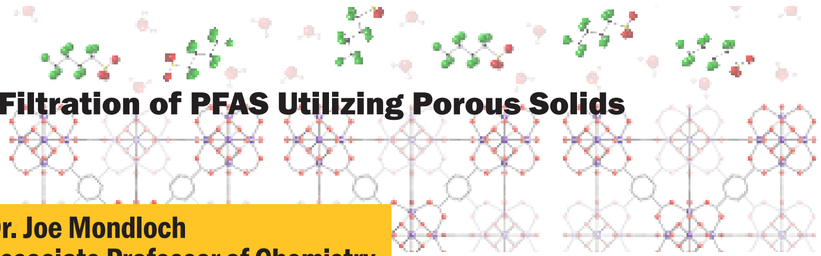
Chemistry Research Opportunities at UWSP



Filtration of PFAS Utilizing Porous Solids

Dr. Joe Mondloch
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Description: Poly- and perflouoroalkyl species (aka PFAS) are ubiquitous man-made chemicals that are persistent in the environment and been shown to cause adverse human health effects. Strategies are needed to remove PFAS from the environment as well as industrial waste streams. Our research focuses on making porous solids called metal–organic frameworks (MOFs) that are capable of removing PFAS from water. Understanding how the mechanism(s) by which this process works is a crucial aim of our research.

Techniques: Powder X-ray Diffraction, NMR & IR Spectroscopy, SDT, Nitrogen Adsorption
General Requirements for Students: Students should have completed Chem 105 and have at least 3 hour/week to commit to research
Number of new students: 4
Project Timeline: Fall

Photoremediation in Hemp: Chemical Analysis

Dr. Shannon Riha
Associate Professor of Chemistry
sriha@uwsp.edu

Description: Hemp has the potential to clean up the soil in which it grows by sequestering toxins (e.g., heavy metals, per- and polyfluoroalkyl substances (PFAS), etc.) into its roots, stems, and flower material. Because hemp is harvested for CBD, among other products, there is concern whether these toxins will end up in consumables. This project aims to identify where and to what extent toxins are sequestered within the hemp plant (i.e., roots, stems, flower material).

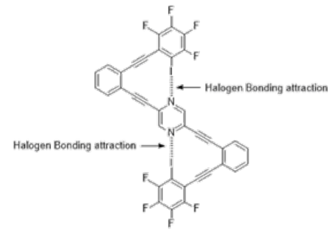
Techniques: Digestions and extractions, high performance liquid chromatography, inductively coupled plasma-optical emission spectroscopy, liquid chromatography-mass spectrometry
General Requirements for Students: Motivated and reliable, can work independently and safely in a laboratory setting, completed CHEM248
Number of new students: 2-4
Project Timeline: Fall and spring

Synthesis and Characterization of Novel Solar Cell Materials

Dr. Shannon Riha
Associate Professor of Chemistry
sriha@uwsp.edu

Description: Chalcogenide perovskites are materials with the chemical formula, ABX3, where element A is a cation with a +2 charge, element B is a cation with a +4 charge, and element X represents S, Se, or Te. Recently, theoretical studies have suggested that chalcogenide perovskites have potential for optoelectronic applications, such as thin film solar cells. In this project, you will explore solid-state and/or colloidal synthetic routes to make the chalcogenide perovskite, BaZrS3.

Techniques: Air-free synthesis methods, solid-state reactions, powder x-ray diffraction, Raman spectroscopy
General Requirements for Students: Can work independently and safely in a laboratory setting, good lab notebook skills, motivated and reliable, three semesters of college chemistry lab experience
Number of new students: 2-4
Project Timeline: Fall and spring



An example of a novel molecule synthesized by a Bowling group student in order to study halogen bonding attractions. Published in the *Journal of Organic Chemistry* in 2018.

Synthesis of Novel Conjugated Molecules

Dr. Nate Bowling
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Description: By studying molecules that occur in nature, chemists have been able to identify and better understand countless molecular phenomena. There are, however, many interesting molecular phenomena that cannot be studied by relying on nature's supply of molecules. In these instances, chemists--like those in the Bowling group--must synthesize new molecules in order to gain an understanding of molecular behavior. Research students in the Bowling group participate in the design, construction, and characterization of novel molecules that can expand our understanding of chemistry.

Techniques: Laboratory synthesis, purification (thin-layer chromatography, flash chromatography), and characterization (NMR, Mass-spec, UV-vis) techniques
General Requirements for Students: Completion of Chem 325/326 with a B or better and/or outstanding performance (A) in Chem 105/106
Number of new students: No limit
Project Timeline: Summer, fall, and spring into the foreseeable future

Department of Chemistry
College of Letters and Science
University of Wisconsin-Stevens Point

MALDI based identification of micro and macro-organisms

Dr. Jim Lawrence
Professor of Chemistry
jlawrenc@uwsp.edu

Description: Dr. Lawrence's lab uses and extensive array of protein biochemistry techniques to study the structure and function of a variety of proteins. We routinely use high quality mass spectrometry to identify individual proteins. We use MALDI mass spectrometry to identify individual proteins as well as unknown microorganisms. We also use the MALDI to identify more complex unknown organisms.

Techniques: Protein extraction, protein quantification, Matrix Assisted Laser Desorbtion Ionization (MALDI) Mass Spectrometry
General Requirements for Students: Biochemistry, Chemistry or Biology majors with an eagerness to learn and expand their knowledge. Freshman, Sophomores and Juniors are especially sought.
Number of new students: 2-3
Project Timeline: Fall, Spring, Summer

Computational Investigation of Halogen Bonded Complexes

Dr. Erin Speetzen
Professor of Chemistry
espeetze@uwsp.edu

Description: My research uses computer modeling to examine the structures and energies for complexes held together by a variety of intermolecular forces, but most commonly halogen bonds. We work closely with experimental collaborators to try to better understand solution- and solid-phase structures and behavior including how different intermolecular forces either work together or compete in these structures.

Techniques: Electronic structure calculations, high performance computing clusters
General Requirements for Students: Completion of Chem 105
Number of new students: 1 or 2
Project Timeline: Fall, Spring

Organic Electrochemistry

Dr. Robin Tanke
Professor of Chemistry
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Description: Organic Chemist routinely carry out oxidation and reduction reactions, many times those reactions involve highly specialized reagents and generate a far amount of waste. To carry out reactions in more economical and environmentally friendly ways, organic chemist have begun using electrochemical cells in order to carry out reactions. However, many of the skills needed to carry out reactions using electrodes are not familiar to organic chemists including myself. This project will explore the use of electrochemical equipment and the control of voltage and current to carry out oxidation and reduction reactions.

Techniques: Organic Synthesis, work up and characterization as well as electrochemistry
General Requirements for Students: Basic laboratory safety and documentation skills
Number of new students: 1-2
Project Timeline: Fall, Spring

Nitrogen Heterocycle Formation

Dr. Katie McGarry
Associate Professor of Chemistry
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Description: Nitrogen heterocycles are prevalent in many biologically active natural products and pharmaceuticals. Improved synthetic methods which introduce nitrogen into a carbon scaffold or achieve formation of a nitrogen heterocycle could provide more efficient access to known molecules or new derivatives that may prove medicinally useful. Research on this project focuses on developing new pathways to accessing these structures.

Techniques: Schlenk line technique, rotary evaporator, NMR
General Requirements for Students: Open to learning, have completed one semester of organic chemistry (Chem 325)
Number of new students: 1-2
Project Timeline: Fall, Spring

Quantification of n-alkanes to quantify nutrient supplies in large herbivores

Dr. Dave Snyder, UWSP Chemistry,
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and David Jaramillo, USDA Marshfield

Description: n-alkanes and other plant-wax compounds can be used as markers to quantify the nutrient supply to large herbivores. The USDA would like us to quantify these compounds in fecal material from cows as a part a local project they are conducting.

Techniques: Automated Solvent Extraction, GC/MS, GC/FID
General Requirements for Students: Prefer students who are currently enrolled or have completed quantitative analysis
Number of new students: 3-4
Project Timeline: Fall, Spring