interfaces

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University of Toronto

Volume 11, Fall 2015
Bioengineering

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UNIVERSITY OF TORONTO

Volume 11, Fall 2015
Bioengineering

Contents

About This Issue
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Bioengineering — Breaking Convention

"…fusing their knowledge in biology and engineering to solve important problems…"

AS YOU LOOK AROUND the Department of Chemical Engineering & Applied Chemistry at the University of Toronto, you will notice an amazing diversity of bioengineering projects and the brilliant academics, researchers, alumni and students leading them. In this issue of *Interfaces*, you will dive into this exciting field and see how people from our Department are fusing their knowledge in biology and engineering to solve important problems applied to environmental sustainability and human health.

Professor **Emma Master**, for example, not only mentors students across the Faculty of Applied Science & Engineering as the Director of its Bioengineering Minor, but she also actively investigates new methods to transform plant waste into plastic-like material, which can be used to create resilient and versatile products. In July 2015, Master was awarded €1.98 million ($2.8 million CAD) from the European Research Council to advance her study in this area.

Alumnus **Michael May** (9T1, PhD 9T8), a former undergraduate and PhD student from our Department, worked alongside University Professor **Michael Sefton** (7T1) on microencapsulation in Sefton's tissue engineering lab. Always entrepreneurial, May took his academic research to the market. In 2000, he and Sefton launched Rimon Therapeutics, a Toronto-based regenerative medicine company that develops novel medical polymers that possess drug-like activity. Today, May is the CEO of the Centre for Commercialization of Regenerative Medicine, creating and sustaining a global nexus for regenerative medicine commercialization.

Professor **Christopher Yip** (8T8), appointed to Director of the University of Toronto's Institute of Biomaterials & Biomedical Engineering in April 2013, provides leadership to more than 80 research engineers and scientists who are engaged in healthcare discovery and product development throughout the GTA. A leading voice in single-molecule biophysics, Yip joined our Department in 1997 and has since received teaching awards from both the Faculty of Medecine and the Faculty of Applied Science & Engineering.

I hope you enjoy this issue of *Interfaces* and meeting a few exceptional members from our Department who are making their mark in bioengineering, as well as all of the great people who are achieving recognition for their accomplishments. Since the last issue of *Interfaces* in Spring 2013, two professors have won the CSChE Hatch Innovation Award (formerly the Syncrude Canada Innovation Award), presented each year to one individual who has made significant contributions to the field of chemical engineering in Canada while under the age of 40. We now also have two University Professors, the highest rank given to only two per cent of U of T professors. Speaking of high honours, **William Breukelman** (5T5) received Canada's most esteemed distinction, the Order of Canada. These are just a few of the accolades connected to our community. Please stay in touch with us through Facebook, LinkedIn and Twitter so we can learn about your successes. All the best!

Grant Allen (8T1, MASc 8T3)
Professor & Chair

by Jennifer Hsu

Teaming Up to Advance Bioengineering

The field of bioengineering is an exciting area that brings biology and engineering together to solve important problems in energy, sustainable manufacturing, the environment and health care.

GIVEN THE STRONG CONNECTION between applied chemical/biochemical and health sciences, many professors from the Department of Chemical Engineering & Applied Chemistry are tapping into bioengineering to balance rapid advances being made in biology and the urgent need for solutions.

For example, Professor Emeritus **Charles Mims** co-directs the Ontario Centre for the Characterization of Advanced Materials (OCCAM), which provides both surface and bulk characterization on scales ranging from the macro to the atomic. Currently, OCCAM's characterization kit supports numerous bio-related projects on campus, in Canada and worldwide.

Researchers from the Faculty of Dentistry have partnered with the OCCAM lab to study material that could improve the performance of load-bearing surgical implants used to replace diseased or traumatically compromised dental or skeletal parts. In addition, the Department of Chemistry and Physical Sciences at UTM are using OCCAM resources to examine biomolecules on surfaces for biochip sensing devices to advance the diagnosis of genetic and other diseases, as well as guide the screening of new drugs.

Aric Pahnke, a PhD candidate, performing cardiac tissue and stem cell research in Milica Radisic's Laboratory for Functional Tissue Engineering.

"The fundamental nature and broad applicability of the information provided by OCCAM has positive impacts across disciplines and industries. By providing critical information regarding the structure-properties-performance relationship, the lab has been at the core of scientific-based innovations," says Mims.

Professor **Elizabeth Edwards** is yet another ChemE researcher who has a number of bioengineering partnerships on the go. Not only does she direct BioZone, a multi-disciplinary lab of nine professors who are advancing innovative biotechnology through partnerships with experts across academia and industry, she also leads the Industrial Biocatalysis Network (IBN). Through this new network, researchers from U of T, UBC, Concordia and industry will work together to uncover enzymes that can convert renewable resources—such as agricultural or forestry waste—into new materials. These processes could substantially reduce energy consumption and carbon emissions compared to fossil fuels.

Igniting favourable environmental ripples are inevitable when passionate researchers from different backgrounds and groups pool their knowledge. One just has to look at Professor **Greg Evans** (8T2, MASc 8T4, PhD 8T9) who specializes in the analysis of air particles and their impact on human health and his collaborative project with colleagues at U of T's Dalla Lana School of Public Health.

Many chronic diseases are now believed to be due to a combination of an individual's genome and their cumulative environmental exposure. Exposomics, analogous to genomics, is an emerging approach to assessing this exposure. Internationally very large research initiatives are planned or underway in this new field but there has been little activity to date in Canada. Evans launched the exposomics research initiative to bring together and leverage existing infrastructure, expertise and research activities across U of T. The program has put in place a foundation of methods and pilot data needed to support large research proposals. The goal is to position U of T to become a leader in this exciting new field.

"…many promising drugs are abandoned early on and some dangerous drugs make it to market."

The components pictured, part of OCCAM's new x-ray photoelectron spectrometer (Thermo Scientific EscaLab 250Xi), allows for in-vacuo sequestering of samples, as well as transfer of samples between orthogonally oriented vacuum chambers.

Is it any surprise that ChemE professors are recognized nationally and internationally for their significant contributions to bioengineering?

Included in this group are **Milica Radisic** and **Molly Shoichet**. This year, the American Institute for Medical and Biological Engineering named Radisic a Fellow. She also won NSERC's E.W.R. Memorial Fellowship and CSChE's Hatch Innovation Award (formerly the Syncrude Canada Innovation Award) for distinguished contributions to the field of chemical engineering in Canada before the age of 40, an award our faculty have won three out of the last four years. Radisic is renowned worldwide for developing a "gym" for cells. She created a bioengineered device that enables cardiomyocytes to contract first a low rate than at a higher rate over a period of time just like they would in a real human heart.

"Animal heart cells have different functional properties than human heart cells, making it impossible to fully capture both positive and negative effects of a drug during pre-clinical testing. As a result, many promising drugs are abandoned early on and some dangerous drugs make it to market. Our system can mature human cardiomyocytes derived from human pluripotent stem cells and leads to a safer and better way to test drugs," explains Radisic.

Molly Shoichet also received a huge honour this year. In March, she was named the L'Oréal-UNESCO Women in Science Laureate for North America. Already the only person ever elected to all three of Canada's science academies and a University Professor (the highest distinction U of T awards its faculty), Shoichet is also U of T's senior advisor to the President on science and engineering engagement and the innovative mind behind collaborative breakthroughs ranging from "space suits" for fragile stem cells to polymer-based "vehicles" that let cancer drugs "drive" to affected areas.

There are certainly great bioengineering strides being made in the Department of Chemical Engineering & Applied Chemistry by its people and partners. Will there be more to come? Absolutely! i

Alumni Profile

by Jennifer Hsu

The Science Behind Business Development

ESTABLISHED IN 1987, Ontario Centres of Excellence (OCE) has grown from a small not-for-profit program into a pivotal force behind the province's economic growth.

Today, OCE drives the commercialization of innovations from publically funded colleges, universities and research hospitals in Ontario; supports and endows early-stage projects that have large income potential; and invests in the development of the next generation of innovators.

To achieve this, OCE relies on a 40-person team of business development managers who are deployed to all corners of the province to find out what is needed by industry. These professionals literally "walk the halls" of schools and hospitals to discover the latest breakthroughs from researchers and then utilize OCE's suite of programs to put these innovations to practical use through commercialization and creation of a company or by finding an industry application for the

"…Today I may learn about a disruptive technology that can "repair" donor lungs that were previously not suitable for transplant…"

Laura Yu "walking the halls" in U of T's Wallberg Building.

academic discovery. **Laura Yu** (0T2, PhD 0T8) is part of this talented OCE crew.

During her graduate studies, Yu guided axon growth by chemically tethering nerve growth factor (NGF) to a biodegradable material from low to high NGF concentrations.

Upon completion of her PhD, Yu joined Baylis Medical Company as a R&D Engineer. She worked there for three years overseeing the development of medical devices specifically for chronic back pain management. It was in this role that she got her first taste of business. Her daily responsibilities included project management activities, as well as R&D to improve existing and new product development. She also worked with Baylis's internal teams to conduct patent searches, develop manufacturing processes and create marketing strategies to support product launches. For Yu, one of the most exciting parts of her job was conducting clinical cases with clinicians using the Baylis products.

"Seeing how clinicians interact with the device is important feedback for product development. It's also very gratifying to see an initial concept, such as a sketch on paper, become an actual product in the hands of clinicians to treat patients. The experience at Baylis Medical has been valuable and important in my current role at OCE," says Yu.

Despite Yu's background in tissue engineering research, it is not unusual to find someone with her wide science/engineering expertise in business cultivation, which she focuses on at OCE.

"Researchers and OCE share a common goal. We aim to commercialize intellectual property developed through research and apply them to solve some of the world's greatest challenges," explains Yu.

Since starting at OCE in 2011, Yu has managed over 120 projects funded by OCE. These projects provided companies, ranging from SMEs to multi-national corporations, access to academic expertise to collaborate and develop innovative solutions to solve technical challenges. If solved, these projects will improve existing products/services or launch new ones, and enable the companies to expand markets, grow revenue, and ultimately sustain and create jobs in Ontario. Some of her projects also included energizing U of T spin-off companies.

Professors **Cathy Chin** and **Tim Bender** from U of T's Department of Chemical Engineering & Applied Chemistry are among the group of researchers Yu has supported.

"Professor Chin was relatively new to the Department when I met her. I informed her about our industry-academic collaborative programs (IACP) and invited her to attend one of our industry-academic partnership forums on mining innovation to meet potential industry partners. Since then, OCE has funded four IACP projects with Cathy and industry partners. In these projects, the industry partners are leveraging Cathy's expertise in catalyst engineering and designs to address technical challenges that are specific to their business needs. One of the projects involves developing a novel catalyst for methane abatement from natural gas engine exhaust. The industry partner expects that global environmental regulations to lower greenhouse gas emissions will become increasingly stringent in the next five years. To be ready to capture this future business opportunity, R&D needs to happen now for the company. Successful completion of the project will build new R&D capacity for the company and enable them to conduct field tests starting with their European customers," says Yu.

Professor Tim Bender, on the other hand, possessed vast industry experience before joining the Department. He understood industry-academic collaboration and how new technologies are brought to market. In this circumstance, Yu focused on helping Bender determine appropriate OCE and federal programs that would fit his project scope for thin film vapour deposition, and how the programs could be leveraged against industry contributions. She also worked closely with Bender in the application phase to provide feedback based on reviewers' expectations.

Yu's success in the world of business development shows that when it comes to bringing a technical idea or innovation to market there may be great value in having someone with scientific training and an entrepreneurial mindset. Almost all of the entrepreneurs Yu has worked with are scientists turned entrepreneurs. They are eager to learn on the spot, overcome hurdles and are excited with the prospect they will better the world with their technologies.

"In my job, I meet lots of intelligent scientists and entrepreneurs. Today I may learn about a disruptive technology that can "repair" donor lungs that were previously not suitable for transplant, increasing the number of donor lungs available for transplant. Tomorrow I may learn about an online platform that can help academic authors promote their publications and scholarly publishers better engage with their readers. Knowing that OCE and I have a hand in supporting them on their successful journeys is the most satisfying and exciting part of my role as a Business Development Manager at OCE," says Yu. i

Alumni Profile

by Jennifer Hsu

A LONG BUT MEANINGFUL JOURNEY

MICHAEL MAY (9T1, PhD 9T8) is President and CEO of the Centre for Commercialization of Regenerative Medicine (CCRM), a global nexus for regenerative medicine commercialization that unifies dynamic business leadership with high value innovative technology development platforms based on demonstrated excellence in fundamental stem cell and biomaterial science.

May is a long-standing member of U of T's Department of Chemical Engineering & Applied Chemistry's Board of Advisors. Through his guidance—and that of 10 other members who sit on the board—the Department has made valuable changes to student curriculum and alumni relations, as well as its vision. It is hard to imagine the board without May's valuable contributions, but had he pursued his initial dreams of becoming a physician that would have been the case.

Recently, May sat down with **Kevin Saludares** (1T5)—a new alumnus—to reminisce about his graduate experience within the Department, the decisions he made that led him to CCRM, and the importance of engineering to launch companies. The following is an edited version of the sit-down meeting between May and Saludares.

"…I found mentors who were able to teach me a great deal, even if they hadn't gone down this exact path themselves."

WHAT WERE YOUR EDUCATIONAL GOALS?

My original goal after graduating from the Department's undergrad program was to go to medical school. However, I became torn between medicine and engineering, as I had a strong interest in both areas. At the end of the day, I stayed with engineering because I was fascinated with the science and medical innovations occurring in engineering at the time. And, I was drawn to business.

I developed a strong desire to figure out how to extract and translate discoveries being made at universities into commercialized products. I knew this was a career goal before starting my PhD in biomedical engineering at the Department.

I entered my PhD with the sole purpose of using my work in the lab to identify a technology and create a company. At the time, there were not many examples to learn from; however, I found mentors who were able to teach me a great deal, even if they hadn't gone down this exact path themselves.

After finishing my PhD, I entered an entrepreneurial postdoctoral position funded by the Ontario Government through an award called the Martin Walmsley Fellowship. I held this position for close to two years and then launched Rimon Therapeutics, which I led for 12 years.

When it comes to industrializing biology and chemistry, engineers play an important and impactful role.

CAN YOU TELL ME A LITTLE MORE ABOUT RIMON THERAPEUTICS?

It is a Toronto-based regenerative medicine company that develops novel medical polymers that possess drug-like activity. I established it with my thesis supervisor, now University Professor **Michael Sefton** (7T1). It was based on technology I invented with him and **Julia Babensee** (9T0, PhD 9T6), another grad student. Julia wanted to become a prof and I wanted to become an entrepreneur so I started the business and she went on to teach at Georgia Tech.

The company started from a single experimental observation. Very early on in our research, we noticed blood vessels growing around medical polymers that were implanted. This one achievement allowed us to create a concept called therapeutic polymers or "Theramers," which led to more inventions. We were able to move the product into a clinical trial for wound healing, which ultimately led to discussions with partners for licensing.

Don't get me wrong, this was a long and complicated process. Nevertheless, it is one that I'm very proud of. I remember the work I had to put in to convince the FDA in the U.S. that we should be regulated as a device even though our product had drug-like activities. The entire process took close to four years.

WHAT INSPIRED YOU TO CREATE CCRM?

This public-private partnership between academic institutions, and also industry, is based on a model created around my experience in the deep trenches of company creation, which extends all the way back to my undergrad years.

Back then, I learned so many lessons in those trenches, but primarily that successful companies are built with incredible support networks. This is why CCRM is built around an academic network, complemented and leveraged by an industry network, which we support through a network of investors and seasoned entrepreneurs.

CCRM is now five-years-old. We have built an industry consortium of nearly 50 companies, we're supporting the launch of 10 more, and we're plugging away everyday looking for the next great idea and business related to regenerative medicine.

We have an exceptional team of 35 professionals who possess strong leadership skills and come from science and engineering backgrounds. When starting a business, there are tons of skills, people and puzzle pieces to put together. Having strong interpersonal and technical skills are essential to making this process work.

CCRM's team has generated many benefits for Canada in terms of job creation and positive impacts to the economy, improved health outcomes, knowledge transfer, knowledge generation, and the list goes on. As CCRM continues to grow and achieve its vision of becoming a global nexus for regenerative medicine commercialization, the benefits to Canada will increase.

Despite Canada's strength in medical science, we do not have a Canadian-based multinational in pharmaceuticals, medical devices or the biologics industries. I want the situation for regenerative medicine to be different. Canada can be the global leader in the industrialization of this leading edge of medicine.

Engineers are needed to work hand-in-hand with fundamental scientists and biologists to industrialize biology. You can't treat patients unless you have a product, and you can't have a product without engineers.

Here again is another example of how engineers will "change the world." i

by Elah Feder

Engineering Life
The New Tech Savvy

"Things don't always go as planned—that's what research is all about—but when it does, it's a wonderful feeling"

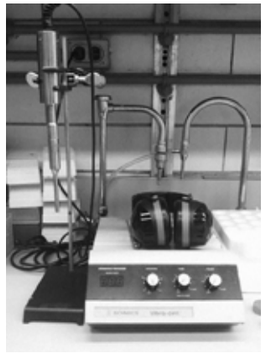
NOT SO LONG AGO, lessons on bioethics and the history of medicine might have seemed out of place in an engineering program, but today, they blend easily into the diverse menu of courses in U of T's Bioengineering Minor. The program was launched in 2006 in the recognition that biological applications were increasingly taking center stage in technological advancement.

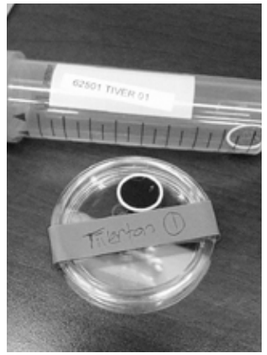
"We also recognized that students were quite curious to learn more," says Professor **Emma Master**, Director of the Bioengineering Minor. "They were hearing more about it in the news and were curious what bioengineering means—and what it can do."

Although bioengineering only congealed into a recognized field in recent decades, Master notes that technological processes and designs rooted in biology have a long history. The use of microbes to ferment yogurt, cheese, beer and wine, for example, are all ancient applications of biology. Microbial processes have also been used in sewage treatment for over a century. Today's bioengineering has leapt beyond yogurt and beer to span everything from developing brain-computer interfaces to synthesizing plant-based polymers that could replace plastic. "The common thread is the application of biology in many areas," says Master.

Bioengineering students like **Jandi Kim** (1T5), who graduated in the spring, have the opportunity to conduct research that gives them practical and theoretical know-how, and helps lay the groundwork for new technologies. For her undergraduate thesis, Kim assessed the toxicity of air samples across Canada—specifically, the oxidative capacity of particulate pollution in the air.

Oxidative damage to the skin, for example, contributes to skin aging. Particulate matter in the air, especially the tiny, 2.5 micrometer variety that Kim studied, has been linked to respiratory diseases, including lung cancer, possibly by inducing oxidative stress. Under the supervision of Professor **Greg Evans** (8T2, MASc 8T4, PhD8T9) and former postdoctoral fellow **Krystal Godri Pollitt** (0T5, MASc 0T8), Kim worked to determine just how much oxidative damage these particulates could inflict on our lungs. She tested 392 samples from British Columbia, Alberta, Ontario and Quebec by mingling the particulates with synthetic lung lining fluid. The fluids contained the same anti-oxidants found in the natural equivalent, and





Jandi Kim and team used the titanium probe sonicator to extract particles loaded on the Tapered Element Oscillating Microbalance (TEOM) Filter.

after incubating the samples with the "lung lining" for several hours, she measured how much these anti-oxidants had been depleted.

After nearly a year of extractions, pipetting, measurements, and data analysis, Kim appeared to have her preliminary results revealing variation in particulate toxicity across the provinces, as well as differences between rural and urban air.

Kim also learned how research is an iterative process and rarely runs smoothly on the first go. Curious patterns in Kim's control data revealed there'd been a systemic error somewhere along the way, possibly in mixing or pipetting. Until the error is found and corrected, her results remain tentative, but despite the complications, the process has left Kim satisfied.

"I was very glad that I did something from the beginning, and I found the result from my research," she said. Though she graduated in June, she's still working to pinpoint the cause of the error and is keen to see the project through.

Katarina Neskovic (1T5) can relate.

"Things don't always go as planned—that's what research is all about—but when it does, it's a wonderful feeling," says Neskovic, who completed her undergraduate thesis with University Professor **Michael Sefton** (7T1) focusing on the role of a novel biomaterial and the complement protein system on blood vessel growth.

Endothelial cells are a critical component of blood vessel growth, or angiogenesis, which line the interior vessel walls and migrate to the site of a wound or developing tissue.

"On the global scale, we want materials that can promote blood vessel growth for tissue engineering applications," says Neskovic. "One of the cornerstones of tissue engineering is bringing a blood supply to the tissue engineered organ." Without blood, of course, the introduced organ could not survive.

For Neskovic, a chemical engineering student, work with tissue cultures was an entirely new experience, but she says she quickly learned what she needed to and got her experiments underway.

Neskovic's experiments focused on a polymer called MMA, short for Poly (Methacrylic Acid-co-Methyl Methacrylate), that previous studies had shown promoted blood vessel growth.

Researchers aren't sure exactly how this occurs, so to start answering that question, Neskovic conducted what are called "scratch assays": simulating wounds in thin layers of lab-grown endothelial cells. As wounds heal—even in lab-grown tissue—endothelial cells migrate toward the gap. When Neskovic threw MMA into the mix, she found it altered that rate of cell migration.

This finding alone doesn't solve the puzzle of MMA's growth-promoting powers, and further research will be needed to confirm Neskovic's results, but her research contributes incrementally to finding the answer.

Since graduating, Neskovic has participated in the Next 36 program, an incubator program that accepts just 36 young entrepreneurs across Canada each year. She's not sure where she'll head next, but says she's loving the entrepreneurial world.

Kim plans to pursue work in the environmental or pharmaceutical industry and she hopes to eventually go on to graduate studies.

Meanwhile, the Bioengineering Minor continues to attract new students, sprouting a second minor last year, which focuses exclusively on medical applications of bioengineering.

"Advances in life sciences are escalating with the advent of genomics and automated platforms for studying biological systems," says Master, "All this means that understanding fundamental aspects of biology is becoming increasingly an important part of being technically savvy." i

Honours & Awards

Members of the Department of Chemical Engineering & Applied Chemistry at U of T help set us apart from the rest.

We are extremely proud of the number of awards and acknowledgements received by our alumni, faculty and students since Spring 2013. Congratulations to each of them on their major achievements.

Alumni

Canadian Academy of Engineering, Fellow
2014—Clement Bowman (5T2, MASC 5T8, PhD 6T1)
Heather Sheardown (9T5)
Jeanette Southwood (8T6, MASc 8T8)
2013—Savvas Hatzikiriakos (6T9, PhD 7T2)

FASE, Engineering Hall of Distinction
2014—William Troost (6T7)

Order of Canada
2013—William Breukelman (5T5)

U of T, Arbor Award
2015—Marisa Sterling (9T1)
Angela Tran Kingyens (MASc 0T7, PhD 1T2)
Stanis Yu (0T0)
2014—Constantine Karayannopoulos (8T3, MASc 8T8)

Faculty

Alan Blizzard Award for Collaborative Training
2014—ILead team: Greg Evans (8T2, MASc 8T4, PhD 8T9), Cecilia Konney, Alison McGuigan (PhD 0T5), Deborah Peart, Douglas Reeve (MASc 6T9, PhD 7T1) + others

American Institute for Medical and Biological Engineering, Fellow
2015—Milica Radisic

Canada Research Chair in Anaerobic Biotechnology
2014—Elizabeth Edwards

Canadian Academy of Engineering, Fellow
2015—Greg Evans (8T2, MASc 8T4, PhD 8T9)
Vladimiros Papangelakis
Michael Sefton (7T1)
2013—Yu-Ling Cheng
Mark Kortschot (MASc 8T5)

Canadian Institute of Mining, Metallurgy and Petroleum, Fellow
2013—Vladimiros Papangelakis

CSChE, Hatch Innovation Award
2015—Milica Radisic

CSChE, Process Safety Management Award
2013—Graeme Norval (8T3, MASc 8T5, PhD 8T9)

CSChE, Syncrude Canada Innovation Award
2014—Radhakrishnan Mahadevan

Engineering Institute of Canada, Fellow
2014—Christopher Yip (8T8)

FASE, Faculty Teaching Award
2014—Greg Evans (8T2, MASc 8T4, PhD 8T9)

FASE, Research Leader Award
2015—Honghi Tran (PhD 8T2)

Institute of Medicine (National Academies, US), Member
2014—Michael Sefton (7T1)

L'Oreal-UNESCO Women in Science Laureate for North America
2015—Molly Shoichet

Metallurgy & Materials Society of Canadian Institute of Mining, Metallurgy and Petroleum, MetSoc Environmental Award
2015—Charles Jia

NSERC, E.W.R. Steacie Memorial Fellowship
2014—Milica Radisic

Ontario Professional Engineers Awards, Gold Medal
2014—Michael Sefton (7T1)

Pulp and Paper Technical Association of Canada, John S. Bates Memorial Gold Medal
2014—Honghi Tran (PhD 8T2)

Faculty

Royal Society of Canada, College of New Scholars
2014 — Milica Radisic

Royal Society of Canada, Fellow
2015 — Levente Diosady (6T6, PhD 7T2)

Society for Chemical Industry Canada, LeSueur Memorial Award
2014 — D. Grant Allen (8T1, MASc 8T3)

Tissue Engineering International & Regenerative Medicine Society, Senior Scientist Award
2014 — Molly Shoichet

Tissue Enginering International & Regenerative Medicine Society, Young Investigator Award
2013 — Alison McGuigan (PhD 0T5)

U of T, Distinguished Professor in Global Engineering
2013 — Yu-Ling Cheng

U of T, Inventor of the Year Award
2013 — Milica Radisic
Molly Shoichet

U of T, President's Teaching Award
2015 — Greg Evans
(8T2, MASc 8T4, PhD 8T9)

U of T, University Professor
2014 — Molly Shoichet

U of T, Vivek Goel Faculty Citizenship Award
2015 — Douglas Reeve
(MASc 6T9, PhD 7T1)

Students

ChemE, Chemical Engineering Plant Design Award
2015 — Aqsa Arif (1T5)
Ishan Gupta (1T5)
Eric Han (1T4 + PEY)
Kim Naval (1T5)
Grant Robson (1T5)
Jerry Wang (1T5)

ChemE, Environmental Engineering Plant Design Award
2015 — Akmal Wasim
Mohamed Faizal (1T5)
Graeme Kirkness (1T5)
Meruyert Kobikova (1T5)
Kevin Saludares (1T5)
Feven Zemicael (1T5)
Maher Zghondi (1T5)

ChemE, Graduate Student Life Catalyst Award
2015 — Solmaz Tabtabaei (PhD 1T5)

ChemE, Sustainable Engineering Plant Design Award
2015 — John Cao (1T5)
Rohil Jaydeep (1T5)
Julian Lam (1T5)
Tiffany Lung (1T5)
Rosaline Tanugraha (1T5)

ChemE, Undergraduate Student Life Catalyst Award
2015 — Patrick Polvorosa (1T5)
Kevin Saludares (1T5)

CSChE, Chemical Engineering Local Section Scholarship
2015 — Carol Choi (1T5 + PEY)

CSChE, Robert G. Auld Technical Paper Competition (2nd place)
2014 — Manyi Zhao (1T4 + PEY)

CSChE, Robert G. Auld Technical Paper Competition (3rd place)
2014 — Yinan Xu (1T4 + PEY)

CSChE, Student Chapter Merit Award
2014 — U of T Student Chapter of CSChE

CSChE, Student Chapter Merit Award, Honourable Mention
2015 — U of T Student Chapter of CSChE

U of T, Gordon Cressy Student Leadership Award
2015 — Praneet Bagga
Ishan Gupta

U of T, Varsity Blues Achievement Award
2015 — Caitlin Laura Maikawa (1T6)
Oluwaseun Olutogun (1T8)
Nicole Lynn Parkes (1T7)

Thank You

Through the generous contributions of our many donors — who support prizes, scholarships and fellowships — we were able to present ChemE-specific awards to over 30 undergraduate and 20 graduate students during the 2014–15 academic year. A few examples of these awards include:

Sponsored Student Awards

Class of 5T9 Leaders of Tomorrow Award
Jason Martins (1T6)

Class of 8T2 Leaders of Tomorrow Award
Enakshi Shah (1T7)

Colcleugh Family Award
Nusrat Nowrin (1T5)
Yalun Li (1T6)
Minh Long Tran (1T7)
Nirali Patel (1T8)

Diran Basmadjian Graduate Scholarship in Chemical Engineering & Applied Chemistry
Douglass Duffy (MASc 1T3, PhD Cand.)

Dorothy Meldrum Szymaszek Student Exchange Fund
Madhushan Perera (1T6)

Eco-Tec Founder's Fellowship
Hanya Ettefagh (MASc Cand.)
Natalia Mykhayiova (PhD Cand.)

Edward Jarvis Tyrrell Fellowship
Jessica Wan-Yan Ngai (MASc Cand.)
Naomi Zimmerman (PhD Cand.)

ERCO Worldwide Leaders of Tomorrow Award
Haroon Dawood (1T6)
Jacqueline Murdock (1T5)

Frank Howard Guest Bursary
Mahbod Hajighasemi (PhD Cand.)
Mehdi Nouraei (MASc 1T3, PhD Cand.)

Helen L. Cross Memorial Award
Zahra Choolaei (PhD Cand.)
Fakhria Muhammad Razeq (MASc Cand.)

Irving O. Shoichet Graduate Scholarship
Nimalan Thavandiran (MASc 1T2, PhD Cand.)
Yun Xiao (PhD Cand.)

Professor Doug Reeve Leaders of Tomorrow Award
Nimalan Thavandiran (MASc 1T2, PhD Cand.)

Professor James W. Smith Leaders of Tomorrow Award
Oluwatobi Edun (1T7)

Professor William F. Graydon Memorial Graduate Fellowship
Douglass Duffy (MASc 1T3, PhD Cand.)

R. W. Missen Memorial Prize in Thermodynamics
Sarah Abdul Ghani (1T4 + PEY)

Troost Family Leaders of Tomorrow Award
Maher Zghondi (1T5)

W. H. Rapson Memorial Award
Sara Eskandarifar (MASc Cand.)
Isabel Sofia Bonilla Toba (PhD Cand.)

William J. Dowkes Graduate Bursary
Eric Jin (PhD Cand.)
Jon Albert Obnamia (PhD Cand.)

In Memoriam

It is with regret that we have learned of the passing of the following ChemE graduates since the last issue of Interfaces in Spring 2013.

—

John E. Akitt (5T6)
January 23, 1933 – June 3, 2014

Kenneth F. S. Allen (5T6)
May 26, 1933 – December 30, 2013

John W. Anderson (4T6)
May 28, 1923 – June 30, 2014

Arthur S. Ashton (4T9)
October 27, 1920 – September 23, 2013

J. A. B. Athey (5T5)
November 6, 1926 – October 6, 2014

Allen S. Berg (7T1)
January 1, 1948 – April 17, 2015

George Bethlendy (7T1)
September 26, 1919 – October 16, 2013

Donald B. Black (5T3)
April 10, 1931 – January 26, 2015

Eric E. Bonham (4T2)
June 18, 1918 – November 25, 2013

Hugh G. Brandford (6T2)
January 13, 1935 – May 7, 2014

Alexander Brown (5T3)
June 4, 1925 – May 23, 2015

Munroe G. A. Burton (5T2)
July 4, 1929 – December 8, 2014

William A. Campbell (4T9)
November 8, 1925 – May 6, 2013

Richard P. Chepak (6T7)
August 26, 1944 – November 4, 2013

Basil Clark (4T0)
October 3, 1918 – September 28, 2013

Carlton G. Corson (4T9, MASc 5T0)
June 30, 1921 – October 7, 2014

Kenneth R. Coulter (4T4)
August 13, 1922 – March 4, 2014

Ardeshir R. Dastur (5T8, MASc 6T0)
November 2, 1935 – February 1, 2014

Howard A. Dube (4T9)
November 17, 1917 – January 29, 2015

Brian Dunk (6T9)
August 12, 1947 – July 31, 2015

Robert L. Edmonds (4T9)
February 29, 1920 – July 20, 2013

Robert W. Edmunds (5T0, MASc 5T1)
December 26, 1923 – June 22, 2014

Robert E. Ella (5T3)
March 31, 1931 – October 25, 2014

Lorne R. Farquhar (4T7)
March 4, 1925 – May 6, 2013

Alexander D. Fisher (3T7)
February 24, 1915 – January 13, 2015

Peter A. Fraser (7T0)
January 22, 1947 – November 19, 2014

Roy Y. Fujii (5T5)
August 12, 1926 – November 12, 2014

Robert Greven (5T6)
October 3, 1933 – May 20, 2015

Gerald L. Grierson (6T3)
March 7, 1941 – October 3, 2013

Orley G. Gunby (4T3)
April 7, 1921 – November 27, 2014

Stanley R. Hatcher (5T8)
August 20, 1932 – November 30, 2014

John C. Henshaw (5T3)
D.O.B. unknown – February 28, 2014

James T. Horn (4T9)
April 14, 1925 – June 19, 2015

James F. Hudgins (5T2)
July 3, 1930 – September 16, 2014

Frank H. Hueston (5T4)
July 30, 1930 – November 13, 2013

Robert E. Huggard (5T0)
August 22, 1927 – April 27, 2015

Barrie W. S. Jackson (5T4)
March 16, 1932 – August 20, 2013

Sydney Jacobs (4T7)
September 28, 1925 – November 29, 2014

Ronald W. Johnson (5T9)
July 1, 1936 – August 1, 2014

M C. Kaufman (4T5)
January 19, 1923 – January 9, 2014

Norman L. Kelly (4T8, MASc 5T0)
March 9, 1926 – January 1, 2015

Frank Kubath (3T8)
October 13, 1914 – September 18, 2014

Claire J. Lamont (4T3)
May 21, 1921 – November 22, 2014

R. C. Lister (5T6)
February 10, 1933 – August 17, 2013

Edward L. Littlejohn (4T9)
September 21, 1927 – May 4, 2013

Donald E. Loudon (4T9, MASc 5T1)
April 2, 1924 – March 4, 2014

George F. Lowrie (4T6)
June 2, 1923 – November 30, 2013

Vernon T. Mack (4T3)
March 12, 1922 – January 21, 2015

Joseph E. Mah (4T4)
November 20, 1914 – October 10, 2014

Eva Mansfield (7T0)
June 8, 1946 – May 2, 2015

Edward E. Martyn (4T8)
December 24, 1925 – August 14, 2013

Saulius A. Masionis (6T6)
March 20, 1943 – October 21, 2013

Graham W. Mitchell (4T8)
August 28, 1920 – July 26, 2015

Keith Mowat (5T3)
June 27, 1930 – September 23, 2013

Paul Paliyenko (5T3, MASc 5T4)
July 26, 1929 – May 7, 2013

Ernest G. Philip (5T3)
November 15, 1929 – September 16, 2013

Richard J. Roberts (5T5)
June 14, 1933 – July 9, 2014

Richard A. Robertson (4T9)
May 10, 1926 – February 1, 2015

Archie M. Robison (4T8)
November 6, 1921 – March 8, 2015

David M. Rogers (5T5)
June 6, 1933 – July 17, 2013

Robert W. Rogers (4T9)
November 7, 1918 – February 22, 2014

Robert G. Rumball (5T2)
May 4, 1930 – March 14, 2015

John R. Shaw (3T7)
October 31, 1914 – September 18, 2014

John R. Sinclair (4T9)
July 27, 1926 – May 19, 2015

John T. Sinclair (4T9)
October 29, 1926 – August 26, 2014

Clarence E. Sloan (4T2)
February 26, 1920 – November 13, 2013

Orville C. Smith (3T7)
June 29, 1914 – May 5, 2014

Edward H. Snider (4T9)
May 9, 1926 – July 24, 2013

William R. Stadelman (4T1)
July 18, 1919 – August 14, 2013

Donald A. Stewart (5T0)
April 5, 1927 – October 9, 2013

Alexander K. Stuart (4T7)
October 11, 1924 – December 20, 2014

William J. P. Sullivan (6T9)
November 2, 1946 – August 9, 2014

John A. Swan BASC (4T8)
February 3, 1926 – October 10, 2014

Philip A. Thomas (6T5)
April 5, 1943 – May 24, 2014

Edward J. Toal (5T5)
October 9, 1931 – November 19, 2014

Gregory G. Vance (8T1)
January 20, 1957 – September 4, 2014

Allan D. Watson (5T0)
October 2, 1928 – May 31, 2015

John A. Wickett (3T9)
October 11, 1914 – September 18, 2014

Upcoming Events

For information on upcoming events visit chem-eng.utoronto.ca

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