


***S***aint ***M***ary's ***U***niversity

***C***hemistry ***A***lumni ***S***ymposium **2026**

***(S.M.U.C.A.S 2026)***

*Thursday, November 12, 2026*

# Welcome Address

Welcome to the Saint Mary's University Chemistry Alumni Symposium 2026 (S.M.U.C.A.S. 2026)

Saint Mary's University acknowledges that the university is located on the ancestral and unceded territory of the Mi'kmaq People.

This territory is covered by the "Treaties of Peace and Friendship" which Mi'kmaq and Wolastoqiyik peoples first signed with the British Crown in 1725.

The treaties did not deal with surrender of lands and resources but in fact, recognized Mi'kmaq and Wolastoqiyik title and established the rules for what was to be an ongoing relationship between nations.

SMU Chemistry is proud to have many alumni who have established themselves as accomplished professionals in everything from the chemical and pharmaceutical industry to high school teaching, dentistry, optometry, medicine, and law.

Over the coming hours we will enjoy a series of presentations delivered by SMU Chemistry alumni based upon the research they have conducted as professors at universities around the world.

Today, we have visitors who are among the twenty SMU Chemistry alumni who have held academic appointments as professors around the world. (plus one more tomorrow for an updated list).

So, sit back, enjoy, be sure to ask questions, and chat with our guests as much as possible. You will have ample opportunity to do so during the morning and afternoon sessions, coffee breaks (thanks to the Dean of Science), lunch and dinner over at the Gorsebrook Lounge later this evening (both meals thanks to SMU Alumni Association).

Cheers, Rob Singer, SMU Chemistry Alumnus '86

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# SMUCAS 2026 Schedule

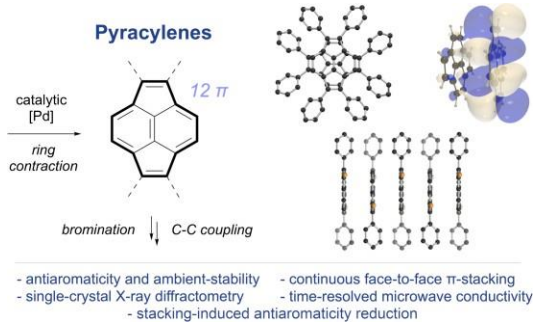
| | | |
|---|---|---|
| **8:30 AM** | **Welcome and Opening Remarks** *(SB255)* | Land Acknowledgement with Coffee |
| **9:00 AM** | **Jeff Farrell** *National Taiwan University* | Pyracylenes: New Synthetic Access and Solid-State Antiaromatic π-Stacking – *Remote via Zoom* |
| **9:30 AM** | **Michael Land** *Mount Saint Vincent University* | Incorporation of phosphorus into β-diketiminate ligands for reaction monitoring |
| **10:00 AM** | **COFFEE BREAK** | Sobey 255 |
| **10:30 AM** | **Christine DeWolf** *Concordia University* | Langmuir Interfacial Films: Tuning Electrostatics and π-Interactions to Control Monolayer and Multilayer Organization |
| **11:00 AM** | **Jane Ferguson** *Saint Mary's University* | Thermodynamics of High-Temperature Systems for Clean Energy Applications |
| **11:30 AM** | **Kim Baines** *Western University* | Sustainability and Ge: From Metal Processing to Catalysis |
| **12:00 PM** | **LUNCH** | Private Dining Room (L298) |
| **1:00 PM** | **Alex Veinot** *Dalhousie University* | Adventures in main group and materials chemistry |
| **1:30 PM** | **Scott Harroun** *University of Windsor* | Characterizing Alkaline Phosphatase Enzymes with Fluorescent Nanoantennas |
| **2:00 PM** | **Ian Pottie** *Mount Saint Vincent University* | Development of 1-Methyl-4-piperidyl p-(18F)Fluorobenzoate as an Imaging Agent for Butyrylcholinesterase |
| **2:30 PM** | **COFFEE BREAK** | Sobey 255 |
| **3:00 PM** | **Travis Holman** *Georgetown University* | Brought to you by the letters S, M, U and Z |
| **3:30 PM** | **Len MacGillivray** *Université de Sherbrooke* | SMU Chemistry - It is Crystal Clear |
| **4:00 PM** | **Mike Zaworotko – Plenary** *University of Limerick* | Crystal Engineering: Then, Now and Next |
| **6:00 PM** | **DINNER** | Gorsebrook Lounge |

**Presentation #1 - Remote via Zoom – 9:00 AM**

## Pyracylenes: New Synthetic Access and Solid-State Antiaromatic π-Stacking

**Jeffrey M. Farrell**
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Sterically unencumbered polycyclic antiaromatic hydrocarbons are attractive candidates for organic electronic materials applications. Moreover, these structures may enable study of "stacked-ring aromaticity" in their π-stacked assemblies.[1] Pyracylene is a nonalternant, antiaromatic hydrocarbon that has long fascinated chemists.[2] However, its synthetic difficulty has impeded its study and application. Recently, our laboratory developed a solution-phase synthesis of pyracylenes via Pd-catalyzed ring contraction of diborinic acids.[3] So-formed pyracylenes were derivatized by bromination and subsequent Pd-catalyzed cross-coupling. All pyracylenes were isolated, fully characterized, and studied by UV–vis absorption spectroscopy, cyclic voltammetry, density functional theory (DFT) calculations, and X-ray crystallography. In the solid state, three pyracylenes formed unprecedented continuous, face-to-face π-stacks with equidistant molecular spacings and 90° twist angles between adjacent monomers. In these stacks, HOMOs of monomers aligned with phase-complementary LUMOs of their neighbors (and vice versa). Nucleus-independent chemical shift (NICS) calculations indicated that this arrangement leads to diminished antiaromaticity of individual monomers.




[1] Corminboeuf, C.; von Ragué Schleyer, P.; Warner, P. *Org. Lett.* **2007**, *9*, 3263−3266.
[2] Trost, B. M.; Bright, G. M.; Frihart, C.; Brittelli, D. *J. Am. Chem. Soc.* **1971**, *93*, 737−745.
[3] Sheng-Yuan Cheng, Jiun-Siang Juang, Yu-Fang Huang, Ting-Yi Lai, Yi-Hung Liu, Fumitaka Ishiwari, Akinori Saeki, Kenji Okada, Ryohei Kishi, Jeffrey M. Farrell *JACS Au* **2026**, 6, 1118–1128.

**Presentation #2 - Sobey SB255 – 9:30 AM**

## Incorporation of phosphorus into β-diketiminate ligands for reaction monitoring

**Michael Land**

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β-Diketiminate (NacNac) ligands are widely used as supporting ligands in main-group and transition-metal chemistry, where their steric environment can be readily tuned at the flanking aryl groups. In contrast, modification of the ligand backbone is synthetically challenging and typically provides modest electronic perturbations. Although NacNac backbones can participate in ligand-centered redox chemistry, these processes are often highly delocalized, making individual redox states difficult to isolate and their influence on metal-centered reactivity difficult to control. Furthermore, NacNacs overwhelmingly enforce a $\kappa^2$-N,N'-bidentate coordination mode, which reliably stabilizes metals, but leaves little room for deliberate bifunctional cooperative binding through additional donor sites.

Incorporating phosphorus into the NacNac backbone offers a method to address these limitations by introducing an element with well-established and readily tunable donor and redox chemistry. Phosphorus can serve as a donor to the metal centers while also undergoing well-defined oxidation reactions that directly alter its electronic and coordination properties. Embedding phosphorus into the NacNac backbone therefore creates an electronically responsive ligand platform in which redox chemistry can be used to systematically modify donor properties. Importantly, the same phosphorus center provides an intrinsic $^{31}$P NMR handle, allowing changes in the electronic and coordination state of the ligand to be directly and rapidly monitored in solution.

Here we appended a $PPh_2$ group to the backbone of a NacNac ligand following the method described by Burford. The resulting γ-phosphino-β-diketiminate undergoes facile oxidation with elemental chalcogens and azides, providing access to four previously unreported oxidized ligands contaminating P=E (E = O, S, Se, NPh) functionalities. Coordination of these ligands to $AlMe_2$ and $InMe_2$ fragments revealed different coordination preferences, including N,N', N,O, N,S, and N,Se binding bonds dependent on the hard-soft acid-base preference of the donor and the metal, while the third donor site remains uncoordinated and available for secondary interactions.

These results demonstrate that simple phosphorus-centered oxidation provides a convenient route to modify the donor properties and coordination modes of a NacNac ligand. At the same time, the phosphorus center provides a readily accessible $^{31}$P NMR reporter. This combination of tunable donor properties and an intrinsic spectroscopic handle highlights the potential of phosphino-NacNac ligands as electronically responsive, multifunctional ligand platforms.

**Presentation #3 - Sobey SB255 – 10:30 AM**

## Langmuir Interfacial Films: Tuning Electrostatics and π-Interactions to Control Monolayer and Multilayer Organization

**Christine DeWolf**

*Department of Chemistry and Biochemistry, Concordia University, Montréal, Canada*

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Langmuir films at the air-water interface exhibit a rich two-dimensional phase behavior that can be exploited for the design of functional materials. Practical application of these materials relies on well-structured, thin film architectures that can be deposited on solid substrates. Amphiphile structural features such as π-conjugated headgroups can be to direct the self-assembly. The film behaviour of two families of amphiphiles comprising incorporating unusual π-interacting headgroups, specifically phosphole-based lipids and gallate-derived surfactants, will be discussed.

Phosphole lipids exhibit electron delocalization that governs their photophysical, redox, and charge transfer characteristics useful for electronic device applications, while phenolic (gallate) surfactants confer antioxidant, meta-chelating and protein binding properties to self-assembled films. Manipulation of the electrostatic and π-interactions is achieved via variation in amphiphile chemical structure (headgroup variations and introducing w-functional groups) or environmental conditions (compression state, pH, counterions and aromatic additives) and affords control over the lateral structure and the transition between monolayer and multilayer states. Insights from these systems provide strategies for designing structured thin films with tunable morphology and functionality for advanced materials applications.

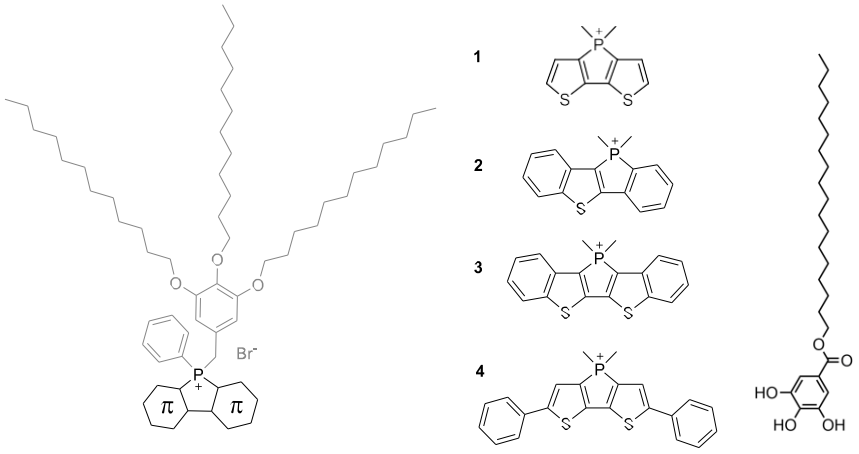



*Figure 1. Chemical structures of the phosphole-lipid series (left) and the gallate surfactant (right)*

**Presentation #4 - Sobey SB255 – 11:00 AM**

## Thermodynamics of High-Temperature Systems for Clean Energy Applications

**Jane Ferguson**

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High-temperature systems play an important role in emerging clean energy technologies, but harsh operating conditions and materials compatibility requirements make them challenging to study. Accurate thermodynamic and thermophysical property data are needed to support the development, deployment, and safe and reliable operation of these technologies. This work combines experimental measurements and thermodynamic modelling, with a focus on molten salt mixtures for use as coolants, heat transfer fluids, and thermal energy storage materials. A custom-built Archimedean density apparatus allows for measurements of molten salt density, while complementary thermal analysis examines phase behaviour and thermal stability. Experimental data and thermodynamic models are used together to characterize temperature and composition dependent properties. Studies of moisture uptake under controlled humidity conditions examine how sample handling affects salt properties, which is relevant to both the reliability of experimental measurements and the handling and storage of molten salts for large-scale deployment in clean energy technologies.

**Presentation #5 - Sobey SB255 – 11:30 AM**

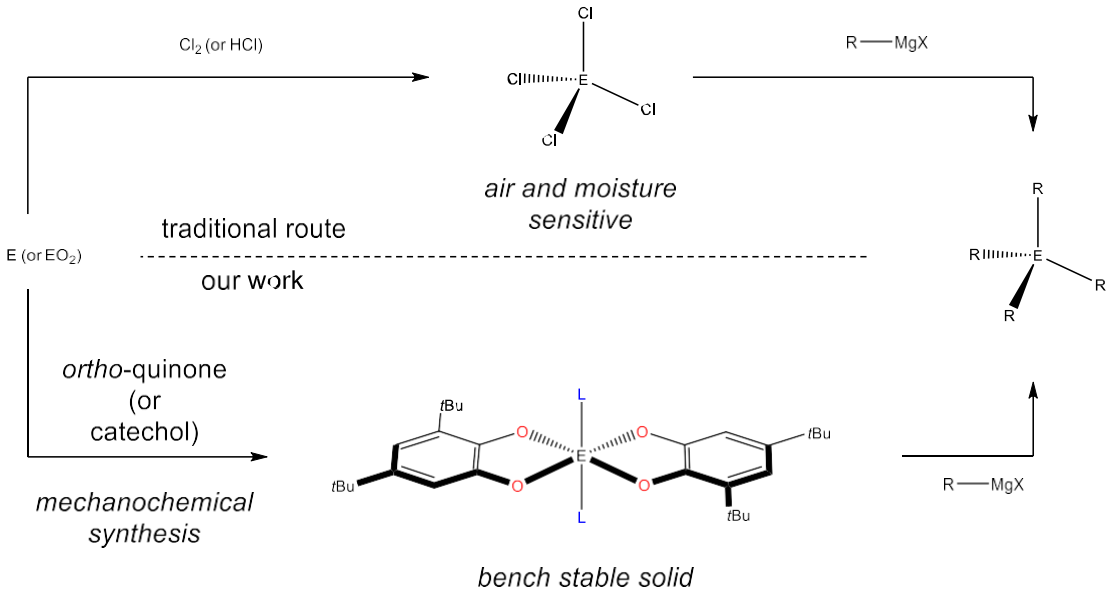
## Sustainability and Ge: From Metal Processing to Catalysis

K. M. Baines

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As a society, we are increasingly aware of the environmental impact of human activity and consequently, the dire need to develop cleaner technologies and to use our resources more efficiently. I will present our efforts towards the development of alternative methods for the processing of germanium and tin, vital technological materials, which avoid the use of highly corrosive and toxic chlorine-based reagents. In addition, the use of hypercoordinate germanium complexes as new main group catalysts will also be discussed.




**Scheme 1.** Synthesis of germanes and stannanes from either the element or the oxide

## Presentation #6 - Sobey SB255 – 1:00 PM

### Adventures in main group and materials chemistry

**Alex J. Veinot**

*Department of Chemistry, Dalhousie University*

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Self-assembled monolayers (SAMs) are single, highly ordered layers of molecules that spontaneously organize themselves on solid surfaces through chemisorption. Molecules attach to surfaces through head groups and van der Waals forces between neighbouring molecules promote densely packed, highly ordered films that are one molecule thick.

For decades, SAMs on gold and other metal surfaces have been dominated by sulfur-based head groups, which benefit from favourable soft-soft interactions with gold. However, their established thermal, chemical and oxidative instabilities have hindered their widespread application,[1] requiring the use of a fundamentally different head group.

In recent years, N-heterocyclic carbene (NHC) SAMs have emerged as an exciting alternative to thiolate SAMs for metal surfaces.[3, 5] As surface ligands, NHCs bind with unprecedented strength to a variety of metal surfaces, and have enhanced biosensors,[6] atomically precise nanoclusters and nanoparticles,[7-9] heterogeneous catalysts,[10] semiconductor manufacturing,[11, 12] and numerous other applications.

In this presentation, I will discuss our group's ongoing efforts to develop a new class of surface modifiers using NHC-adducts of main-group and transition-metal elements. These compounds offer a versatile platform for surface functionalization, combining the strong donor properties of N-heterocyclic carbenes with the diverse reactivity of metal and main-group centers. Our work explores their synthesis, surface immobilization, and potential to generate well-defined interfaces with tunable properties.

## Presentation #7 - Sobey SB255 – 1:30 PM

### Characterizing Alkaline Phosphatase Enzymes with Fluorescent Nanoantennas

**Scott Harroun**

*Department of Chemistry and Biochemistry, University of Windsor, Windsor Ontario*

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Fluorescent nanoantennas are a new tool to study protein function. A fluorescent nanoantenna consists of a fluorophore, a biotin, and an oligonucleotide linker that connects them. The biotin moiety binds to one of the four biotin-binding sites on streptavidin. A biotinylated protein of interest is then introduced, which also binds to the streptavidin platform. In this macromolecular oligonucleotide-streptavidin-protein complex, the high local concentration drives the interaction between the fluorophore and the protein. Then, depending on the nature of the protein and the biochemical event that takes place, such as protein-protein interaction or an enzymatic reaction, the fluorophore-protein interaction can be perturbed by the resulting change in chemical environment. The perturbation of the fluorophore-protein interaction can mediate a signal change, which can be used to characterize the protein's function. By employing DNA of various lengths and fluorophores that interact with different parts of the protein, it is possible at least in principle, to engineer a biosensor to study any type of protein function. One of the advantages of this strategy is that it can be used to rapidly characterize an enzymatic reaction with one addition of any type of substrate, including spectroscopically silent biomolecular and medicinal substrates that do not provide a signal, unlike chromogenic and fluorogenic substrates. This presentation will discuss the application of fluorescent nanoantennas to study alkaline phosphatase enzymes from mammalian and bacterial species, as well as our vision to use this strategy to study other enzyme systems.

## Presentation #8 - Sobey SB255 – 2:00 PM

# Development of 1-Methyl-4-piperidyl *p*-($^{18}$F)Fluorobenzoate as an Imaging Agent for Butyrylcholinesterase

**Ian R. Pottie**[1,2], Andrew Reid[3], Drew DeBay[3], Ian Macdonald[4], Antoun Bou Laouz[5], Sultan Darvesh[1,3,6]

[1]Department of Chemistry and Physics, Mount Saint Vincent University, Halifax, NS, CAN
[2]Department of Chemistry, Saint Mary's University, Halifax, NS, CAN
[3]Department of Medical Neuroscience, Dalhousie University, Halifax, NS, CAN
[4]Department of Diagnostic Radiology(Nuclear Medicine and Neuroradiology), Dalhousie University, Halifax, NS, CAN
[5]Department of Diagnostic Imaging (Cyclotron Unit), Nova Scotia Health Authority, Halifax, CAN
[6]Department of Medicine (Geriatric Medicine and Neurology), Dalhousie University, Halifax, CAN

**Introduction:** Alzheimer's disease (AD) diagnosis requires a clinical dementia syndrome supported by biomarkers of amyloid-β (Aβ) and tau pathology. Although Aβ- and tau-PET can identify AD's biological signature, up to 30% of cognitively normal older adults show substantial plaque and tangle deposition without developing dementia, highlighting the need for biomarkers that better link pathology to clinical expression.

Butyrylcholinesterase (BChE), normally expressed at low cortical levels, becomes enriched within Aβ plaques and neurofibrillary tangles in AD and exhibits altered biochemical properties in these structures. This suggests that imaging BChE activity may provide complementary diagnostic information. We hypothesize that cholinesterase-targeted radiopharmaceuticals can detect plaque-associated BChE *in vivo* using PET, improving diagnostic specificity and potentially identifying individuals with pathological changes who remain cognitively intact.

**Methods:** A library of cholinesterase-targeting ligands was synthesized and characterized using enzyme kinetic assays to determine potency and specificity, complemented by histochemical evaluation in brain tissue. Selected ligands were radiolabeled with $^{18}$F using rapid synthetic protocols and purified using HPLC for biological testing. *Ex vivo* autoradiography was performed to assess target engagement in brain sections. Compounds demonstrating preferential affinity for BChE were administered intravenously to wild type and transgenic AD mouse models for *in vivo* imaging using PET.

**Results:** The synthesized ligands exhibited biochemical specificity for BChE, although histochemical analyses revealed patterns that differed from kinetic measurements. Radiolabeling with $^{18}$F was achieved efficiently for selected compounds. Autoradiographic studies of AD mouse brain sections demonstrated radiotracer accumulation in regions known to contain cholinesterase activity and plaque pathology. *In vivo* PET imaging further delineated areas of pathological enzyme association, supporting the feasibility of BChE-targeted neuroimaging.

**Conclusions:** Small-molecule ligands selective for BChE can be synthesized, radiolabeled, and purified in a manner compatible with neuroimaging workflows. These radiotracers successfully detect cholinesterase enzymes associated with β-amyloid plaques in AD brain tissue. Given the presence of BChE within AD pathological structures, cholinesterase-binding radiopharmaceuticals represent a promising class of imaging agents with potential utility for early and more precise diagnosis of Alzheimer's disease.

**Presentation #9 - Sobey SB255 – 3:00 PM**

## Brought to you by the Letters S, M, U… and Z

***K. Travis Holman***

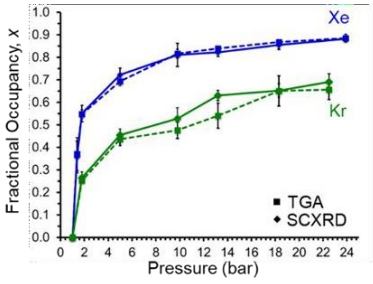
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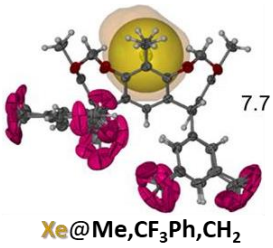
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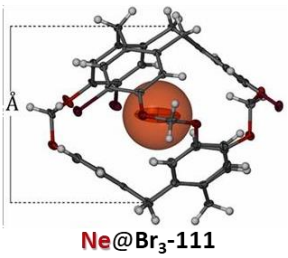
Perhaps more than any other experimental technique in science, X-ray crystallography (link) has yielded the profound structural insights that define our contemporary understanding of chemistry, materials, and life at the atomic level. My own journey with single-crystal X-ray diffraction began in the lab of Prof. Michael J. Zaworotko (Dr. "Z") at Saint Mary's University (SMU) in the 1993-1994 academic year. The undergraduate research experience—in the practicing laboratory, outside of the typical undergraduate science curriculum—strongly shaped my career as a long practicing research chemist, materials scientist, and Professor of Chemistry. It stands as a testament to the transformative impact (and perhaps necessity) of both strong scientific mentorship and direct access to state-of-the-art scientific instrumentation at a primarily undergraduate institution.

In this presentation, I will highlight some of the more unconventional materials science from my research career, centered on crystallographic discoveries—ranging from supramolecular host–guest chemistry, to highly selective sorbents, to crystal engineering of non-linear optical, microporous, or ferroelectric materials, to compounds that confine air gases. Highlights include sub-atomic resolution crystal structures of ordered, host-confined $N_2$, $O_2$, noble gases, freon-41, *etc.* I will also discuss a few intentionally counterintuitive crystallographic experiments, including attempts to measure single-particle/crystal relative gas-sorption kinetics and attempts to estimate tiny solution-binding constants using single-crystal diffraction.



**Presentation #10 - Sobey SB255 – 3:30 PM**

## "SMU Chemistry - It is Crystal Clear"

**Leonard MacGillivray**

*Université de Sherbrooke, Québec J1K 2R1*

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Crystal engineering seeks to understand and control how molecules organize in the solid state. At Saint Mary's University (SMU) in the early 1990s, research in the group of Mike Zaworotko provided an introduction to crystal engineering - a field that was just beginning to take shape. In this presentation, we will plan to revisit the chemistry, people, ideas, and experiences that emerged in the 1990s at SMU and follow influence through developments in crystal engineering and solid-state chemistry. Along the way, examples will show how concepts involving molecular recognition, crystal structure, and reactivity have evolved and continued to create new opportunities in molecular materials. The story begins at Saint Mary's and continues to extend beyond, allowing us to celebrate the lasting influence of SMU Chemistry and the remarkable scientific contributions, mentorship, and friendship of Mike Zaworotko.

**Plenary Presentation #11 - Sobey SB255 – 4:00 PM**

## Crystal Engineering: Then, Now and Next

**Michael Zaworotko**

*Dept. of Chemical Sciences and Bernal Institute, University of Limerick, Ireland*
*Email: xtal@ul.ie*

"What would the properties of materials be if we could really arrange the atoms the way we want them? Richard Feynman asked this question in 1959 and provided an answer that has motivated crystal engineering researchers since the field emerged in the 1990s: "we will get an enormously greater range of possible properties that substances can have, and of **different things that we can do**."

Systematic crystal engineering studies conducted at Saint Mary's in the 1990s focused upon basic design rules for coordination networks, that had only just been introduced by 2025 Nobel Laureate Richard Robson in 1989, and molecular solids (hydrogen-bonded networks). In the 2000s, the focus turned to properties and utility, especially in the context of pharmaceutical science and separations science.

We have thereby learned that systematic pore engineering can profoundly impact the properties of porous solids. But what properties are of most relevance? We will try to answer this question in this lecture by detailing the evolution of crystal engineering and discussing three classes of crystalline material that can indeed **do different things** to address global challenges in sustainability, especially $CO_2$ capture and atmospheric water harvesting (AWH). Specifically, the emergence ultramicroporous materials (then), flexible coordination networks (now) and non-porous and closed pore solids (next) will be exemplified by recent case studies.[1-6] Emphasis will be placed upon the urgent need to design better, cheaper and greener materials to address global challenges and why these classes of material offer reason for optimism.

[1] Koupepidou, K.; Subanbekova, A.; Zaworotko, M.J. *Chemical Communications*, **2025**, *61*, 3109-3126.
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[3] Rahmani, M., *et al. Journal of the American Chemical Society*, **2023**, *145*, 27316-27324.
[4] Eaby, A.C., *et al*. *Journal of the American Chemical Society*, **2025**, *147*, 1813-1822.
[5] Andaloussi, Y.H. *et al*. *Journal of the American Chemical Society*, **2025**, *147*, 46145-46151.
[6] Kong, X.J. *et al*., *Nature Materials*, **2026**, *25*, 1402-1410.

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# NOTES