Exercise Metabolism Fall 2018
APK 7117 (course # 10882)
Dr. Scott Powers, course instructor
Office hours are available immediately followed each class and by appointment
Office: Room 112 FLG
Other hours by appointment (spowers@hhp.ufl.edu)
Course meeting location/time: FLG 235-1:55 PM to 4:55PM–Tuesday
First draft-final syllabus will be posted to course website by August 24

Course overview and objectives: This is an introductory course in exercise metabolism designed to provide students with a basic understanding of numerous aspects of muscle metabolism at the cellular and molecular level. The course objectives include the following: 1) to promote an understanding of experimental techniques and tools that can be used to study metabolism; 2) to promote increased understanding of those factors that regulate both protein synthesis and protein degradation; 3) to achieve an understanding of the metabolic adaptations that occur in skeletal muscle in response to endurance training; topics include exercise and oxidative stress, oxidant signaling in muscle, mitochondrial biogenesis, induction of heat shock proteins in skeletal muscles, and exercise-induced cardioprotection; 4) to improve critical thinking and biological problem solving skills; and 5) to improve scientific oral communication and writing skills. The teaching method will be informal lecture and questions from students are encouraged at any time during the class period. The lecture topics and reading assignments are outlined in the accompanying lecture schedule.

To achieve the aforementioned objectives, the course will be divided into four units of instruction (Figure 1). Note that these units of instruction will be followed by examination that will likely contain multiple choice questions, true/false questions that require a brief explanation of your answer, and/or short answer discussion questions. The point breakdown of the course academic requirements is explained in the next section.

Academic Requirements: Students will be evaluated on the basis of three examinations along with a written literature review centered on a topic related to exercise metabolism (due **Tuesday, November 20, 2018**). The literature review should follow the "brief" or "invited" review format adopted by the Journal of Applied Physiology (please review JAP reviews for examples). The topic does not require prior approval but **must** be germane to exercise metabolism! If you are unclear as to whether your topic will be acceptable, please discuss the issue with the instructor. The literature review should represent an up-to-date review on a specific topic germane to muscle metabolism. Again, topic approval in advance is not required but the theme of the review should be germane to the course topic. Grades will be assigned based on points earned in the course. The relative point value of the three examinations the literature review are as follows:

Exam # 1	**30 points**
Exam # 2	**30 points**
Exam #3	**30 points**
Literature review	**10 points**

Total points =100

Grading Scale based on total points earned:

A = 93 or above
A- = 90-92
B+= 86-89
B = 83-85
B- = 80-82
C+= 76-79
C = 73-75
C- = 70-72
D+ = 66-69
D = 63-65
D- = 60-62

E = < 59 pts

Accommodations for students with disabilities: Students requesting classroom accommodation must first register with the Dean of Student Office. The Dean of Students office will provide documentation to the student who will provide this documentation to the instructor. The instructor will then provide the student with additional time for exams and other appropriate classroom accommodations.

Class attendance, make-up exams, and deadline for literature review completion: 1) Class attendance is not mandatory. 2) Make-up exams will be available for students that cannot take exams during the assigned period due to health or important personal reasons. Please contact instructor in advance for approval of make-up exams. 3) Deadline for literature review is November 20, 2018. Extensions can be provided for extenuating circumstances (i.e., health problems or person reasons) with prior approval by the instructor.

Required textbook: No text books are required for this course. However, numerous suggested readings are provided for students (see suggested reading list later in syllabus).

Online course evaluation: Students are expected to provide feedback on the quality of instruction in this course based upon 10 criteria. These evaluations are conducted online at: https://evaluations.ufl.edu

Note that these evaluations are typically open during the last 2-3 weeks of the semester and students will be provided specific times that these evaluations are open. A summary of these assessments will be available to students at: https://evaluations.ufl.edu.

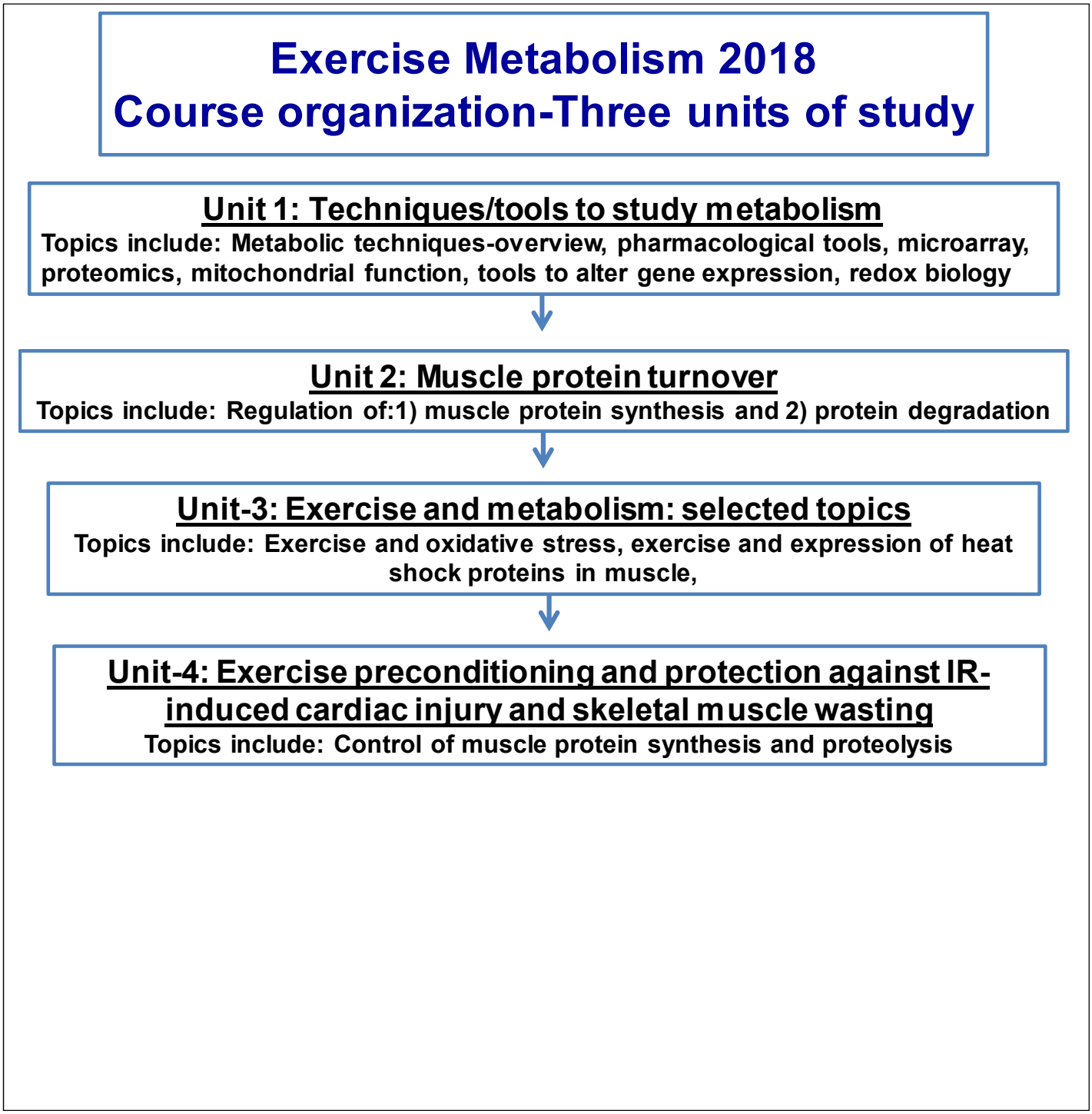
Class demeanor: Students are expected to arrive on class on time but tardiness is acceptable when transportation or personal conflicts require the student to arrive to class later than the scheduled time. Upon arrival to class, please silence your cell phone or other personal communication devices.

UF's honesty policy: UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obliged to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor in this class.

Phone number and contact site for university counseling services and mental health services: 392-1575
http://www.counseling.ufl.edu/cwc/Default.aspx

Phone number for university police department: 392-1111 or please dial 9-1-1 for emergencies.

Figure 1. Summary of course organization for exercise metabolism-APK 7117.



Lecture schedule and topics

Date/course unit/lecture #	Lecture Topic	Reading assignment
August 28 Unit 1	1) Course Introduction 2) Techniques to study metabolism-big picture 3) Pharmacological principles and their applications to study metabolism	Lecture notes
September 4 Unit 1	1) Application of molecular and proteomic techniques to study metabolism 2) Assessment of mitochondrial function	Lecture notes +
September 11 Unit 1	1) Redox biology-short history lesson 2) Redox biology: Sources of oxidants, oxidant damage, and antioxidant systems	Lecture notes + Suggested reading (3, 8, 10)
September 18	**Exam 1 (covers unit 1**	
September 25 Unit 2	1) Measurement of muscle protein synthesis 2) Regulation of muscle protein synthesis and impact of exercise 3) Debate-Are satellite cells required for muscle growth	(1)
October 2 Unit 2	1) Experimental models and measurement of muscle atrophy 2) Proteolytic systems and muscle atrophy	(4)
October 9 Unit 2 Video lectures	1) Radicals, mitochondria signaling and muscle atrophy 2) Renin-angiotensin system and muscle atrophy	(5, 6, 9)
October 16 Unit 3	1) Exercise-induced oxidative stress: cause and consequences 2) Exercise and ROS signaling in skeletal muscle	(2, 12)
October 23 Unit 3	1) Endurance and resistance exercise: are they compatible 2) Endurance exercise induced adaptations in HSPs and mitochondrial phenotype	TBA
October 30	**OOT EXAM 2 (covers units 2&3)**	
November 6	Guest lecture: Cancer cachexia	TBA
November 13 Unit 4	1) Mechanisms responsible for exercise-induced protection against disuse muscle atrophy	TBA
November 20 Unit 4	1) Ischemia-reperfusion injury in heart-overview 2) Exercise-induced cardioprotection	(7, 11)
November 27	Exercise-induced protection against doxorubicin-induced myopathy	TBA

December 4	**EXAM 3**	

Guidelines for writing literature review (due November 20, 2018)

The objective of this assignment is to allow the student to select a topic of interest to exercise metabolism for extensive study. That is, the student reviews the literature and crafts a summary of our existing knowledge on the selected topic. The literature review should be clearly written using an accepted style for scientific reviews (i.e. see Journal of Applied Physiology for examples). The review should contain the following components:

1. Introduction: Brief introduction of the topic to be reviewed (one page 150-200 words).

2. Body of review: (maximal page length, 8 pages-double spaced): The body of the review should address key issues that are germane to the topic. Sub-headings should be used to improve readability. A concise and clear writing style is important for reader understanding. Summaries or conclusions at the end of major section may be appropriate. Note that tables or figures are often useful for illustration or summary of data or important ideas. All figures should have captions and if the figure is not original, the source of the figure should be provided.

3. Summary and conclusions: (one page~150-200 words): The summary or conclusion section should clearly summarize the major points of interest contained in the review. Suggestions for additional research may be included here.

4. List of references: number of references may vary-please use any consistent reference style. In general, original references from the literature should be cited in a scientific review. Nonetheless, for areas not covered in your specific review, it is appropriate to direct the reader other published reviews on the topic.

Six key points to remember about scientific writing:

1. Good organization of ideas is essential.

2. The writing style should be clear and concise. Remember to practice simple rules of pedagogy when writing this review.

3. Use headings to subdivide major sections. Use sub-headings when appropriate to further divide ideas into logical units.

4. Use figures or tables when appropriate (GOOD illustration or figure is worth 1000 words).

5. When presenting a long list of complicated ideas, it is a good idea to end each major section with a brief summary of the major points.

6. Finally, revision is the key to a polished writing project. Therefore, start writing your review early in the semester and revise, revise, and revise.

Suggested reading list[1]

[1] Note that all articles on the suggested reading list are available via pubmed using the UF library route.

1. **Conceicao MS, Vechin FC, Lixandrao M, Damas F, Libardi CA, Tricoli V, Roschel H, Camera D, and Ugrinowitsch C**. Muscle Fiber Hypertrophy and Myonuclei Addition: A Systematic Review and Meta-analysis. *Med Sci Sports Exerc* 50: 1385-1393, 2018.
2. **Powers SK, Duarte J, Kavazis AN, and Talbert EE**. Reactive oxygen species are signalling molecules for skeletal muscle adaptation. *Exp Physiol* 95: 1-9, 2010.
3. **Powers SK, and Jackson MJ**. Exercise-induced oxidative stress: cellular mechanisms and impact on muscle force production. *Physiol Rev* 88: 1243-1276, 2008.
4. **Powers SK, Kavazis AN, and McClung JM**. Oxidative stress and disuse muscle atrophy. *J Appl Physiol (1985)* 102: 2389-2397, 2007.
5. **Powers SK, Morton A, Hyatt H, and Hinkley MJ**. The Renin-Angiotensin System and Skeletal Muscle. *Exerc Sport Sci Rev* 2018.
6. **Powers SK, Morton AB, Ahn B, and Smuder AJ**. Redox control of skeletal muscle atrophy. *Free Radical Bio Med* 98: 208-217, 2016.
7. **Powers SK, Murlasits Z, Wu M, and Kavazis AN**. Ischemia-reperfusion-induced cardiac injury: a brief review. *Med Sci Sports Exerc* 39: 1529-1536, 2007.
8. **Powers SK, Radak Z, and Ji LL**. Exercise-induced oxidative stress: past, present and future. *J Physiol-London* 594: 5081-5092, 2016.
9. **Powers SK, Smuder AJ, and Criswell DS**. Mechanistic links between oxidative stress and disuse muscle atrophy. *Antioxid Redox Signal* 15: 2519-2528, 2011.
10. **Powers SK, Smuder AJ, Kavazis AN, and Hudson MB**. Experimental guidelines for studies designed to investigate the impact of antioxidant supplementation on exercise performance. *Int J Sport Nutr Exerc Metab* 20: 2-14, 2010.
11. **Powers SK, Smuder AJ, Kavazis AN, and Quindry JC**. Mechanisms of exercise-induced cardioprotection. *Physiology (Bethesda)* 29: 27-38, 2014.
12. **Powers SK, Talbert EE, and Adhihetty PJ**. Reactive oxygen and nitrogen species as intracellular signals in skeletal muscle. *J Physiol* 589: 2129-2138, 2011.