

## PSCB90H3 Physical Sciences Research Experience - Summer 2021



This course provides an opportunity for students to work with a faculty member and carry out original research. Students will provide assistance with one of the faculty member's research projects, while also earning credit. Students will gain first-hand exposure to current research methods and share in the excitement of discovery of knowledge acquisition. Progress will be monitored by regular meetings with the faculty member and through a reflective journal. Final results will be presented in a written report and/or a presentation at the end of the term. Approximately 120 hours of work is expected for the course.

**Prerequisite:** Permission of the Course Coordinator (Dr. Shadi Dalili, [sh.dalili@utoronto.ca](mailto:sh.dalili@utoronto.ca))

**Recommended Preparation:** Completion of at least 4.0 credits in a relevant discipline.

**Breadth Requirements:** Natural Sciences

**Link to UTSC Timetable:** <https://utsc.calendar.utoronto.ca/section/physical-sciences>

**Note:** Students must send an application to the course Coordinator (Dr. Shadi Dalili, [sh.dalili@utoronto.ca](mailto:sh.dalili@utoronto.ca)) for admission into this course. Applications must be received by the end of August for Fall enrolment, December 15<sup>th</sup> for Winter enrolment, and **April 30<sup>th</sup> for Summer enrolment.** Typically, students enrolled in a program offered by the Department of Physical and Environmental Sciences and students who have a CGPA of at least 2.5 or higher are granted admission. Approved students will receive a signed course enrolment form to be submitted to the Office of the Registrar.

**Applications must include:**

- 1) A letter of intent indicating the student's wish to enroll in the course
- 2) A list of preferred projects, ranked in order of preference (see project descriptions below)
- 3) A list of relevant courses successfully completed by the student, as well as any relevant courses to be taken during the upcoming semester

## Project 1 (Chemistry)

**Title:** Developing New Lab Material for CHMB41H

**Supervisor:** Prof. Shadi Dalili ([sh.dalili@utoronto.ca](mailto:sh.dalili@utoronto.ca))

### Project Description

Students involved in this project will be able to develop and modify new laboratory experiments for Introductory Organic Chemistry I (CHMB41H). Students will work with the course instructor to select new experiments from the chemistry education literature, test the experiments, and prepare accompanying lab manual instructions and demonstrator notes. Students will learn skills such as literature searching and analysis, and utilize essential lab techniques such as extraction, distillation, recrystallization, reflux, etc. to develop new labs for the course. Students will also develop written scientific and communication skills through preparing lab manual writeups, quizzes, and TA documents for each experiment developed.

Students Required: 1-2 positions

Qualifications: Completion of CHMB42 with a minimum course grade of B+ and lab grade of A-; must be available for lab work 2 full days during the week between 9am-5pm, ideally Tues, Wed and/or Thurs.

*Please send updated resume and transcript to [sh.dalili@utoronto.ca](mailto:sh.dalili@utoronto.ca)*

## Project 2 (Chemistry)

**Title:** Developing New Tutorial Material for CHMB41H

**Supervisor:** Prof. Shadi Dalili ([sh.dalili@utoronto.ca](mailto:sh.dalili@utoronto.ca))

### Project Description

Students involved in this project will be expected to develop new tutorial worksheets and quizzes based on current CHMB41H course content, using reputable scientific resources and textbooks.

Students in this placement will work with the course instructor to select and develop appropriate questions and exercises from the chemistry education literature, textbooks, and online resources to prepare tutorial materials and quizzes, along with demonstrator notes. Students will learn skills such as literature searching and analysis, and proper design of problem sets and questionnaires. Students will also develop written scientific and communication skills through developing problem sets, quizzes, and TA documents for each tutorial section.

Students Required: 1-2 positions

Qualifications: Completion of CHMB42 with a minimum course grade of B+.

*Please send updated resume and transcript to [sh.dalili@utoronto.ca](mailto:sh.dalili@utoronto.ca)*

## Project 3 (Environmental Science)

**Title:** Green Infrastructure Benefits Evidence and Communication

**Supervisor:** Prof. Laura Tozer ([laura.tozer@utoronto.ca](mailto:laura.tozer@utoronto.ca))

### Project Description:

The student will research and synthesize findings on nature-based solutions for city sustainability problems. Nature in cities and towns provides a number of benefits, including managing water, enhancing biodiversity, climate change mitigation and adaptation, and positive impacts for health and well-being. This project involves synthesizing evidence about the performance of green infrastructure particularly for an audience of policy makers and practitioners and it also involves the collection of online information about green infrastructure examples in Canadian communities.

We are working with community partners interested in expanding green infrastructure in Canadian communities to connect research to action. The student will gain skills in academic and grey literature review, case study research on urban green infrastructure, and the communication of scientific evidence for practitioner audiences.

**Qualifications:** Completion of EESA01 or equivalent

### Project 4 (Chemistry)

**Supervisor:** Prof. Nirusha Thavarajah ([nirusha.thavarajah@utoronto.ca](mailto:nirusha.thavarajah@utoronto.ca))

**Title:** Developing New Lab Materials for CHMA10H3 & CHMA11H3

**Project Description:** Students will work with the instructor to develop new lab materials (lab content, pre-lab questions, lab quizzes, lab report sheets, lab demo notes, post-lab question, narrative for lab skills videos and lab skills videos) based on CHMA10H3, & CHMA11H3 course content, text books and other reliable scientific resources.

**Learning Skills:** Literature search, critical thinking, problem solving & scientific writing skills.

**Qualification:** Completion of CHMB42H3 with a minimum grade of B+. Please send updated CV & transcript to [nirusha.thavarajah@utoronto.ca](mailto:nirusha.thavarajah@utoronto.ca).

2 position available for developing CHMA10H3 lab materials

2 position available for developing CHMA11H3 lab materials.

### Project 5 (Chemistry)

**Supervisor:** Prof. Nirusha Thavarajah ([nirusha.thavarajah@utoronto.ca](mailto:nirusha.thavarajah@utoronto.ca))

**Title:** Developing New Tutorials & Test Bank Questions for CHMA10H3 & CHMA11H3

**Project Description:** Students will work with the instructor to develop tutorial and test bank questions based on existing CHMA10H3, & CHMA11H3 course content, text books and other reliable scientific resources. The questions created will be proof read and uploaded on to the CHMA10 & CHMA11 Quercus question bank.

**Learning Skills:** Literature search, critical thinking, problem solving & scientific writing skills.

**Qualification:** Completion of CHMB42H3 with a minimum grade of B+. Students completing CHMA10 & CHMA11H3 with an A or A+ are also eligible to apply. Please send updated CV & transcript to [nirusha.thavarajah@utoronto.ca](mailto:nirusha.thavarajah@utoronto.ca).

1 position available for developing CHMA10H3 tutorial & test bank questions.

1 position available for developing CHMA11H3 tutorial & test bank questions.

### Project 6 (Chemistry)

**Title:** Electrochemical synthesis of ammonia

**Supervisor:** Prof. Oleksandr Voznyy ([o.voznyy@utoronto.ca](mailto:o.voznyy@utoronto.ca))

**Project Description:** Our group is interested in electrochemical reduction of nitrogen gas into ammonia in water. The project will mainly involve electrochemistry testing of catalysts, optimizing electrochemical reactors, NMR analysis. Students could also be exposed to theoretical computations. Students will learn electrochemistry, material science, and chemical engineering knowledge. Students will work on this project led by the PhD student. This project requires in-person lab experiments.

**Qualifications:** Completion of CHMA10, CHMA11, and CHMB16 with minimum grade of B+.