Life Sciences 2L03
Living Systems Lab

Note: This is a tentative outline as of June 2016.
Modifications to module order/content may vary slightly.

LEAD INSTRUCTOR:
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MODULE INSTRUCTORS:
Rosa da Silva
Nikol Piskuric
Krista Madsen
Sunita Nadella

INSTRUCTIONAL ASSISTANTS:
TBA

COURSE DESCRIPTION:

In this laboratory-based, inquiry course we will explore diverse techniques used by researchers to probe fundamental questions in the Life Sciences. The questions that we will examine in Winter 2017 will address fundamental processes of human ageing.

During the first four modules, we will examine mobility and physiological aspects of ageing from human gait assays to the neuromuscular connections that control movement in model organisms such as crickets and worms. We will explore how epidemiological studies can inform our understanding of human ageing. In the second four modules, we will probe some aspects of cellular ageing from the impacts of accelerators of ageing on epithelial cells to the role of telomeres in molecular ageing and the identification of genes that impact the cellular ageing process. We will see how basic research on model organisms can be used to understand and enhance human health and well-being and how such translational research has already impacted our society. We will also explore how ageing is perceived in our society through simulations of the physiological effects of ageing and the examination of how ageing research is represented in popular media.

COURSE AIMS:

In this course, students will have the opportunity to:
- Develop a scientific attitude towards data analysis and interpretation.
- Use different forms of microscopy in the capture and analysis of data.
- Use various techniques and equipment common to studies in physiology, histology, and molecular biology.
- Use animal model systems to study mechanisms of physiological and cellular ageing.
- Learn how to present data for different audiences.
- Engage in scientific discourse with peers and instructors.
- Reflect upon skills learned in the lab.
- Gain an understanding of the principles of translational research
- Discuss the relevance of basic research in society
ONLINE CONTENT:
This course uses Avenue to Learn to post the course outline, assignments, and other notices. Go to http://avenue.mcmaster.ca to find out how to log-on to the course's platform.

TEXTBOOK:
There is no required textbook for this course. Required readings will be provided for each lecture.

EVALUATION:
Each lab will be preceded by an online quiz that will prepare you for the lab techniques. Working in groups of four, you will maintain a collaborative online lab notebook in which you will collect, analyze, and summarize data and plan future experiments. There will be two practical lab tests that will allow you to demonstrate your laboratory and analytical skills. There will be two opportunities to practice scientific communications, through one presentation and one essay. There will be two opportunities for reflections on tutorial activities.

Online quizzes: 10%
Lab notebook: 10%
Practical tests: 40%
Presentation (tutorial): 15%
Essay: 15%
Reflections: 10%

SCHEDULE:
Every module will begin with a lecture on Monday (50 minutes) that will introduce the topic. Your lab will fall on a Monday, Tuesday, Wednesday, or Thursday (1 hour and 50 minutes). Your tutorial will come Wednesday, Thursday, or Friday (1 hour and 50 minutes).

NOTE: Your lab and tutorial scheduling are tied so that you are in the same lab and tutorial as your group partners each week. When you select your lab time, your tutorial time is automatically assigned.

Modules:

Week 1: Movement
Topic lead: Krista Madsen
Gait is the pattern of movement of the limbs of animals, including humans, during locomotion over a solid ground. Gait disorders are common both with aging and are a risk factor for dependence, cognitive decline, falls and death. We will examine how gait is measured and what changes happen as the body ages.
**Week 2: Neurobiology**  
Topic lead: Nikol Piskuric  
The SpikerBox is a "bioamplifier" that allows you to hear and see action potentials of real living neurons. We will use insects as a model for studying neural function using the SpikerBox and examine studies conducted in humans to measure changes that occur with aging.

**Week 3: Neuromuscular junction**  
Topic lead: Rosa da Silva  
Using *C. elegans* as a model system, we will look at how changes in neural function that occur with aging alter movement in these worms.

**Week 4: Epidemiology**  
Topic lead: Kim Dej in collaboration with Parminder Raina CLSA  
The Canadian Longitudinal Study of Aging (CLSA; www.clsae-lcva.ca) is a large, national, long-term study of more than 50,000 people between the ages of 45 and 85. We will partner with CLSA to examine how longitudinal data can be used to understand healthy aging.

**Week 5: Ageing simulation**  
What is it like to experience some of the physiological effects of ageing?

**Week 6:**  
Lab practical test will occur in your lab time slot.

**Week 7: Accelerating aging**  
Topic lead: Sunita Nadella  
Diverse environmental parameters can accelerate aging including temperature, exposure to UV light, oxygen supply, and desiccation. We will partner with the Origins Institute to use their environmental chambers to create conditions that accelerate aging of animal skin and look at histological sections to assay the effects. What is the scientific evidence between anti-ageing products?

**Week 8: Radiation and aging**  
Topic lead: Kim Dej with Maureen MacDonald and Michael Farquharson  
Examination of the effects of radiation in the acceleration of aging by looking at histological sections of rat skin tissue and staining for collagen. By extension, we will look at the role of collagen in cardiovascular health.

**Week 9: Telomere shortening**  
Topic lead: Kim Dej  
We will work with the researchers in the lab of Xu-Dong Zhu to measure changes in telomere length that occur in cell culture and compare this to published data that examines telomere shortening that is correlated with aging in humans. We will measure telomere length by terminal restriction fragment length analysis (tentative…)

**Week 10: Genomics of aging**  
Topic lead: Kim Dej  
What genes have been identified in model organisms such as mice, flies, and worms as regulators of aging? What is the role of these genes in accelerated aging or perhaps decelerating or stopping aging? How can we identify the homologous genes in humans?

**Week 11:**  
Lab practical test will occur in your lab time slot.

**Week 12:**  
*The anti-ageing market*  
How are companies profiting from our desire to stop ageing?
REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK:

If you are absent from the university for a minor medical reason, lasting fewer than 3 days, you may report your absence, **once per term**, without documentation, using the McMaster Student Absence Form. Absences for a longer duration or for other reasons must be reported to your Faculty/Program office, with documentation, and relief from term work may not necessarily be granted.

When using the MSAF, enter the Instructional Assistant name and email (TBA) should be entered as the contact for the course and you must contact the Instructional Assistant 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. Please note that the online MSAF can only be used for term work worth less than 25% and it cannot be used for the final examination.

With an approved MSAF the following accommodations may be granted (accommodation is not guaranteed).

- If you miss a lab or tutorial, you are accountable to your group. You may be able to catch up on data and analysis. You may not be given an opportunity to make-up the lab experience, which is testable on the practical lab tests.
- If you miss one of the two practical tests, you will be expected to complete an equivalent test within 24 hours of your return to campus, which is the time that you submit your MSAF (i.e. when you are well).
- If you miss a deadline for essay submission or a presentation, you will be expected to submit or present the assignment within 24 hours of your return to campus, which is the time that you submit your MSAF (i.e. when you are well). Any late submission without an MSAF will be deducted 10% per day.

ACADEMIC DISHONESTY:

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.

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.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at [http://www.mcmaster.ca/academicintegrity](http://www.mcmaster.ca/academicintegrity)

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. While we encourage you to work with your peers in solving problems on your assignments, copying of answers is not acceptable. Your final work must be your own.
- Copying or using unauthorized aids in tests and examinations.

GRADES:

Grades obtained in Life Science 2L03 will be converted according to the scheme generally used at McMaster University which can be viewed here: [http://registrar.mcmaster.ca/exams/grades/](http://registrar.mcmaster.ca/exams/grades/)

When the final marks are obtained, ALL borderline cases will be reviewed and, where warranted, adjustments will be made in the final mark.