CARLETON UNIVERSITY

RESEARCH AND INTERNATIONAL REVIEW

Research and International
CARLETON UNIVERSITY

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

Published Fall 2017

CONTENTS

Message from Rafik Goubran, Vice-President (Research and International) 2

By the Numbers 4

Award-winning Researchers 6

Research Excellence: Tri-Agency Funding Highlights 8

Showcasing Research Excellence 9

Spotlight on Student Research Achievements 10

Community Engagement 12

Innovation and Entrepreneurship 14

International Engagement 16

Spotlight on the Faculty of Arts and Social Sciences 18

Spotlight on the Faculty of Engineering and Design 19

Spotlight on the Faculty of Public Affairs 20

Spotlight on the Faculty of Science 21

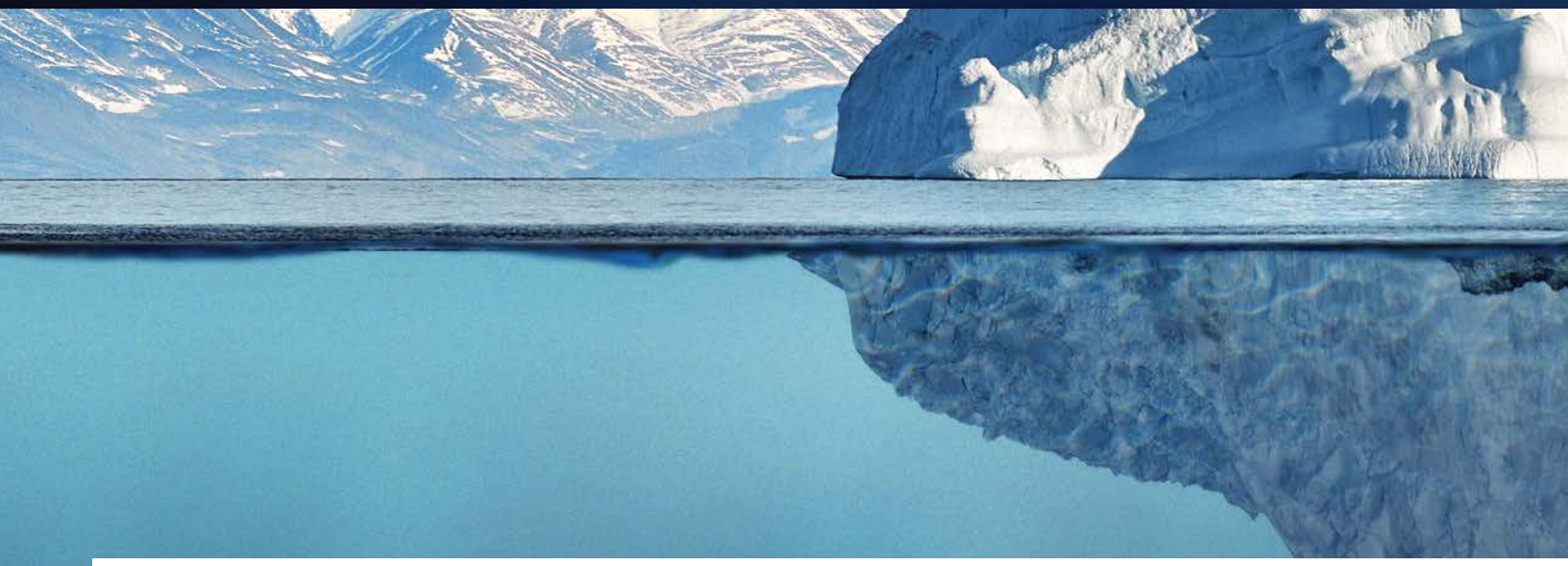
Spotlight on the Sprott School of Business 22

Spotlight on the Faculty of Graduate and Postdoctoral Affairs 23

About Research at Carleton University 25

MESSAGE FROM RAFIK GOUBRAN,

VICE-PRESIDENT (RESEARCH AND INTERNATIONAL)



I am pleased to present Carleton University's *Research and International Review*. This was a particularly remarkable year for Carleton as we looked back to our founding in 1942 as a fledgling college for returning Second World War veterans. As we celebrate our 75th anniversary, we are proud of the progress we have made, particularly in our ever-growing research programs. I am not alone in my admiration for Carleton's research accomplishments. The *Research and International Review* presents the university's research projects, awards and collaborations for the past year. As comprehensive as it appears, it only touches the surface of the innumerable projects our 878 faculty members and 4,043 graduate students are dedicated to.

This year also marked my first as vice-president (Research and International) and Dr. Roseann O'Reilly Runte's last as Carleton University's president and vice-chancellor.

Under Dr. Runte's leadership, Carleton University flourished. State-of-the-art buildings housing new programs have transformed our campus, and accommodate our growing student and faculty population. In addition, 315 new faculty positions have been added, and 34 new graduate programs have been introduced to Carleton's already impressive offerings. Carleton's total publications have expanded to 1,021 this year, from 640 in 2008. This represents an economic impact of $3.7 million in 2016–'17 alone. Carleton is well-positioned for the future. I wish Dr. Runte every success in her future endeavours as she embarks on a new leadership opportunity in research investment.

Carleton University now stands poised to enter a new chapter under the leadership of interim President and Vice-Chancellor Alastair Summerlee. Dr. Summerlee served as president and vice-chancellor at the University of Guelph from 2003 to 2014. He holds a B.Sc. Honours in anatomy and a PhD in medical sciences from the United Kingdom's University of Bristol. His research expertise spans epidemiology, infectious diseases, nutrition and dietetics. In addition to his research commitments, Dr. Summerlee has been a tireless advocate for civic engagement, and hunger and poverty prevention. I look forward to working with him as he takes the helm at Carleton and leads the university into our next 75 years.

BY THE NUMBERS

25,530
Undergraduate Students

4,043
Graduate Students

28
Royal Society Fellows

18
Order of Canada Recipients

25
Canada Research Chairs

3
Killam Award Winners

140,000
Alumni

748
Research Faculty Members

8
Banting Postdoctoral Fellowships

35
Provincial Early Researcher Awards

$55.3M
Sponsored Research Funding (2015)

AWARD-WINNING RESEARCHERS

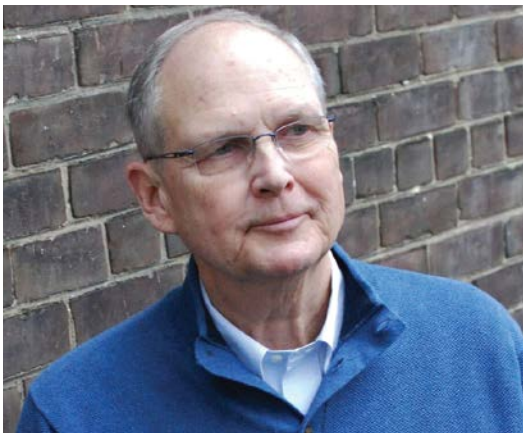
01 | NEW ROYAL SOCIETY OF CANADA FELLOWS AND MEMBERS

Donald Beecher, Department of English, and Lenore Fahrig, Department of Biology, were elected as Fellows to the Royal Society of Canada (RSC). A Royal Society of Canada fellowship is one of highest honours bestowed for Canadian research excellence.

Merlyna Lim, School of Journalism and Communication, and Jennifer Evans, Department of History, were elected members to the Royal Society of Canada's College of New Scholars, Artists and Scientists.

02 | "CALYPSO JEWS" RECEIVES CANADIAN JEWISH LITERARY AWARD

Carleton University's Prof. Sarah Phillips Casteel from the Department of English Language and Literature has received the Canadian Jewish Literary Award for her book *Calypso Jews: Jewishness in the Caribbean Literary Imagination*.



03 | ORDER OF CANADA/STACEY PRIZE FOR NORMAN HILLMER

Chancellor's Professor Norman Hillmer of the Department of History has been appointed to the Order of Canada in recognition of his distinguished contributions to the scholarship and teaching of International Affairs and Canada's place in the world.

Hillmer was also awarded the Stacey Prize by the Canadian Commission for Military History and the Canadian Committee for the History of the Second World War for his book, *O.D. Skelton: A Portrait of Canadian Ambition*.

04 | CLAUDIA SCHRÖDER-ADAMS WINS MERCATOR FELLOWSHIP

Earth Sciences Prof. Claudia Schröder-Adams has been awarded a Mercator Fellowship from the German research foundation Deutsche Forschungsgemeinschaft. The fellowship allowed Schröder-Adams to work in Germany for three months with Jens Herrle at the University of Frankfurt on Arctic research.

05 | AUDREY GIROUARD WINS PIR NATIONAL AWARD

Carleton University's Audrey Girouard, professor in the School of Information Technology, is one of six Canadian scientists to be recognized for educational excellence as part of the Partners in Research National Awards in Science, Technology, Engineering, Mathematics and Biomedicine. Girouard's human-computer interaction research focuses on user interfaces and flexible displays.

06 | MICHEL NAKHLA RECEIVES IEEE AGL MCNAUGHTON GOLD MEDAL

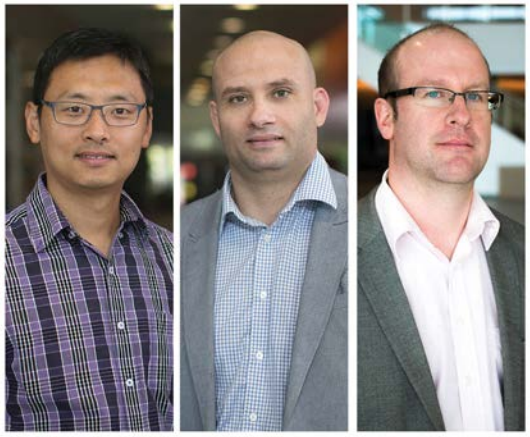
Michel Nakhla, Chancellor's Professor in the Faculty of Engineering and Design's Department of Electronics, has been named the 2017 recipient of the Institute of Electrical and Electronics Engineers (IEEE) Canada's AGL McNaughton Gold Medal. The McNaughton Gold Medal is IEEE Canada's highest honour, recognizing outstanding Canadian engineers for their exceptional contributions to the field.

07 | MARIE-ODILE JUNKER RECEIVES GOVERNOR GENERAL'S INNOVATION AWARD

Marie-Odile Junker, professor of Linguistics and Killam Research Fellow, has received a 2017 Governor General's Innovation Award from the Federation for the Humanities and Social Sciences in recognition for her contributions to Indigenous language documentation.

08 | EARLY RESEARCHER AWARDS

The Government of Ontario awarded Early Researcher Awards (ERA) to three Carleton University researchers. Each of the researchers receive $150,000 to support their work. Prof. Dale Spencer in the Department of Law and Legal Studies focuses on cybercrime and youth, while Prof. Xiaoyu Wang in the Department of Electronics is researching electric vehicles. Prof. Martin Geiger, cross-appointed to the department of Political Science and the Institute of European, Russian and Eurasian Studies, investigates skilled migration.



RESEARCH EXCELLENCE: TRI-AGENCY FUNDING HIGHLIGHTS

SSHRC

01 | INDIGENOUS YOUTH FUTURES

Kim Matheson, director of Carleton University's Canadian Health Adaptations, Innovations and Mobilization (CHAIM) Centre, received a $2.5-million partnership grant from the Social Sciences and Humanities Research Council for her research project, "Youth Futures: Bringing Together Indigenous and Western Approaches to Promote Youth Resilience and Prosperity in First Nations Communities."

Matheson will lead a collaboration between Indigenous and non-Indigenous university and community-based researchers and members of the 33 First Nations in the Sioux Lookout First Nations Health Authority (SLFNHA), and health, cultural, educational, economic and legal organizations.

02 | CANADIAN YOUTH CENTRES RESEARCH

Sarah Todd, professor in the School of Social Work, received a $143,000 Partnership Development Grant from the Social Sciences and Humanities Research Council (SSHRC) for a three-year collaboration between Carleton, the University of Alberta, YCC-CJC, and tech company Distill Mobile. The project will help youth services organizations across Canada access funding and improve programming targeting youth.

NSERC

01 | FLARENET: PARTNERING FOR CLEANER FOSSIL FUEL EMISSIONS

Mechanical and Aerospace Engineering Prof. Matthew Johnson, Canada Research Professor in Energy and Combustion Generated Pollutant Emissions, has received a $5.5 million strategic partnership grant for a strategic network for cleaner fossil fuels. The FlareNet project includes partners from the universities of Alberta, British Columbia, Waterloo, and Western University, as well as Natural Resources Canada, the National Research Council, Environment and Climate Change Canada, the Canadian Association of Petroleum Producers, the Petroleum Technology Alliance Canada, the Alberta Energy Regulator, the United Nations and the World Bank.

02 | 5G WIRELESS ADVANCES

Carleton's School of Information Technology Prof. Richard Yu has been awarded a $600,000 strategic partnership grant for his research into the next generation of wireless networking. Yu is partnering with the University of Manitoba, and several industry partners (see page 15 for more information).

CIHR

01 | ANTIMICROBIAL RESISTANCE STUDY

Carleton University's Alex Wong, professor in the Department of Biology, has received $600,000 to support his research on antimicrobial resistance (AMR). The international initiative will receive the investment over a four-year period.

02 | CONCUSSION RESEARCH

Carleton's Department of Mechanical and Aerospace Engineering Prof. Oren Petel has received a $700,000 grant through a collaboration between CIHR and NSERC for his new concussion research. Petel and fellow co-investigator Hanspeter Frei are working in partnership with the universities of Ottawa and Waterloo, Defence Research and Development Canada's Valcartier Research Centre, the National Institute of Standards and Technology, and industrial partner Cadex Inc.

SHOWCASING RESEARCH EXCELLENCE

01 | PARTNERING IN PARTICLE ASTROPHYSICS

Carleton was one of six Canadian universities to create the Canadian Particle Astrophysics Research Centre (CPARC). The new centre is supported by a $63.7 million investment by the Government of Canada First Research Excellence Fund (CFREF). Queen's University leads the initiative and will host CPARC.

02 | BANU ÖRMECI NAMED JARISLOWSKI CHAIR

Banu Örmeci, professor and Canada Research Chair in Wastewater and Public Health Engineering, was appointed as the first Jarislowsky Chair in Water and Global Health. The $4-million endowed research chair will address critical challenges of water and public health.

03 | NEW CULTURE AND GENDER MENTAL HEALTH RESEARCH CHAIR

Carleton University and the Royal Ottawa Hospital's Institute of Mental Health Research (IMHR) established the Culture and Gender Mental Health Research Chair. Kim Matheson, professor in the Department of Neuroscience was appointed to the joint research chair. Matheson's research explores issues facing culturally underserved communities.

04 | MERRIDEE BUJAKI NAMED FELLOW OF CPA ONTARIO

Merridee Bujaki, professor of Accounting, was elected Fellow of CPA Ontario. Fellowship is the accounting profession's highest distinction and is awarded in recognition of significant career achievement. Bujaki's research focuses on voluntary disclosure in Canadian corporate annual reports and the accounting history of the Rideau Canal.

05 | NEW CANADA RESEARCH CHAIR IN PHYSICS NAMED

Mark Boulay, professor in the Department of Physics, was named a Tier-1 Canada Research Chair (CRC) in Particle Astrophysics and Subatomic Physics. His research is with the DEAP-3600 experiment at SNOLAB, which searches for particles that make up the dark matter of the universe.

06 | PROBLEM GAMBLING RESEARCH RECEIVES PROVINCIAL FUNDING

The Ontario Ministry of Health and Long-term Care (OMHLTC) awarded Michael Wohl and Chris Davis, professors in the Department of Psychology, more than $650,000 to investigate the prevention of problem gambling.

07 | CARLETON HOSTS FULBRIGHT SCHOLAR

Carleton University hosted Brian Payne, professor of History and Canadian Studies at Bridgewater State University. Payne served as the Fulbright Visiting Research Chair in North American Integration in the Department of Political Science.

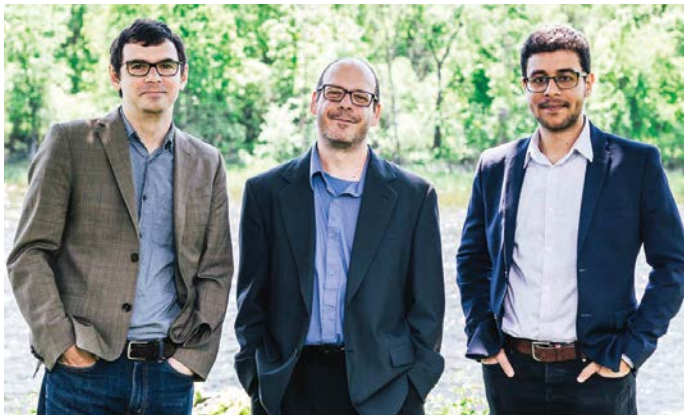
SPOTLIGHT ON STUDENT RESEARCH ACHIEVEMENTS

01 | NEW BANTING POSTDOCTORAL FELLOW

Faculty of Public Affairs researcher Logan Cochrane was awarded a Banting Postdoctoral Fellowship. His work examines how citizen engagement and responsive governments contribute to effective, inclusive governance. The fellowship is worth $70,000 per year for two years.

02 | FOUR VANIER AWARDS FOR GRADUATE STUDENTS

Vanier Canada Graduate Scholarships have been awarded to four doctoral students. Mohamed Abdelazez (Systems and Computer Engineering) is developing a non-invasive, health-care monitoring system. Genevieve Johnston (Sociology) investigates how homeless youth across Canada resist marginalization and develop supportive communities. Lowell Gasoi (Journalism and Communication) explores the relationship between artists and government to understand how policies, funding and regulations are communicated and implemented. Sandy Barron (History) examines the politics of deaf and blind education in Western Canada from 1880 to 1930.



03 | LEADING THE WAY IN ACCESSIBLE DESIGN

Two undergraduate students from the Faculty of Engineering and Design were awarded top prizes at the annual Innovative Designs for Accessibility (IDeA) competition in May 2017, organized by the Council of Ontario Universities. The IDeA competition challenges Ontario undergraduate university students to use their creativity to identify an accessibility-related issue and create an innovative and unique solution.

Micah Rakoff Bellman and Melody Chen, both students of Carleton's Industrial Design program, found their way to the podium, with Bellman's design of a flexible kitchen work space for seniors and people with disabilities taking first place and Chen's design of an accessible closet storage unit rounding out the top three.

Carleton has placed first in the IDeA competition each year since its 2012 inception, with at least two Carleton teams finishing in the top three each year since 2013.

04 | CARLETON'S THREE-MINUTE THESIS COMPETITION

Samuel Dubois (Architecture) won Carleton University's 2017 Three Minute Thesis (3MT) competition for his graduate research presentation "Mining for Thetford's Identity: Reclaiming the Mine Sites of a Former Asbestos Town." Sanita Fejzic (English) was selected as the first runner-up with her project "Truth-Telling in Fiction: Inspiring Empathy", and Derrick Matthew Buchanan (Neuroscience) was also recognized for his project "Brain Stimulation as a Cost-Effective Treatment for Mental Illness and Neurological Disorders."

05 | RECIPIENT OF THE GOVERNOR GENERAL'S MEDAL FOR NEUROSCIENCE

Eloïse Madeleine Kerr, B.Sc. Honours in Neuroscience and Mental Health, was awarded the Governor General's Medal for earning top marks in her graduating class.

Skills Compétences Canada

06 | BIT WINS GOLD AT NATIONAL SKILLS COMPETITION

Charles-Antoine Brosseau, a student in the Algonquin College collaborative Bachelor of Information Technology—Network Technology (BIT-NET) program, won gold at the Skills Canada National Competition 2017 in the IT/Network Systems Administration contest. Brosseau was among 550 Canadian participants who competed in more than 40 skilled trades and technology contests.

COMMUNITY ENGAGEMENT

01 | A VIRTUAL TOUR OF SENATE

The Carleton Immersive Media Studio (CIMS) created an interactive exhibit of Parliament Hill's Centre Block to mark Canada's 150th anniversary. Stephen Fai, director of CIMS, worked with his research team to create a 360-degree virtual reality reconstruction of the Senate of Canada based on the 1916 construction plans. A virtual tour of the Senate foyer, antechamber and chamber was launched in March 2017.

02 | HERITAGE CONSERVATION ON PARLIAMENT HILL

The Carleton Immersive Media Studio (CIMS) is helping the Government of Canada's heritage conservation project on Parliament Hill. CIMS is using robots to create sculptural elements in a variety of materials from digital models obtained by laser scanning and photogrammetry. The technology is being used in the replacement and restoration of deteriorating decorative features. CIMS acquired the joint-arm industrial robots with support from Public Services and Procurement Canada and the Social Sciences and Humanities Research Council of Canada.

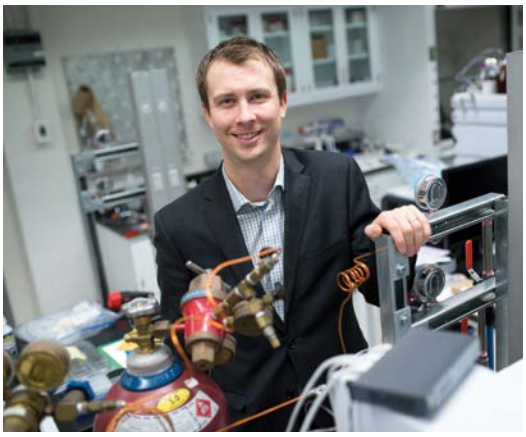
03 | BRIDGEHEAD COFFEE PARTNERS WITH CARLETON

The Carleton Mass Spectrometry Centre (CMSC) is helping Bridgehead Coffee determine how coffee beans deteriorate with age. The $50,000 project is funded by Ontario Centres of Excellence Voucher for Innovation and Productivity program, combined with NSERC support.

Jeff Smith, director of CMSC, uses a mass spectrometer to identify specific chemical changes that take place at a cellular level as coffee ages and changes in flavour. A better understanding of the beans' composition could help Bridgehead determine each coffee bean's "best-before date" to minimize loss of inventory and profits.

04 | FRONT DOOR

Carleton Front Door provides industry partners with access to research expertise and infrastructure. Through a fee-for-service model, Front Door offers R&D partnerships and consulting services across a range of disciplines including nanoscience, life sciences, environmental research, mathematics, and prototyping and manufacturing. Profits generated by Front Door's collaborations help Carleton's departments offset their operating costs.



05 | 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 Biology department's steamy greenhouse doors each year. The nine-day show features 1,300 butterflies representing 41 different species worldwide.

06 | 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.

COMMUNITY OUTREACH BY OUR FACULTIES

The Faculty of Science's series, **Science Café,** addresses scientific issues of the day with Ottawa audiences.

The Faculty of Engineering and Design's lecture series, **Ingenious Talks**, engages the public in discussions of timely an innovative ideas in engineering, design and technology.

The Faculty of Arts and Social Sciences' **CU in the City** presents its research in an engaging way to public audiences in cities across Canada.

The Sprott School of Business hosts the **Sprott Topics** speakers series on an array of topics targeting the Ottawa community.

Visions for Canada 2042 was a two-day interdisciplinary conference attended by researchers, civil servants, non-governmental organizers, graduate students and alumni from across the civic disciplines with the purpose of discussing research and ideas that imagined Canada's future in 2042.

Author Meets Readers invites Carleton faculty, students, and the community to join information discussions on newly published books by Faculty of Public Affairs researchers.

INNOVATION AND ENTREPRENEURSHIP

Carleton has a long history of innovation and collaboration with private and public sectors to promote economic development. Carleton has launched more than 200 startups since 2010.

01 | TIM PROGRAM

A master's-level program, Technology Innovation Management (TIM) leads to a Master of Applied Science (M.A.Sc.) degree, Master of Engineering (M.Eng.) degree, or a Master of Entrepreneurship (M.Ent.) degree. The program trains aspiring entrepreneurs who plan to launch new companies or who are seeking senior roles in established companies. The program also prepares individuals to work with entrepreneurs.

02 | LEAD TO WIN

Carleton's 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.

WORKING WITH INDUSTRY

01 | 5G WIRELESS AND BEYOND

Professors Halim Yanikomeroglu (Systems and Computer Engineering) and Richard Yu (School of Information Technology), along with Minyi Huang (Mathematics and Statistics) have been conducting a research partnership with Huawei Canada and TELUS Canada thanks to support from the Ontario Research Fund—Research Excellence. Their research collaboration, which will continue until the end of 2019, addresses 5th generation wireless networks for "affordable anytime/anywhere" broadband connectivity. The research has involved 10 postdoctoral fellows, 23 graduate students, and a large number of undergraduate students. It is providing training for highly-qualified personnel for industry and has positioned Carleton as an international research and innovation hub in this field.

ANATOMY OF A SUCCESSFUL PARTNERSHIP

All of the postgraduate research personnel affiliated with the project found jobs in the high-tech industry. Carleton has hired former postdoc Ramy Gohary as a professor from this project, while others became faculty members around the world.

4 of the 7
graduated PhD students on this project received the "Carleton University Senate Medal for Outstanding Doctoral Thesis" with more to come

54
Institute of Electrical and Electronics Engineers (IEEE) journal papers—the world's leading archival peer-reviewed periodical for this subject matter

66
IEEE conference papers

17
invention disclosures, all resulting in patent applications

11
patents granted—expected to exceed 30 in coming years

INTERNATIONAL ENGAGEMENT

70
Research MOUs in

30
countries

178
Visiting scholars and researchers from

40
countries

4,090
International fee paying students representing

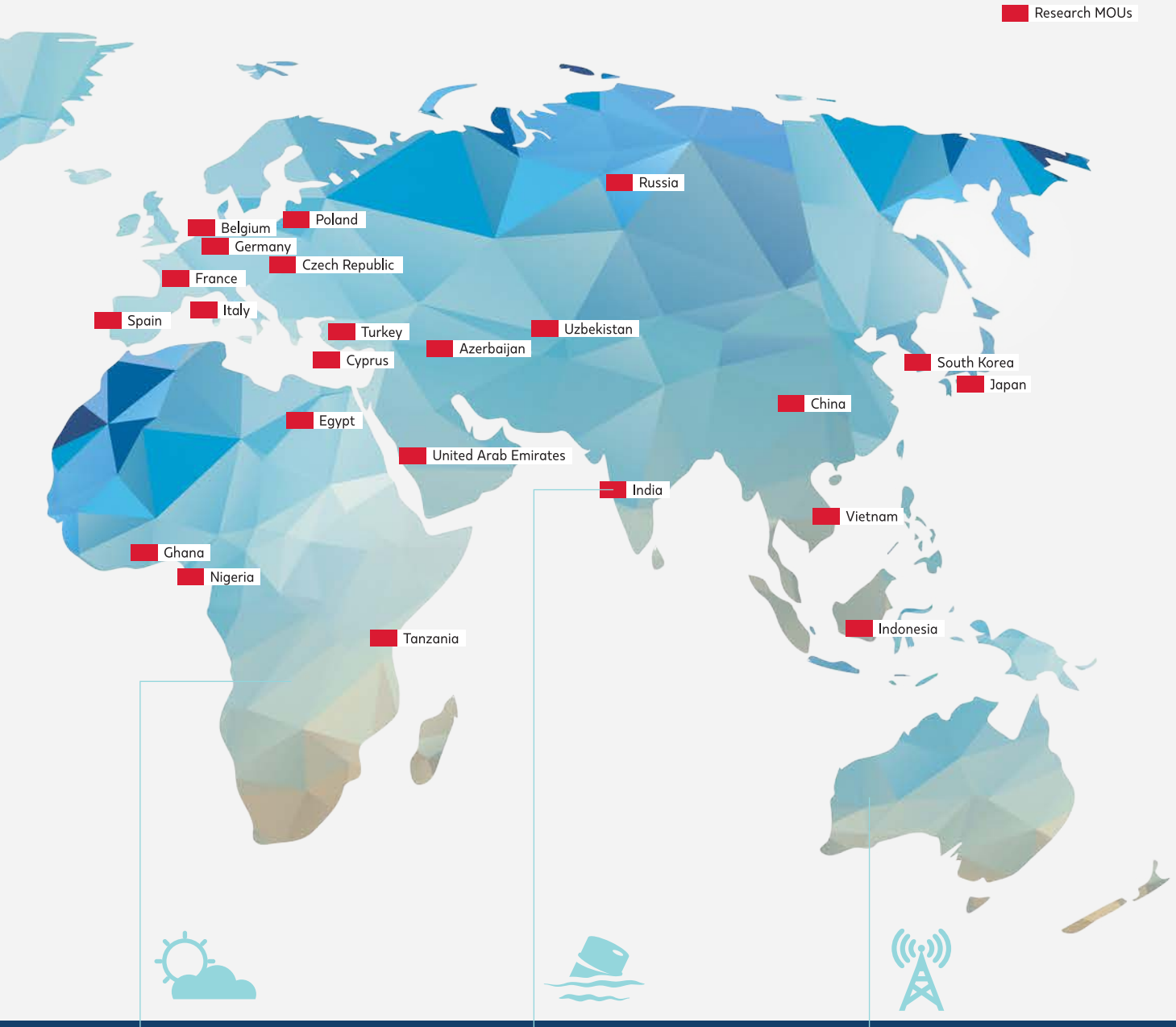
13.67%
of total enrolment

LATIN AMERICA

Laura Macdonald
Canada's role in Latin America

BRAZIL

Kristen Connor
Maternal mortality



AFRICA

Mike Brklacich

QEII Programme: Training the next generation in societal transformation and climate change

INDIA

Onita Basu

Emerging biotechnology for pollution control of River Ganga

AUSTRALIA

Halim Yanikomeroglu

Reliable and sustainable machine-to-machine communication

THE FACULTY OF ARTS AND SOCIAL SCIENCES

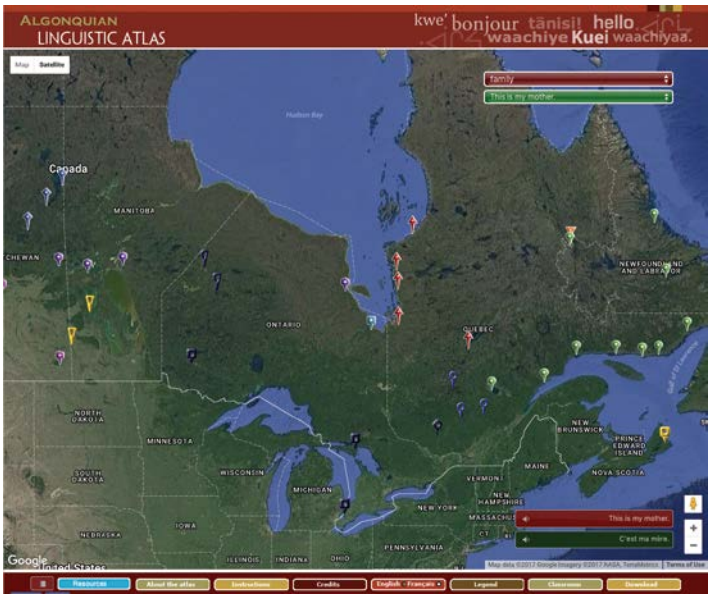
REVITALISATION OF ENDANGERED LANGUAGES

Globalization is threatening traditional languages throughout Canada and abroad. FASS faculty are at the international forefront of Revitalisation of Endangered Languages research and knowledge mobilization. Geographically, our researchers focus on North America, Africa, Scandinavia, the Middle East and the South Pacific. Their research spans language documentation, endangered language discourse and mapping, and influences cultural vibrancy, public policy and education.

ERIK ANONBY (School of Linguistics and Language Studies & Department of French) works with language communities from Canada to Francophone Africa and the Middle East. His interdisciplinary research stresses the importance of linguistic diversity in individual human experience and collective heritage. His innovative use of language mapping involves end users in language documentation and the visualization of these perspectives using linguistic data corpuses. Dr. Anonby's current project on the *Atlas of the Languages of Iran* engages an international team of over 50 researchers.

MARIE-ODILE JUNKER'S (School of Linguistics and Language Studies) love of linguistic diversity propels her active program in Indigenous language documentation, maintenance, and revitalisation. Participatory-action research allows her to engage communities and individuals interested in saving their language and seeing it thrive in the 21st century. Exploring how information and communication technologies can help Indigenous languages, she has developed several websites and online dictionaries for languages of the Algonquian family. She is leading the co-creation of the *Algonquian Linguistic Atlas*, a large collaborative project that is building a digital infrastructure for Algonquian dictionaries and other resources. Dr. Junker's 2017 Governor General Innovation Award is further recognition of her 25 years of leadership and accomplishments in the Revitalisation of Endangered Languages.

KUMIKO MURASUGI (School of Linguistics and Language Studies & Institute of Cognitive Science) examines Inuit languages from a variety of perspectives: structure (morphology and syntax), documentation, dialectal variation, language change, and bilingualism. Her collaborations with colleagues at the University of Toronto and seven Inuit partner organizations focus on developing a multimedia cybercartographic atlas of 12 dialects of Inuit language in Canada. Her documentation and protection of Inuit dialects in combination with her linguistic support to Inuit Tapiriit Kanatami, the national Inuit organization representing the 60,000 Inuit in Canada, represent important contributions to the preservation of Inuit identity at regional through national levels.



SPOTLIGHT ON

THE FACULTY OF ENGINEERING AND DESIGN

THE FUTURE OF WATER: ENGINEERING SUSTAINABLE SOLUTIONS

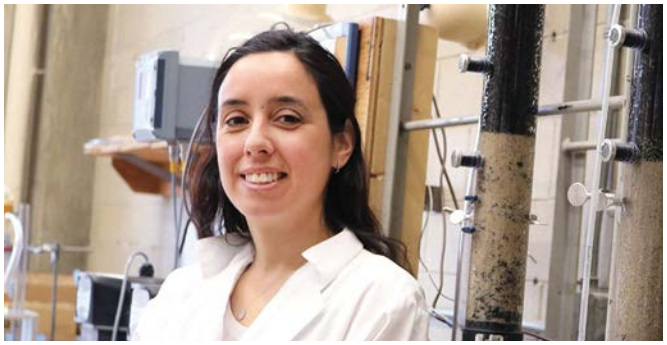
Onita Basu still vividly remembers the exact moment she decided to devote her career to sustainable water solutions and practices. "I was in a second-year chemical engineering lab working with a solution of water that looked relatively clean," she recalls. "When I passed the water through a treatment process I was shocked to see an incredible amount of dissolved copper emerge from the solution and begin coating onto various surfaces. It was an eye-opening experience to realize that we cannot always tell what is in our water."

Now an Environmental Engineering professor and Associate Chair of Graduate Studies in Carleton's Department of Civil and Environmental Engineering, Basu still believes that startling realization hasn't lost its impact. "The pressure that is placed on our natural resources has never been greater than it is today," she says. "The more people we have on our planet, the more difficult it becomes to manage the health of our water systems."

In an effort to help alleviate some of the pressure caused by a surging population, Basu is currently engaged in bio-filtration research, which utilizes the growth of beneficial microbes in filter systems to help remove organic contaminants. Employing this technique provides a viable alternative to chemical treatment options, resulting in a cleaner and more sustainable water treatment process.

Beyond the health of water itself, Basu also understands the importance of improving the sustainability of activities related to its treatment. "Removing pollution from water requires energy, but energy production also requires water, which in many cases results in its contamination," she explains. "It creates a vicious cycle between water and energy needs."

To stabilize this systemic flaw, Basu has been investigating both direct and indirect methods of decreasing energy requirements for water treatment, focusing on elements such as how pumps are operated or how chemical treatments can be reduced, as they too require energy to produce, transport and deploy into the water treatment process.



CISCO RESEARCH CHAIR FOCUSING ON INTERNET OF THINGS

Dr. Mohamed Ibnkahla, named the Cisco Chair in Sensor Technology and the Internet of Things (IoT) in 2015, is now working to develop sensor network technologies that will help facilitate the deployment and upkeep of 5G wireless technology.

With expertise in sensor integration, signal processing and wireless communications, Ibnkahla looks to apply the IoT in many areas, including smart grids, intelligent transportation systems, smart homes and cities, and even food traceability. "We're evolving to consume more and more data as a society," he says. "It's important that there be a dialogue between 5G, information systems and sensor networks in order to accommodate this increase in volume and to improve data processing and transmission."

THE FACULTY OF PUBLIC AFFAIRS

INDIGENOUS PEOPLES OF CANADA'S NORTH: DOCUMENTING A WAY OF LIFE AND IMPROVING LIVING CONDITIONS

Several times a year, Prof. Stephan Schott travels to Nunavut, Nunavik and Nunatsiavut for field work, meetings and workshops with Northern partners.

Along with colleagues at Carleton's Geomatics and Cartographic Research Centre and biologists from Queen's University, Schott and local residents are evaluating subsistence and commercial fishery options to strengthen food security and employment opportunities.

In Gjoa Haven, Nunavut, Schott and his research assistants work with residents who are helping to create an atlas that documents traditional environmental knowledge in the region; the cost of hunting and fishing; and changes to traditional hunting and fishing areas, travel routes, and hazards.

"Our work was initially on food security and fishery strategies, but the local community asked us to include other things. So we are also tracking environmental and travel hazards and food supply by season," says Schott of the project, which is funded by a $5.6 million grant from Genome Canada, in conjunction with other co-funders such as Polar Knowledge Canada and the Government of Nunavut. "Community members have hundreds of years of experience based on knowledge transfer from one generation to another. They also are the ones observing changes. They understand movements and fluctuations in resources and depend on the sustainability of the resources for survival."

At the same time, Prof. Schott is collaborating with political scientists and the regional authorities in Nunavik and Nunatsiavut to identify the impacts of mining operations on local indigenous business and human development, and to improve the realization of benefits for local businesses and communities at each stage of mining development. They're funded by a $296,000 Arctic Net grant.

"What motivates me is to change the living conditions in remote communities that are really struggling with challenges of food security, suicide rates and unemployment," says Schott, who first traveled to Nunavut in 2006. "We are working with people to understand their traditional ways of using resources sustainably and to come up with future visions that balance their traditional way of life with sustainable economic activities in the modern economy."

Prof. Schott is also supervising graduate students with colleagues in the Faculty of Engineering and Design. Their successful collaboration has attracted students from Canada's North who study at Carleton in the interdisciplinary Master of Arts in Sustainable Energy. They then conduct fieldwork in the North, which includes considering alternatives to predominantly fossil-fuel based electricity and heating systems. Prof. Schott maintains that such interdisciplinary collaboration is the only way to address the complex challenges facing Arctic communities.

SPOTLIGHT ON

THE FACULTY OF SCIENCE

CROSS-DISCIPLINE CARLETON TEAM TO DESIGN GROUNDBREAKING PROTEIN-BASED DRUGS

A computer scientist and a biochemist at Carleton University have teamed up to start a company that designs therapeutic peptides derived from human proteins—drugs that may offer a new way of treating complex diseases that no longer respond to current treatments.

After working together for a decade and a half, Frank Dehne, a Chancellor's Professor of Computer Science who runs the Parallel Computing and Data Science Research Lab, and Ashkan Golshani, an award-winning biochemist who leads a molecular biology and genetics lab, registered Designed Biologics Inc. in February. The company will push development of special small peptides that can target specific proteins involved in various human diseases. Designed Biologics is dedicated to the development of small peptides (30 to 75 amino acids) with designed targeting properties. Combining molecular interaction analytics with high performance computing, Designed Biologics creates new classes of small proteins for the treatment of human diseases and diagnostics. Their new smart biologics target traditionally undruggable targets and focus on alternative binding characteristics to engage novel disease fighting mechanisms.

The pair's findings, as well as those of their students and research teams, may impact a pharmaceutical industry that has traditionally focused on antibody- and chemical-based therapies. Their early work was undertaken in partnership with SOSCIP, a collaborative R&D consortium of Ontario academic institutions, OCE and IBM Canada Ltd., with a mandate to drive innovation by providing state-of-the-art advanced computing facilities and expertise to industry-academic collaborative projects. Now that they have calculated the entire 200 million human protein interactions, they believe they are at the forefront of designing new pharmaceuticals using significantly smaller molecules that can attach to specifically targeted proteins, the culprits causing illnesses.

THE SPROTT SCHOOL OF BUSINESS

FROM BUCKETS TO RAIN BARRELS: AN INTERDISCIPLINARY APPROACH TO SUSTAINABLE CLEAN WATER IN TANZANIA

In the rural region of Longido, Tanzania, water access, storage and purification are critical issues that affect the health, social and economic well-being of the local people. Women are responsible for collecting water for their families, which impacts girls' access to education as they are needed to carry water from sources that are often far away from home.

For the past three years, students and faculty from Carleton's Sprott School of Business and Faculty of Engineering and Design have been working together with residents of Longido and TEMBO, a Canadian NGO in Tanzania, to address this issue. This interdisciplinary project called *From Buckets to Rain Barrels* is led by Sprott's Troy Anderson, alongside Onita Basu and Bjarki Hallgrimmson from Carleton's Faculty of Engineering and Design.

Building upon the work done in previous years, interdisciplinary teams of business, engineering and industrial design students research, design and test prototypes that can be used for the collection, purification and storage of water.

Every winter, students and faculty travel to Tanzania where they further research, test, refine and seek feedback on the prototypes from local residents and community leaders, who help evaluate them in terms of cultural acceptance, affordability and sustainability.

A Carleton PhD student spent the summer of 2017 onsite and is making one of facets of the project the topic of his dissertation. The project has also resulted in connections with local academic institutions, and has resulted in our partner becoming one of the key players in a program that brings international postgraduate scholars to Carleton. In addition to continuing undergraduate involvement, the project will also become a destination for a separate program in which Carleton will send scholars abroad, pending program approval. Two other partnerships are currently underway which will expand the scope of the project to food security, and allow for the commercialization of one of the current initiatives.

From Buckets to Rain Barrels was awarded the 2017 David Gillingham Award from the Network of International Business Schools (NIBS), which recognizes outstanding, internationally focused business education projects.

SPOTLIGHT ON

THE FACULTY OF GRADUATE AND POSTDOCTORAL AFFAIRS

IMPROVING WIRELESS NETWORKS

An email attachment that just won't load, a video streaming in a poor resolution, or an Instagram photo that won't pop up. These are all pet peeves of mobile network users who are experiencing a slow and inefficient network connection. If you have ever been aggravated by a slow connection on your smartphone, Carleton student Chengchao Liang's research may be of interest to you. For his PhD in Electrical and Computer Engineering, Liang's research focused on making wireless networks more efficient and effective.

Mathematical modeling, algorithms and protocols design, as well as computer simulation are the main parts of Liang's research and form part of Prof. Richard Yu's research. Yu recently received $600,000 from the Natural Sciences and Engineering Research Council for research into the next generations of wireless networking.

Says Liang: "The most exciting part of my job is that you can see the future of the connected world. You know how mobile networks will evolve and when the next generation network will come. More importantly, you are not just waiting for it to happen, you are making it happen."

PROMOTING YOUTH RESILIENCE IN FIRST NATIONS COMMUNITIES

PhD student Ariel Root is helping Prof. Kim Matheson pursue a SSHRC-funded research project on *Bringing Together Indigenous and Western Approaches to Promote Youth Resilience and Prosperity in First Nations Communities*. The Public Policy student will finish her program from Sioux Lookout, in order to be in the heart of her research. Root will visit remote communities and develop community partnerships and relationships.

"Many people have toes in so many different projects and the best way to meet them, and get a better sense of the on-going initiatives, is to be there, meet people, so you can benefit from all of the opportunities."

When Root is asked about the project's importance, she cites the differences in determinants of health between Indigenous and non-Indigenous communities, as well as underlying inadequacies and insufficiencies in program funding for improvements. She hopes that this project will help bridge some of those gaps.

Research and International
CARLETON UNIVERSITY

ABOUT RESEARCH AT CARLETON UNIVERSITY

Carleton University is a dynamic, interdisciplinary research-intensive institution with a creative international approach to research that has led to many significant discoveries and collaborations in science and engineering, business, public policy and the arts. Home to many award-winning researchers, Carleton is uniquely committed to discovery, knowledge, and understanding of the world around us.

Carleton University's location in Ottawa, the nation's capital, allows unique access for our researchers across many disciplines to such places as Canada's national labs and museums, Library and Archives Canada, federal government departments, and of course, Parliament Hill.

Through entrepreneurship, the building of sustainable communities, and industry partnerships we foster new ideas to create a more prosperous future for Canada and the world.

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

Fall 2017

Editor: Julie Carl, Research Communications Manager

Writer: Nicole Findlay, Senior Communications Strategist

Photography: Brigitte Bouvier, Luther Caverly, Adam Knauff, Jinhong Li, Mike Pinder, Chris Roussakis, Justin Tang

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