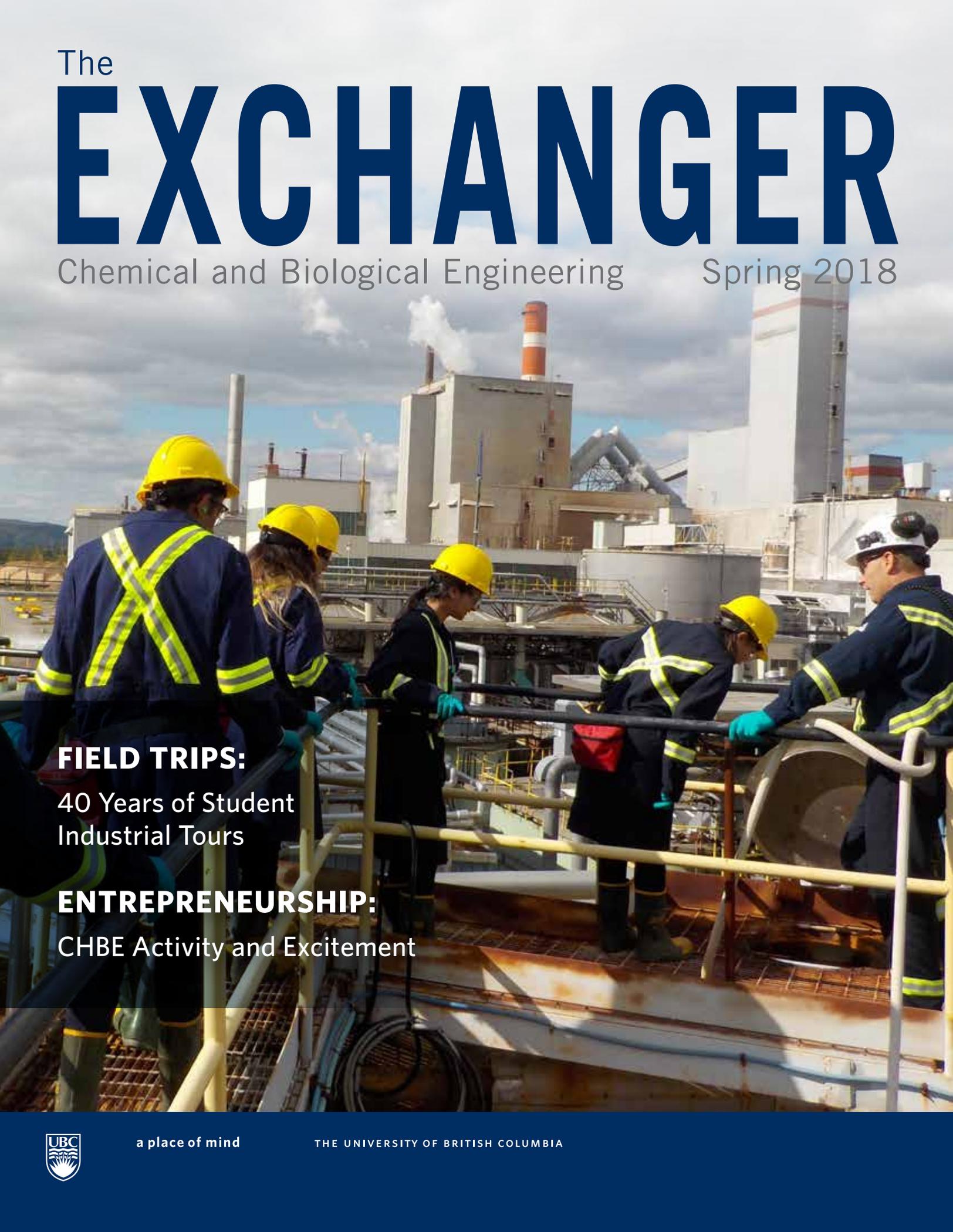


The

EXCHANGER

Chemical and Biological Engineering

Spring 2018



FIELD TRIPS:

40 Years of Student
Industrial Tours

ENTREPRENEURSHIP:

CHBE Activity and Excitement



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 highlights during 2017 from our thriving Department of Chemical and Biological Engineering (CHBE). We again include in the Exchanger the names of the students who graduated from the Department in the May and November 2017 convocations. We take this opportunity to one more time warmly congratulate the class of 2017.

Again, our faculty, staff and students enjoyed significant recognition last year. Notable awards are among others the induction of Dr. Jim Lim to the Canadian Academy of Engineering, the CAIMS Research Prize to Dr. James Feng from the Canadian Applied and Industrial Mathematics Society and the Emerging Leaders in Chemical Engineering award to Dr Vikram Yadav from the Canadian Society for Chemical Engineering. Marlene Chow, Director of Academic Programs was the recipient of the prestigious President's Staff Award for Emerging Leadership. Our students won a number of competitive awards this year including Katherine Lai and Lisa Lee who won the Western Engineering Competition in Banff and Lee Rippon who won the Killam Doctoral Scholarship.

The Department has a strong tradition of creating and nurturing strong collaborations within UBC and beyond. One such example China-Canada Joint Centre for BioEnergy Research and Innovation (CCJCBERI) was jointly initiated by Professor Xiaotao Bi (CHBE) and Professor Tianwei Tan, president of Beijing University of Chemical Technology (BUCT), to foster bioenergy technology development, maturation, demonstration and commercialization through collaboration to utilize abundant biomass resources and to meet the growing demand for renewable energy in Canada and China. Another pocket of research excellence in the Department is Electrochemistry and Electrochemical Engineering. This year's Exchanger features Professor Elod Gyenge's group.

During 2017 our Industry Advisory Council engaged intensively with the Department.

During the 2017 academic year we focused on a common theme for the three Council meetings. The overall theme was "University Research and Innovation, and Interaction with Industry". There is significant appetite for Industry University collaboration and one of the recommendations was to have a simple and more transparent Overhead model.

There is a growing interest in entrepreneurship among UBC students and as you will see in this Newsletter, the entrepreneurial spirit appears to be alive and well in CHBE and the Faculty of Applied Science.

The field trip is an integral part of our curriculum and as you will see in the Newsletter, the students enriched their program with visits to a variety of industrial settings in BC and Alberta.

In 2017, we welcomed CHBE alumnus Pranav Thirumalai, Student and Curriculum advisor and Tobias Donaldson, Engineering Technician to our staff.

Dr. James Olson (BASC Engineering Physics and PhD Chemical Engineering, UBC) is the new Dean of the Faculty of Applied Science. The Department of Chemical and Biological Engineering wishes to congratulate him on his appointment. Dr. Olson did his Doctoral research at UBC's Pulp and Paper Centre with Chemical Engineering Emeritus Professor Richard Kerekes.

We hope that you will enjoy reading the 2018 issue of The Exchanger. We always look forward to hearing from you and welcome visits of alumni and friends to the department.

Dr. Peter Englezos, P.Eng, FCAE
Professor and Head
Department of Chemical and
Biological Engineering

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On the cover

Third Year CHBE students on an industrial tour in Prince George. Students are on top of ChemTrade tanks with Canfor Pulp Mill in the background.

COLLABORATION WITH CHINA ON BIOENERGY RESEARCH AND INNOVATION

Dr. Xiaotao Bi



The China-Canada Joint Centre for BioEnergy Research and Innovation (CCJCBERI) was jointly initiated by Professor Xiaotao Bi and Professor Tianwei Tan, president of Beijing University of Chemical Technology (BUCT), to foster bioenergy technology development, maturation, demonstration and commercialization through collaboration to utilize abundant biomass resources and to meet the growing demand for renewable energy in Canada and China. In August 2015, CCJCBERI was officially established with an MOA signed at the 5th International Conference on Biorefinery at UBC. Xiaotao and Tianwei are the founding Directors, with UBC's Department of Chemical and Biological Engineering (CHBE) coordinating the Centre's administration and operation activities in Canada. The inaugural faculty members of the Centre included 20 professors from UBC's faculty of Applied Science, Science and Forestry including 11 CHBE faculty. The Management Committee in Canada is comprised of Xiaotao Bi, James Olson, Jack Saddler, Kevin Smith and Heather Trajano, three of whom are from CHBE.

Since its establishment, members of CCJCBERI have been actively exploring opportunities and increasing collaborative activities. In February 2016, Xiaotao Bi was invited by the Science, Technology and Innovation Division of Global Affairs Canada to attend the 6th meeting of the Canada-China Joint Committee (CCJC) on Science Technology and Innovation Cooperation held in Ottawa. He presented CCJCBERI in the Clean Technology session of the meeting, and witnessed the signing of a Canada-China Joint Declaration on Clean Technology Cooperation (between Natural Resources Canada, Innovation, Science and Economic Development Canada and the Chinese Ministry of Science and Technology) and a Statement for the Canada-China Joint Science and Technology Action Plan 2016-2018. Since then, Global Affairs Canada and the Chinese Ministry of Science and Technology have been developing a joint funding program to support research collaboration initiatives.

The Centre actively and strategically seeks collaborative funding opportunities in Canada, submitting proposals to NSERC

CREATE, NSERC Strategic Network and CFI Innovation programs. In February 2017, CCJCBERI successfully organized a "Collaboration Strategies Workshop on Bioenergy and Bioeconomy" at CHBE, jointly funded by the UBC VP Research office and an NSERC Connect Grant. Speakers from academia, government and industry (including IEA, NSERC, Global Affairs Canada, Asia Pacific Foundation of Canada, Chinese Ministry of Science and Technology) were invited to assist the Centre formulate research collaboration strategies. After the workshop, a nine-member Advisory Committee was formed with representatives from the UBC VP Research office, provincial government, local and national research institutes, and industries. The Advisory Committee is assisting the Centre to promote its activities and provides advice and guidance to its future development.

In October 2017, CCJCBERI was awarded \$4.5 Million from the Canada Foundation for Innovation (CFI) for a Biorefining Research and Innovation pilot facility. The award was announced by the Minister of

Justice and Attorney General of Canada, Jody Wilson-Raybould, on behalf of the Minister of Science, Kirsty Duncan, at UBC. The Biorefining award will enable nine UBC - CCCJBERI researchers (Bi, Ellis, Grace, Heather, Kirchen, Lim, Saddler, Smith, and Sokhansanj) to build a new 300 m³ high-head lab space to host pilot scale prototypes in the current Bioenergy Research Demonstration Facility (BRDF) on campus. The biomass to bioenergy projects include biomass steam and thermal pre-treatment, extractives separation and purification for biochemicals, biomass catalytic pyrolysis, catalytic tar removal for syngas cleanup, catalytic syngas reforming for high purity hydrogen production and catalytic conversion of syngas, pyrolysis oil to liquid biofuels, and combustion characteristics of syngas and pyrolysis oil. Design is underway and the building is expected to complete in mid-2019.

CJCBERI members (Bi, Smith, Ellis, and Wenli) have also been leading a renewable natural gas (RNG) initiative in the UBC FPIInnovations BC Pulp & Paper Bioproducts Alliance program that involves researchers and industry champions. The project will develop and demonstrate technologies for producing syngas and ultimately renewable natural gas using forest residues to meet increasing market need. Over next three years, the team will scan and evaluate current technologies and simultaneously, address technical challenges in syngas cleanup and methanation through development of novel and low-cost catalysts.

To facilitate and promote exchange of scholars, students and researchers, CCJCBERI has extended its membership from 40 to 70. The current partner institutions include universities, research institutes, not-for-profit and state-owned and private companies in both Canada and China. More than a dozen students and scholars have benefited from CCJCBERI support of visits in the scholarly exchange programs between Chinese and Canadian institutions. Some of them have developed or are developing joint research and demonstration projects in both China and Canada.

In November 2016, facilitated by Xiaotao Bi through the Centre, the UBC Faculty of Applied Science signed an MOU with the South University of Science and Technology of China (SUSTech) to establish a joint PhD supervision program. SUSTech provides full scholarships (\$25k CAD/year) for up to 20 PhD students per year under the joint



CCJCBERI was officially established with an MOA signed at the 5th International Conference on Biorefinery at UBC.

supervision of UBC and SUSTech professors for a UBC PhD degree. Six students in the first cohort in September 2018 including one supervised by CHBE faculty Professor James Feng. Similar joint supervision programs are under discussion between UBC and member institutions in China.

The Centre has been making its biomass and bioenergy research and innovation relevant to regional, national and global renewable energy and circular economy strategies. In September 2017, Xiaotao participated the Vancouver-Beijing Economics Development Forum, together with a delegation led by the Mayor of Vancouver, Gregor Robertson, organized by the Vancouver Economic Commission (VEC) and Beijing Municipal Government. The Centre also established a

strategic partnership with VEC to develop collaborations on municipal waste to clean energy research and deployment to assist Vancouver to achieve its carbon neutral greenest city goal. An MOU signed between CCJCBERI and VEC in Beijing was witnessed by Mayor Robertson and the Director of Asia Pacific Centre at VEC, Mrs. Joan Elangovan.

CCJCBERI has developed a close relationship with the Chinese government and funding agencies since its inception in 2015, and has received strong support and high recognition from the Vancouver Consulate-General of China and Chinese governments. When CCJCBERI was founded in August 2015, the then Consul General, Ms. Fei Liu, attended the MOA signing ceremony and delivered the keynote speech.

The biomass to bioenergy projects include biomass steam and thermal pre-treatment, extractives separation and purification for biochemicals, biomass catalytic pyrolysis, catalytic tar removal for syngas cleanup, catalytic syngas reforming for high purity hydrogen production and catalytic conversion of syngas, pyrolysis oil to liquid biofuels, and combustion characteristics of syngas and pyrolysis oil.



MOU signed between CCJCBERI and VEC in Beijing witnessed by Mayor Robertson and the Director of Asia Pacific Centre at VEC, Mrs. Joan Elangovan.

The Centre has hosted several visits of delegations from central and provincial governments of China. The members of the Centre have been invited by Chinese Embassy to attend important events such as Science, Technology Innovation and Entrepreneurship seminars and the first visit of the new Consul General, Ms. Xiaoling Tong, to UBC.

The Centre has used its annual general meeting (AGM) to review its progress and plan for the future, as well as engage international dialogues on bioenergy and bioeconomy. Building on its 1st AGM in Beijing and 2nd AGM in Vancouver, the 3rd AGM will be held at Beijing University of Chemical Technology on April 9th-10th, in collaboration with the annual general meeting of International Energy Agency (IEA) Task 39 - Commercializing Liquid Biofuels, to be held in China for the first time. With increasing interest on bioenergy in China to combat air pollution and to reduce greenhouse emissions, the Centre will join IEA colleagues to discuss biofuels development strategies and opportunities for the Centre to further strengthen collaborative efforts in developing a bilateral bioenergy and bioeconomy program.

In less than three years, the CCJCBERI has made significant strides in clean energy research, receiving awards of \$4.5M CFI

and \$1M RNG project funds, developing scholarly and student exchanges (including a joint PhD supervision program), and establishing strategic partnerships with international, national and regional



organizations. The establishment of the Centre is recognized by UBC as a major milestone in the UBC-China collaboration, and was nominated as one of the Successful International Collaboration cases by the Chinese Ministry of Foreign Affairs in 2015. The Centre will participate in the UBC's new strategic planning process as a member of the UBC China Council.

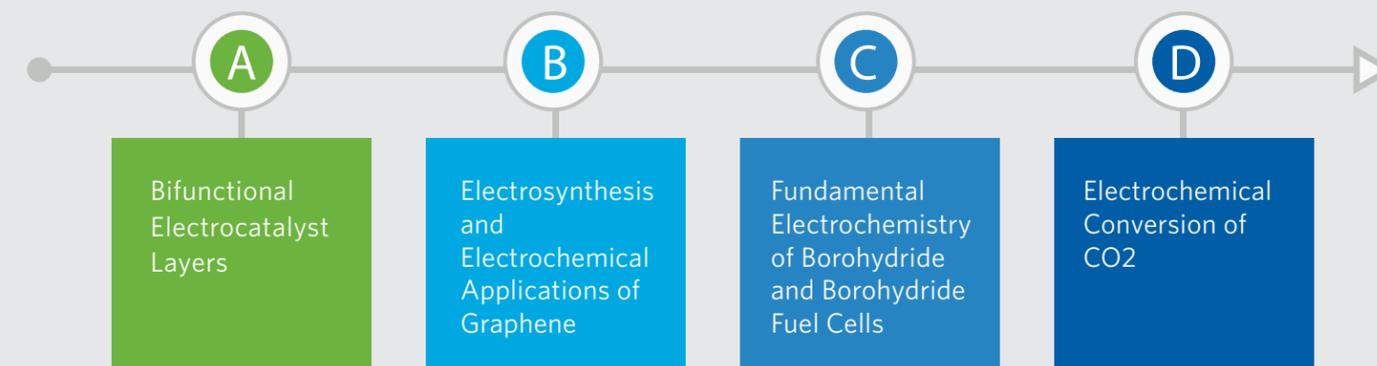
With the rise of China as a global economic superpower, an established higher education powerhouse, global infrastructure developer and clean technology investor, UBC will continue to focus its strategic plan on enhancing bilateral collaboration with the Chinese government on student recruitment and academic exchange while strengthening its research collaboration in clean technology and green energy systems. In the next three-years, the Centre aims to establish a National Centre of Excellence (NCE-CCJCBERI) on collaborative bioenergy research and innovation, with a focus on developing an integrated research team to identify strategic topical areas (e.g. drop-in biofuels, renewable natural gas, bio-hydrogen), establishing China-Canada Joint Bioenergy Laboratories in Canada and China (e.g. Biorefining Research and Innovation Centre at UBC and Waste-to-Energy Joint Lab in Beijing), engaging Canadian and Chinese bioenergy companies and investors to identify, foster and mature one or two technologies for demonstration and commercialization.

For additional information, visit: CCJCBERI. Center at <http://ccjcberry.center/#centre> or contact Ms. Siduo Zhang, Centre coordinator.

LABORATORY OF APPLIED ELECTROCATALYSIS AND ELECTROCHEMICAL ENGINEERING

Prof. Előd Gyenge

Dr. Gyenge's research addresses scientific and engineering challenges encountered in the development of electrochemical technologies for renewable energy generation and storage and chemical synthesis. These challenges are often related to the discovery of high-activity, durable and cost-effective electrocatalysts coupled with their integration in novel electrode and cell designs. The ongoing research interests in Gyenge's lab are grouped in four interacting themes:



Electrochemical processes are at the forefront of worldwide research for the development of technologies for renewable energy generation and storage (applications include diverse classes of batteries, fuel cells, supercapacitors, solar cells), pollution control of gaseous or liquid effluents and, implementation of sustainable inorganic and organic chemical synthesis. Many of these processes rely on complex electrocatalysis,

i.e., heterogeneous catalysis driven by the interfacial electric potential gradient. On a commercial scale, electrocatalytic processes lag behind their thermocatalytic counterparts in both production volume and technological diversity. Many electrochemical systems demonstrate tremendous potential benefits in terms of environmental sustainability but are hampered by sluggish electron transfer

kinetics and lack of active, durable and cost-effective electrocatalysts. Nonetheless, other electrochemical technologies such as the chlor-alkali electrolysis for the simultaneous production of sodium hydroxide and chlorine, became successful on an industrial scale due primarily to the introduction of efficient electrocatalysts such as dimensionally stable anodes (DSA) using mixed oxides (e.g., RuO₂-TiO₂).

A

Bifunctional Electrocatalyst Layers

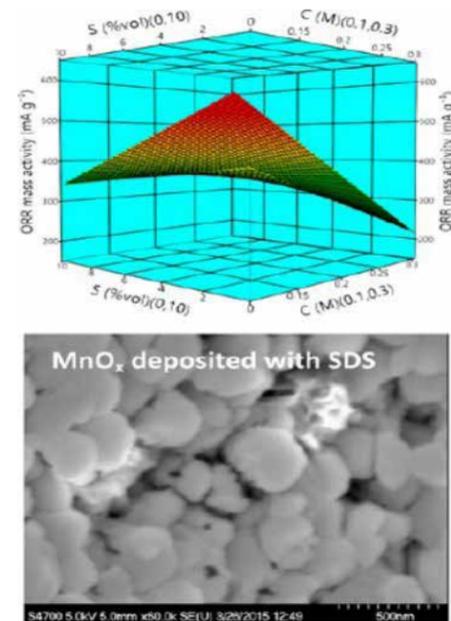
In many electrochemical systems, depending on the mode of operation, a catalyst layer on the electrode has to activate more than one reaction. These types of catalyst layers are referred to as bi- (or multi-) functional catalysts. One such example is the oxygen electrode in rechargeable metal-air batteries. Here, an oxygen evolution reaction (OER) takes place during the battery charging step, whereas oxygen reduction reaction (ORR) occurs during the discharging step (power generation). Rechargeable metal-air batteries such as Zn-air, Mg-air, Al-air, and Li-air have higher theoretical specific energies per active material weight, compared to the Li-ion battery. Their widespread implementation is hindered, however, by challenges in developing adequate cost-effective rechargeable negative and positive electrodes. Moreover, in addition to the intrinsic catalytic activity, the engineering design of bifunctional electrodes is more complex relative to the single reaction counterparts due to the reversed hydrophilic-hydrophobic balance required between the charging and discharging steps.

In Dr. Gyenge's lab there is intense research focused on the development of non-precious metal oxygen electrode bifunctional catalyst layers with the goal to reduce the overall battery cost to less than \$100/kWh. The lab introduced a class of potassium ion intercalated mixed oxides as catalysts, such as manganese oxides (MnOx) combined with perovskites (e.g., LaCoO3). These catalysts demonstrated excellent bifunctional activity for both ORR and OER in alkaline media for various applications (patent pending) (Fig. 2). During a collaboration with ZincNyx Energy Solutions Inc., it was demonstrated that the mixed oxide catalyst layers had superior activity compared to Pt while providing significant (up to 95%) cost reduction for the Zn-air metal battery. These catalyst layers have wide applicability including regenerative fuel cells, MnO2 based batteries and various electrolyzers. These results were obtained with Dr. Pooya

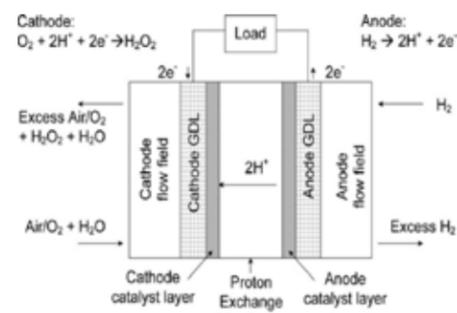
Hosseini (Ph.D., 2016), lab alumni and currently a co-founder of Catalyst Square Materials Ltd.

Dr. Gyenge has a long-standing collaboration in the area of fuel cell electrocatalysis with AFCC and Ballard Power. Current research is focused on improving the durability of fuel cell anodes during potential reversal events. The research targets one mode of fuel cell failure, namely, corrosion of carbon components of the electrodes. Such a scenario could occur under fuel starved conditions (e.g., fuel cell shutdown or start-up). To minimize carbon corrosion, Colin Moore, Ph.D. Candidate, is developing water oxidation (i.e., O2 evolution) catalysts that are compatible with the H2 anode. Another major goal of this research is to gain a clearer understanding of the relationship between the catalyst surface structure and composition with regard to activity and long-term durability as well as to reveal interaction effects between the H2 oxidation and H2O oxidation catalysts (i.e., bifunctional effect). These catalysts are essential for the next generation of reversal tolerant anodes in H2 fuel cells for either automotive or stationary applications.

In the field of O2 electrochemistry, Dr. Gyenge's research also focuses on the two-electron reduction mechanism of O2 to produce H2O2 (hydrogen peroxide). A recent collaboration with Drs. David Wilkinson and A. Bonakdarpour was made possible with funding from the RES'EAU-WaterNET Strategic Network, to investigate PEM electrolyzers for the co-generation of H2O2 and electric power (Fig. 3) (Winton Li, Ph.D., 2017). As part of this work, new cobalt-carbon and organic redox catalyst have been developed. The produced H2O2 concentration meets the requirements for subsequent drinking water purification by advanced oxidation treatments.



Statistical experimental design approach in electrocatalysis research. Optimizing the interaction effects among variables in surfactant assisted electrodeposition of MnOx nanostructures with high bifunctional ORR and OER activity [P. Hosseini-Benhangi]



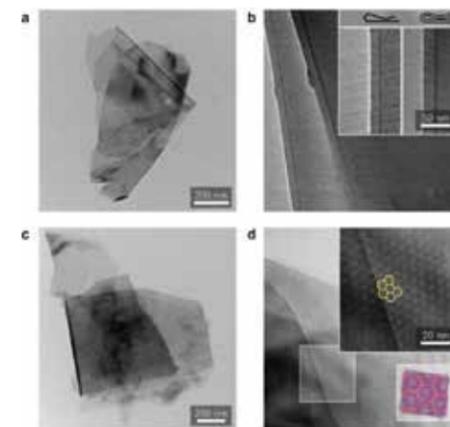
Co-generation of H2O2 for drinking water treatment and electric power in a PEM reactor (i.e., fuel cell - electrosynthesis hybrid). [W. Li, A. Bonakdarpour, E. Gyenge, D.P. Wilkinson, ChemSusChem, 6, 2137 (2013)]

B

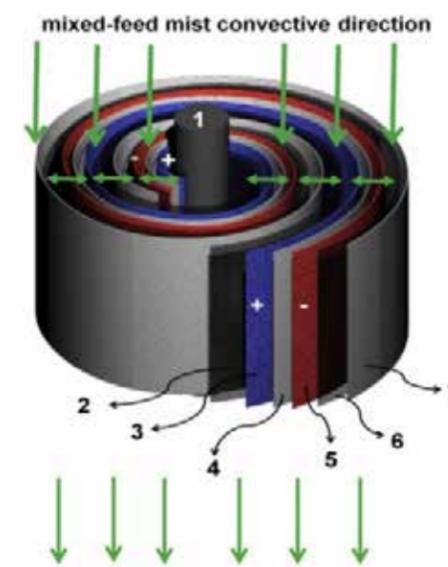
Electrosynthesis and Electrochemical Applications of Graphene

Graphene (composed ideally of one, but in many cases, of a few sp2 carbon layers) is a topic that was awarded a Nobel Prize in Physics (Andre Geim and Konstantin Novoselov, 2010). The field of graphene research has received tremendous attention during the past decade and touched virtually every area of science and engineering including clean energy, catalysis, biomedical applications and capacitors to name a few.

Dr. Gyenge's research in graphene electrosynthesis started in 2009, with a new study on the electrochemically assisted production of graphene microsheets and their application in electrochemical systems. Common graphene flake production techniques are based on aggressive chemical oxidation of graphite-to-graphite oxide followed by exfoliation to graphene oxide and subsequent chemical reduction to graphene (referred to as the modified Hummer method). This production technique can compromise not only the surface but also the electronic properties of graphene due to the presence of high density surface defects. Generally speaking, the harsh chemical treatments involved in this process contravene the image of graphene as the pristine 'new age' nanomaterial. To address these challenges, Dr. Gyenge and his graduate student Taheri-Najafabadi (Ph.D., 2016) introduced a novel graphite electrochemical exfoliation technique that involved the use of low concentration of selected ionic liquids that act as exfoliation agents (Fig. 4). In this technique, graphene microflakes are produced at both the anode and the cathode electrodes increasing the overall energy efficiency of the process. Graphene microflakes were tested as anodes in microbial fuel cells where they produced a 90% higher power density when compared to the conventional carbon black Vulcan XC 72 anodes previously described (Dr. Taheri-Najafabadi and Norvin Ng). The lab activities expanded in another segment of graphene applications previously unexplored in literature - graphene as microporous layer in H2 fuel cells. Together with Dr. D. Wilkinson



Graphene microsheets produced by simultaneous anodic and cathodic graphite electro-exfoliation assisted by ionic liquids. a, b) - anodic exfoliates, c, d) - cathodic exfoliates. [A. Taheri-Najafabadi, E. Gyenge, Carbon 84, 449 (2015)].



Schematic diagram of the Swiss-roll mixed reactant direct borohydride fuel cell. The ion exchange membrane is replaced with a low cost polymer separator. Cost-effective non-precious metal catalysts are utilized at both the anode and cathode [A. Aziznia,

C

and Jeanette Leeuwener (Ph.D., 2017), the group has comprehensively investigated novel graphene-based microporous layers for fuel cell applications. These investigations successfully demonstrated the excellent power density and durability, particularly under challenging fuel cell operating environments such as low humidity, of graphene microflakes.

Fundamental Electrochemistry of Borohydride and Borohydride Fuel Cells

Direct borohydride (NaBH4) fuel cells, are of great interest for researchers due to their high thermodynamic specific energy of 3.45 kWh/kg(NaBH4 + O2) (second highest after H2 fuel cells, 3.66 kWh/kg (H2 + O2), convenient fuel (NaBH4) which can be stored in solid state and cell operation with an alkaline fuel (NaBH4 - NaOH) solution. Dr. Gyenge's group is the only Canadian team investigating borohydride fuel cells encompassing advances regarding the borohydride oxidation kinetics, electro-catalysts and cell designs. His latest research focuses on investigations of the borohydride electro-oxidation kinetics in a molten alkali hydroxide mixture (Andrew Wang, Ph.D. student) and the development of the Swiss-roll mixed reactant fuel cell with Dr. Amin Aziznia (Ph.D., 2013, co-supervised with Prof. Emeritus Colin Oloman). This latter research was expanded in a collaboration with Drs. Plamen Atanassov and Alexey Serov from the University of New Mexico leading to patented selective electrocatalysts. In the novel Swiss-roll mixed reactant cell design, selective non-precious metal electrocatalysts are employed while the costly ion exchange membrane is replaced with a cost-effective polymer separator (Fig. 5). These advantages lower the overall fuel cell system cost which is an essential factor if wider adoption of this technology is to be realized.

D

Technologies and Catalysts for Electrochemical Conversion of CO₂

Dr. Gyenge has been involved in electrochemical conversion of CO₂ since 2014 by utilizing renewable sources for electricity, the electrochemical conversion of CO₂ to useful chemicals could be an attractive option to minimize industrial emissions. However, in the current energy and hydrocarbon-based economic landscape, the electrochemical variant of chemical production from CO₂ is not yet financially viable. Typically, the price of chemicals produced by CO₂ conversion (such as formic acid or methanol) are four to five times higher when produced via the electrochemical route compared to conventional chemical methods. Furthermore, industrial applications of CO₂ electro-reduction routes impose strict demands on the catalyst activity and durability; so much so that during 20,000 hours of continuous operation, the acceptable changes for cell voltage cannot exceed 100 mV. Breakthroughs in electrocatalysis are essential in order to obtain the desired chemical product selectivity (e.g., formic acid, syngas, methane, or methanol), low energy consumption and excellent performance durability. To address some of these challenges a recent collaboration had been initiated with the Dr. Liang Chen from the Institute of Material Technology and Engineering at the Chinese Academy of Sciences. This collaboration has the objective of developing novel MXenes incorporated Cu-based electrodes (Yan Dong, current Ph.D. candidate).

Advancements in the discovery process of novel electrocatalysts require a combined experimental and theoretical, first-principles based, approach. To gain insights into the molecular interactions between adsorbed species and catalytic surfaces, Dr. Gyenge has been collaborating with the Kasai-Dino laboratory for computational surface science and material design at Osaka University, Dept. of Applied Physics (Fig. 6). This collaboration involves application of density functional theory

(DFT) based computational methods to study the adsorption and electrochemical reaction of molecular species relevant to practical electrochemical systems. Via this approach, a thorough understanding of the BH₄- adsorption and oxidation mechanism on many metal and alloy surfaces has been already developed (Fig. 7) and new catalysts were introduced, e.g., Osmium (Os) which is about five times cheaper than Platinum. Recently, the challenging problem of oxide (e.g., MnO_x) electrocatalyst surface simulation has been also initiated. Since 2016, Dr. Gyenge has been specially appointed visiting professor at Osaka University where he gives lectures and research presentations and is actively involved in advising graduate students and researchers. Collaboration in catalysts discovery was also initiated with Dr. Carlos Sanchez, from Laboratoire Interfaces et Systèmes Electrochimique, CNRS and Université Pierre et Marie Curie, Paris, France. The focus here is on advancing electrocatalytic studies by using a new variant of scanning electrochemical microscopy (SECM) operated with a jetting micropipette. Dr. Sanchez graciously hosted Dr. Gyenge's Ph.D. Candidate, Andrew Wang, on a six-month internship funded by Mitacs Globalink. Moreover, Francis Mayer, an M.A.Sc. student in the lab, works with the tip-substrate generation/collection mode of the SECM instrument in collaboration with Dr. Ed Asselin (Dept. of Materials Engineering, UBC). The goal of the project is to expand the applicability of the SECM technique to gas diffusion electrodes relevant for CO₂ electrochemical conversion.



Collaboration with the Kasai-Dino laboratory for Computational Surface Science and Material Design, Osaka University, Japan. Top: with Prof. Hideaki Kasai (Osaka University and since 2015 President of the National Institute of Technology, Akashi, Japan).



Collaboration with the Kasai-Dino laboratory for Computational Surface Science and Material Design, Osaka University, Japan. Top: with Prof. Hideaki Kasai (Osaka University and since 2015 President of the National Institute of Technology, Akashi, Japan).

ENTREPRENEURSHIP IN CHBE

Launching a start-up is difficult and challenging. Significant personal and professional sacrifices typically need to be made, and for novice and veteran entrepreneurs alike, the road to creating and sustaining a thriving venture will be filled with obstacles and many failures. Third Year CHBE students on an industrial tour in Prince George. Students are on top of ChemTrade tanks with Canfor Pulp Mill in the background - that can change it in an instant.

Yet the rewards of entrepreneurship can make the journey worthwhile. Long hours, frequent rejection, the constant need to take risks and juggle numerous responsibilities and changing priorities ... the entrepreneur's life is certainly not for the weak hearted. Nonetheless, striving to overcome such challenges on a daily basis can be uniquely invigorating—as can the prospect of seeing your work improve people's well-being on a large, possibly even global, scale.

At APSC, the entrepreneurial spirit appears to be alive and well. On-campus resources such as entrepreneurship@UBC (e@UBC) are available to help early-stage innovators build viable businesses. And one need only attend an event like Design and Innovation Day—the annual showcase for student research projects—or peruse the winners lists from major start-up competitions to see that APSC students, alumni, and faculty members are hard at work on products and processes with great transformational potential.

Of course, this includes members of the CHBE community who have exemplified the passion, resourcefulness, and other marks of true entrepreneurship for decades. A notable recent example is Innovation OnBoard, a popular venture pitch competition conceived and organized by CHBE students in 2017. Also featuring an innovation fair and workshops led by experienced entrepreneurs and industry professionals, it attracted a wide range of exceptional submissions from UBC students. Innovative projects included coffee cups made from used coffee grounds and a

portable, low-cost electron microscope.

Given the presence of UBC, HATCH, and Creative Destruction Lab West at UBC, what need did Innovation OnBoard hope to fill? Vasilli Triandafilidi, one of the non-profit's founders, explained to The Ubysey that the average students does not have the experience to be a strong candidate when seeking admission to these programs. Innovation OnBoard was conceived to provide classmates, with entrepreneurial aspirations, the opportunity to develop skills and become more competitive for admission to these programs. The Chemical & Biological Engineering Department, the Faculty of Applied Science and e@UBC shared their vision and agreed to collaborate with Innovation OnBoard.

Innovation OnBoard's fundraising and outreach efforts ultimately secured over \$20,000 for events and prizes, expert mentors for the participants, and meetings with key government groups involved in industry development. Working entirely in their free time, the founders and executive were able to achieve exactly what they had set out to do: to "provide participants valuable hands-on experience, leadership training and organizational skills that are not covered in a traditional classroom setting."

en·tre·pre·neur

[,æntɹəˈpreːnər]

NOUN

entrepreneurs (plural noun)

1. a person who organizes and operates a business or businesses, taking on greater than normal financial risks in order to do so.

www.dictionary.com/browse/entrepreneurship?s=t



DR. SANTA ONO TOASTS ACUVA TECHNOLOGIES!

HATCH is UBC's on-campus incubator for UBC technology ventures that are at the stage of developing their products and launching their businesses. Acuva Technologies, a HATCH 2016/17 venture, develops portable water purification systems that employ novel low-power UV-LED.

Acuva's UV-LED water purification systems leverage the proven technologies of ultraviolet germicidal irradiation and LED lights to provide users with safe drinking water that is produced in an energy efficient and environmentally friendly manner. Dr. Fariborz Taghipour, CHBE faculty member, and Dr. Babak Adeli (PhD '16 CHBE) are members of the Acuva team. Dr. Santa Ono, UBC President, visited HATCH on January 4th, 2017 and met with members of the Acuva team.



Dr. Ono and the Acuva Technologies Team at Hatch. Photo Credit: Craig Wilson

INNOVATION ONBOARD

Said Zaid-Alkailani



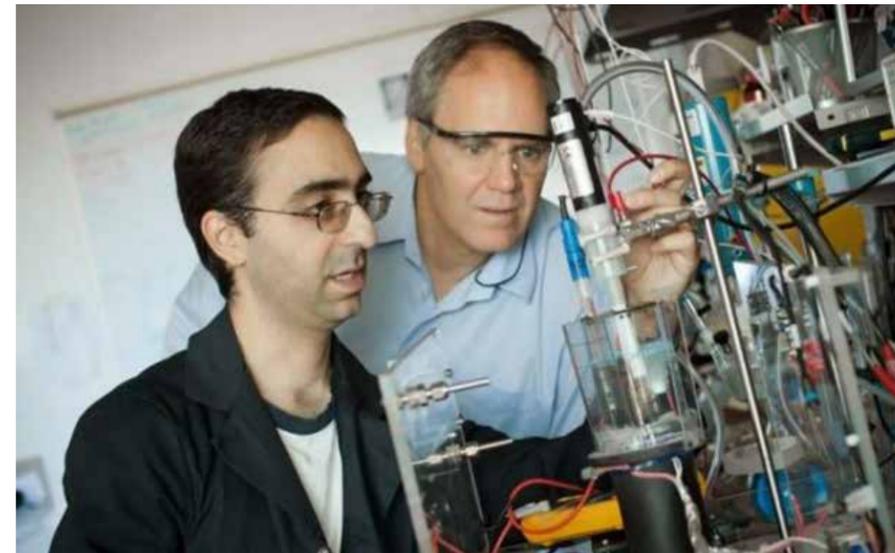
Ph.D. candidate Vasilii Triandafilidi presenting at an IOB event.

Innovation OnBoard (IOB) is a student run, 6-month startup program supported by the Department of Chemical and Biological Engineering (CHBE), the Faculty of Applied Science, and Entrepreneurship at UBC (eUBC). IOB was co-founded by Ph.D. candidate Vasilii Triandafilidi, 4th-year CHBE student Athanasios Kritharis, and 3rd-year CHBE student Said Zaid-Alkailani.

During the first half of the program, participants participate in a series of workshops and seminars that include Prototyping, Competitive Intelligence, and IP101. In the second half of the program, participants established teams and a mentor was assigned to each team. The teams then work on their idea over the winter break, and in January, take part in a two-stage competition. The first stage of the competition is the Innovation Fair, where teams will present ideas using a poster and the option of a prototype.

All guests and participants receive 'Innovation Dollars' to invest in ideas perceived to be most impactful and innovative. The five teams that receive the most investment dollars progress to the final stage of the competition in which participants complete a presentation workshop to develop skills for pitching their idea to a judging panel. This is Innovation OnBoard's first year and so far, it has been a monumental success. A total of 24 teams registered for the competition and exceeded the organizers' goal of 20 teams. Innovation OnBoard will continue inspiring entrepreneurship in UBC for years to come!

MANGROVE WATER TECHNOLOGIES WINS \$3 MILLION GRANT IN GLOBAL CARBON REDUCTION COMPETITION



Dr. Arman Bonakdarpour and Dr. David Wilkinson of Mangrove Water Technologies

Easy to operate, transport, and scale to industrial levels, the modularly designed technology offers an economical alternative to conventional desalination and CO2 removal processes. Indeed, it has the potential to significantly reduce global carbon emissions and help conserve water reserves around the world.

Mangrove Water Technologies, a new UBC spin-off company, will receive up to \$3 million to help commercialize a technology developed at UBC that simultaneously converts carbon dioxide and saline wastewater into value-added chemicals and reusable water. Its economic and environmental impacts could be considerable.

Formed by past and present members of professor David Wilkinson's research group in the UBC Department of Chemical and Biological Engineering, Mangrove is one of four winners of the second round of the Emissions Reduction Alberta (ERA) Grand Challenge:

Innovative Carbon Uses, a multi-year, three-round global competition. In 2014, Wilkinson's group was one of 24 first round winners, each of whom received a \$500,000 prize.

The four winning projects are eligible for up to \$10 million in additional funding through the final round of the competition.

Oil and gas operations produce, among other things, significant amounts of waste in the form of carbon dioxide and saline wastewater. Mangrove's technology — an electrochemical reactor equipped with ion-selective membranes

— desalinates the wastewater and converts the carbon dioxide into carbonate salts and acids for on-site use by the oil and gas industry.

When coupled with a waste gas-to-power system, Mangrove's technology could be capable of removing in excess of one megatonne of CO2 (equivalent to the annual carbon emissions from 210,000 cars) and conserving more than 11 million barrels of water (equivalent to 770 Olympic-sized swimming pools) each year in Alberta alone.

RECIPIENT:
DR. JAMES FENG

AWARD NAME:
CAIMS RESEARCH PRIZE

AWARD ASSOCIATION:
CANADIAN APPLIED AND INDUSTRIAL MATHEMATICS SOCIETY



The Canadian Applied and Industrial Mathematics Society (CAIMS) contributes to the development and maintenance of Applied and Industrial Mathematics in Canada and worldwide, an endeavor that deserves support.

The 2017 CAIMS Research Prize was presented to Professor James Feng from the Department of Mathematics and the Department of Chemical and Biological Engineering at UBC in recognition of his influential contributions to the study of complex fluids.

Prof James Feng is an international expert in multi-component complex fluids, with highly cited work on two-phase flows, moving contact lines, and dynamics of drops, jets, and bubbles. His mathematical research is characterized by challenging scientific computation and novel theoretical insights, and his scientific contributions span physical experiments. He provided a framework for formulating and computing multi-component complex fluid flows and their interfaces, which has since been adopted by other groups, and applied in industrial applications. He has recently made significant advances applying his complex fluid and foam expertise to modeling

biological cells and tissues, focused on the deformation, motility, and mechano-sensing of living cells, and the coupling between biochemical signaling and mechanics that shapes the dynamics of cells and tissues. Feng does great service to applied mathematics in demonstrating both the beauty and the practical applications of sophisticated research based on computation.

Photo credit: Martin Dee

RECIPIENT:
DR. JIM LIM

AWARD NAME:
FELLOW OF THE CANADIAN ACADEMY OF ENGINEERING

AWARD ASSOCIATION:
CANADIAN ACADEMY OF ENGINEERING



The Canadian Academy of Engineering (CAE) comprises many of the country's most accomplished engineers, who have expressed their dedication to the application of science and engineering principles in the interests of the country and its enterprises. Fellows of the Academy are nominated and elected by their peers, in view of their distinguished achievements and career-long service to the engineering profession

Professor Jim Lim was inducted as a Fellow of the Canadian Academy of Engineering (CAE). Dr. Lim has made major contributions to the practice, teaching and advancement of chemical engineering. He has shown unique skills in devising new thermochemical processes for industry and in designing and operating pilot scale units to improve and verify these processes. He has been a key figure in training a generation of chemical engineering students in sound design, process simulation and control, and practical skills needed for successful process operations. He has also been an essential team member in a unique group at UBC showing leadership in multiphase reactors.

<http://www.chbe.ubc.ca/2017/06/27/lim-inducted-as-cae-fellow/>

Photo credit: Martin Dee

RECIPIENT:
DR. VIKRAMADITYA G. YADAV

AWARD NAME:
EMERGING LEADERS IN CHEMICAL ENGINEERING

AWARD ASSOCIATION:
CANADIAN SOCIETY FOR CHEMICAL ENGINEERING



The Canadian Society of Chemical Engineering selected Dr. Yadav, CHBE Assistant Professor, as an Emerging Leader in Chemical Engineering. Vikram joined three others to present at the first plenary session of Emerging Leaders in Chemical Engineering at the 67th Canadian Chemical Engineering Conference in Edmonton. The prestigious session aimed to highlight the vision and leadership of four early career researchers. At the Plenary session, Vikram presented, "Medicine-by-Design: Discovery and Development of a Novel Therapy for Epidermolysis Bullosa Simplex".

Dr. Vikramaditya G. Yadav joined the CHBE in 2014 and he leads a group of researchers working on wide-ranging topics at the interface of biology, chemistry, engineering, medicine and economics. In a short span of 3 years, he has established a world-leading, industrially connected research laboratory that has attracted over \$1 million in research funds, and he is currently working with four biotechnology companies in Vancouver to commercialize his research. He also serves on several administrative committees at the University of British Columbia, is the Associate Director of ECOSCOPE, a Vancouver-based entrepreneurship hub for life scientists, and is the Vice-Chair of the Biotechnology Division of the Chemical Institute of Canada.

Photo credit: Martin Dee

RECIPIENT:
JIUJUN ZHANG, ADJUNCT CHBE

AWARD NAME:
FELLOW OF THE ROYAL SOCIETY OF CANADA

AWARD ASSOCIATION:
ROYAL SOCIETY OF CANADA



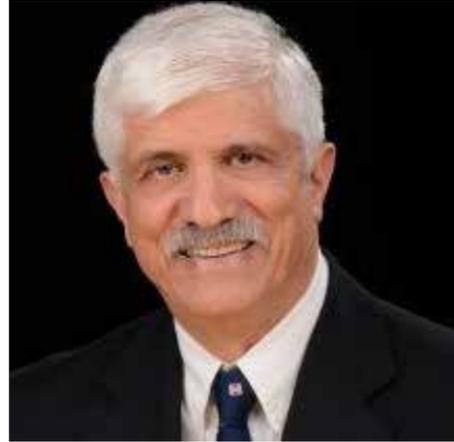
The Royal Society of Canada (RSC) is an institution that comprises the arts, humanities and sciences and one of its main purposes is to promote learning and research in the three academics. Dr. Zhang was elected Fellow of the RSC, Canada's highest peer-elected honor for artists, scholars and scientist. Zhang, described by the RSC as a pioneer of modern fuel cell technology, is a leading figure in the field of electrochemistry. After managing research and development at ATS Electrolube International, he assumed key leadership positions at Ballard Power Systems and the National Research Council of Canada (NRC), where he played an instrumental role in multiple fuel cell- and other electrochemical energy technology-related innovations and fundamental research advances, as well as major government-industry collaborations.

The RSC citation noted, "Jiujun Zhang is a world-renowned expert in electrochemical energy science and technology with over 450 publications and over 24,000 citations. He is one of the pioneers of modern fuel cell technology and has made significant contributions to the science of batteries, sensors, supercapacitors, CO2 electroreduction and other electrochemical devices. He has been listed as one of "The 3000 World Most Influential Scientific Minds" by Thomson Reuters since 2014."

RECIPIENT:
DR. SHAHAB SOKHANSANJ

AWARD NAME:
DISTINGUISHED ACHIEVEMENT AWARD

AWARD ASSOCIATION:
UNITED STATES DEPARTMENT OF ENERGY



Dr. Shahab Sokhansanj is a member of the Billion Ton team that received the Science Serving Society Award. The inscription on the "Distinguished Achievement Award" plaque states "The Award is presented to Shahab Sokhansanj for producing the outstanding scientific analysis in DOE's Billion Ton 2016 Volume 1 report that are being used to guide our country's development of strategies to achieve its goals for a robust bioeconomy." Shahab received the award in May, 2017 signed by Stan Wulschlager, Director, Environmental Sciences Division, Oak Ridge National Laboratory.

RECIPIENT:
MARLENE CHOW

AWARD NAME:
PRESIDENT'S STAFF AWARD FOR EMERGING LEADERSHIP

AWARD ASSOCIATION:
UBC



UBC presents the President's Service Awards for Excellence and other staff awards annually, to recognize staff members who demonstrate outstanding achievement and excellence within the UBC community. Marlene Chow, Director of Academic Programs, Administration and Facilities, in Chemical & Biological Engineering, is a leader and mentor to students in the CHBE programs, assisting them in making connections and taking part in activities to help them succeed at UBC and beyond. As industry connections are key to student outcomes in engineering, Marlene has increased student participation and student options for industrial field trips.

Students regard the Third Year Field Trips as one of the highlights of their program. Under Marlene's leadership and collaboration with technical staff and faculty, lab facilities have been improved and upgraded to improve student-learning experiences and support for student teams has increased

CELEBRATING PROMOTIONS



Dean Parlange watches as Bhushan Gopaluni delivers his presentation, "Towards Self-Driving Processes: Leveraging the Data Revolution". Photo credit: Wendy McHardy



(L-R) Sheldon Green, Peter Englezos, Boris Stoeber, Bhushan Gopaluni, Marek Pawlik, Marc Parlange, Scott Dunbar, Andre Ivanov. Photo credit: Wendy McHardy

Congratulations to **Dr. Bhushan Gopaluni** for his promotion to the rank of Full Professor. Dr. Gopaluni was promoted to full Professor in 2016 and he presented a lecture February 9, 2017 entitled "Towards Self-Driving Processes: Leveraging the Data Revolution". Dr. Gopaluni has received numerous awards including the Dean's Excellence in Service Award and the Killam Teaching Prize, both in 2016.



Dr. Berlinguette considers a comment from the audience after his lecture. Photo Credit: Wendy McHardy



Interim Dean James Olson with Curtis Berlinguette and Head, Peter Englezos. Photo Credit: Wendy McHardy

Congratulations to **Dr. Curtis Berlinguette** for his promotion to the rank of Full Professor. Berlinguette was promoted in 2017 to Professor and on November 29th, 2017, he presented a lecture, "Converting CO2 into Something Useful". Dr. Berlinguette received several awards including the Rutherford Memorial Medal in Chemistry, the E.W.R. Steacie Memorial Fellowships and the Strem Chemical Award for Pure or Applied Inorganic Chemistry.

NEW PEOPLE

TOBIAS DONALDSON | Engeneering technician

Tobias Donaldson is a recent graduate of BCIT's CNC Machinist Technician Diploma program and he is working towards becoming a Journeyman Machinist. Before training at BCIT, Tobias worked as a moldmaker in product development at a local manufacturer. He is also an art photographer and camera designer, earning a degree (BFA) at Emily Carr University in 2007. Tobias brings an enthusiastic attitude and high attention to detail in his work in the CHBE workshop. He enjoys working with students, professors and researchers in the Department and likes to learn about the scientific principles and objectives for each project.



Pranav, a recent UBC graduate (BASc, Chemical Engineering, '17), is working towards his Professional Engineering (P.Eng.) designation in the province of British Columbia. Pranav is starting his engineering career by joining the Department as its Student and Curriculum Support Advisor in August 2017. In addition to advising undergraduate chemical and biological engineering students, Pranav supports faculty activities related to the Department's accredited undergraduate engineering programs. Pranav is also eager to contribute to the undergraduate experiences in the Department.

Photo Credit: Michelle Peng



PRANAV THIRUMALAI
Student and Curriculum Support Advisor

APSC RISING STARS

The stars of UBC Applied Science are people passionate about their chosen field—architecture, landscape architecture, community and regional planning, engineering and nursing—and those that inspire others by making meaningful contributions to the betterment of society. Congratulations to following Chemical and Biological Engineering graduates to the 2017 APSC Rising Stars.

Photo credits: Clare Kiernan



CLINTON LARGE
(BASc '17, CHBE)

"The world is facing some of its most complex problems to date, with world hunger and sustainability as just a couple of examples. We need unique and creative solutions that are only going to come about by thinking in new ways."



DAVID GOERTSEN
(BASc '17, CHBE)

"Through engineering, I have been able to try a variety of different fields I was interested in and get my questions answered by professionals with firsthand knowledge."



ILEANA CO
(MASc '17, CHBE)

"Don't let failure stop you and don't let your grades define you."



MARC APDUHAN
(MASc '17, CHBE)

"Engineering focuses a lot on solving complex problems and simplifying them. What you'll soon find is sometimes there is no exact solution, only one that you can answer to the best of your abilities based on important facts and what you know."

DEPARTMENT SCHOLARSHIPS AND AWARDS

AWARD NAME: **KILLAM DOCTORAL SCHOLARSHIP**

RECIPIENT: **LEE RIPPON**

UBC Killam Doctoral Scholarships are provided annually from the Izaak Walton Killam Memorial Fund for Advanced Studies. It was Mrs. Killam's desire that those selected to receive scholarships: "Be likely to contribute to the advancement of learning or to win distinction in a profession. A Killam scholar should not be a one-sided person... Special distinction of intellect should be founded upon sound character." Killam Doctoral Scholarships are the most prestigious awards available to graduate students at UBC. Lee Rippon (BASc '14 CHBE, MASc '17 CHBE) is continuing his academic studies working on a PhD under the supervision of Dr. Bhushan Gopaluni. In addition to excellence in academics and research, Lee is an active Teaching Assistant.



SAAD DARA
(PhD '17, CHBE)

"A graduate degree in engineering allowed me this opportunity for refinement of my skills and developing depth in my knowledge in a safe learning environment where I was allowed the opportunity to drive a project."



SIANG LIM
(BASc '17, CHML)

"Experience as much of university life as you can while maintaining the grades you will need to pursue your goals."



ZHAOYANG YUAN
(PhD '17, CHBE)

"Trying to break your conventional thoughts and to think in different angles will give you some surprising and interesting results, which are often more than what you expected."

THOMAS EDWARD JAMES BENNETT AWARDS

The Thomas Edward James Bennett Awards were endowed in 2012 as a legacy of Thomas Edward James Bennet, an accomplished alumnus of the Chemical and Biological Engineering department who graduated in 2007. The awards honour his prodigious achievements in a life that ended too soon. His dedication and passion to "live life to the fullest and make a difference through sustainability" inspired many.

The 2017 recipients, Onyinye Ofulue and Marc Apduhan, were selected for their active interest in student enrichment activities, social and environmental concern, academic achievements and leadership qualities. Onyinye is president of the Engineers for a Sustainable World, a student team that converts used vegetable oil from UBC Food Services into biodiesel and soap. Marc is the Engineers Without Borders student team president, is an active undergraduate council member and is developing a food app to reduce food waste.

Mary Kenny celebrated at the 2017 Thomas Bennett Award recipients with Onyinye and Marc, previous award recipients, Lee Rippon and Ryan Rickaby.



(L-R) Mary Kenny, Vivian, Marlene Chow, Onyinye Ofulue, Ryan Rickaby, Marc Apduhan with mom, Mildred and Renault, Jonathan Doan (back), Lee Rippon, Naoko Ellis, C. Jim Lim. Photo credit: Joseph English



(L-R) Ryan Rickaby, Onyinye Ofulue, Mary Kenny, Marc Apduhan, Lee Rippon at 2017 Thomas Bennett Award Ceremony. Photo credit: Joseph English

CHAD BENNINGTON MEMORIAL SCHOLARSHIP

The Chad Bennington Memorial Scholarship is named in memory of Professor Chad Bennington, a faculty member in the Department of Chemical and Biological Engineering and Paprican Industrial Research chair in Chemical Pulping Technology. Scholarships are awarded to students who demonstrate interest, leadership and academic accomplishment in pulp and paper related technologies. The 2017 recipients of the Chad Bennington Scholarship are Ofulue Onyinyechukwu Oluwapelumi, Sun Yi and Samuel Jamie Jackson.

GRACE MENTORSHIP AWARD IN CHEMICAL AND BIOLOGICAL ENGINEERING

The Grace Mentorship Award in Chemical and Biological Engineering was endowed by Dr. John Grace, the Department of Chemical and Biological Engineering and the Faculty of Applied Science. The award is offered to a graduate student or post-doctoral fellow, who has been highly effective in mentoring undergraduate students in the Department of Chemical and Biological Engineering. This year's recipient is Arman Seyed-Ahmadi.

JOHN R. GRACE GRADUATE SCHOLARSHIP IN CHEMICAL AND BIOLOGICAL ENGINEERING

The John R. GRACE Graduate Scholarship in Chemical and Biological Engineering was endowed in honour of Dr. John R. Grace by his wife, Dr. Sherrill E. Grace, 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. The recipient, Chun Haow Kung, is an MASc and his thesis project is "Electrochemical Evaluation and In-Situ Modulation of Surface Wettability".

CLASS OF '67 SCHOLARSHIP

The Class of '67 Scholarship is offered by the Chemical Engineering Class of 1967 to a Department undergraduate student for demonstrated leadership through academics, active involvement in student government, professional societies and community activities. The recipient of the award is Said Zaid-Alkailani who is a class co-representative and was co-organizer of the 3rd Year Field Trip. Said is also involved with a Teaching Learning project, is the Marketing Lead with Innovation OnBoard and was a member of the ChemECar team.



Class of '67 at their 2016 Reunion at UBC

3RD YEAR FIELD TRIPS - 2017

Dana Mraz, Said Zaid-Alkailani



Students on top of salt dissolving tanks at the Canexus plant. Photo credit: Canexus

2017 marked the 40th annual Third Year Field Trip! The field trip was a student initiative, conceived to provide students with industry contacts and exposure to operating facilities. The inaugural field trip in 1977 involved 18 students who drove three rental cars to Fort McMurray and Edmonton. The students were hosted by Syncrude, Imperial Oil, Celanese, Sherritt Gordon Mines and Dow Chemical.

After 40 years, every 3rd year Chemical and Biological Engineering Department student still eagerly awaits the annual field trip. The students continue to gain invaluable industry exposure

during visits to operating facilities in British Columbia and Alberta. What has changed is the size of the student cohort, as 2017 marked the largest 3rd year cohort yet with 113 students participating. The field trips brought students new highlights, memories and challenges associated with two road trips and one local trip.

On September 17th, students ventured from campus on what was to be an unforgettable trip for every student. One bus travelled North East to Rimbey, Edmonton and then continued to Prince George. The second bus ventured east to Castlegar, Trail, Kelowna and

Kamloops. A third group of students visited local industries in the Lower Mainland including Howe Sound, Langley, Richmond and Vancouver. They travelled on charter buses, driving over 6,000 km to visit 22 plants and facilities.

1977 - 18 students drove 3 rented cars and visited 6 plants

2017 - 113 students traveled in 3 charter buses and visited 22 facilities

On field trips, students gain invaluable industry exposure, see applications of technical material learned in academic courses and meet industry professionals.

North Field Trip

On the northern trip bus, while enroute to Calgary, students were able to take advantage of a bus breakdown in Banff to check out the snowy mountain resort. The first tour was at Keyera Rimbey, a mid-stage natural gas processing plant. For many, the exploration of Rimbey was their first real-world engineering experience and the Rimbey gas separation, compression, sour gas processing, NGL extraction, NGL fractionation as well as Sulphur recovery was an eye opening experience. Topping off the tour was lunch prepared by a Rimbey staff member and the opportunity to hear about careers with Keyera and in the natural gas industry.

The students continued to Edmonton and visited Enerkem, the world's first commercial-scale waste-to-biofuels facility of its kind, designed to turn household garbage into biofuels and renewable chemicals. Students viewed the integration of the City of Edmonton's waste sorting, (surprising to students, Edmonton residents do not sort their garbage), with the Enerkem process.

Tuesday started with a tour of Ft. Saskatchewan's Sherritt International metal refinery, a facility that the 1977 cohort visited! The Sherritt refinery treats imported feeds to produce high-purity nickel and cobalt products for export sales. In addition to seeing unique processing facilities, students learned about plant upgrading and maintenance projects and toured the Sherritt research pilot facilities. Next on the itinerary was a visit to the Shell Scotford refinery, a facility larger in area than downtown Vancouver! In addition to learning about upgrading and refining heavy oil,

students heard about Quest, a carbon capture project. Shell capped the visit with introductions to younger engineering staff so that CHBE students could learn more about careers with Shell.

The North tour continued on to Prince George. Ellen Roberts and Darcy Culling of Canfor coordinated an eventful day that included tours of the City of Prince George, Peroxychem, Chemtrade, Husky Refinery, and a Canfor pulp mill. The day started with breakfast and presentations from each company before students were divided into tour groups. During the city tour, students were shown the various amenities, services and affordable housing available in the City of Prince George. Canfor showed students the complete pulp mill production process from receiving chips, cooking and bleaching process, paper machine, control room to packaging and shipping of pulp bales. Chemtrade and Peroxychem produce most of the chemicals for the Canfor operations and the Prince George area. The tours provided students with invaluable insight on how the chemical plants operate and their integration with the pulp mill. Lastly, the Husky tour gave students an appreciation of how a smaller scale oil refinery functions like a larger facility. The Prince George hosts ended the amazing day with a networking dinner at the University of Northern British Columbia. Engineers, managers and staff from Canfor, Chemtrade, Peroxychem, Husky and the City of Prince George attended and students found out more about the career opportunities and lifestyle in Prince George.



Networking dinner at the University of Northern British Columbia hosted by Canfor, Husky Oil, Chemtrade, Peroxychem and the City of Prince George. Photo credit: Ray Bi



Students learn about the Kraft mill process from an expert. Photo credit: Ray Bi

Students enjoying the finer points of wine making



Mr.PG and CHBE 3rd Year students send greetings from Prince George! Photo Credit: Ray Bi



Fully outfitted in personal protective equipment, students are ready for a chemical plant tour.

South Field Trip

After an early morning start, the Southern bus began its tours in the beautiful town of Osoyoos in the Okanagan valley with a tour of Nk'Mip Winery, the first Aboriginal-owned and operated winery in North America. At the winery, students were introduced to the process of wine-making and treated to a wine tasting at the end of the tour. The bus continued to Castlegar where students visited the Zelstoff Celgar Pulp and Paper Mill. The students' very busy day at Celgar began with breakfast and morning presentations on the operations of the mill. The presentations on process flow and equipment specifications, environmental regulations and feed sourcing were extremely detailed and informative. During lunch, students were able to ask questions and learn more about working in the plant. The afternoon included a full tour of the facilities where the students could see all the concepts and processes that had been presented and discussed in the morning.

The next day, students had a full day in the Teck facility in Trail where they were very impressed with the scale of the facility, which includes 18 different plants on site. After a process introduction, students were provided safety gear and toured multiple plant areas including zinc electroplating, leaching and the smelter. The emphasis on safety was not lost on students. They came prepared with steel-toed boots and in some plant areas, wearing respirators was required. They were treated to lunch with plant engineers and operators and had the opportunity to learn more about working in Trail. What is amazing about Trail is the integration between plants so that waste materials from one facility become feed for another.

After the Teck Trail tour, the group travelled north to Kelowna where students visited the wastewater treatment facility and later, the fresh water treatment facility in Kamloops. From these tours, students realized just how intricate water treatment processes are and how crucial these services are to our everyday lives! On the final tour day, students visited the Highland Valley Copper Mine and toured the mill, which processes recovered ore from the mine. A network of crushers and grinders is used to reduce the feed size before the metals are recovered through density separation. The last stop of the trip was at Sun Rype in Kelowna where the entire facility smelled of apples! Students were shown how fruit juice and health snacks are made, the process of developing concentrate and how the food industry is evolving. A very interesting, and tasteful tour!

Students on the local field trip option travelled the Lower Mainland to visit industries. On the first day of tours, students toured the Bioenergy Research Demonstration Facility (BRDF) on the UBC campus or the Lulu Island Wastewater Plant. BRDF was the first North American system to process renewable biomass, ground and chipped wood waste, to generate thermal energy for heating campus buildings. BRDF reduces UBC's reliance on fossil fuels, provides 25% of campus heating needs, and eliminates 14% of campus greenhouse gas emissions. Lulu Island provides secondary treatment to wastewater from the western part of Richmond before discharge into the Fraser River. The treatment plant also uses anaerobic digestion to break down organic materials from wastewater to produce biosolids and methane gas, used to generate all the required heat for the plant's operations. Students agreed that both BRDF and Lulu Island are very important types of plants in the communities they service.

The afternoon tour visited Chemtrade Electrochem in North Vancouver, which produces industrial caustic soda, chlorine and hydrochloric acid - very interesting what can be produced from piles of salt! The chemicals are used in the pulp and paper and water treatment industries.

Tuesday was a day trip to Howe Sound Pulp and Paper, which started with a ferry ride from Horseshoe Bay to Langdale, a first for all the students. Students viewed several aspects of the Howe Sound Mill plant from receiving chips, to pulping operation to the pulp machine and packaging. Students also saw the environmental processes including the water treatment ponds. During lunch, they spoke to mill staff about the mill operations and found out about engineering and environmental work.

During the third day of tours, students visited IPEX Pipe or Alliance Freeze Dry in the morning. At IPEX Pipe, students were able to see the design and manufacture of thermoplastic piping systems. The piping systems are used to convey water, chemicals and gases for municipal, industrial, commercial and residential applications. IPEX also manufactures conduits for power and data cabling. Alliance Freeze Dry creates pet food using a freeze dry process. Students found this very interesting as they usually learn about heating operations.

The final tour was a visit to Central City Brewery, the largest craft brewery in British Columbia. Students walked through the entire beer making process from seeing the grain milling to grist, mash and wort process, fermenting and maturing process and then canning the beer. The tour ended in the Central City Tasting room where students were able to compare the impact of different raw materials, a very satisfying way to end a week of tours!



Students selected one of three field trip options; the North Route bus travelled to Rimbey, Edmonton and Prince George. The South Route bus travelled to Osoyoos, Castlegar, Kelowna and Kamloops. The local bus traveled to Howe Sound and Lower Mainland Communities.

Students were shown how fruit juice and health snacks are made, the process of developing concentrate and how the food industry is evolving.

Summary

The 2017 Third Year Field Trips were a resounding success! Students learned about numerous processes, the importance of safety and the need to develop teamwork, communication and other skills. Students returned from the field trips energized, having learned about industry and having developed an appreciation for their chosen engineering programs. The students also enjoyed the camaraderie, which developed between students on those long bus rides and over meals. The field trips heightened students' motivation in their academic studies and provided an unforgettable bonding experience.

We are grateful to the participating industry partners who opened their doors, welcomed us and provided staff and resources so that students were able to see their facilities, gain understanding of their operations and meet operators and engineers. We gratefully acknowledge the financial support of the Prince George consortium of companies, Canfor, Peroxychem, Chemtrade, Husky Refinery and the City of Prince George, and specifically Martin Pudlas, Ellen Robertson and Darcy Culling from Canfor for coordinating the day in Prince George. We also thank the Shell Canada Ambassador Program (CAP) for its financial support of the field trips. CAP takes the classroom outside campus borders, giving students first-hand experiences and a greater understanding of engineering in the field.

Spring Field Trips

Students are eager to gain as much industry exposure as possible so Third Year students participate in a local industry tour in the spring term. This is also an opportunity for students who were away in the fall to gain industry exposure. Local tour providers were:

- Canexus Corporation
- Chevron Refinery Burnaby
- Annacis Island Wastewater Treatment Plant
- Covanta Waste to Energy Plant, Burnaby
- False Creek Neighborhood Energy Utility

The Spring Field trips provide students industry exposure of a facility in the Lower Mainland. Students visiting the Canexus Chemical plant and the Chevron Refinery learned about industrial safety and about operating facilities within a major city. Students visiting Annacis Island, Covanta or False Creek learned about municipal waste and energy operations.

The students thank the spring Lower Mainland tour hosts for providing the opportunity to visit their facilities and to learn about their operations in urban areas.



Annacis Island operator describes process to 3rd year Chemical and Biological Engineering students



3rd year students check out water treatment operations at Canexus. Photo Credit : Canexus



3rd year students check out water treatment operations at Canexus. Photo Credit : Canexus



3rd Year Field Trip Students in the Canfor yard. Photo credit: Canfor



CHBE 3rd Year students and the Rimbe hosts in front of the gas processing plant. Photo Credit: Ray Bi

Coordinated International Exchange

Jackson Herron, 3rd Year

"Studying abroad at the Technical University of Denmark (DTU) was one of the coolest experiences I have been able to undertake in my undergrad. The facilities and professors at DTU are fantastic, and it was a great way to supplement my education with courses if interest to me. Danes are also fun-loving and balanced people, and I learned a lot from living in their culture. Some of the things I am taking away are their love of "hygge", in-depth knowledge of delicious pastries/rye bread, and their relaxed yet industrious way of life. Of course, studying in Europe also provides the excellent opportunity to travel. It was my first time on the continent, and I made the most of my experience by visiting countries such as Norway, Germany, France, and Hungary!"



Jackson Herron in Denmark, DTU.



Dr. Sue Baldwin listens to a Capstone presentation on Design Day. Photo Credit: Martin Dee

Design Day

Capstone design projects are completed by 4th year students and represent the culmination of their undergraduate program. Capstone projects are a plant design and each project includes process flow diagrams, process and instrument diagrams, plant layout, equipment design, hazard and operability studies (HAZOP's), and an economic review. Students presented posters of their plant design on Design Day and industry representatives, many of whom are CHBE alumni, judged the posters.



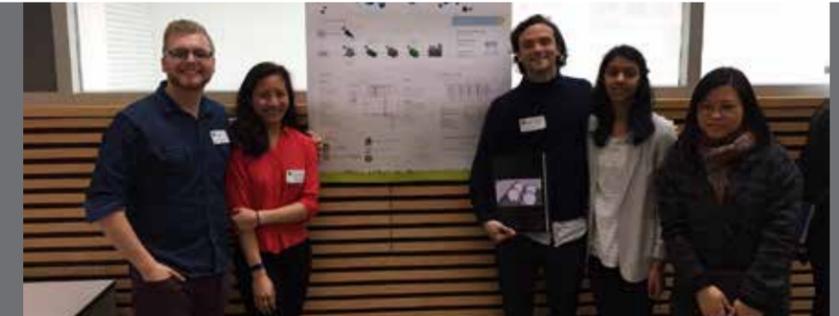
Team members Alex Young and Peng Chan watch as Katherine Lai describes her groups Lithium-ion battery recycling process to Ray Randall (BAsc '79, CHML). Photo Credit: Kai Jacobson

DESIGN DAY WINNERS

B5 - Energy Recovery from Cruise Ship Waste.

(L-R) Clinton Large, Gabrielle Jayme, Enrico Trevisi, Deepali Prasad, Prangthip Suppaiboonsuk. Missing: Dominic Bartlomowicz.

AP Watkinson Design Award (Biological)



Group P9 - Sulphuric Acid and Oleum Production Plant Design.

(L-R): Ajai Hundal, Joban Laura, Alex Murdock, Siang Lim, Mandeep Sidhu and Michael Olson.

The Gas Hydrate Award, The Colin Oroman People's Choice Poster Award Design and Innovation Poster Award.



Group B1- Industrial -Scale, Biocompatible Polyhydroxybutyrate (PHB) Production using Apoptosis-Regulated Recombinant Escherichia Coli.

(L-R): Marc Apduhan, Nathan Chan, Brandon Chin, Ileana Co, David Goertsen and Jeffrey Boschman

Design and Innovation Poster Award Design and Innovation Project Award.



Group P11 - Design and Innovation award for Integrated Production of Propylene Glycol and Dimethyl Carbonate.

(L-R): Ryan Chen, Vanessa Van Aert, Przemek Piwek, Alex Torres, Hassan Assaad, Austin Evans.

Design and Innovation Poster Award Design and Innovation Project Award



Group P6 Renewable Natural Gas and Hydrogen Production from Landfill Design & Innovation Award (Process)

Tampriye ASAWO
Billy BAGHAGIONO
Endla HOILES

Nadia TEJOSANTOSO
Andrew MAY
Eric LOONG

CLASS OF 2017

Welcome, Class of 2017, to your new and celebrated place among more than 3,300 CHBE alumni around the world. We are honoured to have given you a place to discover, to inspire others and to be challenged beyond what you thought was possible. We hope you remember that we will always be that place for you.



The Degree of Bachelor of Applied Science in Chemical Engineering

- Sina Adabi
- Kelvin Mok
- Tampriye Awoala Asawo
- Rachael Ashley Mutsaerts
- Hassan Ghassan Assaad
- Gloria Akite Noki
- Billy Samuel Bahagiono
- Steven Thomas Nowicki
- Melissa Sophie Beaulac
- Uchenna Chukwuka Obuekwe
- Richard Zeng Cao
- Michael Norman Olson
- Jaspreet Kaur Chahal
- Mital Patel
- Alicia Bo-li Chan
- Przemyslaw Piwek
- Dexter Elliot Chan
- Thanisorn Prasertsangcharoen
- Rupekanwal Singh Chandi
- Nida Riaz
- Chiu-Peng Chang
- Brendan Michael Rose
- Pak Lun Chau
- Herdiapal Sandhu
- Tong Chu
- Teboho Sefuthi
- Faye Virmaseli Torregosa Cuadra
- Mandeep Singh Sidhu
- Matthaues Maxwell Medan Anak Engkabang
- Manjot Pal Singh
- Ryan Hassler
- Kamonchanok Sirikan
- Ally Amin Hirji
- James Stewart
- Endla Helve Lauren Hoiles
- Devita Nadia Tejosantoso

- Emily Tsz Wang Hon
- Pranav Thirumalai
- Aaron Lee Horanski
- Xinyi Tian
- Ajai Singh Hundal
- Zhen Tian
- Katherine Heather Lai
- Alex Russell Torres
- Joban Singh Laura
- Vanessa Ann Van Aert
- Manlin Li
- Yi Wei Wang
- Xi Li
- Patrick Marcel Elliott Warren
- Chong Siang Lim
- Yohan Homan Wiputra
- Stephanie Alida MacKinnon
- Christopher Ryan Wong
- Mersad Masic
- Allison Wu
- Mani Massah
- Dijia Wu
- Andrew Scott May

- Christine Seungmin Yi
- Nur Sahira Mohd Sharul
- Alex Han Young
- Qushen Zhang

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

- Tianyu An
- Arthur Fung Yin Leung
- Marc Kelvin Apduhan
- Spencer Kerr Loughlin
- Dominic Bartlomowicz
- Matthew Connor McFee
- Dallyce Kevin Bilodeau
- Sharlene Taylor Phipps
- Jeffrey Thomas Boschman
- Whitney Elizabeth Roe
- Nathan Robert Chan
- James Nikolas Sather Brown
- Brandon Alexander Chin

- Christina Saxvik
- Ileana Louise Yu Co
- Xuan Wen Wang
- David Gerald Goertsen
- Jonathan Christopher Wells
- Christine Lisa Hughes
- Jean-Philippe Faucher
- Da-in Kim
- Enrico Trevisi
- Clinton Thomas Large

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

- Shiva Madadkhani
- Sean McBeath
- Nicholas Joseph McIntosh
- Aigerim Ongalbayeva
- Lee Dale Rippon
- Lucie Solnickova
- Lingfeng Zhao
- LingXiu Zhu



The Degree of Master of Engineering in Chemical and Biological Engineering

- Yilin Fan
- Kareena Gill
- Siyu Xin

The Degree of Doctor of Philosophy in Chemical and Biological Engineering

- Babak Adeli Koudehi
- Pooya Hosseini Benhangi
- Ali Hussain Alzaid
- Dening Jia
- Melissa Barazandegan
- Vinod Kumar Konaganti
- Maziar Derakhshandeh
- Hamid Rezaei
- Pooneh Ghasvareh
- Reza Rezaei
- Bijan Hejazi



Chemical and Biological Engineering students at the Chan Centre Convocation Ceremony. (L-R) Vanessa Ann Van Aert, Mike Tian, Pranav Thirumalai, Arthur Leung. Photo credit: Clare Kiernan



Chemical and Biological Department students at the Chan Center before their convocation ceremony. Photo credit APSC. Photo credit: Bridget Irwin



Brandon Chin and Ileana Co during the convocation ceremony. Photo credit: Clare Kiernan

IRON RING

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 that 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. The Iron Ring ceremony was held March 22, 2017, at the Queen Elizabeth Theatre in downtown Vancouver.



CHBE students at QE theatre after receiving their iron rings. Photo Credit: Mike Tian



The undergraduate class of 2017 at the annual Ritual of the Calling of the Engineer. Photo Credit: Mike Tian

TEACHING AWARDS

Students nominate faculty to receive Teaching Awards, acknowledging their excellence in teaching and assisting students achieve their potential in their undergraduate programs.



2nd Year Teaching Excellence Award:
Dr. Jonathan Verrett



3rd Year Teaching Excellence Award:
Dr. Heather Trajano



4th Year Teaching Excellence Awards:
Dr. Dusko Posarac and Dr. Gabriel Potvin



Graduates, Family and Friends at the CHBE Graduation Reception. Photo credit: Anjali Bhatt



Group P6. Winners of the Design & Innovation Award (Process). (L-R): Tampriye Asawo, Billy Baghahiono, Endla Hoiles, Nadia Tejosantoso, Andrew May, Eric Loong.

RESEARCH DAY 2017 – NANO IS THE NEW BIG

Roza Vaez Ghaemi

Research Day, is an annual graduate student-driven research initiative hosted by CHBE. The event aims to strengthen relations with industry at the graduate level, facilitate collaborations and connect the academic and industrial communities. The theme of the 2017 event was “Nano is the new big”. This 2-day event highlighted the quality of research work conducted by engineering students in the form of a three-minute-thesis competition and poster session. It also featured two keynote presentations, a mock interview workshop, student design competition and plenty of networking opportunities!

The event started with a very interesting and unique “speed networking” workshop, designed and delivered by the Graduate Students Club (GSC). In this workshop, a panel of industry, academia and alumni representatives provided a “speed network” event with graduate students. Panelists included:

- CHBE faculty: Heather Trajano and Gabriel Potvin
- Paul Kenis, Department Head, Chemical and Biomolecular Engineering, University of Illinois at Urbana-Champaign
- Melissa Barazandegan, Associate Research Statistician, Precision Health Economics, (PhD '17 CHBE)
- David Miller, Lecturer, UBC Sauder School of Business, (Senior Executive, Board Member & Educator: Sales, Marketing, Entrepreneurship and Communications), Tony Yang, Program Manager, Centre for Heart Lung Innovation, St. Paul's Hospital (PhD '16 CHBE).

The second day featured keynote addresses from Dr. Shane Ardo, Department of Chemistry and Department of Chemical Engineering & Materials Science, University of California, Irvine and Dr. Kenis.

An Applied Science graduate student poster session, a graduate Three Minute Thesis (3MT) competition and an undergraduate design competition were hosted on the second day. Academic and industrial panels judged the students. ChemECar won the prize for undergraduate design team. Chingqian Cheng and Haidar Kamal won the 1st place and popular vote poster presentation awards, respectively. Mostafa Ahmed, Maryam Reyat and Roza Ghaemi received the 1st, 2nd and People's Choice awards for 3MT.

The event was a resounding success and highlighted the nano-engineering research currently conducted within the Faculty. The event provided a platform to further develop academia and industry relations as well as underlining the importance of research in realizing industrial goals. The event organizers and participants thank our sponsors NSERC, APSC UBC, CHBE UBC, GSS, Ecoscope program and the CScHE for their generous support.

ENVISION'S FLOW CELL AND ALGAE BIOFUELS TEAMS' INAUGURAL YEAR

Victor Chiew

Envision's goal of getting undergraduate students to start thinking about and solving industry problems extends to the energy sector, where the demand for a sustainable source of energy is growing day by day. Two projects emerged to help shed light on this dilemma and the obstacles future engineers will face in solving it.

The algae project focused on the design of a cost-efficient photobioreactor using bioluminescent algae strains. Since the summer of 2017, the focus shifted to the growth and extraction processes; we wanted to combine the different uses of microalgae to maximize production. Cytosolic lipid bodies contain substantial amounts of triacylglycerides (TAG), which can then be processed into biodiesel via transesterification. Monomeric sugars from carbohydrates can be fermented into bioethanol. The project aims to combine three usages of microalgae (reduction of nitrogen content in wastewater, production of biodiesel, and production of bioethanol) into one process. This way, we offset the production cost of algae biofuels by maximizing products.

The flow cell project intended to research the viability of using flow-assisted Zinc - Nickel oxide batteries as a means of energy storage. Essentially, the flow cell is a rechargeable battery, with some different. Conventional rechargeable batteries use stationary (i.e. non-flowing) solutions, with environmentally harmful materials, such as those in lead-acid or lithium-ion batteries. When applying a flowing electrolytic solution to a normal battery, the energy efficiency of it is greatly increased, due to the electrodes' increased exposure to the ions in solution. This is the main benefit of using flow cells instead of conventional rechargeable batteries

On November 27th, members of the flow cell team and algae teams attended CleanEnergyBC's Generate conference to compete in the student poster competition. The conference focuses on clean energy solutions and ideas, and gives opportunities for students to showcase their work to the clean energy industry. Jordan, Shams, Shirley, and Taij from the flow cell team won the undergraduate competition along with a \$500 prize. Their poster describes the benefits of their particular flow cell compared to other battery options, such as its use of cheap and abundant materials, high capacity, and recyclability. The algae team poster presented their approach on simultaneously extracting lipids and carbohydrates using ionic liquids extraction, as well as the potential for combining wastewater treatment with biofuels production.

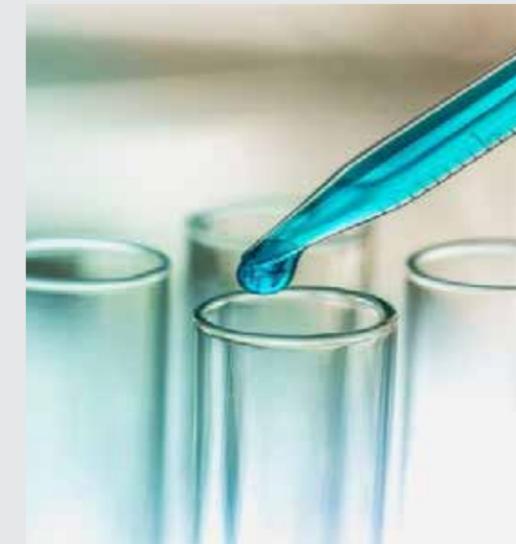


UNDERGRADUATE CLUB

Our department is among one of the largest in the Faculty of Applied Science in terms of size and has a large, diverse community of students from across Canada and the world. The CHBE Undergraduate Club's Executive 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. Comprised of a mix of upper and lower year students, CHBE Undergraduate Club has organized social events, planned industry networking sessions, and advocated for the well-being of undergraduate students. The Undergraduate Club hopes to continue to provide leadership opportunities to students and build a close knit community within the department.



CHBE Undergraduate student executive team



INDUSTRY NIGHT

Career Possibilities and Emerging Trends in Chemical and Biological Engineering, January 26th, 2017

The CHBE Council coordinated a panel of UBC alumni to discuss the possibilities and opportunities in Industry. The panel provided great insights for new graduates planning their engineering career entries.

- Negin Tousi (BASc '15) Water Engineer, WSP
- Veronique Lecault (PhD '12) Co-founder AbCellera
- Mahsa Jamsaz (BASc '06, MEng '12) Process & Energy Engineering Mgr., Sacre-Davey Engineering
- Mike Stewart (JD '14) Partner, ATAC Law, Teaching Adjunct CHBE

The evening continued with the CHBE & ENVE reception, allowing alumni and industry colleagues to mingle and network with UBC faculty and the next generation of CHBE students. The event was well attended with more than 150 students, researchers, faculty and industry and community representatives. Participants presented their work, explored collaboration opportunities, and expanded their professional networks and prepare for future careers.



Tyra Phillips operating the CHBE design entry at Old Red New Red during Engineering Week. Photo Credit: Clare Kiernan



ECS BC STUDENT CHAPTER

Adrian Mora



Participants at the Electrochemists Symposium review posters in the CHBE atrium

On August 4th 2017, the British Columbia Student Chapter hosted the 6th Annual Young Electrochemists Symposium at the University of British Columbia (UBC, Vancouver). This full-day event was held in the Chemical and Biological Engineering Department building and was attended by both graduate and undergraduate students, as well as academic faculty and industrial researchers. The event, highlighted by several interesting talks, covered a wide range of electrochemical topics from electrochemical detection of small molecules to the exchange membranes of fuel cells and electrolyzers. The invited speakers, Dr. David Wilkinson (UBC), Dr. Hogan Yu (SFU), Dr. Loren Kaake (SFU), Dr. Dustin Banham (Ballard Power Systems), Benjamin Britton (Ionomr), and Saad Dara (Mangrove Water Technologies) came from both industry and academia. In addition, students participated in a three-minute thesis pitch and poster competition.

The organizers congratulate the student award recipients on their outstanding research and presentations: Audrey Taylor (SFU, 1st place), Bryan Kung (UBC, 2nd place), and Amelia Hohenadel (SFU, 3rd place). The ECS BC Student Chapter is also grateful to the speakers, students, and sponsors (ECS, Gamble Technologies, the SFU Graduate Chemistry Caucus, SFU GSS, and the UBC Chemical and Biological Engineering Department) who made this event possible. ECS BC Student Chapter looks forward to hosting future events that provide a platform where students, industry, and faculty working locally in the field of electrochemistry, can showcase their research and engage in thought provoking discussion to build future collaborations.

UBC BIOMOD

Amir Reza Meysami Fard

In 2017, 16 undergraduate students from the faculties of science and engineering under the UBC BIOMOD banner with one passion: Helping people through research. This passion led to initiation of an idea and countless hours of hard work to develop and to bring the idea to life. The BIOMOD team concept was to create an inexpensive assay for early diagnosis of lung cancer by creating a novel, sensitive and selective test for lung cancer biomarkers (miRNA). Their assay detects miRNA concentrations in picomolar magnitudes, is highly selective and is capable of working directly with human serum. In addition, the BIOMOD assay is modular, meaning it can be modified to detect other types of cancer, and it is relatively inexpensive with no requirement for expensive equipment to execute the assay.

The BIOMOD team presented their project at the annual BIOMOD jamboree in the University of California, San Francisco and received a Silver project award. While more work is required to develop the miRNA assay for use in clinics around the world, UBC BIOMOD members have certainly taken many of the initial steps to make this dream a reality. For more information on UBC BIOMOD's 2017 team, visit ubcbiomod.com/2017 and check out their project video on YouTube too!"



UBC 2017 BIOMOD Team

UBC BIOMOD

CHBE OIL AND GAS INITIATIVE

Colton Smithson



During the first two months of 2017, the Oil and Gas Initiative (OGI) organized a speaker series to provide students with a better understanding of the petroleum industry. This speaker series involved three professional lectures held at UBC.

The first speaker was Paul Jamieson, a reservoir engineer from ConocoPhillips. Mr. Jamieson spoke on his experiences in industry and provided a brief overview of the various engineering disciplines working at oil and gas sites and their respective duties.

Second, Kamaal Zaidi, Barrister and Solicitor from Alberta provided a lecture on the current and future prospects in the energy sector. Mr. Zaidi touched on the existing and future landscape of the energy industry, including the rise of renewable energy sources such as solar, hydro and geothermal. As a Barrister and Solicitor, he also commented on the effect of recent laws and government legislation on these outcomes in Canada.

Lastly, Dr. Vikram Yadav from the UBC Department of Chemical and Biological

Engineering spoke about biofuels and their impact on the oil and gas industry. Dr. Yadav also discussed the history of the oil and gas industry and drew interesting comparisons and contrasts between the biofuels and oil industries, commenting on the validity of replacing conventional oils with a biofuel infrastructure.

In the spring, the Oil and Gas Initiative organized the Regional level of Students Paper Competition in collaboration with the Society of Petroleum Engineers. Students at the Undergraduate, Masters and PhD level from universities across Canada traveled to UBC to present their research related to Petroleum Engineering. Industry professionals and UBC faculty members judged the competition. The winner from each category (Undergraduate, Masters and PhD) for the regional level was invited to present their paper at the SPE Annual Technical Conference and Exhibition. The Oil and Gas organized the registration, moderation and overall execution of the event held at UBC on March 25th.



UBC O&G Student Members (L-R) Sean Bonnett, Harneet Kaur, Pablo Lacerda Silva, Tyra Phillips, Liam Muir, Colton Smithson

OPEN-CHEM-E INITIATIVE

Said Zaid-Alkailani

Said Zaid-Alkailani and Ngai To Lo attended the annual Canadian Society of Chemical Engineers (CSChE) conference in Edmonton where they presented their work with the Open-ChemE Initiative. Congratulations to Said for taking second place in the Reg Friesen Student Paper Competition!

The Open-ChemE Initiative, founded by Dr. Jonathan Verrett, is aimed at improving the academic experience through the integration of technology and open-source media. Students, Said Zaid-Alkailani, Ngai To Lo, Victor Chiew, Ruben Govindarajan, and Jun Sian Lee, developed an online textbook for materials and energy balances using Jupyter Notebooks and contributed to the vast online repository of Webwork questions for chemical engineering.

Jupyter Notebooks is a platform, which allows the user to use markdown and python kernels to produce notebooks that look pristine, and have computational methods incorporated into them. These notebooks look very similar to textbooks but have the addition of programming which enhances students' problem-solving skills. Webwork is an open source homework-developing platform, which allowed Open Chem-E to produce questions that test student's comprehension of topics. Webwork is very useful because it notes only automatically marks students, but gives the students instantaneous feedback on the question they attempted to solve. Future CHBE students will definitely benefit from the Open-ChemE Initiative!



Ngai To Lo provides an explanation of the Open-ChemE Initiative at the CSChE conference in Edmonton. Said Zaid Alkailani received 2nd place in the Student Paper Competition

CHBeer

Joshua Donaldson

Shams El Nawaii, Siang Lim, Athanasios and Joshua Donaldson attended the 2017 American Institute of Chemical Engineering Conference from October 27th to November 1st. The students presented a workshop on CHBeer, UBC Envision's automated brewing project. Formally UBC Chem E Car, UBC Envision is a design team that encompasses various projects such as an algae biofuels project, a flow cell project, the Chem E Car, and of course; CHBeer.

Fermentation is a process familiar to many chemical engineers. Researching and refining the fermentation process can prove to be challenging, as it is a biological system. CHBeer incorporates many chemical engineering fundamentals with custom instrumentation, software development and machine learning to produce a small process plant (with a product we are passionate about).

In Minneapolis, CHBeer presented our project to over one-hundred chemical engineering students who shared a similar passion of brewing. Our group met students from all around the continent and discussed our programs. Attending various workshops further expanded our knowledge of the process and provided valuable insight into the direction in which the industry is heading.

The team talked to colleagues from the United States Military Academy, who founded the Kicking Mule Brewery, brew on a much larger scale and are specifically research the kinetic modelling of yeast. They showed particular interest in the software that we are developing as well as the instrumentation used. We plan to keep in touch and perhaps even collaborate in the future! Lastly, CHBeer met with a supervisor at Honeywell UOP who is leading a team undertaking similar real-time data processing learning in the oil sector. He was extremely interested in the skills that our team has acquired by working on this project.

We found the conference to be extremely educational and informative. We are incredibly grateful to have had the opportunity to present our project and meet with such incredible influential people in the Chemical Engineering field.



CHBeer Student Members

CHBE STUDENTS PLACE IN THE LIFE SCIENCES START-UP COMPETITION

Two CHBE students, Vasilli Triandafilidi (PhD) and Athanasios Kritharis (3rd year U/G) were members of Tesseract Technologies, one of the 19 initial teams that participated in the 2nd Annual Life Sciences Start-Up Competition.

The start-up competition, announced in September 2016, was open to teams of UBC students, post docs and research associates interested in exploring commercialization of ideas in life sciences, biotech and other areas of human health.

Teams developed business plans and pitched their projects February 23rd, 2017 and Tesseract placed 3rd. Tesseract Technologies' project was development of a new material for treating brain aneurysms. Brain aneurysms are bulges of weak blood vessels in the brain, which can have fatal consequences if untreated. By using a soft material based on bio-compatible polymer instead of platinum wires, they provide safer, cheaper and faster treatment.



Tesseract Technologies (L-R) Yuta Dobashi, Saquib Sarwar, Vasilli Triandafilidi, Athanasios Kritharis, Sean Lumb

IGEM

David Goertsen



The UBC international genetically engineered machine (iGEM) team competes annually, displaying their project on the topic of synthetic biology. Projects are based on experimental research in genetic engineering and are completed with a poster submission, a website, and a 20-minute presentation in Boston, Massachusetts. Projects consists of literary research, experimental design, cell culture, laboratory work, computational modelling, data analysis, website design, fundraising, scientific writing, and community involvement. These project components typically occur over the eight months prior to the competition, from the beginning of March until the end of October.

In 2017, the team developed a solution to combat a plant pathogen, *Agrobacterium tumefaciens*, using CRISPR/Cas9 and conjugative machinery. The UBC iGEM teams have done consistently well in the competition and in 2017 the team built on their success: their work was nominated for best environmental project out of fifty eight teams and best model out of over one hundred undergraduate teams. Three chemical and biological engineering students, David Goertsen, Emma Stanley, and Riley Whittaker were on the team, and both Emma and Riley presented their research for the competition.



2017 UBC iGEM Team Courtesy UBC iGEM Photo Credits: Jojo Das

NATIONAL COLLEGIATE RESEARCH CONFERENCE

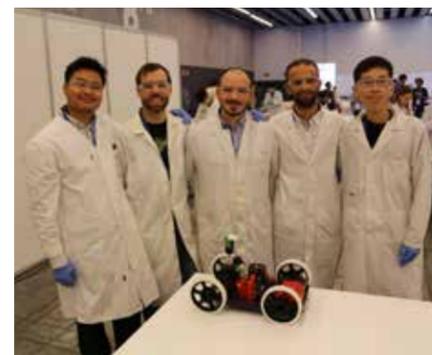
Ileana Co



Ileana Co, Haider Kamal and Ngai To Lo with UBC NCRC team

The National Collegiate Research Conference (NCRC) is a multidisciplinary undergraduate student conference with over 200 participants from universities across the nation. Three CHBE students, Haider Kamal (3rd year), Jamie Ngai To Lo (3rd year) and Ileana Co (4th year), travelled to Harvard University to attend the prestigious conference on January 19-21, 2017. The 3-day program consisted of workshops, panel discussions, mentoring sessions, career and graduate school fairs, a poster presentation, as well as high-profile keynote addresses, including one by Nobel Laureate Dr. Harold Varmus.

The students presented their undergraduate research work in bioengineering topics, supervised by Professor Vikramaditya Yadav. Haider presented his research on the 'Development of a Stimulus Responsive, in-Situ Forming, Nanoparticle-Laden Hydrogel Formulation for Ophthalmic Drug Delivery', which aimed to formulate a novel drug delivery system in the form of eye drops for treating Glaucoma. Ngai To and Ileana's research presented their collaborative work on 'Cerebro-engineering: Developing a pre-clinical model for neurodegeneration towards drug discovery', which focused on using stem cell engineering to create miniature brain models.



Barcelona ChemECar team, ready to roll with their car! (L-R) Siang Lim, Kyle Como, Athanasios Kritharis, Mani Massah, Ray Bi

WORLD CONGRESS OF CHEMICAL ENGINEERING, BARCELONA

The 10th World Congress of Chemical Engineering (WCCE 2017) was in Barcelona, Spain from October 1st to 5th, 2017. Athanasios Kritharis was awarded 1st place in the poster competition in the Biotechnology topic.

Student competitions are also featured at Chemical Engineering conferences and a favorite one for competitors and spectators is the ChemECar competition. The ChemECar competition features show box sized cars, powered by batteries constructed by the teams and stopped by a chemical reaction. To increase the challenge, the distance cars must travel and amount of load carried by the car is announced only one hour before the competition. CHBE ChemECar was invited to compete with 17 other 18 teams from around the world and finished a respectable 7th. In addition, and the Chem-E-Car team won the quiz competition. Athanasios Kritharis, Siang Chiong Lim, Mani Massah, Kyle Como and Ray Bi represented the UBC ChemECar Barcelona team.



ChemECar Team and its car, ready to roll! (L-R) Kyle Como, Athanasios Kritharis, Mani Massah, Siang Lim. Photo credit: Ray Bi

WESTERN ENGINEERING COMPETITION

4th-year Chemical Engineering undergraduate students Katherine Lai and Lisa Lee represented UBC at the Canadian Engineering Competition (CEC) 2017 at the University of Calgary in March. The students represented UBC in the Re-Engineering Competition. Their journey to CEC 2017 started at UBC at the UBC Engineering Competition on October 20, 2016 which they won advancing them the Western Engineering Competition in Banff in January 2017. Winning the Western Engineering Competition led to their participation in the CEC. Congratulations to Katherine and Lisa on their accomplishments!

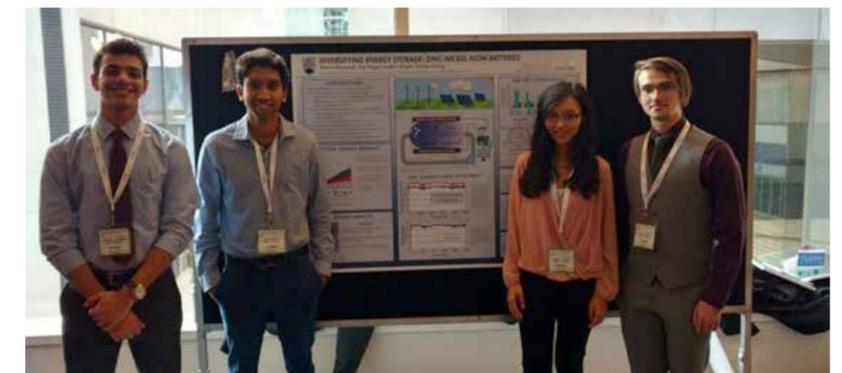


UBC Chemical Engineering undergraduate students Katherine Lai (left) and Lisa Lee (right) at the Canadian Engineering Competition 2017 at the University of Calgary

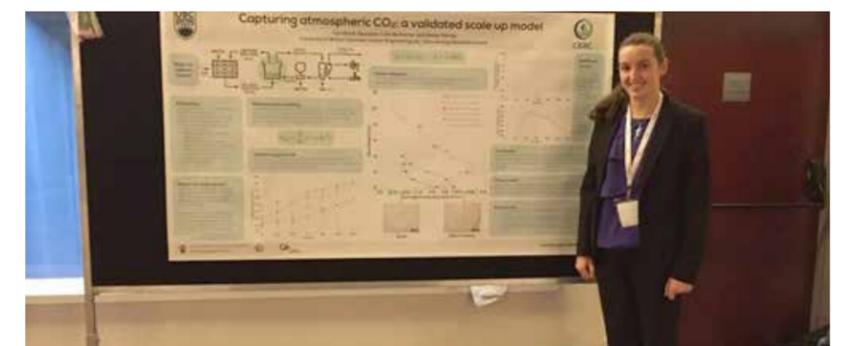
2017 CLEAN ENERGY GENERATE CONFERENCE

Congratulations to the Envision Flow Cell Team and to Caroline Giacomini for their 1st place awards in the poster competitions at the 2017 Clean Energy Generate conference in Vancouver.

Clean Energy BC's goal is to develop a viable power generation and power management industry in British Columbia that serves the public interest by providing cost-effective electricity through the efficient and environmentally responsible development of the province's generation and transmission resources and facilities.



Envision Flow Cell team (Shams Elnawawi, Tajj Taggar, Jordan Wright, and Shirley Zhang) - Undergraduate poster on "Securing Sustainable Energy: Zinc-Nickel Flow Cell Based Microgrids"



Caroline Giacomini - Graduate student poster on "Capturing atmospheric CO2: a validated scale up model".

THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS (AIChE) - 2017 CONFERENCES

The 2017 AIChE Pacific Northwest Student Regional Conference was hosted by Oregon State University in Corvallis. A record 22 students formed the CHBE contingent to participate in ChemE Jeopardy, a research paper competition, a research poster competition, a ChemE Car competition, and an awards ceremony and banquet. This was also the first time that CHBE sent two ChemE Car teams, Senior and Junior, to competition. The weekend was an opportunity for CHBE students to connect with other like-minded undergraduates.

Kelvin Mok presented his team's capstone project and Siang Lim and Haader Kamal presented research papers. Five students presented research posters based on their 4th year thesis projects.

Awards received by CHBE students included:

- Haider Kamal, 2nd place research paper for "Development of a Stimulus Responsive, In-Situ Forming, Nanoparticle-Laden Hydrogel Formulation for Ophthalmic Drug Delivery"
- Siang Lim, 2nd place research poster "Modeling Cell Polarization and Intercalation During Drosophila Germband Extension" - Siang Lim, Rodrigo Fernandez-Gonzalez, James J. Feng
- Junior ChemE Car team, 2nd place ChemE Car poster
- Senior ChemE Car team, 1st place ChemE Car poster



The UBC student contingent at The University of Oregon with the Senior (left) and Junior (right) ChemE Cars.

ENGINEERS FOR A SUSTAINABLE WORLD 2017 UPDATE

Engineers for a Sustainable World (ESW) is an international organization dedicated to the advancement of sustainability in our society. ESW consists of student and professional chapters that undertake engineering and outreach projects in their communities and around the world.

In 2017, ESW-UBC underwent a major review of existing structure. All safety documents were revised and club members performing lab work underwent safety training. We revamped our biodiesel project, where waste oil from UBC Food Services is converted to biodiesel. The team also produced some soap from biodiesel-based glycerine. We implemented a new activity in the form of monthly focus groups, where club members discussed sustainability in critical areas such as Energy and Land, Food & Water Systems. As a future project, the club explored the idea of making bioplastics from plant-based polymers.

Moving forward, ESW-UBC will continue to explore focus topics, improve our biodiesel and soap-making process, organize speaker events, and explore other innovative sustainability projects. ESW-UBC also plans to become more active in engaging in collaborations with other sustainability groups such as UBC Solar, Melt Collective, and Sustaingineers and lobby for better curricular/institutional addressal of climate change. To learn more about or be a part of our club, contact Jackson Herron via: esw@ubcengineers.ca



ESW Team 2017

2017 ACCCE MEETING



Members from the ACCCE meeting outside Kaizer Building with the "Engineering E". Photo Credits: Michelle Pang

The Association of Canadian Chairs of Chemical Engineering (ACCCE) is comprised of the head and chairs of the 22 Chemical Engineering schools in Canada. On June 19th and 20th, UBC Chemical & Biological Engineering hosted the annual spring ACCCE meeting with 17 heads and chairs travelling to Vancouver to attend.

The ACCCE agenda included a diverse range of topics including discussions about Professor of Teaching, Teaching Practices that Promote Student Wellbeing, Capstone Project Best Practices and Minimum NSERC Funding for All. In addition, the agenda featured an Innovation and Entrepreneurship Panel with student and industry members and a visit to HATCH UBC. Dr. Taghipour described how ACUVA, a UV-LED water purification device, was commercializing

with the assistance of HATCH. The Innovation and Entrepreneurship theme continued with tours of Ronin8 Technologies and BC Research pilot facilities. Ronin8 Technologies is a start-up company, recycling circuit boards and using sound waves to separate metals and plastics. BC Research provides clients with a unique technology and commercialization ecosystem in the industrial areas of chemical, petrochemical and clean-tech processes and technologies.

The ACCCE participants were able to enjoy the BC summer weather, touring campus while obtaining exposure the entrepreneurial environment of the Lower Mainland. Our thanks to Ronin8 and BC Research for their graciously providing tours of their unique facilities.

CHBE INDUSTRY ADVISORY COUNCIL (IAC)

Our current IAC members:

Claudio Arato	Chief Technology Officer, Provectus Engineered Materials
Alfred Guenkel	Partner and Principal Chemical Engineer, Noram Engineering and Constructors Ltd.
Clive Brereton	Vice President of Technology, Noram Engineering and Constructors Ltd.
Eric Jervis	Principal Scientist, Stem Cell Technologies
Doris Hiam-Galvez	Director Metals, Hatch
George Peat	Executive Director, GERMMAX
Martin Pudlas	Vice-President Operations, Canfor Pulp and Paper
Tim Watson	Senior Vice President, Project Development, Teck Resources
Peter Wynne	Technical Specialist, Chevron Canada Limited

Leading the IAC as co-chairs are Tim Watson and Dr. David Wilkinson, Professor, Tier 1 Canada Research Chair. During 2017, to support CHBE for its Canadian Engineering Accreditation Board visit, the IAC provided input regarding the technical and communications skills of the graduate of our programs. IAC members also participated in the CHBE Accreditation visit.

For the 2017W academic year, the IAC focused on the theme, "University Research and Innovation, and Interaction with Industry". The three meetings were broken down into the approximate topics:

- Examples of current active university research clusters;
- University support and process for research clusters and engagement of industry in university research;
- Applied Science innovation and entrepreneurship, and its transfer outside the university.

The IAC meetings also provide opportunity for industry to develop a better understanding of CHBE faculty research efforts.

RES'EAU FIRST NATIONS WATER OPERATORS VISIT CHBE

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.

RES'EAU is a Natural Sciences and Engineering Research Council of Canada (NSERC) Strategic Network working in partnership with many other public and private organizations to deliver local solutions to drinking water issues faced by small, rural and indigenous communities (SRC's).

Recent Local Safety Team projects include:

- Transitioning to the new UBC Joint Occupational Health & Safety Committee structure
- Improving new experimental equipment safety audits
- Improving tracking and analysis of injury and other accident data
- Introducing a new enhanced Occupational First Aid (Level 2) program

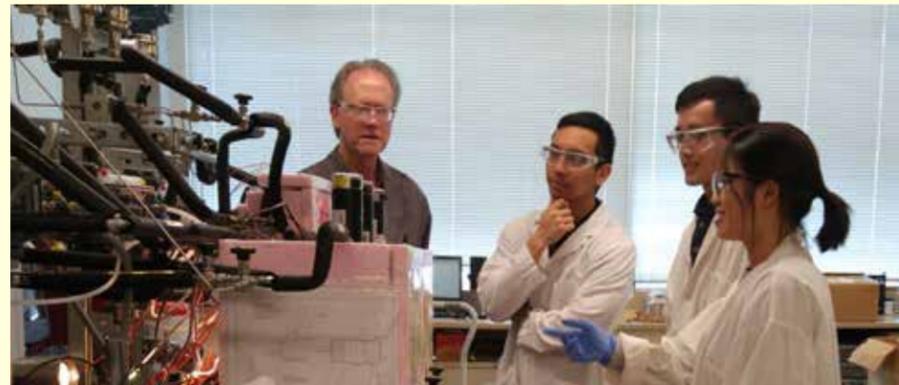
It is the goal of the Department to ensure that everyone at CHBE gets home from work or school safely and to instill safety as a core value into the lives of our students. As our students grow and move on to positions of leadership in industry, academia, and in their own communities, it is our vision that they pass on the message of the importance of safety and continue to ensure that safety is prioritised in all of their major decisions.

HEALTH, SAFETY, AND ENVIRONMENT COMMITTEE

The CHBE Department Local Safety Team 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:

David Wilkinson (Co-chair)	James Nottingham
Marlene Chow (Co-chair)	Riley Whittaker
Miles Garcia	Serge Milaire
Dhanesh Kannangara	Doug Yuen
Sara Chen	Jonathan Doan
Jeremy Rochussen	Gladys Conroy



Serge Milaire and Miles Garcia inspect research apparatus. Photo Credit: Michelle Pang



RES'EAU First Nations Operators in a CHBE Teaching Lab watching a demonstration on particle settling. Photo credit: Keyvan Maleki



RES'EAU First Nations Operators discuss wastewater treatment with MASC student Joanna Lapucha. Photo credit: Keyvan Maleki



RES'EAU First Nations Water Operators in the Chemical and Biological Engineering Building Atrium. Photo Credit: Keyvan Maleki

SANOFI BIOGENIUS

The Applied Science Faculty and Department of Chemical & Biological Engineering were pleased to host the 2017 British Columbia Regional Sanofi Biogenius Competition (SBC) in April 2017. The SBC biotechnology competition (www.biogenius.ca), organized by Partners in Research (PIR), matches high school students with research faculty mentors to complete amazing research projects.

Past elite research projects have ranged from cancer and Alzheimer's disease, to agriculture and the environment. Many ideas have been patented and commercialized, garnering international media attention. UBC faculty have participated as mentors and evaluators. The competition is sponsored by Sanofi Canada who employs over 1900 people in Canada working to prevent illness with vaccines; providing innovative treatments that empower life by fighting pain and easing suffering; and standing by the few who suffer from rare diseases and the millions with long-term chronic conditions.



Dr. Jonathan Verrett encourages participants at the Sanofi Biogenius Competition.



(L-R) Carrie McElroy (Sanofi), Sanofi Biogenius students, Dean Marc Parlange

Congratulations to the 2017 competition winners:

- 1st - Winnie Xu, Elgin Park Secondary
- 2nd - Annie McLeod, Glenlyon Norfolk School
- 3rd - Henry Lendovy, Sentinel Secondary
- 4th - Katharine Lee, Crofton House School
- 5th - Zofka Svec, Glenlyon-Norfolk School

2017 RIDE FOR CLEAN ENERGY



2017 was the 5th Annual Ride for Clean Energy benefiting the Tyler Lewis Clean Energy Research Foundation. The ride, on Saturday August 12th, 2017 boasted seven Department riders comprised of both faculty and students. Each rider pledged to fundraise a minimum of \$250 each, all donated to the Tyler Lewis Clean Energy Research Foundation. The 2017 Ride raised more than \$20,000 for the second consecutive year.

The Foundation is a non-profit organization that annually awards \$10,000 scholarships graduate students enrolled in a Canadian post-secondary institution working in the field of renewable/sustainable energy research. In 2017, the Foundation awarded two scholarships. The Foundation and Ride was established in memory of Tyler Lewis, a Department graduate student who tragically passed away in 2012. The Ride is the Foundation's major annual fundraiser and is pivotal for the continued issuing of the Foundation's yearly grant. To learn more about the foundation, visit www.TylerLewis.ca.

This year's CHBE riders included Bill Cheng, Saad Dara, Naoko Ellis, Ruben Govindarajan, Sean McBeath, Farhang Nesvaderani, Adrian Serrano, Jonathan Verrett, Dave Bruce, James Butler and Dawn Marie Barreira.

OUTREACH AND THE APSC OPEN HOUSE

Outreach events are a welcome and fun opportunity for faculty, staff and students to share their passions about engineering. Visiting high schools and school age groups often visit the Department and during the Annual Applied Science Open House, hundreds of high school and first-year excited students visit. Visitors gain a glimpse of the excitement in our CHBE Department from the Open House showcase event in the atrium featuring a myriad of undergraduate student team and research displays. Visitors are also wowed in the lab with experiments and demonstrations including one involving explosive nitrocellulose. Visits always end well with tasty sample of liquid nitrogen ice cream!

The Department acknowledges with appreciation the Outreach volunteers, which include undergraduate and graduate students, staff and faculty, student team members from UBC ChemECar, UBC BIOMOD, UBC iGEM, Engineers for a Sustainable World UBC Chapter, the Oil and Gas Initiative, and RES'EAU-WaterNET.



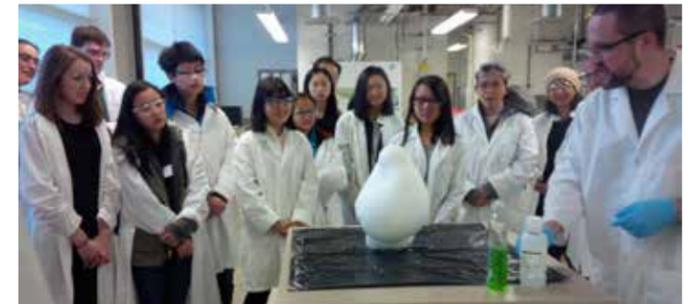
A perfect end to a Minigeers' visit to Chemical and Biological Engineering. ICE CREAM



Postdoctoral Fellow Suellen Satyro demonstrates how UV light can be used in water treatment to APSC Open House attendees. Photo credit: Clare Kiernan



Minigeers designing a water filter - future chemical engineers?



Dr. Potvin demonstrating elephant toothpaste during the Applied Science Open House

December 13th marked UBC's Clean Energy Engineering Capstone Showcase Conference and Industry Night. The full-day event featured 25 MEL students in Clean Energy Engineering presenting methodologies and outcomes of their four-month Capstone Projects to an audience of fellow students, industry partners, alumni and incoming students.

The Capstone Projects offer students practical experience leading complex, multidisciplinary projects relevant to their professional specialization in clean energy engineering. The course is delivered in partnership with industry, a collaboration that translates into real world experience and the development of project management and presentation skills.

Brie Haley, Community Sustainability Specialist at Urban Systems Ltd. and UBC MEng CEEN alumni, Steve Vogel, a MEL student collaborated with Urban Systems Ltd. On a project to assess the pre-feasibility of biomass fueled energy technologies for a remote First Nation community in BC. Haley described the Capstone Projects as "a great opportunity for students to experience real-life projects. From a company point of view, we can offer support to guide students through the project and watch their initiatives to solve the problem. It is fascinating to see the spread and diversity of projects on both the demand and supply side of energy."

Director of Dudzevich Energy Consulting, Airton Dudzevich MEL '16, utilized the occasion to become familiar with the newest Clean Energy Engineering students and to "see their projects ideas and dreams." He reflected on the event, "It is always good to watch brilliant minds starting up their careers, and to notice their passions for clean energy, for the planet and for the coming generations." He is looking forward to the Capstone Showcase Conference in 2018.

Following the conference, the industry night kicked off with a keynote from Dylan Heerema, Analyst at the Pembina Institute, which addresses the energy challenge to reduce harmful impacts of fossil fuels while supporting the transition to a cleaner and safer energy system. Three of the 25 MEL students collaborated with the Pembina Institute during their Capstone Projects and focused on issues such as low cost, net zero retrofits in the social housing and market rental buildings sector.

CLEAN ENERGY ENGINEERING CAPSTONE SHOWCASE CONFERENCE 2017

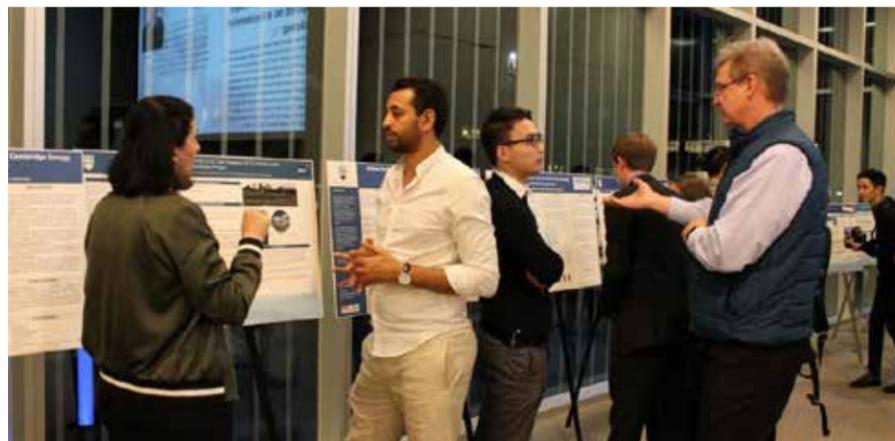
Brittany Ji

The second keynote speaker Dr. Paul Fennell, Professor of Clean Energy at the Imperial College in London, called on the audience to think in a more complex and broad approach of renewable energies, stating it is not "my technology or your technology, it is our technology" - highlighting the power of combining various forms of renewable energy to enable an optimal and efficient form of energy supply.

The conference ended with an evening reception to celebrate completion of the Capstone Projects and to provide further knowledge exchange and networking between the graduating cohort, alumni and industry partners. Co-Director of the MEL in Clean Energy Engineering program,

Dr. Vladan Prodanovic, described the overall successful and inspiring event as "a wish comes true" and promised to make this Conference and Industry Night event a yearly tradition.

The Capstone Projects represent projects from all areas of clean energy, featuring partnerships with industry across the public and private sector, including: BCIT, Cambridge Energy Partners, City of Vancouver, Dudzevich Energy Consulting, Dunsky Energy Consulting, Ecosmart Inc., FEED Engineering Inc., Instream Energy Systems, Ionomr, MSU, Nrstor Inc., Pembina Institute, Pinna Sustainability Inc., Powertech Labs Inc., Syntegra, The Carbon Initiative, UBC and Urban Systems.



2017/18 DISTINGUISHED SPEAKER SERIES



KRISHNASWAMY NANDAKUMAR

Friday, October 20th, 2017

Professor, Louisiana State

Advanced Multiphase Modelling Framework for Chemical Process Innovation



PAUL FENNELL

Friday, November 17th, 2017

Professor, Imperial College of London

Industrial Carbon Capture: From Today to the Future



JULIE KORNFIELD

Friday, January 12th, 2018

Professor, Caltech

Megasupramolecules



JAMES DUMESIC

Friday, February 9th 2018

Professor, University of Alberta

Catalytic Conversion of Lignocellulosic Biomass to Biofuels and Bioproducts



LISA BULLARD

Friday, March 9 2018

Professor, North Carolina State University

Open the Front Door, Close the Back Door: The Impact of Culture on Recruiting and Retention

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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