

Skulematters

THE NEXT WAVE OF WORLD-CLASS RESEARCH

Meet eight engineering professors who are creating a cleaner, safer and better world

BUILDING A FOUNDATION FOR SUCCESS

How four alumnae transferred their engineering competencies into careers in law, academia and corporate leadership

THE RISE OF ELSIE MACGILL

Remembering the U of T alumna who was the world's first female aircraft designer

WOMEN IN ENGINEERING

A tradition of
excellence



Skulematters

ALUMNI MAGAZINE 2015

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GET INVOLVED. STAY CONNECTED. MAKE A DIFFERENCE.

Alumni are integral to helping us foster the next generation of global engineering leaders, while maintaining our status as the best engineering school in Canada. Whether you are looking for opportunities to volunteer your time, contribute to a fundraising campaign or lend your expertise, there are a variety of ways you can leave your mark at Skule™:

- Donate to Boundless: The Campaign for the University of Toronto
- Make a gift to the Centre for Engineering Innovation & Entrepreneurship
- Join the Skule™ Society (Leadership Giving)
- Hire or mentor a student
- Volunteer at a variety of alumni events

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ON THE COVER:

Alumna Elsie MacGill during her time as chief aeronautical engineer at the Canadian Car and Foundry Company (Can-Car).

PHOTO/CANADA AVIATION AND SPACE MUSEUM LIBRARY AND ARCHIVES 16035

A Message from Dean Cristina Amon

It is my privilege to present the 2015 issue of *Skulematters*, the alumni magazine of the Faculty of Applied Science & Engineering.

In this unique issue, we turn the spotlight onto the achievements of women in our U of T Engineering community, past and present. Their stories are inspirational and show the tremendous progress we have made toward increasing diversity within our profession. However, women still account for fewer than 12 per cent of all professional engineers in Canada¹.

Diversity is not only proven to positively impact business outcomes², it deepens the engineering creative process, enhances the student experience and enriches the profession with new perspectives and ideas. There has never been a more important time to acknowledge the critical role diversity plays in driving innovation, which is at the heart of our profession.

The theme of this issue is timely given the extraordinary milestones our Faculty has celebrated over the past year. In 2014, we attracted a record number of applications for our undergraduate programs and admitted the most academically accomplished and diverse first-year class in our history. Women comprised nearly one-third of those entering students — the highest proportion of any first-year engineering class in Canada — and now make up more than one-quarter of both our undergraduate and graduate populations. We are committed to further increasing the diversity of our student body through strategic outreach, and will work diligently to ensure these positive trends will continue.

Our faculty complement is also becoming more diverse. The number of women professors has doubled since 2006, one-quarter of our associate professors and nearly one-third of our assistant professors are also women. In this issue, we feature eight of those professors, each of whom is making an impact with her groundbreaking research (**page 20**).

We also highlight the accomplishments of four alumnae who are innovators and leaders in engineering, business and beyond (**page 28**). Their work speaks to the vibrancy of our U of T Engineering community and the influence our graduates have across many disciplines in addressing global challenges and enriching lives.

As women enter U of T Engineering in record numbers, we must reflect on those who carved a path toward greater diversity in applied sciences and engineering. Our cover story (**page 14**) provides a glimpse into the remarkable life of **Elsie MacGill** (ElecE zT7), who was the first woman to graduate from U of T with an engineering degree and the first Canadian woman to earn a degree in electrical engineering. Nicknamed “Queen of the Hurricanes,”



MacGill continued to blaze trails throughout her life as the world's first female aircraft designer, a leader in Canadian aircraft production during the Second World War and an advocate for women's rights.

MacGill exemplified the qualities of a good engineer: creativity, logical thinking, adaptability and perseverance. At U of T Engineering, these qualities drive our commitment to nurture the creator, maker and innovator in each of our students and prepare them to be global engineering leaders.

Thanks to the unwavering support of our entire U of T Engineering community, including alumni like you, we took a giant leap forward in June 2015 by breaking ground on the Centre for Engineering Innovation & Entrepreneurship (CEIE). When it opens in 2017, the CEIE will offer one of the finest learning and research environments available at any engineering school in the world.

I encourage you to share the stories of women you read about in this issue. Let them inspire all of us to make diversity a priority in our daily lives and leadership decisions. Share them with children who love math and science and help them reimagine their role models. If each of us commits to one small but ongoing change, just imagine the positive transformation that we can achieve together.

Cristina Amon
Dean

¹ *Engineers Canada (2013) Canadian Engineers for Tomorrow: Trends in Engineering Enrollment and Degrees Awarded, 2009–2013*

² *Catalyst (2013) Why Diversity Matters. http://www.catalyst.org/system/files/why_diversity_matters_catalyst_0.pdf*

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The first woman to graduate from U of T with an engineering degree would go on to change the country's social, economic and legal fabric.



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Triple engineering graduate Angela Tran Kingyens has helped to establish a community of alumni in the San Francisco Bay Area.

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Skule™ in Photos



Ron Venter (MIE) speaks to attendees at the CEIE groundbreaking reception in the Bahen Centre for Information Technology.

CEIE Groundbreaking Ceremony June 24, 2015

U of T Engineering alumni, faculty, students and staff gathered to celebrate the groundbreaking of the Centre for Engineering Innovation & Entrepreneurship (CEIE).

PICTURED/ (L-R): ERNESTO DÍAZ LOZANO PATIÑO (YEAR 4 CivE), ENGINEERING SOCIETY PRESIDENT (2015–2016); RON VENTER (MIE), PROFESSOR EMERITUS AND CHAIR OF PROJECT PLANNING COMMITTEE; JUDY GOLDRING, CHAIR OF GOVERNING COUNCIL; MERIC GERTLER, PRESIDENT OF THE UNIVERSITY OF TORONTO; THE HONOURABLE MICHAEL WILSON, CHANCELLOR; CRISTINA AMON, DEAN; GEORGE MYHAL (IndE 7T8), CHAIR OF THE CAMPAIGN EXECUTIVE COMMITTEE AND MAURICIO CURBELO (CivE 1T4), ENGINEERING SOCIETY PRESIDENT (2013–2014).



The Blue Sky Solar Racing solar car on display at the outdoor ceremony.

See page 6 for ways that the CEIE will directly support alumni.



Annual Dean's Dinner

October 24, 2014

Innovation and entrepreneurship were the themes of the 2014 Annual Dean's Dinner at the Faculty Club. The evening celebrated the Faculty's top donors while shining the spotlight on students from U of T Engineering's Entrepreneurship Hatchery. **PICTURED/** (L-R): BARBARA AND FRANK MILLIGAN (MechE 4T8); DEAN CRISTINA AMON; FLORENCE AND SYDNEY COOPER (CivE 4T5); GERALD (MMS 4T3) AND GERALDINE HEFFERNAN. **PHOTO/** GUSTAVO TOLEDO

1

Spring Reunion

May 30, 2015

Spring Reunion 2015 celebrated graduating classes with years ending in 0 or 5. From exhibits and lectures to departmental lunches and dinners, Skule™ grads of all ages found eclectic ways to spend their weekend at the St. George campus. **PICTURED A/** (L-R): LAURI (ElecE 6T5) AND JEAN HIVALA, CELEBRATING HIS BIRTHDAY AT HIS 50TH REUNION. **PHOTO/** MICHAEL TENAGLIA
 Alex King (ElecE 3T5) was presented with a medal celebrating 80 years since his graduation at this year's Chancellor's Circle Medal Ceremony. **PICTURED B/** (L-R): DEAN CRISTINA AMON; CLAIRE KING; ALEX KING; BILL KING AND HELEN MORGAN OUTSIDE OF CONVOCATION HALL.

4

EAA Hong Kong Chapter Holiday Party

November 27, 2014

Alumni and friends celebrated the holiday season at the residence of J. Ian Burchett, the Consul General of Canada in Hong Kong and Macao. **PICTURED A/** (L-R): MATTHEW YUM (IndE 8T1); KATHERINE KOH (ChemE 9T2); JOHN LO (ChemE 9T2); EDDIE TAM (ElecE MASC 9T0); ANNA LAM; AND ANDREW LO (MechE 9T0). **PICTURED B/** (L-R): ANDREW SIT (ElecE 9T6 + PEY); RICHARD LIN (ElecE 9T5); STACEY LOWE; GIMMY CHU (ElecE 0T6); AND SUNNY HAN. **PHOTOS/** DANNY NG

2

BizSkule Calgary

June 4, 2015

U of T Engineering hosted its first ever BizSkule event in Calgary this year. "Enterprising Engineers: Knowing When and How to Embrace Opportunity" featured a panel of engineers who built successful businesses in environmental services, estate wine making and the high-performance sports market. **PICTURED/** MODERATOR AND PANNELISTS (L-R): CLAIRE KENNEDY (ChemE 8T9); JIM WYSE (CivE 6T1); TERRY GUDZOWSKY (GeoE 7T6); AND AUDREY MASCARENHAS (ChemE 8T2). **PHOTO/** TOM DE HAAS

5

Parents & Alumni Reception in Dubai

December 1, 2014

Alumni and parents of U of T Engineering students joined Dean **Cristina Amon** at the Fairmont Hotel's Gulf Auditorium for the first Skule™ gathering of its kind held in Dubai. **PICTURED/** (L-R): PAUL CADARIO (CivE 7T3); ARIF LALANI, CANADA'S AMBASSADOR TO THE UNITED ARAB EMIRATES; AND DEAN CRISTINA AMON. **PHOTO/** GRANT BISHOP

3

Young Alumni Reception

June 8, 2015

Toronto's Steam Whistle Brewery hosted alumni from the classes of 0T0, 0T5, 1T0 and 1T5 for an evening of networking, beer, poutine and brewery tours. **PICTURED/** (L-R): IYIOPE JIBODU (ChemE 0T8); ANDREW FORDE (MSE 1T1, IndE PhD CANDIDATE); AND MICHAEL BOSOMPRA (MechE 1T0). **PHOTO/** TOBIAS WANG

6

Class of 9T5 Reunion Picnic

June 20, 2015

Alumni from the class of 9T5 and their families enjoyed an afternoon of great food, fond memories and children's activities in the Galbraith Building Quad. **PICTURED/** (L-R): MAURO DE FRANCO (CivE 9T5) AND TONY CRIMINISI (ChemE 9T5). **PHOTO/** TOBIAS WANG

7

Visit uoft.me/skule-events to keep your alumni event calendar full.



CEIE: Your home on campus

When it opens in 2017, the Centre for Engineering Innovation & Entrepreneurship (CEIE) will nurture multidisciplinary collaboration and encourage spontaneous interaction on every floor. Here are five ways you can benefit from the 15,000 square metres of space, facilities, centres and institutes at the CEIE.

1 WORLD-CLASS AUDITORIUM

A 500-seat interactive auditorium on the first and second floors will be a marquee facility designed to optimize audience engagement. The auditorium will be wired with the latest technology, and will include features to encourage collaborative and active learning. When not in use for academic purposes, the space will be available for alumni to book through Academic and Campus Events for product launches, keynote addresses or other engagements.

2 INDUSTRY PARTNERSHIPS

The CEIE will feature some of U of T's recently launched premier research centres and institutes throughout the top four floors — giving industry partners access to some of the most innovative minds in robotics, global engineering, sustainable energy, water innovation and more. More than 300 companies already benefit from industry partnerships with U of T Engineering.

To get a head start, contact Jason Chang, Director of Foundation & Corporate Partnerships, at jason.c.chang@utoronto.ca or 416-978-7890 or Illan Kramer, Director of Corporate, Government & International Partnerships, at illan.kramer@utoronto.ca or 416-978-6990.

3 MENTORSHIP OPPORTUNITIES

The Entrepreneurship Hatchery is an opportunity for you to get involved with Canada's next great student-driven startup. In its new home on the sixth floor, the Hatchery will supply an excellent venue for mentorship opportunities with founders and CEOs, venture capitalists and other professionals.

The Institute for Leadership Education in Engineering (ILead) on the seventh floor will offer many volunteer opportunities for Skule™ alumni who are in upper management. ILead offers courses, certificates and co-curricular activities to help students excel as emerging leaders. Visit ilead.engineering.utoronto.ca for more information.

4 SPACES FOR CELEBRATION AND SOCIAL ENGAGEMENT

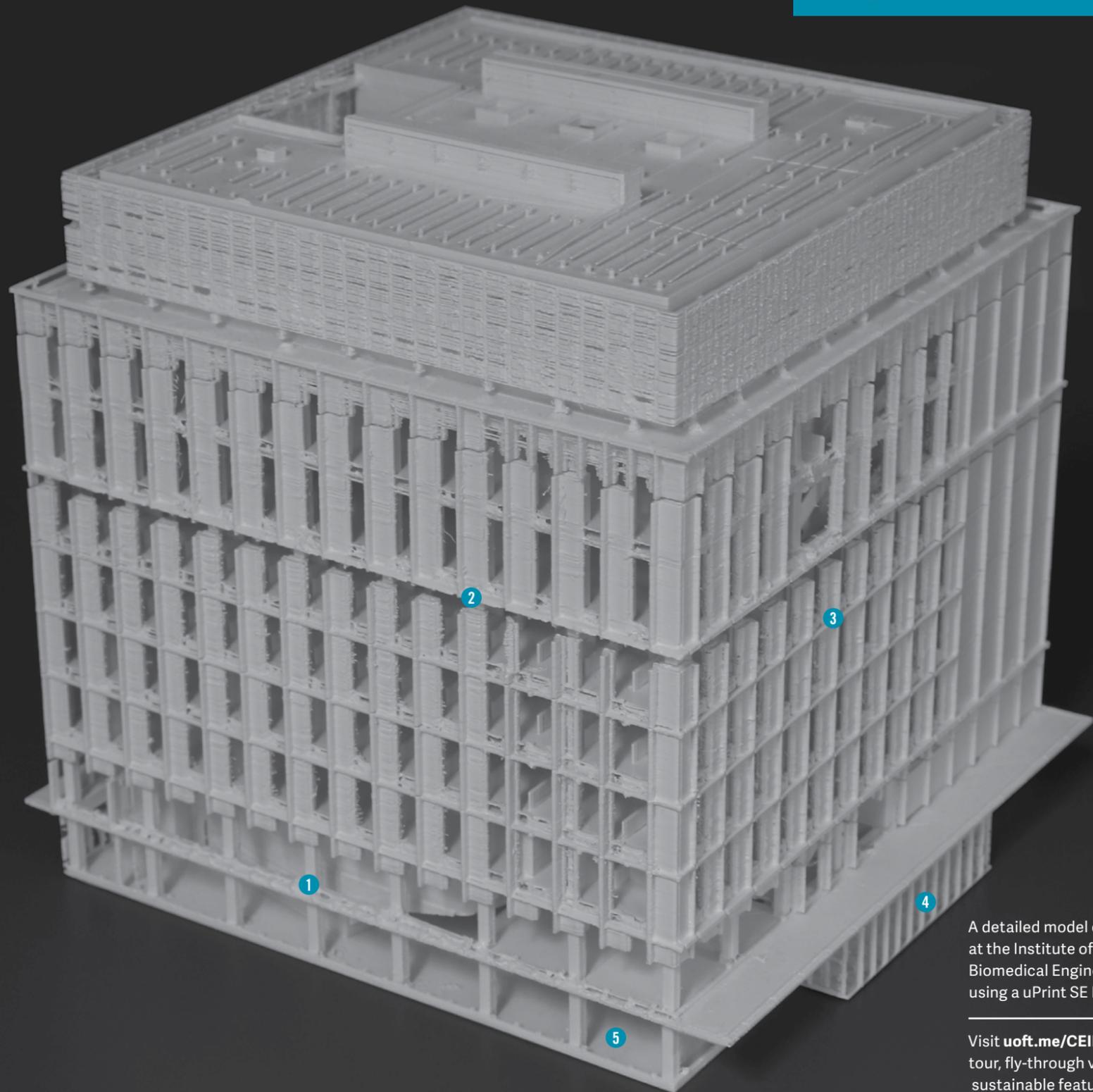
The CEIE will offer multiple open spaces for alumni to socialize with faculty and students. The main entrance of the CEIE will provide a light-filled space for gathering and celebration. A unique atrium on the fifth floor will provide a dramatic event space, and an open-air terrace on the eighth floor will offer a spectacular view of U of T's iconic front campus.

5 INTERACT WITH STUDENTS

Become inspired by the next generation of makers and creators. A versatile space in the lower level will house flexible facilities that will directly serve the requirements of the Faculty's student clubs.



FAST FACT: The CEIE will be the Faculty's 17th building. The spirit of U of T Engineering was born in 1873 with the School of Practical Science — also known as the "Little Red Schoolhouse."



A detailed model of the CEIE printed at the Institute of Biomaterials & Biomedical Engineering Design Studio using a uPrint SE Plus 3D printer.

Visit uoft.me/CEIE for a floor-by-floor tour, fly-through video, overview of sustainable features and more.

Entrepreneurship News

The innovators and makers of U of T Engineering

Point, click and learn

Attollo Social Enterprise, a startup by four U of T alumni, has developed a handheld device and “talking stickers” as a way to help underprivileged children improve cognitive skills. The stickers feature illustrations of familiar objects and come with pre-programmed quick response (QR) codes that are activated by a simple, low-cost reader with playback and recording functions. Parents and caregivers can customize the stickers to talk, sing and read in any language. The innovation earned the team, which includes U of T engineers **Aisha Bukhari** (ElecE oT8) and **Peter Cinat** (CompE oT2), an opportunity to compete for \$1 million at the Hult Prize global final in New York City this fall.



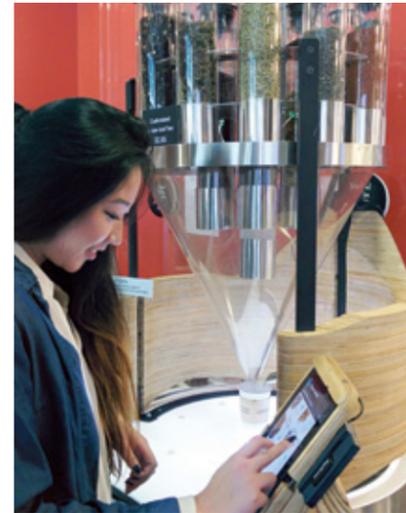
PHOTO/ COURTESY OF ONYX MOTION

Slam-dunk fitness app

Onyx Motion, a U of T startup co-founded by **Marissa Wu** (EngSci 1T3), recently partnered with NBA shooting guard Ben Gordon to help promote Swish — the world’s first digital basketball coaching app. The app uses smartwatch motion sensors to analyze a player’s technique and offers tips on how he or she can improve. Wu said the Swish app is only the first part of Onyx Motion’s plan to move into other sports and industries where kinesthetic learning is key.

Turn on the lights

OTI Lumionics, a company co-founded in 2011 by **Michael Helander** (EngSci oT7, MSE PhD 1T2), was awarded \$5.7 million this year from Sustainable Development Technology Canada to implement a pilot production line capable of producing high volumes of organic light-emitting diode (OLED) lighting panels. OTI Lumionics’ inaugural product — *aerelight*, the world’s first OLED table lamp — was launched to market in 2014.



PHOTO/ COURTESY OF TEABOT

Spot o’ teaBOT

A new startup from **Rehman Merali** (AeroE PhD candidate) enables tea lovers to make a personalized cup of tea from a beverage-wielding robot in 30 seconds or less. Aptly named teaBOT, a prototype was launched in 2013 through Rotman School of Management’s Creative Destruction Lab, and is now part of the JOLT business incubator at the MaRS Discovery District.

Entrepreneur **Francis Shen** (AeroE MASc 8T3) recently established a new entrepreneurial incubation program called UTIAS Start, which backed teaBOT with a grant of \$25,000 earlier this year. The project has been successfully piloted at U of T’s downtown campus, Harry Rosen stores and at the MaRS Discovery district.

Do you have a startup, spinoff or remarkable innovation to share with your Skule™ community? Email skulealumninews@ecf.utoronto.ca with details, and visit uoft.me/engineering-entrepreneurship for more entrepreneurship news.

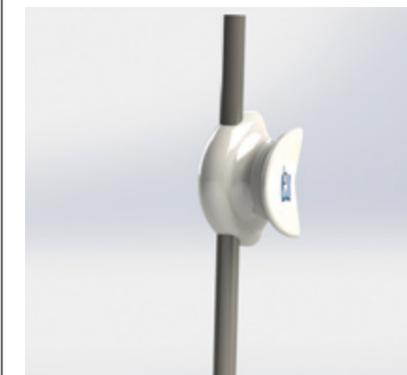
Mopping up the competition

Through The Entrepreneurship Hatchery, U of T Engineering’s startup incubator, **Jeremy Wang, Shuyi Wu, Ryan Williams** and **Noah Yang** (all Year 3 EngSci students) developed PowerWring, a simple device that allows a mop handle to clip on to a wringer handle. PowerWring enables the user to apply force using large upper-body muscles in a completely upright posture, saving time and reducing the risk of back injuries. Earlier this year, the team received word its application for a full patent was officially under review at the United States Patent and Trademark Office — a first for the Hatchery. The innovation also won the team the \$2,500 Orozco Prize at the Hatchery’s Demo Night last year.



Stick-on life optimization

The Magni is the flagship product of Magniware, a Toronto-based startup. It’s designed to sit on the surface of skin and collect detailed physiological data that can help wearers monitor and improve their health. Developed by co-founders **Miles Montgomery** (BioMedE PhD candidate) and fellow U of T student Alex Mosa in 2014, the Magni is a savvy mix of novel chemistry, nano-scale design and electrical and computer engineering. The technology is currently being used by high-performance athletes and rehabilitation researchers.



PHOTO/ COURTESY OF POWERWRING



Hydrogen-powered transport

Ashrith Domun (Year 4 ChemE) understands there is an urgent need to demonstrate the importance of sustainability. Last year, he and his co-founders brought Hydron through U of T Engineering’s Entrepreneurship Hatchery. The company has developed a green business model that outlines the many benefits to fostering hydrogen fuel cell technology on a large scale, including heavy commercial transportation. Hydron has already tested the commercial viability of their plan with a proposal for the shuttle bus service between U of T’s Mississauga and St. George campuses.

Connecting on the nano-scale

Brandon Chen (MechE PhD 1T3) has developed a four-armed robotic manipulator to automate and accelerate testing of the nano-sized integrated circuits within a computer chip. Chen’s company, Toronto Nano Instrumentation Inc., is already attracting the attention of leading semiconductor manufacturers with purchase orders in the queue.



PHOTO/ COURTESY OF BRANDON CHEN

Awards

U of T Engineers continue to earn more awards and honours than faculty at any other Canadian engineering school. We are tremendously proud of all members of the U of T Engineering community who were lauded for their accomplishments this year.

Selected Faculty Awards

Highlights

Cristina Amon (MIE)

Amon received an Ontario Professional Engineers Gold Medal, the province's most prestigious engineering honour, recognizing public service, technical excellence and outstanding professional leadership.

Natalie Enright Jerger (ECE)

Enright Jerger was one of only eight recipients from Canadian universities to receive a Sloan Research Fellowship in 2015, for discovering more efficient ways for on-chip networks to communicate.

Paul Santerre (IBBME, Dentistry)

Santerre received the Principal Award from the Ernest C. Manning Awards Foundation for his technology to reduce blood clotting from medical devices.

Michael Sefton (ChemE, IBBME)

Sefton was invited to join the National Academy of Medicine this year — a rare honour bestowed upon few Canadian scientists and engineers.

Edward (Ted) H. Sargent (ECE)

Sargent, professor and vice-dean, research, was appointed University Professor. This is U of T's highest academic rank, recognizing exceptional scholarly achievement and pre-eminence in a particular field of knowledge.

Awards

American Institute of Steel Construction

Lifetime Achievement Award
Peter Birkemoe (CivE)

Canadian Academy of Engineering

Fellow
Kamran Behdinin (MIE)
Greg Evans (ChemE)
Vladimiro Papangelakis (ChemE)
Michael Sefton (ChemE, IBBME)
Jim Wallace (MIE)

Canadian Society for Mechanical Engineering

C.N. Downing Award
Kamran Behdinin (MIE)

Fellow
Lidan You (MIE)

Jules Stachiewicz Medal
Sanjeev Chandra (MIE)

Engineers Canada

Medal for Distinction in Engineering Education
Jonathan Rose (ECE)

Institute of Electrical and Electronics Engineers

Control Systems Award
Bruce Francis (ECE)

Government of Ontario

Early Researcher Awards
Birsen Donmez (MIE)
Alis Ekmekci (UTIAS)
Rodrigo Fernandez-Gonzalez (IBBME)

Natural Sciences and Engineering Research Council of Canada

E.W.R. Steacie Fellowship
Wei Yu (ECE)

Royal Society of Canada

Fellow
Edward (Ted) H. Sargent (ECE)
Peter Zandstra (IBBME)

Society of Plastics Engineers

Fellow
Hani Naguib (MIE, MSE)

University Health Network

Inventor of the Year Award
Milos Popovic (IBBME)

U of T Distinguished Professors

Digital Communications
Frank Kschischang (ECE)

Microcellular Engineered Plastics
Chul Park (MIE)

Urban Systems Engineering
Mark Fox (MIE)

U of T Inventor of the Year Award

Parham Aarabi (ECE)
Richard Cobbold (IBBME, ECE)
Hugh Liu (UTIAS)

U of T President's Teaching Award

Greg Evans (ChemE)

Selected Undergraduate Student Awards

Canadian Engineering Memorial Foundation

Engineering Ambassador Scholarship
Samantha Stuart (Year 2 MSE)

Minerva Canada

James Ham Safe Design Award
Iman Chalabi (Year 3 ElecE)

John W. Senders Award

Imaginative Design
Qian Liu (Year 4 EngSci + PEY)
Kaiyin Zhu (Year 4 EngSci + PEY)

Schulich Leader Scholarship

Quinton Lowe (Year 1 EngSci)

U of T Gordon Cressy Student Leadership Award

Amanda Aleong (Year 4 EngSci)
Praneet Bagga (Year 4 ChemE + PEY)
Ivan Damnjanovic (Year 4 CivE + PEY)
Nicole D'Mello (Year 4 CivE + PEY)
Marissa Goldsmith (Year 4 IndE + PEY)
Ishan Gupta (Year 4 ChemE + PEY)
Piyush Gupta (Year 4 CompE + PEY)
Mehran Hydary (Year 4 ElecE + PEY)
Eric Ma (BiomedE 1T3, MAsc 1T5 Candidate)
Cassandra Rosen (Year 4 EngSci + PEY)
Amanda Santos (Year 4 MechE)
Kimberly Shen (Year 4 CompE)
Ananya Tandon-Verma (Year 4 IndE + PEY)
Gordon Tang (Year 4 IndE + PEY)
Vinson Truong (Year 4 MSE + PEY)
Alice Ye (Year 4 EngSci + PEY)

Selected Alumni Awards

Canadian Academy of Engineering Fellow

Pu Chen (MIE MAsc 9T3, PhD 9T8)
Anne Sado (IndE 7T7)

Honorary Fellow
Norbert Morgenstern (CivE 5T6)

Engineers Canada

Award for the Support of Women in the Engineering Profession
Samantha Espley (MinE 8T8)

Governor General's Academic Gold Medal

David Zhitomirsky (ECE PhD 1T5)

U.S. National Academy of Engineering

Member
David Yao (IndE MAsc 8T1, PhD 8T3)

MIT Technology Review

Top 35 Innovators Under 35
David He (ElecE 0T5)

Ontario Professional Engineers Awards

Citizenship Award
Claire Kennedy (ChemE 8T9)

Engineering Excellence Medal
Jeanette Southwood (ChemE 8T6, MAsc 8T8)

Management Medal
Michael Butt (CivE 6T3)

University of Toronto Honorary Doctorate

Alfred Aho (EngPhys 6T3)

Selected Graduate Student Awards

2014 James Dyson Award

Arianna McAllister (BioMedE MAsc Candidate)
Lian Leng (MechE MAsc 1To, PhD Candidate)

Vanier Canada Graduate Scholarships

Miles Montgomery (BioMedE PhD Candidate)
Cameron Ritchie (CivE PhD Candidate)
Shrey Sindhwani (BioMedE PhD Candidate)
Lorraine Sugar (CivE PhD Candidate)

2015 Engineering Alumni Association (EAA) Awards

Engineering Alumni Medal

The EAA's highest honour, this award recognizes outstanding achievement, superior accomplishments and flair, and excellence in response to challenges.



Frank Dottori

(ChemE 6T3)
Frank Dottori, president of FADCO Consulting Inc., held

a wide range of positions in both the mining and forest-products industries during his career. He co-founded Tembec Inc. in 1973, which went on to become a large global forest-products company with 55 mills throughout the Americas and Europe, and

assets of approximately \$4 billion. He retired as CEO in January 2006. Throughout his career, Dottori served on numerous industry-related associations including as chairman of the Canadian Pulp and Paper Association, vice-chair of Habitat of Humanity Canada and advisor on the David Suzuki National Business Advisory Board. He received the Order of Canada in 1989.

2015 EAA Awards (continued)

Engineering Alumni Hall of Distinction Award

The EAA is proud to present this assembly of extraordinary alumni selected by their peers for their lifelong accomplishments. Commemorated in a display in the Sandford Fleming Building, Hall of Distinction members are a familiar daily presence in the lives of students and serve as examples to future generations of U of T engineers.



William Breukelman
(ChemE 5T5)
William Breukelman is a successful entrepreneur

and engineer with over 57 years of Canadian and international leadership experience. A pioneer and visionary in imaging businesses, he was a co-founder and past chair of IMAX Corporation, co-founder and past president of AB Sciex Ptd. Ltd. and president of Fischer & Porter Company (now part of ABB). He is currently chair and principal of Business Arts Inc. and founder and director of other cutting-edge imaging ventures. Breukelman was recently appointed as an Officer of the Order of Canada, and received the Queen Elizabeth II Diamond Jubilee Medal, recognizing his long-term entrepreneurial service and achievements to Canada and globally.



Jan Carr
(ElecE 6T8)
Jan Carr has 42 years of experience in the electricity sector as

a professional engineer, holding senior positions in the design and planning of electricity transmission and distribution systems. He was CEO of the Ontario Power Authority from 2005 to 2008. Prior to that, he was vice-chair of the Ontario Energy Board during its transition from a government department to a self-funding independently operated tribunal. He received an honorary degree from the University of Waterloo in 2010 and was inducted as a fellow into the Canadian Academy of Engineering in 2012.



Jay Cross
(EngSci 7T5)
Jay Cross has over 30 years of experience in real estate and

business. He is president of Related Hudson Yards, where he leads financing, planning and construction efforts of the 28-acre Hudson Yards development on the west side of Manhattan. Cross was formerly president of the New York Jets and president of business operations for the Miami Heat. An accomplished sailor, he has been a member of three Canadian Olympic teams.



Emil Frind
(CivE 6T6, MechE MSc 6T7, CivE PhD 7T1)
Emil Frind's background in

engineering combined with his interest in water resources put him on the leading edge of the emerging field of quantitative groundwater science. In 1971, he joined the University of Waterloo's Department of Earth Sciences as a core member of its newly established groundwater group. Most recently, Frind collaborated with the Regional Municipality of Waterloo in developing a strategy for the sustainable use of local groundwater as a drinking water source, saving taxpayers the billion-dollar cost of a Great Lakes pipeline. Frind remains active as a distinguished professor emeritus at the University of Waterloo.

2T5 Mid-Career Achievement Award

Celebrates an individual who has earned respect within the profession and broader community and attained significant achievement within 25 years of graduation.



Janet Elliott
(EngSci 9T0, MechE MSc 9T2, PhD 9T7)
Janet Elliott is a professor and Canada

Research Chair in Thermodynamics in the Department of Chemical and Materials Engineering at the University of Alberta. She currently serves on the editorial board of the journal *Cryobiology* and has been recognized for excellence in research and teaching throughout her career. In 2015, she was named a fellow of the Chemical Institute of Canada and in 2002, *Time* magazine recognized her accomplishments in an article titled, "Canadians Who Define the New Frontiers of Science."



Suneet Singh Tuli
(CivE 9T0)
Suneet Singh Tuli is the co-founder and CEO of DataWind Inc.,

with a mission of bridging the digital divide by breaking the affordability barrier. In 2012, *Forbes* magazine recognized Tuli in its "Impact 15" list, a group of education innovators using technology to revolutionize the classroom. With 25 years of experience as a serial entrepreneur, DataWind's TSX listing represents the third IPO of his career. DataWind has been recognized by the *MIT Technology Review* as among the world's 50 smartest companies in 2013.

7T6 Early Career Award

Recognizes individuals who have become distinguished in their profession and community within 10 years of graduation.



Stefanie Blain-Moraes
(EngSci 0T5, BioMedE PhD 1T0)
Since 2012, Stefanie Blain-Moraes has been

working on electroencephalogram (EEG) assessment and monitoring of consciousness and cognition as a Canadian Institutes of Health Research postdoctoral fellow at the University of Michigan and McMaster University. Her primary areas of interest centre on developing technologies that enhance the lives of individuals who are unable to move or speak. She is currently developing a technology called "biomusic," which converts the physiological signals of unresponsive individuals into musical output.



Todd Reichert
(EngSci 0T5, AeroE PhD 1T1)
In 2012, Todd Reichert and **Cameron**

Robertson (EngSci 0T8, AeroE MSc 0T9) co-founded AeroVelo Inc., a company that has focused on using human-powered vehicles as a teaching platform to demonstrate innovative and creative engineering and challenge perceptions of what is possible. In 2010, Reichert and Robertson led a team of engineering students into the history books of aviation with the first sustained flight of a human-powered flapping-wing aircraft. Three years later, they achieved what many had thought to be impossible with the prize-winning flight of the Atlas human-powered helicopter.

Malcolm F. McGrath Alumni Achievement Award

Recognizes contributions to the Faculty, University or community, in honour of Malcolm McGrath, past Assistant Dean, Alumni Relations.



Christopher Hinde
(CivE 5T0, MSc 5T3)
Christopher "Chris" Hinde has played an active role as a member

and secretary-treasurer of the 5To Engineering Alumni Committee for more than 60 years. Hinde was also co-chair of the Ajax Remembered Campaign, which raised \$400,000 towards the construction of the Ajax House. He later assisted in the creation of the 5To Leadership Award and is an active promoter and participant in the monthly Skule™ Lunch & Learn speaker series.

Engineering Alumni Association Honorary Member

Acknowledges the exceptional contributions of an individual who is not a member of the EAA but has contributed in a very significant way to bettering the Faculty, the EAA and/or the lives of current or future members of the EAA.



Ronald D. Venter
(MIE)
Ron Venter became a professor at U of T Engineering in

1975. Venter has served in leadership roles at the University, most notably as chair of Mechanical Engineering and vice-dean of the Faculty. He has volunteered his time and expertise on a number of committees and was a member of Governing Council. Venter chairs the Project Planning Committee, which was instrumental in developing the much-anticipated Centre for Engineering Innovation & Entrepreneurship.

L.E. (Ted) Jones Award of Distinction

Honours students who exemplify Professor Emeritus L.E. (Ted) Jones' great appreciation of the arts and his love of music.



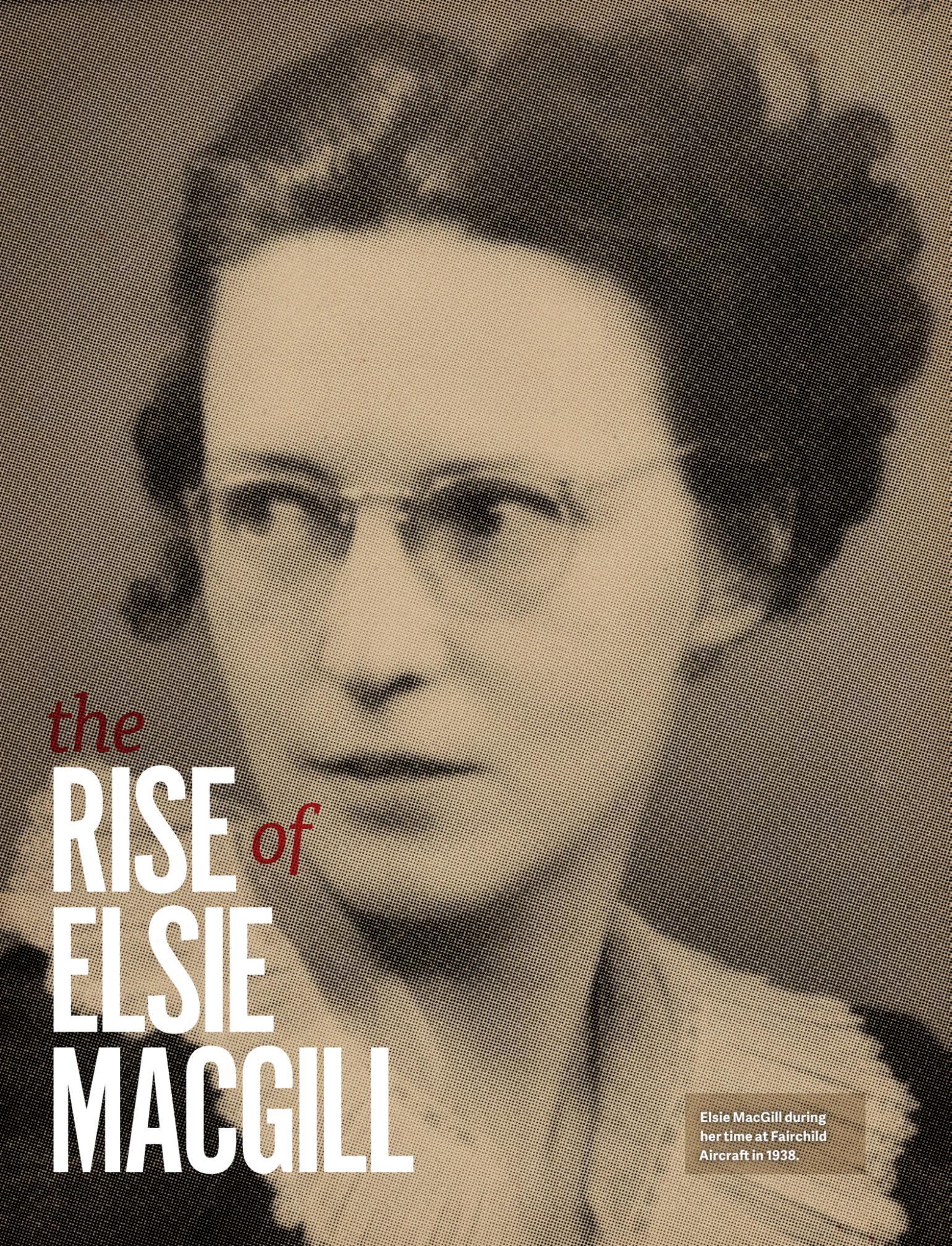
Luca Casciato
(MechE 1T5)
While studying at U of T Engineering, Luca has found his

way into many of Canada's leading orchestras as a violist and has studied with some of the most distinguished classical musicians of our time. He recently performed with the renowned New York String Orchestra for two sold-out performances at Carnegie Hall. Around campus, Casciato could be seen performing regularly with the Appassionata Music Ensemble and the Iron Strings Quartet. Casciato is also an occasional performer of jazz and traditional Italian folk music.



Haruna Monri
(CivE 1T4 + PEY)
Haruna Monri was a member of the Skule™ Orchestra in her

first year and quickly expanded her involvement, becoming first violinist in the Hart House Orchestra, the Iron Strings Quartet and the Skule™ Nite Band. She also brought music to the wider U of T community by performing with the Appassionata Music Group at charity events held by various clubs on campus, and at Faculty and departmental events. Monri was also deeply involved with various school clubs and associations, and earned Dean's List recognition throughout her degree.



the
RISE of
ELSIE
MACGILL

Elsie MacGill during her time at Fairchild Aircraft in 1938.

Elsie Gregory MacGill (ElecE 2T7) was the first woman to graduate from U of T with an engineering degree and the first Canadian woman to earn a degree in electrical engineering. Nicknamed “Queen of the Hurricanes,” she was also the world’s first female aircraft designer and professional aeronautical engineer, helping to shape Canada into a powerhouse of the aeronautical industry during the Second World War.

Yet these are just a few elements of her amazing life story.

SWE magazine, the publication of the U.S.-based Society of Women Engineers, featured MacGill’s career in the cover story of its spring 2011 edition. The article by Dick Bourgeois-Doyle, author of Her Daughter the Engineer: The Life of Elsie Gregory MacGill, is reprinted here in its entirety.

Like their colleagues in the United States, Canadian engineers had many reasons to be proud as the Society of Women Engineers (SWE) — a not-for-profit educational and service organization — marked its 60th anniversary celebration in 2010. The creation of SWE in 1950 inspired engineers internationally and touched careers and lives in many countries. Canadians have a unique reason to applaud the Society’s founders, however, because they gave a boost to one of Canada’s national heroines, a person who went on to change the country’s social, economic and legal fabric, and a person who continues to fascinate and inspire six decades later.

Elsie MacGill was involved in SWE early on, being named an honorary member in 1953. By that time, she had established herself as a leader in the engineering profession for many years. Still, despite her accomplishments, MacGill said that she was truly “astonished” when, that same year, the selection committee made her the unanimous choice to receive the second SWE Achievement Award and the mantle of outstanding woman engineer for that year. Her friends and admirers, however, were not astonished at all.

LEADING TECHNICAL ACCOMPLISHMENTS

MacGill, the pioneering aeronautical engineer, was celebrated during her career as “Queen of the Hurricanes” and credited with a key role in the mass production of the Hawker Hurricane fighter aircraft vital to the Battle of Britain and other major engagements of the Second World War. At that time, MacGill was chief aeronautical engineer at the Canadian Car and Foundry plant where more than 1,450 of the innovative fighters were produced in a complex and challenging environment.

MacGill’s contributions were not limited to her work in mass-producing the fighter plane. She was also responsible for the design of a winterized version of the Hurricane that featured skis, de-icers and other innovative cold-weather equipment that impacted aeronautical systems for years after. Despite this and other high-profile professional achievements that followed the war, MacGill considered her most rewarding times to be the 1930s when she had a front-row seat in the rise of bush flying and northern exploration by air in Canada. As a junior engineer at Fairchild Aircraft near Montreal, she helped in the development of a string of innovative bush planes, including the Super 71, the first all-metal fuselage and monocoque aircraft constructed in Canada.

In 1938, at the age of 33, she left Fairchild to assume her senior post with Canadian Car and Foundry, joining another innovative enterprise. Within months, she was assigned sole responsibility for the design of an entire aircraft, the Maple Leaf II Trainer, making her the first woman anywhere to have done so.

In each of her positions, MacGill gained respect for her insistence on riding with the pilots to record observations on the dangerous first test flights for her planes. Because she had a disability, she would be carried by colleagues and lifted into the aircraft along with her canes.

A succession of firsts

By this point in her life, MacGill had attracted an impressive collection of engineering awards and recognitions and had been celebrated as the first woman aeronautical engineer. She had completed graduate studies in the field; conducted research; worked as a professional and introduced new innovations, including the design of an entire aircraft in the 1920s and 1930s.

Her profile in the profession increased dramatically early in the Second World War when the 33-year-old MacGill was appointed chief aeronautical engineer at the booming Canadian Car and Foundry plant in Fort William, Ont. There, fighter aircraft, notably the famed Hawker Hurricanes, were being built for the Allied forces overseas.

During the war, MacGill was credited with introducing mass production techniques to the aviation industry, modifying the Hurricane for winter use and establishing standards for test pilot reporting. In the post-war years, she continued to break new ground as the first woman aeronautical engineer to open a consulting business and the first to serve as the chair of a United Nations aviation technical committee. In the latter capacity, she led in the drafting of the first airworthiness regulations for the new International Civil Aviation Organization.

In Canada, MacGill was known as the first woman in her country to receive a degree in electrical engineering, in 1927 from the University of Toronto; the first woman to be admitted as full member in the Engineering Institute of Canada; and the first woman to receive the profession's prestigious Gzowski Medal, as well as many other honours. In the United States, at the University of Michigan, she became the first woman anywhere to earn a master's degree in aeronautical engineering. The year was 1929.

Comfortable on both sides of the border, MacGill returned to the U.S. and continued to blaze trails as a woman doctoral student at Massachusetts Institute of Technology (MIT), amidst some of her profession's brightest lights. The list of professional achievements and recognitions would have alone marked MacGill as worthy of celebration, particularly as a pioneer for her gender.

EARLY INFLUENCES

In 1905, MacGill was born to relative affluence in Vancouver, a town that was just emerging from its pioneer days and poised to enter a period of dynamic growth and change. MacGill's early life certainly felt the influence of the women's movement and the Canadian campaign for suffrage as her mother, Helen Gregory MacGill, not only held the distinction of being British Columbia's first female judge, but also was a leading champion for women's rights in her day. The figures who most personified the cause of women's rights in Canada, such as suffragette writer Nellie McClung and painter Emily Carr, were among the frequent guests to the MacGill home. At her mother's "women only" cottage near Vancouver, MacGill learned to chop wood, clean fish and repair water tanks and broken windows. Her talent for repairing equipment was amplified when her high school boyfriend introduced her to the ham radio and the world of electrical engineering.

"Judge Helen" was not the only important influence on MacGill. She also benefited from a close, lifelong bond with her sister, also named Helen, who became a celebrated sociologist. Elsie's later life, which was disrupted by disabling polio, was enriched by her loving relationship with businessman Bill Soulsby, a widower whose daughter and son became cherished stepchildren to MacGill. She married Soulsby in 1943 shortly after the two were jointly fired, ostensibly for a forbidden workplace romance at Canadian Car and Foundry.

True Comics published a comic on MacGill in 1942.



MacGill poses in front of a Maple Leaf Trainer II, alongside Canadian Car and Foundry manager Bill Soulsby — a man she would eventually marry.

IMAGE/ LIBRARY AND ARCHIVES CANADA, MG31-K7 VOLUME 16, FILE 7
PHOTO/ CANADA AND AVIATION SPACE MUSEUM LIBRARY AND ARCHIVES 33815



WOMEN OF SKULE: A TIMELINE

1912

Hildegard E. Scott is the first woman to graduate from the Faculty of Applied Science & Engineering, earning a bachelor of applied science degree in analytical and applied chemistry.



1920

Esther Marjorie Hill receives a bachelor of applied science degree in architecture (a discipline at that time linked to engineering) from the Faculty of Applied Science & Engineering, and becomes the first female architect in Canada.

1947

Marcia Lamont Scott (CivE 4T7) is the first female graduate of the Department of Civil Engineering.

1952

Lois DeGroot (MechE 5T2) and **Madeline Hoare** (MechE 5T2) are the first female graduates of the Department of Mechanical Engineering.



1964

Mary Jane Phillips (ChemE) is the first woman to join the Department of Chemical Engineering & Applied Chemistry as a lecturer in catalysis, receiving tenure in 1977 and retiring from the department in 1997.



1973

Eva Kuhn (CivE) is the first woman to join the Department of Civil Engineering teaching mechanics and graphics and remains in the department until her retirement in 2013.

1975

Marta Escedi (CivE 7T6) is elected the first female president of the Faculty's student body, the Engineering Society.

But there are other, even more moving features of MacGill's life and story that were known to her colleagues and continue to encourage others to this day.

Overcoming great personal odds

On the eve of her 1929 graduation from Michigan, 24-year-old MacGill fell ill to awaken the next morning fully paralyzed from the waist down. She had been struck by a form of polio and would spend the next three years confined to bed and a wheelchair at her parents' Vancouver home. Her plans for a wedding and the launch of her engineering career were cancelled, and she had reason to wonder whether her personal and professional lives would ever recover. But she kept her career aspirations alive by writing journal and magazine articles on aviation from her bed, and slowly she regained enough strength to use metal walking sticks to get around.

As soon as she was self-sufficient, she moved back east to MIT, and then to the string of industry projects that made her mark and reputation in engineering.

Ironically, the high point of her recognition by SWE in 1953 was followed by a serious setback a few months later. She slipped on a rug and broke her good leg, plunging her back into a wheelchair and into a series of ill-advised surgical treatments that threatened to disable her permanently. Again, she recovered, and again she used the enforced convalescence to write. This time, she produced a biography of her late mother, Helen Gregory MacGill, the first woman in Canada to receive the title of "judge."

Did you know? U of T Engineering's Dean **Cristina Amon** has been recognized by SWE as Distinguished Engineering Educator in 1999, Professor of the Year in 2000 and received an Achievement Award in 2011—57 years after the same award was presented to MacGill.

GROWING INTO ACTIVISM

For most of her life, Elsie MacGill did not recognize gender bias and, perhaps inspired by her mother's example and the need to confront her own challenges, chose to ignore any hurdles in her career. She began a magazine article in 1946 by saying "no particular barriers face women entering professional engineering in Canada." Within a few lines, however, she acknowledged that some schools would not admit women, some industries would not hire them and good jobs were difficult to secure. Her position was that these were not real barriers because one only had to "knock harder" or go around the corner and find someone who would accept you.

This point of view started to shift when MacGill approached the age of 50 and plunged into the project of her suffragette mother's biography. By her own admission, she started to absorb her late mother's perspective and stepped into a leading role in a new wave of feminism in Canada. In the late 1950s and early 1960s, MacGill was the driving force in many women's organizations locally, regionally and nationally.

Another turning point

The experience of writing *My Mother, the Judge* stirred new passions in MacGill, prompting her, now nearing the age of 50, to plunge into the cause of women's rights in a more energetic way. This led to her election as national president of the Canadian Federation of Business and Professional Women's Clubs, and subsequently, to membership as effective vice-chair of the landmark Royal Commission on the Status of Women in Canada in 1967. Through the Royal Commission, MacGill influenced laws and national policies, often through words that were reflected in federal legislation, for decades to follow.

Her death in 1980, at the age of 75, was indirectly caused by her disability. At the time, many felt her life had been cut short. It was clearly full, however, and its impact has been enduring.

Those who wonder where MacGill found the strength and motivation to persist through disabling illness; periods of economic, social and military struggles; and gender bias that denied her some professional opportunities, often point to the role model of her mother, her sister's support, and the love of her husband, Bill Soulsby, and her stepchildren.

Those who knew MacGill best also suggest that she was buoyed through hardships and challenges by what her colleagues described as a "rare sense of humour and scintillating sense of fun."

The model of having fun while striving to improve the world and to do one's personal best may, in fact, be MacGill's greatest legacy to her profession, her gender and humanity.



Taken on the occasion of MacGill receiving an honorary degree from the University of Toronto in 1973.

PHOTO/ UNIVERSITY OF TORONTO ARCHIVES AND RECORDS MANAGEMENT SERVICES 2008-58-2MS

CREDITS: Dick Bourgeois-Doyle lives in Ottawa and is Secretary General of the National Research Council of Canada. He previously served as chief of staff to the minister of science and technology and the minister of fisheries and oceans. A former broadcaster and journalist, Bourgeois-Doyle has contributed to many articles, TV features and radio programs on the history of Canadian science and creativity. In addition to his book on MacGill, his works include the biographies George J. Klein: The Great Inventor and Stubborn: Big Ed Caswell and the Line from the Valley to the Northland. His latest book is *What's So Funny?*, the first comprehensive review of the Leacock Medal for Humour. He was also editor of *Renaissance II: Canadian Creativity and Innovation in the New Millennium*. A new biography on MacGill has been published this past year: *Queen of the Hurricanes: The Fearless Elsie MacGill* by Crystal Sissons.

1984

Ursula Franklin also becomes the first woman at U of T to be named University Professor, the University's highest honour.



1992

Susan McCahan (MIE) is the first female professor in the Department of Mechanical Engineering (now Mechanical & Industrial Engineering).



2000

Yu-Ling Cheng (ChemE) is the first woman named division chair, leading the Division of Engineering Science.



2006

Cristina Amon (MIE) is the Faculty's first female dean, as well as alumni professor of bioengineering in the Department of Mechanical & Industrial Engineering.



2008

Brenda McCabe (CivE) is appointed the first female chair of the Department of Civil Engineering.



2009

Jean Zu (MIE) is appointed MIE's first female chair.



2013

Heather MacLean (CivE) is the first female to hold the title of associate chair of graduate studies for the Department of Civil Engineering.



2014

Deepa Kundur (ECE) becomes the first female associate chair for the Division of Engineering Science.



THE NEXT WAVE OF WORLD-CLASS RESEARCH

Eight engineering professors — all appointed in recent years — are creating innovative solutions in bioengineering, sustainability, communications and enabling technologies.

by TYLER IRVING

GISELE AZIMI

Making the most of rare earths

Rare earth elements (REEs) — neodymium, cerium, samarium and 14 others — are found in an increasing number of technologically advanced products. The unique magnetic properties of some are critical for making everything from smartphones and earbud headphones to wind turbines and electric cars. The ability of others to speed up chemical reactions makes them useful in manufacturing as well as in automotive catalytic converters. Because of their importance to the economy, developed countries including Canada have accelerated efforts to satisfy demand for rare earth elements.

Gisele Azimi (ChemE, MSE) is using her unique knowledge of materials science and chemical engineering to change the way we extract, utilize and recycle these elements. She is developing chemical processing techniques that can extract REEs not only from natural resources, but also from materials that would otherwise

be discarded as waste. For example, Azimi and her team are creating processes that can be used on old automobile catalytic converters to recover REEs and precious metals such as platinum.

During her post-doctoral studies at MIT, Azimi discovered a new property of REEs: when made into ceramics, they have a powerful ability to repel water. These ceramics can be applied to airplane wings or wind turbine blades to prevent ice buildup, making these technologies safer. They can also be applied to steam turbine blades or condensers — key pieces of industrial process equipment — to increase efficiency and reduce energy use.

On the extraction side, Azimi and her team are currently optimizing a technique for recovering REEs from phosphogypsum, a byproduct of the fertilizer industry, as well as automotive catalytic converters. They also partnered with researchers at the U of T Engineering's Centre for Advanced Coating Technologies to develop the spray-coating techniques needed to commercially apply their new water-repelling ceramics.



“Rare earth elements can address a wide range of sustainability issues, from better electric cars and wind turbines to more energy-efficient processes. I believe researching extraction and utilization of these elements paves the way to take on the big challenges in energy and the environment.”



One of Bilton's projects involves working with communities in Mexico's Yucatan Peninsula and development organizations such as Fondo para La Paz to design small-scale desalination plants. These plants, which are powered by solar energy, take brackish groundwater and make it drinkable. Another project, still in the development stages, involves using renewable energy to improve oxygen exchange in fish farms in Vietnam. This will improve yields of fish, which are an important source of protein in the developing world.

AMY BILTON

Water and energy technologies for remote communities

Modern plants for water treatment or energy generation are typically designed to feed into existing infrastructure, such as city-wide plumbing or electrical grids. But people in remote communities — especially in the developing world — often lack this infrastructure. When areas with small or widely dispersed populations can't afford the latest and greatest, they have to make do with older, less effective technologies, or simply go without.

Amy Bilton (MIE) and her team specialize in the creation of small, low-cost water and energy systems for remote communities in the developing and developed world. They use custom computer tools to optimize the design of technologies for local conditions, taking into account cost, availability of local materials and expertise required for maintenance. Where practical, they take advantage of renewable energy resources, such as wind and solar power.



“Sometimes it can be simple concepts applied in innovative ways that make some of the biggest improvements in quality of life for people. I love working in an area where I can make a connection with a community and see the direct impact of my work.”

HAI-LING MARGARET CHENG

Visualizing the human body

Magnetic resonance imaging (MRI) is one of the most powerful, non-invasive techniques we have for looking inside the body. Though it's not as sharp as an x-ray, it avoids the health risks associated with x-ray radiation. MRI is commonly used to diagnose cancer and brain disease. However, **Hai-Ling Margaret Cheng** (IBBME, ECE) believes it can do much more.

MRI works by using a magnetic field to excite the hydrogen atoms in a particular part of the body. These atoms then give off radio-frequency signals that can be detected. Cheng and her team are devising ways to generate new signal contrast from tissues and new approaches to analyzing the imaging data. Though the techniques are new, they are designed for use on existing MRI

scanners, allowing them to be widely applied. The goal is to extract more quantitative information from the scans and probe beyond anatomy into the physiological, cellular and molecular level.

If MRI can be made to look beyond anatomy, we may be able to detect many diseases much sooner. For example, if we can detect the changed cellular activity of cancer cells, we will be able to detect smaller tumours and catch cancer earlier on in the process, when chances of survival are greatest. But Cheng has even bigger ambitions. She aims to use MRI on tissue grafts or other implants, creating a non-invasive way to see how well they are integrating into the body. Such an approach could also guide the development of new and emerging stem cell-based therapies.

Cheng and her team are collaborating with U of T chemists to develop new contrast agents — compounds that can be injected into the body to light up even smaller features in MRI scans. These agents, combined with tweaks to how the machine works, will enable MRI to better diagnose disease and actively

track how well treatments are working. A better picture of what is going on in the body will help scientists repair damage and treat major diseases, including cancer and cardiovascular conditions.



"I chose MRI because I wanted to do something to help people and contribute to society. I previously worked in aerospace, and I knew a lot about how signals are processed from radar, for example. MRI signals are processed in a somewhat similar way, so the marriage of biomedical research and electrical engineering was a perfect fit."

NATALIE ENRIGHT JERGER

Designing faster computers



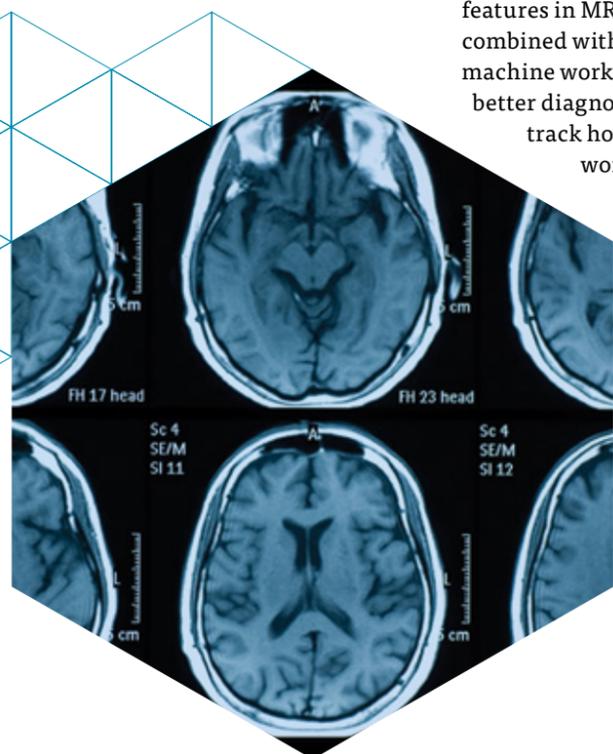
"Computers touch every aspect of people's lives. Being able to provide easy access to tremendous amounts of information is a really exciting capability. I also enjoy the intellectual challenge of trying to solve this really cool engineering puzzle."

Every few years, advances in manufacturing technology dramatically increase the number of components that can be etched onto a computer chip. Yet designing a faster computer isn't simply a matter of fitting more circuits into less space. The arrangement of components into an integrated processor must be carefully designed, a process known as computer architecture.

Natalie Enright Jerger (ECE) is a leading computer architect. In her lab, she develops computer programs that can simulate various arrangements of processor components. The simulations allow her team to test out many different designs and optimize them for computing speed, power usage, cost, size and a host of other parameters. Chip manufacturers such as Intel, AMD and Qualcomm collaborate with Enright Jerger to turn these new ideas into reality.

One recent project in the lab revolved around a technique called approximate computing. The method takes advantage of the fact that for some applications, the odd processing error is acceptable. For example, in a streaming video, a few incorrect pixels per frame would go unnoticed by most viewers. A low, controlled error rate can allow for faster processing without the need for more power and increased battery life for portable devices.

The team is also working on a project that aims to overcome the limitations of larger computer chips. As chips increase in size, the chances of one component failing and rendering the whole chip defective are increased. In the lab, Enright Jerger and her students are developing ways of making large chips by networking many smaller chips together. This helps reduce the material and manufacturing costs of superior computing power.



PENNEY GILBERT

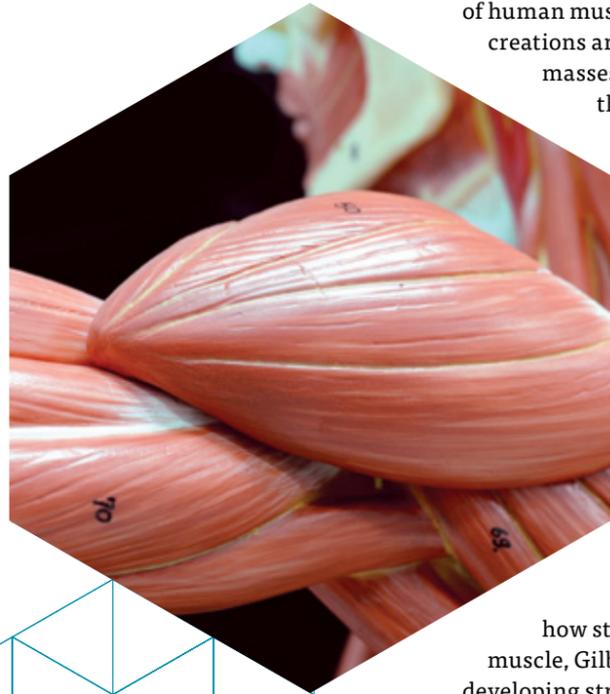
Engineering muscle

Our muscles constantly repair and remodel themselves in response to the stresses they experience. However, as we age, this ability wanes and we become more prone to falls. Injuries from falls cost Canada's health-care system close to \$2 billion each year. On top of that, muscle wasting is a common feature of many genetic and neuromuscular disorders.

Penney Gilbert (IBBME) uses human stem cells to grow tiny facsimiles of human muscle in the lab. Her creations are more than simply masses of cells; they organize themselves into long muscle fibres and even incorporate nerve cells that tell the muscle when to twitch in response to a stimulus. Growing these tiny model muscles outside the body has taught Gilbert and her team a lot about how stem cells transform into the tissues they will become.

By understanding how stem cells become muscle, Gilbert and her team are developing strategies to help repair muscle in the elderly or anyone else experiencing muscle wasting. For example, they are working to discover drugs that could stimulate the body's own stem cells to regenerate muscle tissue. Further in the future, if lab-grown muscles can be made large enough, they could even implant new muscles grown from the patient's own cells.

Gilbert and her team have made many copies of their tiny muscle facsimiles, which can be used to screen libraries of known chemical compounds for their ability to stimulate muscle repair. Because these samples can be grown from a patient's own cells, the screens can tell which drugs are most likely to be effective in that particular patient, a significant step toward personalized medicine.



“Engineers think about science in a really different way. They create tools that allow us to ask biological questions that we couldn't otherwise ask. I love thinking about biology with engineering principles in mind.”

KERYN LIAN

Powering the future

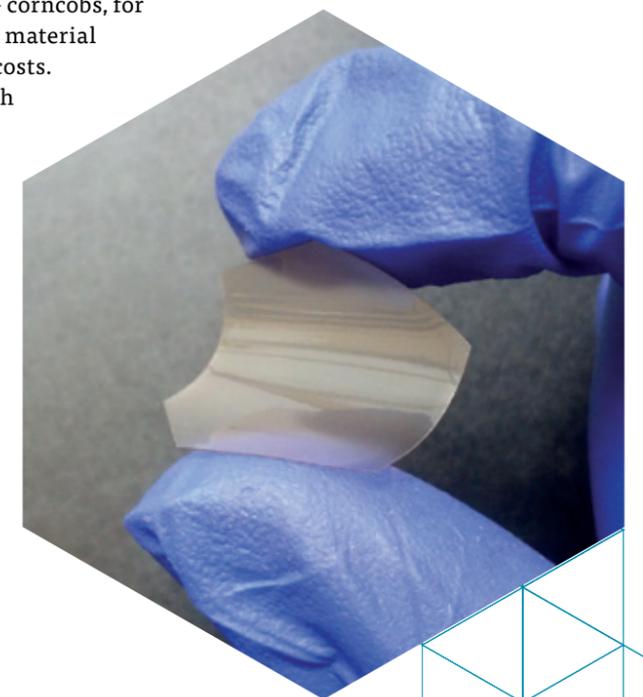
With billions of electronic devices already on the market and a growing worldwide interest in electric vehicles, providing portable power is a key engineering challenge for the future. Next-generation power sources will have to be smaller, lighter and less expensive than existing options. Moreover, if they can be made flexible enough, they could make a game-changing difference in the burgeoning market for wearable devices, from smart watches to temperature-responsive clothing.

Keryn Lian (MSE) and her team build electrochemical capacitors. Like rechargeable batteries, electrochemical capacitors store charge via ion adsorption and/or changing chemical reactions into electricity and vice versa. However, the power and the rate at which they discharge are much higher than traditional batteries. This makes them ideal for providing a boost of power when needed, such as when an electric vehicle is driving up a hill or when a power-hungry app is activated. Though some electrochemical capacitors are commercially available, Lian's lab is experimenting with new materials that could reduce costs while maintaining or improving performance.

The devices the researchers are building are based on membranes made of ionically conductive polymers, a kind of plastic. Because they contain no liquid, they can't leak like batteries. They are also smaller, lighter and can be made flexible enough to fit into almost any space, whether it's the body of a vehicle, the casing of a mobile phone or the underside of a solar panel. Inexpensive electrochemical capacitors could dramatically increase the performance of any of these products.

One of Lian's students recently created a flexible polymer electrolyte membrane (pictured) that conducts charge faster than any other, even beating some liquid electrolytes used in today's batteries. Other projects involve making electrodes out of agricultural waste — corncobs, for example — to reduce material and manufacturing costs. Lian collaborates with industrial partners to bring these new technologies to market.

“People are using more and more energy, but they don't want to have to carry additional weight. The market for flexible electronics is getting bigger and bigger. Anything we can do to make people's lives easier will be the right way to go.”



ELODIE PASSEPORT

Green infrastructures to remove environmental contaminants



“My goal is to see better, more integrated management of environmental problems. This means small treatment systems in homes combined with efficient, large-scale processes that mimic nature. I want to put all my efforts into preserving our environment.”

Each year, humans use thousands of tonnes of organic chemical compounds, such as pharmaceuticals, antibiotics, pesticides and more. These substances eventually make their way into streams, lakes and oceans. Many of these compounds are known or suspected to have potentially toxic effects on these aquatic ecosystems and need to be removed. Yet, surprisingly little is known about how they move through the environment, or their final fate.

Elodie Passeport (CivE, ChemE) is dealing with this problem through two complementary strategies. Using isotope ratio mass spectrometry — a chemical analysis technique — Passeport and her team can trace the fate of the chemical contaminants in samples collected from industrial, agricultural and urban areas. For example, they can determine whether the chemicals are being broken down by bacteria or sunlight, or merely sticking to soil or clay. In the lab, Passeport and her team validate this work by building working models of wetlands (pictured) or other natural and engineered ecosystems.



Passeport aims to usher in a new era of “green infrastructures” by redesigning wastewater treatment systems to take advantage of natural processes, including bacterial action, that break down or filter out harmful compounds. Her work will also influence government policy by helping to identify where compounds end up and which ones need to be regulated most urgently.

Passeport is collaborating with Ontario companies that design bioretention cells, a water treatment system that leverages natural processes to remove organic chemical contaminants from stormwater runoff. Her work will determine the roles played by each element of the system, including soil composition, water levels and vegetation, and help optimize overall function.

ANGELA SCHOELLIG

Scanning from the sky

Canada is full of sparsely populated landscapes: think of an expanse of prairie, or a northern forest dotted with small lakes. Keeping track of environmental conditions in these vast areas is a labour-intensive process. But the rise of unmanned aerial vehicles (UAVs), also called drones, could be a game-changer.

Angela Schoellig (UTIAS) helps drones learn to fly themselves more accurately and safely. Schoellig and her team develop algorithms that allow UAVs to take information from sensors such as onboard cameras and analyze it to figure out where they are. She’s also working to enable drones to sense when conditions are too rainy or windy to fly and park themselves until conditions improve.

Some UAVs are currently used for environmental monitoring, such as scanning farmers’ fields for pest infestations.



However, these devices depend to a large degree on radio control from ground stations and on GPS signals; if these are unavailable, the drone becomes lost, and can’t always find a safe place to land. They also have trouble coping with unforeseen conditions, from wind gusts to full-blown storms. If Schoellig and her team can enable drones to learn from their surroundings, it would allow them to range well beyond their current reach and stay in the field for longer periods of time. Teams of drones could cover large areas more efficiently than any currently available technology.

Schoellig recently embarked on a project aimed at using drones to monitor toxic algae blooms in freshwater lakes. The UAVs use floats to land on the surface of the lake and dip a small sensor into the water, scanning with a laser to measure algae concentration. The technology would allow researchers to take more samples from many locations within a lake or many lakes in a geographic area, and sample much more frequently than is currently possible.

If the warning signs of a toxic bloom are detected early enough, humans could intervene, releasing chemical or biological agents to stop the bloom before it starts.



“I did a lot of theoretical research into automation but I really wanted to see the math in action. For decades, robots have been working in industrial settings where the environment is very predictable. I was excited by the challenge of taking robots into the real world.”

BUILDING A FOUNDATION FOR SUCCESS

A U of T Engineering degree can lead to many diverse career paths. Meet four alumnae who have transferred their engineering competencies into positions in finance, law, academia and corporate leadership.

by JAMIE HUNTER



Teo Dechev

(MinE 9T6)

Chief Executive Officer, President & Director at Mundoro Capital, Vancouver

CAREER SNAPSHOT Prior to joining Mundoro Capital in 2006, Dechev spent 10 years in the capital markets as an equity research analyst and investment banker, advising resource and technology companies on financings, initial public offerings and mergers, and acquisitions mandates.

SKULE™ AFFILIATION She is a member of the Engineering Alumni Association Executive Board and the Lassonde Mineral Engineering Program's Advisory Board.

DID YOU KNOW? Dechev's first job out of school was working for legendary Bay Street mining entrepreneur and alumnus **J. Patrick Sheridan** (GeoE 5T5), who introduced her to commodity trading.

Prior to joining Mundoro Capital, you spent some time as an investment banker. How did you go from mineral engineering to finance?

I went from commodities trading on the corporate side, to equity research at an investment bank. In equity research you are responsible for valuation, for example, determining the value of a mining company. If you have the technical understanding of how a mine operates and what metallurgical processes are relevant versus not, it makes you that much more of an effective analyst. It's not uncommon in investment-banking to have equity research analysts that are specialists in their sector. An engineering education is a great foundation that can be applied to analyzing companies that operate in various branches of engineering, such as mining engineering, computer engineering, biomedical engineering, etc.

How do you apply your engineering education to your role at Mundoro Capital?

Technical knowledge is tremendously important. As well, from my management and leadership

perspective, engineering does a really good job of giving you the skill set to solve complex problems. You're really pushed to understand and use systematic processes. I believe U of T Engineering, in particular, does an excellent job with that ... you're taught how to take a complex issue and solve the problem using systematic steps while working in a team-based environment.

How do you maintain your team's daily motivation and inspiration?

The key to motivating talented people is to give them a challenging problem to solve. In the case of a mineral resource company, that may be to discover a great deposit or to develop an existing deposit. From our company's point of view, we're in a prolific mineral belt in an emerging region (southeastern Europe) that has the potential to be a mineral hub for Europe in the future. Our team is excited to operate there, and are applying leading exploration methodology to this area that has not previously been systematically explored. That keeps everyone in the company motivated and energetic because there is the opportunity for new discovery.

"The key to motivating talented people is to give them a challenging problem to solve."

"You can bring innovation into whatever job you're doing."



Catherine Lacavera

(CompE 9T7)

Director, IP and Litigation at Google Inc., Mountain View, Calif.

CAREER SNAPSHOT Joined Google in 2005 after spending nearly four years at White & Case LLP, a global law firm based in New York City.

SKULE™ AFFILIATION Lacavera currently sits on The Edward S. Rogers Sr. Department of Electrical & Computer Engineering Board of Advisors. She is also involved with The Entrepreneurship Hatchery as a volunteer and donor.

DID YOU KNOW? Success runs in the family. Her brother is alumnus **Anthony Lacavera** (CompE 9T7), founder, chairman and CEO at Globalive Holdings.

Your career plan was always to end up in patent law. Do you apply anything from your computer engineering degree to your current role at Google?

First and foremost, an engineering degree gives you instantaneous credibility among other engineers and attorneys. People know that engineering gives you a baseline education in math and science. A lot of what I do requires a technical understanding of software and hardware, and the Internet. My underlying technical knowledge helps me understand my work.

Fortune magazine called you "Google's secret weapon in the smartphone wars." What has been your secret to success?

I've been fortunate — I have an amazing team. Google attracts great talent and I've been given this amazing opportunity to put together an incredible and supportive team of people that work really well together. There's a willingness at Google to put resources behind and fight for principle, which has allowed me to be successful.

You are surrounded by incredible technology at Google's campus in Mountain View. Do you ever miss being involved on the innovation side of things?

My consolation prize — if you can call it that — is that I'm on the defensive line. Others are building these amazing products and I'm helping to make sure there are no barriers to getting the product to market. But on the other hand, you can bring innovation into whatever job you're doing. My team is designed around what I call the "Model T Ford of patent litigation" because we've created these processes for how every case is handled — from soup to nuts, every aspect of litigation. That's engineering. We're handling fully one per cent of all patent litigation in the United States and we wouldn't be able to scale at that rate or to that level with such a small team without that type of process in place.

“The bottom line was that I wanted to do what I was passionate about and make a difference.”



Audrey Mascarenhas

(ChemE 8T2)

President & Chief Executive Officer, Questor Technology Inc., Calgary

CAREER SNAPSHOT In 1999, after a 17-year tenure with Gulf Canada Resources Ltd., Mascarenhas joined Questor Technology Inc., an international environmental oil field service company focused on clean air technologies.

SKULE™ AFFILIATION Mascarenhas recently participated as a panellist in BizSkule's first keynote speaker event held in Calgary.

DID YOU KNOW? She was the recipient of the Ernst & Young Entrepreneur of the Year 2011 Prairies Award for the Cleantech and Environmental Services category.

You took a calculated risk to get to where you are today — leaving a large, established company to head a startup. What drove you take that risk?

At that point, I felt I had an amazing career and I was in a good financial place. I wanted to see how I could integrate my business and technical skills and use it to grow, learn a little bit more and make a difference. There were five employees when I started. Now there are over 25 of us and we're expanding.

How did your background in engineering help to shape the kind of business leader you are today?

One of the beautiful aspects of an engineering education is that it teaches you how to solve problems. Engineers don't look at a problem as the end of the world. I think engineering really helped me, personally, to look at things out of the box. It gave me the energy to find another way.

How did you first get the idea that the innovation behind Questor's waste-gas incinerators would be essential for the oil and gas industry?

I knew, from my oil and gas background, that wasting gas was a significant issue for our industry. And I always felt that flaring — the burning of natural gas that cannot be processed or sold — wasn't great practice. We weren't doing it efficiently, putting all of these pollutants into the air. But it was also such a waste of energy. In 1999, when I decided that I was going to focus on solutions to flaring, I received a lot of flack for that. There were lots of comments saying that nobody was ever going to care about the environment and that I was wasting my skill and talent. The bottom line, which is what I said to everyone, was that I wanted to do what I was passionate about and make a difference.

“I realized there was an amazing synergy between what I had been doing in my career — my background, the skills I built — and my interests in the city and applied education.”



Anne Sado

(IndE 7T7)

President, George Brown College, Toronto

CAREER SNAPSHOT Sado's career began with Bell Canada in 1977. After spending 25 years with the company — and a brief turn as principal with Helix Commerce International — she became president of George Brown College in 2004.

SKULE™ AFFILIATION In the past, Sado was an active member of the President's Council of the Engineering Alumni Association, Dean's Advisory Board and Engineering Campaign Cabinet.

DID YOU KNOW? She was appointed Member of the Order of Canada in 2013, one of the country's highest civilian honours.

Looking back at 2004, why did you decide to leave the corporate landscape for a career in academia?

I had the good fortune of being eligible for an early retirement so I decided it would be great to think about a different future. Almost immediately after leaving, the opportunity at George Brown presented itself, so I decided to pursue the option. What I realized was that there was an amazing synergy between what I had been doing in my career — my background, the skills I built — and my interests in the city and applied education. I was selected for the role. Here I am in my 12th year and I haven't looked back.

Do you currently apply any of your engineering competencies to your role at George Brown?

My engineering education, especially in industrial, really made me think about things as a system and how

everything fits together. So when I think of my leadership style and the institution that I'm managing, I take a look at the big picture, how things fit together and what element or areas of expertise I require to make the entire system work. I let people run with their parts so I don't have to manage every aspect of it. If I can see that the pieces are fitting together, it's working. But if it's not working, I can break it down and figure out where we need to focus some attention.

What advice would you give a new engineering graduate going into a leadership position for the first time?

Rely on the expertise of those around you. Build relationships with your team. Get to know them. Have them tell you about their jobs, their roles and responsibilities. Build the trust. Listen and learn first, then you can move on from there.

DEPARTMENT OF CHEMICAL ENGINEERING & APPLIED CHEMISTRY

www.chem-eng.utoronto.ca



Professor Molly Shoichet in her lab.

A year in the life of Molly Shoichet

Professor **Molly Shoichet** (ChemE, IBBME), Tier 1 Canada Research Chair in Tissue Engineering, investigates a wide scope of medical-related challenges, from healing spinal cord injuries to blindness, using stem cell therapy. The impact of her work extends beyond the laboratory, driven in part by her dedication to mentoring, teaching and motivating her students and colleagues.

Last fall, U of T President Meric Gertler appointed Shoichet as the senior adviser on science and engineering engagement. In this new role, Shoichet collaborates with colleagues from across the University to promote U of T's exciting discoveries to the public.

In March 2015, she was named the L'Oréal-UNESCO For Women in Science North American laureate, an award that honours the outstanding discoveries of women researchers

and encourages more women to enter science and technology-focused careers.

And she recently launched Research2Reality, a social-media campaign designed to shine a spotlight on the work of researchers across the country. It is one of the most ambitious outreach efforts of its kind in Canada to date and it comes at a time when research advocates worldwide are trying to persuade governments of the importance of basic, curiosity-driven research.

Shoichet is the only Canadian inducted into all three of Canada's national academies: the Royal Society of Canada, the Canadian Academy of Engineering, and the Canadian Academy of Health Sciences. In June 2014, she was named University Professor, one of U of T's most prestigious titles. This distinguished rank is given to just two per cent of tenured faculty, serving to highlight her outstanding contributions to research and teaching.

BIOZONE RESEARCHERS LEAD NEW PROJECTS

Professors **Elizabeth Edwards** (ChemE) and **Emma Master** (ChemE), two members of the BioZone leadership team, are providing their expertise to new programs that will address some of society's most urgent environmental needs.

Last fall, the Natural Sciences and Engineering Research Council announced a five-year, \$5-million grant to create the Industrial Biocatalysis Network. Based at the University of Toronto and led by Edwards, the network will explore new methods of using eco-friendly enzymes — instead of fossil fuels — to produce environmentally friendly chemicals, plastics and other products.

In early 2015, the European Research Council announced that Master received €2 million over five years for her BHIVE program (Bio-derived High Value polymers through novel Enzyme function), which will harness the benefits of genomics and new functional screens to develop new ways of transforming plant fibres — including forestry and agricultural waste — into greener alternatives to plastics.

JEANETTE SOUTHWOOD RETURNS TO CHEMICAL ENGINEERING

In February 2015, alumna **Jeanette Southwood** (ChemE 8T6, MASC 8T8) joined the Board of Advisers for Chemical Engineering & Applied Chemistry, the department's go-to committee of industry experts. She is an award-winning engineer who leads the Urban Development & Infrastructure and Global Sustainable Cities teams at Golder Associates. Southwood's work recently won her the 2015 Professional Engineers of Ontario Medal for Engineering Excellence.

PHOTO/ COURTESY OF L'ORÉAL CANADA

DEPARTMENT OF CIVIL ENGINEERING

www.civil.engineering.utoronto.ca

Shear design: U of T's largest-ever structural experiment

Graduate student **Phil Quach** (CivE 1T2, MASC 1T5) led a groundbreaking experiment in the Structures Lab to discover the effect of extreme size on shear resistance.

Quach and his team created a four-metre high, 20-metre long slab that was reinforced longitudinally in one end of the member, and both longitudinally and transversely in the other end. It was the largest concrete slab in the world used to test

shear resistance. As the demand for larger infrastructure and buildings increases, so does the need for greater understanding of how larger slabs of reinforced concrete — like those used in roofs, for example — behave under shear forces.

"This was huge for me," Quach said. "When the project was presented to me, I was like a kid in a candy shop; I didn't think I'd get to work on something of this scale."

Quach's work was supervised by Civil Engineering professors **Evan Bentz** and **Michael Collins**. Collins and fellow professor **Frank Vecchio** (CivE)

developed the Modified Compression Field Theory to explain shear behaviour in 1986.

A shear failure is a critical issue that all engineers want to prevent. It is one of the ways a structure can collapse catastrophically with little to no warning, such as Quebec's De la Concorde overpass in 2006.

"When we're dealing with design of buildings and industrial facilities, we have one chance to get it right," Bentz said. "We have to make sure we know the behaviour of the materials."



Members of Donna Vakalis's family and friends, who have never been able to watch her compete, were in the stands cheering her on during the Pan Am Games.

PHD CANDIDATE ON THE ROAD TO RIO

Following her fourth-place finish at the TO2015 Pan Am Games earlier this year, **Donna Vakalis** (CivE PhD Candidate) has secured her spot with Team Canada for the 2016 Olympic Games in Rio de Janeiro. Vakalis is a versatile athlete who competes in the modern pentathlon, which includes fencing, swimming, equestrian, pistol shooting and running. When she's not training, Vakalis studies the impact of indoor building environments on public health and productivity under the supervision of professors **Heather MacLean** (CivE) and **Jeffrey Siegel** (CivE).

Sasha Gollish (CivE MEng 1T0, EngEd PhD Candidate) also participated in the Pan Am Games, representing Canada in the 1500m. She won a bronze medal.

CIVIL ENGINEERING WELCOMES NEW TRANSPORTATION EXPERT

Professor **Marianne Hatzopoulou**, (CivE) Canada Research Chair in Transportation and Air Quality, will be bringing her expertise at the intersection of transportation and environmental analysis to the University of Toronto.

She was previously an assistant professor and Canada Research Chair at McGill University.

Hatzopoulou focuses on modelling road transport emissions and urban air quality and the evaluation of

population exposure to air pollution. She is interested in explaining the interactions between the daily activities and travel patterns of urban dwellers, and the generation and dispersion of traffic emissions in urban environments.

PHOTO/ COURTESY OF DONNA VAKALIS

THE EDWARD S. ROGERS SR. DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

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As president of the You're Next Career Network, Mingyi Bian found her calling in helping her fellow students find theirs.

She's next

Mingyi Bian's (Year 4 ElecE + PEY) job is to help you find your dream engineering job — an unexpected talent for a woman who never planned to be an engineer in the first place.

"I applied on a bet with a high school friend," Bian said. "I had no plans to do engineering, but came to a Track 1 reception as someone's guest. We heard from Track 1 alumni, and I was just hooked. I think I'm still friends with 100 per cent of the people I met there."

Those she met at the reception included past Engineering Society president **Teresa Nguyen** (CivE 1T5) and You're Next Career Network (YNCN) founder **Yi-Wei Ang** (IndE 1T2 + PEY) and past president **Gordon Tang** (IndE 1T4 + PEY).

As president of the hugely successful YNCN, Bian leads a group of 46 engineering students who are devoted to generating diverse employment and internship opportunities for themselves and their classmates. They're organized into three teams: corporate, startup and student development. Most devote more than 20 hours a week to keeping their well-oiled machine

running, on top of the already ambitious engineering workload.

"We ourselves benefit from doing it — it's a service-based group," Bian said. "There are both intrinsic and extrinsic benefits."

Bian initially joined YNCN as a member of the student development team before heading to Switzerland in her third year for an exchange at ETH Zurich, then participating in the Professional Experience Year (PEY) program. When she returned, Tang encouraged her to take over as president at the end of his term. For the 2015–2016 school year, she is focused on strengthening and extending ties with alumni, increasing coordination with the Engineering Career Centre and capitalizing on overlap with the robust student club network.

"My roommate said that fourth year is all about legacy," Bian said. "And that got me thinking about the legacy I want to leave behind, and how I can build on something I've already started."

AARABI, COBBOLD NAMED INVENTORS OF THE YEAR

Professors **Parham Aarabi** (ECE) and **Richard Cobbold** (IBBME, ECE) have each been named U of T Inventors of the Year, an honour that recognizes them for commercializing technology that stands to effect real change in society. Their two products were among just five U of T spinoffs honoured in 2015.

Aarabi is the inventor of X-Touch, the only commercially available technology that can instantly transform any surface to become tap-sensitive without any hardware add-ons. The system uses unique acoustic signatures generated by taps at specific locations to turn any table, wall or lab bench into an interface for the mobile device placed on it.

Cobbold and **Amir Manbachi** (EngSci oT8, BioMedE MASc 1T0, PhD 1T4) are the inventors and founders of **PedicProbe™**, a medical device that uses ultrasound technology to give surgeons a clearer picture during operations where screws are inserted into the spine. The technology could prevent navigational errors and significantly reduce the rate of revision surgeries, in addition to being more portable and affordable than what's available today.

PHOTO/ MARIT MITCHELL

DIVISION OF ENGINEERING SCIENCE

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Raffaello D'Andrea demonstrates a quadcopter in flight in a robot lab at TEDGlobal in 2013.

I, robotics

Raffaello D'Andrea (EngSci 9T1) has been recognized for advancing the field of robotics with the 2015 Engelberger Award from the Robotic Industries Association, which is sometimes called the "Nobel Prize" of robotics.

"It's the most prestigious award there is in the robotics field, and it is an honour to be recognized by your peers," D'Andrea said.

Although he has been an engineering professor, entrepreneur and artist, he's best known as the inventor of several types of autonomous robots — machines that can juggle, play soccer and also accomplish practical tasks.

In the early 2000s, D'Andrea co-founded Kiva Systems, a company that designs and builds large robotic systems that autonomously move, sort and distribute goods in warehouses.

"In 2003, I was approached by Mick Mountz, who had worked at home grocery delivery company Webvan that had gone bankrupt, in part because their distribution costs were too high," D'Andrea said. "He had this idea that mobile robots could solve this large problem in distribution. He was very convincing about the

PHOTO/ JAMES DUNCAN DAVIDSON



MIND OVER MACHINE

Maryam Shanechi (EngSci 0T4) will return to Skule™ in January 2016 to speak at the 11th annual Engineering Science Education Conference. *MIT Technology Review* recently listed Shanechi among the world's top "35 Innovators Under 35" for her work on brain-machine interfaces. These interfaces restore movement in paralysis, control anesthesia and stimulate the brain during neuropsychiatric disorder treatment. She is an assistant professor at the University of Southern California.

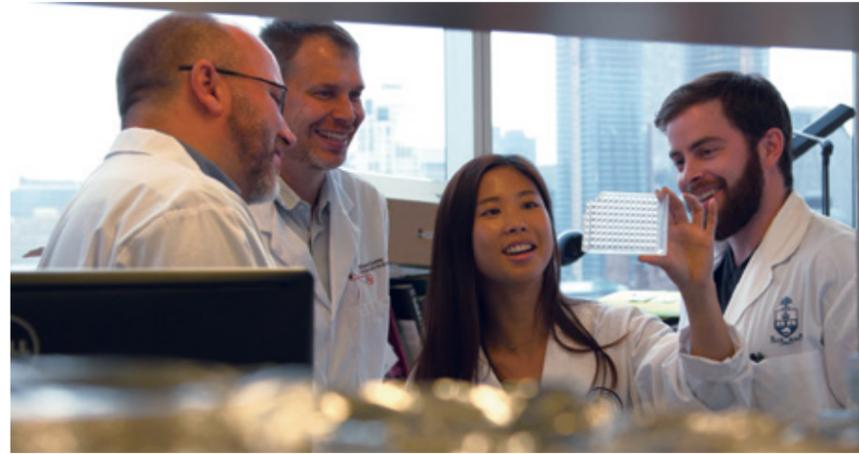
ENGSCI CONNECT

Explore the unlimited potential of EngSci. This spring, EngSci Connect was launched through Graduway — an alumni networking platform. Mentor senior students, reconnect with classmates, find employment or recruit for your team, seek advice, discover events and so much more. In just three short months, EngSci Connect gained over 1,200 members. Take 20 seconds or less using your LinkedIn, Facebook or email account to join today at engsciconnect.ca.

PHOTO/ COURTESY OF MARYAM SHANECHI

INSTITUTE OF BIOMATERIALS & BIOMEDICAL ENGINEERING

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Professors Craig Simmons and Peter Zandstra (left) are leading new bioengineering research to improve heart health. Pictured with IBBME PhD candidates Jennifer Ma and Curtis Woodford.

New approaches to cardiovascular health care

The Translational Biology and Engineering Program (TBEP) — a key component of the new Ted Rogers Centre for Heart Research (TRCHR) — will be a powerful addition to the network of researchers and educators aiming to accelerate treatment development and reduce the estimated \$2.3-billion cost of managing moderate and severe heart failure in Canada.

Ten U of T researchers and their graduate students from U of T Engineering, the Faculty of Dentistry and the Faculty of Medicine will work side by side in the open and collaborative research space to advance clinical applications in genomic medicine, regenerative medicine, tissue engineering and advanced cardiac care. TBEP will occupy an entire floor of the MaRS Phase 2 building in Toronto's Discovery District beginning in fall 2015.

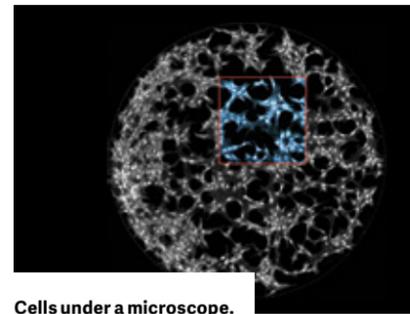
"We're going to be embedded on the same floor as people from the Faculty of Medicine and within a hospital research complex, so our

students will be working side by side, exchanging ideas with one another," said **Craig Simmons** (MIE, IBBME), the Canada Research Chair in Mechanobiology. "The interaction that will occur just because we're physically in the same place is bound to result in new ideas, new approaches and new innovations that wouldn't have happened otherwise."

Simmons was appointed TBEP's scientific director in July.

TBEP's roster of U of T Engineering faculty also includes award-winning researchers **Hai-Ling Margaret Cheng** (IBBME, ECE), **Rodrigo Fernandez-Gonzalez** (IBBME) and **Paul Santerre** (IBBME, Dentistry), who will combine stem cell technology with new approaches in biomaterials, cellular and tissue engineering for the regeneration of heart muscle, coronary vessels and heart valves.

The University of Toronto, Hospital for Sick Children and the University Health Network announced the creation of the Ted Rogers Centre for Heart Research in November 2014, funded by an unprecedented donation of \$130 million from the Rogers family — the largest monetary gift ever made to a Canadian health-care initiative.



Cells under a microscope.

DIGITAL MICROFLUIDICS

Biomedical engineers at U of T have developed a device that helps them more accurately visualize how cells respond to hormones. The team harnessed the emerging power of digital microfluidics to add chemicals to cells in rapid-fire sequence, which enables them to take snapshots of the cells' internal wiring.

For example, the first drop might contain a hormone that tells cells to grow faster. Within seconds, this hormone sets off a chain reaction called a "phosphorylation cascade," modifying certain proteins within the cell in a specific sequence. To see these changes, scientists deliver a second drop containing formaldehyde, which freezes all the proteins in place. They then deliver a third drop containing fluorescent antibodies that stick only to the proteins modified in the cascade. Looking at the antibodies in a microscope provides a snapshot of what has changed and what hasn't.

"It's like a flipboard; each snapshot gives us a static image, but when you combine them all together, you can see movement or action," said **Dean Chamberlain**, a post-doctoral researcher at IBBME, the Donnelly Centre for Cellular and Biomolecular Research and the Department of Chemistry.

The team hopes the insight will help them find new ways to fight cancer.

PHOTO/ COURTESY OF Q MEDIA SOLUTIONS

PHOTO/ COURTESY OF ALPHONSUS NG

DEPARTMENT OF MECHANICAL & INDUSTRIAL ENGINEERING

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Dalia El Helou (MechE 1T5) celebrates the milestone.



125 years strong

The Department of Mechanical & Industrial Engineering (MIE) hit a big milestone in 2015, celebrating the 125th year of the mechanical engineering program at U of T.

The program has grown substantially since 1890, when, **Robert Alexander Ross** was the first and only mechanical engineering student to graduate at the University.

"Today, our alumni are spread across the world — from India, to China, to the United Kingdom — while our MIE researchers are engineering solutions that can be felt in those very countries, and beyond," said Professor **Jean Zu** (MIE), who chairs the department. "We have built such a powerful legacy over the last 125 years, a legacy of research and academic excellence. I know the department's influence and innovations will gain even more momentum into the next 125 years."

To celebrate mechanical engineering's 125-year legacy, the department has hosted a number of celebrations throughout 2015, including a research seminar on

"Engineering the Human Body" with Professor **Craig Simmons** (MIE, IBBME), which was attended by faculty, staff and students across the university; an MIE Design Showcase with keynote speeches by Professor Emeritus **Ronald D. Venter** (MIE) and Professor **Jim Wallace** (MIE); and an MIE Graduate Research Symposium & 125 MechE Celebratory Graduate Gala, featuring Dean **Cristina Amon** and prominent mechanical engineering graduates, including Professor **David Erickson** (MechE MAsc oT1, PhD oT4) of Cornell University and **Bill Buckley** (MechE 7T1), former CEO of Shawcor Ltd.

Celebrations will continue until the end of 2015. Visit uoft.me/mech125 to view a commemorative video and learn more about mechanical engineering's 125-year history and upcoming events.

In spring 2015, the department also published the third issue of its alumni magazine, *Momentum*. Visit uoft.me/momentum2015 to read feature stories on 125 years of mechanical engineering and MIE's global impact on teaching and research.

Professor Mark Fox at a recent lecture.



MARK FOX HONoured FOR PIONEERING WORK IN URBAN SYSTEMS ENGINEERING

Industrial engineering professor **Mark Fox** (MIE) has been named U of T Distinguished Professor of Urban Systems Engineering. The honour recognizes his exceptional career achievements and promise. Fox — a pioneer in the theory and application of artificial intelligence in industrial systems, and the director of the Enterprise Integration Laboratory (EIL) — is one of only 25 U of T faculty members and six U of T Engineering professors that hold this distinction.

HELPING DRIVERS KEEP THEIR EYES ON THE ROAD

Industrial engineering professor **Birsen Donmez** (MIE) continues to make news with her research on human-car interactions. In June 2015, she was honoured with the Early Researcher Award by the Government of Ontario for her work. To help prevent driver distraction, her lab uses eye tracking, proximity sensors and other measurements to generate post-trip reports on a driver's performance.

PHOTO/ PAUL TEREFEKNO

DEPARTMENT OF MATERIALS SCIENCE & ENGINEERING

www.mse.utoronto.ca

MSE student wins national scholarship for mentorship of young women

Samantha Stuart (Year 2 MSE) is one of only five women from across Canada to receive a 2015 Engineering Ambassador Scholarship from the Canadian Engineering Memorial Foundation.

The annual scholarship honours one student in each of Canada's five regions — British Columbia, the Prairies, Ontario, Quebec and Atlantic Canada — who have shown leadership in attracting other young women to engineering.

Stuart's award recognizes her work with high school students to communicate the importance of studying science, technology, engineering and math (STEM) topics.

"I credit a lot of my success to mentors — people who explained what STEM is and why it's something I should consider," Stuart said. "I wanted to jump in and do something right away to help other people have the same experience that I did."

Stuart has been heavily involved in Science Expo Youth Empowerment Group, including running logistics for their major annual conference in Ontario. Science Expo is a not-for-profit organization that helps connect students interested in STEM with mentors, enrichment programs and other opportunities to learn more about the field.

She spent the summer in Professor **Benjamin Hatton's** (MSE) Microstructured Surfaces & Adaptive Materials Lab. Her research included

Samantha Stuart received the prestigious Engineering Ambassador Scholarship from the Canadian Engineering Memorial Foundation.



work on bacteria-resistant coating for materials that can be implanted inside the human body, as well as studying silica-based films for use in optoelectronic devices like light-emitting diodes (LEDs).

She is also the Engineering Society's incoming director for Hi-Skule, which runs design competitions to promote the study

of engineering in high school and elementary school.

"I think one of the big problems in high school is that you take math, you take chemistry, you take physics, but you don't take engineering, so there's a general confusion about what it actually is," she said. "I'm really excited to take on that challenge."

100% OF MSE GRADUATING STUDENTS GIVE BACK

The 2014–2015 graduating class had a lot to be thankful for — so much so that every fourth-year student donated back to a giving program that will benefit next year's cohort of students.

Gratitude, U of T Engineering's fundraising campaign for graduating students, set a new record for participation, with 100 per cent of full-time, fourth-year MSE students contributing to the campaign. The Faculty-wide participation record was

also 10 percentage points higher than the previous year.

"It has been an amazing ride for all of us in the last four to five years," said **Vinson Truong** (MSE 1T4 + PEY), last year's outgoing MSE Club chair. "Our professors, staff, teaching assistants and fellow students consistently foster a welcoming community in our department. We hope future MSE students will continue to build on this positive atmosphere with our class gift."

UNIVERSITY OF TORONTO INSTITUTE FOR AEROSPACE STUDIES

www.utias.utoronto.ca



Professor Alis Ekmekci delivers a lecture on flow-induced noise issue associated with aircraft landing gear.

UTIAS professor receives Ontario Ministry of Research and Innovation award

Professor **Alis Ekmekci** (UTIAS) received the Ontario Ministry of Research and Innovation's Early Researcher Award (ERA) — one of only three ERA recipients from U of T Engineering in 2015.

Ekmekci's award will further her experimental investigation into two major engineering challenges: reducing the noise and damage caused by wind or ocean currents flowing around structures — from off-shore oil rigs to high-rise buildings and bridges — and the flow-induced noise issue associated with aircraft landing gear. The research will look for possible causes of noise generation and work toward developing realistic noise and damage mitigation solutions.

Ekmekci received a New Researcher Award from the Connaught Foundation in 2013, which she said helped to position her for the ERA.

"The Connaught award provided the means to acquire important instrumentation needed for the

experiments associated with the flow-induced vibration problem, which is the first problem to be investigated through the Early Researcher Award," she said.

Ekmekci runs the Experimental Fluid Dynamics lab at UTIAS, which is equipped with state-of-the-art experimental facilities and instrumentation. She and her graduate students conduct research into various flow problems, including unsteady separated flows, vortex dynamics, flow-induced noise and vibration problems, and the development of passive flow control methodologies. She also works in collaboration with a number of industrial partners, including Bombardier Aerospace, Messier-Bugatti-Dowty, RWDI and Multimatic, on projects that include flow-induced noise and its mitigation in aircraft landing gear, flow-induced vibration control in slender structures, bridge aerodynamics and automobile aerodynamics.

Ekmekci received a BAsC from Istanbul Technical University and her MASc and PhD from Lehigh University. She was the first female faculty member to be hired at UTIAS.



BANNER YEAR FOR DRONE EXPERT

U of T named **Hugh Liu** (UTIAS) one of three Inventors of the Year for 2015 for developing a system that synchronizes groups of unmanned aerial vehicles (UAVs) to behave as a single entity. The honour recognizes exceptional researchers who are commercializing new technologies.

Liu, leading a team of U of T, Waterloo and York professors, also received a \$1.65-million grant from the Natural Sciences and Engineering Research Council of Canada (NSERC) to train 150 students over the next six years to work on research related to UAVs, including agricultural and environmental monitoring, which will lead to the formation of the Centre for Aerial Robotics Research and Education (CARRE) at UTIAS.

UTIAS DIRECTOR SELECTED AS TURNBULL LECTURER

David Zingg, professor and director of UTIAS, was named The W. Rupert Turnbull Lecturer for 2015 in recognition of his wide-ranging contributions to sustainable aviation. His lecture was entitled "Toward Sustainable Aviation: Exploratory Aerodynamic Shape Optimization." The Turnbull lecturer is selected on the basis of significant achievement in the scientific or engineering fields of aeronautics, space-associated technologies or their application.

Honour Roll

The collective generosity of U of T Engineering's vibrant community of alumni, faculty, students and friends is nothing short of outstanding. We offer our deep thanks for your tremendous support and dedication.

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“Our donation is our legacy. We want the students to know who we are and what is important to us.”

—**Nicolas Kordellas** (MechE 5T9) and **Shirley Tripp** on their donation and pledge to endow scholarships to benefit students at U of T Engineering and the Lawrence S. Bloomberg Faculty of Nursing.

Ottawa-based developer **Samuel Lyon Sachs** (IndE 4T9), pictured (left) with U of T President Meric Gertler, provided a generous \$1-million gift to strengthen collaborations between U of T Engineering and Israel's Technion Institute of Technology.



Legacy Gifts

Planned gifts help fund the work of our students, scholars and researchers through bequests, insurance gifts, trust agreements and charitable annuities.

King's College Heritage Society

The King's College Heritage Society recognizes alumni and friends who have thoughtfully made a provision for the University. As of April 30, 2015, the following individuals have remembered the Faculty of Applied Science & Engineering in their estate plans.

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Annual Fund gifts from alumni, parents and friends are at the heart of philanthropy at U of T Engineering. These gifts — whether unrestricted or designated to a department, program or initiative — provide the Faculty with a base of support on which to build new infrastructure and programs.

Skule™ Society Donors

The Faculty of Applied Science & Engineering is grateful to the following members of the Skule™ Society for their generous and ongoing support. Their annual gifts of \$1,000 to \$24,999 (or of \$250 and above for current students and young alumni who have graduated in the last decade) enhance the experiences of our students, contribute to Faculty excellence and improve our labs and classrooms. Donors listed below have made leadership gifts or pledges to the Faculty between May 1, 2014 and April 30, 2015.

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Back to Skule™ Home is where the heart is

by JAMIE HUNTER

Triple engineering graduate **Angela Tran Kingyens** (EngSci oT5, ChemE MAsc oT7, PhD iT2) may live in the San Francisco Bay Area, but her heart is still at the University of Toronto.

“U of T has given me so much in so many ways,” Tran Kingyens said. “I received my formal and informal education there. I grew up in the hallways of the Wallberg Building as a kid while my dad [chemical engineering professor **Honghi Tran**] was in his lab. I was even married at Knox College. U of T is home. It’s in my blood.”

Since leaving for Silicon Valley in 2010 to establish a career as both an entrepreneur and investor, Tran Kingyens has remained active as a Skule™ volunteer.

She regularly offers her time and expertise to the Institute for Leadership Education in Engineering (ILead), a program that gave Tran Kingyens the confidence to make decisions based on what she values, and pursue a career that helps others to create positive change. She has also been involved with The Entrepreneurship Hatchery, where she has participated as a speaker and mentor.

But it is as co-founder of the Engineering Alumni Association (EAA) San Francisco Bay Area Chapter that she has made the biggest impact off campus. Tran Kingyens has worked hard to establish a community of like-minded U of T Engineering alumni there that hosts networking and social events. However, she sees much more potential for the group to increase its impact.



The yellow bricks of Wallberg: Angela Tran Kingyens visits her old stomping ground.

“I would love for this community to drive more value beyond social networking,” she said. “I want the chapter to be a hub for business and research opportunities, given that it is situated in the tech capital of the world. If someone is looking for partners or customers in the Valley, they should be able to come to us and ask for help. In addition to being home to the most innovative companies, there are also amazing schools here with Stanford University and the University of California, Berkeley. So, I definitely see our chapter as a gateway for U of T.”

Tran Kingyens’ professional connections to the best and brightest in Silicon Valley run deep. She began

her career as a partner at Insight Data Science, a startup that helps people with PhDs transition from academic research to careers in industry via a six-week training program, and is still involved as a mentor. Today she is an associate at Version One Ventures, an early-stage fund that invests in consumer Internet, software and mobile entrepreneurs across North America. Version One counts U of T Engineering startup Wattpad among the more than 50 companies in its portfolio.

“I am fortunate to work with smart, driven and courageous people every single day,” she said. “As an investor, you get to learn from these people and the brilliant ideas that they have. I think this is what captivates me. I get to be around the best.”



SUSTAINABLE ENERGY, ROBOTICS OR OFF-ROAD CAR DESIGN?

THANKFULLY, MEGAN DOESN'T HAVE TO CHOOSE.

Legacy giving makes it possible. Mechanical Engineering student Megan Mattes (BAsC 2017) knows that now is the time to explore, and so she has chosen two streams: Energy & the Environment and Mechatronics. When she’s not in class, Megan is designing rough-terrain vehicles. One reason she can seize every opportunity is J. Edgar McAllister’s bequest, which created the scholarship that Megan received, easing her financial stress. Include a bequest to the Faculty in your will and you too can encourage curious minds like Megan.

To talk about legacy giving, contact:
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