

McMASTER UNIVERSITY
Department of Kinesiology

KINESIOLOGY 2CC3

CARDIORESPIRATORY & METABOLIC EXERCISE PHYSIOLOGY

Term 2

Winter 2018

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Office Hours: Thursdays 1pm – 3pm or by appointment

I. COURSE DESCRIPTION

This course is designed to provide students with a broad understanding of the human body's physiological response to exercise, including acute adjustments and adaptations that occur in response to physical training. Major emphasis is placed on the cardiorespiratory and skeletal muscle metabolic systems, and the integrative manner in which these systems adapt in an attempt to maintain cellular homeostasis during exercise. The course builds upon the foundation of knowledge constructed through the KINESIOL 1A03/1AA3 (Anatomy and Physiology) course, and students will be expected to be familiar with fundamental concepts previously introduced during their first year of study.

II. COURSE OBJECTIVES

Course Content Objectives

Upon completion of this course, the student will be able to:

1. Explain the concept of bioenergetics and how it relates to fuel use in the body.
2. Explain the function and mechanism of enzymes in the body and discuss factors that affect enzyme activity.
3. Identify the fuels and tissues important for exercise metabolism.
4. Describe the key metabolic pathways, enzymes and transporters involved in exercise metabolism.
5. Explain how and why the relative contribution of the energy systems changes with exercise intensity and duration.
6. Describe calorimetry and how and why it is used.
7. Discuss the measurement of respiratory exchange ratio – assumptions, benefits and limitations.

8. Explain oxygen uptake, how it is measured, how it changes with exercise, how it changes with training, and how it is used to determine energy expenditure.
9. Explain the lactate threshold – how, when and why it occurs, and how it changes with training.
10. Identify the hormones that are released during exercise and describe their functions.
11. Explain how skeletal muscle metabolism adapts to endurance training.
12. Describe the pressure, volume and valve changes that occur during the cardiac cycle.
13. Describe how cardiac output, heart rate and stroke volume change and are regulated with acute exercise and training.
14. Explain the vascular changes that occur during exercise to alter blood flow.
15. Describe the relationship between oxygen uptake, cardiac output and oxygen extraction in skeletal muscle during exercise.
16. Describe the blood pressure response to aerobic and resistance exercise.
17. Explain respiration changes with acute exercise and training and how respiration is regulated.
18. Describe the determinants of blood oxygen content and how they are regulated.
19. Explain the oxyhemoglobin dissociation curve and how it can change with exercise.
20. Describe the partial pressure and blood oxygen saturation changes throughout the body at rest and during exercise.
21. Explain how carbon dioxide is carried in the blood.

Skill and Value-Based Learning Objectives:

Upon completion of this course, the student will demonstrate competencies in:

- **Exercise testing** including a wingate test, VO₂max test and an Astrand test.
- **Use of the powerlab system** for collection of data for wingate tests and VO₂max tests.

- **Laboratory and exercise testing safety procedures** to ensure the safety of exercising individuals and during recovery from exercise.
- **Professionalism, proper record keeping and discretion** when dealing with subject privacy and data collection from the laboratory exercise testing.
- **Teamwork and interpersonal skills** by engaging in and/or initiating participation in small group laboratory exercises and discussion boards.
- **Personal organization and time management** to multi-task, set priorities, and allocate time effectively to meet deadlines such as tests, prelab quizzes, exams, and lecture/lab attendance.
- **Professional interaction and communication** via email, online forums, and face to face meetings with professors, staff, teaching assistants, and peers.
- **Displaying appropriate and respectful behaviour** towards the Kinesiology undergraduate laboratory and instructors, staff, teaching assistants, and peers.

III. RESOURCES AND REFERENCE MATERIAL

Required Resources:

- Custom Coursepack
- i-clicker

There is no specific textbook for the course, however a courseware pack is available for purchase that contains most of the PowerPoint images that will be presented during lectures. It is the instructor's hope that — by making most of the course material available in hard copy format in advance — students will be able to focus on listening during lectures instead of scrambling to try and copy material that is presented on screen. Students are encouraged to bring the coursepack to each lecture. If students require additional reference material in the form of a traditional textbook, the course instructor can offer suggestions in this regard.

As indicated above, it is expected that students will enter the course with a solid fundamental understanding of basic anatomy and physiology, i.e., to a level developed following the introductory course KINESIOL 1A03/1AA3 (Anatomy and Physiology). In this regard, students may find it useful to refer back to their introductory anatomy and physiology textbook in order to review fundamental concepts previously introduced.

IV. POLICY ON THE USE OF CALCULATORS IN TESTS AND EXAMINATIONS

Calculators will be permitted during tests. Permission is restricted to **non-programmable** calculators only (e.g., CASIO FX991).

V. **TOPIC OUTLINE**

METABOLISM AND ENERGY PROVISION

- (A) Energy Production
 - Regulation of cellular respiration
 - Fuel utilization at rest and during exercise
- (B) Non-oxidative Energy Provision During Exercise
 - The energy continuum
 - Measurement of non-oxidative metabolism
 - Energy provision during high-intensity exercise
- (C) Oxidative Energy Provision During Exercise
 - The concept of maximal oxygen uptake
 - Measurement of aerobic metabolism
 - Quantifying fuel utilization during exercise
- (D) Metabolic Training Principles and Adaptations
 - Application of training principles for metabolic enhancement
 - Metabolic adaptations to exercise training

CARDIOVASCULAR FUNCTION AND REGULATION IN EXERCISE

- (A) The Cardiovascular System
 - Cardiovascular dynamics
 - Regulation of cardiovascular system
- (B) Cardiovascular Response to Exercise
 - Regulation of cardiac output and blood flow during exercise
 - Regulation of oxygen extraction by skeletal muscle
- (C) Cardiorespiratory Adaptations to Training
 - Cardiovascular adaptations to chronic training

RESPIRATORY FUNCTION AND REGULATION IN EXERCISE

- (A) Respiration
 - Regulation of pulmonary ventilation
 - Gas exchange and transport
- (B) Respiratory Exercise Response and Training Adaptations
 - Response of the respiratory system to exercise
 - Respiratory training adaptations

VI. ASSIGNMENTS AND GRADING

The following system shall be used to determine the student's final grade. Changes to the grading scheme are NOT permitted under any circumstances.

First term test – Fri, Feb 2	25% of final grade
Second term test – Tues, Mar 13	25% of final grade
iclicker questions in lecture	5% of final grade
Final exam	35% of final grade
Laboratory prelab quiz & reports	10% of final grade

The term tests are scheduled by the instructor and each test is written during a regular 50-min lecture slot, whereas the final exam is scheduled by the Registrar's Office. All tests and exams will consist of both multiple-choice (recognition-type) and short-answer (recall-type) questions. The final exam is cumulative and will assess comprehension of material and important concepts presented over the course of the entire term. See part V of this outline for a description of expectations regarding laboratory reports.

iclicker assessment (in-class component only) - Due to the possibility of absences or technical difficulties, 90% of the questions correct over the term will equal 100% (eg. if 30 questions are asked, 27 correct responses would count as 100%). Marks will then be calculated as a percentage of this maximum. MSAF will not be accepted for missed iclickers.

iclicker Testing Rules:

- 1. All class notes and any other reference material are not allowed during iclicker testing**
- 2. No electronics allowed during iclicker testing (aside from your iclicker remote)**
- 3. You may discuss with your neighbour during in-class testing, but testing during pre-labs is an independent assessment, so no talking at that time.**
- 4. Absolutely no recording devices during iclicker testing. If you use one, I will charge you with academic dishonesty.**

VII. LABORATORY EXERCISES

1. Purpose

Laboratory exercises serve to (1) reinforce concepts presented in lectures and readings, and (2) provide exposure to laboratory equipment. With our new undergraduate laboratory space and equipment, we encourage every student to obtain some "hands-on" experience and all students are expected to actively participate in the labs. **Please come to all labs dressed appropriately for an exercise activity.** If you cannot exercise for a medical or another reason, please let your TA know. There will be four labs during the course, spaced approximately 2-3 weeks apart.

Specific lab dates are during the weeks of: Jan 29, Feb 12, Mar 5 and Mar 19.

2. Lab Manuals

The courseware pack contains all of the laboratory outlines and assignments. You are expected to read over the laboratory outline before coming to the lab.

3. Lab Sections

You have been scheduled into a lab section as designated on your timetable. If you have not been given a lab slot or if a conflict arises for academic reasons (e.g., a course is rescheduled), you will have the opportunity to transfer into a different lab section. Note that potential transfers depend on space availability. Lab changes will be permitted **ONLY** for academic reasons. In this case, you **MUST** obtain written permission/confirmation (in the form of an e-mail message) from both the lab instructor for the lab you are vacating and the lab instructor for the lab you are joining.

4. Pre-Lab Quizzes

Pre-lab quizzes will consist of iclicker questions at the start of your lab. Questions will cover material from the lab manual and/or material provided to you on Avenue before the labs begin.

5. Lab Submission Procedure

(A) Lab reports are considered individual assignments and normal University policies regarding academic honesty will apply (see below). In this course we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students can submit their work electronically via the Avenue course dropboxes which use Turnitin.com to check for academic dishonesty. Students who do not wish to submit their work through Turnitin.com must instead submit a hard copy to their TA by the same deadline as for the electronic dropboxes. No penalty will be assigned to a student who does not submit work through Turnitin.com. To see the Turnitin.com policy, please go to www.mcmaster.ca/academicintegrity

(B) The report for a particular lab should be handed in ON AVENUE before the beginning of your next scheduled lab session (i.e., report for lab #1 is due before the start of lab #2). The submission for the final lab report will be 1 WEEK from the start of the final lab.

(C) All lab reports **MUST** be submitted in WORD or PDF format.

(D) Lab reports **MUST** be typed otherwise they will **NOT** be accepted. Graphs are to be created using graphics software (e.g., using Microsoft Excel); hand-drawn graphs are not acceptable. Each lab report **MUST** include a separate cover page that lists student name, ID number, lab number, name of lab instructor, and lab time slot.

(E) Failure to hand in your lab before your next lab session will result in a mark of **ZERO** being assigned for that report, unless there is a legitimate reason (see below). Problems with Avenue dropbox submissions will not be a valid excuse for handing the lab in late (unless Avenue is down completely or having University wide issues). After submitting, verify your lab report has been uploaded correctly by checking for a receipt in Avenue email.

(F) If you are unable to attend a lab for a legitimate reason such as illness, the appropriate documentation must be submitted to the Office of the Associate Dean (ie MSAF). In this instance, you **MUST** advise your lab instructor of your absence as soon as possible. You are also expected to attend another lab section that week in order to make up for the missed lab, except in the case of a prolonged medical absence or other extraordinary circumstances.

VIII. POLICY REGARDING DEFERRED TESTS AND EXAMS

Students who miss tests or exams for legitimate reasons such as illness may be allowed to write a deferred or "make-up" test. The format is usually different from the regularly scheduled test/exam and typically requires written responses to short-answer or essay-type questions. For all instances, an MSAF must be submitted (see below) or appropriate documentation must be submitted to the Office of the Associate Dean, Faculty of Science (BSB 129) within 3 days of the missed work.

Students who miss a Registrar-scheduled final exam can apply to the Associate Dean's office for permission to write in the deferred final exam schedule. In all cases, appropriate documentation must be submitted to the Office of the Associate Dean, Faculty of Science, for consideration of deferred examination permission. Under no circumstances will the instructor re-schedule a final exam for individual students.

IX. MCMASTER STUDENT ABSENCE FORM

If you are absent from the university for a minor medical or personal reason, lasting fewer than 3 days, you may report your absence, without documentation, using the McMaster Student Absence Form (as long as the missed work is worth less than 25% of the final course grade). Absences for a longer duration or for other reasons (eg. Religious, personal) must be reported to your Faculty/Program office, with documentation, and relief from term work may not necessarily be granted. When using the MSAF, report your absence to howartkr@mcmaster.ca. Then contact the instructor/lab TA immediately (normally within 2 working days) by email/telephone/in person to learn what relief may be granted for the work you have missed, and relevant details such as revised deadlines, or time and location of a make-up exam.

X. ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Academic Accommodation of Students with Disabilities Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140, ext. 2865 or e-mail sas@mcmaster.ca. For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities.

XI. ACADEMIC INTEGRITY

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences (e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript reading "Grade of F assigned for academic dishonesty", and/or suspension or expulsion from the university). It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3, located at: <http://www.mcmaster.ca/univsec/policy/AcademicIntegrity.pdf>

The following illustrates only three forms of academic dishonesty:

- Plagiarism (e.g. the submission of work that is not one's own or for which other credit has been obtained),
- Improper collaboration in group work.
- Copying or using unauthorized aids in tests and examinations.

XII. COMMUNICATION POLICY & ON-LINE LEARNING RESOURCES

Announcements regarding scheduled test and lab dates, potential changes to course content and other information or updates relevant to the course will be communicated to students during lectures. Students are expected to take all necessary steps to obtain this information, the primary means being regular class attendance. McMaster e-mail accounts and **Avenue to Learn** may also be used to communicate information to students.

Avenue to learn: avenue.mcmaster.ca

- Students are expected to check **Avenue at least twice each week**. **Avenue** will be the instructor's main method of communication with students.
- Students are responsible for any course content that is delivered via **Avenue**. Details regarding this online content will be given in class.
- It is the responsibility of the student to take all necessary steps to find out about course changes including, but not limited to, class attendance, changes to schedules, announcements and instructions.
- Any instructions/announcements that are verbally given in lecture are the responsibility of the student.
- **The instructor will only communicate with students via their official McMaster email account.**

Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

XIII. USE OF COURSE MATERIALS

Course materials provided by the instructor are for use by students registered in this class only. Under no circumstances are these materials to be shared, posted or sold to a third party without permission from the instructor. This includes, but not limited to, online posting of lecture/lab notes, online lectures, recordings of lectures, or any lab materials on a website other than the Avenue site designed for the course.

XIV. COURSE OUTLINES AS CONTRACTS BETWEEN STUDENTS AND THE UNIVERSITY

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes. Also, the course instructor will maintain an Avenue to Learn component for the course and students are expected to monitor (i.e., check the Avenue to Learn notice board and postings) at least twice per week and be aware of any changes that are made.

XV. STUDENT SUCCESS CENTRE

The Student Success Centre (SSC) is a resource for all McMaster students and offers services in several areas including Academic Concerns. SSC is located in Gilmour Hall (GH) 110 and their website can be found at: <http://studentsuccess.mcmaster.ca>

Students can speak to academic counselors or review materials online to help with:

- Marks, test results, academic performance
- Motivation, interest in courses, sense of direction
- Time management, study habits, personal organization
- Stress in dealing with the academic workload
- Time management, study habits, personal organization
- Listening and note taking in university lectures
- Reading for university courses
- Preparing for or writing tests and exams; multiple-choice tests

XVI. FEEDBACK

It really helps us improve our services when we hear from our students, faculty and staff about what we can do better. A feedback process brings to our attention situations in which we may not have adequately considered accessibility and allows us to better plan for accessibility in the future.