This course provides an opportunity for students to work closely with a faculty member. Students will provide assistance with one of the faculty member's research projects, while also earning course credit. Students will gain first-hand exposure to current research methods, and share in the excitement of discovery and knowledge acquisition. Progress will be monitored by regular meetings with the faculty member and through a reflective

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Open access databases on plant functional traits the morphological, chemical, and physiological characteristics of plants and plant parts such as leaves, roots, and stems have been instrumental in advancing our understanding of how environmental change is influencing terrestrial ecosystems worldwide. Owing to the popularity and utility of trait databases for ecological research, in recent years there has been an explosion of open access functional trait databases. There now exists dozens of individual trait databases, which cumulatively contain thousands of observations on plant traits across thousands of different plant species. Each database differs in its focal species, geographic location, or traits. As such, it has become challenging to 1) understand the differences of trait databases, and 2) quickly identify a trait database that is most applicable to a given research question or project. This PSCB90 project is focused on summarizing, categorizing, and documenting the dozens of plant trait databases that exist globally. Under the supervision of Dr. Martin, this project entails locating, reading, and summarizing scientific papers on functional trait databases, and management and analyzing this data in Excel. In doing so, this project is expected to contribute to an invited peer-reviewed publication in the journal *Functional Ecology* in 2022.

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Scientific evidence for warming of the climate system is clear. Although attempts have been made to tackle the climate change, warming due to anthropogenic emissions of greenhouse gases will continue over the next two or three decades. This will continue to cause impacts on human system including infrastructure, industry and natural resources. Therefore, countries, regions, and cities will have to adapt to the changes that are already underway. A part of the solution to this problem is to

Students involved in this project will perform literature search for the new laboratory experiments for the new General Chemistry II CHMA12H3 course. Each experiment will be evaluated on relevance to the course material, price, and level of difficulty. Most promising experiments will be performed in a lab. Students will participate in preparation of the practical part of each experiment as well as prepare sets of potential quiz questions. The working schedule will be bu
availability.

Completion of CHMB41/42 with a minimum grade of B+.

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.

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

Developing and Optimizing ligand exchange procedures for heavy-metal free quantum dot inks for thin-film solar cells.

One of the key challenges in the development of thin-film quantum dot based solar cells, involves converting CQD solutions to perfectly packed, high quality films. During the synthesis, the dots are covered with organic ligands, preventing aggregation in solution. These organic ligands need to be removed, to achieve a compact conductive active layer. This project will focus on investigating ligand exchange processes, which would allow for the conversion to very short conductive ligands composed of halides or inorganic compounds.

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

Prof. Oleksandr Voznyy (o.voznyy@utoronto.ca)

Developing Earth Abundant Metal Catalysts for Water Oxidation in Acid

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Water oxidation is an integral component of various electrocatalytic processes such as CO2 reduction and water splitting. Unfortunately, its high energy requirements make the process a hinderance to the overall efficiency of the parent processes. Catalysts have been developed to minimize this bottleneck; however, the majority remain limited to alkaline conditions, with few counterparts capable of delivering in acidic conditions, the conditions of choice for PEM based fuel-cell systems. This project will focus on the development of novel high-performance earth abundant catalysts for OER.

Material synthesis and electrochemical characterization.

This will vary from week to week depending on the work. A minimum of 10-20 hours a week are recommended.

CHMB31 and CHMB42 are recommended but not necessary

Students will work with the faculty member and collaborate with students from the Diversity in the Workplace (MGHC23) course at UTSC and students from a South Asian University to -member