

INSPIRE 3EL3 – Experiential Learning Opportunities CO2 – Perspectives in Science Interession, 2022

COURSE OFFERING

Term: Interession 2022

Mode of Delivery: Virtual

Class Dates: Tuesdays & Thursdays in May from 12:30pm-3:30pm; link on Avenue

COURSE COORDINATOR(S)/INSTRUCTOR(S)

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COURSE DETAILS

Class Time and Location: Tuesdays & Thursdays in May from 12:30pm-3:30pm; link on Avenue

This course will be held online via Zoom. Please see the Avenue to Learn site for the course at the beginning of the term for access information. Course evaluations that were previously held in-person will now also be conducted online. Again, please see the Avenue to Learn site for details at the start of the term.

COURSE DESCRIPTION

There are many perspectives to understanding the world, and science provides a method for society to objectively build knowledge. However, scientific papers and textbooks are written by humans who have their **own perspectives, biases and agendas**; often, the **behind the scenes story** is even more interesting.

While exploring an eclectic mix of fascinating topics with short modules from working scientists, we will explore the **history, philosophy, controversies and applications of science**.

In this course, students will gain an expanded view of the nature of scientific research, in-depth knowledge of **contemporary research questions** that scientists at McMaster University are exploring, and become informed and **critical consumers of science** in the media.

COURSE OVERVIEW AND ASSESSMENTS

Course Schedule – Tuesdays & Thursdays in May from 12:30pm-3:30pm

Course Topics

1. What is science? With Dr. Joe Kim and Dr. Constance Imbault (May 3th, 2022)

In this module, we will cover the history and philosophy of science. What is the scientific method? And how do your own individual biases and perspectives impact the type of science you choose to do? We'll also talk about the practical implications and issues of the science of learning, and the differences between doing research in the lab and in the classroom. **No assignment**

2. Co-design scenarios for the future of education with Dr. Ari Mazzeo (May 3rd, 2022)

Using a Scenario building format this workshop will engage students in an online conversation around the Future of Education. The dialogue will follow three key questions and n.3 Scenarios. The students will work in groups to co-create possible solutions. The workshop will finish with a round of key themes/wishes for the future of future of Education collected in a moodboard.

Assignment TBD

3. From proton to picture – an overview of MR imaging with Dr. Bhanu Sharma (May 5th, 2022)

We have all heard about MRI, or magnetic resonance imaging. But do we know how **magnetism** and **resonance** allow us to produce clinical **images**? This module will take you from “proton to picture”, and aims to leave you with an understanding of how MRI scanners generate the images they do. This module will focus on high-level concepts rather than MR physics and requires no prior background in the field. There will be a special emphasis on brain imaging, and in particular, an imaging technique known as functional MRI (fMRI), which allows us to visualize and understand which parts of the brain are active during rest or a given task. We will also use “fMRI heatmaps” to understand how different parts of the brain are associated with one another. The talk will end with a discussion of the research and clinical applications of fMRI.

Assignment: You will be given a set of fMRI images (or “heatmaps”), on a group of

anonymized patients. You will be asked to provide a high-level explanation of how these images are produced, and also explain how you would interpret the images.

4. Enhanced Data Visualization using Python with Dr. Jan-Hendrik Pohls (May 10th, 2022)

A picture is worth a thousand words. This adage is even more true in the current times where we are overloaded with information. Excellent figures generally draw our attention while messy and unorganized figures show the opposite effect. However, graphical software to prepare publishable figures is often expensive and needs to be updated often. The software package Python, on the other hand, has the advantage that a single script can set you up for your entire studies.

The objective of this module is that students can create a variety of figures (*e.g.*, bar charts, pie charts, and heat maps) which can be published in high-impact journals. At the start of the class, students will get familiar with the software package Python. After the introduction, the students will learn to import datasets, fit the data, and generate figures. **Assignment: You will import experimental data, fit the data to exponential functions, and plot the experimental and fitted data in one publishable figure.**

5. Conservation physiology of endangered Canadian fishes with Dr. Andy Turko (May 12th, 2022)

Freshwater ecosystems are one of the most threatened habitats on earth, and Canada's streams, rivers, and lakes are no exception. About 1 in 3 of Canada's freshwater fishes are currently considered to be at risk of extinction. Unfortunately, we know very little about *WHY* populations of these species are in decline, making it difficult to design and implement effective conservation programs. In this module we will learn about the emerging field of *conservation physiology* and its potential to help us uncover the mechanisms responsible for population declines of endangered species. We will learn about several of the scientific tools that conservation physiologists use to study endangered fishes and their responses to changes in the environment. We will also discuss how experimental results from physiological research can be applied to improve several key strategies for species recovery including habitat protection, restoration, and reintroduction. Case studies will include the saga of the redbreasted dace, an endangered fish that may have once lived on the McMaster campus, and after the module we will take an optional excursion to see the former habitat of this fish and discuss some of the restoration activities that have taken place. **Your assignment will be to read the COSEWIC assessment and status report of one of Canada's endangered species and design a physiological experiment to test one of the hypothesized mechanisms thought to be responsible for the population decline of that species.**

6. Chlorinated water and human lives: A piquant mixture of a chili pepper and water in a restaurant glass with Dr. Si Pan (May 17th, 2022)

Humans ingest chlorinated water. I do. And I'd better make sure the water has enough chlorine, especially in a restaurant. Why? Let's look at the play between municipal water, free chlorine, and human health. Also, see if you can understand why I was smelling the very strong chili pepper, before and after dipping it into the water the waiter just gave me. **Explain to a general audience why chlorine is added to water. You can do this in a one-page report, or you can be creative and create a one-page infographic or a 3 minute video.**

7. What can we learn from thought experiments? with Dr. Filippo Costantini (May 19th, 2022)

Experiments play a pivotal role in many different natural sciences since they provide data that can corroborate or falsify a theory. Thought experiments too play an important role in science; but they also have a central role in philosophy. In this class we are going to analyze some of the most famous philosophical thought experiments (such as the trolley problem, the brain in the vat and the Swamp man) to understand what we can learn from them, and how they can shade new light on common ideas and concepts. **Assignment: There are many sci-fi movies that take inspiration from philosophical thought experiments. The most famous example is *The Matrix*, which is based on the brain in the vat thought experiment. But there are others (see for example: <https://theconversation.com/thought-experiments-the-films-that-turn-us-into-philosophers-31338>).**

8. Sex matters: how to study sex differences in the manifestation and progression of diabetes with Dr. Monica De Paoli (May 24th, 2022)

Research in the biomedical field, a wide area of research performed in cells, animal models and humans, has historically been conducted in male subjects. However, findings have been applied to the general population which includes men, women, and gender diverse people which is not exactly the “tailored healthcare” that we all strive for. In recent years this one-size-fits-all-approach overlooked significant differences that we can find in various diseases such as diabetes. For example, did you know that women before menopause have less chance to develop diabetes, compared to men or women after menopause? In this seminar I will take you on a research journey where I will show you how we can assess these sex differences using animal models of diabetes to better understand what is going on in humans. **In your assignment you'll get to be a doctor and you will interpret a widely used diabetes assessment tool.**

9. Understanding Problems in Star and Planet Formation with Dr. Bo Zhao (May 26th, 2022)

Astronomy and Astrophysics are fascinating topics but often seem to be distanced from our daily lives. In fact, most astronomical phenomena we see from earth do not have clear interpretations due to the limit in the current observational instrumentation (e.g., ground-based and space telescopes). As researchers in this field, we constantly strive to understand such astronomical phenomena and provide the best interpretation from basic principles of physics and mathematics. In this short course, we will go through a handful of long-standing puzzles surrounding the formation of stars and planets, and discuss the possible solutions as well as their limitations. **A few of these problems will be given as assignments for you to think through by searching existing literature.**

COURSE EVALUATION/REQUIREMENTS

ASSESSMENT STRATEGY. As is the case with most INSPIRE courses, there will be no tests or exams in this course.

1. **Module Assignment (8 assignments x 10% = 80%):** Each module will have a different assignment. A document outlining the instructions for each assignment will be posted on Avenue.
2. **Final Paper (20%):** At the end of the term, you will submit a final paper talking about what you have learned about science. In this paper, we expect you to reflect upon your learning. Full instructions will be posted on Avenue.

ADMINISTRATIVE POLICIES AND PROCEDURES

E-mail Policy: E-mails must originate from a valid McMaster account, and be sent to the instructor's McMaster email. Please do not use the Avenue messaging function. You must use your McMaster email account to message the instructor. Any email originating from another provider will be deleted (we cannot confirm that the email has come from you).

STUDENTS WITH ACCOMMODATIONS (SAS)

Students With Accommodations (SAS). Please discuss your accommodations with the instructor early in the term so that accommodations can be in place before they are needed.

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”.

ACADEMIC ACCOMMODATIONS 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 ACCOMMODATIONS FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBERVANCES (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

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). 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, 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 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.

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](https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/), 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.

INCLUSIVITY AND ACADEMIC INTEGRITY

The University values integrity, inclusiveness and teamwork, and strives to support the personal and collective growth of the McMaster student community.

These values are foundational to ensuring campus environments – both in-person and virtual – are conducive to personal wellbeing and academic success.

AUTHENTICITY / PLAGARISM DETECTION

In this course, we will be using 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 www.mcmaster.ca/academicintegrity.

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.

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.