We recognize and acknowledge that McMaster University meets and learns on the traditional territories of the Mississauga and Haudenosaunee nations, and within the lands protected by the "Dish With One Spoon" wampum, an agreement amongst all allied Nations to peaceably share and care for the resources around the Great Lakes.

BIOCHEM 4M03 - Cellular and Integrated Metabolism
2023 Winter Term

Instructors: Jonathan Schertzer, Gregory Steinberg | **Office Hours:** By Appointment

Lectures: Monday, Wednesday, Thursday: 1:30pm

TA(s)

- Head TA: Daniel Marko markod5@mcmaster.ca
- TA: Arshpreet Bhatwa bhatwaa@mcmaster.ca
- TA: Nazli Robin robinn14@mcmaster.ca
- TA : Megan Schuck schucm1@mcmaster.ca

Introduction

Core concepts include:

- Biochemical basis of nutrient metabolism and energy balance
- Metabolic physiology and integrative responses that relate to metabolic health and metabolic disease

Course Details

Undergraduate course in Biochemistry

TITLE: Cellular and Integrated Metabolism

Dates: Monday January 9 – Wed April 12, 2023

Time: 1:30 – 2:20pm (Monday, Wednesday, Thursday)

Place: PGCLL M16

Course Coordinator: Dr. Jonathan Schertzer

Course Website: Avenue to Learn

Course Professors

- Course Coordinator: Jonathan Schertzer, PhD, Associate Professor, Department of Biochemistry and Biomedical Science
    - schertze@mcmaster.ca
    - Happy to meet with you (by appointment)
- Instructor: Greg Steinberg, PhD, Professor, Department of Medicine, Associate Member, Department of Biochemistry and Biomedical Sciences
    - gsteinberg@mcmaster.ca
    - Happy to meet with you (by appointment)

Your professors have a background in physiology and metabolism. They are available for questions before and after class. They are happy to meet with you, but your experienced TA's are your first point of contact.

Teaching Assistants

Normally, this course has 4 well-qualified teaching assistants with a background in biochemistry, metabolism, immunology, microbiology and physiology. These TAs are able to assist you with questions regarding course material, assignments and initial queries with marking and mark assignments. TAs will have pre-organized office hours by appointment or announced in class and set in the Avenue to Learn calendar. It is possible that TAs will not

be available or reduced this term and changes to the course will be made accordingly.

Course Description

The goal of this course is to gain an advanced understanding of nutrition and metabolism that will integrate previous knowledge in nutrition, biochemistry, molecular biology, physiology, genetics and endocrinology. It is assumed students have a basic knowledge of these areas. This course will examine the role of macronutrients in fundamental biochemical processes as they relate to health and disease, over the life course. You will study the biochemical metabolism of macronutrients including carbohydrates, fat and protein and their metabolic regulation. You will be introduced to the biochemical basis of nutrient metabolism, metabolic physiology and integrative responses that relate to metabolic health and metabolic disease. The course will review current scientific literature and pertinent research papers as they relate to disease and disease processes.

Topics in this course will focus on metabolism and gene-environment interactions in relation to common chronic metabolic diseases, including obesity, diabetes, cardiovascular disease, and fatty liver disease.

The sessions will be didactic lecture, although all instructors engage in much discussion that requires participation from students. Specific areas of nutrition to be covered are: 1) carbohydrate metabolism; 2) fatty acid metabolism; 3) energy balance; 4) immunometabolism; 5) diabetes and insulin resistance; 6) metabolism across the life course including maternal, fetal and placental metabolism.

Intended Learning Outcomes

At the end of this course students will be able to explain and apply the integrated biochemical

pathways that are discussed in lecture as they relate to metabolism in both a healthy and disease related context. Knowledge of these pathways will be tested in multiple choice, short answer and long answer questions during in-class tests and a final cumulative exam. The students will be able to analyze and evaluate disease state conditions, using integrated biochemical pathways, in a major research paper (i.e., an assignment) and recommend a health-related action. Students will also be able to apply their knowledge in participatory in-class "Journal Club" type assessments of published papers. NOTE: published papers discussed in "Journal Club" lectures are testable material.

By the end of this course, students should be able to understand:

- Macronutrient metabolism in fundamental biochemical processes as they relate to health and disease
- Processes regulating energy balance
- Basis of immunometabolism in metabolic disease
- Basis of host-microbe interactions in metabolic disease

Materials & Fees - Resource Material

There is NO required text for the course, below are optional items:

- Gropper SS and Smith JL. Advanced Nutrition and Human Metabolism. Sixth edition, 2012 Wadsworth, Division of Thomson Learning Inc, Belmont, USA. (in HSC library)

Websites with reliable information on nutrition include:

- Health Canada, Office of Nutrition Policy and Promotion – see free download section http://www.hc-sc.gc.ca/fn-an/nutrition/reference/index-eng.php
- Health Canada, Health Claims for Foods - www.hc-sc.gc.ca/food-aliment/english/subjects/health_claims/index.html

- American Society for Nutrition – PODCASTS http://www.nutrition.org/publications/podcasts/

Virtual Course Delivery

Based on university and public health guidelines, it is possible that in-person events will change to virtual course delivery

To follow and participate in virtual classes it is expected that you have reliable access to the following:

- A computer that meets performance requirements found here.
- An internet connection that is fast enough to stream video.
- Computer accessories that enable class participation, such as a microphone, speakers and webcam when needed.

If you think that you will not be able to meet these requirements, please contact uts@mcmaster.ca as soon as you can. Please visit the Technology Resources for Students page for detailed requirements. If you use assistive technology or believe that our platforms might be a barrier to participating, please contact Student Accessibility Services, sas@mcmaster.ca, for support.

Course Overview and Assessment

Methods of Evaluation:

At times during the term, it may make sense to modify the schedule and/or assessments in the course. The instructor reserves the right to modify elements of the course and will notify students accordingly. Notification will be provided in class or online (Avenue to Learn).

1) IN CLASS TESTS (4 x 15% = 60% final grade)

The course is divided into 4 sections. Each of the sections will be tested individually. Tests are held in class and are short and long answer, and some multiple-choice questions. In general, each test is comprised primarily of material from the section that was just taught. Therefore, generally, tests are comprised of material that is non-cumulative from previous sections. However, some core concepts cross all testable sections.

- Each test is worth 15% of the final grade.

2) ASSIGNMENT (1x = 25% final grade)

Students will be graded on one essay-style Assignment. The objective of this assignment is to use the knowledge gained in the lectures to evaluate a current issue in metabolism and its relationship to disease. Student will be graded on their ability to critically review the scientific literature on specific topics as they relate to the biochemistry of metabolism and nutrition. This involves the ability to appreciate the strengths and weaknesses of primary research articles using human clinical trials versus basic science in animal or cell-based models. In these assignments, students will be asked to take a stand on an issue that could affect the treatment choices of a population and present it as a recommendation to change clinical practice.

Assignments are to be submitted electronically via A2L Dropbox and are due by 5pm on the set due date (refer to the lecture schedule for due dates). Any assignments received after 5pm on the due date is considered late and will incur a 10% deduction on the final mark. For every day thereafter, there is a 10% per day deduction in the final mark.

3) FINAL EXAM (15% final grade)

The final exam is cumulative. The majority of questions on the final exam will test your knowledge on integrating all of the course material, but there will be focus on material that has not yet been tested during the in-class tests. The final exam will have some questions testing your knowledge on integrating concepts from all sections of the course. The exam will be made up of multiple choice, short answer, and long answer (essay-type) questions.

Remarking of assignment and tests

Please refer to the **Dept of Biochemistry and Biomedical Sciences for policies** on remarking and viewing of assignments, tests and exams at http://fhs.mcmaster.ca/biochem/undergraduate/forms_and_procedures.html.

This course follows the policies as they are laid out on the Department website.

Course Evaluation

We value students' comments and evaluation of our lectures and teaching materials and ask that all students please complete the final course evaluation at the end of the semester. Final grades will be rounded up to the nearest GPA for all students (to a maximum of 1 percentage) if the class response to Course evaluation is >65%.

Please complete the course evaluation and encourage your classmates to do so!

Lecture Schedule 2023

This lecture schedule is based upon current university and public health guidelines and may be subject to changes during the term. Any changes to the schedule or course delivery will be communicated on the course announcements section on Avenue to Learn. Please check the announcements prior to attending class.

Note: 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.

Lecture #	Day	Date	Lecture title	Topic	Instructor
1	Monday	9-Jan-23	Welcome to 4MO3	Introduction to course	GS
2	Wednesday	11-Jan-23	CHO metabolism: fed	CHO classification, absorption, insulin secretion	SR
3	Thursday	12-Jan-23	Fatty Acid Metabolism: Fed	Sources of fatty acids; fatty acid absorption	SR
4	Monday	16-Jan-23	CHO metabolism: fed	Glucose uptake, glycogen synthesis, fatty acid synthesis	GS
5	Wednesday	18-Jan-23	CHO metabolism: fasting	Glycogenolysis, Gluconeogenesis	GS
6	Thursday	19-Jan-23	Fatty Acid Metabolism	Regulation of fatty acid transport and oxidation	GS
7	Monday	23-Jan-23	Journal Club	Contemporary issue in metabolism	GS
8	Wednesday	25-Jan-23	Review	In Class Review #1	GS
9	Thursday	26-Jan-23	In class Test	Test #1	GS
10	Monday	30-Jan-23	CHO/FA metabolism	Exercise	GS
11	Wednesday	01-Feb-23	Regulation of Energy Balance	Appetite Control	GS
12	Thursday	02-Feb-23	Regulation of Energy Balance	Resting Energy Expenditure; role of BAT	GS
13	Monday	06-Feb-23	Integrative Metabolism: Diabetes	Current therapies for diabetes	GS
14	Wednesday	08-Feb-23	Journal Club	Contemporary issue in metabolism	GS
15	Thursday	09-Feb-23	Review	In class Review #2	GS
16	Monday	13-Feb-23	In class Test	Test #2	GS

17	Wednesday	15-Feb-22	Scientific writing and Journal critique	Scientific writing and critique of papers (Part 1)	SR
18	Thursday	16-Feb-22	Scientific writing and Journal critique	How to write and critique papers (Part 2)	SR
	Monday	20-Feb-23	*READING WEEK*	*NO CLASS*	
	Wednesday	22-Feb-23	*READING WEEK*	*NO CLASS*	
	Thursday	23-Feb-23	*READING WEEK*	*NO CLASS*	
19	Monday	27-Feb-23	Nutrients and Metabolism	"A" vitamin and metabolism	JS
20	Wednesday	01-Mar-23	Integrative Metabolism: Performance	Metabolism of ergogenic aids	JS
21	Thursday	02-Mar-23	Integrative Metabolism: disease	Insulin resistance: T2D	JS
22	Monday	06-Mar-23	Integrative Metabolism: Disease	Immunometabolism: T2D	JS
23	Wednesday	08-Mar-23	Integrative Metabolism: Disease	Immunometabolism: flora/obesity	JS
24	Thursday	09-Mar-23	Review	In class Review #3	JS
25	Monday	13-Mar-23	Online Test	Test #3	JS
26	Wednesday	15-Mar-23	Immunology-metabolism	Contemporary issue in immunometabolism	DM
27	Thursday	16-Mar-23	Metabolism: Host-microbe	Contemporary issue in microbiota and metabolism	HF
28	Monday	20-Mar-23	Integrative Metabolism: Disease	Lipoproteins: Structure and function	JS
29	Wednesday	22-Mar-23	Integrative Metabolism: Disease	Lipoproteins: CVD	JS
30	Thursday	23-Mar-23	Integrative Metabolism: Disease	Immunometabolism: CVD	JS
31	Monday	27-Mar-23	Review	In class Review #4	JS
32	Wednesday	29-Mar-23	Online Test	Test #4	JS
33	Thursday	30-Mar-23	Early Life Origins of Health and Disease	Sex differences in metabolism and diabetes ASSIGNMENT IS DUE	DS
34	Monday	03-Apr-23	Early Life Origins of Health and Disease	Maternal lineage contributions to metabolism	DS

35	Wednesday	05-Apr-23	Early Life Origins of Health and Disease	Paternal lineage contributions to metabolism	DS
	Thursday	06-Apr-23	Personal Review	NO CLASS: Prepare for review session	
36	Monday	10-Apr-23	Review	In class Review for final exam	JS
	Wednesday	12-Apr-23	Personal Review	NO CLASS: Prepare for final Exam	

Requests for Relief for Missed Academic Term Work

McMaster Student Absence Form (MSAF): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

This course abides by the MSAF rules and regulations of the Faculty of Science Associate Dean's office. http://www.science.mcmaster.ca/associatedean/ . Please email the Course Coordinator for MSAF enquiries.

Academic Accommodation of Students with Disabilities

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's *Academic Accommodation of Students with Disabilities* policy.

Academic Accommodation for Religious, Indigenous Or Spiritual Observances (Riso)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

Courses with An On-Line Element

In this course we will be using Avenue to learn (A2L). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, usernames 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 a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

Online Proctoring

This course may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

Academic Integrity

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

It is your responsibility to understand what constitutes academic dishonesty.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g., the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the *Academic Integrity Policy*, located at https://secretariat.mcmaster.ca/university-policies-procedures- guidelines/

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.

In this course we may use a software package designed to reveal plagiarism to monitor the content of the Assignment. Students may be required to submit their work electronically and in hard copy so that it can be checked for academic dishonesty.

To avoid plagiarism just follow these basic rules:

1. Do not copy text from articles that have been written by others and offer it as your own work.
2. If you need to quote text written by another author(s), copy the passage accurately, enclose it in quotation marks and reference it appropriately.
3. If you wish to paraphrase (or summarize) experimental results, conclusions, or an original idea or opinion which has been published by another author(s) give a reference to the article.

Authenticity / Plagiarism Detection

In this course we will be using use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to the McMaster Office of Academic Integrity's webpage.

Conduct Expectations

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all our living, learning and working communities. These expectations are described in the *Code of Student Rights & Responsibilities* (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

Copyright and Recording

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

Research Ethics -N/A

Extreme Circumstances

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

Note: Policy on Late Withdrawal

McMaster University provides a Late Withdrawal option to assist students who have become Irretrievably behind in a course. Students who have fallen behind with assignments and/or are not prepared to write final examinations (or equivalent) in one or more courses are encouraged to make use of this option and must contact their Academic Advisor in the Faculty/Program Office. Students will work with their Academic Advisor to discuss the situation and what steps they can take to prevent a recurrence.

The maximum number of units for which students may request a Late Withdrawal is 18 units throughout their undergraduate degree.

Students may request a Late Withdrawal, without petition, no later than the last day of classes in the relevant Term. However, it is important to note that:

- Requests for Late Withdrawal cannot be made in courses for which the final exam (or equivalent) has been attempted or completed. This also includes courses where a final grade has been assigned (e.g., clinical courses).
- Such requests will be cancelled or revoked if it is determined that the student attempted or completed the final exam (or equivalent).
- Students cannot use the Late Withdrawal option for courses in which they are under investigation or for which they have been found guilty of academic dishonesty.

Course(s) approved for Late Withdrawal will be:

- Assigned a non-numeric grade of LWD, in lieu of an alpha/numerical grade
- Excluded from the calculation of the GPA
- Ineligible for tuition refund

Approval of a late withdrawal is final, and requests to be re-enrolled in the withdrawn course(s) will not be considered. A withdrawal will not preclude students from enrolling in the course(s) in a subsequent term.