The University of Texas at Tyler  
Department of Health and Kinesiology  

Syllabus  

KINE 5313 Exercise Physiology I (3 semester credit hours)  
Spring Semester, 2015  

INSTRUCTOR INFORMATION  

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COMMUNICATION WITH INSTRUCTOR  

Please feel free to contact me throughout the semester by email, phone, text or in person (if you are in the area). I don’t mind your phoning me at my home or via my cell phone (numbers included above), but I do ask that you try to be considerate with such calls. All email correspondence associated with this course should be directed to jschwane@uttyler.edu. VERY IMPORTANT: Every email you send to me related to the course should have “KINE5313” in the subject line. This helps with automatic sorting of my email. Also, always be sure your email includes your name somewhere, so it is obvious to me who the sender is. This applies especially if your email address does not include your name. Please note that as a general rule I do not reply to email on weekends (Friday late afternoon till Monday morning). I often do reply on weekends, but please do not expect that. If you send a message via email that you think requires my urgent attention, please type “URGENT” in the subject line, but please save such messages for truly urgent cases. If you send me a text message, please be sure to identify yourself.  

VERY IMPORTANT: Students are required to use their Patriot email accounts for course work. If all is working properly, your Patriot email address will be automatically loaded into Blackboard for this course. I don’t mind if you send me emails from another account (as long as I can tell who has sent the email!), but I will send email via addresses in the course from time to time. Therefore, it is essential that you check your Patriot account on a regular basis.  

Office hours: My regular hours this semester are 2:00-4:00 p.m. on Wednesdays and 9:30-11:30 a.m. on Thursdays. (These and all other times I state in the syllabus refer to the Central Time Zone.) I will try very hard to be in my office during those times, so those are good times to “drop in” at my office, in person, by phone or virtually. Please feel free to contact me at other times also. If I am available to visit with you at such times, I will do so. If not, or as a regular alternative to office hours, please send me an email with options of times for us to talk, in person or by phone. Then I will confirm an appointment time via return email.
Based on student interest, I will happily arrange a regular “virtual meeting” time for live chats to discuss course material or other course-related matters.

**COURSE DESCRIPTION**

Exercise physiology is the study of how the body functions in response to acute and chronic exercise. Rather than presenting a comprehensive overview of all topics in exercise physiology, this course emphasizes skeletal muscle function and metabolism. (Other topics typically addressed in a comprehensive survey course may also be touched on as they relate to muscle function and metabolism.) There are various approaches one may take to studying exercise physiology in terms of sequence of topics. As you will see, I think the essence of acute exercise is contractions of skeletal muscles. And then during exercise, other physiological adaptations take place in response to and/or to support the contracting muscles. A major category of these adaptations is metabolism, the chemical reactions that provide the energy for muscle contractions and relate in other ways to the muscle contractions. The two major topics this course addresses are “Skeletal Muscle” and “Metabolism.” (Other major topics, for example, cardiovascular and pulmonary physiology, are addressed in another of our exercise physiology courses.) If the essence of exercise is contractions of skeletal muscles, it makes sense to start this course by addressing the physiology of skeletal muscle and then address metabolism. And this is the sequence I often follow in a course such as this. I am going to reverse the order of these topics this semester, however. My reason for this is primarily a pragmatic one related to assignments. There will be four assignments that deal with laboratory data, all related to exercise metabolism. These will require a significant amount of time to properly complete. Therefore, I want to start these early in the semester to allow plenty of time to complete them before end-of-semester pressures may limit time to work on them. Besides this pragmatic reason for addressing metabolism first this semester, conceptually, it is not unreasonable or unworkable to start an exercise physiology course with metabolism, addressing first the concept of exercise as work, an energy-requiring process, and how energy is made available to do exercise. And then address skeletal muscle, including how muscle tissue uses the energy made available in metabolism.

This course has many of the features of a traditional face-to-face course in an on-campus, classroom setting, including virtual lectures, readings in textbooks or of textbook-like material, discussions (mostly asynchronous, but with option of synchronous), reviews of research literature, written assignments, and exams. The primary difference between this course and a traditional course is the Internet-based delivery of information from instructor to student, from student to instructor, and from student(s) to student(s). The course is designed so you can complete all requirements asynchronously, that is, there will be no precisely scheduled meetings with required attendance, like weekly class sessions in an on-campus course. Therefore, with a few exceptions (particularly related to exams, which are discussed later), and within the schedule of due dates for assignments and the like, you may access online course content, participate in online discussions, and do assignments at times that work best for you.

Exercise physiology is a discipline that has a lot of content that must be learned. Even if the ultimate interest is the application of exercise physiology, for example in the training of athletes, teaching physical education, or prescribing exercise for clients in health-promotion or rehabilitation programs, one must first learn the concepts and theory. And there are many concepts in exercise physiology. As noted above, the content of this course is organized into two major topics (not counting a brief introductory lecture), the first dealing with exercise metabolism and the second dealing with skeletal muscle function. Content will be presented in several ways:

- I will provide extensive written material in pdf format. I will refer to this material as “Schwane’s Textbook.” The material is similar to what is presented in a textbook, though with fewer graphics.
• You may access related content via standard textbooks (though none is required for this course) and via the Internet. Regarding the latter, from time to time I will direct you to specific sites on the Internet.

• I have recorded lectures using software named “Tegrity.” Tegrity records voice and Power Point slides or other visuals that are displayed on the computer monitor during the lecture. These recordings will be accessible to students via Blackboard.

• Related to the previous bullet point (i.e., lectures via Tegrity), I will make Power Point slides available. These will be identical or nearly identical to the slides shown in the lectures via Tegrity, so they will be available to you for reference and note-taking when watching a lecture via Tegrity, as well as for subsequent review.

The course also includes several lab exercises, involving viewing of video recordings of lab tests (accessible via Assignments > Labs > Lab Demonstration Videos in Blackboard) and working with lab data.

COURSE OBJECTIVES

Objectives of UT Tyler’s master’s degree programs related to kinesiology include: Graduates will be able to—

1. critically read and discuss published research related to kinesiology;
2. discuss in writing issues related to kinesiology, identifying, analyzing and defending different viewpoints;
3. apply theoretical concepts from the kinesiology research literature to professional practice; and
4. use computer technology to manage data, access information, and communicate effectively.

This course addresses these objectives through the following:

1. study of basic facts, concepts and theories of exercise physiology, with emphasis on the areas of skeletal muscle and exercise metabolism;
2. critically reading and discussing research related to exercise physiology;
3. discussing in writing questions and viewpoints related to exercise physiology, analyzing and supporting viewpoints based on research evidence;
4. applying theoretical concepts in exercise physiology; and
5. using computer technology to access information related to exercise physiology, and to communicate effectively about exercise physiology.

A list of specific learning objectives is listed in an appendix at the end of this syllabus, as well as in association with related material in “Schwane’s Textbook” and lab materials.

PREREQUISITES

You must be eligible to take graduate courses at The University of Texas at Tyler to take this course. Eight semester hours of undergraduate anatomy and physiology or equivalent and other college science courses, such as chemistry, provide very useful background for exercise physiology, but such courses are not absolute prerequisites. If you are uncertain regarding your readiness for this course, please discuss this with the course instructor as soon as possible.

In the Course Outline area of the course in Blackboard, reference is made to multimedia educational modules available via “HippoCampus,” a free, public website produced by NROC (the National
Repository of Online Courses) – [http://www.hippocampus.org/](http://www.hippocampus.org/). Some of these modules in the area of biology (“Biology II for AP”) provide excellent background or explanation related to topics and concepts we study in this course. These may be helpful for all students, but especially for a student with relatively little previous study of basic sciences.

**TEXTBOOK(S)**

No textbook is required, but you may wish to have and use a standard exercise physiology textbook (e.g., *Exercise Physiology: Theory and Application to Fitness and Performance*, by Scott K. Powers & Edward T. Howley [McGraw-Hill] or *Physiology of Sport and Exercise*, by W. Larry Kenney, Jack H. Wilmore & David L. Costill [Human Kinetics]).

I recommend that you have access to a basic anatomy and physiology textbook. We will review some basic physiology and related anatomy in this course, but only a small amount of what you should know as the basis for study of the physiology of exercise. Therefore, you may need to review some basic anatomy and physiology on your own. Of course, basic information about anatomy and physiology is available on the Internet in lieu of a printed textbook.

**GENERAL INFORMATION**

**Course Outline**

A very important site in the course is the outline of course content, accessed via the Course Outline link in Blackboard. The Course Outline area summarizes key information about the course (e.g. major topic titles, reading and other assignments). Please familiarize yourself with the Course Outline at the beginning of the course. You should refer to it a lot throughout the course.

**Discussions on the “D.B.” (Discussion Board)**

Asynchronous online discussions are a very important component of this course. Almost without exception, for a student to do well in the course, s/he must participate regularly and insightfully in the online discussions. Discussions open to the entire class will be found on the Discussion Board (D.B.) in Blackboard. Other discussion forums will be restricted to subgroups of students. Each major topic will have designated discussion forums, either for the entire class or for small groups. Also, some assignments will be done in small groups, and discussions related to those assignments will be done in the restricted online forums. In addition to discussions that I initiate, any time you would like to ask a question or make a comment intended to facilitate learning (analogous to asking a question or commenting in a traditional classroom setting), you should post your question or comment in a designated D.B. forum. This will be the best opportunity for you to ask questions and have material clarified. In doing this, other students will be helped too.

Forums on the D.B. are all designated for discussions of specific topics or segments of the course, with one exception—the “Coffee Shop.” The Coffee Shop is a forum on the D.B. intended for students to discuss anything they wish, analogous to discussions over coffee or a soft drink in your favorite spot for meeting other students on or off campus. As a general rule, I will stay out of these discussions, unless specifically invited to join in. Please note, however, that I have access to all online discussions.

The regular D.B. forums use threaded, asynchronous discussions. “Threaded” refers to continuation of a discussion of a specific topic or question (the “thread”); “asynchronous” means no two people have to be communicating at the same time (in real time), as in a face-to-face conversation—rather, you participate
in the discussion when the time is convenient for you (within limits set by the semester schedule). The D.B. also has the option of synchronous, live chat sessions. Such sessions involve two or more people in a virtual conference room at the same time communicating back and forth in real time. You may want to schedule chat sessions with other students or with the instructor.

When you click the Discussion Board link in Blackboard, a list of forums will appear. Each of these is a link that leads to the messages posted in that forum. In each forum, each post is a link leading to a person’s message. With each message is a Reply button. Clicking on the Reply opens a new area for you to reply to that specific message, either with a comment or follow-up question. Replying in this way maintains the subject thread. Messages in a given thread are organized together, making it easier to follow the posts. If you want to add a question or comment in a forum that is new and not in response to a previous post (i.e., you want to start a new thread), use the Create Thread link. This will open an area for your message. When you submit this message, a new thread will be started. Note carefully: Be sure you really want to start a new thread before doing so. If you simply want to respond to someone else’s post (including one of the instructor’s posts), you should reply and not start a new thread. Many online discussion forums will have a lot of comments before they are completed. It will be much easier for everyone to follow discussions if we all try to follow these guidelines about threads.

You may attach documents, photos and other items to D.B. posts. Do not, however, routinely use attachments for your discussion posts. This makes following a discussion much more difficult. Please save the attachment option for truly lengthy items, reference material or items (e.g., JPEG images) that cannot be pasted into the discussion post itself.

Since most online discussions will be asynchronous, other responses will be posted while you are not in the discussion areas. To stay abreast of discussions, I strongly recommend that you check the discussion forums at least twice each week, and preferably every day. Also, you should read all posts on the D.B. Some exam questions may be based on online discussions.

Assignments

At the start of the semester or shortly thereafter, all planned assignments that involve points toward your grade in the course will be listed by titles in the Course Outline. (I reserve the right to add assignments during the semester, although I do not anticipate doing that.) With possible exceptions, details of assignments requiring student responses that will be graded will be accessible via the Assignments link. In this area, you will have access to my detailed description of, and instructions for, each assignment, including the specific required activity and product(s) that must be developed and submitted. You will also have access to an area for submitting comments or final assignment products (if the assignment calls for this). This area allows you to post information directly, much like in a D.B. forum, and to upload (copy) products as attachments.

VERY IMPORTANT: I am definitely a stickler regarding completing and submitting assignments exactly as instructed, so please pay close attention to assignment instructions. Doing exactly what is instructed for a given assignment will greatly improve your chances of earning a good score on the assignment. Close attention should also be paid to the method of submitting completed assignments. Different assignments will be submitted in different ways, including uploading in the Assignments area of Blackboard, posting in a designated forum on the D.B., and sending as an email attachment. Be sure to submit each completed assignment as that assignment instructs.
Exams

Exams will likely include objective sections consisting of multiple-choice and true-false items. These sections will be accessed online via the Exams link in Blackboard. Exams will be accessible only at certain times, however. I will make each exam accessible at the appropriate time during the semester. An announcement will be posted to alert you when an exam is accessible. An exam may also have subjective items. If so, specific instructions will be given at an appropriate time regarding accessing those items and submitting responses.

Time Requirements

In general, you should expect to spend a similar amount of time completing the requirements of this online course as you would spend on the same course taught in the traditional classroom format. In case you are not aware, in the 2014-15 academic year, UT Tyler has shortened the calendar length of the fall and spring semesters to 14 weeks each (not counting final exam week), from the more typical 15 weeks. This means, of course, that the same material must be addressed in a shorter segment of the calendar, so more must be addressed each week. And this, in turn, requires students to spend more time per week. As a rough guideline, you should spend at least 10-12 hours per week on this course viewing lectures via Tegrity, reading “Schwane’s Textbook,” doing assignments, reviewing, and doing other activities that may be required or that otherwise help you understand the material presented.

You will have access to most course materials from the start of the course to the end, just as you have access to a textbook at all times. So, you can look ahead and even study ahead, or go back and review, any time you want. This is not a self-paced course, however. Assigned discussions, written assignments, exams, and the like will follow a schedule spread over the semester (similar to a class in the traditional format). There will be set dates for assignments and discussions and deadlines by which you must complete assignments. Due dates for completing assignments are listed later in this syllabus.

Library Services

UT Tyler’s Muntz Library may be accessed via http://library.utt Tyler.edu/. A link to the Muntz Library is also available on UT Tyler’s Home Page (www.utt Tyler.edu). The librarian assigned to the Department of Health and Kinesiology is Michael Skinner. You may contact him for assistance related to the Library (903-566-7165; michaelskinner@utt Tyler.edu).

You will likely want to use searchable databases provided online via the Muntz Library. Searches are best started at http://library.utt Tyler.edu/research. The best database for exercise science in general and exercise physiology in particular is Medline (EBSCO).

An alternative method of searching for research articles published in Medline is to use PubMed (http://www.ncbi.nlm.nih.gov/pubmed) to search for a list of papers (with full reference) related to one or more key terms (or authors). Almost every citation on such a list has a link to the abstract of the paper, and some have links to free copies of the complete text of the paper (although such free full-text copies are the exception in PubMed). If you find a paper of interest that does not provide a free full-text copy, the paper will likely be available via the UT Tyler Library (see above).

TECHNICAL SUPPORT

Information about technical support for Blackboard and this online course is available on your Blackboard login page (https://blackboard.utt Tyler.edu/webapps/portal/frameset.jsp) accessed via UT Tyler’s Web site.
COURSE CALENDAR

This semester officially begins on Monday, January 12, 2014, and ends on Friday, May 1, 2014 (i.e., the semester is 14 weeks long plus the final-exam week). Following is a summary of the schedule of topics addressed in this course.

<table>
<thead>
<tr>
<th>Date Range</th>
<th>Topic</th>
</tr>
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<tbody>
<tr>
<td>January 12-17</td>
<td>Introduction to the Course and to Exercise Physiology</td>
</tr>
<tr>
<td>January 18 – March 18</td>
<td>Major Topic 1—Energy Metabolism (Note that the deadline for completing the related Lab 4 assignment falls outside of this time period.)</td>
</tr>
<tr>
<td>March 19 – April 25</td>
<td>Major Topic 2—Skeletal Muscle</td>
</tr>
<tr>
<td>March 9-13</td>
<td>Spring Break</td>
</tr>
<tr>
<td>March 23</td>
<td>Last day to withdraw from course with grade of W (This must be done via UT Tyler's Registrar's Office.)</td>
</tr>
</tbody>
</table>

Following is a list of deadlines for submitting assignments, and tentative dates of exams. All deadlines are 5:00 p.m. (Central Time) on designated dates, unless I specify otherwise at a later date. Students are encouraged to submit assignments before deadlines, to allow more time for feedback prior to related exams. You should refer to this schedule frequently throughout the course. I strongly recommend that at the start of the semester you note key dates and deadlines on your own personal calendar.

<table>
<thead>
<tr>
<th>Date(s)</th>
<th>Assignment Deadline or Dates Exam Will Be Accessible</th>
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<tbody>
<tr>
<td>January 18</td>
<td>Assignment 1 – Pre-test</td>
</tr>
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<td></td>
<td>Assignment 2 – Self-introduction</td>
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<td></td>
<td>Assignment 3 – Syllabus</td>
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<tr>
<td>February 4</td>
<td>Assignment 4 – Lab 1</td>
</tr>
<tr>
<td>February 18</td>
<td>Assignment 5 – Lab 2</td>
</tr>
<tr>
<td>February 21</td>
<td>Assignment 6 – Research Abstract – Metabolism</td>
</tr>
<tr>
<td>March 4</td>
<td>Assignment 7 – Lab 3</td>
</tr>
<tr>
<td>Mar. 15-19</td>
<td>Tentative dates for accessing and completing Mid-term Exam</td>
</tr>
<tr>
<td>March 26</td>
<td>Assignment 8 – Lab 4</td>
</tr>
<tr>
<td>April 9</td>
<td>Assignment 9 – Rome &amp; Lindstedt Article</td>
</tr>
<tr>
<td>April 11</td>
<td>Assignment 10 – Research Abstract – Muscle</td>
</tr>
<tr>
<td>April 27-30</td>
<td>Tentative dates for accessing and completing Final Exam</td>
</tr>
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</table>

GRADING

Each student’s final grade for the course will be based on a total of 1,000 possible points, with letter grade assigned based on the following scale of point totals.

- A – 900-1,000
- B – 800-899
- C – 700-799
- D – 600-699
- F – <600

Your point total for the course will be determined as follows.
POSSIBLE POINTS

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<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Mid-term Exam</td>
<td>300</td>
</tr>
<tr>
<td>Final Exam (comprehensive)</td>
<td>400</td>
</tr>
<tr>
<td>Assignments</td>
<td>300a</td>
</tr>
</tbody>
</table>

Total 1,000

Bonus or Extra Credit 50b

a At the start of the semester, 10 assignments are planned. (I reserve the right to add assignments as the course progresses, but this is not likely. I also reserve the right to cancel assignments.) I recommend that you peruse all of the assignments early in the semester, to get a sense of the time and effort that will be involved in completing the assignments. Some assignments will be completed individually, and others with a small group. For grading purposes, all assignments will be weighted the same, except each of the four labs will be weighted double (primarily because the labs will involve more time and effort to complete). When computing a student’s final course grade, for allocating the number of points out of the 300 possible for assignments, an average percent score on all assignments (included the double weighting of each lab) will be computed; then this percent equivalent of 300 possible points will be added to the course total.

b Up to 50 bonus or extra-credit points may be earned based on the student’s score on the “Pre-test” that is Assignment 1. Details regarding this are presented in the description of Assignment 1.

IMPORTANT NOTE REGARDING CLASS PARTICIPATION: As you can see, no points toward the final course grade have been allocated specifically for participation (e.g., all-class discussions); therefore, none will be subtracted for nonparticipation either. Participation can, however, affect a student’s grade, in the following ways.

a) If a student’s point total for exams and assignments is within 25 points of the minimum required for a higher grade (e.g., point total of 875 compared to minimum of 900 required for grade of A; point total of 775 compared to minimum of 800 required for grade of B), if I judge that student to have participated regularly and insightfully in class discussions throughout the semester, I will award the higher grade.

b) Failure to contribute appropriately to small-group work on assignments will result in lowering of the given student’s grade on the relevant assignment, compared to the grade based on the quality of the submitted assignment.

c) Participation or nonparticipation in discussions is likely to affect learning, and thereby affect points earned on exams and some assignments.

NOTE REGARDING THE ONLINE GRADE BOOK (“MY GRADES“): The grade book in Blackboard is not very flexible or user friendly, at least not in my hands. For various reasons, the grade book may not have an accurate running total of a student’s points throughout the course. If you would ever want clarification of your status regarding grades, please ask the instructor.

INSTRUCTOR AND UNIVERSITY POLICIES

Students Rights and Responsibilities
To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: http://www.rettyler.edu/wellness/StudentRightsandResponsibilities.html
**Grade Replacement/Forgiveness**
If you are repeating this course for a grade replacement, you must file intent to receive grade forgiveness with the registrar by the 12th day of class. Failure to do so will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates will receive grade forgiveness (grade replacement) for only three course repeats; graduates, for two course repeats during his/her career at UT Tyler.

**Disability Services**
In accordance with federal law, a student requesting accommodation must provide documentation of his/her disability to the Disability Support Services counselor. If you have a disability, including a learning disability, for which you request an accommodation, please contact Ida MacDonald in the Disability Support Services office in UC 282, or call (903) 566-7079.

**Student Absence due to Religious Observance**
Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

**Student Absence for University-Sponsored Events and Activities**
If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

**Social Security and FERPA Statement:**
It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

You should also be aware of UT Tyler’s Student Code of Conduct, Section 2.09 in the University’s Handbook of Operating Procedures ([http://www.uttler.edu/ohr/hop/files/HOPCh2-8-31-03.pdf](http://www.uttler.edu/ohr/hop/files/HOPCh2-8-31-03.pdf)), especially the subsection dealing with scholastic dishonesty.

Please also note the policy related to incomplete grades. The University allows incomplete course grades in extenuating circumstances, at the discretion of the instructor. With an online course, completing course work to change an incomplete grade after the semester the course is offered is often more complicated and difficult than with a regular on-campus class. Therefore, I will be very reluctant to give a grade of Incomplete. If you truly have extenuating circumstances that will prevent you from finishing the course on time, discuss this with me as soon as you can. A student who is awarded a grade of “I” has a maximum of one semester to complete course requirements and have the grade changed to a permanent letter grade; otherwise, the grade automatically is changed to an “F.”

Note also my policy regarding late submission of an assignment: The total possible points for an assignment will be reduced by 20% of the original point total for every day past the deadline. The grade on a late assignment will then be awarded relative to the reduced total. After 5 days past the deadline, no points can be earned. If extenuating circumstances are involved, you should discuss this with me as soon as you can.
Appendix – Specific Learning Objectives

The list below includes the objectives associated with all units, lessons and labs in the course. Objectives 6-56 relate primarily to exercise metabolism; Objectives 57-99 relate primarily to skeletal muscle structure and function.

After completion of this course, the successful student should be able to:

1. Describe what is meant by and included in the discipline of exercise physiology. Include in this description reference to anatomy, normal vs. abnormal function, and pathology.
2. State 10 specific examples of exercise, including five examples from competitive athletics and five examples that are not directly related to competitive athletics. For each of these examples, as well as other examples that may be presented, discuss what makes it "exercise" and the relative demands of strength, power and endurance. Include the concepts of absolute intensity and relative intensity.
3. Write definitions of acute exercise and chronic exercise, and illustrate each of these concepts with at least three examples.
4. Write a definition of physiological mechanism.
5. Explain the two basic principles of training, the Overload Principle and the Principle of Specificity. For each, list two exercise examples that involve application of the principle and briefly discuss each example to clarify the application of the principle.
6. Draw a graph that depicts the relationship between rate of work and rate of energy required, and explain this relationship.
7. Write definitions of work and power, and illustrate each of these variables with examples of exercise activities.
8. Given appropriate data, calculate work and power.
9. Write definitions of power input, power output, and mechanical efficiency, and explain the relationships among these variables.
10. Given appropriate data, do calculations involving power input, power output and mechanical efficiency.
11. State limitations of the concept of physical work (as strictly defined) in exercise physiology.
12. Define energy; state examples of different types of energy and how each type can be converted to work.
13. Define economy of locomotion. Explain why economy is a more useful concept and measured variable in many exercise situations, and explain the advantages a runner has who is more economical at a certain running speed.
14. Explain and give examples of a physiological steady state. Briefly explain why some argue that the body is never in a steady state.
15. List and briefly discuss factors that are associated with running economy.
16. Discuss the following: Can running economy be improved with training?
17. Define the following terms, and be able to use each term appropriately in discussions: energy metabolism, catabolism, anabolism, exergonic, endergonic, ATP, ADP, ATP hydrolysis, ADP phosphorylation, CK, CP, anaerobic glycolysis, aerobic glycolysis, lactate, lactic acid, aerobic metabolism, electron transport chain, Krebs Cycle, glycogen, fatty acid, triglyceride, lipoprotein, amino acid.
18. Discuss the critical role of ATP hydrolysis and ADP phosphorylation in exercise physiology.
19. List the three methods or systems the body has for making ATP, and the strengths and limitations of each method.
20. Discuss the role of NAD (and NADH2) and FAD (and FADH2) in energy metabolism.
21. Discuss the relationships among the following: aerobic glycolysis, Krebs (TCA) Cycle, beta oxidation, electron transport system.

22. Define the following terms, and be able to use each term appropriately in discussions: respiratory quotient, respiratory exchange ratio, cross-over concept, peptide bond, transamination, transaminase, nitrogen balance equation, nitrogen balance, positive nitrogen balance, negative nitrogen balance, anabolic state, catabolic state, carbohydrate loading.

23. Discuss the relationship between power output and power input during an acute bout of exercise; include one or more absolute principles that are applicable.

24. Discuss the roles of the ATP-formation methods in exercise of different intensities and durations. In each case, identify the most likely metabolic limitation of each acute bout of exercise if the exercise is limited by metabolism.

25. Compare and contrast carbohydrates and fats as substrates for ATP formation via aerobic metabolism. In doing this, point out the strengths and the limitations of these two substrates.

26. Describe the effects of exercise intensity and duration on the relative amounts of carbohydrates and fats used as substrates for aerobic metabolism.

27. Discuss the role of proteins as substrate for ATP formation via aerobic metabolism in (a) a person with normal nutritional status and (b) a starving person.

28. Discuss some of the dietary regimens that can affect energy metabolism during acute exercise.

29. Define the following terms, and be able to use each term appropriately in discussions: lactate shuttle, lactate threshold, maximal lactate stead state, acidosis, hyperglycemia, hypoglycemia, gluconeogenesis, Cori Cycle, glucose-alanine cycle, oxygen debt, excess postexercise oxygen consumption.

30. List the substances to which lactate can be converted.

31. Describe the responses of blood lactate concentration to exercise of different intensities and durations. Relate these responses to the concepts of rate of appearance in the blood and rate of disappearance from the blood.

32. Discuss the relationship between exercise intensity and lactate threshold as it affects endurance performance.

33. Discuss the roles of the liver and skeletal muscles in blood glucose homeostasis under various conditions, including resting and acute exercise.

34. Discuss oxygen debt and excess postexercise oxygen consumption -- the terms themselves, the concept, and the causes of the oxygen debt or excess postexercise oxygen consumption.

35. Describe the two major potential goals of training in terms of metabolism.

36. Identify the changes that must take place in each of the three ATP-formation methods if (a) maximal power and (b) fatigue-resistance are to change.

37. Discuss the specific effects of increased mitochondrial mass in trained skeletal muscles on endurance performance.

38. Discuss how training-induced changes in aerobic metabolism interact with anaerobic metabolism during exercise.

39. Discuss general mechanisms by which metabolism is controlled.

40. Define the following terms and be able to use each term appropriately in discussions: aerobic, anaerobic, aerobic metabolism, anaerobic metabolism, aerobic exercise, anaerobic exercise. Distinguish between common meanings and uses of these terms in different settings.

41. Given appropriate data, calculate work and power during a step test.

42. Given appropriate data, calculate work and power during a test on the Monark mechanically braked bicycle ergometer.

43. Given appropriate data, calculate mechanical efficiency.

44. Describe the standard Wingate Anaerobic Power Test.

45. Given appropriate data, calculate peak power, mean power, and fatigue index during a standard Wingate Anaerobic Power Test. Compare results to appropriate norms.
46. Given appropriate data, calculate and express running economy in ml/kg/m and in m/ml/kg. Compare results to appropriate norms.

47. List basic equipment that is needed to measure oxygen consumption.

48. Define abbreviations commonly used in pulmonary gas exchange measurements.

49. List variables that must be measured in order to determine oxygen consumption.

50. Discuss the basic concept of VO₂ as the difference between volume of oxygen breathed in and volume of oxygen breathed out.

51. Discuss the basic concept of VCO₂ as the difference between the volume of carbon dioxide breathed in and the volume of carbon dioxide breathed out.

52. Discuss the concept of expressing gas volumes such as VO₂ related to a standard set of conditions, including why this is necessary.

53. Given pertinent data, calculate VO₂ and VCO₂.

54. Describe the response of VO₂ to an acute bout of exercise, both at intensities below VO₂max and at intensities above VO₂max. This description should include the concepts of oxygen demand, oxygen deficit, steady-state VO₂ and excess postexercise oxygen consumption, and distinguish between responses of individuals of different sizes and fitness levels to exercise of various types.

55. Describe the relationship between VO₂ and exercise intensity or power output, including the concept of VO₂max.

56. Describe the general protocol that is used for measuring VO₂max.

57. Define: primary tissue, striated muscle tissue, skeletal muscle tissue, irritability, conductivity, compliance, stiffness, viscoelasticity, viscosity, elasticity, contractility, muscle contraction, types of muscle contraction (static, dynamic, isometric, concentric, eccentric, isotonic, isokinetic), torque, sliding filament theory of contraction, alpha motor neuron, motor unit.

58. Distinguish between muscle as a primary tissue and muscle as an organ. Give examples of each.

59. Discuss the three major types of skeletal muscle contractions, explaining for each type the relationship between opposing force (torque) and the muscle's force (torque), and the function of the contraction type. Apply this information to analysis of human movements, such as, moving weights or other objects, walking or running on different grades, and jumping and landing from jumps.

60. Describe and/or draw a diagram to illustrate the basic gross and microscopic anatomy of skeletal muscle. Include the following: endomysium, perimysium, epimysium, tendon, muscle organ, fascicle, fiber, myofibril, myofilament, sarcolemma, sarcoplasmic reticulum, sarcosomes, myoplasm (sarcoplasm), Z-disks, M-line, sarcomere, troponin, tropomyosin, troponin-tropomyosin complex, motor endplate, axon of alpha motor neuron. Define each of these terms.

61. Describe the basic mechanism of muscle fiber contraction. In your description, include the following: the roles or involvement of ATP, myosin, actin, the troponin-tropomyosin complex, calcium, the sarcoplasmic reticulum, the calcium pump, the sodium-potassium pump, the sarcolemma, action potential.

62. Define the following with reference to skeletal muscle: twitch, summation, tetanus. Discuss the relationship among these and explain the mechanism. Describe the common features by which a twitch is characterized, and explain the determinant of each feature.

63. List the three activities of muscle fibers that account for nearly all the energy demand during contraction. Explain the reason energy is required for each activity. State the relative contribution of each to the total energy required during muscle contraction.

64. Contrast concentric and eccentric muscle contractions in terms of the crossbridge cycle and the energy demand.

65. Define: muscle fiber type, histochemistry, functional dedifferentiation.

66. Discuss what variables must be measured to categorize the different types of muscle fibers.

67. Discuss the normal distribution of skeletal muscle fiber types in muscles of humans and the impact of fiber type distribution in muscle organs on success in athletic events of different types.
68. Discuss the conversion of skeletal muscle fibers from one type to another: Is it possible? What has to change to bring about changes in fiber twitch speed or in fiber endurance capacity? If fiber characteristics can change, is this easily accomplished?

69. Make a table with data that summarizes the classical distinctions between the three skeletal muscle fiber types (I, IIa, IIx) in terms of twitch speed, oxidative capacity, and glycolytic capacity.

70. Describe the types of exercise activities for which each type of skeletal muscle fiber has advantage(s) over the others. List three specific examples from recreational exercise or athletics for each type of exercise.

71. Define: motor unit recruitment, motor unit derecruitment, rate coding, size principle, Lo, Po, Vmax.

72. Discuss the concept of "effective force output," and state three specific examples representing a wide range of actual force output values.

73. Differentiate between active force development and passive force development by muscle.

74. Discuss why active cross-sectional area is a fundamental determinant of the amount of force generated by a muscle at a given instant. List three basic factors that determine the potential active cross-sectional area of a muscle organ.

75. Discuss recruitment and rate coding as mechanisms for regulating muscle force output, answering the questions: What is the basic mechanism of each? As a general principle, how are these mechanisms used in different types of muscle contractions? Give several specific examples?

76. Discuss the effect of muscle length on its maximal ability to develop force, answering: How are active force and passive force involved, and what is the mechanism of involvement of each of these? How big a factor is the length-tension relationship in normal human movements? Why?

77. Summarize the force-velocity relationship in skeletal muscle both in words and with a graph. State the primary determinants of Vmax and PO.

78. Discuss the force-velocity relationship as it applies to skeletal muscles in the intact human body, answering the questions: What determines the exact points on the force-velocity curve for a given muscle? What parts of the curve actually apply and which (if any) do not? Does fiber type distribution affect this relationship?

79. Discuss the relationship between muscle force (or load moved) and power, from both the theoretical and the applied perspective.

80. Discuss how training can (or cannot) affect the load-velocity-power relationships.

81. Define: stretch-shorten cycle, plyometric training, force (moment) arm.

82. Discuss the stretch-shorten cycle, including: Describe the hypothetical mechanisms by which the force of a concentric muscle contraction is potentiated in a stretch-shorten cycle. Discuss the meaning of force potentiation in both submaximal and maximal contractions. Describe three specific movements from recreational or athletic activities that involve the stretch-shorten cycle.

83. Describe how lengths of a lever and the moment arms of the lever determine effectiveness of muscular force in human movements. State two specific examples.

84. State two definitions of neuromuscular fatigue and state an example of each from human performance.

85. Discuss the role of central fatigue (fatigue of central origin, i.e., the higher centers of the brain) in human performance.

86. List three possible sites in skeletal muscle fibers at which changes could lead to fatigue. For each site, briefly describe at least one change and how it could lead to fatigue.

87. Briefly discuss the general principle regarding the dependence of muscle force output on the ratio of ATP demand to ATP supply. On the basis of this principle, state two examples of metabolic factors that cause a reduction in muscle force output.

88. List three specific ways in which hydrogen ions can lead to impaired muscle force development.

89. Define: plasticity, hypertrophy, hyperplasia, atrophy, exertional rhabdomyolysis.
90. List at least four experimental methods that have been used in physiology to chronically alter muscle activity.
91. List three general types of overload to which skeletal muscle can be exposed in training. State how they differ from each other.
92. Discuss the possible mechanisms of increased skeletal muscle strength in response to force-overload training. Include the following concepts in your discussion: neural facilitation, muscle organ hypertrophy, muscle fiber hypertrophy, hyperplasia.
93. Discuss the effects, if any, of training-induced skeletal muscle hypertrophy on (a) the muscle's ability to lift a load rapidly, (b) the muscle's ability to generate power, and (c) the muscle's endurance capacity.
94. Discuss the general mechanism of increased endurance capacity of a skeletal muscle in response to endurance training.
95. Discuss the effects, if any, of training-induced increase in skeletal muscle endurance on the muscle's (a) strength, (b) speed, and (c) power.
96. Discuss training of skeletal muscles with high-power overload: How is high-power overload related to high-speed training? What physiological change has to occur in muscle fibers for maximal power to increase? Is high-power overload training a good way to increase strength and vice versa? Why?/Why not?
97. List at least four factors that affect the rate at which a skeletal muscle atrophies in response to disuse.
98. Describe the characteristics of delayed (onset) muscle soreness (DMS or DOMS) that distinguish this pain from other pains that may be associated with exercise.
99. Discuss DMS, including: List at least four symptoms besides the soreness pain that usually are a part of this syndrome. How are eccentric muscle contractions related to DMS? Can DMS be prevented, and if so, how? Is it "bad" to exercise with sore muscles?