GREEN BY DESIGN: ADVANCES IN CHEMISTRY AND ENGINEERING

A symposium on **May 23-25, 2018**
Hosted by the Green Chemistry Initiative

University of Toronto St George Campus
Toronto, Canada

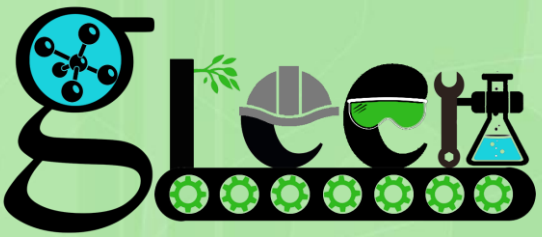


Image created by Yuchan Dong

Table of Contents

Symposium Schedule

Wednesday, May 23, 2018

Location: Lash Miller, 80 St. George Street & Wilson Hall, 40 Willcocks St

2:00 pm – 3:00 pm	**REGISTRATION & COFFEE**
3:00 pm – 5:00 pm	**Crash Course in Green Chemistry** Prof. Andy Dicks, University of Toronto *Davenport Seminar Room, 80 St. George St*
5:00 pm – 6:00 pm	**BREAK**
6:00 pm – 7:30 pm	**Keynote Public Lecture** **Nanostructure Materials for Sustainability and Clean Environment** Prof. Frank Gu, University of Waterloo *WI 1016, Wilson Hall, 40 Willcocks St*

Thursday, May 24, 2018

Location: *WI 1016, Wilson Hall, 40 Willcocks St*

9:00 am – 9:55 am	**REGISTRATION & COFFEE**
9:55 am – 10:00 am	**Opening Remarks**
10:00 am – 10:45 am	**Mining Anaerobic Microbial Communities and their Metagenomes** Prof. Elizabeth Edwards, University of Toronto
10:45 am – 11:30 am	**R&D Supporting Clean Tech Innovation in the Oil Sands** Dr. Cécile Siewe, Natural Resources Canada
11:30 am – 12:30 pm	**LUNCH**
12:30 pm – 1:15 pm	**Sustainable Materials Innovation at Patagonia** Dr. Laura Hoch, Patagonia
1:15 pm – 2:00 pm	**The Journey Towards Sustainability for Automatic Dishwashing Detergents in a Phosphate-free World** Dr. Scott Backer, Dow Chemical
2:00 pm – 2:30 pm	**COFFEE BREAK**
2:30 pm – 3:15 pm	**Using Food to Protect Food: Taking Inspiration From Nature to Reduce Negative Externalities Along the Fresh Food Supply Chain** Dr. Jenny Du, Apeel Science
3:15 pm – 4:00 pm	**Designing Safe Chemicals** Dr. Charles Barton, Sherwin-Williams
4:00 pm – 4:30 pm	**BREAK**
4:30 pm – 6:30 pm	**POSTER & NETWORKING SESSION** ***Davenport Atrium, 80 St. George St***
6:30 pm	**Group Dinners with Invited Speakers** (only speakers' expenses will be covered by GCI)

Friday, May 25, 2018

Location: *WI 1016, Wilson Hall, 40 Willcocks St*

9:30 am – 10:00 am	**COFFEE**
10:00 am – 10:45 am	**Fiber Optic Sensing Technology for Harsh Environments** Dr. Amir Azhari, AOMS technologies Inc..
10:45 am – 11:30 am	**Advanced Materials Development for Bioenergy Processes** Philippe Dauphin, Natural Resources Canada
11:30 am – 12:30 pm	**LUNCH**
12:30 pm – 2:45 pm	**Life Cycle Assessment Challenges Related to Biomass Conversion** Dr. Nathan Manion, Queen's University
2:45 pm – 3:15 pm	**COFFEE BREAK**
3:15 pm – 4:15 pm	**Panel Discussion with Speakers** (Dr. Laura Hoch, Dr. Jenny Du, Dr. Amir Azhari, Dr. Scott Backer)
4:15 pm – 4:30 pm	**Announcement of Poster Prizes & Concluding Remarks** *Green Chemistry Initiative*
4:45 pm	**NETWORKING DINNER & SOCIAL** **WITH SPEAKERS & THE GREEN CHEMISTRY INITIATIVE** ***Location**: Prenup Pub, 191 College St

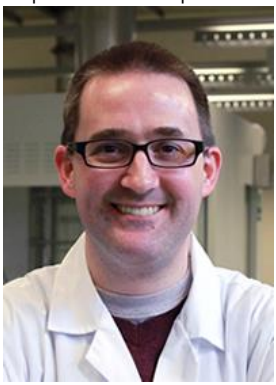
For the duration of the Symposium, if you need assistance please contact either Yuchan Dong at (416) 578-5251, or Rachel Hems at (647) 449-1407. At the Symposium, anyone wearing a green name badge will be able to help you.

Lecture Abstracts & Speaker Bios

Crash Course in Green Chemistry

Prof. Andrew (Andy) Dicks, University of Toronto

Abstract: As the kick-off to the 2018 Green By Design: Advances in Chemistry and Engineering, 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.

Keynote Lecture: Nanostructured materials for sustainability and clean environment

Prof. Frank Gu, University of Waterloo, Canada Research Chair

Abstract: Nanotechnology is the understanding and control of matter generally in the 1–100 nm dimension range. Detailed understanding of chemical interactions and recent technological advances have created the possibility of designing nano-structured materials tailored for specific applications. Professor Gu heads an interdisciplinary research group that combines functional polymers and polymer metal oxide materials to solve problems in health and environmental protection. This seminar will showcase several major activities in Gu's lab for healthcare and environmental remediation applications.

Biography: Prof. Frank Gu is a Canada Research Chair and Associate Professor in the Department of Chemical Engineering at the University of Waterloo. Dr. Gu received his Ph.D. from Queen's University, Canada, where he majored in chemical engineering. Following completion of his graduate program, he pursued postdoctoral research at Massachusetts Institute of Technology and Harvard Medical School. In July 2008, Dr. Gu joined Department of Chemical Engineering at the University of Waterloo as an Assistant Professor. Dr. Gu has established a frontier research program in Nanotechnology Engineering, with important advances in medical and life science applications. Leading-edge projects have produced new materials and tools for targeted drug delivery, rapid pathogen detection, and passive water treatment. His research has had tangible impacts on his field and industry, including mucoadhesive nanoparticles for the treatment of Dry Eye Disease, and photocatalytic water treatment technologies that are the core technology of H2nanO, a Canadian startup company. Dr. Gu has authored and co-authored more than 200 journal and conference publications, as well as 25 U.S. and World patents and applications.

Mining Anaerobic Microbial Communities and their Metagenomes

Prof. Elizabeth A. Edwards, Professor, Tier 1 Canada Research Chair in Anaerobic Biotechnology, University of Toronto

Abstract: Microbes typically live in close association with one another in mixed communities. These communities maintain high levels of complex interactions exchanging nutrients, vitamins and other chemicals. The microbes in these mixed communities therefore function very differently from microbes isolated in pure cultures in the laboratory, producing phenotypes that can't be replicated in one individual cell type. Thus, microbial communities and their interactions must be studied as a whole to fully understand their properties and dynamic relationships. These complex interactions add to the difficult task of deciphering metagenomic (mixed community DNA) sequencing data. Large numbers of genes have no known function, or function that is very poorly defined. Our research Centre has been exploring enzymes from metagenomes, and microbial community dynamics in defined mixed microbial consortia used to treat wastes. For example, groundwater contamination is a serious threat to global health and prosperity. Petroleum hydrocarbons, industrial solvents, pesticides, herbicides and metals are some of the most frequent culprits. Some microbes have evolved and adapted to transform or detoxify contaminants in the environment. A fascinating group of subsurface microorganisms, collectively referred to as organohalide-respiring bacteria, are significant players in the global halogen cycle. Certain species, such as Dehalococcoides, can dechlorinate the major dry-cleaning solvent tetrachloroethene and the common industrial solvent trichloroethene to the benign product ethene. Remarkably, these organisms obtain energy for growth from dechlorination and several successful demonstrations of bioaugmentation, where an aquifer is inoculated with culture, have led to the development of a commercial market for such dechlorinating cultures.

Biography: Dr. Elizabeth A. Edwards is a Professor in the Departments of Chemical Engineering and Applied Chemistry and Cell and Systems Biology (Status only) at the University of Toronto. Her research interests include bioremediation, the application of molecular biology and metagenomics to uncover novel anaerobic microbial processes, and the transition of laboratory research into application. Over the two decades, Dr. Edwards' research team has discovered and characterized novel microbial cultures such as the now commercial KB-1® consortium that metabolize pollutants previously thought to be recalcitrant. This discovery led to the founding of SiREM Laboratories (www.siremlab.com) in Guelph in 2002 that recently celebrated 15 years in business.

R&D Supporting Clean Tech Innovation in the Oil Sands

Dr. Cécile Siewe, Director General, Natural Resources Canada

Abstract: Dr. Cécile Siewe's presentation will start by providing a quick overview of the Canada's oil sands industry. This overview will include the oil sands' relevance in terms of global reserves, expected growth, economic contribution, and environmental footprint. She will then present the Government of Canada's policies and funding commitments related to R&D in the oil sands, and will describe how the CanmetENERGY research centres fit into the departmental structure of Natural Resources Canada. Dr. Siewe will conclude her presentation by describing the three R&D areas at CanmetENERGY-Devon where she is the Director General, and how these research areas support clean tech innovation.

Biography: Cécile Siewe was appointed Director General fo CanmetENERGY-Devon, Innovation and Energy Technology Sector, at Natural Resources Canada (NRCan) in May 2016. She is responsible for the management and direction of the Devon-based components of NRCan's CanmetENERGY research and technology innovation programs; and provides national leadership for the fossil fuel portfolio to drive sustainable energy development and ue, and the mitigation of related environmental impacts with particular emphasis on unconventional oil and gas (shale, oil sands)

Prior to her appointment, Dr. Siewe worked in the private sector in the oil sands and heavy oil. For the past 10 years she has held a number of management position at Shell Canada most recently as Technology Development Manager for Upgrading & Froth Treatment, Oil Sands Joint Venture. In additional to her private sector experience, she spent seven years working at the Canada Revenue Agency as a Regional Technology Advisor for Oil& Gas in the Scientific Research & Experimental Development Program (SRED).

Dr. Siewe has a Ph.d in Chemical Engineering from Imperial College, University of London. She also holds an MBA from the University of Calgary and a Bachelor in Science in Industrial Chemistry from City University in London, UK.

Sustainable Materials Innovation at Patagonia

Dr. Laura Hoch, Materials Innovation Engineer, Patagonia Inc

Abstract: At Patagonia, our mission is to build the best product, cause no unnecessary harm, and use business to help inspire solutions to the environmental crisis. This presentation will highlight Patagonia's approach to sustainable innovation as well as how we scout for and incorporate new green technologies that can help us to improve the overall environmental footprint and performance of our products and manufacturing processes. I will also highlight several examples of recent green chemistry innovations that we have co-developed with our supply chain partners to create more environmentally friendly, high-performing products and gear.

Biography: Dr. Laura Hoch is currently a Materials Innovation Engineer at Patagonia Inc., where she is responsible for the research, identification, acquisition, and development of novel and sustainable chemistry and textile technologies for use in Patagonia's product lines. Prior to Patagonia, Laura worked as a Technical Fellow for the Green Chemistry & Commerce Council (GC3), focusing on establishing and growing the GC3 Green & Bio-based Chemistry Startup Network and providing technical expertise and support to GC3 project groups. She holds a PhD in Inorganic Materials Chemistry from the University of Toronto and has over 10 years of experience in applied materials chemistry research and design.

The journey towards sustainability for Automatic Dishwashing Detergents in a Phosphate-Free World

Dr. Scott Backer, Senior R&D Chemist, Dow Chemical

Abstract: Over the last decade, a significant shift in the sustainability profile for detergent formulations has been taking place. In order to combat eutrophication of waterways, regulations requiring the removal of sodium tripolyphosphate from detergents in the developing world have been proposed and implemented. This has radically altered the strategies of formulators, as new combinations of ingredients are required to take the place of once-abundant phosphates. One area of research has been on novel polymers capable of dispersing inorganic salts formed as detergents come into contact with hard water. These dispersants are classically low to moderate polyacrylic acids, while excellent performers, demonstrate minimal biodegradability. This talk will discuss strategies used to design and test a new class of biodegradable dispersants which exceed the performance of current dispersants while significantly increasing the overall level of biodegradable polymeric carbon.

Biography: Scott Backer received his Bachelors of Science at the University of Florida in 2000, graduating Cum Laude with a major in Chemistry and a minor in theatre performance. He received a Ph.D. from the University of California at Berkeley, where he studied under Professor Jean M.J. Fréchet. Dr. Backer's research included synthesis of partially fluorinated polymers for lithographic photoresists, scanning probe lithographic techniques and novel soluble fullerenoids for organic electronic applications. In 2006 he joined DuPont as a manufacturing technologies chemist where he worked on the reduction of perfluorooctanoic acid (PFOA) from a variety of fluorinated products. After joining the Dow Chemical company in 2010, he began work as a Senior R&D Chemist focused on novel polymers and small molecules for use in automatic dishwashing detergents. Currently an Associate Scientist in the Dow Home and Personal Care Business, Dr. Backer is engaged in the development of biodegradable polymers for detergent applications.

Using Food to Protect Food: Taking Inspiration From Nature to Reduce Negative Externalities Along the Fresh Food Supply Chain

Dr. Jenny Du, Vice President of Operations, Apeel Sciences

Abstract: According to the United Nations Food and Agriculture Organization (FAO), approximately 45% of fresh fruits and vegetables that are grown are wasted globally. Apeel Sciences draws inspiration from Nature to develop materials that may be applied to fresh fruits and vegetables postharvest to mitigate decay due to abiotic stressors. By reducing postharvest losses and waste, Apeel's edible, shelf-life extension products can positively impact the challenges of providing food security for a growing global population and minimizing the environmental impacts of agriculture.

In this presentation, we will share how we, as an early-stage company, have sought to weave sustainable principles and practices throughout our technical and business operations. Examples will include how we've used tools such as Life Cycle Assessment to inform ongoing and new chemical process development, as well as we how we've thus far addressed the unexpected challenges of navigating the competing forces across "idealized" sustainability philosophies, technology development, market and consumer demand, and regulatory oversight.

Biography: Jenny earned her Bachelor's Degree in Engineering Chemistry and her PhD in Chemistry from Queen's University (Kingston, ON, Canada) where, during her graduate studies, she was awarded an Alexander Graham Bell Canada Graduate Scholarship by the Natural Sciences and Engineering Research Council of Canada in recognition of her research work. Following completion of her doctoral degree, she joined the Chemistry Department at UCSB as a postdoctoral researcher where she worked for 2 years prior to joining Apeel Sciences as the Director of Extraction Engineering. She is now the Vice President of Operations at Apeel Sciences, where she is responsible for leading the company's efforts in Regulatory Affairs & Compliance, Facilities, Supply Chain & Logistics, IT, and EH&S.

Designing Safe Chemicals

Dr. Charles (Chuck) Barton, Global Manager of Toxicology & Risk Assessment, Sherwin-Williams

Abstract: Based upon its most recent safety assessment and ongoing review of the scientific evidence, the U.S. Food and Drug Administration (FDA) continues to conclude that bisphenol-A (BPA) is safe at the levels occurring in food and beverages using BPA-coated packaging. However, driven by increased regulatory restrictions and consumer concerns, demand for BPA-free alternatives is increasing. A product development process is needed to ensure these new BPA-free can coatings meet the most stringent regulatory requirements and utilizes the least hazardous available materials. The process should bring to market technologies which have minimal level of global regulatory concern now and in the future, while maintaining food packaging safety and exceptional performance. Using industry-leading standards and the pharmaceutical process as a model, the Safety by Design process was deployed as the protocol for early screening of chemicals being considered as alternatives to BPA. To date, Valspar (now part of Sherwin-Williams) has been awarded hundreds of non-BPA patents worldwide and 32 non-BPA Food Contact Notifications from the FDA. Now, the Sherwin-Williams Packaging Division is launching Safety by Design 2.0, where the Safety by Design process will be employed up the supply chain to assess the safety of chemicals used in the manufacturing of Sherwin-Williams food and beverage packaging coatings.

Biography: Chuck Barton works for Valspar Corporation (now owned by Sherwin-Williams). As the #1 global supplier of regulated food contact coatings for metal packaging, Valspar is leading the way in the development of new materials designed to meet consumer demand for performance and safety. Chuck leads a team of toxicologists/regulatory specialists that supports Valspar businesses throughout the world with issues including EPA TSCA, CA Prop 65, FDA Food Contact Substance (FCS) Notifications, EU REACH/ECHA submissions/CLP, Korea REACH, China GHS, SDS hazard classifications, and much more. Chuck received his Ph.D. in Toxicology at the University of Louisiana in Monroe, LA. He completed postdoctoral training in Toxicology at Michigan State University. He has spent his career focusing on the evaluation of potential public and occupational health risks associated with exposure to chemicals in a variety of settings, including academia, government, pharmaceutical and consumer product industries. He was the State Toxicologist of Iowa for seven years. In addition, he has served on the adjunct faculty for several universities. Chuck has over 90 publications, and currently serves as the Editor-in-Chief for MOJ Toxicology (MOJT) and an Editor for Open Access Journal of Toxicology (OAJT). He is a member of over a dozen professional societies, having served as an officer in several. He is a

Diplomate of the American Board of Toxicology and served on the Board of Directors for the American Board of Toxicology. He is the President-Elect for the Allegheny-Erie Chapter of the Society of Toxicology. Chuck has been appointed to six National Academy of Sciences committees, six U.S. Pharmacopeia committees, and one ISO committee. He has provided litigation support as an expert witness for many diverse civil and criminal cases associated with many elements of toxicology. Most recently, Chuck was appointed to the U.S. Environmental Protection Agency's Science Advisory Committee on Chemicals and to its Board of Scientific Counselors.

Fiber Optic Sensing Technology for Harsh Environments

Dr. Amir Azhari, co-founder and President, AOMS technologies Inc

Abstract: Fiber Bragg gratings (FBGs) are well-known as sensors for temperature and strain monitoring. Sensing by optically probing the strain-induced Bragg shift can also be extended to sense other parameters such as chemical substances, hydrocarbons, and pH if appropriate materials and coatings can be developed. In this study, the perofrmnace of fiber optic sensors coated with multiple polymeric materials is investogated. For the fiber optic pH sensor, protonation and deprotonation of acidic or basic pendant groups on the polymer cause a pH-dependant osmotic pressure difference which leads to the swelling and deswelling of the polymer relative to the external conditions. This propensity to swell can be translated into a strain which is detected by the FBG. In this work, the FBG section of a fiber optic is coated with the custom designed, nanostructure polymer materials. By tuning the micro and nanostructure of the polymer and the cross-linked density by creating various super porous polymers, we explore the relationship between the polymer mechanical properties and the strain induced on the FBG in order to find optimal formulations with sufficient sensitivity. The various porous structures also lead to different time scales for swelling and thus dictate the sensor response time. Using the materials and device architecture developed, we demonstrate the ability to reversibly detect changes in pH over a wide range (3 to 8). The as-developed quasi-distributed FBG pH sensor cable can be used for real-time monitoring of chemical substances in harsh environments such as chemical and wastewater treatment plants, and also in smart greenhouses.

Biography: AOMS Technologies Inc. is an integrated optical sensing technology company based in Toronto which uses fiber optics to empower industries with uninterrupted monitoring of multidimensional performance data.

Amir, received his BSc (2005) and MSc (2008) in Materials Engineering from IUST and also holds an MBA degree from the University of Tehran, and a PhD (2017) from the University of Waterloo, Canada in Mechanical Engineering, Nano Technology. Amir has co-authored more than 15 papers in peer-reviewed scientific journals and international conferences, book chapters, and patents.

Advanced Materials Development for Bioenergy Processes

Philippe Dauphin, Director General, Natural Resources Canada

Abstract: The presentation will start with a broad context of the context in which we operate. NRCan is at the centre of the Government's Clean Tech agenda, helping deliver on its Mission Innovation commitments, as well as the Clean Growth program. Under Mission Innovation, we have just committed to co-lead Challenge #6, which aims at develop a platform to accelerate the exploration, discovery, and use of new high-performance, low-cost clean energy materials (http://mission-innovation.net/our-work/innovation-challenges/clean-energy-materials-challenge/). I can then drill down to my laboratory's work in developing advanced materials for a number of energy-related applications. One of these applications is bioenergy. As Canadian industry is developing new processes to extract energy from biomass, it is faced with challenging conditions for materials, especially high temperature corrosion. It is important to understand these conditions and select materials that will not fail prematurely.

Biography: Philippe Dauphin was named Director General of CanmetMATERIALS (CMAT) in Hamilton, Ontario, effective July 29, 2013.

Philippe joined NRCan in 1992 as the Business Development Coordinator at the CanmetMINING (CMIN) laboratory. Over the next 25 years, he has played diverse roles in research management, technology transfer, business development and policy, before joining the Energy Sector. Most recently, Philippe was acting Director General of the CanmetENERGY where he managed a large clean energy research laboratory.

Philippe graduated in 1984 with a Bachelor's Degree in Mining Engineering from Laval University and has experience in policy, management and marketing of R&D and research.

Case Study: Life Cycle Assessment Challenges Related to Biomass Conversion

Dr. Nathan Manion, Postdoctoral Fellow at Queen's University

Abstract: A common method used to evaluate potential environmental impacts and help inform decision-making is Life Cycle Assessment (LCA). This methodology has been designed to consider all aspects related to the production, use, and ultimate disposal of a product, including inputs and outputs from each stage in the value chain. LCAs are challenged when they are used to assess product systems that might include inputs such as biomass which are derived from dynamic environmental systems. This is important, as there is increasing interest in Ontario and other regions of Canada in expanding the use of our biomass resources for materials, chemicals, fuels, and energy. A sustainable bioconversion platform has the potential to maximize Canada's biomass resources, but achieving sustainability within these systems requires a reliable way for feedstock producers, industry, and policy-makers to assess environmental impacts. Unfortunately, it has been observed that different LCAs on similar bio-based products, such as biofuels, can generate conflicting results, largely due to the uncertainty associated with dynamic ecological systems. Current research approaches to resolving challenges when applying LCA methods to bioconversion platforms for biofuel production are reviewed and highlighted using several in-depth case studies. The workshop explores how each stage in the LCA supply chain may require their own unique approach in order to facilitate better results.

Biography: Nathan is a Postdoctoral Fellow at Queen's University in the Department of Geography & Planning, conducting research in the Renewable Energy Development and Implementation (REDi) lab under the supervision of Dr. Warren Mabee. Broadly his research interests lie in understanding human-environmental systems and how improved assessment and management approaches can be used to improve their sustainability. Assessing many of the emerging sustainable agroecosystem approaches or bioenergy technologies requires an interdisciplinary approach that requires a technical understanding of physical and biochemical processes, but also socio-economic and community dynamics, environmental assessment protocols, and natural resource management approaches. His current research in the REDi lab specifically focuses on ways to evolve our understanding of land-use impacts at local and regional scales as a way to improve decision-making about future land use, energy production, and the policies that may influence them.

Poster Presentations

4:30 – 6:30pm on Thursday, May 24, 2018
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 25, 2018.

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

Remediation of Oil Sands Tailings Using Green Nanoengineered Sponge
Pavani Cherukupally, Wei Sun, Daryl Williams, Geoffrey Ozin, Amy Bilton, Chul Park
University of Toronto

Morris Group Iron Chemistry
Karl Z. Demmans, Matthew V. Gradiski, Molly M.-H. Sung, Robert H. Morris
University of Toronto

Bulk and Surface Chemistry of Iron in the Formation and Aging of Secondary Organics Relevant to Atmospheric Systems
Aseel Al Nimer
Laurier

Waterborne epoxy-thiol decorated silica sol-gel coatings: Impact of crosslinking on corrosion prevention
Shegufa Shetranjiwalla, Andrew Vreugdenhil
Trent University

Entirely lipid-derived thermoplastic poly(ester urethane)s: Effect of structure on physical properties
Shegufa Shetranjiwalla, Suresh S. Narine
Trent University

Cross-linked chitosan beads doped with calcium for organophosphate removal from aqueous solution
Mohammad H. Mahaninia, Lee D. Wilson
University of Saskatchewan

Catalytically Active Silicon Hydride Nanosheets for CO_2 Reduction
Darius Hung, Chenxi Qian, Wei Sun
University of Toronto

Tailoring Surface Frustrated Lewis Pairs of $In_2O_{3-x}(OH)_y$ for Gas-Phase Heterogeneous Photocatalytic Reduction of CO_2
Yuchan Dong, Geoffrey A. Ozin
University of Toronto

Photocatalytic Hydrogenation of Carbon Dioxide with High Selectivity to Methanol at Atmospheric Pressure
Lu Wang, Mireille Ghoussoub, Geoffrey A. Ozin
University of Toronto

ATR-FTIR Studies on the Initial Binding Kinetics of Arsenicals at the Organic-Hematite Interface
Mohammad Aminur Rahman, Arthur Situm, Hind A. Al-Abadleh
Laurier

A Robust Lewis Acidic Phosphonium Catalyst in the Synthesis of Heterocycles via Hydroarylation of Alkynes
James H. W. LaFortune, Julia M. Bayne, Louie Fan, and Douglas W. Stephan
University of Toronto

Solar Fuels - Next Gen Fuel from CO_2
Thomas Wood, Paul Duchesne, Thomas Dingle, Alexandra Travasoli, Mireille Ghoussoub, Athan Tountas, Lourdes Hurtado, Yuchan Dong, Young Li, Navid Soheilnia, Geoffrey Ozin
University of Toronto

The chemical structure effects of alkylbenzenes on soot formation in a laminar co-flow flame
Carson Chu, Prof. Murray J. Thomson
University of Toronto

In Situ Electron Microscopy Studies For Clean Combustion
Anton Sediako, Murray J. Thomson
University of Toronto

Production of A Universal Plant-Based Substrate System for Cellulase Activity Assays
Kathleen Hefferon, Borja Cantero, Uzma Badar
University of Toronto

Chemo-Enzymatic Upgrading of Hemicellulose Oligosaccharides
Spencer Imbrogno, Emma Master
University of Toronto

USING ATR-FTIR SPECTROSCOPY FOR DETERMINING ACTIVATION ENERGY OF ADSORPTION ON HEMATITE NANOPARTICLES
Sara Soldoozy, Dr. Hind Al-Abadleh
Laurier

Lignin modification for Bio-based resin application
Maryam Arefmanesh, Emma R. Master, Mojgan Nejad
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:

Karl Demmans, Alex Waked – Co-Chair

Rachel Hems– Blog Coordinator and Social Media Coordinator

Molly Sung– Secretary

Karlee Bamford– Treasurer

Yuchan Dong– Symposium Coordinator

Kevin Szkop – Seminar Series Coordinator

Brian Tsui– Website Coordinator

Members-at-Large: Alessandra Augurusa, Brian De La Franier, Connie Tang, Levy Cao, Cynthia Cheung, David Djenic, Devon Holst, Gabrielle Hoover, Maria Karcz, Shira Joudan, Judy Tsao, James LaFortune, and Gustav Wulf, Julia Bayne, Laura Reyes, Lilin Tong, Matthew Gradiski, Samantha Smith

Contact Information:

Email: green@chem.utoronto.ca Website: www.greenchemuoft.ca

Blog: greenchemuoft.wordpress.ca GreenChemUofT

Symposium Locations

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

2. **Wilson Hall** – Room WI 1016, Wilson Hall 40 Willcocks St, Toronto ON, M5S 1C6 (Note: food is not allowed in this room)

3. **Prenup Pub** – 191 College St, Toronto, ON M5T 1P9 (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. Your 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 (455 Spadina Ave) – Excellent poutine
Thai Basil (467 Bloor St W) – Great Thai plac

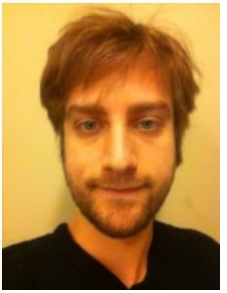
GCI symposium team members

Karlee Bamford
Funding& Expenses Coordinator

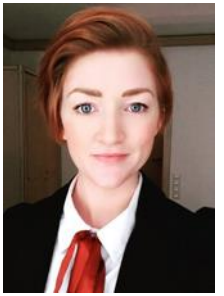
Yuchan Dong
Symposium Coordinator

Karl Demmans
Speaker Coordinator

Rachel Hems
Participants Coordinator

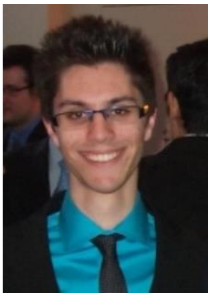


James LaFortune
Logistic Coordinator



Samantha Smith
Publicity Coordinator

Brian Tsui
Publicity Coordinator



Alex Waked
General Helper

The GCI symposium team would like to thank:

The whole GCI team, Mohsen Rahmani (U of T AMIGAS president), Anna Liza, Shannon Osborne, Jennifer Hsu, Rebecca L. Cross, U of T Chemistry Student Union, Nancy Shi, Rebecca Jockusch, Lili Tong, U of T SPE group (Pavani Cherukupally, Solmaz Karamikamkar, Maedeh Amirmalek)

Symposium Sponsors

University of Toronto Environmental Resource Network

Chemistry
UNIVERSITY OF TORONTO

Chemical Institute of Canada | ***For Our Future***
Institut de chimie du Canada | ***Pour notre avenir***

SUPPORTED BY STUDENT INITIATIVE FUND

Mechanical & Industrial Engineering
UNIVERSITY OF TORONTO

UNIVERSITY OF TORONTO
FACULTY OF ARTS & SCIENCE

UTGSU

Chemical Engineering & Applied Chemistry
UNIVERSITY OF TORONTO

Tweet with us! @GreenChemUofT #GCISym18 and #GreenByDesign