

PSCB90H3 Physical Sciences Research Experience – Fall 2024



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. Effie Sauer, effie.sauer@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 should connect with a faculty supervisor, then reach out to the course coordinator (Dr. Effie Sauer, effie.sauer@utoronto.ca) to request a Supervised Study Form. After this form is completed and signed, you will be added to the course on ACORN automatically. 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** are granted admission.

Please see the following page for a **preliminary** list of available projects
(More will be posted in late August)

Project 1 (Chemistry)

Supervisor: Prof. Effie Sauer (effie.sauer@utoronto.ca)

Title: Development of New Laboratory Experiments for CHMC42

Number of Positions: 1-2 students

Project Description: Students involved in this project will work closely with the faculty supervisor to research, test and troubleshoot new experiments for use in Organic Synthesis (CHMC42). Experiments will be evaluated for safety, reliability, and alignment with key course topics. In addition to testing and troubleshooting the experiments, students will participate in the development of accompanying lab materials including lab manual pages, demonstrator notes and quiz questions. As part of the project, students will further develop their skills in literature research, critical thinking, writing, scientific reporting and communication.

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

Project 2 (Chemistry)

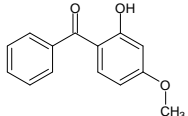
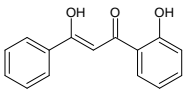
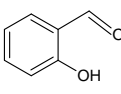
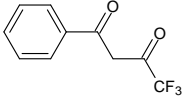
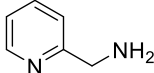
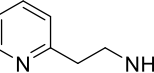
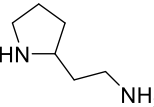
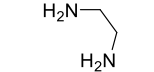
Supervisor: Prof. Alen Hadzovic (alen.hadzovic@utoronto.ca)

Title: Developing the library of keto-amine ligands for coordination chemistry

Number of Positions: 1 student

Project Description: The goal of this project is to synthesize and characterize keto-amine compounds that are potential ligands in coordination chemistry. The approach, somewhat similar to combinatorial chemistry, is based on the matrix below (with ketone and amine reactants presented in top row and left column respectively). The goal is not to completely fill the matrix, but rather have clear, reproducible synthetic procedures and complete characterization for each completed reaction during the academic year. The characterization of the products involves physical description, basic solubility tests (for solid products), spectroscopic characterization (NMR, IR) and, where applicable, single crystal X-ray analysis. This work is going to further develop basic lab skills, interpretation of spectra, scientific writing skills (experimental procedure, data analysis and presentation etc.), and formal scientific writing skills.

Qualifications: Completion of two or more B-level chemistry courses (preferably CHMB31 & CHMB41), with an average grade of B, and lab grades of B+. The project is particularly suited for students interested in pursuing C- and D-level inorganic chemistry courses (or those already enrolled) as an introduction to the research in the field. For further information and to express interest in this project (or other opportunities) please send an e-mail to alen.hadzovic@utoronto.ca.

C=O compounds \ Amines					
		1	2	3	4
	A				
	B				
	C				
	D				

Project 3 (Chemistry)

Supervisor: Prof. Alen Hadzovic (alen.hadzovic@utoronto.ca)

Title: Development of New Laboratory Experiments for CHMB31

Number of Positions: 2 students

Project Description: The students involved in this project will work on developing new experiments for Introduction to Inorganic Chemistry (CHMB31) laboratory. Future experiments will focus on simple acid-base and redox chemistry and simple inorganic synthesis. The tasks involved include developing and designing the experimental procedures, carrying out the actual experimental procedure, organization of results, preparation of material for lab manual and demonstrators, and report sheets. The critical component will also be the direct integration of experiments with the course material, existing CHMB31 lab experiments and videos for online labs. The students will further develop literature research skills, critical analysis of available materials (literature, course, and laboratory), writing skills, scientific reporting, and communication.

Qualifications: Completion of CHMB31 with a minimum course grade of B and lab grade of B+. For further information and to express interest in this project (or other opportunities) please send an e-mail to alen.hadzovic@utoronto.ca.

Project 4 (Chemistry)

Supervisor: Prof. Alen Hadzovic (alen.hadzovic@utoronto.ca)

Title: Lithium: From geosphere to anthroposphere

Number of Positions: 1 student

Project Description: In today's technological and information-driven society, lithium batteries play a central role. Found everywhere from cellphones to electric vehicles, they power, what we believe to be, a cleaner future and provide the flow of information. But at what cost? This project is going to collect information and critically analyze the industrial and chemical route from lithium ores to the point of consumption (or as far as we can find the information). The aims are to better understand the impact of lithium production on our environment and society and to discuss the sustainability of the processes involved. The multifaceted approach will look at these questions from geological, industrial, environmental and sustainability points of view. The material will be used as a basis for educational material in sustainability-focused environmental studies and in introductory inorganic chemistry courses. Most of the work can be done remotely. The students will develop literature research skills, critical analysis, organization, and presentation of collected material. The project is particularly suitable for students interested in interdisciplinary research (environmental studies, geology, chemical industry, chemistry, and society) and is an extension of "Discovery of Lithium: Times and Places."

Qualifications: Completion of two or more B-level chemistry courses (preferably CHMB31), with an average grade of B. Asset are courses from EES (geology related in particular) and EST programs. For further information and to express interest in this project (or other opportunities) please send an e-mail to alen.hadzovic@utoronto.ca.

Project 5 (Chemistry)

Supervisor: Prof. Shadi Dalili (sh.dalili@utoronto.ca)

Title: Campus Farm Project

Number of Positions: 1-2

Project Description: One of the goals of this project is to select several top proposals from prior experiential learning projects that student groups had submitted in previous semesters of the CHMB41H course and transform them into research-based undergraduate labs, not only for the course, but as research projects for our 2nd year (PSCB90Y) and 4th year (CHMD90Y) research students.

Students involved in this project will be responsible for testing out some of the top proposals for projects such as: a) identifying substances to favour the development of traditional tobacco plant microbiome in the soil; b) developing a natural rabbit repellent spray to protect farm crops; and c) preparing natural fertilizers using waste and compost generated on the farm using non-toxic and household products and chemicals, to name only a few.

Students will visit the Campus Farm to collect samples and use them in the lab, employing techniques learned in analytical and organic chemistry courses, to test and develop protocols for the above-mentioned projects. Successful methods and any developed materials will be given to the Campus Farm for testing and assessment of efficacy for their intended purpose.

Students will be responsible for writing lab manual protocols and reports on the final outcomes.

Qualifications: Completion of CHMB41H/CHMB42H and CHMB16H 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.