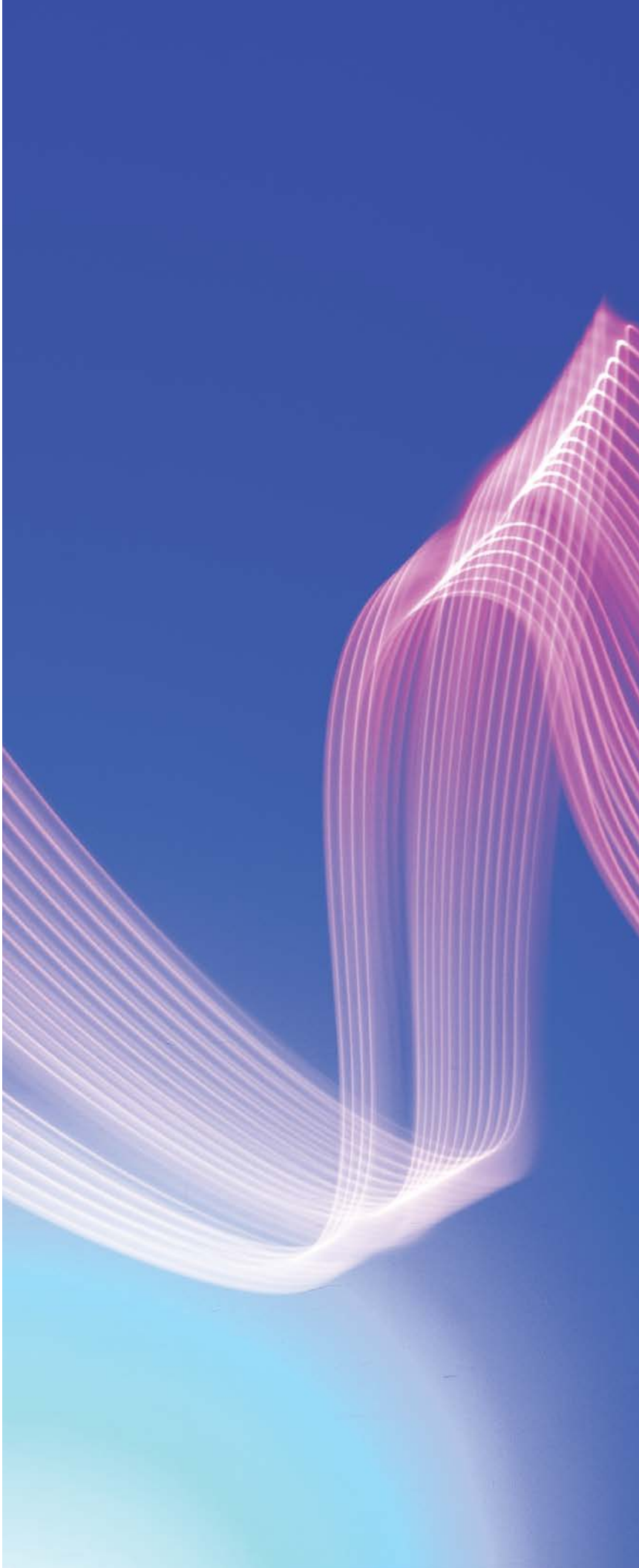
Carleton UNIVERSITY

Carleton University Research and International Review

Research and International
CARLETON UNIVERSITY



Office of the Vice-President (Research and International)

CARLETON UNIVERSITY
503 Tory Building
1125 Colonel By Drive
Ottawa, Ontario
K1S 5B6

research.carleton.ca

@cu_research

Rafik Goubran
Vice-President
(Research and International)

Sandra Crocker
Associate Vice-President
(Strategic Initiatives and Operations)

Karen Schwartz
Interim Associate Vice-President
(Research and International)

Andrea Lawrance
Director, Carleton Office for
Research Initiatives and Services (CORIS)

Julie Carl
Research Communications Manager

Published 2019

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Message from the President and Vice-Chancellor and the Vice-President (Research and International)

Rafik Goubran, Vice President (Research and International), left, and Benoit-Antoine Bacon, President and Vice-Chancellor (right), stand with Catherine McKenna, Minister of Environment and Climate Change in front of Carleton's noted living lab, the Urbandale Centre for Home Energy Research in August 2018.

At Carleton, research is the air we breathe and we are so pleased to showcase our many recent successes in this edition of our Research and International Review. Our community is charging ahead with more exciting research projects, awards and collaborations than ever, and with 929 faculty members and 30,416 students, we have many success stories to celebrate. Some exceptional highlights this year include our contributions to the realms of energy efficiency, accessibility and autonomous vehicles.

We have a long history of leadership in **energy efficiency** research. This year we launched an exciting national organization located here on campus named Efficiency Canada that will, building on our existing research and policy expertise, advocate for energy-efficient public policies. We welcomed Minister of Environment and Climate Change Catherine McKenna to campus to announce substantial funding for our research in energy-efficient buildings. Additionally, the 220-square-foot Northern Nomad tiny house, created as a fourth-year capstone project by students in the Faculty of Engineering and Design, attracted lots of attention.

In August, Minister of Seniors and Accessibility Raymond Cho praised Carleton for its leadership in accessibility services, from on-campus support for students with disabilities to **accessibility** design efforts by students in the Advanced Biomechatronics and Locomotion (ABL) Lab. Other initiatives that boost our profile in this field include the Carleton University Accessible Experiential Learning (CUAEL) project and the David C. Onley Initiative for Employment and Enterprise Development, both of which connect students with disabilities to employment, entrepreneurial opportunities and mentorships. Professor Adrian Chan is a leader in this area with his new experiential Research and Education in Accessibility, Design, and Innovation (READi) training program.

Carleton is also helping to create transportation of the future. Across the university, over 125 researchers from six faculties are engaged in projects related to connected systems and **autonomous vehicles**, from design aspects to safety to connectivity. Together these researchers are working with industry partners to help to transform Ottawa into an international R&D hub. Among many highlights, Minister McKenna again came to campus for a major funding announcement in this field, and NASA's top leader Jim Bridenstine came to Carleton in November to demonstrate new Mars rover technology developed by Carleton-based startup Mission Control Space Services.

We would be remiss if we didn't also highlight many outstanding contributions in other research fields such as sustainability and climate change, Indigenous and Northern communities, particle physics, AI and deep learning, international relations, Africa, and sensors technology, to name but a few.

Please continue reading to learn more about the impacts of research at Carleton University.

Benoit-Antoine Bacon
President and Vice-Chancellor

Rafik Goubran
Vice-President (Research and International)

By the Numbers

26,321
Undergraduate Students

153,000
Alumni

4,095
Graduate Students

929
Full-time Faculty Members

27
Canada Research Chairs

$70.3M
Sponsored Research Funding in 2017/18

8
Banting Postdoctoral Fellowships

29
Royal Society Fellows

38
Provincial Early Researcher Award Recipients

3
Killam Award Winners

21
Order of Canada Recipients

14.4%
increase in Tri-Agency funding over 5 years

10%
increase in scholarly output*

7.4%
increase in number of Carleton University authors*

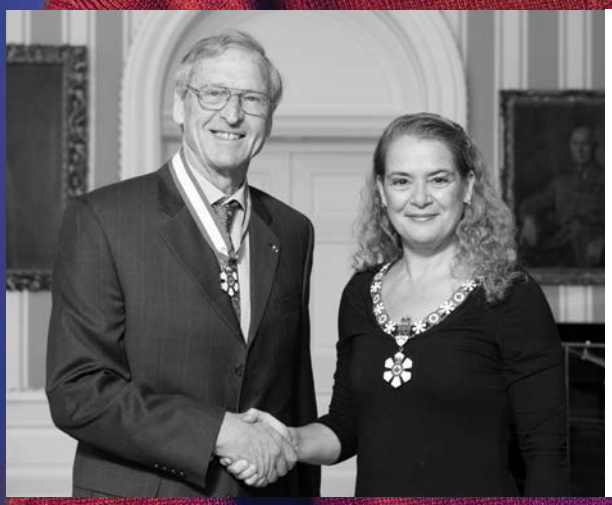
166.8%
increase in not-for-profit research income growth over 10 years**

82,168
citations*

7.5
citations per publication*

* SCOPUS 2013-2018
** Re$earch Infosource

Award-winning Research



David Sinclair appointed Officer of the Order of Canada

David Sinclair, Distinguished Research Professor in the Department of Physics, was appointed as an Officer of the Order of Canada. The Order of Canada is one of the country's highest civilian honours.

Sinclair is recognized for his "exceptional contributions to the field of experimental sub-atomic physics and for his leadership as a founding director of the Sudbury Neutrino Observatory (SNO) project."

Carleton physicist recognized by Royal Society of Canada, named Deputy Spokesperson at ATLAS

Manuella Vincter, professor in the Department of Physics, has been elected as a Fellow to the Royal Society of Canada (RSC) in recognition of the high level of excellence demonstrated during her career. Vincter's research focusses on precision measurements of the electroweak force, the structure of the neutron and proton, and most recently the properties of the W and Z bosons.

Additionally, Vincter has been selected as Deputy Spokesperson for ATLAS at CERN, the European organization for nuclear research. She played a leading role in the scientific development of the collaboration, which in 2012 discovered the Higgs boson particle. The spokesperson and two deputies oversee all aspects of the ATLAS physics project, including operations of the detector and its scientific output.

Carleton professors honoured by the Royal Society of Canada

Lenore Fahrig[1], professor in the Department of Biology, was awarded the Royal Society of Canada's 2018 Miroslaw Romanowski Medal. The award recognizes contributions to resolving scientific aspects of environmental problems. Fahrig's research looks at habitat connectivity and fragmentation, road ecology and sustainable agriculture.

Graeme Auld[2], professor in the School of Public Policy and Administration, was elected to the Royal Society of Canada's College of New Scholars, Artists and Scientists. The College recognizes researchers who demonstrate a high level of excellence at an early point in their careers. Auld's research focuses on global environmental policy and politics.

[1]

[2]

Carleton researchers receive Early Researcher Awards

Two Carleton University researchers have been honoured with the Ontario government's Early Researcher Awards (ERA), valued at $150,000. **Marina Milyavskaya**[1], an assistant professor in the Department of Psychology, studies goal setting and motivation. **Hanika Rizo**[2], an assistant professor in the Department of Earth Sciences, studies the formative period of the earth.

Steven Cooke elected to the Royal Canadian Geographical Society

Steven Cooke[3], Canada Research Chair in Fish Ecology and Conservation Physiology, was elected as a Fellow of the Royal Canadian Geographical Society (RCGS). The RCGS recognizes those who have made extraordinary contributions to understanding the diverse geographical and natural heritage of Canada. Cooke is recognized for his contribution to improving the sustainability of all fishing sectors by working on common problems such as post-release stress and mortality.

[1]

[3]

[2]

Chris Burn honoured with Governor General's Polar Medal, awarded Higher Doctorate of Science

Department of Geography and Environmental Studies professor **Chris Burn** has won the Governor General of Canada's Canadian Polar Medal. The award celebrates Canada's northern heritage and recognizes extraordinary service to the polar regions and Canada's North. Burn has made deep contributions to scientific knowledge, engaged in collaborative projects with northern agencies, and trained the next generation of northern researchers.

Additionally, Burn was awarded a Higher Doctorate of Science (DSc) in Geography from Durham University in the United Kingdom. The university has awarded just 10 higher doctorates since 1999. Supervisor of Carleton's new Northern Studies graduate programs, Burn's primary research focus is on field investigation of permafrost environments in western Arctic Canada.

Jean-Guy Godin awarded Fry Medal by Canadian Society of Zoologists

Jean-Guy Godin, Chancellor's Professor in the Department of Biology, was awarded the 2018 F.E.J. Fry Medal by the Canadian Society of Zoologists. The medal honours a Canadian zoologist who has made an outstanding contribution to their field. Godin's expertise is in behavioural ecology and his research interests focus on the evolution of behavioural adaptations for survival and reproduction, particularly in fish.

Winnie Ye receives three engineering awards

Winnie Ye, professor in the Department of Electronics, has received the 2018 Engineering Medal for Research and Development from Professional Engineers Ontario (PEO). She also received the Engineering Excellence Award from the PEO's Ottawa chapter, which is awarded to a local engineer who has developed an innovative application of engineering knowledge and principles. Ye was also awarded the Women in Engineering Inspiring Member of the Year Award by the Institute of Electrical and Electronics Engineers (IEEE). Ye's research field is photonics, and her focus is on how silicon photonic devices can be used for telecommunication and data communication.

Kyle Biggar receives Banting Discovery Award

Kyle Biggar, professor in the Department of Biology, received a Banting Discovery Award for his cancer research. The Discovery Award is a one-year grant of up to $25,000 for innovative health and biomedical research projects by outstanding new investigators at universities and research institutes in Canada. Biggar's research focuses on identifying of new substrates of the histone methyltransferase enzyme, SMYD3, and their implication in lung cancer development.

Richard Yu recognized by engineering association

Richard Yu, a professor the School of Information Technology, has been named a Fellow of the Institute of Electrical and Electronics Engineers (IEEE). Yu is recognized for his "contributions to mobility management and radio resource allocation in mobile wireless networks."

Carleton University Research Achievement Award Winners 2018

The Carleton University Research Achievement Awards recognize outstanding research achievements and excellence by Carleton faculty members.

From left to right: James Green, Norman Hillmer, Hanika Rizo, Stephen Godfrey, Rafik Goubran, Thomas Sherratt, Marina Milyavskaya, Philip Kaisary, Luciara Nardon. Absent: Barbara Leckie and Halim Yanikomeroglu.

The 2018 recipients are:

Stephen Godfrey,
Department of Physics
New Directions Towards the Understanding of Dark Matter

James Green,
Department of Systems and Computer Engineering
Real-time Monitoring of Vibrations and Noise During Neonatal Patient Transport

Norman Hillmer,
Department History
Canada and Peacekeeping: A Contradictory History

Philip Kaisary,
Department of Law and Legal Studies
The Haitian Revolution and Rights: Liberation, Law, Poetics

Barbara Leckie,
Department of English Language and Literature, and the Institute for the Comparative Study of Literature, Art, and Culture
Unfinished: A Cultural History of Nineteenth-Century Procrastination

Marina Milyavskaya,
Department of Psychology
Motivation and Obstacles to Healthy Eating: Situation Selection or Subjective Perception?

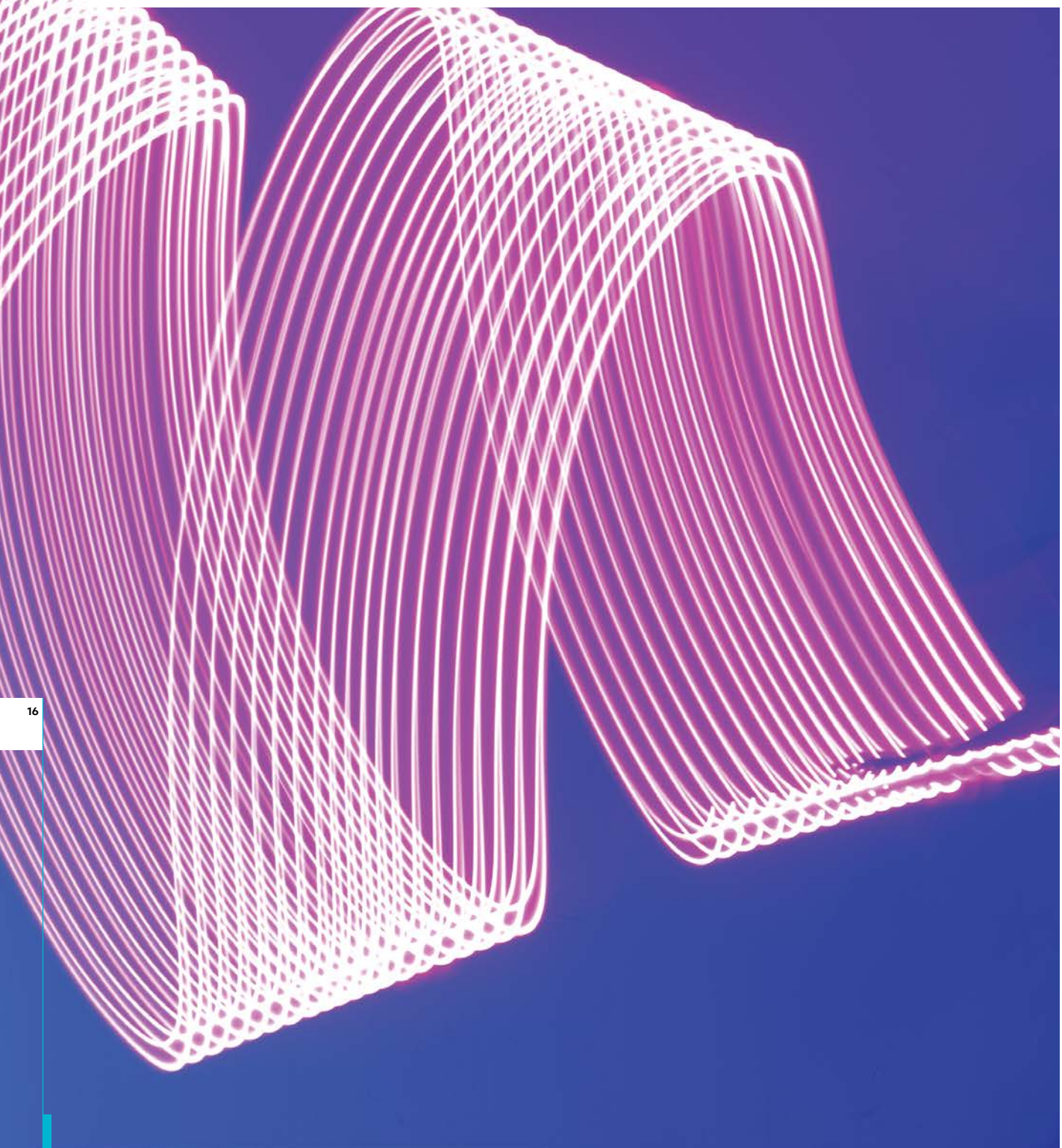
Luciara Nardon,
Sprott School of Business
Newcomers' Career Advancement

Hanika Rizo,
Department of Earth Sciences
Establishing a New Laboratory for the Study of Earth's Earliest Times

Thomas Sherratt,
Department of Biology
The Evolution of Flash Behaviour

Halim Yanikomeroglu,
Department of Systems and Computer Engineering
CAN-UAVs 2030: Connected, Autonomous, and Networked UAVs Towards 2030s

Research Excellence:
Tri-Agency Funding Highlights



Social Sciences and Humanities Research Council (SSHRC)

NEW PARTNERSHIP IN GLOBAL REFUGEE POLICY

James Milner, professor in the Department of Political Science, received a $2.5 million SSHRC Partnership Grant. Funding from other partners brings his total to $3.6 million for a project called "Civil Society and the Global Refugee Regime: Understanding and Enhancing Impact through the Implementation of Global Refugee Policy." The team's research will focus on efforts to implement global refugee policy in Jordan, Kenya, Lebanon and Tanzania in collaboration with a global team of academics, government agencies and human rights advocates.

INDIGENOUS TREATY IMPLEMENTATION RESEARCH RECEIVES INJECTION FOR COLLABORATION

Stephanie Irlbacher-Fox, an adjunct research professor in the School of Public Policy and Administration, has been awarded a $2.5 million SSHRC Partnership Grant for her project "Modern Treaty Implementation Research: Strengthening our Shared Future." In collaboration with the Land Claims Agreements Coalition and its Indigenous treaty organization and government members, this partnership will investigate challenges in Indigenous treaty implementation. Based in Yellowknife, NWT, Irlbacher-Fox recruited a team of academics, land claim practitioners and Indigenous self-governments for the project.

Canadian Institutes of Health Research (CIHR)

PERPETUAL CHRONIC PAIN

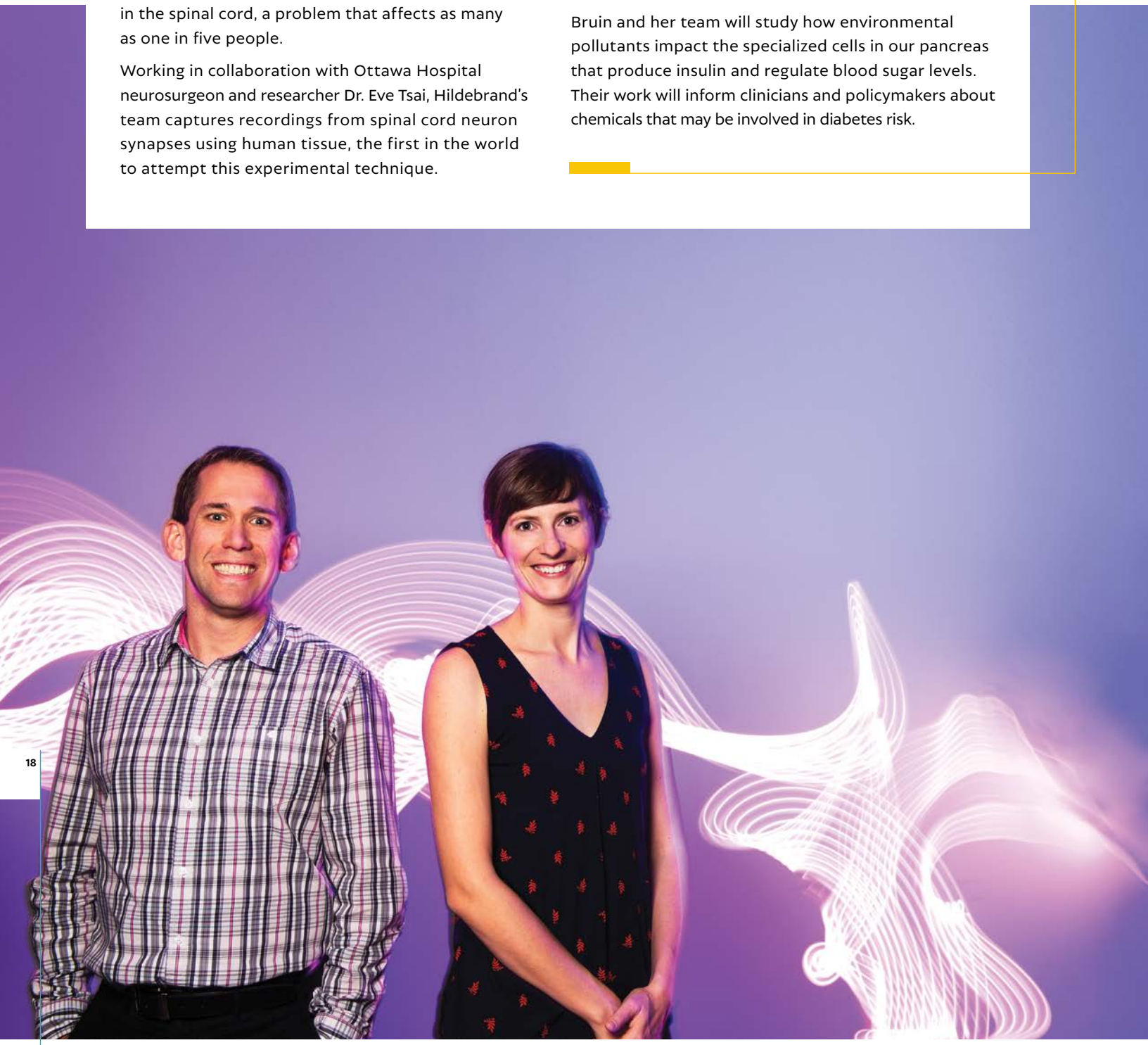
Mike Hildebrand, professor in the Department of Neuroscience, in conjunction with two other labs, has received a five-year grant worth $573,750 from CIHR to continue his research on perpetual chronic pain in the spinal cord, a problem that affects as many as one in five people.

Working in collaboration with Ottawa Hospital neurosurgeon and researcher Dr. Eve Tsai, Hildebrand's team captures recordings from spinal cord neuron synapses using human tissue, the first in the world to attempt this experimental technique.

IMPACTS OF POLLUTANTS ON DIABETES

Jenny Bruin, professor in the Department of Biology, received $750,000 from CIHR to support her innovative research on the factors that trigger diabetes onset and progression.

Bruin and her team will study how environmental pollutants impact the specialized cells in our pancreas that produce insulin and regulate blood sugar levels. Their work will inform clinicians and policymakers about chemicals that may be involved in diabetes risk.



Natural Sciences and Engineering Research Council (NSERC)

ACCESSIBILITY PROGRAM SUPPORT

Adrian Chan[1], professor in the Department of Systems and Computer Engineering, has received an NSERC Collaborative Research and Training Program (CREATE) grant worth $1.65 million over six years.

The grant will support Chan's Research and Education in Accessibility, Design, and Innovation (READi) program, which provides training to help incorporate accessibility into research, design, and development processes. The program involves nine other researchers from Carleton, the University of Ottawa, and Queen's University.

CONSERVATION IN THE RIDEAU CANAL WATERWAY

Steven Cooke[2], Canada Research Chair in Fish Ecology and Conservation Physiology, along with Carleton colleagues and others from various universities, have been awarded an NSERC Strategic Partnership grant to support managing Parks Canada's historic Rideau and Trent-Severn waterways to maintain and enhance ecosystem services.

The project will provide many opportunities for undergraduates and graduates to get involved in research, which focus on the influence of dam and lock station presence and operations and the effects of shoreline habitat and aquatic management strategies on ecosystem structure.

OIL SANDS TAILINGS MANAGEMENT

Paul Simms[3], professor in the Department of Civil and Environmental Engineering, in partnership with the University of Alberta, has received more than $2 million over four years through the NSERC Collaborative Research and Development (CRD) program. This research will investigate faster and cheaper measurement devices and techniques for evaluating long-term management of oil sands tailings.

[1]

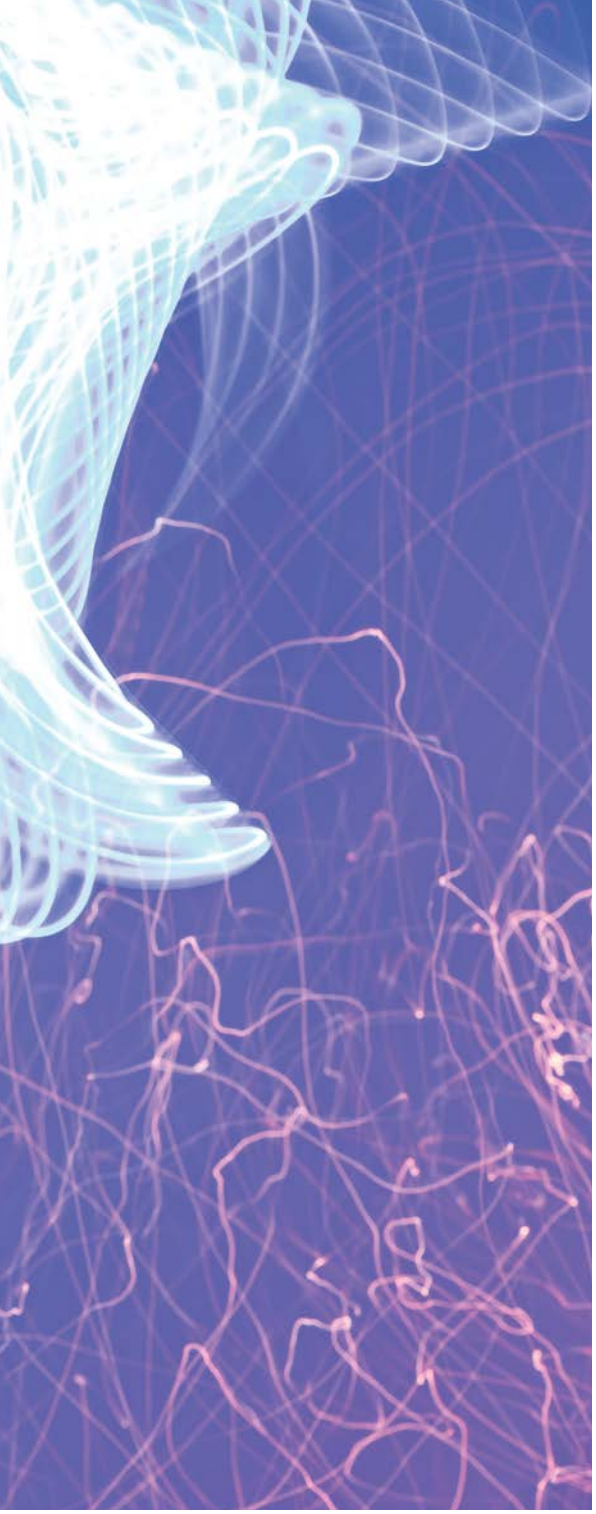
[2]

[3]

Research Excellence: Canada Foundation for Innovation Funding Highlights

Neutrinos and dark matter

Mark Boulay, Canada Research Chair in Particle Astrophysics and Subatomic Physics, has received over $3.3 million from the Canada Foundation for Innovation for his research into neutrinos and dark matter at the SNOLAB in Sudbury, Ont. The funds support the Facility for Development of Noble Liquid Detectors and Optical Readout for Subatomic Physics and Particle Astrophysics, which will enable world-class research into next generation detectors for neutrino-less double beta decay and dark matter.



Research Support Fund vital to supporting research

The Tri-Agency's Research Support Fund assists Canadian post-secondary institutions with the expenses associated with the management of their research enterprise. The generous contributions of this fund are paramount to the success of strategic investments at Carleton.

Some of the activities this fund supports include the Carleton Front Door program, which provides access to research expertise and infrastructure to external partners, and the Carleton Innovation Transfer Office, which provides commercialization support for university researchers and students to monetize intellectual property. Also supported is the Research Ethics Office, without which the university could not ensure that all research involving people meets the highest ethical and regulatory standards.

[1]

Showcasing Research Excellence

Canada Research Chairs established in Neuroscience and in North American Indigenous Art and Material Culture

Hongyu Sun[1], assistant professor in the Department of Neuroscience, has been named Canada Research Chair (CRC) in Developmental Neuroscience. Sun will study the cellular and molecular mechanisms of brain development in early life.

Prof. **Carmen Robertson**[2] is jointly appointed in the School of Indigenous and Canadian Studies, School for Studies in Art and Culture, the School of Indigenous and Canadian Studies, and the Institute for Comparative Studies in Literature, Art, and Culture. Her focus is on the artworks of contemporary Indigenous art, particularly that of Anishnaabe artist Norval Morrisseau.

Jacques Albert, Canada Research Chair in Advanced Photonic Components (Tier 1), and **Stephan Gruber**, Canada Research Chair in Climate Change Impacts/Adaptation in Northern Canada (Tier 2) have had their Chairs renewed.

[2]

Efficiency Canada launched

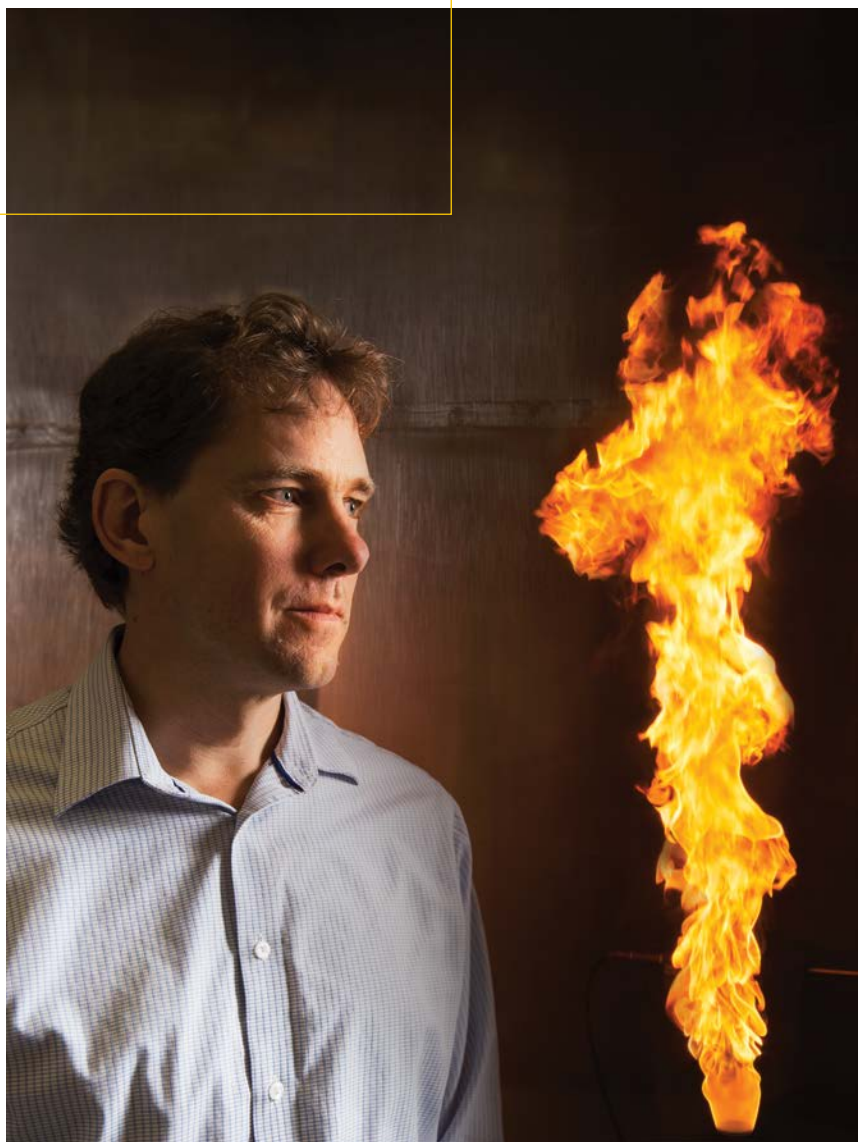
Carleton University received a significant 2-year commitment from the Ivey Foundation, The Trottier Foundation, The Donner Foundation and The McConnell Foundation to create a new national energy efficiency advocacy and policy organization. Efficiency Canada will develop an active program of knowledge transfer, knowledge mobilization and research in the energy efficiency domain.

Launched in November 2018 with Minister of Finance **Bill Morneau** in attendance, Efficiency Canada involves researchers from the Faculty of Engineering and Design and the Faculty of Public Affairs, as well as allies from other higher education institutions, private-sector businesses, utilities and governments. Efficiency Canada evolved out of the 20-year-old Canadian Energy Efficiency Alliance (CEEA).

Carleton report finds Alberta gas emissions higher than estimated

Matthew Johnson, professor in the Department of Mechanical and Aerospace Engineering and director of the Energy and Emissions Research Lab, along with several co-authors have published a study in *Environmental Science and Technology Journal* that suggests methane emissions in the Canadian oil and gas sector are significantly higher than currently estimated and reveals critical gaps in current reporting requirements.

The study used an aircraft to measure methane emissions from two Canadian oil and gas production regions and compared these results with current federal estimates and industry reported data. The results suggest that total methane emissions are probably at least 25 to 50 per cent greater than current government estimates.

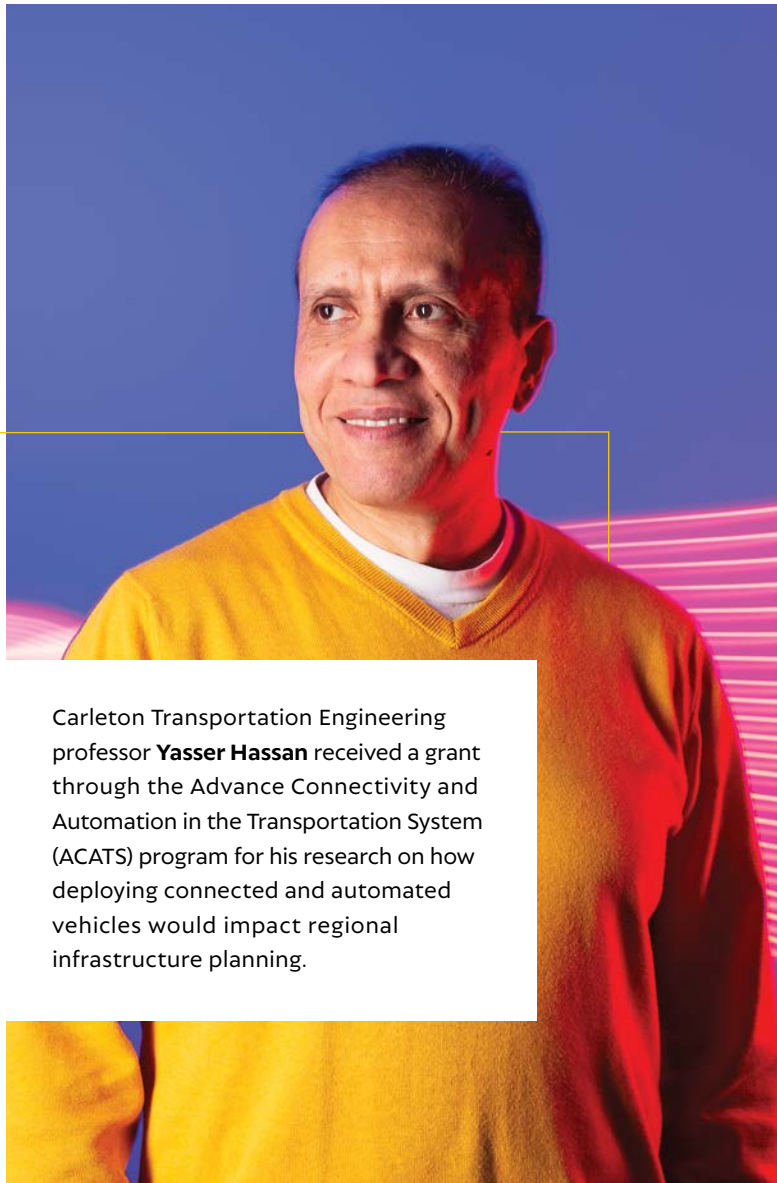


Carleton engineering researchers receive Transport Canada funds

Three Carleton professors have received grants from Transport Canada for their innovative research.

Mostafa El Sayed, director of Carleton's Aerospace Structures and Material Engineering Lab, has received a Clean Rail Academic Grant to improve the design of railway cars using his long experience at Bombardier, to make them lighter, stronger and safer using multidisciplinary design optimization employing hybrid materials.

Jeremy Laliberté, assistant professor in the Department of Mechanical and Aerospace Engineering, received funding for his research on the long-term environmental, fatigue and chemical exposure hazards of the lightweight materials used in freight rail. He is also a Canadian leader in UAV research.



Carleton Transportation Engineering professor **Yasser Hassan** received a grant through the Advance Connectivity and Automation in the Transportation System (ACATS) program for his research on how deploying connected and automated vehicles would impact regional infrastructure planning.

McDonald Astroparticle Physics Research Institute launched

The new Arthur B. McDonald Canadian Astroparticle Physics Research Institute, a collaborative project between six universities including Carleton University, has opened its doors at Queen's University. **Arthur McDonald** is professor emeritus at Queen's and was co-winner of the Nobel Prize in Physics in 2015. The institute aims to unify astroparticle physical research across Canada, and leverages Carleton University's leadership in Canadian and international physics research.

Canada 150 Research Chair in Gender and African Politics named

Carleton welcomes **Shireen Hassim**, an internationally renowned expert in feminist theory, politics, social movements and collective action, for a seven-year term as Canada 150 Research Chair in Gender and African Politics. A distinguished visiting professor at the Radcliffe Institute for Advanced Study at Harvard, Hassim was also a faculty member at the University of the Witwatersrand in South Africa where she is the first black female full professor of political science in the country. The Institute for African Studies becomes her academic home on campus.

Carleton names Helmut Kallmann Chair for Music in Canada

Carleton has created a new endowed chair to help graduate and undergraduate students research topics related to Canadian music. The Helmut Kallmann Chair for Music in Canada was established thanks to a commitment of $2 million from Carleton Distinguished Research Professor Elaine Keillor and support from The Koerner Foundation. Helmut Kallmann was the former head of the music division at Library and Archives Canada.

Dr. Ellen Waterman has been announced as the first Chair, taking effect on January 1st, 2019. For many years, Dr. Waterman has been a familiar and central figure on the Canadian music scene. She brings to the Chair a distinguished record of research and performance practice, touching on diverse areas such as contemporary composition, creative improvisation, acoustic ecology, and music and disability.

Spotlight on Student Research Achievements

Governor General's Academic Medal winner

Graham Cree[1], a graduate student in the Department of Physics, won a Governor General's Academic Medal for his work with Carleton's ATLAS research group to develop a way to measure more accurately the Higgs boson particle's mass, width and interaction rate. Cree, along with other winners from across Canada, was celebrated at the inaugural Ontario Graduate Studies Celebration of Academic Excellence event established by Carleton University.

Vanier Awards

Vanier Canada Graduate Scholarships were awarded to **Trycia Bazinet**[2] from the School of Indigenous and Canadian Studies, and **Émélie Desrochers-Turgeon**[3], from the Azrieli School of Architecture and Urbanism. The award provides Canadian PhD students with $50,000 per year for three years of their doctoral studies.

Bazinet's research focuses on exploring the relationship of the Indigenous community in Apitipik, Northern Quebec with nearby Lake Abitibi and the colonial influence of white settlers. Desrochers-Turgeon's research studies settler colonial spatial practices in the Canadian Arctic.

NSERC's Science, Action! Video competition

Brandon Robinson[4], a Master of Applied Science student in the Department of Civil and Environmental Engineering, won second place in the Natural Sciences and Engineering Research Council of Canada (NSERC) Science, Action! video contest. Robinson is the first Carleton student to win a top-three spot in the competition, which earned him a $3,000 prize. His 60-second video featured his work with wind tunnel tests focussing on the interaction of flexible structures and airflow, such as the swaying of the CN Tower in high winds.

Graduate student among top 25 SSHRC Storytellers

Michelle MacQueen[5], a master's student in the Music and Culture program, was among the top 25 finalists of the Social Sciences and Humanities Research Council's (SSHRC) Storyteller competition. Her entry, titled "Critical Constructions of Canadianness: The Tragically Hip and Representations of Canadian Identity" examines the iconic rock band and Canadian identity. Her entry garnered her a cash prize of $3,000. Architecture student among top ten in competition

Architecture student among top ten in competition

Justin Yan[6], a first-year Master of Architecture student, earned a place in the top ten of a competition for students held by The American Institute of Architects Committee on the Environment (AIA COTE). The only winner from Canada, he created a project titled "City Centre Glassworks: An Adaptive Reuse Workshop and Experimentation Facility", which is a workshop space for manufacturing architectural glass. Yan won a US$2,000 prize and attended the AIA's National Convention in New York City where his project was on display.

NSERC Aboriginal Ambassador Award

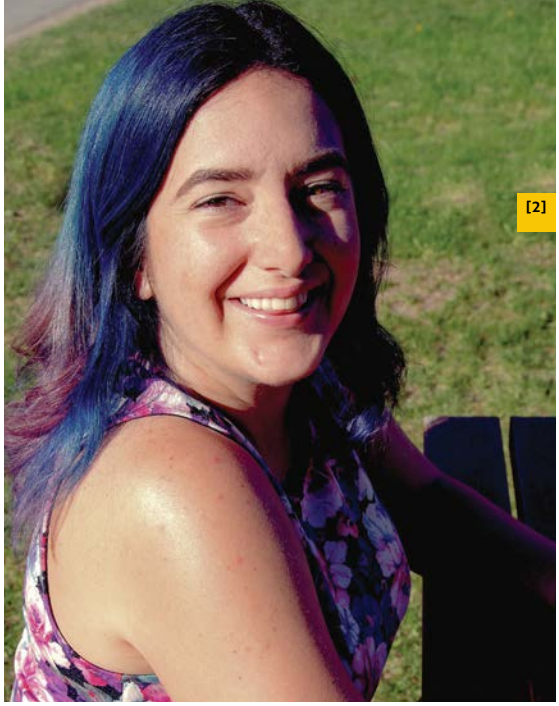
Andrea Reid[7], a PhD candidate in biology and National Geographic Young Explorer, has won a Natural Sciences and Engineering Research Council of Canada (NSERC) Aboriginal Ambassador Award. Reid's research focuses on sustainability of Pacific salmon fisheries, using radio telemetry technology to track Pacific salmon as they migrate to spawn, with the goal of identifying fishing practices that result in the highest overall survival in these fish. She travelled to her grandmother's north-central Indigenous (Nisga'a) community in British Columbia where she had the opportunity to teach elementary school children about her research.

Engineering students create net-zero energy house

Faculty of Engineering and Design students created an innovative "Northern Nomad[8]" tiny house, to show how an Ottawa-based home can have a net-zero energy footprint and onsite water generation.

The 220-square-foot house, which began as a fourth-year capstone class project, sustains itself by storing solar power and collecting atmospheric water. The house is equipped with sensors and monitors, which researchers will use to collect data and perform energy research over the next few years.


[1]


[2]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[5]


[6]


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[2]

Innovation and Entrepreneurship

Global cybersecurity resource

Tony Bailetti[1] and **Dan Craigen**[2] showcased the work of Carleton's Global Cybersecurity Resource (GCR) to Prime Minister Justin Trudeau when he toured the Bayview Yards technology and entrepreneurship centre last April. Craigen is the director of the GCR, and Bailetti is the director of Carleton's Technology Innovation Management (TIM) program, and cross-appointed to the Sprott School of Business and the Department of Systems and Computer Engineering. The team showed Trudeau a prototype "canary"—a sensor device that can be installed in a company's server room to detect intrusions, such as a malware attack. The device was developed by the GCR and created onsite at Bayview Yards in the MadeMill makerspace.

Funded by $3 million over two years from the Federal Economic Development Agency for Southern Ontario's Investing in Regional Diversification initiative, the GCR uses academic expertise to tackle cybersecurity challenges while providing students and recent graduates with the educational experiences they need to become successful in the tech sector.

International space collaboration features Carleton technology

In November, officials from both the National Aeronautics and Space Administration (NASA) and the Canadian Space Agency attended a demonstration by Carleton-based Mission Control of its software for the J5 planetary rover prototype. The event exemplified the international space collaboration between the two countries, which will continue next year when Mission Control's Autonomous Soil Assessment System technology will be used by a NASA-funded research team from Texas A&M University for a simulated Mars mission in Iceland. The plan is to eventually deploy the technology on a rover during NASA's mission to Mars in 2020.

Finding a common standard for social enterprise success

Kate Ruff, an accounting professor in the Sprott School of Business, is collaborating with social enterprises, activators, incubators, academics, funders and government to pilot a new model for social impact measurement in Canada.

The Common Approach project uses the cloud, data innovations, and 50+ years of existing Canadian impact measurement knowledge to develop a flexible standard that allows organizations to measure the impact of their work without being forced into rigid measurement frameworks, while at the same time allowing portfolio-level and sector-level aggregation.

The project builds on extensive consultations by the Ontario Social Enterprise Measurement Impact Task Force, partners with the Carleton Centre for Community Innovation (3Ci) among other organizations, and is funded by the Ontario Ministry of Economic Development, Job Creation and Trade and Employment and Social Development Canada (ESDC).

James Bridenstine, Administrator of NASA, speaks on campus in November 2018.

Carleton University has a long history of innovation and collaboration with private and public sectors to promote economic development, and has launched more than 200 startups since 2010. Two of our signature programs include:

TIM Program

The Technology Innovation Management (TIM) program leads to a Master of Applied Science (MASc) degree, Master of Engineering (MEng) degree, or a Master of Entrepreneurship (MEnt) degree. The program trains aspiring entrepreneurs who plan to launch new companies or seeking senior roles in established companies. The program also prepares individuals to work with entrepreneurs.

Lead To Win

The Lead To Win program helps high-potential, start-up businesses in the National Capital Region accelerate their growth and generate employment and economic prosperity in the city. Lead To Win comprises collaborations between individuals and organizations to help post-secondary students and community entrepreneurs launch and grow their ventures. Each venture is expected to generate annual revenue of $1 million within three years.

Meet a few of our accomplished women in Science and Engineering

Manuella Vincter

Manuella Vincter[1], professor in the Department of Physics, has been a member of the ATLAS experiment at CERN since 1998, and is currently the leader in this important international physics initiative, which in 2012 discovered the Higgs boson.

With many distinctions under her belt, some of which are mentioned in this publication, Vincter has made precision measurements of the electroweak force, the structure of the neutron and proton, and most recently the properties of the W and Z bosons, the carriers of the electroweak force.

Lenore Fahrig

Professor **Lenore Fahrig**[2], Department of Biology, has won many accolades in her career, including receiving the Royal Society of Canada's Miroslaw Romanowski Medal noted in this publication.

One of the highest cited researchers at Carleton University, she studies the effects of landscape structure on abundance, distribution and persistence of organisms. Fahrig's research also looks at how wildlife populations are affected by roads and traffic, using a combination of spatial simulation modelling and field studies on a wide range of different organisms.

Cynthia Cruickshank

Cynthia Cruickshank[3] is an associate professor in the Department of Mechanical and Aerospace Engineering. Her research interests involve the design and optimization of solar thermal energy systems and sensible heat storages related to energy efficient and sustainable energy concepts for commercial and residential applications.

As director of the Solar Energy Systems Laboratory, Cruickshank has developed collaborative partnerships with other Canadian universities, particularly those engaged in the NSERC Solar Buildings Research Network. Since 2010, Dr. Cruickshank has also been an active member of the Canadian Home Builders Association Technical Research Committee.

CU-WISE

Carleton University has a chapter of Women in Science and Engineering called CU-WISE that invites women in these disciplines to networking events, mentoring sessions, and professional development opportunities. They promote internships and scholarships to members, and provide support and inspiration to members in the development of their leadership skills and careers.

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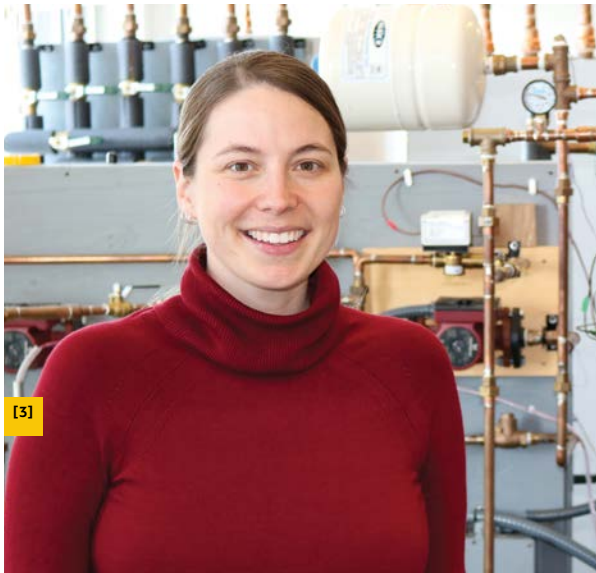
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Sonia Chiasson

Sonia Chiasson[4] is an associate professor in the School of Computer Science, and holds the Canada Research Chair in User-centric Cybersecurity. She also leads Carleton's Human Oriented Research in Usable Security (CHORUS) lab, and also distinguishes herself as the deputy scientific director of the Smart Cybersecurity Network, SERENE-RISC, a Network of Centers of Excellence of Canada.

Chiasson's main research interests are in usable security: the intersection between human-computer interaction (HCI) and computer security. She researches user authentication, usable security for mobile devices, and endeavours to improve end users' mental models of computer security.

Hanika Rizo

Hanika Rizo[5], is an assistant professor in Department of Earth Sciences, and in 2018 received a Province of Ontario Early Researcher Award, as you have seen earlier in this publication.

This award relates to her important investigations into the early geochemical evolution of the Earth, specifically focusing on extinct isotope systems in Northern Labrador. This involves unravelling geological processes that happened more than 4 billion years ago.

Audrey Girouard

Audrey Girouard[6], associate professor in the School of Information Technology, leads the Creative Interactions Lab at Carleton. Working on next generation technology, her research pioneers novel interaction techniques with emerging user interfaces.

In 2017, she was one of six distinguished Canadian scientists to be recognized by the Partners in Research National Awards in Science, Technology, Engineering, Mathematics and Biomedicine. She received the Technology Ambassador Award.

Winnie Ye

Winnie Ye[7] holds the Canada Research Chair in Nano-scale Integrated Circuit Design for Reliable Opto-electronics and Sensors. As an associate professor in the Department of Electronics, Ye's research focusses on developing advanced nano-sized sensors that will offer affordable, sensitive, reliable, and compact screening of compound mixtures, without being sensitive to ambient temperature. Weather-immune technology will be especially attractive for developing countries that have extreme temperatures and lack resources for cooling.

Ye's work will ultimately lead to the identification of organic compounds to treat life-threatening diseases such as malaria, anthrax, tuberculosis, and stomach cancer, and could eventually aid in the discovery of vaccines or new drugs.


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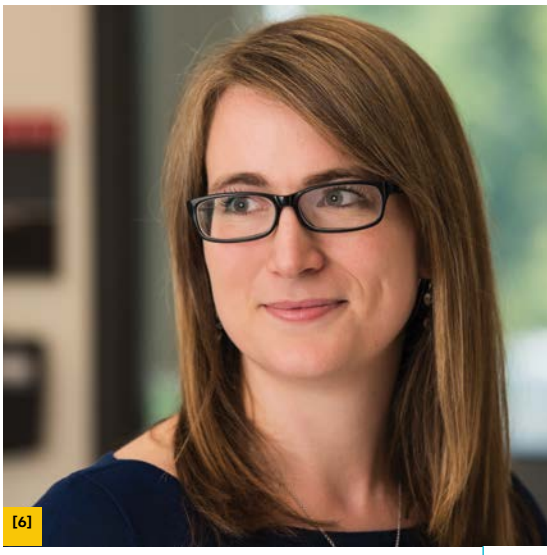
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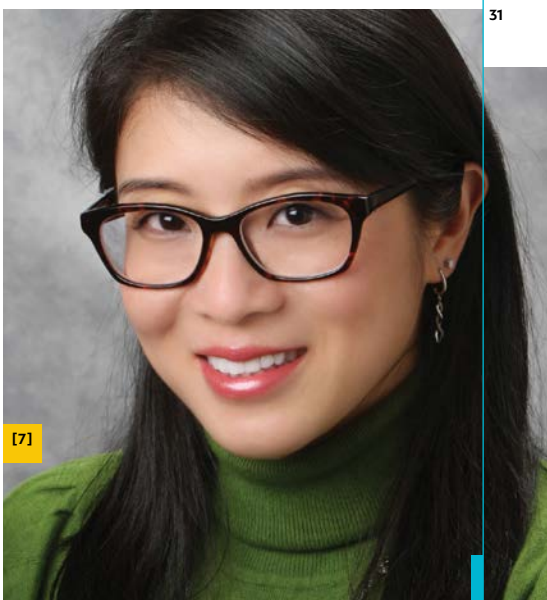
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Community Engagement

Saving lives from opioid overdose

Jeff Smith, professor in the Department of Chemistry and director of the Carleton Mass Spectrometry Centre (CMSC) has teamed up with principal investigator Lynne Leonard from the University of Ottawa's School of Epidemiology and Public Health on a project that has the potential to provide a first defense against toxic street drugs.

The team analyzes the makeup of street drug samples at an Ottawa supervised injection site using a portable mass spectrometer. The size of a bread maker, it provides the precise "chemical signature" of a substance based on the mass of its constituent molecules in less than 20 seconds. Using a sample as small as a single drop of liquid, the machine has the potential to prevent opioid overdoses before they happen.

The three-year project is supported by $500,000 from the Canadian Institutes of Health Research (CIHR) and could lead to mass spectrometry testing at more locations in Canada. Smith has also received the Young Investigator Award from the Canadian Society for Mass Spectrometry (CSMS), nominated based on the impact of his research.

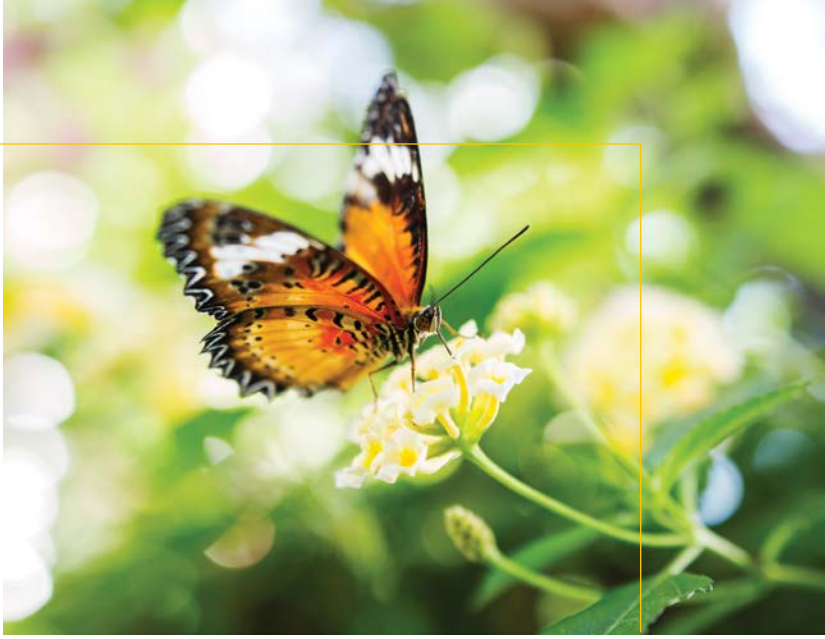
Capital Kiosks brings history to city sidewalks

Carleton's Centre for Public History, led by **David Dean**, teamed up with the Workers' History Museum, design firm Chapter One Studio, and local artist Ross Rheaume to transform 17 grey traffic control boxes into street-side historical exhibits.

Funded by the City of Ottawa, the project allows the approximately 32,000 pedestrians who pass the boxes daily to get a history lesson while they wait for their light to turn. Topics included everything from the history of buildings like the

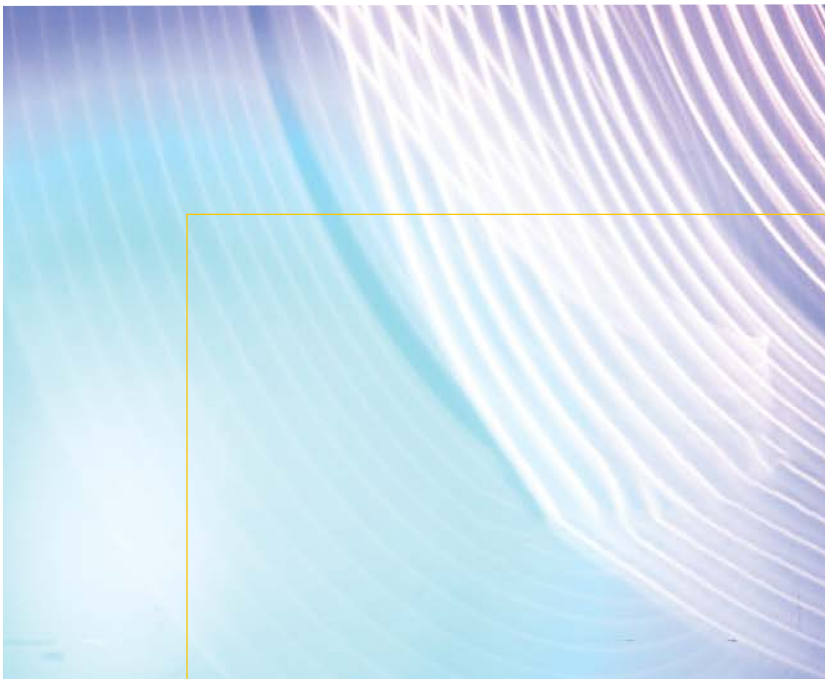
Annual butterfly show

The annual butterfly show at Carleton University is open to the public at no cost. More than 1,000 Ottawa-area students and 10,000 visitors total come through the Department of Biology's steamy greenhouse doors each year. The nine-day show features 1,300 butterflies representing 41 different species worldwide.



Chemistry magic show

Carleton University's chemistry magic shows inspire, entertain and encourage youth to take an interest in science. Through visual demonstrations and hands-on activities, audiences learn about chemical and scientific principles, and their applications and impacts on our everyday lives.



Canada-Wide Science Fair

Carleton hosted the 2018 Canada-Wide Science Fair which brought together 500 of the country's top young scientists and an audience of approximately 10,000 students, teachers, and members of the public. Science Minister Kirsty Duncan and Environment and Climate Change Minister Catherine McKenna also participated.

Students between the ages of 12 and 18 displayed innovative projects and competed for nearly $1 million in prizes and scholarships. Government agencies and Carleton's faculty members introduced themselves to students in a trade show featuring interesting technologies and scientific tools.

Launch of AGE-WELL national innovation hub

Carleton has launched the AGE-WELL national innovation hub featuring two research facilities that will focus on sensor-based smart technologies addressing mobility and memory challenges faced by older adults. The project was created in partnership with the Bruyère Research Institute and the AGE-WELL Network of Centres of Excellence, and features research facilities at both Carleton University and Ottawa's Élisabeth Bruyère Hospital.

At the Bruyère location, researchers will use a model apartment to test sensors and develop innovative tools to address concerns with seniors living independently. The data collected from the sensors, such as how often someone is getting out of bed and if there's any difficulty doing it, can be sent to a phone app or used to contact someone immediately in case of an emergency.

Partnerships and Collaborations

Carleton's Richard Ernst receives NSERC CRD funding for volcanic event research

Department of Earth Sciences scientist-in-residence **Richard Ernst** has received $600,000 from the Natural Sciences and Engineering Research Council of Canada (NSERC) as part of the Collaborative Research and Development (CRD) program for his research on huge volcanic events. Ernst will conduct this research with fellow Carleton collaborators and partners from the University of Toronto, University of Saskatchewan, Cardiff University in the U.K., and the University of Nevada—Las Vegas. He has also received $300,000 from three sponsors—Anglo American/De Beers, First Quantum Minerals and Rio Tinto.

Ernst's research focuses on Large Igneous Provinces, which are huge volume volcanic events that occur every 20 to 30 million years and help to reveal the configuration of ancient supercontinents and provide clues to mass extinctions and climate change. They are also an important tool for finding new ore, and oil and gas deposits.

Carleton students consulting for First Nation in Moose Factory

Carleton students have been called on by the MoCreebec Eeyoud First Nation in Moose Factory to consult on a plan to reduce energy costs and take ownership of their power consumption. **Joshua Russell** and **Keelia LaFreniere** are Sustainable Energy master's program candidates who visited Moose Factory for 18 days to conduct field-work, work with local energy auditors and lead community capacity-building workshops. The students are being co-supervised by Stephan Schott from the School of Public Policy and Administration and Jean Duquette from the Faculty of Engineering and Design. Their project is funded by the Independent Electricity System Operators' (IESO) educational capacity building program.

Carleton's Richard Yu collaborating with Blackberry-QNX on connected vehicles

Richard Yu, a professor in the School of Information Technology is collaborating with Blackberry-QNX on a project to create and test connected vehicle systems and autonomous vehicles. Enabling connectivity between cars has the potential to assist in crash prevention along with other safety, mobility and environmental benefits.

The project aims to design, develop and test several application software programs, with a focus on creating mobile vehicle networks that are resistant to hacking and piracy. The project is funded by the Canadian Safety and Security Program (CSSP) and Blackberry-QNX, who will provide support with programming, coding, software development support as well as lab facilities.

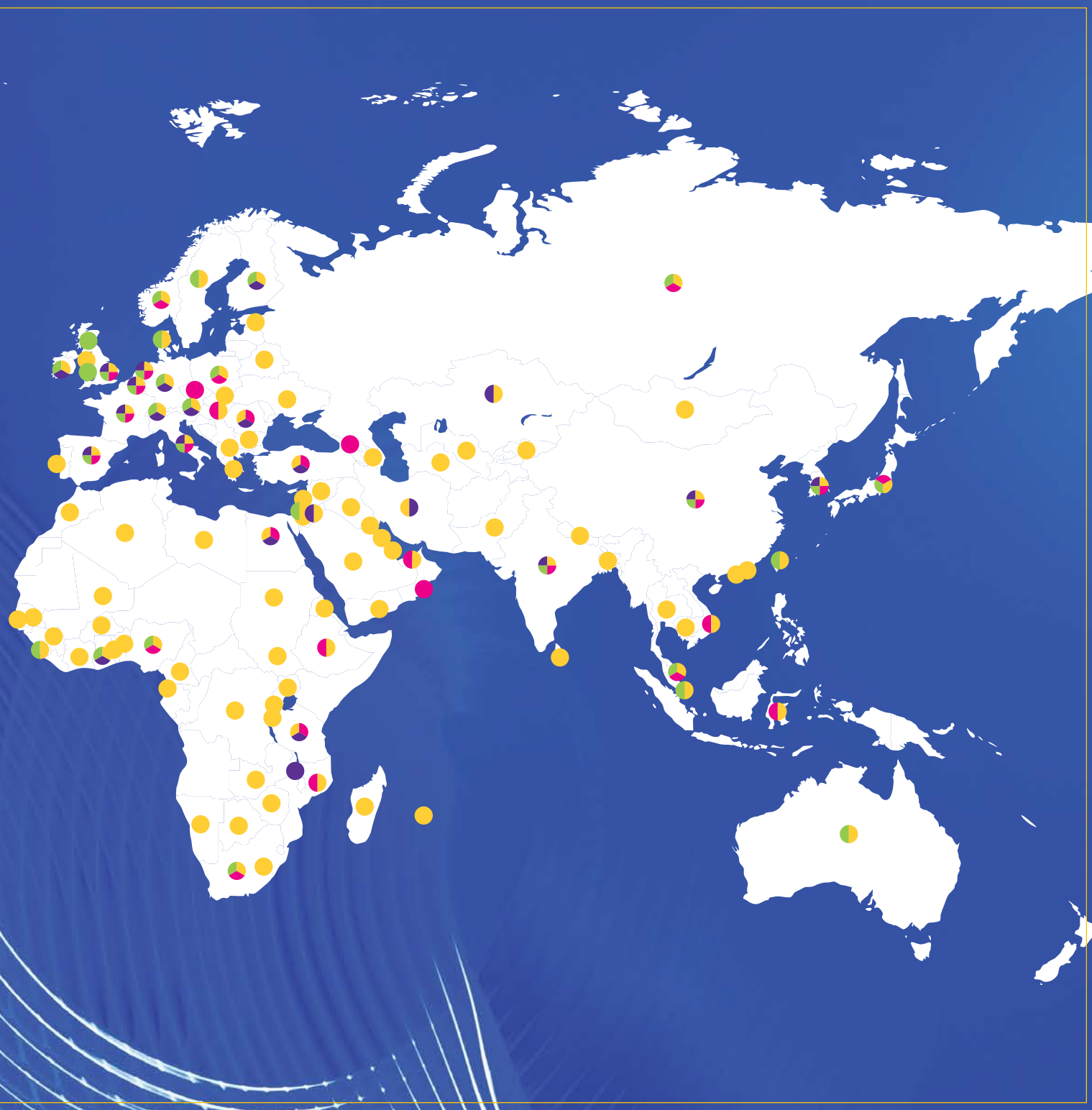
International Engagement

93
MOUs in
40 countries

150
Visiting scholars
from 29 countries

178
Student exchange
partners in
39 countries

4,331
international
students
representing
14% of total
enrolment in
127 countries



GCRC researchers Prof. Kumiko Murasugi, Amos Hayes and PhD candidate Jacqueline Chapman stand with their digital atlas in front of a photo showing the Paipai and Kumeyaay peoples as they document their language, songs, and geography using the Nunaliit atlas framework deployed in Mexico. (Baja California, 2018)

Cybercartography project maps culture of Indigenous communities in Mexico

Carleton's **Fraser Taylor**[1] is a Chancellor's Distinguished Research Professor of International Affairs, Geography and Environmental Studies, and the director of the Geomatics and Cartographic Research Centre (GCRC). Considered a world leader in the field of cybercartography, he received important funding from the Commission for Environmental Cooperation (CEC) to support work with Indigenous communities in Mexico on the integration of environmental knowledge and priorities through the creation of a leading-edge digital atlas.

The CEC was established by the governments of Canada, Mexico and the United States through the North American Agreement on Environmental Cooperation, the environmental side agreement to NAFTA. In 2018, the CEC awarded funds to just nine projects, chosen from over 300 applications.

Linked with a Social Sciences and Humanities Research Council grant for an international partnership development project for innovative Indigenous cybercartography development in Mexico and Brazil, the overall work of the GCRC includes the installation of the Nunaliit Atlas Platform in CentroGeo, Infotec and Terra Peninsular facilities in Mexico. The CEC funds were dedicated specifically to the participation of Indigenous community representatives in the training workshops with the academic and environmental organization researchers and technical personnel.

Heritage Engineering program provides hands-on experience for students

The NSERC CREATE Heritage Engineering program led by program director and engineering professor **Mario Santana** was launched in May 2015 as a research, training and internship program designed to give students hands-on experiences in the built heritage industry. In 2018, they continued to develop skills in areas such as building digitization, sustainability simulation and building rehabilitation.

Students intern with program collaborators in industry, government and non-profit organizations in the built heritage sector in Ottawa, Toronto, Fredericton, Montreal, Washington and Los Angeles, as well as in Italy, Spain, Germany, Belgium, France and Nepal.

The program sees students participating in day-long expert workshops 3 or 4 times per year, and they also receive funding to present papers at conferences and participate in heritage competitions. Recent student projects range from working with the National Research Council in Ottawa on research into historic masonry to interning with Factum Arte in Madrid on digital documentation and representative techniques.

Students also work with architecture firms, engineering firms and software research firms as well as conservation institutes. The program accepts graduate students at the master's, PhD and post-doctorate levels, and already boasts 12 alumni and 12 current students.

Santana says the students find the experience very valuable as a way to connect with industry and government partners.

Carleton partners with Cuso International to assist farmers in Peru

Carleton has partnered with international development organization Cuso International to help small-scale farmers in Peru. Students in the Bachelor of Global and International Studies program (BGInS) are using Skype, email and other communication technologies to work with professionals and community leaders in Lima. The students provide research and project design support while developing strategies and products for the farmers.

Carleton is the first university in Canada to participate in the partnership, and Cuso anticipates the initiative will kick off a new wave of e-volunteering opportunities for Carleton students, and that the project will be used as a model for other Canadian universities and international partners.

Mexican environmental study tour kicks off at Carleton

Carleton was the first stop on a week-long tour by a delegation of 25 Mexican government officials, engineers, analysts and environmental experts trying to better understand how Canada is fighting climate change and to consider how Canadian research initiatives are applicable in Mexico.

The group toured the flaring lab of **Matthew Johnson**, professor in Mechanical and Aerospace Engineering and director of Carleton's Energy and Emissions Research Lab (EERL), whose research includes a focus on measuring and reducing pollutant emissions generated by natural gas flares in the hydraulic fracturing process. Global flaring is believed to be a dominant source of black carbon deposition on snow and ice in the Arctic.

The study tour was organized with the help of the Mexican government, Environment and Climate Change Canada (ECCC), and Natural Resources Canada, in part to help Mexico reach its nationally determined contribution to diminish greenhouse gas emissions by 22 per cent.

Carleton launches network on EU-Canada relations

Carleton has launched the Jean Monnet Network on EU-Canada Relations: The EU and Canada in Dialogue, to promote a deeper understanding of the European integration process and the implications of the new agreements for Canada.

The project involves a network of universities with expertise in the European Union (EU)-Canada relationship, including the four European partner universities of University of Antwerp, Technical University Darmstadt, Technical University Munich and the University of Latvia. Joint research and knowledge exchange, including student internships and study visits, will be the major focus for the partnership, which will also promote public learning through workshops in Canada and Europe.

The EU-Canada network operates within Carleton's Centre for European Studies (CES) and the Canada-Europe Transatlantic Dialogue, a larger Canada-EU network hosted at Carleton. CES also hosts a Jean Monnet EU Centre of Excellence, two Jean Monnet Chairs and a Jean Monnet high school outreach program, all co-funded by the Erasmus Plus program of the European Union. Scholars from several universities across Canada are involved in the network as part of the Carleton team.

Carleton shares smart city expertise with India

Carleton's Canada-India Centre for Excellence (CICE), led by manager **Harry Sharma,** and its partners in India have launched the Canada–India Smart Cities Centre of Excellence for Capacity Building (CI-SCECB) project to promote smart cities. The initiative will tap into Carleton's expertise in areas such as wastewater treatment, urban infrastructure and municipal governance to train Indian city planners. India is in the midst of a massive US $15-billion Smart Cities Mission to upgrade and modernize civic infrastructure in 100 cities and 500 smaller towns.

Carleton's CICE will offer training programs in Ottawa for Indian planners and designers to leverage the university's capacity and networks of researchers.

Several units will be involved, including the Centre for Urban Research and Education (CURE), the Carleton Urban Research Lab (C-URL) and the Global Water Institute (GWI). Also involved is Prof. Mohamed Ibnkahla, who holds the Natural Sciences and Engineering Research Council (NSERC)/Cisco Senior Industrial Research Chair in Sensor Networks for the Internet of Things.

CI-SCECB intends to train 150 urban planners over the next three years and build platforms and tools for smart city planning, with support from at least 50 Canadian students.

Canada-India acceleration program for women tech entrepreneurs

Carleton has collaborated with the All India Council for Technical Education (AICTE), India's national regulator for colleges and institutes, to support women tech entrepreneurs in both countries.

The Canada-India Acceleration Program (CIAP) will help Canadian women scale up their companies in untapped markets in cities across India with mentorship from global entrepreneurs, more than 200 incubators, meaningful connections to corporations, potential seed funding and internship opportunities. A similar program will send women entrepreneurs from India to Canada. CIAP will employ the expertise of existing Carleton programs, including the Lead to Win (LTW) incubator and the Canada-India Centre for Excellence (CICE).

The five-year program aims to support 50 Canadian and 50 Indian startups. Carleton intends to replicate the model with international partners in Africa and Brazil.

Research Highlights **from our Faculties**

Spotlight on the Faculty of Arts and Social Sciences

Cognitive Science embraces diverse research interests, with a focus on the connections between the mind and the brain.

Research Focus

Since 2004, Carleton's Institute of Cognitive Science has embraced scholars from many disciplines in the pursuit of understanding the complexities of the human brain. "We all study foundational elements—cognition, which means understanding, thinking, learning, and language—but the research occurring in cognitive science is quite diverse," says the Institute's director, Chancellor's Professor **Jo-Anne LeFevre**[1]. The range of faculty research projects in the Institute illustrates this variety.

For instance, **Kasia Muldner**[2] focuses on student learning and creativity, particularly as they relate to technologies and the instructional process, while **Chris Herdman**[3] and **Kathy Van Benthem**[4] work on virtual reality systems for airline pilot assessment and training. Concurrently, **Deepthi Kamawar**[5] studies the development of children's understanding of how others think. These are but a few examples of the distinct scholarship in the Institute which also includes research focusing on modeling imagination, understanding speech perception, and developing relatable artificial intelligence agents.

The Institute

Emerging from a lecture series and honours undergraduate program back in 1991, the Institute formalized a robust research and teaching centre that today includes over 20 direct and cross-appointed faculty, and academic programs at the bachelor (BCogSc), master's (MCogSc) and PhD levels. The Institute also features research clusters such as the Visualization and Simulation (VSIM) Centre, the Language, Logic, and Information group, the Science of Imagination lab, and the Multimodal Assessment of Human Cognition in Laboratory and Naturalistic Settings (MACLaN) lab.

Research Projects

A couple of projects embody both the diversity and essence of the Institute:

- Professor LeFevre's latest project is the Social Sciences and Humanities Research Council-supported Language Learning and Math Achievement study. Working in collaboration with researchers across Canada, she aspires to understand the role of language in math learning. This project is particularly pertinent given the current educational focus on problem-based learning. "There is a high verbal component to the way math is currently taught, making this an interesting and important question," says LeFevre.
- In **Olessia Jouravlev**'s[6] Language and Social Cognition lab, concentration is on individual differences in language acquisition and use. Her students examine, for example, why some people have difficulty communicating complex ideas or learning languages other than their mother tongue while others learn new languages much more easily. One of Jouravlev's most recent projects, published in The Journal of Psychological Science, used electroencephalography to examine the way our brains process conversations. Her findings demonstrated how speakers and listeners model each other's states of mind as well as those of conversational bystanders. "The broad expertise of students and faculty in the Institute of Cognitive Science allows myself and my lab members to conduct a truly interdisciplinary investigation of communication and social interaction in human beings," says Dr. Jouravlev.

The Institute of Cognitive Science at Carleton University is a unique and internationally renowned hub for researchers and students who aim to further discern the nuances and mysteries of the human brain and related human behaviours.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Spotlight on the Faculty of Engineering and Design

Carleton students continue winning streak in accessibility design competition

Recent graduate **Alicia Stewart**[1] won a top spot in the National Innovative Design for Accessibility (IDeA) competition, an annual event where Carleton students have achieved first place titles since its inception in 2012. Organized by Universities Canada, the competition challenges university students across Canada to develop innovative, cost-effective and practical solutions to accessibility-related issues for people with disabilities.

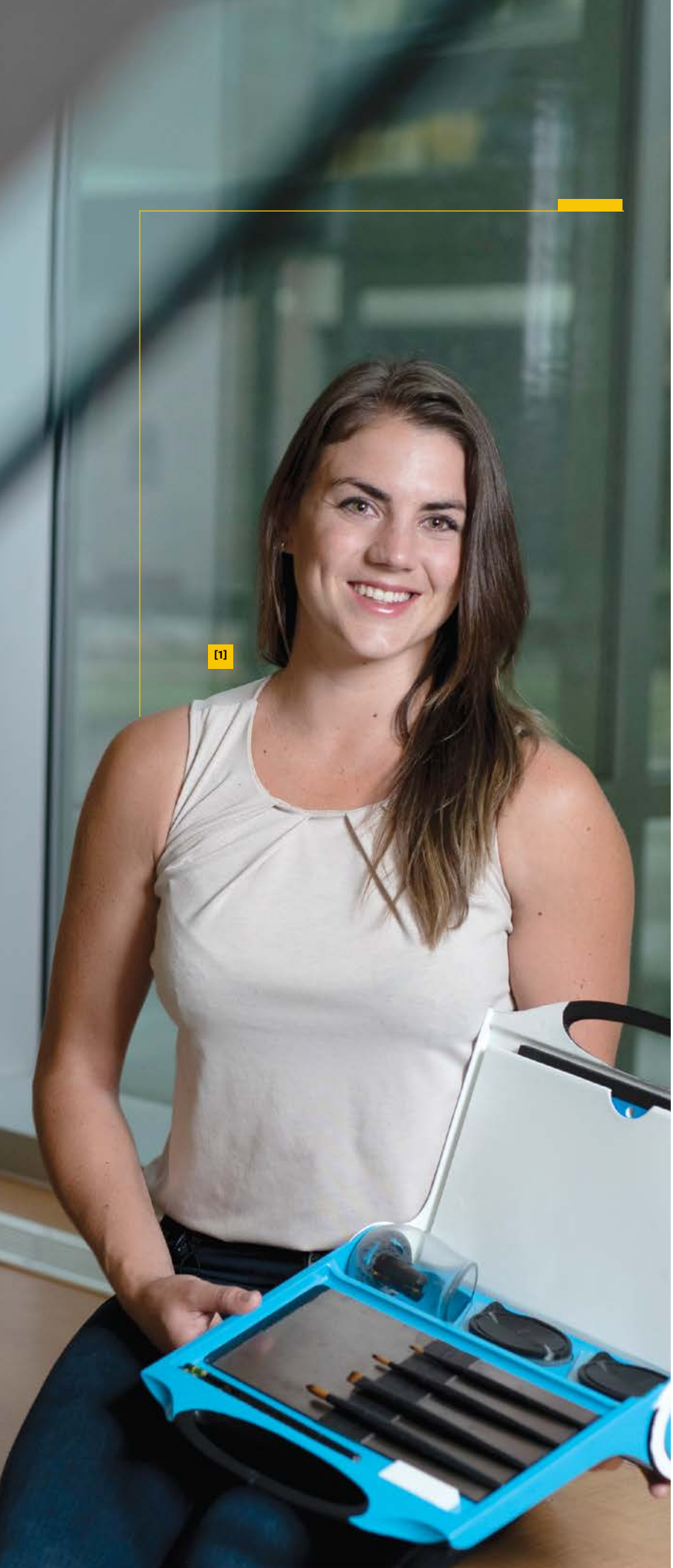
Stewart is joined by five other students from the Bachelor of Industrial Design (BID) program who also earned top rankings in the program's five categories.

As a first-place winner, Stewart received a $2000 prize and the opportunity to present her project at the Canadian Innovation Exchange (CIX) conference in Toronto. Her project is a comprehensive art kit with a brush-cleaning device and a set of reusable paint mixing cards, designed to help people with cognitive disabilities to make art. Stewart worked with BEING Studio, an Ottawa non-profit art space supporting artists with developmental disabilities.

Second place winners included **Brandon Lewandowski** and **Rob Shudra**, who each received $1500. Lewandowski worked with Dovercourt Recreation Centre in Ottawa to create an interactive balancing exercise board[2] that uses music and vibrations to encourage older exercisers to mimic a fitness instructor's motions. Shudra created a seat design to help people avoid deep-vein thrombosis during air travel in partnership with Canada's National Research Council flight research lab.

Jenny Suh and **Alanna Bamber**, a current Master of Industrial Design student, worked with the Canada Science and Technology Museum to develop their third-place projects. Both developed prototypes for museum seating: in Bamber's case a seat[3] that enhances accessibility for women who are breastfeeding, and from Suh a children's seat[4] that can be rocked and spun, allowing children to stay active and entertained. Each received a prize of $1,000.

The students' supervisors, Profs. Chantal Trudel and Lois Frankel, are enthusiastic about their win. "It's really exciting for us because so much of our work at this school focuses on how to improve well-being and health through design," says Frankel. "Industrial designers love to make peoples' lives better through our work. This competition supports this idea and ideal."



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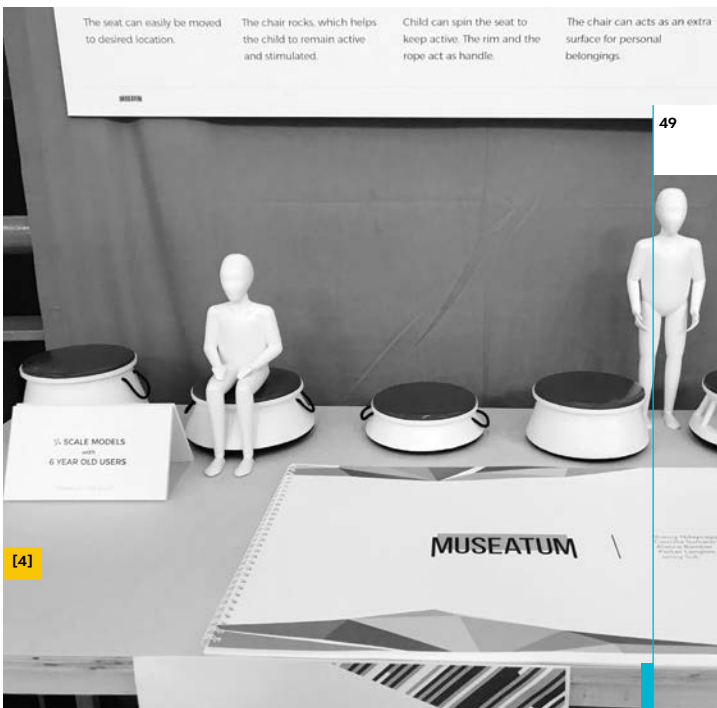

The seat can easily be moved to desired location.
The chair rocks, which helps the child to remain active and stimulated.
Child can spin the seat to keep active. The rim and the rope act as handle.
The chair can acts as an extra surface for personal belongings.
SCALE MODELS
with
6 YEAR OLD USERS
MUSEATUM

[4]

Spotlight on the Faculty of Public Affairs

New network aims to boost information sharing on military research and information

Stephen Saideman has a big goal: to create a Canadian Defense and Security Network that would see academic institutions, military organizations, government departments and everyday citizens start sharing information and resources. "That way we can do a better job of communicating, we can learn from the military, and we can do research projects that can help the government and the military be more effective," he says.

Saideman, who holds the Paterson Chair in International Affairs in Carleton's Norman Paterson School of International Affairs (NPSIA), is currently pursuing grants and partnerships to help fund and support the network, which already includes 30 partners and 100 academics. Based at NPSIA, the network would support meetings, conferences, workshops and research centres. Saideman says a precedent for such a network existed up until six years ago, and that besides reinstating this essential communication channel, he hopes to open it to new voices. "Part of the effort is to foster not just a new generation of defense and security people in government, the private sector and academia, but a more diverse one."

Besides developing the new network, Saideman is also in the middle of a new research collaboration to understand the role of legislatures in overseeing militaries. It's a project that emerged from a conversation with a Canadian MP and has taken him and his research collaborators around the world to consult with elected officials, journalists and academics in countries like Brazil, Chile, Japan and South Korea to investigate the ways that various countries handle military oversight.

While Saideman's research efforts and graduate teaching (current topics include civil-military relations and U.S. foreign policy) keep him busy, he is also a standout on social media, blogging almost daily and active on Twitter, with over 12,000 followers. He says he makes the effort because he values public engagement. "I realized there's a need to communicate beyond the academy, both to the government and to the public," he says, adding that he now meets people in real life who first knew him from his blog, and that he learns a lot by following others, including journalists, military experts and other academics. "I get educated on Twitter all the time by folks who are much smarter and better trained in various topics than I am."

Saideman says he feels even more responsibility to maintain this public outreach given his role as Paterson Chair. "That's what I can contribute to NPSIA, to help NPSIA promote itself in the world. I was doing all that stuff before, but I feel more responsibility to do it here."

Spotlight on the Faculty of Science

For Claudia Schröder-Adams the High Arctic of Canada holds many secrets

To arrive at the field camps where Department of Earth Sciences professor **Claudia Schröder-Adams** and her team conduct their research in the Canadian High Arctic requires a flight to Resolute, Nunavut, followed by a Twin Otter plane ride to a landing strip on Axel Heiberg Island. Helicopter flights take the team the rest of the way, where they investigate the arctic sedimentary basins that tell the history of the ancient world. To say it's remote is an understatement. "We always take two weeks of extra food in case we can't get pulled out," Schröder-Adams says, recalling one time when the helicopter broke down and they had to drink salty creek water.

To Schröder-Adams, the travel effort is worthwhile. "We have had tremendous luck bringing a lot of material back, supported by excellent logistical assistance and favorable weather," she says. As climate change becomes more apparent in the modern world, Schröder-Adams' investigation into how the Arctic responded to environmental changes in previous warm phases like the Cretaceous Period (145-66 million years ago) is even more relevant. The polar region is a geologist's dream—thanks to the Arctic's lack of vegetation and superbly exposed rock faces that hold an archive of earth history.

Supported by the Natural Sciences and Engineering Research Council, petroleum company ConocoPhillips, the Geological Survey of Canada and the German Research Foundation, Schröder-Adams has now conducted several seasons of field research in the Arctic. On her expedition in 2014, she enlisted a young research assistant from the northern community of Arviat to help her produce a documentary film sharing her research with a broader audience. Titled "Arctic Greenhouse", the film premiered at the Canadian Museum of Nature and the University of Frankfurt. She hopes to repeat this endeavour with another local guide from an Arctic community on her upcoming field season, this time delivered in Inuktitut and English.

This past year Schröder-Adams was awarded the Mercator Fellowship from the German Research Foundation, allowing her to spend several months pursuing research at Goethe University in Frankfurt, which is also the academic home of her long-time collaborator, Professor Jens Herrle. The fellowship also represented a return to her country of origin, where Schröder-Adams says she first realized her love for the outdoors by going on hikes with her naturalist father.

Highlights of her teaching career have been the field courses she's led to the Antarctic Peninsula, New Zealand, Germany, Switzerland, the Canadian Rocky Mountains and Nova Scotia. "It was always a great pleasure to me to take students in the field because I have so much enthusiasm for it myself," she says.

Spotlight on the Sprott School of Business

Business professor affirms the value of school policing program

Police officers are under pressure these days to justify themselves as an expense line in the public budget. Now a study by Sprott School of Business professor **Linda Duxbury** and Carleton psychology professor **Craig Bennell** offers the Peel region's $9-million School Resource Officer (SRO) program a boost by confirming that their efforts not only reduce crime and bullying but also provide extensive social and economic benefits.

Established 22 years ago and unique in Ontario, the SRO program sees officers patrolling schools, monitoring social media and participating in extra-curriculars, as well as responding to criminal activity. To verify the program's effectiveness, Duxbury and Bennell surveyed nearly 1300 students from five schools, who reported feeling less stressed, missing less school, and being mentally healthier thanks to the police presence. Administrators also reduced time spent on disciplinary activities.

Funded by the Social Sciences and Humanities Research Council, the extensive two-year study involved interviewing almost 100 officers, supervisors, parents and administrators, reviewing daily police activity records, and even shadowing officers on 10 occasions. "To do this well it took a lot of time and a lot of energy," says Duxbury. She adds that undertaking research with such a direct connection to community is rewarding. "I really get a charge out of making a difference and seeing a difference," says Duxbury.

Duxbury, who is now working on a project with the Ontario Provincial Police, says it's also rewarding to provide data for a group that is often under scrutiny. "Police need an advocate who can speak from data to say, 'yes, in fact, what they do is valuable and here's why it's valuable,'" she says.

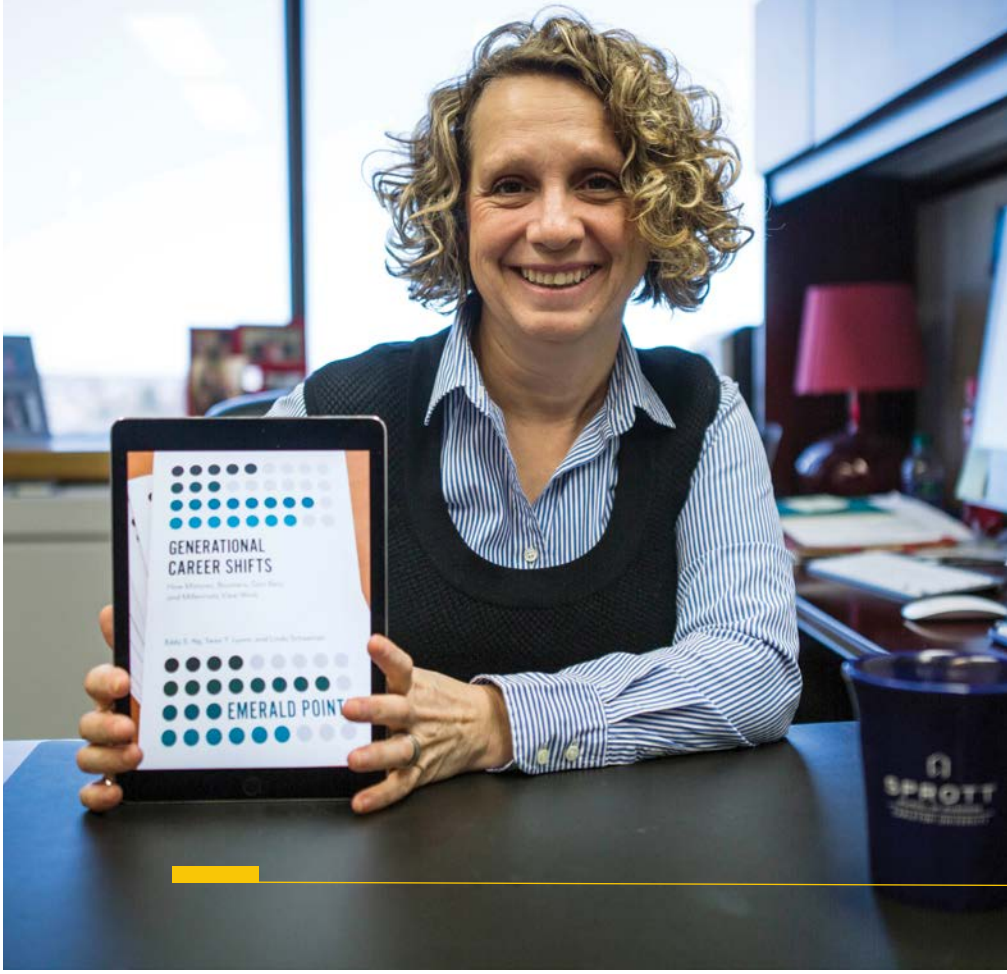
Linda Schweitzer Tracks Generational Career Shifts

Companies have pulled out all the stops in the race to attract millennial talent, but have they alienated other demographics in the process? What we value most changes as we age, and the three generations currently in our workplaces have had vastly different career trajectories and value different things.

Linda Schweitzer, associate professor and interim dean at Carleton University's Sprott School of Business co-authored Generational Career Shifts: How Veterans, Boomers, Xers and Millennials View Work, with Dalhousie's Eddy S. Ng and Guelph's Sean T. Lyons (PhD/04). The book examines career trajectories The book examines career trajectories and workplace values of current workers and older retired workers over the first 10 years of their careers, considering the first 25 years of the latter three.

"Everybody wants information to do their jobs, and to be doing the job they expected. It's about managing expectations and being transparent. And they want work-life balance, but what exactly that means varies," says Schweitzer.

Each generation's workplace experience and perception is impacted by economic and cultural trends. Baby boomers began their careers during an economic boom and advanced rapidly, millennials were told they'd step into a leadership vacuum left by retiring boomers, and generation X got caught in an inter-generational squeeze play with lingering ramifications.



"Generation X didn't advance quickly because baby boomers took jobs and kept them, and now millennials are going to lap them. They seem more ambitious, and it's only taken them five years to get to the same point," says Schweitzer.

The generational experience of millennials also presents unique challenges. Their narrative was that they'd step into a leadership void left by retiring boomers. Except boomers haven't retired.

On average, millennials expect to be promoted within a year of graduation and when reality fails to meet expectations, they're prepared to jump ship. *Generational Career Shifts* found they changed jobs more than their predecessors. "When I talk to employers I tell them, you need to be honest with people. Don't upsell the job; they aren't going to stick around if it's not what they thought it would be. They'll quit," Schweitzer says.

The next generation is already waiting in the wings, and they don't necessarily have the same values. "Everybody is starting to talk about generation Z," Schweitzer says, "who we're saying are born after 1995. The oldest of them just graduated university.

"Their desires are similar to those of millennials, but generation Z hasn't been told they'll inherit the Earth. They've come up with a narrative of a lack of jobs, precarious work and difficulty getting ahead. They don't have the same expectations – and that will make all the difference in the world."

Spotlight on the Faculty of Graduate and Postdoctoral Affairs

Three-minute thesis competition

Daniella Briotto Faustino was the 2018 second-place winner in the provincial Three Minute Thesis (3MT) competition held at York University. Briotto Faustino won a $1,000 prize when she came in first at Carleton's annual campus competition, now in its sixth year. The competition challenges graduate students to describe their research in 180 seconds or less.

Briotto Faustino, a student in the School of Information Technology, is working on a flexible device for entering bend passwords, an authentication whereby a sequence of bend gestures performed on the device works as a password. The device is designed for people with vision impairments as more tactile alternative to PINs, and is based on research of two previous students of her supervisor Audrey Girouard.

The second place in Carleton's 3MT was awarded to Architecture master's student Victoria McCartney, who designed easily transportable wildfire shelters for evacuees called Tinderboxes. Third place went to Mohamed Abdelazez in the Department of Systems and Computer Engineering, and the People's Choice award went to Applied Science master's student Amin Ghaziaskar.

Pierre Elliott Trudeau Foundation Scholar

Carleton doctoral student **Fahad Ahmad** is one of 15 recipients of a unique doctoral scholarship from The Pierre Elliott Trudeau Foundation. The scholarship focuses on academic excellence and civic engagement and provides up to $60,000 annually. Ahmad is the second Carleton student to receive this award since 2003 and the first from the School of Public Policy and Administration.

Ahmad's research examines how counter-radicalization policies impact the work of non-profit and community organizations serving Muslim communities in Canada and the United Kingdom. He also received the Social Sciences and Humanities Research Council's Joseph-Armand Bombardier Canada Graduate Studies Doctoral Scholarship for his doctoral dissertation.

Research and International
CARLETON UNIVERSITY

Published by the Office of the Vice-President, (Research and International)

CARLETON UNIVERSITY

2019

Editor: Julie Carl, Research Communications Manager

Writer: CodeWord Communications

Studio and selected photography: Luther Caverly

Other images and photography:
Adam Landry, Luther Caverly, Chris Roussakis, Samantha Stuart Photography, Sgt. Johanie Maheu (Rideau Hall OSGG), Lindsay Ralph, Justin Tang, Prof. Jens Herrle, Dwayne Brown, Troy Whalen