Dr. Olena Zenkina

Website: olenazenkina.ca

Research Interests: Our research focuses on Green Chemistry, Energy storage, and Molecular Self-Assembly

Selected Publications:

Laschuk N.O, Ebralidze I.I., Zenkina O.V. "Polypyridine-Based Architectures for Smart Electrochromic and Energy Storage Materials" Canadian J. Chem. 2023, 101, 400–417. Link

Fruehwald H.M., Zenkina O.V., Easton E.B. "Carbon-Nitrogen-Metal Material as a High Performing Oxygen Evolution Catalyst." Catalyst Sci. Technology, 2022, 12, 3102 - 3105. Link

Ahmad R., Di Palo V., Bell M., Zenkina O.V. , Easton E.B. "Surface-Enhanced Counter Electrode Materials for the Fabrication of Ultradurable Electrochromic Devices." ACS Appl Energy Mater, 2022, 5, 3905 – 3914. Link

Fruehwald H.M., Melino P.D., MacLean B.J., Zenkina O.V., Easton E.B. "Carbon Materials Functionalized by Nitrogenous Ligands for Dual Application in Energy Storage and Production: Fuel Cells and Supercapacitors." Electrochimica Acta, 2022, 414, 140209. Link

Project Descriptions

1. Preparation of surface confined materials for selective metal ion sensing and removal of heavy metals

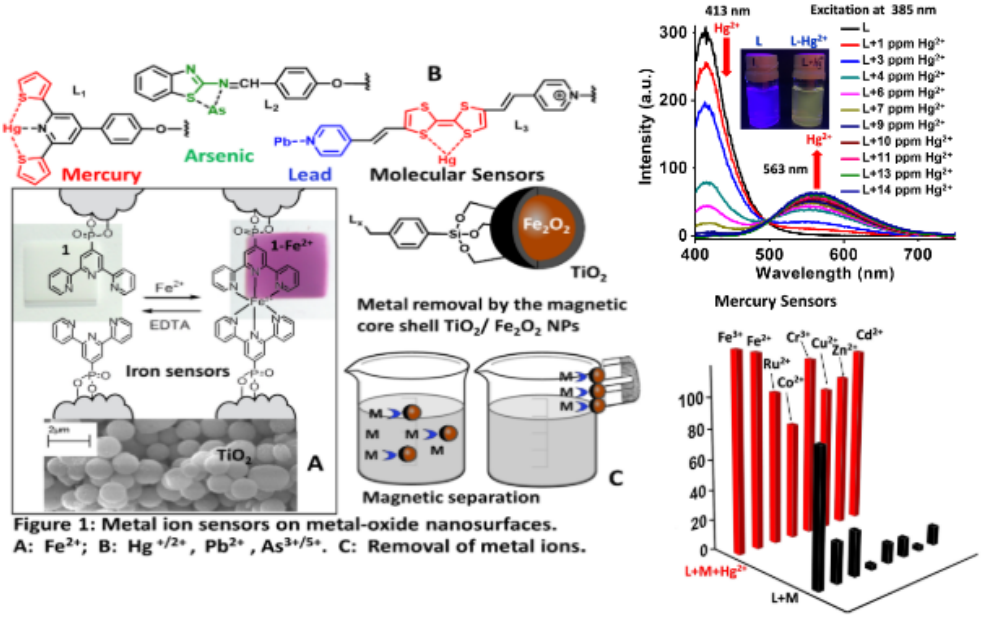


Figure 1: Metal ion sensors on metal-oxide nanosurfaces. A: Fe^{2+}; B: $Hg^{+/2+}$, Pb^{2+}, $As^{3+/5+}$. C: Removal of metal ions.

2. Preparation of coordination based functional electrochromic materials and metal wires on the conductive surfaces (with Professor Brad Easton)

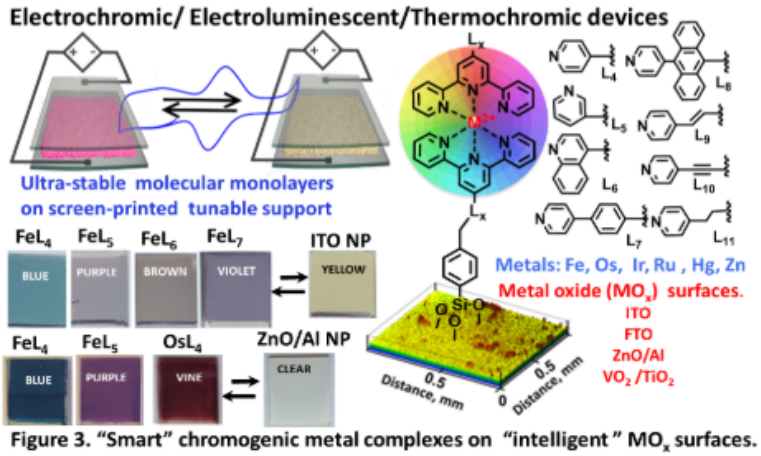
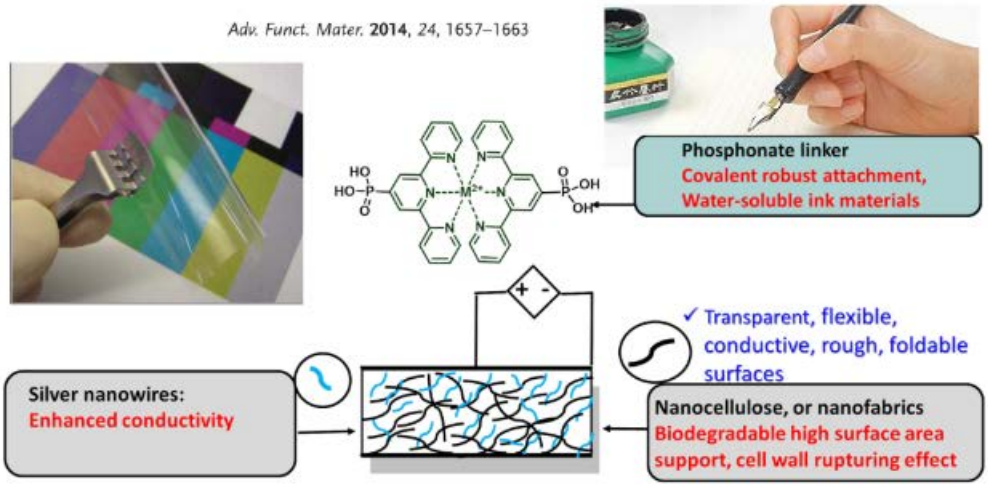


Figure 3. "Smart" chromogenic metal complexes on "intelligent" MO_x surfaces.

3. Nanocellulose based conductive surfaces for smart molecular materials

We interested to make a water-soluble ink of different colours from well defined transition metal complexes and to be able to "write" (covalently introduce electrochromic molecules) on the transparent biodegradable nanopaper. Novel materials may allow an easy electrochemically switching between colours and / or erasing of colours. We target erasable, bendable transparent, multicolor electrochromic paper. This is a totally new research direction in our group. We will closely collaborate with group of Prof. Easton on Electrochemistry side of this project.



Dr. Brad Easton

Website: http://www.bradeaston.ca

Research Interests: electrochemistry, materials chemistry, fuel cells, sensors, carbon surface chemistry, electrochromics.

Selected Publications:

S. Christian-Robinson, F. Kong, E.B. Easton, F.M. Kerton "Modification of calcium carbonate from blue mussel shells with copper oxide nanoparticles", *RSC Sustainability* , In Press (2025) 146067. doi: 10.1039/d5su00188a ** Open Access **

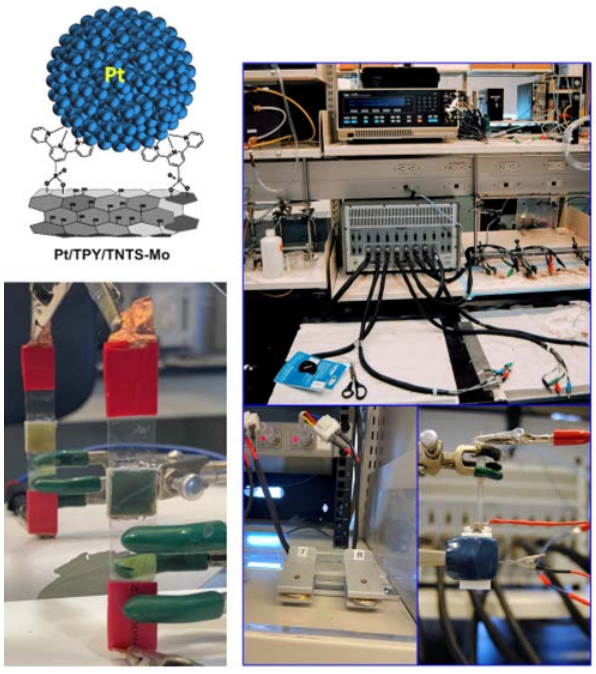
F. Kong, R. Alipour Moghadam Esfahani, O.K.L. Strong, I.I. Ebralidze, A. J. Vreugdenhil, E.B. Easton, "Cu-doped Titanium Suboxide Fuel Cell Catalyst Support Prepared by Sol-gel Method: Unveiling the Role of Cu as a Lone Dopant", *Electrochimica Acta*, 524 (2025) 146067. doi: 10.1016/j.electacta.2025.146067. ** Open Access **

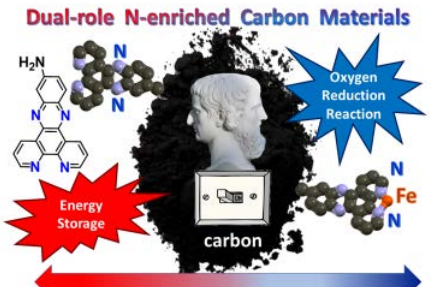
P.G. Pickup, E.B. Easton, "Electrocatalysts for the oxidation of ethanol in proton exchange membrane fuel cells, electrolysis cells, and sensors", *Current Opinion in Electrochemistry*, 47 (2024) 101553. doi: 10.1016/j.coelec.2024.101553 ** Open Access **

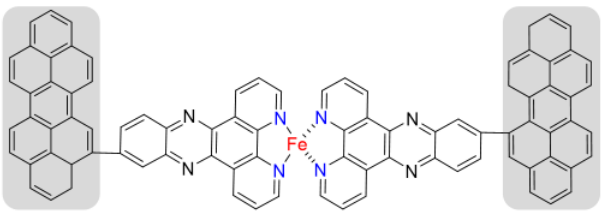
V. Di Palo, M. Saeidi, R. Ahmad, I.I. Ebralidze, E.B. Easton, O.V. Zenkina, "Novel exceptionally durable asymmetric double-side electrochromic device architecture", *Solar Energy Materials and Solar Cells*, 15 (2024) 112963. doi:10.1016/j.solmat.2024.112963 ** Open Access **

Project Descriptions:

1. Electrochemical stability of novel metal oxide-based fuel cell supports
2. Surface modification of carbons for electrochemical energy storage
3. Novel cell designs for advanced electrochromic materials (co-supervised with Dr. Zenkina)







Dr. Fedor Naumkin

Website: https://www.researchgate.net/profile/Fedor-Naumkin-2

Research Interests: The Computational Nanochemistry research deals with the design of new nanosystems (intermolecular complexes, molecular junctions & interfaces, clusters), prediction and analysis of their structures, properties, inter-relationships between those. Of specific current interest are novel systems with molecules:

(1) trapped between counter-ions and thus stimulated to isomerise/react;

(2) linked by metals in assemblies with controllable shape alterations.

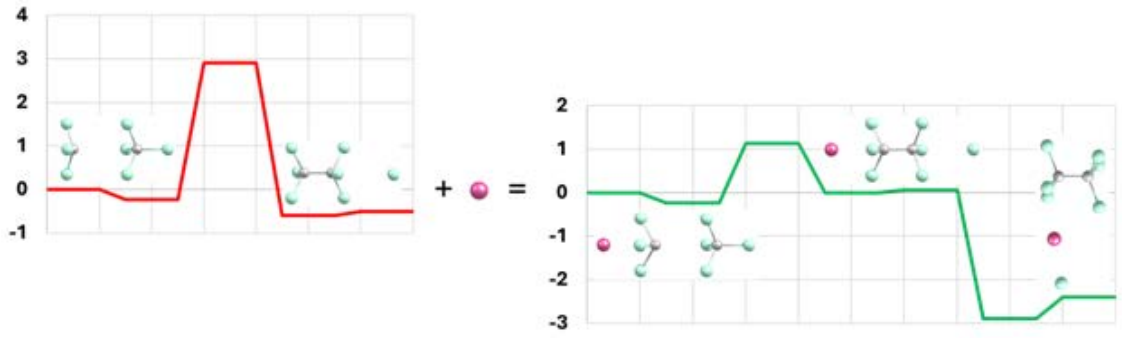
Various possible applications include:

- building blocks for materials with desired properties,

- light detection and utilization, molecular electronics and machinery,

- efficient energy storage at molecular level,

- molecular self-assembly and induced reactions, etc.



C-C bonding of halocarbons via a “cross-coupling” involving non-covalently attached counterions

Selected Publications:

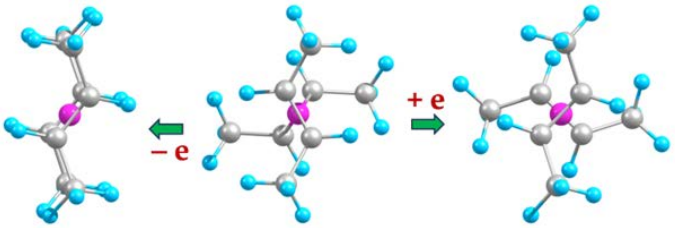
S. Kerr* and F. Y. Naumkin, C-C Bonding in Molecular Systems via Cross-Coupling-like Reactions Involving Noncovalently Bound Constituent Ions. Molecules 29, 4429 (2024).

M. Giammarco* and F. Y. Naumkin Carbon-Carbon Bond Formation “Catalyzed” by Ion-Pair Constituents, ChemistrySelect, 8, e202300057 (2023).

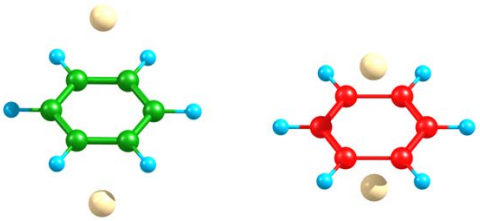
M. Sullivan* and F. Y. Naumkin, Supramolecular complexes with insertion-enhanced polarity and tuned IR spectra. Int. J. Quantum Chem., 121, e26534 (2021).

Project Descriptions:

1) Modelling of supramolecular species with high polarity, enhanced IR activity, charge- and spin-controlled structures
2) Simulation of field-induced transformations and reactions of molecules trapped in ion-pairs. The student will computationally investigate a series of insertion complexes of molecules and atoms. These systems are to be suitably designed, their structures optimized in terms of energy, and stability, polarity, IR spectra, etc. studied. In a project the student will acquire practical experience of working with a state-of-the-art quantum-chemistry software and modern visualization tools, on high-performance computing facilities accessible at and through the Ontario Tech U.



Metalloid-organic complexes with charge-controlled shapes



M-Bz-M complex isomers with high and low aromaticity

Dr. Jean-Paul Desaulniers

Website: https://jpdesaulniers.com/

Research Interests: My research interests aim to understand the structure and function of RNA, through chemical modification via organic chemistry. We evaluate these novel RNAs using biophysical analyses and biological assays. These have important applications for gene-silencing or gene-activation.

Selected Publications:

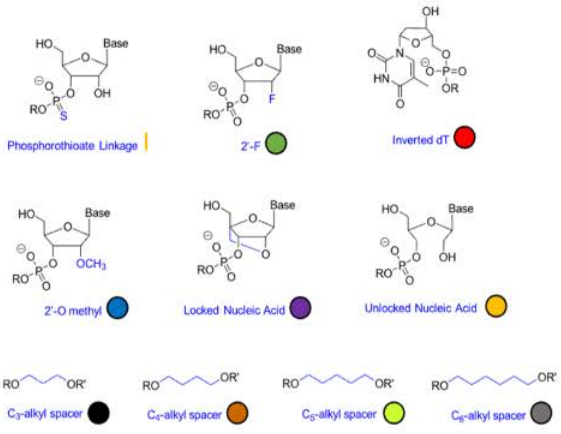
W. Obrom, W. Yingyuen, T. Nanmong, K. Deekamwong, P. Tawachkultanadilok, J. Wittayakun, S. Prayoonpokarac, Y. Poo-arporn, K. Föttinger, J.-P. Desaulniers and S. Loiha. "Investigating the role of zeolite supports in Ni-based catalysts for CO2-methanation using in situ/operando XAS–GC-MS" *Microporous and Mesoporous Materials*, **2025**, *390,* 113548

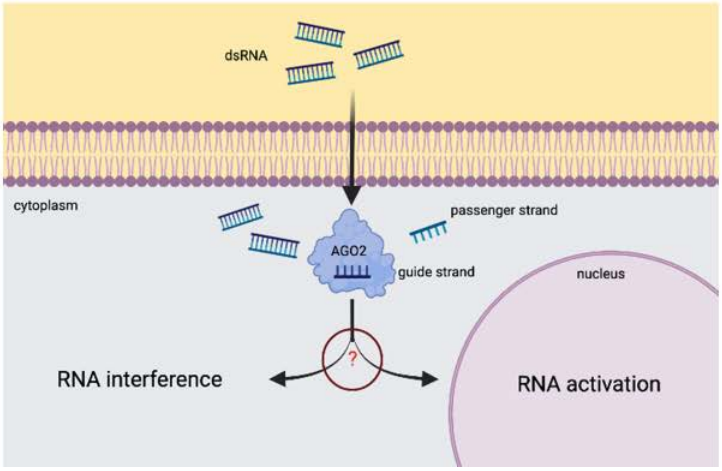
A. Collins, S. Varley, T. Clark, N. Chubb, S. Forrester and J.-P. Desaulniers. "Increased activity of CF3-derivatised levamisole at the ACC-2 receptor from the parasitic nematode *Haemonchus contortus*" *International Journal for Parisitology: Drugs and Drug Resistance,* **2025**, *27,* 100587

M. Mateus, M. L. Hammill, D. B. D. Simmons and J.-P. Desaulniers. "Injection of *Ortho*-Functionalized Tetrafluorinated Azobenzene-Containing siRNAs into Japanese Medaka Embryos for Photocontrolled Gene Silencing" *Current Protocols in Molecular Biology* **2024**, *11,* e70051

Project Descriptions:

1) Synthesis and evaluation of gene-silencing RNAs
2) Synthesis of photoresponsive RNAs





Dr. Liliana Trevani

Website: https://www.researchgate.net/profile/Liliana-Trevani

Research Interests: Hydrothermal chemistry, materials science, electrochemistry, and thermodynamics.

Selected Publications:

Advancing Hydrodynamic Electrochemistry: A Channel Flow Cell for High-Temperature and High-Pressure Applications. M. Abdulaziz, A. Petruk, F. Samiee, K. Pichugin, G. Sciaini, L. Trevani. *Journal of Physical Chemistry C*, **2025** *129* (21), 9726-9735.

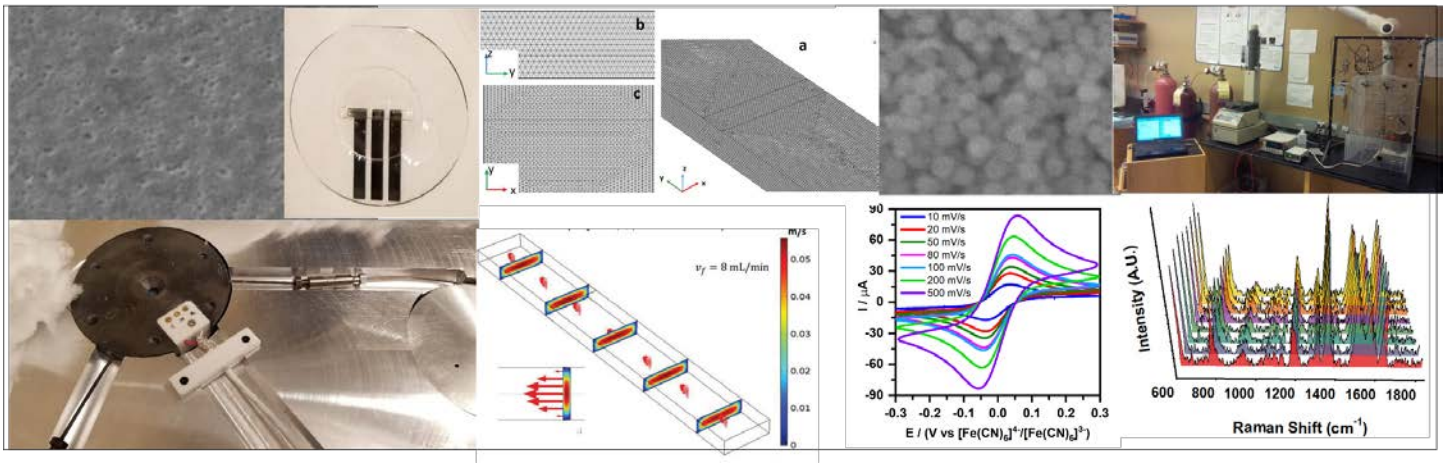
Exploring Platinum Thin Films as Electrodes for High-Temperature and-Pressure Electrochemical Studies in Aqueous Systems. M. Abdulaziz, A. Petruk, T. George, N. Shaw, G. Sciaini, L. Trevani, *Electrochemical Science Advances*, e202400018, **2024.**

Low-cost preparation of 3D-Au@ SiO2 substrates for surface-enhanced Raman spectroscopy and finite difference time domain enhancement analysis. R. E. Simpson, A. Callanan, D. Patel, M. Abdulaziz, N.R. Agarwal, L. Trevani, *Thin Solid Films,* 803, 140436, **2024.**

Interdisciplinary Undergraduate Laboratory for an Integrated Chemistry/Biology Program: Synthesis of Silver Nanoparticles (AgNPs)-Cellulose Composite Materials with Antimicrobial Activity. C. Scott, N.H. Wisdom, K. Coulter, S. Bardin, J. L. Strap, L. Trevani. *J. Chemical Education* 100 (4), 1446-1454, **2023.**

Project Descriptions:

1) Hydrothermal electrochemistry and catalysis: Impact of temperature and pressure on target electrochemical processes (methanol oxidation, oxygen reduction reaction, and CO_2 reduction).
2) Chemical complexation studies under hydrothermal conditions using spectroscopic and electrochemical methods.
3) Comsol Multiphysics - Numerical simulation of electrochemical processes.
4) Spectroelectrochemical sensors: Synthesis, characterization and analytical applications of thin films.



Dr. Yuri Bolshan

Website: https://sites.ontariotechu.ca/yuri-bolshan/about/index.php

Research Interests: Pharmaceutical / Synthetic Organic Chemistry

Selected Publications:

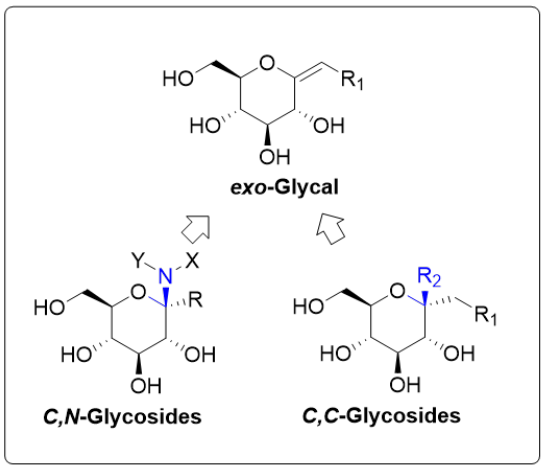
Jeffery Regier, Supriya Ghanty and Yuri Bolshan. Stereoselective Palladium-Catalyzed Arylation of *Exo*-Glycals with Aryl Iodides. *J. Org. Chem* published online

Samira Barmaki, Arlene Ali, Jean-Paul Desaulniers and Yuri Bolshan. Bromination of codeine and its derivatives: Revisitng a 95 year old process. *Tetrahedron Lett.* **2020**, *61*, 152234

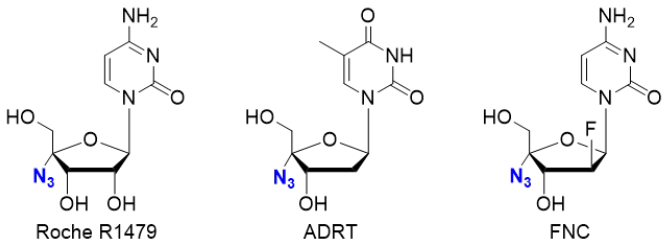
Dylan H. Harris, Renata Barichello and Yuri Bolshan. Brønsted Acid-Catalyzed Alkenylation of Salicylaldehydes with Vinylboronic Acids: Synthesis of 1,4-Dienes and *2H*-Chromenes. *Eur. J. Org. Chem.* **2020**, 6000–6003

Project Descriptions:

1) Development of Brønsted acid and metal-catalyzed methodologies for the synthesis of unnatural pharmaceutically relevant C-, C,N- and C,C-glycosides

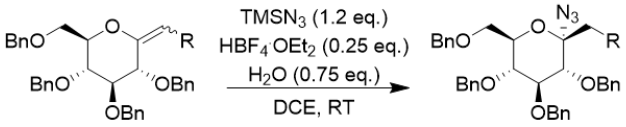


Unnatural, stable *C,N and C,C*-glycoside functionality



Antiviral agents

Selected publications



J. Regier, Y. Bolshan *J. Org. Chem.* **2024**, *89*, 141–151

Dr. Kevin Coulter

Research Interests: Inorganic and Organic Synthesis, Electrocatalysis

Project Descriptions:

1) Synthesis of cyclam based ligand complexes covalently attached to carbon electrodes and determination of their electrocatalytic CO_2 reduction activity.

2) Synthesis of N_4S macrobicycle ligand complexes and determination of their electrocatalytic CO_2 reduction activity

3) Synthesis of N_2S_2 ligand complexes and determination of their electrocatalytic CO_2 reduction activity

4) Synthesis of Mo(dithiolene) complexes covalently attached to carbon electrodes and determination of their electrocatalytic CO_2 reduction activity

5) Synthesis of bis-N_2S_2 binuclear ligand complexes and Determination of CO_2 reduction activity