Green Chemistry Applied in Industry Symposium

Hosted by the

Green Chemistry Initiative

at the

University of Toronto
St. George Campus
Toronto, Ontario
Canada

May 13-15, 2015

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Symposium Schedule

Wednesday, May 13, 2015

Location: Davenport East, Lash Miller, 80 St. George Street

5:00 pm – 6:00 pm	**REGISTRATION**
6:00 pm – 8:00 pm	**Crash Course in Green Chemistry: An Industrial & Academic Perspective** Dr. Andrew Dicks *University of Toronto*

Thursday, May 14, 2015

Location: KP108, Koffler House, 569 Spadina Crescent

9:00 am – 9:55 am	**REGISTRATION**
9:55 am – 10:00 am	**Opening Remarks**
10:00 am – 10:45 am	**Green Chemistry in Industry: GC3 Goals and Projects** Anna Ivanova *Green Chemistry & Commerce Council*
10:45 am – 11:30 am	**VWR's Sustainability Journey** Megan Maltenfort *VWR International*
11:30 am – 12:30 pm	**LUNCH**
12:30 pm – 1:15 pm	**Practical Applications of Green Chemistry at Sigma-Aldrich** Dr. Ettigounder Ponnusamy and Jeffrey Whitford *Sigma-Aldrich*
1:15 pm – 2:00 pm	**Silicon Wafers and Photovoltaics** Vladimir Tarasov *1366 Technologies*
2:00 pm – 2:30 pm	**COFFEE BREAK**
2:30 pm – 3:15 pm	**Developing New Pathways for Catalysis: Current Work at GreenCentre Canada** Dr. Paul Thornton *GreenCentre Canada*
3:15 pm – 4:00 pm	**Sustainable Materials for Xerographic and Solid Ink Jet Printing** Dr. Guerino Sacripante *Xerox Research Centre of Canada*
4:00 pm – 4:30 pm	**WALK TO POSTER SESSION & SHORT BREAK**
4:30 pm – 6:30 pm	**Poster & Networking Session** ***Location**: Davenport Atrium, Lash Miller, 80 St. George Street

Friday, May 15, 2015

Location: BA1170, Bahen Centre, 40 St. George Street

10:00 am – 10:45 am	**Tools for Process Intensification** Dr. Robert Tinder *Proteaf Technologies LLC*
10:45 am – 11:30 am	**Solvent-Free Synthesis** Prof. Tomislav Friščić *McGill University*
11:30 am – 12:30 pm	**LUNCH**
12:30 pm – 1:15 pm	**Funding Opportunities for Sustainable Technologies** Flora Livesey *Sustainable Development Technology Canada*
1:15 pm – 2:00 pm	**Coatings with Improved Eco-Footprint through the use of Polymer Pigment Composites** Stan Brownell *The Dow Chemical Company*
2:00 pm – 2:45 pm	**Computational Chemistry with Applications** Prof. Ian Hamilton *Wilfrid Laurier University*
2:45 pm – 3:15 pm	**COFFEE BREAK**
3:15 pm – 3:45 pm	**Preparing for the Future: Advice from Industry** Karl Demmans *Green Chemistry Initiative*
3:45 pm – 4:15 pm	**Open Discussion – Green Chemistry in Industry** Moderator: Karl Demmans
4:15 pm – 4:30 pm	**Announcement of Poster Prizes & Concluding Remarks**
4:30 pm – 6:30 pm	**Social with the Green Chemistry Initiative** ***Location**: Harvest Kitchen, 124 Harbord Street

For the duration of the Symposium, if you need assistance please contact either Laura Reyes at (416)845-2816, or Jonathon Moir at (647)236-1308. At the Symposium, anyone wearing a green name badge will be able to help you.

Lecture Abstracts & Speaker Bios

Crash Course in Green Chemistry: An Industrial & Academic Perspective

Dr. Andrew Dicks, University of Toronto

Abstract: As the kick-off to the 2015 Green Chemistry Applied in Industry Symposium, this seminar will cover some basics of green chemistry and sustainability as they relate to research in academic and industrial venues. It will be grounded in some of the fundamental 12 Principles that were established by Anastas and Warner, including: simple metrics, greener solvent and reagent alternatives, energy considerations for reactions, and strategies for waste management and recycling. Case studies will be introduced in conjunction with literature resources in order for attendees to learn about opportunities to "green up" their own practical work.

Biography: Andrew (Andy) Dicks was hired in 2001 at the University of Toronto as a teaching faculty member. He developed an interest in green chemistry instruction two years later, when an undergraduate student under his supervision started performing organic reactions in water. Since that time he has published multiple experiments that showcase green principles to students, such as using recyclable solvents, catalytic reactivity, solvent-free transformations and atom-economic reactions. This work has led to co-development of a third-year undergraduate course (Organic Synthesis Techniques) that profiles sustainable technologies from both practical and theoretical perspectives. In 2011 he edited a "how-to" book for college instructors (Green Organic Chemistry in Lecture and Laboratory), and received the American Chemical Society Committee on Environmental Improvement Award for Incorporating Sustainability into Chemistry Education. A current pedagogical interest of his is the incorporation of green chemistry decision-making into undergraduate curricula.

Green Chemistry in Industry: GC3 Goals & Projects

Anna Ivanova, Green Chemistry & Commerce Council

Abstract: The Green Chemistry and Commerce Council (GC3) is a business-to-business forum that advances the application of green chemistry across supply chains. Once a year, GC3 members and other interested organizations come together to discuss their utilization of green chemistry and what can be done to further its adoption in industry. The result of this conference is a series of projects that are carried out by GC3 staff over the course of the following year. Anna Ivanova, the GC3's green chemist, will give an overview of the GC3's main project areas—innovation, education, mainstreaming, and retail—and share some examples of successful initiatives facilitated by the GC3, as well as ongoing projects.

Biography: Anna Ivanova is a green chemist at the Green Chemistry and Commerce Council in Lowell, MA, where she works to advance the adoption of green chemistry in industry. Her primary project areas at the GC3 are innovation and education. Anna earned her B.Sc. in chemistry from Caltech in 2012, and her M.Sc. in chemistry from Carnegie Mellon in 2014. She is also the communications director for NESSE, the Network of Early-Career Sustainable Scientists and Engineers, which aims to connect early-career researchers who are passionate about sustainability. Read more about the Green Chemistry & Commerce Council at http://www.greenchemistryandcommerce.org, and about NESSE at http://www.sustainablescientists.org/about/.

VWR's Sustainability Journey

Megan Matlenfort, VWR International

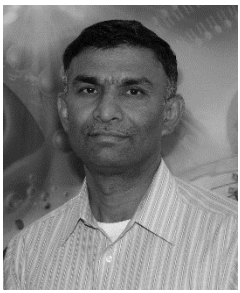
Abstract: Learn about VWR's journey to promote sustainable business practices within their own organization and throughout the supply chain. Get insight into how VWR has built a global initiative focused on reducing negative environmental impact, maximizing positive social impact, while improving the financial performance of the organization. VWR's Sustainability Manager will share how the organization has navigated this new way of thinking, how they have achieved buy-in, the importance of public reporting and goal setting, and how the Company continues to be innovative in this space. There will be a focus on how transparency around sustainability has positively impacted business relationships and strengthened customer collaborations and how VWR is shifting toward more supplier engagement to meet customer needs around environmentally preferable products and supplier performance. More specifically, VWR will speak to their efforts to build transparency around environmental product attributes and customer reporting to help customers meet their sustainable procurement goals. They will also touch on green chemistry specifically, in the context of environmentally preferable products, and more sustainable alternatives offered by VWR's chemical suppliers.

Biography: Megan Maltenfort is the Sustainability Manager for VWR International, LLC, a global distributor of laboratory supplies. In her role, Megan leads critical sustainability initiatives internally to manage waste and resource use effectively and develops innovative solutions for VWR customers to meet their own sustainability goals. By finding opportunities to collaborate with customers and suppliers and with a constant focus on internal improvement, Megan has helped VWR to reduce overall operational impacts. Megan received a Master's degree in Environmental Management from Duke University and a Bachelor of Arts in Science, Technology, and Society from Vassar College.

Practical Applications of Green Chemistry at Sigma-Aldrich

Dr. Ettigounder Ponnusamy & Jeffrey Whitford, Sigma-Aldrich

Abstract: Sigma-Aldrich is committed to sustainable growth, which is good for the environment, people and customers. Over the past three years, Sigma-Aldrich has focused on broadening its product portfolio to help its customers reduce chemical related impact on human health and eliminate/minimize contamination of the environment through its dedicated, sustainable prevention program. Sigma-Aldrich's scientists are also involved in this process by continuously searching for greener alternatives, and environmentally friendly reaction media to enable a more efficient manufacturing process. Recently Sigma-Aldrich created DOZN™, a unique quantitative green chemistry analysis tool based on the 12 principles of green chemistry. DOZN™ provides a framework for learning, designing or improving materials, products, processes and systems. DOZN™ scores products and processes based on proprietary metrics to arrive at an aggregate score ranging from 100 to 0, with lower values indicating preferential results. The system calculates these scores based on manufacturing inputs and easily obtainable data including GHS (Globally Harmonized System) information. DOZN™ is flexible enough to span the diverse product portfolio of Sigma-Aldrich ranging from chemistry to biology-based products. The system has been validated and verified by Environ International to ensure best practices are applied. During this presentation, we will demonstrate the practical application of the 12 principles and how Sigma-Aldrich is translating them into tangible tools for the scientific community through real examples of our greener re-engineered processes/products.



Biography: Ettigounder Ponnusamy 'Samy' has worked at Sigma-Aldrich for over 27 years in various R&D roles and currently works as a Research Fellow in Green Chemistry. Samy started Sigma-Aldrich's Worldwide Green Chemistry Team in 2007 and currently leads the Green Chemistry Team. He is also one of the co-chairs for the ACS GCI's Chemical Manufacturer Roundtable.

Samy is a research and development scientist with over 30 years of industrial and 7 years of academic research experience in product and greener process development, polymer processing and greener manufacturing from laboratory to pilot plant scales utilizing green chemistry principles. He has experience in designing greener syntheses and characterizations of various polymers for targeted drug delivery applications, organic molecules for medical research, product, process and analytical

method development. His major responsibilities have included managing/executing various projects across the corporation in multi-functional groups, problem solving/trouble-shooting, greener chemistry, technology transfers to various divisions in the corporation, new products and process improvements. Many of these polymers are used as backbones for active pharmaceutical ingredients (API) in clinical trials (phase I, II & III) for targeted drug delivery applications by biopharmaceutical industries. Ponnusamy's work was recognized by the St. Louis Academy of Science, and he was awarded an outstanding scientist award in 2011 and also inducted as a Fellow of the St. Louis Academy of Science.

Ponnusamy earned his PhD in Polymer Chemistry from University of Madras, India and completed postdoctoral work at the University of Illinois at Chicago and has 30 research publications and 7 patents.

Biography: Jeffrey Whitford joined Sigma-Aldrich in 2005 and has served in a variety of positions most recently as the company's first-ever head of Global Citizenship. In his latest role, Whitford is responsible for developing and implementing strategic programs designed to enhance Sigma-Aldrich's position as a global leader in greener chemistry, environmental sustainability and social responsibility. He works to integrate sustainable development concepts into the strategic plans for each of Sigma-Aldrich's business units. He also directs the company's largest global citizenship initiative, Team Sigma-Aldrich, where employees in 25 countries participate in charitable events. Whitford has guided Sigma-Aldrich to recognition for leadership in their CSR efforts from the CDP, Dow Jones Sustainability Index, #20 from the Corporate Knights Global 100 at the World Economic Forum at Davos, #5 in the US on Newsweek's Green Rankings, #1 in the Materials Sector on The Civic 50 and #5 on Corporate Responsibility Magazine's Top 100 Corporate Citizens.

Whitford earned a bachelor's degree in Journalism and Advertising from the University of Missouri-Columbia and recently earned a master's degree in business administration at Washington University in St. Louis.

Silicon Wafers and Photovoltaics

Vladimir Tarasov, 1366 Technologies

Abstract: Photovoltaics have grown faster in their generation capacity than any other renewable energy source, largely due to advances in manufacturing technologies and economies of scale. In 2011, solar PV module prices crossed the threshold of $1.00/Watt, widely regarded as a threshold for grid parity with conventional electricity sources and the widespread adoption of PV as a mainstream energy generation technology. In 2013, the global generating capacity of photovoltaics grew to 139 GW of installed PV, a 6-fold increase over 4 years prior. So much of solar PV's growth has occurred within the last decade that 98% of all currently installed PV systems were built after 2004, and 50% of them in the last two years.

This talk will delve into the reasons for solar PV's rapid growth, the history of photovoltaics research, the current state of the PV market, the structure and fabrication of a standard multicrystalline silicon solar cell, and a brief overview of 1366 Technologies' Direct Wafer process.

1366 Technologies is a Massachusetts-based startup company developing a technique to produce solar silicon wafers, the backbone of 90% of today's solar cells, by casting them directly from molten silicon rather than the prevailing method in which wafers are cut from a large ingot, a process involving over 16 steps and rendering half of the silicon unusable.

Biography: Vlad Tarasov is presently a Senior Engineer with 1366 Technologies, where he has worked for over six years on projects ranging from advanced electroplated solar cell metallization to microstructured wet chemical texturing of silicon surfaces. He is currently working on optimizing the controlled nucleation and growth of silicon towards the formation of high-quality solar-grade wafers.

Previously during his junior year in college, Vlad cofounded Levant Power Inc. to commercialize a high-performance regenerative shock absorber technology for automobiles, trains, and heavy trucks. He and his cofounders spun the company out of MIT, and Levant Power currently employs over 40 people in its pursuit of a next-generation vehicular regenerative suspension.

He holds a B.S. degree in Materials Science and Engineering from MIT, where he completed an undergraduate thesis on controlling the self-assembly of gold nanoparticles using engineered solvent interactions.

Developing New Pathways for Catalysis: Current Work at GreenCentre Canada

Dr. Paul Thornton, GreenCentre Canada

Abstract: GreenCentre Canada is a Centre of Excellence for Commercialization and Research that aims to bring breakthrough technologies in sustainable chemistry to the global chemistry enterprise. Funded by the governments of Ontario and Canada, as well as our industry partners, our mission is to bridge the "commercialization gap" that exists between inventions from academia and their eventual adoption by industry. This presentation will offer an overview of how this unique commercialization model functions in the context of developing new catalysts for use in industrial contexts.

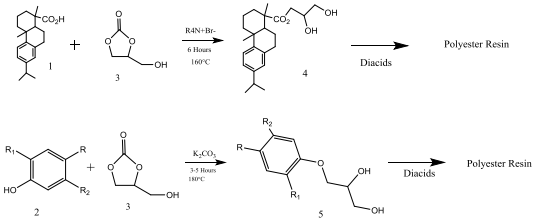
Industry has an ongoing need for better catalytic processes. Catalysts that offer novel reactivity have great potential but present challenges in determining appropriate applications while also facing competition from incumbent technologies. Two technologies under development at GreenCentre include a class of catalysts for the hydrogenation of esters and a system for immobilization of catalysts previously only employed in homogeneous systems. The major technical challenges of these technologies will be discussed, as will potential applications in the fine chemical industry.

Biography: Paul is a native of New Brunswick. He obtained his BSc. in Chemistry and Biology from the University of New Brunswick in 2003. He then pursued graduate studies at Dalhousie University, where he studied total synthesis and methodology development under the supervision of Professor Jean Burnell. His thesis work focused on novel applications of the Pauson-Khand reaction for complex molecule synthesis. He completed his doctoral degree in 2009. He then undertook postdoctoral research with Professor Jeff Aube at the University of Kansas where he undertook the synthesis of compound libraries and developed applications of flow chemistry. In 2011 he joined GreenCentre Canada and is currently one of the company's Technical Development Managers. Paul's role at GreenCentre involves planning and managing technical work for various projects, including those with academic researchers and technologies, and with industry.

Sustainable Materials for Xerographic and Solid Ink Jet Printing

Dr. Guerino Sacripante, Xerox Research Centre of Canada

Abstract: Recently, Rosin acids and lignin have attracted considerable attention as a renewable source of valuable chemical species. The purpose of this work is to synthetically demonstrate the feasibility of using these natural occurring materials to successfully manufacture toners and Inks for Xerographic and Ink Jet Printers resins. Sustainable materials such as natural phenols as well as phenolics from lignin based fragments are transformed to organic diols (4) or (5) utilizing a solvent free base catalyzed reaction with bio-based glycerin carbonate (3). The corresponding organic diols are then polymerization with various diacids, including bio-based succinic acid to afford polyester resins. These polyester resins are subsequently emulsified to nano-sized particles, and coalesced to micron sized composites for use as xerographic marking materials.



Biography: Guerino received his undergraduate followed by a Ph.D. (1986) at McGill University in synthetic organic chemistry. He then joined the Xerox Research Centre of Canada in 1987, and is currently a Research Fellow. In his 29 year career, Guerino has developed the design of novel functional polymers and resins for use in xerographic toners, and most notably, also pioneered the Xerox Emulsion Aggregation (EA) Toner nanotechnology to synthesize micron-sized particles in a bottoms-up approach from nanometer sized components. He has authored over 200 patents for Xerox, and currently committed to integrate the principles of environmental and green chemistry & engineering into the design and manufacturing of de-inkable and sustainable solid Inks and toners.

Tools for Process Intensification

Dr. Robert Tinder, Proteaf Technologies LLC

Abstract: With the ability to reduce continuous manufacturing tools to the laboratory, continuous processing is rapidly taking hold in all stages of industry. Such tools are enabling processes to be conducted with less solvent, faster and safer than ever before. In short, intense processes are Green processes. Presented will be a series of examples for workflow development, and conversion of batch chemistry to flow with comparisons to conventional batch processing.

Biography: Robert Tinder, Ph.D. has worked in both academia and industry holding positions of increasing responsibility at Baylor College of Medicine, Isis Pharmaceuticals, Wyeth Pharmaceuticals, and Hoffmann-LaRoche. He has expertise in biophysics, chemo-informatics, robotics and microreactor technology. His practical work experience ranges from biophysical research, traditional medicinal chemistry, computational chemistry to process research and development. He is the co-founder of Proteaf Technologies LLC where he has spearheaded a number of development projects around the globe.

Solvent-Free Synthesis

Prof. Tomislav Friščić, McGill University

Abstract: Whereas solvents are unavoidable in a range of activities, from chemical education and laboratory research to industrial manufacturing, they are also a critical hindrance of sustainability and safety. Typically used in hundred-fold excess with respect to reactants, solvents cause major energy losses associated with heating and their removal. They are a central safety issue due to toxicity, flammability and spill hazard. While the dependence of chemistry on solvents is a result of a widespread belief that dissolution is necessary for reactivity, in the past 5 years we have demonstrated the ability to induce reactions of solids through catalytic additives, including trace liquid phases and simple salts.[1] Facilitated by mechanical agitation in a ball mill, such mechanochemical reactivity offers cleaner, faster and high-yielding synthetic methodologies for a wide range of chemical transformations, from organic synthesis to making metal-organic frameworks.[2] This presentation outlines some of our recent advances in using mechanochemistry for the discovery of chemical transformations, especially those useful in making pharmaceutically attractive targets,[3] and for the discovery of previously unknown metal-organic frameworks.[4] These advances are enabled solely through the application of mechanochemistry, and in some cases resulted from the application of recently introduced methodologies for real-time monitoring of mechanochemical milling reactions.[5] Thus, this presentation will highlight mechanochemistry and the solid state not only as means for 'greening' chemical and materials synthesis, but also as a new environment for their development and discovery.
References: [1] Friščić Chem. Soc. Rev. 2012, 41, 3493-3510.; [2] James et al. Chem. Soc. Rev. 2012, 41, 413-447.; [3] Tan, Mottillo, Katsenis, Štrukil and Friščić Angew. Chem. Int. Ed. 2014, 53, 9321-9324.; [4] Katsenis et al. Nature Commun. 2015, 6:6662.; [5] Friščić et al. Nature Chem. 2013, 5, 66-73.

Biography: Tomislav Friščić is an Assistant Professor and a William Dawson Scholar at the Department of Chemistry, McGill University. He received his B.Sc. at the University of Zagreb with Branko Kaitner (2001), followed by a Ph.D. with Len MacGillivray at the University of Iowa (2006). He was a post-doctoral associate with William Jones (2006) and a Herchel Smith Research Fellow at the University of Cambridge (2008). His group is developing solid-state catalytic and self-assembly methodologies in diverse areas of organic, metal-organic, pharmaceutical and materials synthesis. He has co-authored >130 research and review articles and was awarded the 2011 RSC Harrison-Meldola Medal, the 2014 ChemComm Emerging Investigator Award and the 2014 McGill Tomlinson Scientist Award. He is a Fellow of the Royal Society of Chemistry and, since 2013, member of the Editorial Board of CrystEngComm.

Funding Opportunities for Sustainable Technologies

Flora Livesey, Sustainable Development Technology Canada

Abstract: This presentation will focus on Sustainable Development and Technology Canada (SDTC) in general, our mandate, how we fund projects and how our funding helps these projects advance to commercialization. I will profile several of our portfolio projects that are green chemistry related, and show how they fit our mandate and what they hope to achieve by completing the project.

Biography: Flora Livesey completed a BScEng in Civil Engineering at the University of New Brunswick (UNB) before specializing in Wind Engineering (the study of wind loading on structures) at the University of Western Ontario (UWO) where she completed her MScEng. This experience led to working in Denmark for over 7 years in a wind tunnel facility, performing testing on some of the world's tallest buildings and longest bridges. Upon returning to Canada, she completed her MBA at the University of Ottawa while working in various organizations and industries as a Project Manager. She has been with SDTC since 2009 where she initially worked as a Manager, Projects and lately as a Funding Advisor, a role that fulfils her love of meeting people, learning about new technologies and helping applicants navigate the SDTC funding process.

Coatings with Improved Eco-Footprint through the use of Polymer Pigment Composites

Stan Brownell, Dow Chemicals

Abstract: In the United States, approximately 700 million gallons of house paint are produced each year. Practical adsorbing latex polymer technology is a new innovation in the coatings industry which offers the ability to improve the sustainability while lowering the cost of paint. This is accomplished by reducing dependence on TiO_2, a key raw material with a large impact on the environmental footprint of white and pastel paint bases. This novel technology replaces the conventional paint binder with a smarter material which does everything the conventional binder does while additionally improving pigment efficiency. These polymeric pre-composite binder particles have been designed to interact with coatings grade TiO_2 particles. By employing pre-composite binders during the standard paint making process, pigment/polymer composites self-assemble which result in a more ordered distribution of TiO_2 in the paint film, improving not only hiding but barrier properties as well.

Pre-composite polymers offer a powerful advantage by combining improvements in sustainability, performance, and economics. This innovative technology provides cost-efficient improvements in key sustainability metrics as demonstrated by a third-party validated life cycle assessment. Production of this technology is measured by millions of pounds and was recently awarded a US EPA Presidential Green Chemistry Challenge Award.

Biography: Stan Brownell, Research Scientist in the Hiding Technologies group of Dow Coatings Materials, earned his BS in Chemistry from Millsaps College in 2000 and an MS in Organic Chemistry from the Georgia Institute of Technology in 2002. Stan joined the coatings business of Rohm and Haas in 2005 (now The Dow Chemical Company) and has worked in Architectural Coatings the last ten years. In 2009, he moved into the Hiding Technologies group at Dow and led the synthesis work that culminated in the commercialization of the first generation of Dow's EVOQUE™ adsorbing polymer technology. Currently, Stan is the project group leader responsible for designing the next generation of Dow's EVOQUE™ product platform. He has filed 18 patent applications and was one of the recipients of the 2013 Presidential Green Chemistry Challenge Award for work on adsorbing polymer technology. Prior to joining Rohm and Haas, Stan worked in the Applied Research Group at Behr Process for two years.

Computational Chemistry with Applications

Prof. Ian Hamilton, Wilfrid Laurier University

Abstract: I will give a brief introduction to computational chemistry with a focus on ab initio quantum chemical methods and the advantages of density functional theory calculations over traditional wave function based calculations. I will consider both zero Kelvin calculations and finite temperature ab initio molecular dynamics calculations. As examples, I will then discuss the use of computational chemistry to understand the properties of two diverse systems of relevance to green chemistry: the inter-conversion of complexes of arsenic (a well-known toxic metal) in an aqueous environment, and the band gap of quantum dots (which are ligand-protected nanocrystals that are used in photovoltaic devices).

Biography: My academic career has been very rewarding. Following a PhD in theoretical/computational chemistry at the University of Toronto I was a Research Associate at the University of Chicago and a University Research Fellow at the University of Ottawa before joining the Chemistry Department at Wilfrid Laurier University where I am now Professor of Chemistry. I am also Adjunct Professor of Chemistry at the University of Waterloo. I have been a visiting scientist/professor at the Fields Institute in Toronto, the Agency for Industrial Science and Technology in Japan (where I was a STA fellow), the Centre of Theoretical Chemistry and Physics in New Zealand (with support from the Massey University International Visitor Research Fund), and the University of Toronto.

Preparing for the Future: Advice from Industry

Karl Demmans, Green Chemistry Initiative

Abstract: We asked our speakers to answer various questions pertaining to the differences in industrial and academic chemistry lab practices, the necessary skill set and experiences required to make a job application stand out, and how both experience and level of education could affect the career opportunities available to students after graduation. We've combined these answers into a short discussion that may answer questions you have about life in the chemical industry and getting a position in industry without industrial experience. We will discuss experiences our speakers have had and share their advice.

Biography: Karl Demmans obtained his undergraduate degree at McGill University in 2012 with two summers' worth of experience working with Dr. Audrey Moores on ionic liquids as recyclable media for the hydroformylation of long-chain alkenes. After a thrilling vacation through Europe, he returned to McGill and worked with Dr. Tomislav Friščić on solvent-free mechanochemistry via ball milling. With the strong encouragement of Dr. Friščić and Dr. Moores, he attended many conferences including IDW and the Sustainability Chemistry Summit, forming a newfound interest in smaller, welcoming conferences and revitalizing his interest in Green Chemistry. In 2013, he gladly accepted a graduate position with Dr. Robert Morris working on catalyst recycling for the hydrogenation of ketones using an iron-based catalyst. Karl is a key member of the Green Chemistry Initiative at U of T, including being this year's Symposium Coordinator.

Poster Session Presentations

Thursday, May 14, 2015. 4:30 pm - 6:30 pm
Davenport Atrium, Lash Miller, 80 St. George Street

Boards will be available starting Thursday morning. Please use velcro dots provided. Winners of the poster prizes will be announced during the closing remarks, on Friday May 15, 2015.

Poster abstracts are available at:
http://greenchemuoft.ca/symposium.php

Catalytic Formylation of Primary/Secondary Amine with CO_2 and H_2
M. A. Affan, P. G. Jessop*
Queen's University

Synthesis and Characterization of Biochars Made from Anaerobically Difested Food Wastes for Water Remediation
N. Almalki, T. Laredo*
Lakehead University

Minimizing the Copper Leaching in CuAAC Reactions by a Thin Carbon Shell on Cu-Fe Microparticles
M. Bateman, M. Masnadi, P. Zhao, O. Trautschold, N. Braidy, B. Koel, A. Moores*
McGill University

Electrophilic Phosphonium Dications Derived From Pyridine and Ferrocene Scaffolds
J. M. Bayne, I. Mallov, M. H. Holthausen, M. Mehta, D. W. Stephan*
University of Toronto

A Single-Component Photocatalyst for Gas-Phase CO_2 Reduction: Toward Efficient Solar Fuel Production
L. B. Hoch, T. E. Wood, P. G. O'Brien, K. Liao, L. M. Reyes, C. A. Mims, G. A. Ozin*
University of Toronto

Phosphonium/Aminosilane Frustrated Lewis Pairs for Carbon Dioxide Reduction
J. LaFortune, T. vom Stein, D. W. Stephan*
University of Toronto

Development of Novel 3,5-Dimethylisoxazoles Bromodomain Inhibitors
S. Liu, M. R. McKeown, H. Fu, D. L. Buckley, J. Qi, J. E. Bradner*, W. Zhang*
University of Massachusetts Boston

Synthesis of 3-Acetamido-5-acetylfuran From N-Acetyl-D-glucosamine Using Ionic Liquids
Y. Liu, F.M. Kerton*

Memorial University

Synthesis of Highly Ordered Mesoporous BiOBr-Bi_2WO_6 Nanosheet Composites with Efficient Photocatalytic Activity
M. Zhu, L. Qiu, C. Lu, M. C. Goh*
University of Toronto

Modified Chitosan Beads with Different Cross-Linkers for Phosphate Removal from Aqueous Solution
M. Mahaninia, L. Wilon
University of Saskatchewan

Ruthenium Complexes for Chemical and Solar Energy Applications
D. E. Prokopchuk, M. M.-H. Sung, R. H. Morris*
University of Toronto

Pesticides and Oxodegradable Agriculture Mulch
K. Snyder
Lakehead University

Perovskite Thin Films for Potential Solar Cell Application: A Study on Film Degradation
C. Tran, Y. Liu
University of Toronto

Other Posters

Green Chemistry Initiative
University of Toronto

Ozin Group – Nanomaterial Photocatalysts for Solar Fuels Production
University of Toronto

Morris Group
University of Toronto

About the Green Chemistry Initiative

Who We Are: Launched in October 2012, the Green Chemistry Initiative is made up of graduate and undergraduate students currently working in the Department of Chemistry at the University of Toronto. We all come from a variety of disciplines, but have similar goals when it comes to green chemistry.

Our Mission: To raise awareness about green chemistry in order to promote sustainable practices within the chemistry community at the University of Toronto. Through seminars, workshops, and networking, the Green Chemistry Initiative strives to educate scientists and engineers about important green chemistry concepts that are relevant to chemical research and the community at large.

Our Current Projects: The GCI runs three main ongoing events: a weekly trivia challenge, a monthly seminar series, and an annual workshop or symposium. In addition to these core activities, we have many other projects to promote green chemistry, including: a campaign for chemical waste awareness, a campaign to reduce fumehood energy consumption, incorporation of more green chemistry content in undergraduate courses, an online video series explaining the 12 principles of green chemistry, several community outreach events, participation in several national and international conferences, and collaboration with organizations worldwide.

Our Current Members:

Co-Chairs: Laura Hoch and Laura Reyes

Secretary: James LaFortune

Treasurer: Erika Daley

Symposium Coordinator: Karl Demmans

Seminar Series Coordinators: Jonathon Moir and Ian Mallov

Website Coordinator: Brian De La Franier

Trivia Coordniator: Elisa Carrera

Members-at-Large: Julia Bayne, Nadine Borduas, Cookie Cho, David Djenic, Yuchan Dong, Kiril Fedorov, Rachel Hems, Maria Karcz, Sarah Kavassalis, Lisa Kozycz, Mark Miltenburg, Peter Mirtchev, Shawn Postle, Judy Tsao, Megan Willis, Annabelle Wong, and Gustav Wulf.

Contact Information:

Email: green@chem.utoronto.ca

Website: www.greenchemuoft.ca

Blog: greenchemuoft.wordpress.ca

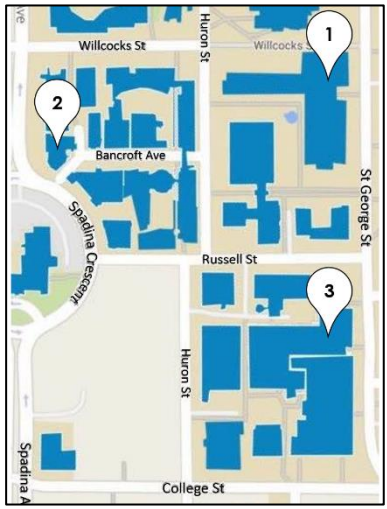
GreenChemUofT

1. **Lash Miller Chemical Laboratories** – Davenport East & Atrium (3rd floor), 80 St. George Street, Toronto ON, M5S 3H6

2. **Koffler House** – KP108 (Main floor), 569 Spadina Crescent, Toronto ON, M5S 2J7

3. **Bahen Centre for Information Technology** – BA1170 (Main floor), 40 St. George Street, Toronto ON, M5S 2E4

4. **Harvest Kitchen** – 124 Harbord Street, Toronto ON, M5S 1G6 (not shown on map, but very close to campus)



Wi-Fi Access for Visitors

The University of Toronto is a member of the 'eduroam' (education roaming) network, which allows faculty, staff, and students to access wireless services at any participating institution by logging in with their home institution credentials.

To access wifi, simply try to connect to the 'eduroam' network and it will prompt you to sign in. The username and password will be given to external participants at registration. You user name is your user ID (for your home institution) with the @universityurl at the end. For example, for Queen's University it would be userid@queensu.ca. The password is the normal password you use to sign in at your home institution. If you have any problems connecting to eduroam, please visit: http://eduroam.utoronto.ca/setup.html

Suggested Places to Eat Near UofT

Famoso Pizzeria (386 Bloor St W) – Brick oven pizza and Italian
Fresh (326 Bloor St W) – Modern vegetarian food
Harbord House (150 Harbord St) – Craft beer and fancy pub food
Harvest Kitchen (124 Harbord St) – Fresh, locally sourced food
Mother's Dumplings (421 Spadina Ave) – Delicious dumplings and Chinese
Prenup Pub (191 College St) – Great beer selection and pub food
Smoke's Poutinerie (390 Bloor St W) – Excellent poutine
Thai Basil (467 Bloor St W) – Great Thai place

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