

School of Kinesiology, Faculty of Health Sciences
Department of Physiology and Pharmacology, Schulich School of Medicine and Dentistry

Western University

KIN 4432A/PHYSIOL and PHARM 4420A
Physiology of Exercise

Instructor: Dr. Baraa Al-Khazraji

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Office Hours: Fridays 10:30-11:30am (please email in advance)

Teaching Assistants: Stephen Klassen (sklasse9@uwo.ca) and Erin Moir (mmoir@uwo.ca)

Course Format:

Lectures: Thursdays 9:30 - 11:30 a.m., and Fridays 9:30 – 10:30 a.m.

Location: Somerville House (SH) 3345

Course Description: This course evaluates the integration of neural and vascular factors in regulating blood pressure and blood flow during physiological stressors. An emphasis is placed on understanding these regulatory mechanisms during exercise, and how modifications made during aging, some disease states, and extreme physiological stressors impact blood pressure and/or flow regulation. A major component of the course involves discussing the interaction of cardiovascular neural reflexes with local tissue vascular control during the adjustment of blood pressure and/or blood flow. The course challenges the student to take on an integrative approach to learning in order to appreciate how several systems interact to sustain cardiovascular homeostasis.

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

Anti-requisite(s)/Pre-requisite(s)/Co-requisite(s) if applicable:

You are responsible for ensuring that you have successfully completed all course pre-requisites, and that you have not taken an anti-requisite course. Lack of a pre-requisite or the completion of an anti-requisite cannot be used as a basis for appeal. If you are found 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.

Learning Outcomes:

Upon completion of this course, students will be able to:

1. **Identify and explain** theoretical terms, concepts, and ideologies related to systemic and local cardiovascular and autonomic nervous system adjustments in the context of exercise. (Knowledge & Understanding)
2. **Utilize** theoretical terms, concepts and ideologies to experimental approaches to the study of reflex cardiovascular control and how these (and other) systems work together in complex integrative physiology during cardiovascular homeostasis. (Application)
3. **Outline and distinguish** theoretical and experimental approaches to the study of cardiovascular homeostasis and how such variations in approaches affect interpretations. (Analysis)
4. **Compare and appraise** research and theoretical knowledge (both from class and existing literature) as it relates to the regulation of blood pressure and blood flow at rest and during exercise in various populations. (Evaluation)
5. **Apply** acquired skills in evaluating research (through assignments and class discussion) to investigate how the body accomplishes goals such as elevating blood pressure, or adjusting blood flow to skeletal muscle during exercise, and how such options vary from person to person. Students will **assemble** research findings and concepts from class and relate these to the topics discussed in class (e.g., via schematic mind-map). (Creation)

Readings:

Course materials, including course outline, readings and lecture notes, are available on the OWL website for this course. Past exams or exam questions are not available. Readings that parallel the lectures are assigned. The readings are in journal article or book chapter format. The readings labelled “REQUIRED” address major components of the course and are examinable. These readings are published comprehensive reviews on relevant topics. It is your responsibility to extract parts of these readings that are pertinent to the course. These directions will also be provided during lectures. Readings labelled “SUPPLEMENTAL” are for more directed readings on weekly lectures and may be targeted for assignments. The weekly readings will emphasize the physiology, methodology and/or clinical aspects regarding reflex cardiovascular control. You are responsible for obtaining and reading all course readings.

Required Course Material:

All required readings and lecture slides will be posted on OWL. No textbooks are required for this course.

Course Evaluation Summary:

1. Assignment 1: Critical evaluation of literature Date: September 29th, 2017 (submit via OWL)	15%
2. Midterm Examination Date: October 19th, 2017 (in-class)	30%
3. Assignment 2: Critical evaluation of literature. Date: November 17th, 2017 (submit via OWL)	15%
4. Final Examination: <i>Minimally cumulative</i> Date: TBD	40%

Assignment Information

The two assignments in this course are intended to provide you with the opportunity to perform a literature search for a given research question derived from class content. You will learn how to extract *relevant* information from these manuscripts such that you are able to provide a summary of arguments that are in support and against the overall conclusion.

Tentative List of Topics Covered in Class**1. Course Introduction & Basic Description of Vascular Mechanics**

Course introduction, expected course learning outcomes, and description of assignments/mid-term are presented, followed by discussion on biophysics of the cardiovascular system, vascular mechanics and blood flow.

2. Vasodilation: Increasing blood flow and oxygen delivery.

What is the blood flow responses to exercise? What are some hypotheses of potential mechanism(s) mediating exercise vasodilation?

3. Autonomic Cardiovascular Control During Exercise:**3.1. The Sympathetic Nervous System:**

Neuroanatomy, Neurotransmitters, Cellular Vasoconstriction Pathways, Measurement.

3.2. The Baroreflex

The basic physiology of acute baroreflex-mediated neurovascular adjustments to orthostasis.

3.3. The Exercise Pressor Response (the Metaboreflex) in health and disease

Sensory nerve fibres from skeletal muscle signal changes in muscle metabolism that elicit a cardiovascular response.

4. Central Command

The brain remains a frontier area of research in many aspects, including exercise science. How are muscle activation and cardiovascular responses coordinated during exercise? This lecture will expose students to the concept of central command, and touch on recent neuroimaging studies that examine the cortical organization for cardiovascular control during exercise.

5. Sympatholysis: Balancing the field between vasodilation and vasoconstriction during exercise.

This lecture will attempt to tie many aspects of this course together by addressing the following question: How does one reconcile the considerable vasodilation to satisfy blood flow needs of exercising muscle with the competitive need to defend blood pressure in the face of limited cardiac output? Is muscle blood flow or blood pressure the regulated variable during exercise?

6. Regulation of Heart Rate and Methods Related to Research Into Exercise-Induced Bradycardia.

How does the brain control heart rate? What is the specific role of the autonomic nervous system in heart rate control during exercise? What are some research methods used to characterize the role of the autonomic nervous system in heart rate control?

7. Cerebral Blood Flow Control

The control of blood flow to the brain differs markedly from skeletal muscle. Yet, some believe that failure to meet adequate perfusion of the brain is the fundamental determinant of exercise fatigue.

Disclaimer Note: Time may not permit complete coverage of all topics outlined above. The timing and content of lectures might change depending on classroom discussions.

Course/University Policies

1. **Lateness/Absences:** Assignments are due at the times indicated at the time of announcement and will not be accepted late, except under medical or other compassionate circumstances. Assignments are to be handed in by the student: *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:** 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 (ex KIN students ~ KIN Undergraduate Office) not to the instructor, with a request for relief specifying the nature of the accommodation being requested. In the event of a medical request, this documentation should be obtained at the time of the initial consultation with the physician or walk-in clinic. An "Accommodation Consideration Request Form" found online or in the Kinesiology Undergraduate Office" for **ALL**

such accommodation requests must be submitted into the appropriate Counselling office of the student's Faculty/School of registration. 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 the Professor's attention immediately. 15% of course grades will be posted by the last day to drop a course.

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*): example- APA style is the approved style of writing for all assignments produced for this course. Please refer to Western University Library webpage for information on citation style and format or consult the APA publication manual: Publication manual of the American Psychological Association (6th ed.). (2009). Washington, DC: American Psychological Association.

6. According to the **Examination Conflict policy**, Please see the Office of the Registrar policy on Exam Conflict and Multiple Exam Situations. **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, and received, 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/>

Students who are in emotional/mental distress should refer to Mental Health@Western <http://www.uwo.ca/uwocom/mentalhealth/> for a complete list of options about how to obtain help.