Course Prerequisite

Concurrent enrollment in, or completion of, ENS 304 or a comparable course.

Course Goals
The primary goal of this course is to further your understanding of exercise physiology. A second but equally important goal is to enhance your ability for critical thinking on exercise physiology using the scientific process. This includes formation of a research question, hypothesis, designing an experiment, and inferring conclusions from data. Secondary goals include improving technology skills to assist collecting and analyzing data, and writing and oral communication skills for demonstrating understanding of the physiological principles.

School Learning Goals and Objectives
Your experiences in this course provide opportunities to support the following School of Exercise and Nutritional Sciences learning goals and objectives:

Learning Goal 1  Demonstrate core critical thinking skills and dispositions to ask and answer questions relevant to exercise and nutritional science.
Objective 1.1 Critically evaluate published research in the discipline
Objective 1.2 Evaluate alternative solutions to a discipline-based problem.
Objective 1.3 Present opposing viewpoints and alternative hypotheses on issues in exercise and nutritional science.
Objective 1.5 Actively seek out discipline-based questions as opportunities to apply core critical thinking skills.

Learning Goal 2  Demonstrate effective oral, written, and other interpersonal skills to help communicate knowledge and promote health and wellbeing in diverse communities.
Objective 2.1 Use effective technical writing skills to communicate information about exercise and nutritional science.
Objective 2.2 Use effective oral presentation skills to present information to peers and other professionals.

Learning Goal 3  Demonstrate understanding of scientific concepts, principles, and methods used in the study of exercise and nutritional science.
Objective 3.2 Identify the steps in the scientific method of research.
Objective 3.5 Design a research study and collect, analyze, and evaluate findings in relation to a proposed hypothesis.

Learning Goal 4  Use an array of technologies to support inquiry and professional practice.
Objective 4.1 Use the internet and e-mail to communicate with others and find valid information.
Objective 4.2 Use various technology instrumentations to measure phenomena of interest.
Objective 4.4 Use presentation software to report project findings.
Student Learning Outcomes

1. Identify the steps of the scientific process.
2. Describe the primary way that muscle force is controlled.
3. Contrast the strengths and weaknesses of underwater weighing, bioelectrical impedance, and skinfold measurement for estimating body composition.
4. Describe the heart rate and blood pressure response to rhythmic and static exercise.
5. Use indirect calorimetry to measure energy expenditure during exercise.
6. Describe the interaction of the three energy pathways at the onset of exercise and how their relative contribution changes over time.
7. Explain the lactate threshold and reason for its occurrence.
8. Describe the physiological mechanisms that explain the ventilatory threshold and why it correlates with the lactate threshold.
9. Develop a research question and experimental design, collect and analyze the data, and describe the significance of your findings.

Course Overview

In the early lab sessions, you will be given a specific research question and, with a small group, resolve how to answer the question. Students will form into small groups to collect data and determine how the data should be analyzed and reported. Later, the research question given to you will be vague, and it will be up to each lab group to focus the research question that will be investigated. These labs will cover a range of topics in exercise physiology including, motor unit recruitment, body composition, and cardiovascular and metabolic responses to exercise. Following these labs, each student will submit a 1-page report summarizing the results and discussing the significance of his/her findings.

The last part of the semester will be devoted to completing an independent research project. Working in groups of 3-4 students (no larger), groups will formulate a research question and hypothesis on an exercise physiology topic as well as develop an experimental design to answer the question. Thus, you will be responsible for planning the experiment, analyzing and interpreting the results, and forming a conclusion. After completing a project, each group will make a 10-15 min oral presentation and, additionally, all group members will individually submit a 5-6-page paper on the study.

Course Expectations

Most, if not all of us, have spent our entire academic career learning in a passive environment. The instructor's role in this learning style is to inform students on what to prepare for course exams and to organize the relevant information in a manner that facilitates memorization. After being told what information must be learned, students prepare for memorizing answers to fact-oriented, multiple-choice exam questions. This traditional style of learning prepares students to respond to fact-oriented questions, but it does not adequately prepare them to evaluate information or synthesize new information from existing data. Students become adept at figuring out how to respond to exam questions. However, when faced with the challenge of answering a more complex question, this learning style can lead to difficulties in developing an answer, analyzing data, or forming conclusions.

To address these concerns, this course has changed the traditional roles of the instructor and students. Students must now be an active participant, which means much more than just collecting data and writing up results. Rather, you, working collaboratively with your research group, will first figure out how to conduct your experiment, analyze and summarize the data, and to clearly present your findings. The instructor's role has also changed to focus on facilitating this process rather than simply imparting information. You will be given fewer instructions on what to do, what to observe, or how to interpret your observations. The instructor is here to assist and point you in the general direction, but finding and navigating a path to an answer requires greater involvement from you.

Crashing Policy

No more than 16 students will be allowed in a section. More than 16 students begins to impact the time that the instructor can spend with each student and affecting their learning in the class. When openings are available, the order of preference will be given to: 1) students preparing to enter an ENS graduate program, 2) graduating seniors, 3) seniors, and 4) all other students.
Course Materials
- Blackboard (https://blackboard.sdsu.edu)
- Exercise Physiology Lab Manual (downloadable from Blackboard)
- general exercise physiology text

Lab Policies
1. Cell phones are to be turned off during class. This includes text messaging!
2. Dress appropriately for an exercise setting (sneakers, shorts, sportsbras, T-shirts, etc.).
3. You must follow biosafety procedures when handling blood. Report all injuries or finger sticks to your instructor!
4. In the lab, there is to be NO eating or drinking of other than bottled (no glass) water.

Class Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Learning Objectives</th>
<th>Assignments</th>
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</thead>
<tbody>
<tr>
<td>Aug 27</td>
<td>First day of class</td>
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</tbody>
</table>
| 1 | Introduction to lab, lab policies and expectations, course evaluations, scientific method, graph interpretation | 1. Define physiology, homeostasis, and steady state.  
2. Contrast the difference between a dependent variable and an independent variable.  
3. Discuss the effective use of statistics and graphs in scientific studies. | |
| Sep 3 | Labor Day – no class | | |
| 2 | Lab 1 – Motor Unit Recruitment and Force Output | 4. Identify the components of the motor unit.  
5. Explain the “all-or-nothing” principle of skeletal muscle recruitment.  
6. Explain how motor unit recruitment is monitored.  
7. Discuss the primary way that force output by skeletal muscles is controlled. | Quiz 1 |
| 3 | Lab 2 – Body Composition Assessment | 8. Explain what is being measured during a body composition assessment.  
9. Discuss the principles of hydrostatic (underwater) weighing, anthropometric (skinfold) measurements, and bioelectrical impedance (BIA) for assessing body composition.  
10. Interpret a body composition assessment. | Quiz 2, Lab 1 report |
| 4 | Lab 3 – Cardiovascular Responses to Exercise | 11. Demonstrate competence in using a Monarch cycle ergometer and measuring heart rate and blood pressure.  
12. Discuss the effect of peripheral resistance on blood pressure during exercise.  
13. Describe the effect of graded exercise on the cardiac output and blood pressure responses.  
14. Contrast and explain the differences of cardiovascular responses to dynamic (rhythmic) and static (isometric) exercise. | Quiz 3, Lab 2 report |
| 5 | Lab 4 – Measurement of Energy Expenditure | 15. Explain why indirect calorimetry can be used to measure energy expenditure.  
16. Discuss the meaning of \( \text{V} \text{O}_2 \) and RER.  
17. Calibrate a ParvoMedics metabolic system.  
18. Use indirect calorimetry to measure energy expenditure during moderate-intensity exercise. | Quiz 4, Lab 3 report |
| 6 | Lab 5 – Oxygen Deficit and Excess Postexercise Oxygen Consumption | 19. Describe the interaction of the three energy pathways at the onset of exercise and how their relative contribution changes over time.  
20. Describe the relationship of oxygen uptake kinetics and the oxygen deficit.  
21. Explain the reason for the excess post-exercise oxygen consumption. | Quiz 5 |
| 7 | Lab 6 – Metabolic Responses to Prolonged Exercise | 22. Discuss the effects of exercise duration on energy expenditure and the fuel mixture during moderate-intensity exercise.  
23. Use Borg’s Rating of Perceived Exertion (RPE) to assess an exercising individual’s effort. | Quiz 6, Lab 5 report |
| 8 | Lab 7 – Metabolic Responses to Graded Exercise | 24. Demonstrate an understanding of the lab biosafety procedures.  
25. Describe the effects of exercise intensity on energy expenditure and the fuel mixture.  
26. Identify the lactate threshold from a graded exercise test.  
27. Explain the lactate threshold and reasoning for its occurrence. | Quiz 7, Lab 6 report |
| 9 | Lab 8 – Respiratory Responses to Graded Exercise | 28. Identify lactate threshold from gas exchange data.  
29. Discuss the physiological mechanisms that explain the ventilatory threshold and why it correlates with the lactate threshold.  
30. Explain when and why the RER will exceed 1.0.  
31. Discuss the significance of \( \text{V} \text{O}_2 \text{max} \). | Quiz 8, Lab 7 report |
| 10 | Research Methods and Design | 32. Summarize the steps of the scientific process.  
33. Contrast the scientific method from trial-and-error for acquiring new information.  
34. Develop a focused research question for your small-group research project. | Lab 8 report, Research project proposal due |
| Nov 12 | Veteran’s Day – no class |  |
| 12 | Data Collection |  |
| 13 | Data Collection |  |
| 14 | Data Collection |  |
| 15 | Research Project Presentations | 35. Orally communicate the findings and significance of your research project that includes an effective PowerPoint presentation.  
36. Submit a written paper that effectively communicates the findings and significance of your research project. | Research papers |
| Dec 7 | Last day of class |  |
Course Evaluation

Your course grade will be based on the accumulated score from quizzes, lab reports, and research projects.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Points</th>
<th>Grading Scale</th>
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</thead>
<tbody>
<tr>
<td>8 quizzes (10 points each, drop lowest score)</td>
<td>70 points</td>
<td>A &gt;92.0%</td>
</tr>
<tr>
<td>Biosafety quiz</td>
<td>8 points</td>
<td>A- 90.0 – 91.9%</td>
</tr>
<tr>
<td>7 lab reports (15 points each)</td>
<td>105 points</td>
<td>B+ 88.0 – 89.9%</td>
</tr>
<tr>
<td>group presentation (nongraded)</td>
<td>0 points</td>
<td>B 82.0 – 87.9%</td>
</tr>
<tr>
<td>group presentation (graded)</td>
<td>50 points</td>
<td>B- 80.0 – 81.9%</td>
</tr>
<tr>
<td>individual research paper</td>
<td>150 points</td>
<td>C+ 78.0 – 79.9%</td>
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<tr>
<td>TOTAL</td>
<td>383 points</td>
<td>C 72.0 – 77.9%</td>
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<td>C- 70.0 – 71.9%</td>
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<td>D+ 68.0 – 69.9%</td>
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<td>D 62.0 – 67.9%</td>
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<td>D- 60.0 – 61.9%</td>
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<td>F &gt;60.0%</td>
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Class Attendance

Attendance at each lab meeting is required unless you are collecting data outside of the lab. If you know that you will be missing a class because of a planned absence or religious observance, you are to notify your instructor by the end of the second week of class. He/she will make a reasonable accommodation for your absence. Other legitimate absences are accepted, although your lab instructor may require documentation. Regardless, you remain responsible for any missed assignments.
Statement on Cheating and Plagiarism

Cheating is the actual or attempted practice of fraudulent or deceptive acts for the purpose of improving one’s grade or obtaining course credit; such acts also include assisting another student to do so. Typically, such acts occur in relation to examinations. However, it is the intent of this definition that the term ‘cheating’ not be limited to examination situations only, but that it include any and all actions by a student that are intended to gain an unearned academic advantage by fraudulent or deceptive means. Plagiarism is a specific form of cheating which consists of the misuse of the published and/or unpublished works of others by misrepresenting the material (i.e., their intellectual property) so used as one’s own work. Penalties for cheating and plagiarism range from a 0 or F on a particular assignment, through an F for the course, to expulsion from the University. For more information on the University’s policy regarding cheating and plagiarism, refer to the Schedule of Courses (‘Legal Notices on Cheating and Plagiarism’) or the University Catalog (‘Policies and Regulations’).

Students with Disabilities

The University is committed to providing reasonable academic accommodation to students with disabilities. The Student Disability Services Office provides university academic support services and specialized assistance to students with disabilities. Individuals with physical, perceptual, or learning disabilities as addressed by the Americans with Disabilities Act should contact Student Disability Services office for information regarding accommodations at (619) 594-6473 (http://www.sa.sdsu.edu/dss/dss_home.html). Moreover, you should notify me so that reasonable efforts can be made to accommodate you.

This syllabus and schedule are subject to change in the event of extenuating circumstances.