

Acknowledgement of Indigenous Peoples and Traditional Territories:

York University recognizes that many Indigenous nations have longstanding relationships with the territories upon which our campuses are located that precede the establishment of York University. We acknowledge our presence on the traditional territories of the Mississaugas of Credit First Nation, the Huron-Wendat, the Haudenosaunee Confederacy and the Métis Nation of Ontario.

**York University, Faculty of Health
School of Kinesiology and Health Science
KINE 4445 3.0 PHYSIOLOGICAL BASIS OF FATIGUE**

Course Director: Dr. Arthur Cheng (email: ajcheng@yorku.ca)

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****** This course is designated as in-person teaching. However, due to the current COVID situation, the course will depend on remote teaching on eClass until January 31st, 2022. You will be updated of any changes in the status of the course regarding in-person or remote teaching by the Course Director. All times in the course outline or elsewhere related to this course are in local Toronto time. ******

Official class location (when in-person teaching resumes):**

Health Nursing and Environmental Studies (HNE) building, Room 034

Official “class time”: Tuesday and Thursday 1:00 – 2:30pm. This course will be taught both synchronously and asynchronously, meaning that lecture recordings will be provided in advance of scheduled live lectures. Live classes will occur on Zoom during this class time, and the primary purpose of the live classes will be to supplement the lecture material via a large Q&A session and where relevant, additional exercises to reinforce learning (e.g., Kahoot quizzes). **The live classes will not be recorded and will only be for the benefit of those who attend.**

NOTE: In the instance that eClass malfunctions, consider copying the Zoom link for our KINE4445 remote classroom onto your desktop so you will not be disrupted by any eClass malfunctions.

Lecture recordings: Please note that 1) the recordings should be used for educational purposes only and as a means for enhancing accessibility; 2) students do not have permission to duplicate, copy and/or distribute the recordings outside of the class (these acts can violate not only copyright laws but also **FIPPA** <https://www.ontario.ca/laws/statute/90f31> and intellectual property rights); and 3) all recordings are to be destroyed after the end of classes.

Office Hours: The instructor is generally available for questions following the class. There are no formal office hours. You must book a time by emailing the Course Director at ajcheng@yorku.ca, or the assigned TA to be sure to have sufficient time to review your questions. Remote meetings are normally conducted on the KINE4445 eClass Zoom classroom link.

NOTE: To respect privacy, any meetings are only to take place between the student and the Course Director and it is your responsibility to inform the Course Director if anyone else is in the room. Any type of recording of meetings conducted between the student and Course Director are prohibited.

Technical Requirements for Taking this Course: Since some components of the course will be delivered remotely, several platforms will be used (e.g., eClass, Zoom, Kahoot, and Slido) through

which students will interact with the course materials, the course directors, Teaching Assistants, as well as one another. Therefore, a computer or smart device with a camera and microphone is required to complete the course.

Useful links describing computing information, resources and help for students:

<u>Student Guide to Moodle</u>	https://lthelp.yorku.ca/student-guide-to-moodle
<u>Computing for Students Website</u>	https://student.computing.yorku.ca/
<u>Student Guide to eLearning at York University</u>	http://elearning-guide.apps01.yorku.ca/
<u>Learning Skills Services</u>	https://lss.info.yorku.ca/online-learning/
<u>Zoom@YorkU User Reference Guide</u>	http://staff.computing.yorku.ca/wp-content/uploads/sites/3/2012/02/Zoom@YorkU-User-Reference-Guide.pdf
<u>Zoom@YorkU Best Practices</u>	https://staff.computing.yorku.ca/wp-content/uploads/sites/3/2020/03/Zoom@YorkU-Best-Practicesv2.pdf

Internet Connection Issues: Students must make every effort to arrange adequate internet connection, especially for any online tests and exams. If a student has any specific concerns about their internet connection, they should seek all available options for writing their exam in a location with a stable internet connection. In the event that a student is not confident they can access a reliable internet connection, they should communicate their concerns to the Course Director well in advance of the test/exam.

A way to determine Internet connection and speed: there are online tests, such as [Speedtest](https://www.speedtest.net/), <https://www.speedtest.net/> that can be run.

COURSE DESCRIPTION:

Scope: This course is an in-depth examination of the physiological processes that limit muscular contractile activity during physical activity. Evaluation of systems and processes impacting exercise-induced fatigue (fatigability) will range from cellular through to whole body perspectives. An evidenced-based approach using human and animal models of physical activity will include topics, such as: central limitations (central nervous system) and peripheral limitations (cellular, ionic and metabolic regulation; substrate depletion; and product accumulation(s)), and these concepts will be applied to holistically understand the mechanism of fatigue in situations such as aging and disease.

COURSE OBJECTIVES:

By the completion of this course, successful students will be able to:

- Identify appropriate definitions, protocols, designs, and methods used in the study of exercise-induced fatigue
- Describe and explain the extent to which various cellular sites contribute to exercise-induced fatigue
- Develop and apply critical thinking skills to assess fatigue mechanisms under specific situations and determine effective interventions to counteract fatigue

COURSE LEARNING OUTCOMES:

Students should be able to demonstrate mastery of the following abilities:

- Contextualize and communicate information of generally accepted concepts and principles in muscle function, fatigability and performance of physical activity.
- Be able to think critically and understand theory(ies) and recurrent issues in muscle function, fatigability and performance of physical activity.
- Apply knowledge to particular problems or situations (problem-solve) encountered within

neuromuscular muscle function in exercise-induced fatigue and be aware of the limits in knowledge and methodologies when analyzing, evaluating, interpreting and disseminating information.

READINGS and TEXTBOOKS:

There is NO required course textbook and/or workbook for KINE 4445

Where appropriate, **required** readings (i.e., their content is eligible for assessment on class assessments/exams) in the form of handouts, articles from scientific journals and review articles will be identified and posted on eClass.

COURSE EVALUATION: IMPORTANT NOTE - Students are responsible for being actively involved in the course, and for checking eClass regularly and frequently to ensure you have the latest information about the course. “I did not know because I was not online” or “because I did not check eClass” are not excuses that will be accepted under any circumstances for the course.

<u>Required Grading Components</u>		<u>Important Deadlines/Dates</u>
Critical Assessment Project #1	5%	Feb. 18
Critical Assessment Project #2	10%	Mar. 18
In-Class Exam #1*	30%	Feb. 10
In-Class Exam #2*	30%	Mar. 24
Translational Fatigue Project – Group Assignment	25% total	
Topic Abstract Deadline***	(5%)	Feb. 4
Fatigue Mechanism (Oral Presentation)	(5%)	Mar. 1, 3
Intervention (Oral Presentation)	(10%)	Mar. 29, 31, Apr. 5, 7
Presentation slides submission	(5%)	Apr. 7

* In-Class Exams will begin at 1:00pm.

*****NOTE:** The topic must be **PRE-APPROVED** by the instructor before the Topic Abstract Deadline or otherwise the Course Director will pick your topic for your group.

CRITICAL ASSESSMENT PROJECTS (C.A.P.)– Each student will be responsible for critical appraisal of a research paper (specific topics and papers will be determined by the instructor). An overview of the critical appraisal approach to be used for this project will be included in the lecture material. In general, a student’s report must conform to the format/style identified in the critical appraisal lecture. All students are required to submit the assignments on eClass at 11:59pm on the deadlines mentioned above in section “Required Grading Component”. **Be sure the assignment is the required format (PDF) and to allow yourself sufficient time to complete/submit the project before the deadline – the grades for late assignments will be deducted at a rate of 10% per day off of your final grade for this assignment.**

EXAMS: Exams will be held within the designated class time of 1:00 – 2:30 pm for KINE4445. The content to be assessed for the in-class exams is non- cumulative. Assessments may include combinations of multiple choice and short answer, and will cover content from lectures, in-class discussions and assigned required readings. Tests will require students to demonstrate in-depth knowledge and application of course content.

If you begin a test and it is interrupted due to technology issues (i.e. lost internet connection), email the Course Director IMMEDIATELY at ajcheng@yorku.ca. On a case-by-case basis, the Course Director will either re-open the test or assign a deferred test. The Course Director will be monitoring the ajcheng@yorku.ca email account at all times during exams.

TRANSLATIONAL FATIGUE PROJECT - GROUP ASSIGNMENT - An overview of this group assignment will be included in the lecture material. Students will form groups of **3 people** and will be required to prepare: 1) a **Topic Abstract**, 2) a **5-min Oral Presentation of the Fatigue Mechanism(s) in your chosen scenario**, 2) a **10-min Oral Presentation of your Proposed Intervention**, and 3) **submission of your Presentation Slides** focused on determining the mechanisms of fatigue in a particular fatigue-related scenario with evidence-based advice on how to counteract fatigue specific to the needs of that scenario. Students can choose their research topic **BUT- the student's specific focus/topic must be approved after consultation with the course director (this must occur prior to the deadline shown in "Required Grading Components")**.

1) **Topic Abstract:** The abstract will be a maximum of 200 words and will outline the specific case scenario being investigated, and it will outline the proposed fatigue mechanisms involved. You will also state your proposed intervention in counteracting fatigue. Add at least one reference to support your proposed fatigue mechanism, and add at least one reference to support your proposed intervention. This abstract will help quick start the research for your project. The abstract should be in 12 pt. font and double spaced. (5% of final grade)

1) **Fatigue Mechanisms Presentation:** This oral presentation will be 5 min and maximum 5 powerpoint slides and will introduce the specific case scenario with at least 3 peer-reviewed journal references used to explain the potential mechanism causing fatigue under this circumstance. This presentation will also help you prepare for your final graded oral presentation with student and professor feedback provided to improve your presentation material and presentation style. (5% of final grade)

2) **Intervention Presentation:** This oral presentation will take place in-class on dates shown in "*Required Grading Components*" and will be 10 min with a maximum of 10 powerpoint slides, followed by a 5 min Q&A period. This presentation includes content from your Fatigue Mechanisms Presentation with additional new content on your evidence-based intervention to counteract fatigue. (10% of final grade)

3) **Presentation Slides Submission:** Submit the final presentation slides used in your oral presentation for grading. (5% of final grade) The Presentation Slides must be submitted on eClass by 11:59pm on deadline shown in "*Required Grading Components*". **The grades for late assignments will be deducted at a rate of 10% per day off of your final grade for this assignment.**

Grading: The grading scheme for this course conforms to the 9-point grading system used in undergraduate programs at York. Assignments and tests/exams will be given a numeric grade out of 100, which will correspond to a letter grade (e.g. A+ = 90 to 100, A = 80 to 90, B+ = 75 to 79, etc). Should a student have issue with the grade received, a written submission to the Course Director must be received within one week of receiving the grade with specific detail on why the grade should be changed. Re-marking may result in the grade going up, down, or staying the same.

Policies:

Course Conflicts: Taking any overlapping course occurring at the same lecture time as KINE4445 is **NOT PERMITTED** as this will interfere with the student's ability to attend live lectures, it will result in conflicting exam times, and it will create conflicts with scheduling your group oral presentations. **Under no circumstances will the Course Director accommodate to students taking another course that conflicts with KINE4445.**

Grading: Any appeal for grade revision (a) must be received by the Course Director WITHIN 7 CALENDAR DAYS following the date of the assessment/assignment/exam grade being released, b) must be MADE IN WRITING, and c) must EXPLICITLY STATE why the student believes the grade is in error. Grade disputes after this 7-calendar day period will not be considered.

Missed assessments/exam/assignments: If you miss an assessment/exam/assignment for a legitimate reason (i.e. illness), you are expected to email the Course Director (ajcheng@yorku.ca) and attach the Faculty of Health Missed Test Documentation (<https://yorku.ca/health/academic-resources/missed-test-form/>) **within 7 calendar days of the test** to be considered for a deferred assessment/exam/assignment. No further supporting documentation is required.

Deferred Exam Dates: Unless otherwise stated, deferred exams will take place on the following dates: Deferred In-Class Exam #1 (Friday Mar. 4th, 7:00-8:30pm), Deferred In-Class Exam #2 (Friday Apr. 8th, 7:00-8:30pm).

Lateness Penalty (as described above): Exceptions to the lateness penalty for valid reasons such as illness, compassionate grounds, etc., may be entertained by the Course Director but will require appropriate supporting documentation. In the absence of a legitimate documented reason for submitting a late assignment, the students requests may be denied.

IMPORTANT COURSE INFORMATION FOR STUDENTS

All students are expected to familiarize themselves with the following information, available on the Senate Committee on Curriculum & Academic Standards webpage (see Policies, Procedures, and Regulations) at <https://www.yorku.ca/secretariat/policies/>

- Senate policy on academic honesty and the academic integrity module
- Ethics Review Process for research involving human participants
- Course requirement accommodation for students with disabilities, including physical, medical, systemic, learning and psychiatric disabilities
- Student Conduct Standards
- Religious Observance Accommodation

York's Academic Honesty Policy and Procedures/Academic Integrity Module

In this course, we strive to maintain academic integrity to the highest extent possible. Please familiarize yourself with the meaning of academic integrity by completing SPARK's [Academic Integrity module](#) at the beginning of the course. Breaches of academic integrity range from cheating (i.e., the improper crediting of another's work, the representation of another's ideas as your own, etc.) to aiding and abetting (helping someone else to cheat). All breaches in this course will be reported to the appropriate university authorities, and can be punishable according to the [Senate Policy on Academic Honesty](#).

To promote academic integrity in this course, students will be normally required to submit their written assignments to Turnitin (via eClass) for a review of textual similarity and the detection of possible plagiarism. In so doing, students will allow their material to be included as source documents in the Turnitin.com reference database, where they will be used only for the purpose of detecting

plagiarism. The terms that apply to the University's use of the Turnitin service are described on the Turnitin.com website.

COURSE OUTLINE:

The course material below provides an overview of some of the course content. The instructor will attempt to cover the following sections and topics but not necessarily in the order presented below and/or in formal lectures. Some topics may be covered less formerly in assigned readings and/or assigned projects depending on the circumstances and needs of the class.

Definitions and Conceptual Framework of Fatigue
Historical perspectives of fatigue
Methodological approaches and models in the study of fatigue
Quantifying exercise-induced fatigue

Major Theme: Effects of Exercise Intensity on Fatigue (high-intensity vs. prolonged endurance exercise)

Potential Sites of Exercise-induced Fatigue

Central Fatigue:

- motor unit recruitment and activation
- voluntary activation of the motor cortex
- supraspinal and spinal mechanisms of central fatigue
- compound muscle action potential
- neuromuscular junction

Peripheral Fatigue:

- sarcolemmal membrane transmission and function
- intracellular calcium handling (sarcoplasmic reticulum, SERCA)
- myofibrillar fatigue (myofibrillar calcium sensitivity, crossbridge attachment and kinetics)
- substrate depletion – ATP, CP and glycogen
- metabolite accumulation – lactic acid, hydrogen ion, inorganic phosphate, ADP
- reactive oxygen and nitrogen species – ROS/RNS
- cardiorespiratory fatigue – respiratory muscle fatigue, cardiac fatigue

Fatigue in Specific Populations:

- aging
- disease (e.g., ALS, multiple sclerosis, McArdle's disease, mitochondrial myopathy)
- COVID-19