

USCDornsife

**HBIO 320 – Muscle Physiology**

**4 Units**

**Spring 2021—Tu,Th—2:00 PM - 3:20 PM (PST)**

**Location: ONLINE**

**Instructor: Casey Donovan, Ph.D., Professor**

**Office:** On-line

**Office Hours:** Tuesday 3:30 PM - 4:30 PM (*Zoom Sessions*)

**Contact Info:** [donovan@usc.edu](mailto:donovan@usc.edu), (213) 740-3005

**For Spring 2021, the lectures and labs for this course will be taught online.**

**There will be 2 Wellness days that fall on Tuesday and Thursday during the spring semester and the class will not meet on those days (March 23 and April 22).**

## Learning Objectives

The primary objective of HBIO 320 is to develop a fundamental understanding of the structure and function of human skeletal muscle, its neural control and adaptation.

- To identify and explain the functional attributes of the contractile, cytoskeletal, and connective tissue elements that comprise skeletal muscle.
- To identify and explain the processes involved in motor nerve conduction, excitation-contraction coupling, muscle contraction, and motor unit recruitment.
- To model and explain the physiological/mechanical outcomes of skeletal muscle contraction, the impact of recruiting various muscle fiber types, and the energetic demands of muscle contraction.
- To explain skeletal muscle adaptation in response to changes in use, disuse, injury, aging, and pathological conditions.

**Degree Learning Objectives** (*relevant Human Biology BS & BA degree objectives addressed in part by this course*)

- *To develop a deeper understanding of the central and cross-disciplinary concepts of human biology*
- *To identify, locate, and describe the structure/function of cells, their subcellular components, tissues, organs, and organ systems of the human body.*
- *To apply cross-disciplinary scientific principles to explain how humans operate, adapt or evolve.*
- *To compile, analyze, synthesize and criticize primary articles. Use discipline-related criteria to identify which opinions can be accepted, rejected or need further study.*

## Course Notes

### General Course Outline:

1. Skeletal muscle and motor neuron anatomy/composition, excitation contraction coupling. Skeletal muscle mechanics
2. Muscle fiber type, motor unit recruitment, muscle energetics and blood flow.
3. Skeletal muscle fatigue, muscle adaptation under normal and pathological conditions and comparisons with cardiac and smooth muscle.

## Required Readings and Supplementary Materials

### Required:

Skeletal Muscle Structure, Function, and Plasticity. 3<sup>rd</sup> edition, Lieber, R.L., Wolters Kluwer, Lippincott Williams & Wilkins, Baltimore, MD, 2010. eText ISBN: 9781451168914, 1451168918 (available as an e-book from VitalSource) < <https://www.vitalsource.com/products/skeletal-muscle-structure-function-and-richard-lieber-v9781451168914?term=lieber+skeletal+muscle>>

### Recommended:

Biochemistry Primer for Exercise Science. 4th ed. Tiidus, Peter M., A. Russell Tupling and Michael E. Huston. Human Kinetics, Champaign, IL, 2012. ISBN 9781492583431.

## Grading Breakdown

Midterm Exam #1	30%
Midterm Exam #2	30%
Final Exam	40% ( <i>comprehensive exam</i> )

## Additional Policies

### Online lectures:

- 1) Lectures for this course will be delivered via the Zoom platform. If you have not used this platform before, please go to <https://keepteaching.usc.edu/students/student-toolkit/classroom/zoom/> for instructions on how to download and use Zoom.
- 2) While lectures will be taped for asynchronous viewing, you are expected to attend/view the lecture when scheduled unless you are located in a substantially distant time zone (ie. +3/-4 hours from PST). If you are located in a distant time zone, alert the instructor that you will be attending “asynchronously”, so accommodations can be made for exams and office hours.
- 3) Copies of the lecture powerpoints will be provided on Blackboard, though in some cases they may vary from those of the actual presentation (eg. different illustrations, added notes, etc.). These are not intended as a replacement for attending lecture and you will be responsible for material covered in lecture that may not appear on the provided powerpoints/notes. If you have a question on a powerpoint/notes from a lecture you have not attended, you will be advised to view the cloud recording of that lecture first.
- 4) The powerpoints/notes and cloud recordings for this course are provided solely for your use in class and are not to be used or disseminated beyond this course. **As per SCampus Part C:** *“Notes or recordings made by students based on a university class or lecture may only be made for purposes of individual or group study, or for other usual non-commercial purposes that reasonably arise from the student’s membership in the class or attendance at the university. This restriction also applies to any information distributed, disseminated or in any way displayed for use in relationship to the class, whether obtained in class, via email or otherwise on the internet, or via any other medium. Actions in violation of this policy constitute a violation of the Student Conduct Code, and may subject an individual or entity to university discipline and/or legal proceedings.”*

### Online Exams:

- 1) This course requires the use of LockDown Browser and a webcam for online exams. If you are unfamiliar with the Respondus LockDown Browser and Monitor, please see the following link <https://keepteaching.usc.edu/students/student-toolkit/classroom/respondus/>
- 2) You will need to access the exams through Blackboard, which will be found under the “Assignments” tab. A practice exam will be provided within the first few weeks for the purpose of familiarizing you with exam format and use of Respondus/Monitor.
- 3) Make-up Exams:
  - a) As a rule, make-up exams will not be given unless preapproved by the instructor or written/verifiable evidence of a medical emergency is provided (**exceptions to this rule will be made for any Covid-19 related illnesses**).
  - b) Make-up exams will not be preapproved unless University policy provides for such accommodations (e.g. religious holidays, athletic competition, etc.) or extenuating circumstances are involved, **including problems with internet connections during exams**.
  - c) Where accommodations can be anticipated (e.g. religious holidays, athletic competition) requests must be made within the first 3 weeks of the semester.
  - d) **Note:** *While covering the same material, make-up exams may be distinct from the main exam in content (ie. different questions).*

## Course Schedule: A Tentative Weekly Breakdown

Date	Lecture Topic	Readings/Chapters	
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Jan. 19	Introduction/Overview: Muscle Architecture	1	
Jan. 21	Skeletal Muscle Proteins: Contractile	1	
Jan. 26	Skeletal Muscle Proteins: Cytoskeleton		
Jan. 28	Skeletal Muscle Proteins: Cytoskeleton		
Feb. 2	Motor Neuron: Structure & Proteins		
Feb. 4	Motor Neuron: Neural Transmission		
Feb. 9	Neuromuscular Junction & Transmission		
Feb. 11	Excitation-Contraction Coupling	2 (p.41-46)	
Feb. 16	Skeletal Muscle Mechanics	2 (p.46-63)	
Feb. 18	Skeletal Muscle Mechanics	2 (p.46-63)	
<b>Feb. 23</b>	<b>MIDTERM 1</b>		
Feb. 25	Motor Unit & Fiber Types Motor Unit Recruitment	2 (p.64-84)	
March 2	Motor Unit & Fiber Types Motor Unit Recruitment	2 (p.64-84)	
March 4	The Production of Movement	3 (p.93-119)	
March 9	Muscle Receptors		
March 11	Muscle Energetics: ATP, CP and Glycolysis		2 & 3
March 16	Muscle Energetics: TCA cycle		4 & 5
March 18	Muscle Energetics: ETC		4 & 5
<b>March 23</b>	<b>Wellness Day</b>		
March 25	Muscle Energetics: Blood Borne Substrates		5 & 6
March 30	Skeletal Muscle Blood Flow		
April 1	Skeletal Muscle Fatigue	2 (p.84-89)	
<b>April 6</b>	<b>MIDTERM 2</b>		
April 8	Adaptations to Increased Use	4	
April 13	Adaptations to Increased Use	4	
April 15	Adaptations to decreased Use	5	
April 20	Muscle Denervation & Re-Innervation	5	
<b>April 22</b>	<b>Wellness Day</b>		
April 27	Muscle Injury, Degeneration & Regeneration	6	
April 29	Cardiac Muscle & Smooth Muscle		
May 6	<b>FINAL EXAM – 2:00 – 4:00 PM</b>		

## ***Statement on Academic Conduct and Support Systems***

### **Academic Conduct:**

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” [policy.usc.edu/scampus-part-b](https://policy.usc.edu/scampus-part-b). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, [policy.usc.edu/scientific-misconduct](https://policy.usc.edu/scientific-misconduct).

### **Support Systems:**

*Student Health Counseling Services - (213) 740-7711 – 24/7 on call*  
[engemannshc.usc.edu/counseling](https://engemannshc.usc.edu/counseling)

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

*National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call*  
[suicidepreventionlifeline.org](https://suicidepreventionlifeline.org)

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

*Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call*  
[engemannshc.usc.edu/rsvp](https://engemannshc.usc.edu/rsvp)

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

*Office of Equity and Diversity (OED) | Title IX - (213) 740-5086*  
[equity.usc.edu](https://equity.usc.edu), [titleix.usc.edu](https://titleix.usc.edu)

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

*Bias Assessment Response and Support - (213) 740-2421*  
[studentaffairs.usc.edu/bias-assessment-response-support](https://studentaffairs.usc.edu/bias-assessment-response-support)

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

*The Office of Disability Services and Programs - (213) 740-0776*  
[dsp.usc.edu](https://dsp.usc.edu)

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

*USC Support and Advocacy - (213) 821-4710*

[studentaffairs.usc.edu/ssu](http://studentaffairs.usc.edu/ssu)

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

*Diversity at USC - (213) 740-2101*

[diversity.usc.edu](http://diversity.usc.edu)

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

*USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu), [emergency.usc.edu](http://emergency.usc.edu)

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

*USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call*

[dps.usc.edu](http://dps.usc.edu)

Non-emergency assistance or information.