

Fundamentals of Skeletal Muscle

APK4101 | Class # 21468 | 3 Credits | Fall 2023

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Course Info

INSTRUCTOR

Elisabeth Barton, PhD

Office: 202D Florida Gym

Office Phone: 352-294-1714

Email: erbarton@ufl.edu

Preferred Method of Contact: email or in person at class

COURSE COORDINATOR

Michele Duval-Martin

Email: mduvalmartin@ufl.edu

OFFICE HOURS

Tues Period 9 or by appointment; in person or via Zoom

MEETING

ARB R5-265 T period 8 and R periods 7-8

TIME/LOCATION

COURSE DESCRIPTION

The course will provide a comprehensive background of skeletal muscle properties, focusing on key aspects of function at the protein, cellular and whole organ level. Major topics include muscle contraction and force generation, fuel sources and energy utilization, growth and development, and an introduction to pathology.

PREREQUISITE KNOWLEDGE AND SKILLS

The course is open to juniors and seniors who have earned a B or better in APK2105c (Applied Human Physiology with Lab).

REQUIRED AND RECOMMENDED MATERIALS

All lecture and reading materials will be provided through Canvas. There is no required text for this course. However, a recommended reference textbook is "Muscle: Fundamental Biology and Mechanisms of Disease" edited by Joseph A. Hill and Eric N. Olson. Academic Press, 2012.

COURSE FORMAT

Live lectures by experts on each topic will be given during class time in person. Recorded lectures from previous years may be available for reference and review. In addition, paper presentations and discussions by students will occur in association with each major topic. Throughout the course, open discussion of the topics is encouraged, and faculty will allow for discussion time during the lecture period.

COURSE LEARNING OBJECTIVES:

Students will have met the course goals if they can:

- **Name** and **describe** structural components of a skeletal muscle, including intra- and extracellular organization.
- **Explain** physiological mechanisms of skeletal muscle function, growth, aging, and adaptation.
- **Explain** the pathophysiology of specific skeletal muscle disorders.
- **Describe** common methods used in skeletal muscle research and **compare** and **contrast** when these methods are best used.
- **Discuss** and **critically appraise** scientific literature related to skeletal muscle.

Course & University Policies

ATTENDANCE POLICY

Attendance is encouraged for all class time sessions. You will be excused from class if you have a legitimate reason to be gone; please send an email before class starts as to why you need to miss the class. These will be kept on file for the semester. Please note: the University has specific reasons that are acceptable for missing class, which apply to both undergrad and grad students. You can find this at <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>:

"In general, acceptable reasons for absence from or failure to participate in class include illness, serious family emergencies, special curricular requirements (e.g., judging trips, field trips, professional conferences), military obligation, severe weather conditions, religious holidays and participation in official university activities such as music performances, athletic competition or debate. Absences from class for court-imposed legal obligations (e.g., jury duty or subpoena) must be excused. Other reasons also may be approved."

PERSONAL CONDUCT POLICY

For written assignments the instructor submits all material to TURNITIN.com, which is designed to determine whether what you have written is original material. Penalties for plagiarism will be enforced in this class. It may have extreme consequences such as receiving an F (failure) for the entire class, depending on the severity of the infraction. Understanding this aspect of scholarship is required to prepare you as a scientist, scholar and professional. Please review the UF Honor Pledge Code for students (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) which specifies a number of behaviors that are in violation of the code and possible sanctions. Furthermore, you are obliged to report any condition that facilitates academic misconduct in others. Please contact me directly if you have any concerns about ongoing misconduct.

EXAM MAKE-UP POLICY

If you miss an exam due to an excused absence, a make-up exam will be scheduled at the earliest feasible date. If an exam is missed due to an unexcused absence, then a make-up exam will be scheduled, but 10 points will be deducted from the final score for every 3 days of delay. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

ACCOMMODATING STUDENTS WITH DISABILITIES

Students requesting classroom accommodation must first register with the Dean of Student's Office. The Dean of Students Office will then provide documentation to the student who will provide this documentation to the instructor when requesting accommodation. We are very tolerant of special needs; please contact one of the

course directors to discuss any issues or concerns. More information about the UF Disability Resource Center can be found at: <https://drc.dso.ufl.edu/>.

COURSE EVALUATIONS

Students in this class are participating in GatorEvals. This evaluation system is designed to be more informative to instructors so that teaching effectiveness is enhanced and to be more seamlessly linked to UF's CANVAS learning management system. Students can complete their evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Thank you for serving as a partner in this important effort. Good participation in these evaluations is extremely important for maintaining and improving the quality of coursework at UF. Consider it a privilege to participate in UF's future by doing your evaluations. The outcome of these is used in many ways to make this a better environment for you and future students. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

Getting Help

HEALTH AND WELLNESS

- U Matter, We Care: If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575
- Counseling and Wellness Center: <https://counseling.ufl.edu/>, 352-392-1575
- Sexual Assault Recovery Services (SARS) - Student Health Care Center, 392-1161
- University Police Department, 392-1111 (or 9-1-1 for emergencies) <http://www.police.ufl.edu/>

ACADEMIC RESOURCES

- E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. <https://lss.at.ufl.edu/help.shtml>
- Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling. <https://career.ufl.edu/>
- Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.
- Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <http://teachingcenter.ufl.edu/>
- Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <http://writing.ufl.edu/writing-studio/>
- Student Complaints On-Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/> On-Line Students Complaints: <http://distance.ufl.edu/student-complaint-process/>

Grading

There will be 4 exams each covering 1 segment of the course, and the exams will not be cumulative. These exams will comprise 80% of the grade. In addition, students will be formed into small groups, and be required to complete a special topic project within 1 segment of the course. These will be presented during class time and help to emphasize concepts. The special project will be worth 20% of the final grade. Grading will be determined by a standard conversion of a percent score to a letter grade using the transformation below. However, note that exams may be graded on a curve, depending on class performance, and thus the eventual letter grade will reflect the curve. Grades will be calculated to the nearest 2 decimal places. Information on current UF grading policies for assigning grades can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>.

| Letter Grade | Percent of Total Points Associated with Each Letter Grade | GPA Impact of Each Letter Grade |
|--------------|-----------------------------------------------------------|---------------------------------|
| A | 94.00-100% | 4.0 |
| A- | 90.00-93.99% | 3.67 |
| B+ | 87.00-89.99% | 3.33 |
| B | 84.00-86.99% | 3.0 |
| B- | 80.00-83.99% | 2.67 |
| C+ | 77.00-79.99% | 2.33 |
| C | 74.00-76.99% | 2.0 |
| C- | 70.00-73.99% | 1.67 |
| D+ | 67.00-69.99% | 1.33 |
| D | 64.00-66.99% | 1.0 |
| D- | 60.00-63.99% | .67 |
| E | 0-59.99% | 0.0 |

Presentation rubrics for evaluation:

Students will be assigned a classic research paper that underlies the basis of one subject area of the course. Presentations will be made during class time, with anticipated length of 10-15 minutes.

The following points should be covered:

- a. *Format:* Powerpoint slides
- b. *Introduction and Background:* What is the main goal of the study and what is the underlying problem the authors are trying to resolve? This is most important for the “classic” papers
- c. *Methods:* Are there any innovative strategies used? What are the techniques that are central to the study? Remember to put this in context if the paper is >20 years old.
- d. *Results:* Review the figures, and stress the key findings
- e. *Discussion:* Are you convinced by the results? What are the implications of the findings? What would be the next step? What are the holes/flaws?

A successful presentation will address all of the above, and bring in additional resources to help explain the details of the study. At the beginning of the course, these points to a successful presentation will be reviewed, and information will be retained on the E-learning site for reference. Following the presentation, faculty attending will provide feedback to the presenter in terms of what went well, and suggestions for improvement in future presentations.

SUCCESS AND STUDY TIPS

This course delves into the seminal discoveries of skeletal muscle, and as such, provides an opportunity for students to put their current work in the context of these findings. All students are encouraged to ask questions during and after class, and to review not only the lecture notes associated with each topic, but also the accompanying papers. While grading will be based on performance in the exams and presentations, we hope that students will also come away with appreciation of the history of muscle and how this leads to where we are today in this field.

Weekly Course Schedule

| Week | Time | Date | Topic | Instructor |
|------|-----------|--------|-----------------------------------------------------------|--------------------|
| 1 | 1:55-3:50 | 24-Aug | Introduction/Muscle Overview | Sweeney |
| 2 | 3:00-3:50 | 29-Aug | Muscle Histology | Rivera-Zengotita |
| | 1:55-3:50 | 31-Aug | Mechanisms of Contraction | Sweeney |
| 3 | 3:00-3:50 | 5-Sep | Action Potentials/NMJ | Matt Lee |
| | 1:55-3:50 | 7-Sep | SR/EC Coupling/Calcium handling/signaling | Wei-LaPierre |
| 4 | 3:00-3:50 | 12-Sep | Motor Units and fiber types | Barton |
| | 1:55-3:50 | 14-Sep | Muscle Histological Diagnosis | Rivera-Zengotita |
| 5 | 3:00-3:50 | 19-Sep | EXAM 1 (Aug 24 - Sep. 12) | Weeks 1-4 |
| | 1:55-3:50 | 21-Sep | Mitochondrial Function and Structure | Heppele |
| 6 | 3:00-3:50 | 26-Sep | Muscle Bioenergetics: Demand Side Energetics | Walter |
| | 1:55-3:50 | 28-Sep | Delivery and Selection of Fuel Sources in Skeletal Muscle | Ryan |
| 7 | 3:00-3:50 | 3-Oct | Muscle Adaptation | Barton |
| | 1:55-3:50 | 5-Oct | Student Presentations | Barton/Sweeney |
| 8 | 3:00-3:50 | 10-Oct | Student Presentations | Barton/Sweeney |
| | 1:55-3:50 | 12-Oct | EXAM 2 (Sep. 14 - Oct. 10) | Weeks 4-8 |
| 9 | 3:00-3:50 | 17-Oct | Muscle Development | Barton |
| | 1:55-3:50 | 19-Oct | Post Natal Growth | Barton |
| 10 | 3:00-3:50 | 24-Oct | Hypertrophy | Hammers |
| | 1:55-3:50 | 26-Oct | Atrophy (proteasome and autophagy) | Judge |
| 11 | 3:00-3:50 | 31-Oct | Regeneration/Degeneration | Barton |
| | 1:55-3:50 | 2-Nov | Extracellular Matrix | Barton |
| 12 | 3:00-3:50 | 7-Nov | Circadian Biology in Muscle | Esser |
| | 1:55-3:50 | 9-Nov | EXAM 3 (Oct. 17 - Nov. 2) | Weeks 9-11 |
| 13 | 3:00-3:50 | 14-Nov | Aging/Sarcopenia | Hammers |
| | 1:55-3:50 | 16-Nov | Muscle Imaging | Walter |
| 14 | 3:00-3:50 | 21-Nov | DMD/Neuromuscular Disease | Sweeney |
| | 1:55-3:50 | 23-Nov | NO CLASS Thanksgiving | |
| 15 | 3:00-3:50 | 28-Nov | Student Presentations | Barton/Sweeney |
| | 1:55-3:50 | 30-Nov | Graduate Student Project Presentations | Barton/Sweeney |
| 16 | 3:00-3:50 | 5-Dec | EXAM 4 (Nov. 7 - Nov. 30) | Weeks 12-15 |