

**THE UNIVERSITY OF WESTERN ONTARIO
SCHOOL OF KINESIOLOGY**

Exercise Physiology: Muscle Function and Metabolism
KIN 4430F - 2016

Instructors:

Dr. Charles Rice
Dr. Greg Marsh

Office Phone:

519-661-1628
519 661-3408

email:

crice@uwo.ca
gdmarsh@uwo.ca

Course TAs:

TBA

Office Hours:

Office hours are arranged by appointment (email or phone) with the appropriate instructor, or the TA.

Course Description:

The focus is on the structure and function of skeletal muscle with an emphasis on muscle plasticity and the adaptive response to exercise.

Pre-requisite: Kin 2230, or equivalent

Please note: You are responsible for ensuring that you have successfully completed all course prerequisites, and that you have not taken an anti-requisite course. Lack of a prerequisite or the completion of an anti-requisite cannot be used as a basis for appeal.

If you are found to be ineligible for a course, you may be removed from it at any time and you will receive no adjustment to your fees. This decision cannot be appealed.

NOTE: All course information including grades, assignment outlines, deadlines, etc. are available via WebCT.

Course Format:

This half course meets **10:30 to 11:30 Mondays, Wednesdays and Fridays in UCC - 37.**

This is a team-taught course with each instructor providing approximately 16 hours of lecture on various topics related to skeletal muscle structure and function at both the cellular and whole system level.

Learning Objectives:

Upon completion of this course students will be able to:

1. Identify and understand concepts of basic skeletal muscle and spinal motor neuron architecture, physiology and metabolism as they relate to voluntary movement in health, exercise training and some clinical situations.
2. Appreciate and critically evaluate the limitations in understanding of the function of various key processes, and their adaptability in response to exercise and disuse.

3. Explore and synthesize this information in a research context.
4. Develop skills in the written expression of ideas through analysis of research papers and exams.
5. Further develop abilities of critical reflection on ideas in scientific understanding relating to the above topics, and integration with other courses of the curriculum.

Course Requirements and Evaluations:

Term Assignments 30% - Two (15% each) research review papers will be assigned for students to independently read and respond by summarizing the topic to demonstrate an understanding of the question, purpose, methodology and interpretation of the theme of the research topic. Due dates for these approximately 4-6 page typed (double spaced) submissions are:

Monday, October 17th @ 10:30 a.m. (beginning of class)
Friday, November 25th @ 10:30 a.m. (beginning of class)

No extensions without penalty - 10% deduction per day.
 Readings and further details will be posted on OWL.

Written Exams 70% - 2 exams (35% each) each of 2 hours duration administered following each section on the following planned dates:
 Dr. Rice – **Tuesday, 25 October @ ~5:00 p.m.**
 Dr. Noble – scheduled by the registrar in the December exam schedule

- examination format will be a combination of multiple choice and short answer questions. Material will be from lectures and assigned readings.

Text:

There is no single text required for the course but selected textbooks are listed for background or review material and with sections directly related to the course lecture topics.

For review and fundamental understanding of the main concepts discussed in the course refer to one, or more of the following textbooks available in the library or on-line:

- a) McIntosh, B.R., Gardiner, P.F. and McComas, A.J. *Skeletal Muscle: Form and Function*, 2nd ed., Human Kinetics Publishers, Champaign, Ill., c2006. Chaps: 1-4, 9, 10, 12, 13, 15, 16-21, & 22.
- b) Tipton, C.M. (editor), and section editors, Sawka, M.N., Tate, C.A., and Terjung, R.L. *ACSM's Advanced Exercise Physiology*. Lippincott Williams & Wilkins, c2006., Philadelphia, PA. Chapters: 3, 5, 6, 7 and 8, OR 2nd edition P.A. Farrell et al (editors) 2011.
- c) Houston, M.E. *Biochemistry Primer for Exercise Science*, 3rd ed. Human Kinetics Publishers, Champaign, Ill., 2006.
- d) Gardiner, P.F. *Neuromuscular Aspects of Physical Activity 1st or 2nd ed.* Human Kinetics

Publishers, Champaign, Ill., c2001 or c2010

PLEASE NOTE:

- Lectures introduce a topic and give focus, and required readings expand on some of the topics to appreciate current research directions.
- For the course and readings - understand concepts and not technical details

COURSE OVERVIEW

Week 1 – Friday September 9: - Course Introduction (Rice and Marsh)

I. MOTOR UNIT STRUCTURE, FUNCTION and ACTIVITY (C. Rice)

Week 2: - starts September 12: Skeletal muscle – structure & function; and the motoneurone

- introduction/review of muscle, structure/function, related factors in control of force and phenotypic determinants.
- model of striated muscle
- overview of motoneurone and action potential generation and propagation
- neuromuscular transmission

Week 3 – starts September 19: Neuromuscular transmission, and the motor unit (MU).

- coordination of neural and muscular factors in the generation and control of muscle force
- special properties and features of motor units – e.g. length/tension, force/velocity, power, potentiation
- MU recruitment

Week 4 – starts September 26: Motor unit properties and adaptations

- rate coding of motor units and adaptations

Week 5 – starts October 03: Motor unit adaptations: Fatigue & exercise

- neuromuscular sites and mechanisms of fatigue

Week 6 – Monday 10th Thanksgiving; starts October 12: Motor unit adaptations: Exercise & inactivity

- exercise strength training - emphasis on neural factors

Week 7 – starts October 17th: Motor unit adaptations: Inactivity & aging

- immobilization, sarcopenia, exercise

Week 8 – Monday October 24: Finish topics/Review - Midterm on Tuesday 27th evening

**No class Wed Oct. 26th and study break 27th & 29th

II. MUSCLE METABOLISM (G. Marsh)

Week 9 – starts October 31: Energy systems

- Energy system interaction during exercise
- AMPK, the intracellular fuel gauge

Week 10 – starts November 07: Muscle protein metabolism

- regulation of muscle protein turnover
- muscle atrophy and hypertrophy

Week 11 – starts November 14 Skeletal muscle carbohydrate metabolism

- glucose and glycogen metabolism during exercise.
- regulation of glucose uptake during exercise
- lactate as a fuel

Week 12 – starts November 21: Lipid metabolism, the glucose-fatty acid cycle

- control of fat metabolism during exercise
- interaction of fat and carbohydrate metabolism

Week 13 – starts November 28: Metabolic adaptations to exercise training/sex differences

- exercise and mitochondrial function
- are females more resistant to fatigue?

III. EXERCISE AND BONE (G. Marsh)

Week 14 – December 05 & 07: Exercise and Bone

- osteogenic response of bone to increased loading
- aging and the osteogenic response

Last day of classes is Wednesday Dec 07.

***Note: Course Content:**

Our plan is that the topics listed above will be covered, but it is possible that time will not permit all topics to be covered, or that other topics may be added or substituted.

Assignment Format:

Four (4) to six (6) double-spaced, typed pages

- all page margins should be 2.5 cm
- font and font size should be either Times New Roman 12 pt or Arial 11 pt

PLAGIARISM WILL NOT BE TOLERATED and could result in the assignment being given a failing grade

- using **direct quotes** without appropriate quotation marks and referencing constitutes **plagiarism**
- if you summarize or paraphrase another author's ideas or arguments without referencing, this also constitutes **plagiarism**
- **copying all or sections of another student's work is plagiarism**
- if you simply paraphrase an article or combine paraphrased segments from a number of original articles, even if you have appropriately referenced them, this constitutes **plagiarism**
- the essential feature that makes your work **unique**, even though you are reviewing the work of others, is the way in which you combine the thoughts, arguments, and ideas so as to present your own viewpoint

in a novel way.

The following statements [as corrected by Senate] on Plagiarism and cheating in multiple-choice exams should be added to course outlines:

Plagiarism: Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar).

Plagiarism Checking: The University of Western Ontario uses software for plagiarism checking.

“All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).”

Cheating: For computer-marked multiple-choice tests and/or exams, The University of Western Ontario may use software to check for unusual coincidences in answer patterns that may indicate cheating.

University Policies

1. Lateness/Absences: Assignments are due at the beginning of class on the assigned due date and will not be accepted late, except under medical or other compassionate circumstances. Electronic submission of assignments will not be accepted (unless otherwise specified) under any circumstances. Submitting a late assignment without appropriate documentation will result in a zero (0) grade. Appropriate documentation for assignments worth less than 10% should be submitted to the Undergraduate office. A missed mid-term examination without appropriate documentation will result in a zero (0) grade. The course policy is not to allow make-ups for scheduled midterms, presentations or final exams, nor to assign a grade of Incomplete without acceptable and verifiable medical (or equivalent compassionate) reasons. Acceptable reasons might include hospital stays, serious illness, family emergencies (like serious accidents or illness, death) or similar circumstances.

2. Written documentation: Whenever possible, students who require academic accommodation should provide notification and documentation in advance of due dates, examinations, etc. stating specific reasons and dates. Students must follow up with their professors and their Academic Counselling office in a timely manner. Documentation for any request for accommodation shall be submitted directly, as soon as possible, to the appropriate Academic Counselling Office of the student’s Faculty/School of registration not to the instructor, with a request for relief specifying the nature of the accommodation being requested. This documentation should be obtained at the time of the initial consultation with the physician or walk-in clinic. These documents will be retained in the student’s file, and will be held in confidence in accordance with the University’s Official Student Record Information Privacy Policy.

See <https://studentservices.uwo.ca/secure/index.cfm> for specific policy and forms relating to accommodation.

3. Grades: Where possible assignment objectives and rubrics will be posted on OWL. Should you have a concern regarding the grade you received for an assignment or feel that it is unfair in any way, you must wait 24 hours from the receipt of the assignment to approach the instructor or TA. In doing so, please make an appointment and prepare in writing, with evidence, why you feel your grade is inappropriate. Please be aware that in requesting a grade reassessment, your grade could go up/down/or stay the same. Note that calculations errors (which do occur!) should be brought to my attention immediately.

4. Scholastic offences: They are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:
http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf.

A) Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence (see Scholastic Offence Policy in the Western Academic Calendar). All required papers might be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between Western University and Turnitin.com (<http://www.turnitin.com>)

B) Computer marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

5. Formatting (as recommended by the course instructor): Exercise physiology style – be consistent!

6. According to the **Examination Conflict policy**, “A student who is scheduled to write more than two examinations in any 24-hour period may request alternative arrangements through the office of their Academic Counsellor.” *This policy does NOT apply to mid-term examinations. There will be no make-up for the mid-term exam. Students who miss this exam with a valid reason will have the final re-weighted accordingly.

7. Classroom Behaviour: Class will begin promptly at the time specified at the top of page one of this syllabus. In the event that you must arrive late, please enter the classroom with a minimal disturbance to the class. I reserve the right to lock the classroom door and deny entrance if lateness becomes a common occurrence. Excessive talking during class time is disruptive, disrespectful, and will not be tolerated. Students engaging in such behaviour may be asked to leave the room. Cellular phones, pagers, and text-messaging devices are disruptive when they ring in class. If you must bring these with you, please place them on silent mode or turn them off during class. Failure to do so may result in your being asked to leave.

8. Laptops for the purpose of typing lecture notes are permitted in class, but please be respectful to your fellow students and turn the sound off. If I receive complaints from other

students regarding noise or other disruptive behaviour (e.g., watching videos on YouTube.com, updating your Facebook status, playing Solitaire), your classroom laptop privileges will be revoked.

9. Audio and/or videotaping of lectures is not permitted unless approval has been sought from the instructor in advance.

STUDENT CODE OF CONDUCT

The purpose of the Code of Student Conduct is to define the general standard of conduct expected of students registered at Western University, provide examples of behaviour that constitutes a breach of this standard of conduct, provide examples of sanctions that may be imposed, and set out the disciplinary procedures that the University will follow. For more information, visit <http://www.uwo.ca/univsec/board/code.pdf>

ENGLISH PROFICIENCY FOR THE ASSIGNMENT OF GRADES

Visit the website <http://www.uwo.ca/univsec/handbook/exam/english.pdf>

SUPPORT SERVICES

There are various support services around campus and these include, but are not limited to:

1. Student Development Centre -- <http://www.sdc.uwo.ca/ssd/>
2. Student Health -- <http://www.shs.uwo.ca/student/studenthealthservices.html>
3. Registrar's Office -- <http://www.registrar.uwo.ca/>
4. Ombuds Office -- <http://www.uwo.ca/ombuds/>