

School of Kinesiology
Faculty of Health Sciences
Western University
Kinesiology 2230a
Fall 2018
Introductory Exercise Physiology

Lecturer: Glen Belfry PhD

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Calendar Course Description: The physiological basis of muscular exercise and training. The course will examine metabolic, cardiorespiratory and muscular adaptations to acute and chronic exercise.

Antirequisite: HS 272a/b

Prerequisite: Completion of the first year Kinesiology program. Registration in the School of Kinesiology.

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.

Course Format: Lectures are scheduled **Monday, Wednesday and Friday, 12:30-1:20 pm.**
Room: P&AB-106. Some lectures may be conducted as a seminar in which review of previous material may be undertaken.

During the term each student will attend **4 laboratory sessions.** At present, you should be scheduled into a laboratory section; Tuesday 11:30 am to 2:30 pm (section 2 and 3), Tuesday 7 pm to 10 pm (section 4 and 5), Wednesday 1:30 pm to 4:30 pm (section 6 and 7), Wednesday 7 pm to 10 pm (section 8 and 9), Thursday 11:30 am to 2:30 pm (section 10 and 11) and Friday 1:30 pm to 4:30 pm (section 12 and 13), in Thames Hall 2108. **Labs are every other week.** Week one labs have even numbers, week two are odd numbers. If you are unable to attend the appropriate

lab session for a **legitimate** (see below) reason, you must notify the lab coordinator **in advance**. Appropriate dress (gym wear) **is required** during these labs.

Lab Schedule:

Each lab is run for 2 weeks. You attend one lab every 2 weeks.

Week 1 of each lab; sections 2-4-6-8-10-12

Week 2 of each lab; sections 3-5-7-9-11-13

Labs begin the week of September 17 (Week 1) or September 24 (Week 2)

LAB TOPICS

Lab 1: Enzyme kinetics

Lab 2: Static lung volumes and ventilatory response to incremental exercise.

Lab 3: Oxygen uptake and carbon dioxide response to incremental exercise.

Lab 4: Muscle contractile properties

Evaluation: Evaluation of the student's progress in this course will be assessed via 2 mid-term exams, a laboratory exam and a **COMPREHENSIVE** final exam. Lecture examinations will be of the multiple choice type, whereas the laboratory exam will consist of short answers and calculative questions requiring data manipulation and evaluation.

Examination	Value%	Date	Room(s) TBA
Lecture Mid-term #1	20	Thursday, October 18	5:30-6:45 P.M.
Lecture Mid-term #2	20	Thursday, November 15	5:30-6:45 P.M.
Laboratory Exam	20	Thursday, November 29	5:30-7:30 P.M.
Laboratory Quizzes	5		
Final Comprehensive Exam	35	TBA	

Lecture Outline:**Readings****Topic**1. METABOLISM DURING EXERCISE

- a. What is energy?
- b. Energy value in food
- c. Factors affecting energy production
- d. Anaerobic energy sources
 - 1. ATP
 - 2. CP
 - 3. Glycolysis
- e. Aerobic energy sources
 - 1. Carbohydrate
 - 2. Lipid
- f. Significance of various energy sources and foods
- g. Oxygen uptake
 - 1. indirect calorimetry
- h. Lactic acid production
- i. EPOC
- j. Metabolic causes of fatigue

Learning Objectives
 To be able to:

- 1. Identify the amount of energy derived from food of different types.
- 2. To understand those factors which may influence energy release.
- 3. Explain the basic energy stores, their power and capacity.
- 4. Identify and explain the anaerobic energy stores.
- 5. Understand the basic aerobic pathways for both carbohydrate and lipid metabolism.
- 6. Identify the significance of the energy delivery systems to athletic events of various durations.
- 7. Understand some effects of exercise nutrition
- 8. Outline the kinetics of the oxygen uptake curve.
- 9. Differentiate between steady-state and maximum oxygen consumption.
- 10. Understand the importance of maximal oxygen consumption (VO_2max) to endurance performance.
- 11. Understand and be able to calculate VO_2 via indirect calorimetry.
- 12. Recognize the meaning and use of ATPS, STPD & BTPS.
- 13. Understand the concept of RER.
- 14. Understand the reasons for, and the relative production and importance of lactic acid production.
- 15. Outline the reasons for and functions of the EPOC.

2. VENTILATION DURING EXERCISE

- a. Lung structure and function
- b. Mechanics of ventilation
- c. Static lung volumes
- d. Gas pressures and exchange
- e. Gas transport in the blood
- f. Ventilatory control
- g. Ventilation during exercise
- h. Ventilation as a limiting factor to exercise

- Learning Objectives
To be able to:
1. Outline lung structure and its relation to function.
 2. Outline how lung volume is altered and understand those factors which influence maximal capacity.
 3. Identify the static lung volumes and understand their relationship to dynamic ventilation.
 4. Explain how gas pressure acts as the driving force for gas exchange.
 5. Explain how gas (O₂ and CO₂) is transported in the blood and the significance of the oxyhemoglobin curve.
 6. Outline the manner in which control may be exerted over the ventilatory system.
 7. Identify what happens to ventilation during exercise.
 8. Discuss why or why not, ventilation may be a limiting factor to exercise.
 9. Outline how acid-base status is maintained.
 10. Recognize the influence of physical training on respiratory adaptations.

3. CARDIOVASCULAR FUNCTION DURING EXERCISE

- a. Cardiac structure and function
- b. The circulatory system
- c. Cardiac output
- d. Relation between cardiac performance and oxygen uptake
- e. Blood pressure and exercise
- f. Distribution of blood flow
- g. Cardiac control

- Learning Objectives
To be able to:
1. Discuss the relationship between cardiac structure and function.
 2. Outline the manner in which blood is circulated to our bodies as well as the function of various subsections of the circulatory system.

3. Indicate the influence of exercise on blood pressure and the determination of mean arterial pressure.
4. Discuss the intrinsic and extrinsic regulation of the cardiac cycle.
5. Discuss those factors controlling blood flow distribution.
6. Outline the factors affecting cardiac output and the influence of exercise on these factors.
7. Indicate those factors responsible for increased cardiac performance during exercise.
8. To understand the relation between cardiac output and oxygen uptake.
9. To be aware of the influence of training on the heart and the cardiovascular system.

4. MUSCLE FUNCTION DURING EXERCISE

- a. Muscle structure and function
- b. The mechanism of muscular contractions. Some important contractile properties
- d. Neuromuscular control of movement
 1. Motor units
 2. Recruitment pattern
 3. Muscle fibre types
 4. Feedback loops
- e. Muscle soreness & recovery

- Learning Objectives
- To be able to:
1. Outline muscle structure and function at the level of both whole muscle and individual sarcomere.
 2. Outline the sequence of contractile events starting with initiation of a neural signal to relaxation of the muscle.
 3. Explain the concept of motor units and their importance to a graded contraction.
 4. Outline the various types of muscle fibers;
 - a. classification schemes
 - b. metabolic potential
 - c. association with $m\dot{V}O_2$ and athletic success
 5. Outline the manner in which muscles may grow or be altered by activity at the subcellular level.
 6. Discuss the significance of various proprioceptors to muscle function
 7. Understand the basic mechanisms of muscle injury and recovery

TRAINING ADAPTATIONS TO EXERCISE

a. Physiological responses to training

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| Learning Objectives | 1. | Identify the major cardiovascular, respiratory and muscular adaptations that occur with different forms of training. |
| To be able to: | 2. | Identify the cellular changes of anaerobic and anaerobic systems that occur with different forms of training. |
| | 3. | Discuss the influence of initial fitness, frequency, duration, intensity, and mode of training on adaptation. |

- Note:**
1. All lectures will be posted on WebCT in Power Point format.
 2. During the course of the semester we will attempt to cover the material indicated. It is possible that we might not complete the suggested material, or that additional material may be added.
 3. Lectures will be developed with the text as primary source, but additional material will be commonly included, therefore attendance at lectures is recommended.
 4. The learning objectives associated with each section are designed to assist the student in focusing their reading and effort. The topics to be discussed cannot be considered exclusive however, and the student is responsible for all material covered.
 5. Laboratory sections have been determined well in advance. Legitimate excuses for missing or re-scheduling labs include illness, compassionate circumstances, etc. Extended vacations, extra work, etc. do not qualify.
 6. Exam periods have been selected to conflict as little as possible with other scheduled classes. Please report any potential conflicts **NOW**, do not wait until the week before the exam. Further, exams have been scheduled well in advance, hence, planned vacations, job interviews etc. will **not** be accepted as valid reasons to miss a scheduled exam. As a general policy, the instructor will not entertain any questions within a one day period before the day of a scheduled exam. Please note that computer software (ScanExam II) will be employed to check for unusual coincidences in answer patterns that may indicate cheating on multiple choice exams.

Course/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*): 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**, “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/>