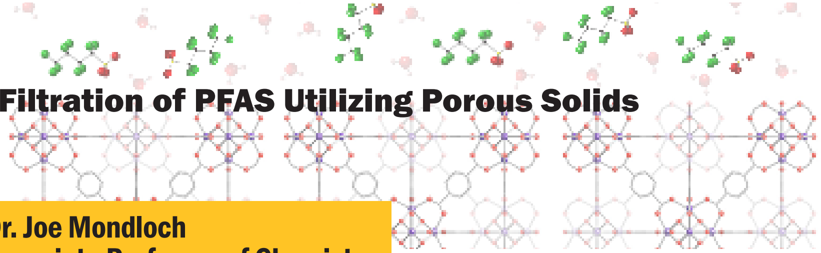
Chemistry Research Opportunities at UWSP



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 hours/week to commit to research
Number of new students: 4
Project Timeline: Fall or spring

Chemical Analysis of Hemp

Professors Dr. Shannon Riha (PI) **, Dr. Laura Cole** (Co-PI), **Dr. Brian Barringer** (Co-PI), **Dr. Ann Impullitti** (Co-PI), **and Dr. Bryant Schrenbroch** (Co-PI)
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Description: Environmental factors can play a significant role in the quality of hemp and its products (CBD, fibers, etc.). This research targets the analysis of hemp phytochemistry by means of chromatography and spectroscopy. In particular, we analyze how the growth environment may influence the production of cannabinoids and terpenes, which are chemical compounds that give hemp its medicinal applications. Another area of research in our group investigates where and to what extent toxins (e.g., heavy metals and PFAS) are sequestered within the hemp plant tissue.

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 or PI/Co-PI recommended
Number of new students: 2-3
Project Timeline: Fall and spring

Synthesis and Characterization of Novel Solar Cell Materials

Dr. Shannon Riha
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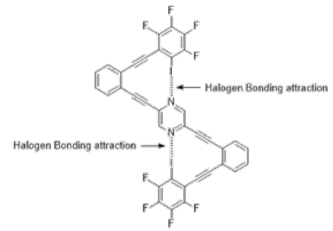
Description: Chalcogenide perovskites are materials with the chemical formula, ABX3, where element A is a cation with a +2 charge, element B is a cation with a +4 charge, and element X represents S, Se, or Te. Recently, theoretical studies have suggested that chalcogenide perovskites have potential for 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
Professor of Chemistry
nbowling@uwsp.edu

Description: Our group makes molecules that have never existed in order to study and design specific electronic properties into the molecules.
Techniques: Organic Synthesis, Purification/Chromatography, Characterization/NMR Spectroscopy
General Requirements for Students: Minimum of B in Chem 325 and Chem 326 or exceptional performance in Chem 105/106
Number of new students: 1-8
Project Timeline: Summer

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 and 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 and spring

Synthesis of Polymerization Catalysts

Dr. Dana Haagenson
Associate Professor of Chemistry
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Description: Catalysts are used in the yearly production of hundreds of millions of tons of plastic. New catalysts are continually being developed to more efficiently make plastics and/or modify their properties. Our group designs and synthesizes inorganic ligands which are used to prepare compounds of titanium, zirconium, and other metals. These metal compounds are potential active catalysts for the polymerization reactions used in the manufacturing of plastics.

Techniques: Air-free synthesis, product purification and characterization (NMR)
General Requirements for Students: Completion of Chem 105/106
Number of new students: 2-4
Project Timeline: Fall and spring

Studying How Ligand Binding Impacts Protein Stability

Dr. Amanda Jonsson
Associate Professor of Chemistry
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Description: Serum albumins are the major soluble protein in the bloodstream and have many functions, including binding to a wide variety of small molecules, including many drugs. Understanding how compounds interact with serum albumin proteins can help us understand how drugs and other small compounds behave in the body. We will be using bovine serum albumin (BSA) as our model protein and exploring how different small molecules bind to the protein and whether ligand binding impacts the stability of the albumin protein.
Techniques: UV-vis and fluorescence spectroscopy, DSC
General Requirements for Students: Completion of Chem 106
Number of new students: 1-2
Project Timeline: Fall

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 and spring