

The

EXCHANGER

Chemical and Biological Engineering

January 2017

TURNING THE TIDE:

Engineering a New Future for
Water in Small, Rural and First
Nations Communities

MAKING PROGRESS, ONE COMMUNITY AT A TIME

RES'EAU
WATERNET

An NSERC Small Water System Strategic Network

mobile water treatment lab



a place of mind

THE UNIVERSITY OF BRITISH COLUMBIA

MESSAGE FROM THE DEPARTMENT HEAD



The current issue of 'The Exchanger', our department's newsletter, provides the highlights from our thriving Department of Chemical and Biological Engineering of 2016. One of the features in this issue is Research aiming to provide lasting solutions to the problem of clean water supply in small, rural and First Nations Communities. Under the leadership of Professor Madjid Mohseni, engineers, scientists and social scientists from across the country researchers have conducted leading edge research in the past few years with support from NSERC, other government sources and the private sector. Important applications have come out of this work that have a direct and positive impact on the well-being of many communities.

Research Day was a success in 2016 as it gave us the opportunity to celebrate the first 100 years of chemical engineering at UBC and to look into the future with excitement for our discipline. Former CHBE professor and Dean of APSC, Dr. Axel Meisen (FCIC, FCAE) gave the CHBE Centennial Lecture: "The Future of Fossil Carbons with Implications for Engineering". We also had keynotes from Dr. Sylvian Coulombe, Professor and Department Chair, Department of Chemical Engineering, McGill University who spoke about "Plasma Processes for Resource Recovery and Energy Applications" and from Dr. Christopher E. Wilmer, University of Pittsburgh who spoke about "Engineering Porous Materials for Fun and Profit".

Again, our faculty and students enjoyed significant recognition last year. Notable awards included, among others, the E.W.R. Steacie Memorial Fellowship (Dr. Curtis Berlinguette), the Killam Teaching Prize (Dr. Bhushan Gopaluni) and the APSC Rising Star award to four of our students (Ayesha Shahzad, Cynthia Ni, Nick McIntosh, and Sean McBeath).

In 2016, we welcomed Dr. John Frostad as assistant professor in our department, jointly appointed with the Faculty of Land and food systems, and Dr. Jonathan Verrett as Instructor. We look forward to their contributions to our teaching and research programs. We also welcomed a CHBE alumnus Joseph English, Gina Abernethy, Miles Garcia and Michelle Pang to our staff.

Our 3rd Year students enthusiastically embarked on the annual field trips and were warmly welcomed by numerous industrial hosts. For the first time, student traveled to north to Prince George. The field trips are a valuable extension of classroom learning and we are appreciative of the generosity of all our hosts.

This year 'The Exchanger' includes the names of the students who graduated from the Department in the May and November 2016 convocations. We warmly congratulate all the students and wish them every success in their future endeavours.

We hope that you will enjoy reading the 2017 issue of 'The Exchanger'. We always look forward to hearing from you and welcome visits of alumni and friends to the department.

A handwritten signature in black ink, appearing to be 'PE' with a stylized flourish.

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On the cover

The RES'EAU WaterNET van at Middle River, 150 km northeast of Fort. St. James in northern BC. The van houses different water treatment technologies including filtration, UV, ion exchange and chlorination.

Photo by RES'EAU WaterNET team

BUBBLING DOWN ON FOAMS

Dr. John M. Frostad, Assistant Professor

We encounter foams everyday in products such as comfortable foam mattresses, refreshing beverages, and delicious desserts. They can also be found in nature, such as the protective foam of the young froghopper, affectionately known as “spit bugs”. In the early stages of development, the insects live on plants where they encase themselves in a foam that they produce for protection against predators, insulation against extreme temperatures, and avoiding dehydration. Other examples of foams in nature include pumice stones formed from volcanic foam, and the bark of the cork tree.

On one hand, foams can be used to great advantage for strong yet lightweight construction materials, separation of minerals from ore through froth flotation, and for consumer products like shaving cream. Proteins in eggs and cream stabilize the meringue and whipped cream that give a Dacquoise its delightfully light and delicate texture. On the other hand, foams can be extremely problematic when they occur in bioreactors, hydraulic systems, and washing machines. The presence of foams in engine lubricating oils can result in oxidation, cavitation, and overheating that will damage the engine.

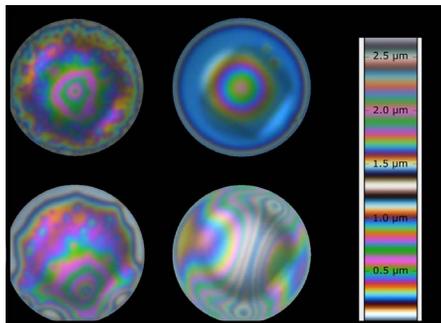


Figure 2. Interferograms of foam films (approximately 1 mm in diameter) made from common materials

Despite the prevalence of foams around us, our scientific understanding of the physics and chemistry which govern them are still far from complete. For example, consider the foam or “head” that forms on a freshly poured glass of beer. Beer connoisseurs have very strong opinions regarding the quantity, density, stability, and appearance of this foam. Unfortunately,

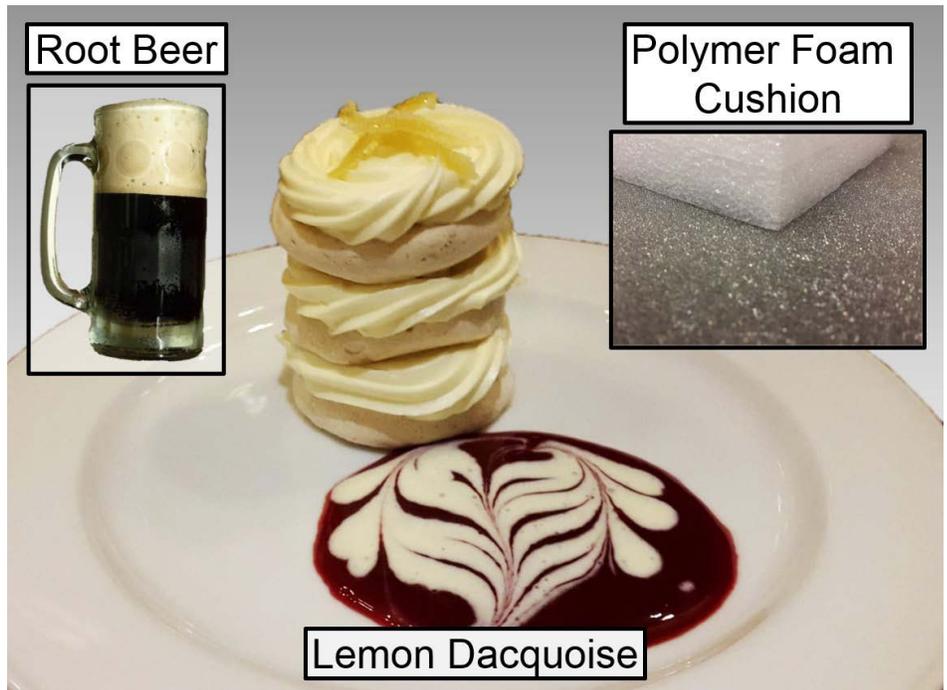


Figure 1. Examples of common foams

beer manufacturers have little control over the properties of the foam and generally must resort to trial-and-error methods for adjusting the final product. Because of this lack in understanding, the study of foams is of great interest and poses many challenging and interesting questions for researchers.

The Frostad group studies the physics of the interfaces between air and liquid that make up foams. This is particularly important because foams have a high interfacial-area-to-volume ratio, so the properties of the interfaces have a large effect on the resulting foam. In particular, the Frostad group specializes in developing new experimental techniques for probing the mechanical properties of interfaces. One instrument developed by Dr. Frostad takes advantage of a technique called interferometry. The principle is that light-waves reflecting from the upper and lower interfaces of a film interfere constructively and destructively to produce different colors depending on the thickness of the film.

Figure 2 shows several interferograms resulting from a single bubble of air

floating at the surface of a liquid. A thin layer of liquid separates the bubble from the air above the liquid and prevents it from popping. Each band of color in the interferogram corresponds to a particular film thickness as shown in the color map in Figure 2. For example, the pink dot at the center of the Root Beer film indicates that it is $\sim 600 \times \mu\text{m}$ thick, while the blue region near the outer edge is $\sim 250 \times \mu\text{m}$ thick. These beautiful images provide a powerful way of visualizing, and more importantly quantifying, the flow of liquid within a foam. The selection of foaming liquids shown in Figure 2 illustrates the wide range of dynamics and the complex structures that can occur in foams.

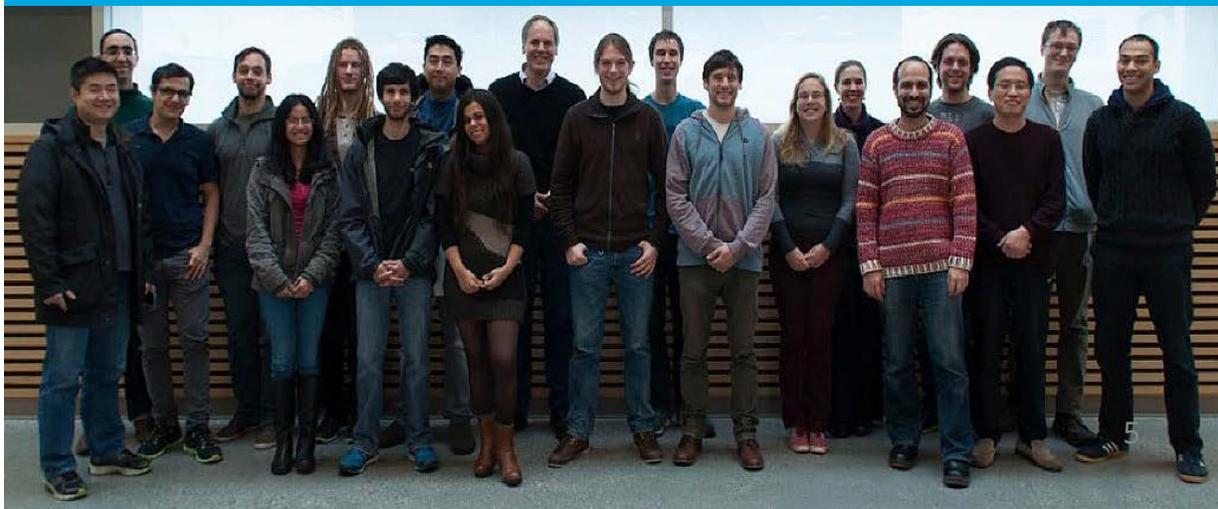
Using this interferometric data, Dr. Frostad has shown that experiments using just a single bubble are correlated to bulk foam properties like density and stability that are of interest to consumers. This means that we are one step closer to being able to make your favorite beverage with the perfect foam. In addition, these learnings can be directly applied to a wide range of other foam systems and expanded to understand liquid-liquid systems or emulsions as well.

ENERGY AND WATER: GREENING EXISTING PROCESSES AND INTRODUCING INNOVATIVE SOLUTIONS

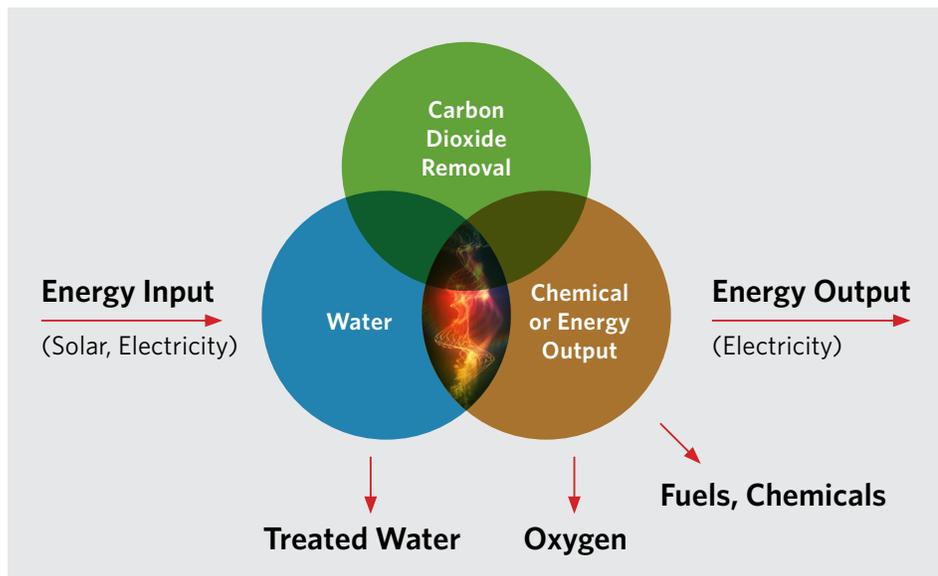
Dr. David Wilkinson, Professor



Energy and water are two of the most important challenges facing humanity today and it is estimated that by the middle of the 21st century we will need to double energy production and water use.



The Wilkinson group research at UBC is focused on greening existing processes and introducing innovative solutions to energy and water. The research is mainly at the intersection of water treatment, carbon dioxide (CO₂) conversion and mitigation, and the production of chemicals and energy. The focus is on electrochemical and photochemical approaches to clean and sustainable energy conversion, production, and storage.



Research at the energy intersections

The Wilkinson group is also very active in the electrochemical treatment of wastewater and drinking water which is a relatively new and growing area of research. Some of this research is part of the NSERC RES'EAU-WaterNet Strategic Network and IC-IMPACTS which focus on drinking water for small and remote communities. Current research involves electrochemical production of peroxide, electro-coagulation, electrochemical production of ferrates, and capacitive deionization.

The group is also active in research on the coupling of CO₂ and other GHGs and wastewater treatment to create high value chemicals. This research was initiated with the winning of an international Grand Challenge from the Climate Change and Emissions Management Corporation (CCEMC) and further funding from Western Economic Diversification Canada (WD). This current research using a new approach to electrodialysis has the potential to have a large impact on global CO₂ emissions while addressing the issue of decreasing global water reserves. The novel technology uses CO₂ for example to desalinate industrial wastewater, creating a smaller carbon footprint and an economical alternative to conventional desalination and CO₂ removal technology. This waste-to-value technology combines salts present in industrial

wastewater with CO₂ in an electrochemical cell to convert the CO₂ into high-value chemicals such as carbonate salts and acids that are useful in industry. In contrast to technologies which try to address each issue separately, the coupling of both of these processes is unique and highly valuable for industry and is expected to have a significant impact on CO₂ removal. This research is presently being spun out into a company.

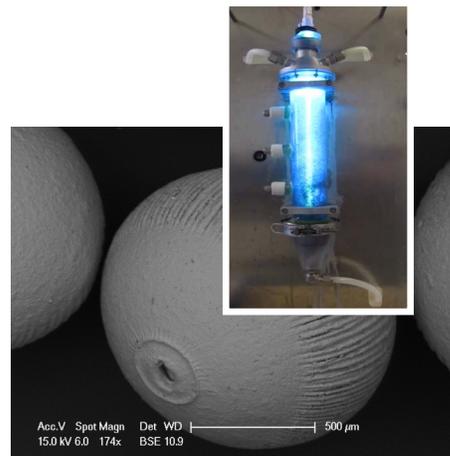
Another active area of research is the development of novel nanostructured photo-catalysts and photo-chemical reactors for solar conversion of CO₂ into clean energy fuels and useful chemicals. This is a continuation of research that was initiated with grants from Carbon Management Canada (CMC) and the Pacific Institute for Climate Solutions (PICS). The fuels and chemicals produced from CO₂

such as methane, hydrogen, methanol, ethanol and formic acid, can be utilized in thermochemical processes and/or in electrochemical devices such as fuel cells, and in a variety of industrial processes where CO₂ is produced. Our current research in collaboration with the Taghipour group, with a UV-irradiated or solar light fluidized bed reactor allows scalability of photocatalytic processes and is being applied successfully in various catalytic applications including photo-assisted water splitting. The main goals for this ongoing research are to demonstrate high enough catalytic activity,



selectivity, and conversion efficiency from the reactor and photocatalyst for solar fuels to meet the requirements for industrial-scale applications.

Hydrogen, electrolyzers, and fuel cells are an important part of the global energy sector and are becoming increasingly important in the implementation of renewables, power to gas strategies for grid management, and zero emission transportation. The objectives of the Wilkinson group research are to close existing technology gaps and develop the next generation platforms for low temperature fuel cells and electrolyzers.



Presently, the group has collaborations with the German Fraunhofer Institute and the Technical University of Berlin on electrolyzers, and with the UK company Johnson Matthey Fuel Cells on fuel cells. The research focuses on the critical components of these electrochemical systems including the catalyst and catalyst layer, and the associated electrode and cell design for energy conversion and energy storage. Important goals for the research are to reduce catalyst loading, and improve the performance and efficiency of the limiting oxygen evolution reaction (OER) in electrolyzers, and the limiting oxygen reduction reaction (ORR) in fuel cells. Some of this research is part of an NSERC Strategic Network entitled Catalysis Research for Polymer Electrolyte Fuel Cells (CaRPE FC). Further research involves developing optimal nano-structured catalyst layers, and researching new catalytic promotional effects such as electrical activation of the catalyst layers with low parasitic energy use.

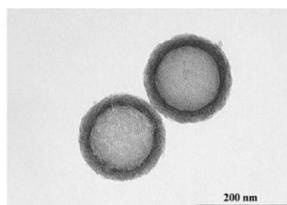
The Wilkinson group is active in research investigating new approaches to electrochemical devices particularly in the merging and hybridization of technologies. An example would be looking at the opportunities for Zinc and MnO_2 , to be both a battery and a metal air fuel cell. Another



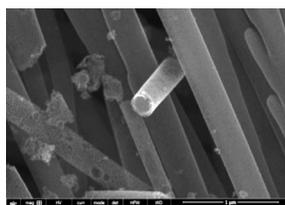
example would be the development of a low cost hydrogen (or other fuel) redox fuel cell which integrates some aspects of the redox flow battery with the Polymer Electrolyte Membrane Fuel Cell (PEMFC). This approach, first demonstrated by the Wilkinson group, has made it possible to move to a scalable membrane-less structure with almost no platinum group metals resulting in substantial cost reduction. This research was identified by the Electrochemical Society as an important new electrochemical science and technology to watch.

Another active area is the research and synthesis of new advanced functional materials based on hierarchical structures

for electrochemical and photochemical applications. These materials are rationally designed providing a link between macroscopic properties and subscale properties. Professor Wilkinson is one of ten principle investigators in the UBC CREATE Nanomaterials Science and Technology Programs (NanoMat). The Wilkinson group is also working with one of the premier global catalyst companies Johnson Matthey in the UK on developing new hierarchical catalysts and catalyst supports, and hierarchical carbons for different applications. An example would be multimodal porous carbon (MPC) with controlled porosity at different length scales and controlled hydrophobicity.



Hollow core / mesoporous shell carbon sphere (HCCS)



Hollow mesoporous carbon nanofiber (MCNF)

The leading research of the Wilkinson group and its collaborators is at the intersection of water, energy and chemicals. It has tremendous potential to provide solutions to global energy challenges.

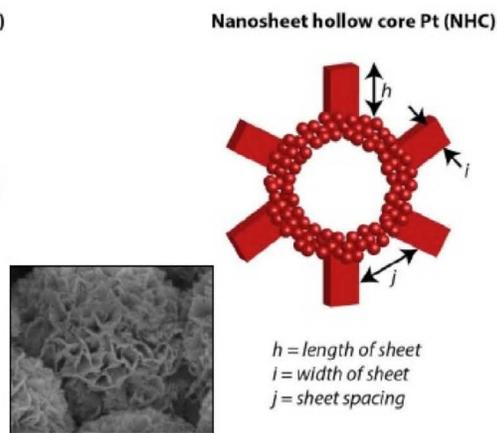
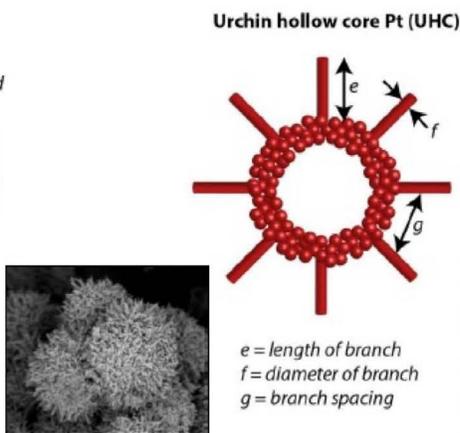
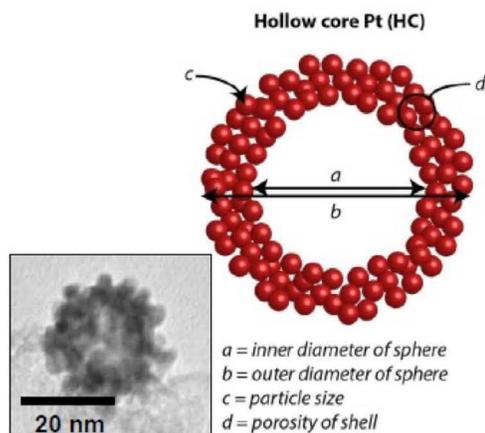


Image credit: Dr. Blaise Pinaud

TURNING THE TIDE: ENGINEERING A NEW FUTURE FOR WATER IN SMALL, RURAL AND FIRST NATIONS COMMUNITIES

RES'EAU-WaterNET team

A UBC-based network says rethinking traditional paradigms about innovation and tapping into the expertise of multiple disciplines is only part of the solution to solving 21st century community health challenges in Canada.

*A remote, small First Nations reserve with only a **handful** of homes southwest of Kamloops. An isolated island community of fewer than **600** people. A rural, lakeside enclave of **7,500** whose population more than doubles with vacationers each summer. A suburban municipality of **18,000**, assuming control of its water utilities.*

In 2013 and 2014, RES'EAU and UBC's Chemical and Biological Engineering Department welcomed more than 100 water operators from BC First Nations communities for discussions and demonstration on water issues and the science behind potential solutions."



What do they have in common?

All four have struggled with the complex task of designing and implementing new drinking water disinfection and distribution systems. As small communities, the deck can be stacked against them – most technological solutions for removing pathogens and chemicals from source waters have traditionally been designed with larger-scale systems and populations in mind.

To level the playing field, all four communities have also tapped into the expertise of a unique Canadian research network headquartered at UBC's Chemical and Biological Engineering (CHBE) Department. RES'EAU-WaterNET's R&D team includes 18 world-class scientists from eight universities across Canada, supported by more than 100 students and post-doctoral fellows. The program also leverages millions of dollars in human and technological capital from several public and private partnering organizations. Together, the consortium is on a mission to make access to safe drinking water a priority for small, rural and First Nations communities (SRCs) by achieving breakthroughs in engineering, chemistry, genomics and the social sciences that can be applied to water health monitoring and treatment technology development specifically for use in these settings.

For Canada, the drinking water stakes are anything but small. More than six million people here – equivalent to twice the population of Toronto – and 2.5 billion people worldwide live in small, rural, remote and off-grid communities. Isolated locations, smaller tax bases, widely varied geopolitical and environmental factors and a lack of skilled labour have kept SRCs at a disadvantage in terms of the community health benefits seen in medium- and large-sized municipalities through improvements in larger-scale, centralized infrastructure. This has left SRC populations exposed to significant health risks, diminished economic potential and, in many cases, poor quality of life.

Of all small communities, First Nations across Canada have been particularly affected. Across the country, anywhere from 75 to 100 indigenous communities are living with boil-water advisories, some of which have been in place for decades. The worst cases have played out in the headlines as awareness of the pervasive problem grows, and awareness has also turned to action on many fronts. Earlier this year, the Trudeau government dedicated \$2 billion in its first budget for drinking- and wastewater infrastructure funding to end the water crisis on First Nations reserves by 2021.



“Working with dozens of small communities over the past nine years has taught us that solving drinking water challenges in these settings is not simply a technological or budgeting exercise,” says Dr. Madjid Mohseni, a CHBE professor and scientific director of RES’EAU. “From the perspective of a community’s health and wellbeing, water does not exist in a vacuum. Issues in housing, energy and other infrastructure can be just as important, and so if real solutions are to be made in any of these areas we must consider individual communities holistically, looking at overcoming their unique obstacles and defining success in their terms. Funding is necessary, technology is necessary – but top-down, cookie-cutter solutions won’t work.”

stakeholders and foster deeper appreciation of water, particularly among youth. These have included holding summer camps at universities for indigenous youth to learn about water sciences, video production courses for young people to document local opinion on water issues, remote research projects that engage local high school students in the collection and analysis of water samples in their community, and more.

They also document the critical perspectives of local water utility operators, whose experience and insights are invaluable to any new system’s design and uptake. In many small communities, operators lack formal training, as it can be difficult for them to attract and retain trained professionals. Their input is essential, as they have first-



A trust circle is held with community members and project partners to mark the competition of a new drinking water plant installation in Lytton First Nation.”

That’s the operative approach behind RES’EAU’s Community Circle platform, an approach to innovation for SRCs that places as much emphasis on meaningful community engagement as it does on the cutting-edge science taking place in its research portfolio. First, RES’EAU works closely with local government and relevant provincial authorities regarding a project’s goals as well as local regulatory requirements. The team consults the public about local drinking water issues and informs them about potential solutions.

Outreach activities include open houses, public meetings and traditional First Nations talking circles, as well as surveys, youth education programs and other approaches designed to simultaneously inform and seek community feedback. The importance of water in a historical, cultural and scientific context is both shared and learned by the RES’EAU teams, who have employed unique models to connect with

hand experience not only with existing systems and related challenges, but also with how infrastructure changes are made within the community, the prevailing local attitude toward drinking water and potential improvements, and the degree to which operators can adopt and maintain any new disinfection approach. Operators’ feedback is also used to identify innovation priorities in RES’EAU’s research program that are relevant to rural communities.

The outcomes of these activities are analyzed and used to set priorities for producing new knowledge and engineering technological solutions. Approaches that show potential are next piloted in the field, with feedback from end users and utility representatives incorporated into the refinement process. Results are then validated by industrial partners, who ensure solutions are practical, efficient and sustainable from an O&M perspective, and that they meet stringent regulatory requirements.

RES’EAU-WATERNET COMMUNITY CIRCLES APPROACH

Community Engagement

- Used to initiate the process
- Take place regularly throughout the project
- Continue after project completion to discuss opportunities for improvements

Water sampling and analyses

- Conducted over the course of the project to monitor seasonal changes in water quality
- Engages community members, helps promote knowledge of their system

Water research

- Based on water quality results, research is conducted to develop treatment options to be piloted in the field

Pilot Testing

- Mobile water treatment plants are brought to the source to engage community and operators

Facilitating implementation of full-scale treatment solutions

- Consultants and suppliers are engaged and RES’EAU with the Community Circle works to see that the communities voice is heard throughout this step

“The Community Circles process is all about closing the loop on the R&D cycle,”

Mohseni explains.

“We do that by spending nearly as much time in the community as we do in the lab, asking questions and listening to the people who truly own the problem we are trying to solve. We’ve found that, if we engage them before, during and post-implementation, we can co-create solutions they can truly own, as well.”

Collaborations between academia and industry are integral to Canada’s innovation strategy, but the process is hindered by several obstacles, Mohseni notes. Industry is rarely engaged early in helping to define problems and potential solutions, and industrial partners are therefore often forced to re-engineer solutions late in the process to ensure they are cost-effective. Leaving industry’s point of view out of a project’s planning stages can create downstream manufacturing delays, or leave a promising technology to wither on the vine.

It all boils down to recognizing that new types of partnerships and new frameworks for collaboration are necessary in an age where the role of users has become as important as suppliers in the innovation and technology transfer process, Mohseni says. “The Community Circles approach is our response to that need, and we are excited by its potential translation beyond water to solve any issue where community-centric, decentralized systems will improve community health.”

RES’EAU’s work with small and indigenous communities has made a significant impact over the years, as the team has transformed a poorly understood issue of low national priority into a hot topic of discussion in Canada. A short list of its successes are highlighted in the sidebar below. Mohseni stresses, that despite the network’s advances since its inception in 2008, much work remains to be done in Canada.

“It has taken us nearly a decade to work with small and indigenous communities on their water systems and transform what we have learned into a roadmap for innovation in SRCs,” he explains. “We’ve shown that Community Circles are effective models of collaboration, but they are time- and resource-intensive projects.” When you consider First Nations alone, there are nearly 620 in Canada, 198 of them in BC alone.

“It’s a daunting task, but we are confident that we have a model that is efficient and impactful – the next step is to scale it up so more communities can benefit from it.”

As RES’EAU’s core funding through the Natural Sciences and Engineering Research Council nears the end of its term, Mohseni is confident the network can lead future coordinated efforts in BC and Canada to mobilize the Community Circles approach on a wider scale.

“In many ways, I think our work is just beginning,” he says. “Canada can be a global leader in providing decentralized solutions for community health, and BC can lead the way at home.”

RES’EAU-WATERNET: KEY ACHIEVEMENTS

- Streamlined R&D process by capturing user communities’ needs, expectations, preferences and dislikes;
- Positively influenced communities’ perceptions about the benefits of collaborating with academia (e.g., outreach, youth programs);
- Incorporated user communities and operators in solution-development process;
- Performed/performing proof of concept (POC) for several innovative treatment technologies suitable for local situations;
- Encouraged better cooperation among government departments and agencies (federal and provincial), NGOs, professional associations, user communities and academia (receiving over \$3M in cash contributions from various government organizations);
- Developed effective mechanisms to bring communities, researchers and industry together to solve significant and complex problems; and,
- Streamlined project management approaches.
- Trained Canada’s next generation of water professionals who understand small communities; to date, over 100 post-doctoral, PhD, Master’s and undergraduate students have worked with RES’EAU.

MAKING PROGRESS, ONE COMMUNITY AT A TIME

To date, RES'EAU-WaterNET has worked with dozens of communities as part of its Community Circles program. From small First Nations reserves to larger suburban enclaves, many of the issues they face are similar – but solutions must be a fit with the unique geography, history, culture, political landscape of each. Check out these highlights from just a few communities they have helped so far.



Lytton First Nation IR25 (Nickeyeah)

Background:

Lytton First Nation is located in BC on 14,161 acres of land divided into 56 reserves. The reserves are located at the site of the Indigenous Village of Kumsheen, meaning, “where the rivers cross.”

The Lytton First Nation is rich in natural resources. Water availability is perhaps one of the most significant natural resources available to the Nation. The Stein River water system meets the water needs of a large proportion of community members while other community wells provide water to other members. Natural spring waters are available in various areas.

Scope of Work:

Here, the Community Circle focused on upgrading the water system, including improving water intake and treatment as well as the local reservoir. This work required an understanding of the seasonal variability in source water quality while assessing the feasibility of various technologies for water treatment (including bag, cartridge and self-cleaning filters, ion exchange, activated carbon and UV systems) in the community using the network's Mobile Water Treatment Pilot Plant.

Outcomes:

Upgrades were made to the water intake, and the installation of a full scale water treatment plant and water storage have been completed. Along the way, local operators were consulted to ensure the end goal was always top of mind.

Dzit'lainli (Middle River) (Tl'azt'en First Nations)

Background:

Tl'azt'en First Nation is looking to reintroduce an effective water treatment system for the Middle River community. Located over 110 km from Fort St. James, BC, Middle River currently has five to eight year-round residents, and an additional five to ten non-permanent residents. The community is currently under a boil water advisory. Over the course of 3 years, RES'EAU-WaterNET staff met several times with the elders, residents, elected counselors, the chief and several public works staff of the Tl'azt'en First Nation. All these consultations resulted in the articulation of the challenges and identification of potential solutions for the community's drinking water.

Scope of Work:

The work in Middle River involves study of spatial and temporal variability of the source water along with design and implementation of a robust treatment system that can be operated and maintained by the part-time operator residing in the community. Also, working with both the Tl'azt'en Nation and Lytton First Nation communities, RES'EAU has partnered with Indigenous and Northern Affairs Canada (INAC), Opus DaytonKnight, Viqua and the First Nations Health Authority (FNHA) to conduct a one-year feasibility study of point-of-entry (POE) water systems. Eight homes have been selected to test the performance and cost effectiveness of a POE system, as well as assess the communities' perceptions of it over time.

Progress/Updates:

The RES'EAU Mobile Water Treatment Pilot Plant was utilized to investigate and evaluate a number of potential technologies in Middle River. The results of this investigation along with the data gathered on source water quality variation has formed the basis for the detailed design and implementation phase of the work which will be completed in summer 2017.

Lhoosk'uz Dené Nation (Kluskus First Nations)

Background:

An isolated First Nations community in central British Columbia, the Kluskus Reserve lacks access to potable water meeting the Canadian federal and provincial standards. Two deep, untreated water wells with high iron and manganese levels are the current water source. These heavy metals cannot be removed via boiling. The residents find the colour, taste and residual stains of the water unpleasant and thus rely on bottled water for consumption. Kluskus is in the process of determining the feasibility of an alternative drinking water source. Currently, the community lives under a boil water advisory.

In 2014, RES'EAU-WaterNET and the Department of Chemical and Biological Engineering at UBC welcomed Chief Liliane Squinas and Lhoosk'uz Dené Nation for a facility tour and discussion. In 2015, several CHBE 4th year undergraduate students working with RES'EAU, on their capstone design project, designed a water treatment system for use in an access-limited environment in Kluskus First Nations.



Scope of Work:

The student capstone design formed the foundation for further research and field work in 2015 and 2016, on determining the feasibility of alternative groundwater and surface water supplies as well as treatment options. This process involved developing a comprehensive water quality database for each source, understanding trends in source water quality, collecting data on their potential to form disinfection by-products, and finalizing the detailed design of the treatment system for implementation.

Cowichan Valley Regional District (CVRD)

Background:

CVRD encompasses a large area of 3,475 square kilometres, including four municipalities, nine electoral areas and 34 different utilities. This Community Circle focused on the Shawnigan Lake North Water System, which is used by 2,000 residents (though water is drawn from the lake, which is used by a population of 7,000). The impacts of climate change warm the lake, affecting water quality and increasing demand; population growth and seasonal use also increases demand, which leads to fluctuations in flow and inconsistent chlorine dosing. The formation of disinfection by-products (DBPs) and aesthetic issues are also problems. Current treatment approaches do not adequately address parasite inactivation or removal, and very little space is available to upgrade the treatment facility.

Scope of Work:

This Community Circle involved research on national and international models of devolved water governance, as well as a project seeking to understand climate and watershed land-use impacts on chemical and microbial quality of source water and community vulnerability. RES'EAU has also evaluated several alternative treatment technologies with the mobile plant to compare performance, operating costs and practicality. The goal of the project has been to determine the most feasible and sustainable water treatment alternatives for Shawnigan Lake and similar communities.

Progress/Updates:

From November 2014 to June 2015, RES'EAU conducted a pilot plant study to evaluate the efficacy and operability of treatment options (nanofiltration, ion exchange and direct filtration) to disinfect and remove organics from the water while improving taste and reducing odour compounds. CVRD has used our pilot results in their applications for provincial funding and is currently undertaking an overall budgetary review and design of the treatment system. Community engagement consisted of two public meetings, an open house at the mobile pilot plant and private tours of the plant for local decision makers and school youth.

As part of the same Community Circle initiative, RES'EAU also participated in a process to improve the governance capacity of small and First Nations communities by developing recommendations for water management in the CVRD region.

Van Anda Improvement District (VAID)

Background:

The Van Anda Improvement District (VAID) is a small community of 550 people located on Texada Island, one of the Gulf Islands. VAID's drinking water is unique in that water from Priest Lake is high in dissolved organic carbon (organic material that results from the decomposition of plants and animals). While the district has set aside a capital reserve fund for a new water system, pilot testing the many potential new technologies would rapidly deplete the fund.

Scope of Work:

The Community Circle here strives to identify, validate and implement sustainable technologies and processes that form a multi-barrier approach geared toward VAID's distinct needs. RES'EAU, in close collaboration with the Board of Trustees, has been evaluating several prospective solutions simultaneously in our Mobile Water Treatment Pilot Plant at an efficient cost. The outcome will be a system the community can afford to implement and maintain, while providing quality drinking water and fully protecting the health of the community.

Progress/Updates:

To date, the RES'EAU team has tested promising technologies with our mobile treatment plant, while community interactions have built solid, trusting relationships with community members and raised awareness of the issues. Thus, the community is better informed and equipped to move forward on implementing solutions.

DR. JOHN M. FROSTAD | Assistant Professor

Dr. John M. Frostad has joined the University of British Columbia as a joint member of two programs: Chemical and Biological Engineering, along with Food, Nutrition, and Health. This unique opportunity to bridge his background in Chemical Engineering with his research interests in Food Science is what attracted Dr. Frostad to UBC. As a native of the Pacific Northwest, having grown up just across the border in Spokane, Washington, the move to UBC also brings Dr. Frostad closer to home and he enthusiastically praises the natural beauty of Vancouver, B.C.

Dr. Frostad comes to UBC from Stanford University where he spent a year and a half as a postdoctoral scholar. Before that, he worked for 2 years at Bend Research, a division of Capsugel, as a Research Chemical Engineer where he enjoyed working on a wide variety of projects ranging from the development of technology for the purification of monoclonal antibodies to mathematical modeling of pharmaceutical processing equipment. Dr. Frostad received his BS (with honors) from the University of Washington and PhD from

the University of California, Santa Barbara, both in Chemical Engineering.

Dr. Frostad's research is aimed at improving our fundamental understanding of multiphase fluid systems including emulsions, foams and suspensions. This type of research forms the base level of understanding needed to advance technology in a wide variety of applications including the development of functional foods, enhanced oil recovery processes, new drug delivery vehicles, more comfortable contact lenses and many others. His approach centers on the development of new and unique experimental tools for testing theoretical models, characterizing novel materials and discovering new phenomena. One long-term goal of John's research is to enable the production of new food products that are engineered to meet the various needs of modern mankind with regard to better sustainability, improved health and nutrition and higher quality of life.

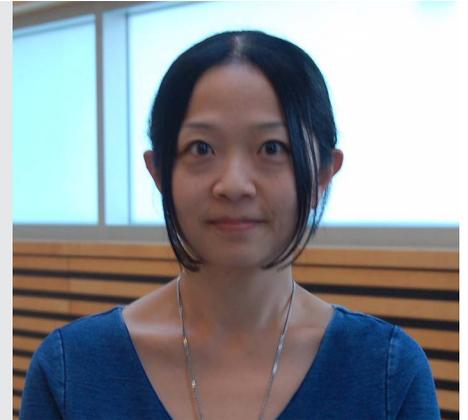
DR. JONATHAN VERRETT | Instructor I

Dr. Jonathan Verrett is excited to join the Department of Chemical and Biological Engineering as an instructor in the Educational Leadership Stream. At UBC, Dr. Verrett looks forward to supporting opportunities around engineering design for students, both inside and outside of the curriculum. He believes curiosity and discussion are fundamental to the development of great engineers and aims to facilitate spaces for these interactions in his classroom. During his Ph.D studies, Dr. Verrett was heavily involved in teaching and supervised multiple exchange students from countries including Japan and France. Having been appointed as a Tomlinson Graduate Teaching Fellow during his PhD, he worked with graduate students across a variety of scientific disciplines to lead teaching workshops for graduate and undergraduate students in science, engineering and medicine. He hopes to continue this work training the next generation of engineering educators at UBC by creating opportunities for graduate students to hone their pedagogical skills through practice, feedback and reflection.

Dr. Verrett obtained his Ph.D. in Chemical Engineering at McGill University, where he also earlier completed his Bachelor's studies in the same discipline. His interest in energy systems has led him to undertake research on a variety of topics including biological hydrogen production, photocatalysis and gas hydrates. Dr. Verrett's Ph.D. studies focused on heat and mass transfer in multiphase systems, specifically the formation kinetics of gas hydrates and crystal growth promotion mechanisms. During his studies he received numerous national and international awards, including an Erasmus scholarship to support studies at the Université Paris-Sud in France. He considers himself very fortunate to be working with amazing colleagues and student leaders at UBC to provide a university environment where everyone can achieve their full potential.

GINA ABERNETHY | Graduate Programs Manager

Gina Abernethy graduated with a BA (Hons.) in English Literature in 2004 and traveled around Europe, then worked at various institutions until joining the Department in May 2016 as the Graduate Programs Manager following her role as a Recruitment & Admissions Coordinator at the Sauder School of Business. While supporting and managing graduate student programs at CHBE she enjoys working with students and colleagues across Applied Science. With a passion for travel and food culture and having lived in various countries including Iran, Egypt, Cyprus and most recently the UK, she finds a particular interest in collaborating with international students – the multicultural element of the Department is something she finds very rewarding. Gina looks forward to contributing to graduate program development and is happy to have found such a welcoming and supportive department to call home.



Joseph English is a recent UBC graduate (BASc, Chemical Engineering, '16) working towards his Professional Engineering (PEng) designation in the province of British Columbia. Joseph is starting his engineering career by joining the Department as its Student and Curriculum Support Advisor in April, 2016. In addition to advising undergraduate chemical and biological engineering students, Joseph supports faculty activities in preparation of the upcoming review of its accredited undergraduate engineering programs. Joseph is eager to contribute to the undergraduate experiences here in the Department.



JOSEPH ENGLISH Student and Curriculum Support Advisor

MILES GARCIA Safety Program Coordinator



From the sunny deserts of the United Arab Emirates to the cool tundra of Northern Alberta & BC, Miles Garcia has experienced first-hand the value of structured and proactive workplace health & safety programs in diverse work environments. He immigrated to Canada at age 18, graduated from Simon Fraser University (SFU) with a Bachelor of Science in Health Sciences, and went to work in the Canadian oil & gas industry. Today, he provides safety & sustainability support services to CHBE while enjoying the temperate climate of the Pacific Northwest in beautiful Vancouver.



MICHELLE PANG | Administrative Support

Michelle Pang is a recent UBC graduate (BA, Geography – Environment and Sustainability) and she joined the Department in December 2016 as an Administrative Assistant and Assistant to Department Head. Born in Hong Kong and raised in Vancouver, she loves the beautiful outdoors that B.C. has to offer, as well as the vast choices of dining and cuisine. Michelle's previous experiences working with local and international students from the UBC Arts Vancouver Summer Program has piqued her interest in event planning and student interaction in an education environment. Ultimately, she would like to use her experiences in administration and student interaction to facilitate and contribute to the CHBE family.

HEALTH, SAFETY, AND ENVIRONMENT COMMITTEE

Miles Garcia, Safety Program Co-ordinator

The Chemical and Biological Engineering Building Health, Safety, and Environment (HSE) Committee includes faculty, staff, and students who meet monthly to discuss health, safety, and environmental issues, opportunities for improvements and to review any safety incidents that have occurred.

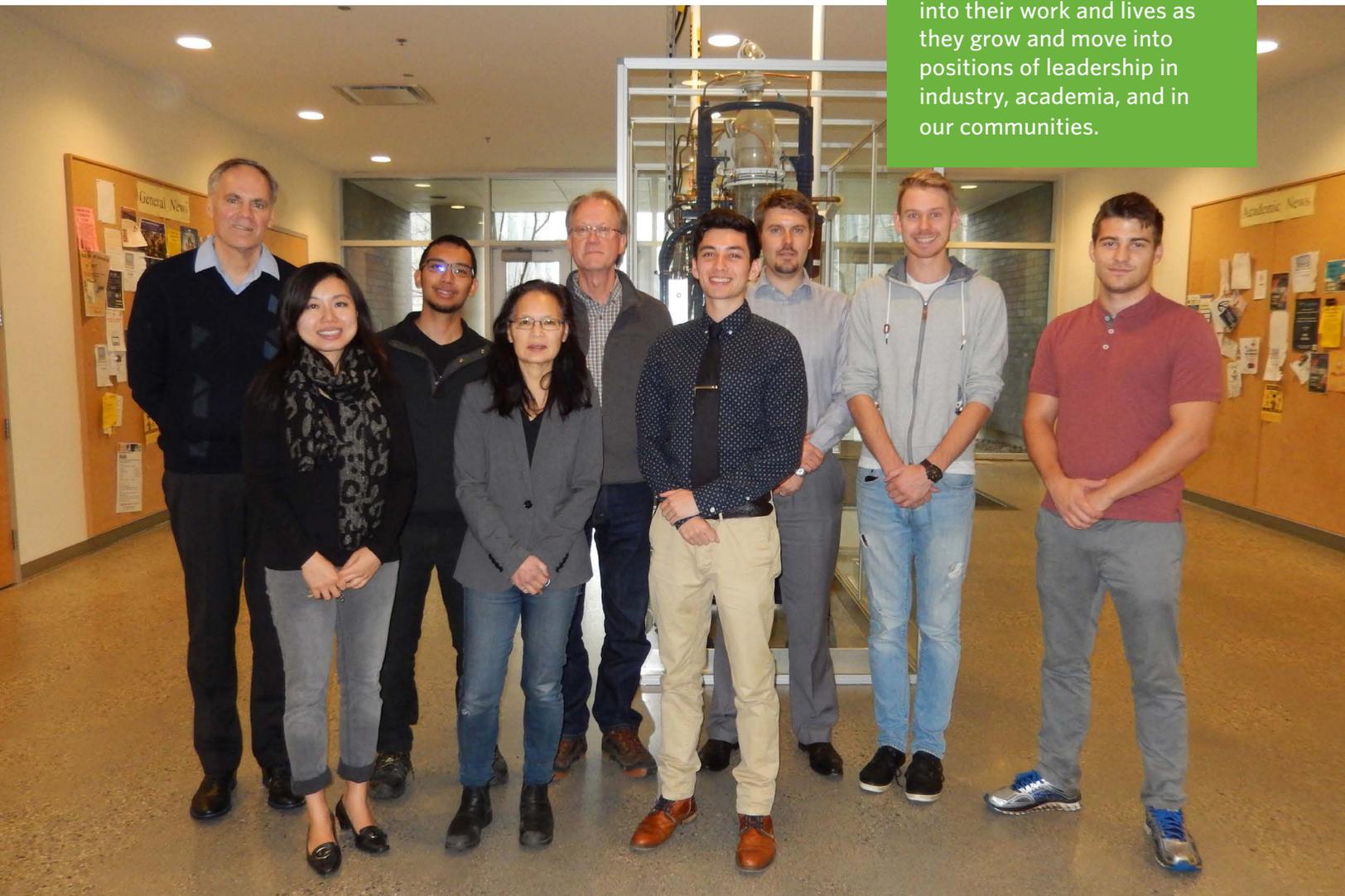
Our 2016-17 committee members include:

- Dr. David Wilkinson (co-chair)
- Marlene Chow (co-chair)
- Miles Garcia
- Dr. Dhanesh Kannangara
- Sara Chen
- Jeremy Rochussen
- Jeffrey Boschman
- David Goertsen
- Serge Milaire
- Doug Yuen
- Daniel Korvin
- Jonathan Doan
- Gladys Conroy

Recent HSE Committee initiatives include:

1. Earthquake preparedness
2. Improving safety documentation, record-keeping, data collection, and analysis
3. Introducing new safety policies to prevent incident re-occurrence

The Committee is dedicated to ensuring that everyone in our community gets home from work and school safely by instilling safety as a core value. It is our vision that our students integrate safety into their work and lives as they grow and move into positions of leadership in industry, academia, and in our communities.



(L-R) Dr. David Wilkinson, Sara Chen, Miles Garcia, Marlene Chow, Serge Milaire, Jeffrey Boschman, Jonathan Doan, David Goertsen, and Daniel Korvin

INDUSTRY ADVISORY COUNCIL

Our current IAC members are:

- **Claudio Arrato**, P.Eng - Chief Technology Officer, Provectus Engineered Materials
- **Terry Chmelyk** - Advanced Control Solutions Manager, Spartan Controls
- **Alfred Guenkel**, P.Eng. - Partner & Principal Chemical Engineer, Noram Engineering & Constructors Ltd.
- **Eric Jervis** - Principal Scientist, Stem Cell Technologies
- **George Peat** - Executive Director, GERMMAX
- **Martin Pudlas** P.Eng. - Vice-President, Operations, Canfor Pulp and Paper
- **Tim Watson** - Senior Vice President, Project Development, Teck Resources Limited
- **Melissa Winfield Lesk**, P.Eng. - Western North America Regional Director - Environmental Services Group, Hatch
- **Peter Wynne**, P.Eng. - Technical Specialist, Chevron Canada Limited

Leading the IAC as Chair is Tim Watson, Senior Vice President, Project Development, Teck Resources Limited and the Co-chair is Dr. David Wilkinson, Professor Tier I Canada Research Chair. During 2016, we thanked Simon Malin for his contributions to the IAC and wish him the best. We look forward to working with Melissa Winfield-Lesk, P.Eng., of Hatch who joined the IAC in October, 2016.

The Department's Industry Advisory Council was convened in mid-2012 and since then, council members have provided valuable feedback to Department ideas and initiatives. The Department continues to value its relationship with IAC members and their assistance with:

- Co-op and Undergraduate Student Professional Development
- Graduate Student Professional Development
- Research - University / Industry Collaboration
- Development (fundraising) and Alumni Engagement



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together

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DR. CURTIS BERLINGUETTE



Dr. Curtis Berlinguette is an associate professor of chemistry and chemical & biological engineering at the University of British Columbia. He currently leads a research program fully dedicated to solar energy conversion schemes, including the study of interfacial processes in dye-sensitized solar cells, and developing economically viable ways of storing solar electricity as high density fuels. Dr. Berlinguette holds several patents, has authored over 60 scientific articles, holds a Tier II Canada Research Chair in Solar Energy Conversion, and was awarded an Alfred P. Sloan Research Fellowship. Dr. Berlinguette's outstanding work has received the following recognitions:

Rutherford Memorial Medal in Chemistry

The Rutherford Memorial Medals were established in 1980 by the Royal Society of Canada in memory of Lord Rutherford of Nelson. The medals are awarded for outstanding research in any branch of physics and chemistry and in recognition of Lord Rutherford's own research carried out in Canada at a relatively young age.

E. W. R. Steacie Memorial Fellowships

Up to six Steacie Fellowships are awarded annually to enhance the career development of outstanding and highly promising scientists and engineers who are faculty members of Canadian universities.

Strem Chemicals Award for Pure or Applied Inorganic Chemistry

The Strem Chemicals Award is presented to a Canadian citizen or landed immigrant who has made an outstanding contribution to inorganic chemistry, demonstrating exceptional promise, while working in Canada.

DR. ELÖD GYENGE



Founders' Award in Bioenergy Excellence

The International Bioenergy Conference and Exhibition Founders' Award in Bioenergy Excellence recognizes individuals who exemplify vision, innovation and leadership in advancing the industry in tangible ways. Dr. Shahab Sokhansanj received his award at the 7th International Bioenergy Conference and Exhibition in June, 2016.

DR. EZRA KWOK



Specially Appointed Professor in the Graduate School of Engineering at Osaka University

Between January 1 and March 31 2016 and again between October 1 and October 31, 2106, Dr. Elöd Gyenge was a Specially Appointed Professor in the Graduate School of Engineering at Osaka University and also cross-appointed at the Institute of Academic Initiatives.

DR. SHAHAB SOKHANSANJ



WesTEC External Leader in Science and Technology Award

The Western Canada Technical Excellence Conference, (WesTEC), is an annual event held at the Fort Saskatchewan Dow Chemical facility. It celebrates and elevates technical innovations, enhanced work process efficiencies and process safety and technology breakthroughs. WesTEC highlights the strong culture of excellence in science and technology woven through the fabric of our organization. The award for External Leader in Science and Technology recognizes an individual, outside of Dow, that best exemplifies the traits and values associated with this culture. Dr. Ezra Kwok received the award in October 2016.

DR. MADJID MOHSENI



Wall Scholar Research Award

The Peter Wall Institute for Advanced Studies Wall Scholar Research Award provides support for full-time, tenured or tenure-stream UBC faculty members to spend one year in residence, in a collaborative, interdisciplinary environment. Wall Scholars are chosen among leading UBC research from all academic disciplines, with the objective of creating a dynamic and diverse intellectual community at the Institute.

As a 2016 Wall Scholar, Dr. Madjid Mohseni plans to work towards developing and implementing a partnership strategy to help engage researchers from across the UBC campus, on issues and challenges of First Nations drinking water.

Dr. Bhushan Gopaluni, Professor and Associate Head Undergraduate Studies, provides exemplary service and teaching in such areas as leading the graduate attributes and program improvement committee, coordinating data collection for the accreditation review and designing feedback methods for processing and improving programs. As student advisor, he has helped develop CHBE's Co-ordinated international student exchange program as well as leading undergraduate student development within the Industry Advisory Council, inspiring and running a repertoire of beneficial extracurricular activities. Dr. Gopaluni leads by example as he demonstrates care, passion, dedication and a desire to nurture and develop student talents. His contributions are recognized by faculty, staff and students and he has earned universal respect from the CHBE community. Dr. Gopaluni's service and teaching has received the following recognition:

Dean's Excellence in Service Award

The Dean's Award for Excellence in Service acknowledges the exceptional service and leadership that faculty members provide to their departments outside of their research and teaching duties.

Killam Teaching Prize

The Killam Teaching Prize is awarded annually to faculty nominated by students, colleagues and alumni in recognition of excellence in teaching. Dr. Bhushan Gopaluni was recognized at the May 2016 graduation ceremonies.

DR. BHUSHAN GOPALUNI



DR. DAVID WILKINSON



Dr. David Wilkinson is an internationally recognized Canadian researcher who has made distinctive and outstanding contributions in the fields of electrochemistry, electrochemical engineering, and clean energy technology covering a wide range of research from fundamental material science and catalysis, to engineering design and operation. Dr. Wilkinson is working to develop an adaptable and cost-effective electrochemical cell platform with Noram Engineering. His work has received the following recognitions:

Technology Ambassador Award

Partners In Research's mandate is to educate the public about the importance and significance of research within the biomedical and natural sciences, technology, engineering and mathematics domains. Its National Awards celebrate the promotion to the public of leading Canadian research through outreach activities and recognizes the impact of this research on the lives of Canadians.

BCIC Ignite Award

BC Innovation Council (BCIC) Ignite is funded by the Natural Resources and Applied Sciences (NRAS) Endowment Fund, established by the Province of British Columbia to enhance the quality of life residents by building a strong research and development, advanced training, technology transfer and commercialization environment. Assessment is in collaboration with the National Research Council of Canada Industrial Research Assistance Program (NRC-IRAP).



BCWWA STUDENT DESIGN COMPETITION

Laith Furatian, 2016 Competition Chair (PhD Candidate, CHBE)



Photo Credit: Mike Crane

Resort Municipality of Whistler's Wastewater Treatment Plant; Credit: Mike Crane

The British Columbia Water and Wastewater Association (BCWWA) held their fourth annual Student Design Competition in 2016. Open to 3rd and 4th year engineering undergraduate and graduate students, the competition is an opportunity for student teams to develop a practical solution to a real environmental engineering municipality challenge. Each team is paired with both an academic advisor and an industry advisor who provide mentorship.

The resort Municipality of Whistler sponsored the 2016 challenge of designing

a tertiary wastewater treatment process to reduce the amount of phosphorus discharged to the Cheakamus River. Whistler presents unique challenges due to the proximity of sensitive ecosystems, limited available plant footprint and fluctuating populations as a year round tourist destination. A site visit to the Whistler wastewater treatment plant was provided for student team representatives.

The team deliverables, a design notebook submitted in March and oral presentation in April, were equally weighted to promote the importance of both technical and communication skills by a judging panel of academia and industry members. Top teams presented their work at the BCWWA Annual Conference and the winning team advanced to the Water Environment Federation student design competition in New Orleans.

Student participation in the competition has increased, over 40 students participated in 2016. The majority are Chemical and Biological Engineering students including 3rd place team, Andrew May, Chong Siang Lim, and Yohan Wiputra.

The Department of Chemical and Biological Engineering has supported the BCWWA competition by providing faculty advisors, presentation space and financial sponsorship. Also, the competition Chair for the past two years is a Department doctoral candidate.

KILLAM GTA AWARD



Sean McBeath, MAsc candidate, was a recipient of a 2016 UBC Killam Graduate Teaching Assistant Award. Only 16 awards are presented annually at UBC. This award recognized Sean's outstanding contributions to teaching and learning at UBC, and in particular to Chemical and Biological Engineering.



UNDERGRADUATE SHINES AT AIChE 2016 STUDENT CONFERENCE

Over 300 American Institute of Chemical Engineers (AIChE) student members presented their findings in sustainability, catalysis and reaction engineering, computing and process control, environmental aspects of chemical engineering, as well as food, pharmaceutical, bioengineering, fuels, petrochemicals, energy, materials, separations, among other topics at the AIChE Annual Student Conference. Undergraduate Haider Kamal's poster entitled 'Development of a Stimulus Responsive, in-Situ Forming, Nanoparticle-Laden Hydrogel Formulation for Ophthalmic Drug Delivery' received the 2nd Place Award in the Food, Pharmaceuticals, and Biotechnology category. Haider's developed his findings last summer under the supervision of Dr. Vikram Yadav through the UBC Work-Learn program.



Haider Kamal with AIChE Award

BIOMOD

UBC BIOMOD AT BIOMOD JAMBOREE 2016

Ileana Co, UBC BIOMOD Co-Captain (BASc Candidate, CHBE)

On October 29-30, 2016, the UBC BIOMOD team travelled to the BIOMOD competition at the University of California, San Francisco (UCSF), and presented their project entitled 'A Dual-Ligand Targeted "Trojan Bull" Drug Delivery System for Glioblastoma Multiforme'. After 9 months of brainstorming topics, designing and performing experiments, and working on project deliverables, the team is back from the Jamboree with a Gold Placement and Second Place Audience Choice Category Award!



Back Row: (L-R) Nathan Chan, Derek Chan, Edward Wang, Amir Meysami Fard, Will Xi, Chanpreet Mangat, and Rika Sugimoto;

Front Row: Jeff Boschman, Ileana Co, Lena Choi, Lily Takeuchi, Valerie Chu, and Angel Chu

The UBC BIOMOD team is comprised of 17 amazing undergraduate students across both the engineering and life sciences departments of UBC. The team competes annually at the BIOMOD competition, which was founded in 2011 by the Wyss Institute for Biologically Inspired Engineering at Harvard University. Operating in the realm of the nanosized world, engineers are challenged to think out of the box and innovate solutions using biomolecules such as proteins, lipids and DNA, to solve complicated problems. This year, the team decided to tackle the intriguing problem of drug delivery to a highly malignant form of brain cancer called Glioblastoma Multiforme (GBM). The UBC BIOMOD team created a way to 'smuggle' drugs through the extremely selective blood brain barrier (BBB) by attaching target-specific proteins called ligands onto a drug vehicle called a liposome to target receptors on the BBB, and ensure that drug delivery is tumor-specific.

The BIOMOD experience is one that can be described as fun, challenging and fulfilling all at the same time. The teamwork, camaraderie, creativity and perseverance of each and every team member truly contributed to the success of the project! This high-level of achievement would also not have been possible without the support and expertise of UBC faculty and graduate students, as well as funding from the NSERC Create ECOSCOPE Program. More information about the activities of UBC BIOMOD can be found on the team website: www.ubcbiomod.com.

CHEM-E-CAR COMPETITION AT AICHE SAN FRANCISCO 2016

Athanasios Kritharis, UBC Chem-E-Car Co-Captain (BASc Candidate, CHML)

2016 was a very exciting year for the Chem-E-Car team; 2016 has been a very exciting year for the Chem-E-Car team; we have presented in 7 conferences ranging from the future of energy industry to innovations in chemical engineering. From these events we have won 5 different awards. Notably, we placed 1st among 41 teams from all over the world for our poster presentation at the American Institute of Chemical Engineers (AIChE) 2016 Student Conference in San Francisco.

In addition to this success, the team has progressed immensely. From a minor group of 5 students two years ago, the team has grown to a 40+ member organization.

In addition to our Chem-E-Car activities, we are working on four different projects including a rechargeable microgrid system, and a water quality testing phone app. Our equipment has also been upgraded thanks to an extremely generous donation from our Diamond Sponsor, the Daniel Family Foundation. We would also like to thank: Precision NanoSystems, BotFeeder, MG Chemicals, Digital Ocean, FortisBC, and CHBE for all of their support.

The 2016-2017 period promises to be extremely exciting for Chem-E-Car as we have been invited to compete as the representatives of Canada at the 10th Annual World Chemical Engineering Congress to be held in Barcelona, Spain. To keep current on our latest activities, we invite you to visit our team website and blog at www.ubcchemecar.com.

CHEM/E-CAR



(L-R) Ray Bi, Kyle Como, Ngai To Lo, Athanasios Kritharis (Captain), Andrew May, Siang Lim, Arjun Bhagwat, Dr. Jonathan Verrett (AIChE faculty advisor), and Mani Massah

UBC IGEM AT IGEM GIANT JAMBOREE 2016

David Goertsen, UBC iGEM Team Member (BASc Candidate, CHBE)

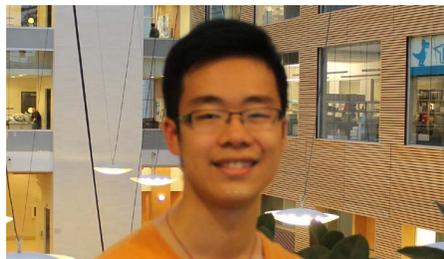


The international genetic engineering machine competition (iGEM) is a showcase of work and advances in the rapidly advancing field of synthetic biology. Over three hundred teams from 42 countries participated in this year's competition, travelling to the iGEM Giant Jamboree to present their research in synthetic biology. Two students from the Chemical and Biological Engineering department participated in this year's UBC iGEM team and attended the jamboree: 4th year student David Goertsen (BASc Candidate, CHBE) and 3rd year student Anson Yam (BASc Candidate, CHML). The UBC iGEM team was nominated

for the best manufacturing project in the competition, and received a gold ranking. Not only does this competition provide a platform for students to practice biological engineering fundamentals and concepts, it allows students to gain experience in project management, teamwork, and good laboratory practices that will be invaluable in industry.

This year's UBC team aimed to provide value to wood waste from the forestry industry by degrading biomass into sugars which can then be converted using biological metabolism into valuable products. To accomplish this, the genetic code for the catalytic unit of a cellulase, an enzyme degrading cellulose, was inserted into the genetic code for the surface

expressed proteins of *Caulobacter crescentus*. By engineering the S-layer, an array of expressed proteins on the surface of *C. crescentus* displayed cellulolytic activity, and could hydrolyze cellulose as a feedstock into monomeric sugars. These sugars could then be metabolized, not only by the *C. crescentus*, but also other species in a co-culture that could be dedicated to making valuable products. The team validated their research with a proof of concept, in which a co-culture of the engineered strain of *C. crescentus* and *E. coli* MG1655 were cultured to statistically significant densities on cellulose as the sole feedstock, which neither culture can metabolize naturally. More information about UBC iGEM and their project can be found at http://2016.igem.org/Team:British_Columbia.



16 iGEM Team Member Anson Yam



16 iGEM Team Member David Goertsen



The UBC Oil&Gas Initiative is a multidisciplinary student-run organization that aims to connect the UBC community to the Canadian Oil and Gas industry, while engaging students in technical discussions, networking events, and competitions. The initiative works to educate students on emerging aspects of Canadian and global energy, as well as promote technological innovation for the next generation of energy leaders. In February 2017 the club will be hosting a series of guest lectures with professionals from industry and academia, focusing on various technological and sustainable advancements in oil and gas.

The Oil&Gas Initiative recently became the official UBC Student Chapter of the Society of Petroleum Engineers (SPE), and hosts and participates in several SPE events. Earlier this year, a team of Oil&Gas Initiative members represented UBC at the Alberta Student Energy Conference (ASEC) in Calgary, and competed against several Canadian universities in the ASEC Energy Bowl. In addition, the club is honoured to help host the 2017 SPE Canada Regional Student Paper Contest in March. The paper competition requires students from Canadian universities to apply engineering and business principles to create solutions to real-world challenges in the energy industry.

UBC OIL AND GAS INITIATIVE

Sean Bonnett, President (BASc Candidate, CHML)



Regional Student Paper Contest 2016 in St. John's, Newfoundland, Entrants Jonathan Muller, left, and Alex Chow, right, along with faculty advisor, Mr. Michael Schoen, centre.

Next spring, the Oil&Gas Initiative will host its second annual Liquefied Natural Gas case competition. Previously the club collaborated with Petronas to develop a competition requiring students to form a strategy to construct an LNG terminal on the coast of British Columbia, while taking into account several business, social, and engineering challenges. This year, the team hopes to further educate students about emerging technologies and practices in Canada's energy industry, and provide its members with the resources to succeed in the field. For further information on the Oil & Gas Initiative, please visit our website at oginitiative.ca or email us at info@oginitiative.ca.

DEPARTMENT SCHOLARSHIPS AND AWARDS



(L-R) Nathan Chan, Lee Rippon, Mary Kenny, and Ryan Rickaby at 2016 Thomas Bennett Award Ceremony"

THOMAS BENNETT AWARD

On April 22, 2016, the University of British Columbia's Chemical and Biological Engineering Department hosted the award ceremony of the Thomas Bennett Student Enrichment Memorial Awards in Chemical and Biological Engineering. Nathan Chan and Ryan Rickaby, this year's recipients, were selected based on their participation in student enrichment activities, social and environmental concern, academic achievement, and leadership qualities.

The awards were officially endowed in 2012 as a legacy of Thomas Edward James Bennett, an accomplished alumnus of the Chemical and Biological Engineering Department who graduated in 2007. During his time at UBC, Tom made a positive and lasting impression on students, staff, and faculty in the Faculty of Applied Science, many of whom were devastated by his untimely death in a tragic mountain climbing incident on April 1st, 2010, at the age of 26.

CHAD BENNINGTON MEMORIAL SCHOLARSHIP

The Chad Bennington Memorial Scholarship was awarded to Melissa Beaulac. The award is named in honour of Professor Chad Bennington, a faculty member in the Department of Chemical and Biological Engineering who passed away suddenly in 2010. The Chad Bennington scholarships are awarded to the student who demonstrates interest, leadership, and academic accomplishment in pulp and paper related technologies.

JOEL BERT MEMORIAL SCHOLARSHIP

This scholarship has been endowed by family and friends in memory of Dr. Joel Bert, who was a UBC faculty member for over twenty years in the Department of Chemical and Biological Engineering. The scholarship is offered to an undergraduate student in the final year of Chemical and Biological Engineering, with preference given to those with an interest in applying engineering principles to human health concerns. This year's recipient was Nathan Chan.

JOHN R. GRACE GRADUATE SCHOLARSHIP

The John R. Grace Graduate Scholarship was awarded to Ruixu Wang. The award is for graduate students in Chemical and Biological Engineering who demonstrate academic excellence and potential for service to society by performing research on energy, the environment, and/or multi-phase systems.

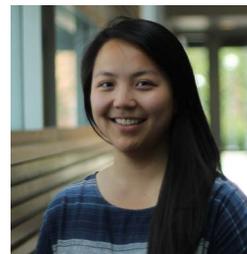
APSC RISING STARS

The UBC APSC Rising Stars of 2016 are people passionate about their chosen field - architecture, landscape architecture, community and regional planning, engineering and nursing. They are individuals that inspire others by making meaningful contributions to the betterment of society. In 2016, four CHBE students were honored as UBC APSC Rising Stars. Congratulations to all on well-deserved recognition for their achievements to date. We wish them well in all of their future endeavors!



AYESHA SHAHZAD
(BASc '16, CHML)

"If you asked a 10 year old to come up with an idea for a browser-based online game, how can they envision that idea if they have never seen or interacted with a computer?"



CYNTHIA NI
(BASc '16, CHBE)

"What I find most valuable is the lesson that there is no right or best solution - everything has a trade-off; every resolution is a balance of compromises; systems are complex and everything is interconnected."



NICK MCINTOSH
(MASc '16, CHBE)

"I hope to not only brighten the perception people have of the profession but also make others more aware of, and interested in, some of the physical processes in place around them every day."



SEAN MCBEATH
(MASc '16, CHBE)

"I had a love for science throughout high school and wanted that love to materialize into a career where I could make a difference. I felt like engineering was that way of making a difference."

GRADUATION DAY

The Graduation Day Reception was hosted in the Chemical and Biological Building Auditorium and Atrium after the spring Convocation ceremony held May 31, 2016. It was an opportunity to recognize the achievements of exceptional students as well as some exceptional teachers. Speeches and awards were followed by a reception with refreshments afterwards.

The 6th ICGH Process Design and Dr. Colin Oloman Team Poster Awards were given to the 'Sulphuric Acid Production via Double-Contact Absorption' team and Dr. A. Paul Watkinson Design Award was given to the Lion's Gate Waste Water Treatment' team in recognition of the superior achievement of capstone design project teams on Graduate Day. The GLS-6 Award to given to graduate student Jeanette Leuwner. Teaching Excellence Awards as decided by the undergraduate graduating class were given to faculty Drs. Jimmy Feng, Heather Trajano, Vikram Yadav, and Jim Lim.

6TH INTERNATIONAL CONFERENCE ON GAS HYDRATES PROCESS DESIGN AWARD

(L-R) Dr. Peter Englezos (Awardee), Sabreen Sherwani (BASc, CHML, '16), Ayesha Shahzad (BASc, CHML, '16), Ravleen Kaur Julka (BASc, CHML, '16), Harsimran Kaur (BASc, CHML, '16), Mediha Ahmed (BASc, CHML, '16), Greta Bahagiono (BASc, CHML, '16), and Dr. C. Jim Lim (Team Supervisor)



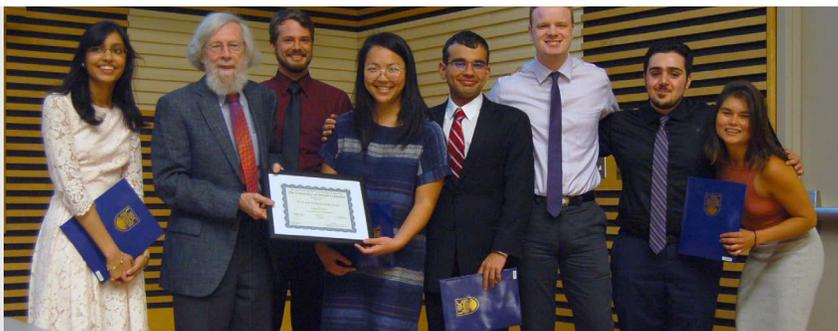
DR. COLIN OLOMAN TEAM POSTER AWARD

(L-R) Dr. Colin Oloman (Awardee), Ayesha Shahzad (BASc, CHML, '16), Mediha Ahmed (BASc, CHML, '16), Harsimran Kaur (BASc, CHML, '16), Ravleen Kaur Julka (BASc, CHML, '16), Greta Bahagiono (BASc, CHML, '16), and Sabreen Sherwani (BASc, CHML, '16)]



DR. A. PAUL WATKINSON DESIGN AWARD

(L-R) Priya Prasad (BASc, CHBE, '16), Dr. A. Paul Watkinson (Awardee), Christopher Lovell (BASc, CHBE, '16), Cynthia Ni (BASc, CHBE, '16), Alireza Nazari (BASc, CHBE, '16), Gregory Archer (BASc, CHBE, '16), Farbod Rahimi-Nejad (BASc, CHBE, '16), and Torrey Sirdevan (BASc, CHBE, '16)



TEACHING EXCELLENCE AWARD

(L-R) Teaching Excellence Award winners Drs. Jimmy Feng, Heather Trajano, Vikram Yadav, and Jim Lim.



CLASS OF 2016

Welcome, Class of 2016, to your new and honoured place among more than 3,300 CHBE alumni around the world. We are honoured to have given you a place to discover, inspire others and be challenged beyond what you thought was possible. We hope you know we will always be that place for you.



Credit: Martin Dee / UBC Communications and Marketing

The Degree of Bachelor of Applied Science in Chemical Engineering

- Abdullah, Mohammad Zishan
- Ahmed, Madiha
- Althaf, Arshad Ali Khan
- Amir, Nurul Hidayah
- Bahagiono, Greta Valen
- Bai, Shan
- Bednarek, Sebastian
- Botta, Filippo
- Chan, Jaron Jun-ling
- Chongpaisansakul, Onjaree
- Chow, Philip Yongkuan
- Delikatny, Matthew
- Einarsson, Sean
- English, Joseph Tyler
- George, Courtney Anne Scotney
- Hu, Xiao
- Huang, Hsien Hung

- Julka, Ravleen Kaur
- Kaur, Harsimran
- Kim, Se Ho
- Kochhar, Keshav
- Lee, Kenneth Ryan
- Lee, Nayeon
- Leross, John Joseph
- McDonell, Lesley Rosemary Irmgard
- Muller, Jonathan Jacob
- Naypes, Ameree Chanelle
- Pahal, Sarpreet Singh
- Ruan, Vincent Yuen
- Ruiz, Priscilla Carazatto
- Sanopal, Navjot
- Shahzad, Ayesha
- Sherwani, Sabreen
- Singh, Hansdeep
- Singh, Koowarbir Indar
- Snyder, Kehl
- Webster, Austin
- Yuan, Yigai

The Degree of Bachelor of Applied Science in Chemical and Biological Engineering

- Archer, Gregory
- Arnold, Liam Patrick
- Chow, Alexander
- Kamp, Arella Bryn
- Lovell, Christopher
- Nazari, Alireza
- Ni, Cynthia
- Pang, Man Hang
- Prasad, Priya Darshini
- Rahimi-Nejad, Farbod
- Sirdevan, Frances Torrey
- Toye, Marcus Jackson
- Warner, Jeffrey
- Wong, Jennifer Hau Sum
- Wong Shui Wan, Perry Ian Liong Dhat
- Zhao, Tian Lun

The Degree of Master of Applied Science in Chemical and Biological Engineering

- Alamoudi, Majed Abdulkader
- Fakhfakh, Kareem Adam
- Feng, Xianzhong
- Haji Malayeri, Adel
- Hudkins, Jesse Ron
- Serrano Mora, Adrian Alberto
- Tsai, Yiting
- Tsai, Pin-Wen Wendy

The Degree of Master of Engineering in Chemical and Biological Engineering

- Chan, David Andrew
- Cheng, Long
- Cheng, Xianwen
- Daniel, Lius
- Gupta, Pranay
- Li, Xinglong
- Liu, Zhengyang
- Shabbir, Fahad

- Sharma, Rahul Anand
- Wang, Haoyu
- Wosik, Piotr Dominik
- Zhu, Yinwen

The Degree of Master of Science in Chemical and Biological Engineering

- Mehta, Sean Arvind
- Subedi, Gaurav

The Degree of Doctor of Philosophy in Chemical and Biological Engineering

- Al-Shibl, Mohammad
- Alyani, Mina
- Bagheri, Mehdi
- Ekram, Fatemeh
- Jafari Naimi, Ladan
- Reilly, Kevin Thomas
- Saville, Frank Alan
- Taheri Najafabadi, Amin
- Tebianian, Sina
- Wang, Wei
- Yang, Cheng Wei Tony

THE RITUAL OF THE CALLING OF THE ENGINEER

The Iron Ring may be worn on the little finger of the working hand by any engineer who has been obligated at an authorized ceremony of the Ritual of the Calling of the Engineer. The ring symbolizes the pride which engineers have in their profession, while simultaneously reminding them of their humility. The ring serves as a reminder to the engineer and others of the engineer's obligation to live by a high standard of professional conduct. It is not a symbol of qualification as an engineer - this is determined by the provincial and territorial licensing bodies [Camp 1, Toronto]. The ceremony was held on Wednesday, March 9, 2016, at the Queen Elizabeth Theatre in downtown Vancouver.



Obligated Members of CHBE and CHML Class of '16; Photo Courtesy of the Engineering Undergraduate Society"

CHBE UNDERGRADUATE CLUB

Mike Tian, Co-President (BASc Candidate, CHML)



CHBE Undergraduate Club 2015/16 Executive Council

Over the years, the Undergraduate Club has organized social events, planned industry networking sessions, and advocated for the well-being of undergraduate students. In recent years, the undergraduate population has almost doubled, and our department is now among the largest in the Faculty of Applied Science in terms of size. The increasing popularity of CHBE at UBC has come with both blessings and challenges. We have a large, diverse community of students from across Canada and the world. The Undergraduate Club's Exec team and Officers are dedicated to improving the experience of the students as well as representing CHBE to the broader engineering community at UBC and beyond.

CHBE Undergraduate Club 2016/17 Executive Council

APSC OPEN HOUSE 2016

Hundreds of high school and first-year students, braved a cold, rainy Saturday to learn all about Applied Science at the University of British Columbia at its annual Open House on November 26, 2016. An academic fair was held all day in the Fred Kaiser atrium along with presentations, advising, tours, and demonstrations throughout the Applied Science complex. Students, staff, and faculty from the Department of Chemical and Biological Engineering were busy providing a glimpse of daily life here on campus: providing insights into undergraduate programs in the Department at the academic fair; highlighting undergraduate and graduate research during presentations, wowing visitors with hands-on experiments including an explosive demonstration using nitrocellulose (a.k.a. guncotton) during lab tours; and lastly showcasing activities of student clubs, teams, and research groups in the Chemical and Biological Engineering building. A bonus was free liquid nitrogen ice cream!

Dr. Gabriel Potvin Making 'Elephant Toothpaste' at Open House;



Photo Credit: Shengyang (Steve) Zhang (BASc CHBE Candidate)"

The Department thanks the Open House volunteers including undergraduate and graduate students, staff, and faculty, as well as student team representatives from UBC Chem-E-Car, UBC BIOMOD, UBC iGEM, Engineers for a Sustainable World UBC Chapter, the Oil & Gas Initiative and research group representation from RES'EAU-WaterNET.



Dr. David Bruce (PhD CHBE '12) presenting Elizabeth Fisher (MSc Candidate, CHEM) with 3MT/poster competition prize

The event included 5 talks by some of the most notable electrochemical scientists working in the province (from both academia and industry sectors) namely, Dr. Kjeang and Dr. Leach from Simon Fraser University (SFU), Dr. Stolar from Ballard Power, Dr. Campbell from NanoOne, and Dr. Bruce from ZincNyx.

YOUNG ELECTROCHEMISTS SYMPOSIUM 2016

Farhang Nesveradani (MAsc Candidate, CHBE)

These talks were followed by a presentation by Dr. Zhao who represented Mitacs Canada, a non-profit organization that provides fellowship opportunities to student and postdoc researchers in Canada. The day-long symposium was concluded by a series of student 3-minute thesis (3MT) presentations with 17 participants and a poster competition during the evening reception with 19 posters on display from students from UBC, SFU, and University of Victoria (UVIC). The event was funded by many proud partners, those include Department of Chemistry at SFU, Department of Chemical and Biological Engineering at UBC, our hosts, and the Electrochemical Society. Our sponsors allowed us to provide free registrations that included breakfast, lunch, and multiple coffee breaks as well as refreshments and appetizers during the evening reception. All the speakers were also given appreciation gifts. Additionally, Ballard Power, NanoOne, and Electrochemical Society Canada Section provided funds for the student awards from the 3MT and poster competition. Winners of the 3MT/poster competition were Audery Taylor from SFU (first prize), Elizabeth Fisher from UBC (second Prize), and Mahdieh Atighilorestani from UVIC (3rd prize). We are proud to say that YES 2016 attracted more than 64 attendees from different departments at the UBC, SFU, and UVIC, and visiting scholars from Japan.

CHEMICAL AND BIOLOGICAL ENGINEERING RESEARCH DAY 2016: ENERGY SOLUTIONS FOR A SUSTAINABLE FUTURE IN SMALL, RURAL AND FIRST NATIONS COMMUNITIES

Vasilii Triandafilidi (PhD Candidate, CHBE) and Roza Ghaemi (PhD Candidate, CHBE),
Organizing Committee Members



Research Day 2016 Poster and Networking Session

Engineering Research Day 2016 'Energy solutions for a sustainable future' was successfully held on February 11th in the Chemical and Biological Engineering Building. Research Day 2016 attracted 155 participants including engineering graduate students, UBC student design teams, faculty members, researchers and industry representatives with judges for the competitions being selected from both academia (from CHBE and other APSC departments) and industry. The full-day event featured:

- CHBE Centennial Lecture by Dr. Axel Meisen (Professor Emeritus, CHBE; Former President of the Canadian Commission for UNESCO; Former President of Memorial University; Former Dean of Applied Science UBC) entitled 'The Future of Fossil Carbons with Implications for Engineering'.
- Keynote presentation by Dr. Sylvain Coulombe (Professor and Chair, Chemical Engineering, McGill University) entitled 'Plasma Processes for Resource Recovery and Energy Applications'.
- Keynote presentation by Dr. Chris Wilmer (Assistant Professor, Chemical and Petroleum Engineering, University of Pittsburgh; co-founder NuMat Technologies) entitled 'Engineering Porous Materials for Fun and Profit'.
- Technical presentations in the format of the 3-Minute Thesis (3MT) and Poster
- Exhibitions of Student Design Teams in APSC
- 'Shrinking the Gap Between Academia and Industry' panel discussion featuring:
 - Dr. David Wilkinson (Professor and Associate Head - External and Faculty, CHBE; Canadian Research Chair in Clean Energy Fuel Cell Technology; BAsC CHBE '78)
 - Claudio Arato (VP - Engineering, Ronin8; CTO, Provectus, BAsC CHBE '90)
 - Richard Sones (Director of Industrial Partnerships, ASPC)
 - Dr. Christopher Wilmer (Assistant Professor, Chemical and Petroleum Engineering, University of Pittsburgh; co-founder NuMat Technologies)
 - Dr. Sherry Zhao (Business Development Specialist, Mitacs; PhD CHEM '14)



Research Day 2016 Organizing Committee and Volunteers



(Top to Bottom) Speakers Drs. Axel Meisen, Sylvain Coulombe, and Chris Wilmer

Engineering Research Day is a graduate student initiative established in 2013 run by graduate students with support from the faculty members of Department of Chemical and Biological Engineering (CHBE). The objectives of this whole day event are:

- To showcase the research work conducted in engineering departments of UBC across the Faculty of Applied Science (APSC)
- To enhance the academia-industry relationship
- Position engineering departments in UBC in the frame of major industrial projects held in British Columbia
- To provide lots of networking opportunities and to facilitate collaborations

The 2016 Research Day Organizing Committee extends its gratitude to the above organizations for their sponsorship and support of Research Day 2016

3RD YEAR FIELD TRIPS - 2016

Tyra Phillips and Tony Wu, CHBE Undergraduate Club Third Year Representatives



2016 Third Year Field Trip North, Southeast, and Local Tours

Every 3rd year Chemical and Biological Engineering Department student eagerly awaits the annual field trip, “Over three thousand kilometers, five nights on the road and countless hours of sleep on a bus!”. Each year, 3rd year students gain invaluable industry exposure during visits to operating facilities in British Columbia and Alberta. This year brought new highlights, memories and challenges associated with organizing the two road trips and one local field trip for students. The field trips are 50% funded through the Shell Campus

Ambassador Program (CAP), a program that takes the classroom outside campus borders, giving students first-hand experiences and a greater understanding of engineering in the field.

On September 25th, eighty-nine students ventured from campus on what was to be an unforgettable trip. Half of the students travelled North to Prince George and then continued East to Edmonton. The rest ventured East to Castlegar, Trail and Fernie and joined the other group in Edmonton. A third group of students visited local industries in the Lower Mainland.

It was an opportunity to understand how to apply what we learn to “real-life situations.” It was very eye-opening to see all these working professionals and what they do at each site, and definitely is a momentous part of our undergraduate experience.

Northern Tour

The enthusiasm of the employees really impressed me. What a chemical plant looks like; it was the first time I have visited one.

In Prince George, students woke up early for a busy day of tours coordinated by Canfor, one of the world's largest producers of sustainable lumber, pulp and paper. Students toured Canfor Pulp & Paper, PeroxyChem, Chemtrade, and Husky operations. At Canfor, students toured the kraft pulp mill and learned about mill processes, met operators, visited the modernized, control center and observed how people are trained.

PeroxyChem and Chemtrade manufacture chemicals to supply Canfor pulp mills and other customers. Chemtrade manufactures sodium chlorate and hydrogen from an electrolysis process with salt, water and electricity. Operators demonstrated the strength of the magnetic field with wrenches and coins. In addition to producing sodium chlorate, Chemtrade also processes soap scum from Canfor into crude tall oil (CTO) for use as an alternate energy source. PeroxyChem manufactures hydrogen peroxide with hydrogen from Chemtrade. The Husky refinery produces all grades of low Sulphur unleaded gasoline and seasonal diesel fuels as well as mixed propane and butane, and heavy fuel

oil for the local market. During the day, students had a breather and toured the City of Prince George.

In the evening, the students were graciously hosted to a dinner at the Prince George Civic Center by Canfor, PeroxyChem, Chemtrade and the City of Prince George. The students were welcomed in a video address by Mayor Lyn Hall and Martin Pudlas, VP of Canfor and networked with professionals to learn a little bit more about life as a professional engineer in the City of Prince George. An exhausting but exciting, jam-packed day!

The following day, students had an opportunity to relax when their bus travelled East through Mount Robson and Jasper national parks. A new experience for students, most of whom had never travelled north of Vancouver.

In Edmonton, students toured the Dow Chemical plant, which produces hydrocarbons, ethylene, polyethylene, and electricity. The group also visited Enerkem Biofuels, an operation which processes the municipal waste from the City of Edmonton to produce methanol as a biofuel.



Students break bread with Prince George professionals



Students monitor control panel at Canfor



Students pose with Mr. PG on way to Prince George, BC

SouthEast BC Tour

In the exquisite, Okanagan valley town of Osoyoos, the Castlegar group was introduced to Nk'Mip winery. The students toured the winery and viewed fermentation and aging processes. This was followed by wine sampling, which was a greatly appreciated start to the field trip. On the second day, students visited Teck Trail Operations, one of the world's largest, fully integrated zinc and lead smelting and refining complexes. The site has 23 plants and the students were amazed at the scale of operation. Students also learned about environmental regulations and controls and how to utilize the waste from one operation as the feed for another.

On the third day, students visiting Zelstoff Celgar, started with morning presentations about mill processes, which included procuring wood chips, and the Kraft pulping, bleaching and environmental processes. In the afternoon, the students toured the mill site. They were awed by the wood chip piles and size of the kiln and digester. What were numbers and units in students' notes became real.

The next day students were hosted by Teck again, this time at the Sparwood coal processing plant. Students learned how metallurgical coal is transported from open pit mines to the plant for processing and cleaning and transported to the coast where it is shipped worldwide. Students also visited the new state-of-the-art Line Creek water treatment process, which removes selenium from wastewater.



I learned that process units can be integrated to reduce waste and ultimately be highly economic and more environmentally sustainable for the company.



Students learning about pulp industry in Zelstoff Celgar

Students lining up in front of haul truck in Sparwood, BC



Shell

The two groups were hosted together by Shell at their Quest site for a presentation and tour. The presentation introduced bitumen upgrading operations and the new, innovative Shell carbon capture and sequestration operations. Quest captures more than one million tonnes of CO₂ emissions from Shell's oil sands operations annually and stores it deep underground.



North and Southeast Tour students reunited at Shell

Working in a plant environment requires teamwork. Engineers have to coordinate with operators and have meeting frequently. Apart from engineering knowledge, communication, teamwork and ability to get along and work well with people is key to work in a chemical plant.

The 2016 Third Year Field Trips were a resounding success! Students learned about numerous processes, the importance of safety and the need to develop teamwork and other skills. Students returned exhausted from the week, having learned about industry and a whole, new meaning for their degree. The trip renewed everyone's motivation to continue their work in the classroom and provided an unforgettable, bonding experience.

We are grateful and appreciative of the tour hosts who welcomed us, opened their doors, dedicated their staff to provide presentations and met with us, as well as providing meals and refreshments. In particular, we would like to thank Martin Pudlas, Ellen Robertson and Darcy Culling from Canfor for coordinating the Prince George tours and dinner and Zitin Lamba, Michael Liu and the Shell Canada Campus Ambassador program for their support of the field trips.



Students learning about water treatment at the Seymour Capilano Water Filtration plant

Local Tour

On the first day of local field trips, students toured CertainTeed, producer of gypsum board and the Seymour Capilano Water Filtration (SCWF) plant with Dr. Jonathan Verrett. The SCWF plant supplies the lower mainland with fresh water. By the end of the day, there were more than a few blisters from breaking in new steel-toed boots but students had a great understanding of continuous processes!

Students also visited the Carbon Engineering plant in Squamish. Carbon Engineering (CE) is commercializing technology to capture carbon dioxide directly from the atmosphere, which is converted into syngas. The final tour for the group was the Central City Brewery to learn about beer-making and sample some of their award-winning products.

CHBE GRADUATE STUDENTS CLUB

Roza Ghaemi, co-President (PhD Candidate, CHBE)

CHBE graduate student club (GSC) executive is a group of 12 passionate graduate students who commit to shape the CHBE community into a thriving, dynamic, and positive one where all graduate students can get more connected, build relationships and be as successful as possible. We hope to continue the efforts that have been put forth by the other council members in the past years and help making a positive, welcoming and supporting environment.

This year, the GSC has worked tirelessly to provide graduate students with the best possible graduate life experience. As part of our mission statement, the GSC is responsible for building community within the department, and aiming academic and professional development of the students.

For the GSC, things have been moving quickly since day one. Our first event of the year, a summer hike in Norvan falls was great adventure. We kept that momentum going throughout the year, with countless popular events, such as our Foosball tournament, September Welcome Back Day, and Several professional development workshops. We will have our CHBE Christmas lunch in December, which is a great opportunity for unionizing CHBE community.

The GSC has been hard at work this year. Read on for our greatest catches!

- Foosball Tournament:** The main goal of this annual tradition is to have graduates socialize casually around fun activities; this event is especially important as it is friendly competition followed by a pizza social on a Friday afternoon.
- September "Welcome Back Day":** In early September we hosted an ice-breaker event where the new graduate students discussed briefly with another about various subjects. It followed a "human- bingo" model followed by a pizza social, where everyone could talk in small groups.
- Halloween Pumpkin Carving Contest:** This simple competition-type event is a CHBE yearly tradition that struck a chord with the graduate students who sometimes just want some time to relax, have a friendly talk and perhaps take a break from their hard work in the research lab. The event also contributed to establishing and strengthening relationships between the council members and other students.
- Professional Development Workshop on 3MT Presentation:** A very popular professional development workshop with tip and tricks from the previous years 3MT winners and judges. This interactive session hold on late November targeted 3MT competition participants with a touch on general public speaking and oral presentation skills from Jacqui Brinkman, the Manager of Graduate Pathways to Success Program.



(L-R) Lucie Solnickova, Council Member (MAsc Candidate, CHBE); Jun Siang Lee, Council Member (PhD Candidate, CHBE); Haoqi Wang, VP - Sports (PhD Candidate, CHBE); Angelica Reyes, co-VP - Social (MAsc Candidate, CHBE); Carmen Bayly, Council Member (PhD Candidate, CHBE); Roza Ghaemi, co-President (PhD Candidate, CHBE); Danielle Salvatore, co-President (PhD Candidate, CHBE); Anupama Sharan (MAsc Candidate, CHBE); Julia Varela (PhD Candidate, CHBE); and Vasilii Triandafilidi (PhD Candidate, CHBE)"

CHBE INDUSTRY EVENTS



Photo Credit: Tony Wu

The CHBE Department students actively engaged with Industry during two events in 2016. A February event featuring an industry panel and a November speed networking event. The February Industry event started with a presentation from Pascal Beauchesne, PhD, Senior Scientist, Process and Analytical Development of Juno Therapeutics. The event continued with an industry panel of five chemical and biological engineers representing a broad range of industries and positions. The panelists shared their stories about their early experiences and provided advice to students. The panelists included:

- **Wendy Cheng**, EIT, Applications Engineer
- Control Systems, Spartan Controls
- **David Houghton**, EIT, Water and Wastewater Process Engineer - AECOM
- **Rebecca Burton**, PEng, Process Engineer
- Chevron Refinery
- **Travis Janke**, PEng, Director of Engineering
- Ronin8
- **Calvin Chan**, Process Development Engineer
- Juno Therapeutics

The UBC CHBE & ENVE Industry Night was held during the evening of November 8, 2016, in the Engineering Student Centre. Attendees had the unique opportunity to meet and network with alumni and the next generation of CHBE & ENVE students. The evening included speed networking with students followed by an open reception. Complementary appetizers and beverages were served to the participants.

CHBE UNDERGRADS AT CSCHE2016 IN QUEBEC CITY

Marc Aduhan, CHBE Undergraduate Club Industry Coordinator (BASc Candidate, CHBE)

Four UBC CHBE undergraduate students - Marc Aduhan, Tyra Phillips, JP Faucher, and Ileana Co, travelled to Quebec City and attend the CSChE2016 conference October 16-19, 2016. By participating at CSChE2016, the delegates were able to develop their professional portfolio and widen their network of professional contacts with industry representatives, high-profile engineering researchers, and other Canadian chemical engineering students. The support of the University facilitated their exposure to exciting technologies and career opportunities for chemical and biological engineers in Canada. This has ultimately impacted their career path decisions, such as choosing to become professional engineers, educators, researchers, or even businessmen. Furthermore, participation at the Robert G. Auld Student Oral Competition was possible giving individuals a chance to gain national oratory experience and contributing to UBC's reputation in the Canadian Society for Chemical Engineering.



(L-R) UBC CHBE CSChE2016 delegates JP Faucher, Tyra Phillips, Marc Aduhan, and Ileana Co"]

MASTERS OF ENGINEERING LEADERSHIP PROGRAMS

The Faculty of Applied Science introduced innovative one-year Master of Engineering Leadership (MEL) professional programs during 2016 and the Department was pleased to actively support three of the programs. MEL students learn from experts, deepening their technical skills, while enhancing business and leadership abilities and connecting with a network of like-minded professionals.

The Department in conjunction with Mechanical Engineering, Civil Engineering and the Faculty of Forestry, offered the Clean Energy (CEEN), Green Bio-Products (GBPR) and Integrated Water Management (IWME) MEL programs.

The intensive programs commence in January, continue through summer and complete in December. Department faculty providing instruction and expertise to the programs include:

IWME: Professors Sue Baldwin and Madjid Mohseni

GBPR: Professor Mark Martinez (Director), Assistant Professor Heather Trajano and Instructor Nuwan Sella Kapu

CEEN: Senior Instructor Vldan Prodanovic (Director) and Professor Xiaotao Bi

Congratulations to the MEL students on their successful program completion and best wishes for a bright future!

UBC Applied Science



"The MEL in Green Bio-Products program provides students with a pathway to working in the greenest industry on earth."

Dr. Mark Martinez

"UBC is a great place for students, who also benefit from the university's excellent connections across the globe."

Dr. Vldan Prodanovic

"I see this program as a combination of business with advanced training in water management from both a civil engineering and chemical engineering perspective."

Dr. Greg Lawrence



2016 MEL CEEN gala



2016 MEL GBPR gala



2016 MEL IWME gala

A CELEBRATION OF CLEAN ENERGY INNOVATION, CREATIVITY AND KNOWLEDGE EXCHANGE

UBC MEL marks the inaugural CEEN Capstone Showcase Conference and Industry Night



The MEL Capstone course, delivered in partnership with Industry, provides students practical experience leading complex, multidisciplinary projects. December 12 marked the inaugural Clean Energy Engineering (CEEN) Capstone Showcase Conference and Industry Night. The cohort of 21 students presented clean energy engineering projects, potential solutions to address real-world industry, market or societal needs. Industry partnerships across the public and private sector, included: AYO, SES Consulting, UBC CIRS, Fortis BC, Surrey City Energy, TRAK International, Heliolytics, Midgard Consulting (SaskPower) and Polymer Research Technologies.

Industry Night kicked off with a keynote presentation from Dr. Paul Kariya, executive director of Clean Energy BC, an organization that promotes and supports the sustainable growth of the clean energy sector in the province. Dr. Kariya called on the audience to think in a more collaborative way about the development of the clean energy sector in BC. In particular, he encouraged more active partnership and engagement with First Nations communities who have a significant role to play in helping to advance sustainable clean energy projects across the province.

“The clean energy revolution is absolutely sweeping the world, and the revolution is underway,” Kariya said. “There’s no stopping the wave of activity in the Canadian and global clean energy space.”

2016 RIDE FOR CLEAN ENERGY



Sean McBeath (MAsc Candidate, CHBE; BAsc CHBE '13)



Farhang Nesvaderani (MAsc candidate; BAsc, CHML, 2014), left, and Adrian Serrano (PhD candidate), right, taking a breather*

The fourth Annual Ride for Clean Energy benefitting the Tyler Lewis Clean Energy Research Foundation took place under sunny skies on August 6th, 2016. Forty participants including seven CHBE graduate students, alumni and faculty embarked on the beautiful 75 km ride navigating through the scenic Fraser Valley, starting from Harrison Mills and ending in Maple Ridge. CHBE riders included alumni James Butler (PhD, CHBE, '14), Saad Dara (PhD candidate; MAsc, CHBE, '12; BAsc, CHML, '10), Farhang Nesvaderani (MAsc candidate; BAsc, CHML, 2014), Adrian Serrano (PhD candidate), Dawn Marie Barreira (MEng, CEEN, 2014)), Ryan Anderson (PhD, CHBE, '12), David Chan (MEng, CHBE, '16; BAsc, CHML, '11), Shehin Rahemtulla (MEng, CEEN, '15), Cheryl Gomes (MEng, CHBE, '14), Dave Bruce (PhD, CHBE, '12) and Sean McBeath (MAsc candidate; BAsc, CHBE, '13) along with Professor Naoko Ellis (PhD, CHBE, '03; PEng). Workshop staff Doug Yuen and Graham Liebelt were also instrumental in the transport of bikes from Vancouver to the start of the ride.

The Tyler Lewis Clean Energy Research Foundation is a non-profit organization that awards a yearly grant to a graduate student enrolled in a Canadian post-secondary institution, in the field of renewable/sustainable energy research, with a \$10,000 scholarship. The Foundation and Ride was established in memory of Tyler Lewis, a CHBE graduate student who tragically passed away in 2012. The Ride is set as the Foundation's major annual fundraiser and proved itself as just that by raising \$25,210 to go directly to the Foundation, the biggest tally in the event's history so far. The money raised is pivotal for the continued issuing of the Foundation's yearly grant.

The Tyler Lewis Clean Energy Research Foundation thanks the involvement of CHBE in the Ride for Clean Energy, as well as the continued involvement in the years to come. To find out more about the Foundation, you can visit the website at www.tylerlewis.ca. For further information about the Foundation or how you can get involved with the ride in years to come, get in touch with Foundation board member Sean McBeath (smcbeath@chbe.ubc.ca).

APSC CENTENNIAL CELEBRATION DEAN'S MEDAL RECIPIENTS

The Faculty of Applied Science Dean's Medal of Distinction was created in 2015 to mark the celebration of the University of British Columbia and Applied Science's 100th anniversary. The medal serves to recognize individuals who have brought high honour to the Faculty and/or who have made long standing/significant contributions to advance its vision, mission and mandate.



APSC Centennial Celebration Dean's Medal Recipients (L-R): Top Row: Claudio Arato (Alumnus, BAsc CHML '91), Dr. Amit Chakma (Alumnus, M MAsc CHML '84; PhD CHML '87), Dr. Denis Conner (Alumnus, PhD CHML '59), Ken Dobell (Alumnus, BAsc CHML '64), and Dr. Norman Epstein (Professor Emeritus, CHBE); Middle Row: Randy Findlay (Alumnus, BAsc CHML '73), Dr. John Grace (Professor Emeritus, CHBE), Dr. Richard Kerekes (Professor Emeritus), and Henry F. Man (BAsc CHML '83); Bottom Row: Sean McBeath (Alumnus, BAsc CHBE '13), Dr. Axel Meisen (Faculty Emeritus, CHBE), Eric P. Newell (Alumnus, BAsc CHML '67), Henry Wakabayashi (Alumnus, BAsc CHML '58), and Dr. David Wilkinson (Professor and Alumnus, BAsc CHML '78)]

CHEMICAL ENGINEERING GRADUATES CELEBRATE 60 YEARS REUNION

Bob Kendrick, CHML '56

On September 22nd five Chemical Engineering graduates from the class of 1956, accompanied by their wives, met in the Chemical & Biological Engineering Building to celebrate 60 years since graduation. They were met by Dr. Peter Englezos, head of the department, and Tara Newell, the Alumni Relations Coordinator for the Faculty of Applied Science. Each alumni was given a UBC Engineering "goodie" bag and offered coffee and a snack.

Dr. Englezos made an interesting presentation that provided insight into how large and varied



CHML Class of '56

the department had grown in the 60 years since the group graduated. His presentation was enhanced by comments from Dr. Norman Epstein and memories from several of the graduates. Following the presentation Dr. Englezos led the group in a tour of the building, which included entry to a lab and two student offices. The students that were encountered during the tour were eager to converse with members of the group, especially when they realized just how long ago it was that the members of the group had graduated. The graduates were very impressed by all that

they saw in the building and couldn't help comparing with the facilities that they had left behind in "The Pit" in the basement of the old Chemistry Building on Main Mall.

Following the tour, the group headed to Mahoney's for lunch for a taste of pub food and a chance to chat. On the following day the group met again for lunch, this time at the restaurant in Queen Elizabeth Park, Seasons in the Park. Here again there was much talk and reminiscing supplemented with excellent food and wine. All agreed that the reunion had been successful.

CHEMICAL ENGINEERING 1966 - "50 YEARS"

Peter Hemnes, CHML '66



CHML Class of '66 and Faculty

The 1966 Chemical Engineering class held its 50th anniversary reunion on September 21st to 23rd. The class' seventh reunion since graduating was based at the Granville Island Hotel; activities included a beer night for the grads, a dinner for the spouses, lunch on campus, dinner at the hotel and breakfast at the 'Off The Tracks Bistro' on the Island. Eighteen of the twenty one remaining grads and their spouses attended the reunion. The photo was taken during the lunch at the new Engineering Students Centre, a recommended venue for reunions, and includes Dr. Englezos, Chemical and Biological Engineering Department Head, and retired Chemical Engineering professors Dr. Epstein, Dr. Branion and Dr. Wilkinson (all of whom still have an office on campus). Sadly missing from the photo, as they are no longer with us, are Ron Nicholson, Morris Mennell and Marlene Gosling. Marlene, the only female among the nearly 1,000 engineering students in 1966, passed away in June, 2016.

CHEMICAL ENGINEERING CLASS OF '67



Class of '67

The fall of '16 was a busy time for alumni reunions in the Department of Chemical and Biological Engineering. Members from the CHML class of '67 gathered on Friday, September 23, in the Chemical and Biological Engineering Building to mark 49 years since their time here as undergraduates. They were welcomed back to the University of British Columbia Vancouver Campus by Department Professor and Head, Dr. Peter Englezos, on behalf of the Department as well as by the Alumni Relations Coordinator Tara Newell in the Office of the Dean on behalf of the Faculty of Applied Science. Alumni were interested to learn how many things have changed such as the growth and evolution of both the Department and the University of British Columbia over the years. The class was transported back 49 years and with emeritus faculty, Drs. Norman Epstein and Richard Branion, shared memorable moments from their time here as students.

2016/17 DISTINGUISHED SPEAKER SERIES



DR. BIAO HUANG – September 23, 2016
Professor, University of Alberta

Process Data Analytics – Data Based Image Process with Application in Oil Sands Separation Unit



DR. CHRISTOPHER YIP – October 21, 2016
Professor, University of Toronto

New Adventures in Imaging: Opportunities in the Microscopy Makerspace



DR. TOM MCLEISH – November 4, 2016
Professor, Durham University

Molecular Theory of Polymer Rheology from Chemistry to Processing



DR. BOB HAYES – November 23, 2016
Professor, University of Alberta

Multi-Scale Modelling of Structured Catalytic Reactors



DR. DAVID SEDLAK – January 13, 2017
Professor, University of California, Berkeley

The Next Urban Water Revolution



DR. SANJOY BANERJEE – February 3, 2017
Professor, City College of New York



DR. KLAUS LACKNER – March 3, 2017
Professor, Arizona State University

Direct Air Capture as a Tool for Carbon Management

The Distinguished Speaker Series invites Canadian and international researchers outstanding in their field to give presentations in the Department. More information about the series can be found on our website, chbe.ubc.ca/news-events/speaker-series/

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