KINS 5690/7690 Skeletal Muscle and Mitochondria Physiology
Computer Title: Advanced Muscle Phys
Spring 2018

Instructor

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Course Description

This advanced topics course will focus predominately on the biology of mitochondria and the physiology of one cell type in which the mitochondria live, skeletal muscle. Topics and discussions will range from mitochondrial biogenesis during skeletal muscle adaptation to mitochondrial dysfunction in diseases such as aging, diabetes, and Alzheimer's.

Mitochondria are the combustion engines of skeletal muscle, utilizing macro-nutrients and oxygen to produce 90% of the cell's energy via a process called oxidative phosphorylation. Unfortunately, mtDNA is highly susceptible to mutations and lacks the robust repair processes of nuclear DNA. Damage to mtDNA, and subsequent mitochondrial dysfunction, increases the production of chemically reactive species called reactive oxygen species (ROS), which can damage vital components of the muscle and nerve cell, ultimately contributing to severe disability associated with aging, mitochondrial myopathies, neuromuscular diseases, and Alzheimer's disease. Fortunately, exercise training is known to enhance new mitochondrial synthesis, as well as the removal of damaged mitochondria. We will discuss these topics and more as we explore the powerhouse of the cell and its role in health and disease.

Course Goals

- To understand mtDNA damage and the processes for repair
- To understand how dysfunctional mitochondria populations contribute to disease pathology
- To understand mitochondrial biogenesis and removal in skeletal muscle in health and disease
- To obtain hands-on experience in methods to assess mitochondrial content and function in skeletal muscle
- To critically evaluate scientific literature on mitochondria and muscle physiology

Prerequisites

- Principles of Biology I (BIOL 1107)
- One of the following
    - Instructor permission
    - Principles of Biology II (BIOL 1108)
    - Introductory Biochemistry and Molecular Biology (BCMB/BIOL/CHEM 3100)
    - Exercise Physiology (KINS 4630)
    - Elements of Physiology (VPHY 3100)

Office hours By appointment

Meetings

Class	Tuesday, Thursday 3:30 – 4:45
Room	Ramsey Building, Room 202
Final Exam	May 3, 2018 (3:30 – 6:30 PM)

Textbook None. Access to lecture notes and journal articles will be through eLC.

Assessment

Daily class participation	30%
Weekly online quiz	25%
Group research proposal	20%
Final exam	25%

Grading policy
To comply with new pilot grading system, 100-92 A, 91-90 A-, 89-88 B+, 87-82 B, 81-80 B-, 79-78 C+, 77-72 C, 71-70 C-, etc.

If a student wishes to have an exam re-graded, she/he must submit in writing the nature of the problem, and the exam, no later than one week after the exam has been returned. The entire exam will be rechecked.

Daily class participation
In lieu of a textbook, students will be required to read one research article prior to each lecture. Class participation will be assessed via individual, small group, and entire class exercises. You will only receive participation credit if you are present in class. A zero (0) will be assigned unless there is an excused absence approved at least 24 hours prior to class. The exercises include:

1) Individual multiple choice questions
2) Individual multiple choice questions averaged across each small group
3) Small group activity sheet
4) Entire class quiz

Quizzes
There will be short online quizzes at the end of each week accessible through eLC. Questions will pertain to the lecture notes and journal articles from that week's class sessions.

Group research proposal
Toward the end of the semester, students will be divided into small groups that will formulate research questions and a research proposal, including hypothesis, study design, expected outcomes, and interpretation. Groups will pitch proposals during the final week of class.

Final examination
The final examination will contain multiple choice and short answer questions pertaining to the material covered in class.

Experiential Learning
Multiple lecture sessions will be in the laboratory gaining hands-on experience in methods of assessing mitochondrial content and function in skeletal muscle. These are briefly listed below:

1: using spectrophotometer to determine Krebs cycle, fatty acid oxidation, and electron transport chain enzyme activities
2: using Clark-type electrode to measure oxygen consumption rates of live mitochondria isolated from skeletal muscle
3: using near-infrared technology to non-invasively assess mitochondrial function in humans

Honors and Graduate Credit

Honors and graduate credit will require extra work. Graduate and honors students will have different exams than the undergraduates in order to document their advanced ability to integrate and apply research-based information about skeletal muscle and mitochondrial physiology. Also, graduate and honors students will be required to do the following to document their advanced skills in critical thinking, appropriately evaluating the research literature, and competency in applying this research-based information: write a research-based paper that reviews a selected mitochondrial disease and treatment topic (5 to 10 pages, with 5 to 10 references).

Attendance

Attendance is mandatory due to the interactive nature of the class. However, as unfortunate circumstances do occur throughout the semester, three excused absences are allowed. Students must provide more than 24 hour notice if an absence is going to occur on an oral presentation, quiz, and/or midterm day. No make-up exams or quizzes will be given unless official UGA excuse is given (i.e., medical leave, etc.). Students are required to notify course instructor prior to an exam or quiz in order to obtain permission to reschedule an exam or lab session.

WebCT This course will make use of eLC New. Class information, quiz and exam results, and slides used in the class lectures will be posted on eLC New.

Tentative Schedule

University Honor Code and Academic Honesty Policy

All academic work must meet the standards contained in "A Culture of Honesty." Each student is responsible to inform themselves about those standards before performing any academic work.

Copies of the honor code can be obtained from the Office of the Vice President for Instruction or may be viewed at the following web site: http://www.uga.edu/ovpi/honesty/acadhon.htm