the research must be consistent with University policies. Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.