



## **HBIO 320 – Muscle Physiology (4 Units) Spring 2024**

**Lecture:** T/Th 2:00pm-3:20pm (PST)

**Location:** SOS B2

### **Instructor**

**Charles Kikutaro Crawford (Kiki), PhD**

**Office:** PED 109

**Office Hours:** TBD

**Contact Info:** [charles.crawford@usc.edu](mailto:charles.crawford@usc.edu)

### **Learning Objectives**

The primary learning objective of this course is to develop a physiological understanding of human skeletal muscle including muscle structure, function, adaptation, and its control by the nervous system.

- Recognize functional components of skeletal muscle including contractile and cytoskeletal proteins and connective tissue and describe their role in muscle physiology
- Describe the role of the nervous system in muscle physiology, including specific processes such as excitation-contraction coupling, motor unit recruitment, and propagation of action potentials
- Recognize the effects of muscle metabolism and fiber type on skeletal muscle contraction.
- Discuss how skeletal muscle adapts to various stimuli
- Compare how skeletal muscle functions differently from cardiac and smooth muscle

### **Prerequisites**

Required: BISC 220Lg or BISC 221Lg

Recommended: Chem 105aL & 105bL or CHEM 115aL & 115bL; HBIO 301L

### **Required Books**

Skeletal Muscle Structure, Function, and Plasticity. 3rd 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>>

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

### **Other Required Materials**

You will need an internet-enabled device with browser capabilities such as a computer or tablet. We will use Blackboard for course communication and to submit your homework assignments.

[USC Technology Rental Program](https://itservices.usc.edu/spaces/laptoploaner/) (<https://itservices.usc.edu/spaces/laptoploaner/>): Students who need resources to participate in this class can apply to the university's equipment rental program. The Student Basic Needs team

will work with you to distribute equipment (if you are eligible). Please visit <https://studentbasicneeds.usc.edu/resources/technology-assistance/> to apply and for more information.

### Lecture Policies

Lectures will be provided in-person without recordings. Zoom lectures may be given in the event of extenuating circumstances such as instructor illness.

Lecture Powerpoint presentations will be provided via Blackboard, though they may be missing information provided during the lecture. Lecture Powerpoint presentations are not to be disseminated beyond this course.

Attendance is not collected, though it is essential for success in the course.

### Grading Breakdown

Midterm Exam 1	25%
Midterm Exam 2	25%
Final Exam (cumulative)	30%
Homework Assignments	20%

### Grading Scale

A	94-100
A-	90-93.99
B+	87-89.99
B	83-86.99
B-	80-82.99
C+	77-79.99
C	73-76.99
C-	70-72.99
D+	67-69.99
D	63-66.99
D-	60-62.99
F	≤59.99

### Exams

There will be two midterm exams and one final exam. Exams will be done in-person and on paper.

Makup exams will only be provided if the student has preapproval by the instructor (provided for religious holidays, athletic competitions, etc) or a documented excuse providing evidence of necessity (illness, medical emergency, etc). Instructor preapproval must be acquired within the first 3 weeks of the semester.

### Homework Assignments

There will be five homework assignments. These assignments will be posted on Blackboard. Due dates will also be posted on Blackboard. Late homework assignments will be accepted for one week after the due date, with a maximum grade of 80%.

### Extra Credit Project

Students may earn a maximum of 3% extra credit (depending on the project selected) to their grade if they complete a final project. If a student chooses to do a final project, **they must submit a project proposal by 4/2/2024**. Students who do not submit a project proposal by this date will not be eligible for extra credit. The project proposal template will be posted on Blackboard.

Students may choose between three different project options

- Create a 15-20 minute educational video on a disease or physiological phenomenon relevant to muscle physiology (maximum 3% extra credit)
- Write a final exam for HBIO 320 (same format and question structure as seen in the midterm exams) (maximum 2% extra credit)
- Create an illustrated study guide for three lectures' worth of content in HBIO 320 (maximum 3 % extra credit)

### **OSAS Accommodations**

Please provide any OSAS Accommodations letters to your instructor within the first two weeks of the course to allow the facilitation of your accommodation.

### **Academic Integrity**

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the [USC Student Handbook](#). All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The use of artificial intelligence on homework assignments or projects is unacceptable.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the [student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

## Course Lecture Schedule

This is a tentative course schedule that is subject to change

<b>Date</b>	<b>Lecture Topic</b>	<b>Due (11:59pm)</b>
Jan. 9	Introduction and Muscle Architecture	
Jan. 11	Contractile Proteins	
Jan. 16	Cytoskeleton	
Jan. 18	Motor Neuron: Structure and Proteins	Homework 1
Jan. 23	Motor Neuron: Neural Transmission	
Jan. 25	Neuromuscular Junction	
Jan. 30	Excitation-Contraction Coupling	
Feb. 1	Muscle Mechanics I	
Feb. 6	Muscle Mechanics II	
Feb. 8	Review Day	Homework 2
Feb. 13	<b>Midterm 1</b>	
Feb. 15	Bioenergetics I	
Feb. 20	Bioenergetics II	
<b>Feb. 22</b>	Bioenergetics III	
Feb. 27	Muscle Substrate Selection and Utilization	
Feb. 29	Exercise Metabolism	Homework 3
Mar. 5	Muscle Blood Flow	
Mar. 7	Muscle Fiber Types	
Mar. 12	Spring Break	
Mar. 14	Spring Break	
Mar. 19	Fatigue	
Mar. 21	Satellite Cells	
Mar. 26	Review Day	Homework 4
Mar. 28	<b>Midterm 2</b>	
Apr. 2	Muscle Plasticity I	Project Proposal
Apr. 4	Muscle Plasticity II	
Apr. 9	Muscle Plasticity III	
Apr. 11	The Physiology of Captain America	
Apr. 16	Muscular Dystrophy	
Apr. 18	Myokine Signaling	Homework 5
Apr. 22	Cardiac Muscle	
Apr 25	Smooth Muscle	
<b>May 2<sup>nd</sup></b>	<b>Final Exam</b>	

## Support Resources

Student Health Counseling Services - (213) 740-7711 – 24/7 on call  
[engemannshc.usc.edu/counseling](http://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](http://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](http://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](http://equity.usc.edu), [titleix.usc.edu](http://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](http://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](http://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/ssa](http://studentaffairs.usc.edu/ssa)

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.