



ANNUAL REVIEW

FACULTY OF SCIENCE
2018

DEAN'S MESSAGE

In these pages, you will meet up and coming, as well as established Faculty of Science researchers all doing exciting new and groundbreaking research in their fields. Research that will make life easier, lead to more sustainable methods, deal with the effects of climate change, find better ways to calculate retirement funds and explore the beauty of light and how it can be used to treat age-related disorders.

There are professors who take teaching to a whole new level of student engagement, highlights of awards won, events that brought the community to our campus, and students who achieved success and travelled abroad to experience new things. We do all this with the help of volunteers, alumni and supporters that come together to foster new opportunities to create, discover, learn, impact, reach deeper in to the community and up into the stars. I hope you enjoy the journey.

Interim Dean EJ Janse van Rensburg

DEAN'S ROUND-UP OF 2018

JANUARY

A new series of videos tackling weird and quirky science questions answered by York Science researchers were added to the Faculty's *Did You Know* channel.

The Faculty's Annual Honours and Awards Ceremony celebrated the outstanding achievements of students and faculty members. Science Communicator in Residence and BBC Environment Correspondent **Matt McGrath** gave the keynote talk.

FEBRUARY

The Department of Science & Technology Studies hosted the event UX Jobs in the Gaming Industry for graduate students.

MARCH

In partnership with the Fields Institute, the Faculty of Science hosted a sold-out **York Science Forum [1]** with Nobel Laureate **Arthur McDonald**. McDonald presented "From the smallest particles to the evolution of the universe: Amazing measurements made 2 km underground," followed by a panel discussion also featuring **Sampa Bhadra** and **Scott Menary** (Physics & Astronomy). The event was moderated by York Science Communicator in Residence **Matt McGrath**, a BBC environment reporter.

The Faculty's packed Science Unplugged event featured a presentation by Science Communicator in Residence **Matt McGrath [2]** and the unveiling of YSciCore.

[1]



[4]



Members of the Department of Mathematics & Statistics, including **Steven Chen**, **Kosal Chin**, **Jane Heffernan**, **Robert Jordan**, **Neal Madras**, **Varvara Nika**, **Jianhong Wu**, **Jane Zhang**, and **Hongmei Zhu** organized a three-day Math for Real workshop at the Fields Institute. The event included 28 high school students from seven cities.

APRIL

York Science Communicator in Residence **Matt McGrath** co-hosted a science communication workshop with colleague **Alok Jha [3]**, author and former science correspondent at *The Guardian*. The sold-out event also included presentations from freelancer **Jenny Carpenter**, *Metro News* reporter **Genna Buck** and *The Globe and Mail* science reporter **Ivan Semeniuk**.

[2]



MAY

The Faculty of Science hosted another successful Science Rendezvous at the Markham Farmers' Market.

Sapna Sharma (Biology) received the York University President's Emerging Research Leadership Award and **Laurence Packer** (Biology) was elected to the Fellowship of the Royal Entomological Society of London.

[6]



[5]



JUNE

James Temerty [4] received an honorary degree at the Science & Engineering spring convocation ceremony.

Nantel Bergeron (Mathematics & Statistics) was named a Distinguished Research Professor. **Patrick Ingram** (Mathematics & Statistics) received the G. de B. Robinson Award from the Canadian Mathematical Society.

JULY

The **Allan I Carswell Observatory team** hosted Mars Extravaganza July 25 to August 1.

Amenda Chow (Mathematics & Statistics) received an award from the Academic Innovation Fund to develop an experimental math space.

AUGUST

Alumnus **Paul Sanberg [5]** received the York Bryden Alumni Award for Outstanding Contribution.

More than 50 students participated in the 2018 Faculty of Science

[3]



Summer Undergraduate Research Conference on Aug. 7.

SEPTEMBER

Alumna **Pamela Ohashi** (BSc 1982) received the Robert L. Noble Award from the Canadian Cancer Society for her research on the role of the immune system in the development and progression of cancer.

OCTOBER

York Science Communicator in Residence **Molly Segal** held a workshop, "Taxonomy of an Audio Story: How Radio Journalists and Podcasters Make Stories out of Science," and invited guest and CBC *Quirks & Quarks* producer **Sonya Buyting**.

Jennifer Chen (Chemistry) was named to the Top 40 Under 40 Power List 2018 by *The Analytical Scientist* magazine. **Sylvie Morin** (Chemistry) received an

NSERC Engage Grant and **Amro Zayed** (Biology) was elected as the president of the Entomological Society of Ontario.

NOVEMBER

Grad students and faculty, including **Nadia Tsvetkov**, **Amanda Liczner**, **Laurence Packer** and **Amro Zayed** (all in Biology), from across southern Ontario and beyond were buzzing at the annual **BeeCon [6]** conference with presentations on bee behaviour, genetics and genomics, conservation and more.

DECEMBER

Thomas Salisbury (Mathematics and Statistics) is named to the Inaugural Class of Fellows of the Canadian Mathematical Society (CMS). The Fellows Program recognizes mathematicians who have made significant contributions to the profession and to the Canadian Mathematical Society.

SCIENTIST JOINTLY APPOINTED TO LEAD YORK U'S PARTICIPATION IN NEUTRINO SEARCH



Her Excellency the Right Honorable Julie Payette, Governor General of Canada; Nigel Lockyer, director of Fermilab; York U Faculty of Science Dean Ray Jayawardhana; and Physicist Deborah Harris. Image courtesy of Fermilab

The search for the origins of the universe received a huge boost in 2018 with the joint appointment of leading researcher and particle physicist Deborah Harris to lead York University's participation in the Fermilab-hosted Deep Underground Neutrino Experiment (DUNE).

The news heralded the official start of the partnership between York University's Faculty of Science and Fermilab, an American-based particle physics laboratory.

The Governor General of Canada Julie Payette, an engineer and former astronaut, joined officials from Fermilab and Faculty of Science Dean Ray Jayawardhana at the U.S. Department of Energy's Fermi National Accelerator Laboratory in Illinois for a tour of the facility.

The partnership with Fermilab reflects York's commitment to world-leading research

In her new role, Harris will hold the title of professor at York University while continuing as a senior scientist at Fermilab and a leader in the study of elusive subatomic particles called neutrinos. She led the construction of the MINERvA neutrino detector at Fermilab



Julie Payette, Governor General of Canada, is greeted by Ray Jayawardhana. Image courtesy of Fermilab

and served as co-leader of the experiment's scientific collaboration since 2010.

As a member of the DUNE team, Harris collaborates with more than 1,000 colleagues from around the world. Together, the international DUNE collaboration will advance research into neutrinos. These tiny particles are the most abundant in the universe, but little understood, although they could answer some of the biggest questions in physics.

"The partnership with Fermilab reflects York's commitment to world-leading research," said Jayawardhana. "We are delighted to team up with the international collaboration building LBNF and DUNE, giving our researchers and students frontline opportunities to make significant discoveries on a global scale."

DUNE, together with the Long-Baseline Neutrino Facility (LBNF), will send the world's most intense

beam of high-energy neutrinos 800 miles through the earth from Fermilab to the world's most advanced neutrino detector one mile underground at the Sanford Underground Research Facility in South Dakota. LBNF/DUNE, which broke ground last July, will include contributions from scientists and engineers around the globe.

Fermilab Director Nigel Lockyer, a graduate of York University and former director of TRIUMF, Canada's national laboratory for particle and nuclear physics, said: "DUNE could unlock the mystery of why matter and the universe exist. I'm delighted to be joining forces with the faculty and students from my alma mater to build the world's most ambitious neutrino experiment."

STELLAR \$3M ENDOWMENT HELPS STUDENTS, COMMUNITY REACH FOR THE STARS AND BEYOND

With a galactic \$3-million investment, made in partnership with York University Professor Emeritus Allan Carswell and the Carswell Family Foundation, York University is sharing the wonders of the universe with students, youth in the community and the public through the creation of a new Chair.

The Allan I. Carswell Chair for the Public Understanding of Astronomy in the Faculty of Science, thought to be the first of its kind in North America, is dedicated to science engagement and outreach. It will benefit students and the public through education and activities, involving telescopes at the Allan I. Carswell Observatory, as well as novel technologies such as virtual reality. The endowment will also support the York Science Communicator in Residence program to enhance student-learning opportunities in science communications.

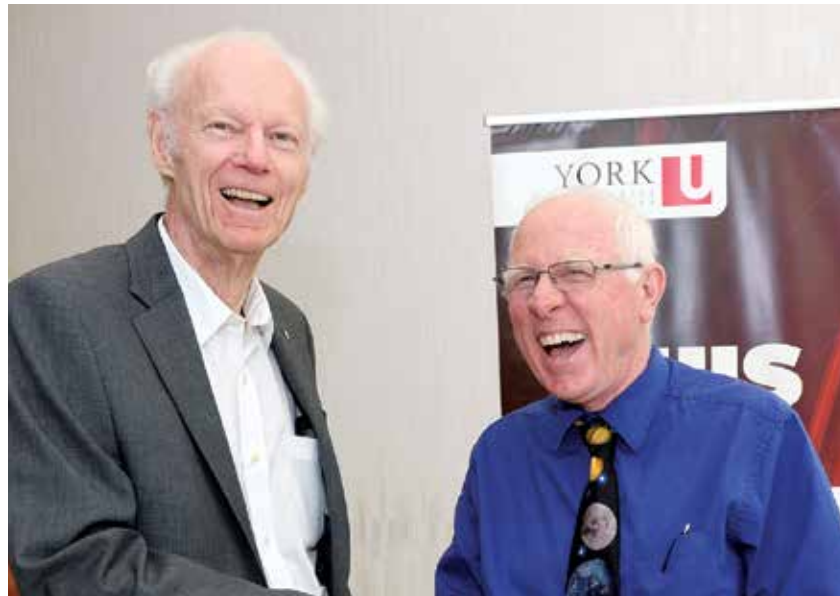
The first holder of the Carswell Chair for a three-year term is University Professor and Senior Lecturer Paul Delaney. Delaney is well known within the University and the broader community for his public outreach and frequent media appearances explaining the mysteries of the universe in a way that everyone can understand.

Working with the Science Communicator in Residence program and the observatory, the Chair will also enhance undergraduate and graduate learning opportunities in science communications. The Chair will be poised to keep pace with emerging technologies, changes in science education, and develop innovative ways to teach, communicate and involve students, as well as the broader community, in the excitement of science.

York University will match the \$1.5 million gift from the Carswell Family Foundation for a total of \$3 million.

“With this generous gift to the Faculty of Science from Allan Carswell and the Carswell Family Foundation, York University will enhance the exciting educational opportunities in astronomy that we offer our students, while also growing our community outreach initiatives as part of our institutional commitment to public service. Allan’s immense generosity will benefit students, faculty and the public here and across the country, and allow a whole new generation to explore the wonders of our galaxy.”

Rhonda Lenton, president and vice-chancellor at York University



Allan Carswell and Paul Delaney

“The Carswell Chair embodies a truly inspired, exciting and meaningful vision for science engagement – one that is unique in its scope and far-reaching in its impact. Having been drawn to the wonders of space as a kid, I can attest personally to astronomy’s power to stimulate the imagination and instill a passion for science.”

Ray Jayawardhana, dean of the Faculty of Science

LAUNCH OF BIOANALYTICAL CORE FACILITY SERVES RESEARCH COMMUNITY

The Faculty of Science officially launches a new cutting-edge facility named YSciCore, which will provide bioanalytical support to scientists at York University and beyond.

Based in the Life Sciences Building on the Keele Campus, YSciCore offers rapid, high-quality analyses to internal and external clients using state-of-the-art microscopy, nuclear magnetic resonance and mass spectrometry platforms. Technical experts, who can supply critical support from the earliest stages of project design to specialized sample preparation and data analysis, will manage each platform.

The development of YSciCore involved extensive consultations with researchers as well as technical staff led by Professor Derek Wilson in the Department of Chemistry, and key investments by the Faculty of Science to upgrade critical facility equipment.

YSciCore has already attracted interest from local industrial clients including Apotex, Sanofi, Dalton Pharmaceuticals and ImmunoBiochem, among others.

MICROSCOPY AT YSciCore

With microscopy, you can view and capture images of samples that cannot be seen by the unaided eye. Scientists use microscopy to view biological samples like viruses and cells, a variety of large molecules, the characteristics of various surfaces, and more. The microscopy platform of YSciCore includes a FEI Quanta 3D dual beam microscope, a Zeiss Spinning Disk Confocal Microscope and a Zeiss Laser Scanning Confocal Microscope. The FEI Quanta 3D dual beam microscope provides high resolution imaging performance that can deliver full dynamic characterizations of samples. The Zeiss Spinning Disk Confocal Microscope is used for fast live cell imaging, while the Zeiss Laser Scanning Confocal Microscope is used for high resolution optical sectioning and 3D imaging.

NUCLEAR MAGNETIC RESONANCE AT YSciCore

Nuclear Magnetic Resonance (NMR) spectroscopy is a widely used and essential technique for identifying chemical and biochemical structure, reactivity and molecular behaviour in solution. Similar to the Magnetic Resonance Imaging (MRI) spectrometers commonly used in the healthcare system, NMR combines a magnetic field and low energy radio frequency to investigate samples. The NMR platform at YSciCore includes a 700 MHz NMR spectrometer that allows researchers to investigate the nature of complex biochemical and chemical systems on a molecular level. The instrument is uniquely equipped with enhanced sensitivity to enable the study of very small amounts of material, and it implements the newest methods for data collection.

MASS SPECTROMETRY AT YSciCore

Mass Spectrometers measure the mass of objects, particularly atoms and molecules. They have enabled scientists to decipher the innermost workings of the cell, identify diagnostic blood markers in disease, and develop immunotherapies to combat our deadliest pathogens. The mass spectrometry platform of YSciCore houses some of the most advanced instrumentation available that is helping researchers answer their most complex questions. It includes the high-resolution Orbitrap Elite, which provides clients access to state-of-the-art identification and characterization workflows in proteomics, lipidomics and metabolomics with unparalleled mass accuracy and specificity.

“The frontline instruments in YSciCore are already being used by researchers in the Faculty of Science to conduct a wide variety of investigations, ranging from environmental analysis to clinical proteomics. As a more integrated facility with enhanced support, YSciCore will now open up its equipment and expertise to the broader community and enable research intensification at York on an unprecedented scale.”

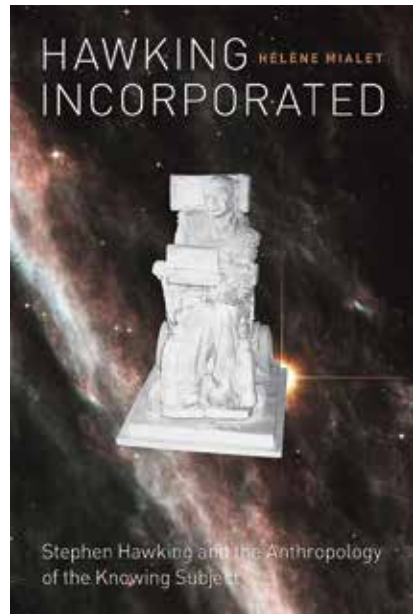
Ray Jayawardhana, dean of the Faculty of Science

IN THE MEDIA SPOTLIGHT



HIDING IN PLAIN SIGHT

Wendy Taylor (Physics and Astronomy) spoke to CBC's "Quirks & Quarks" about where the Higgs boson was hiding. It wasn't she explained, but it needed a particle collider to find it, such as the Large Hadron Collider at the European Organization for Nuclear Research, which could collide billions of protons over a two-year period.



A BRILLIANT MIND

Following the death of Stephen Hawking in March, **Héline Mialet** (Science and Technology Studies), who had written about his reliance on technology and people for a decade, spoke to various media outlets about his legacy, his fascination, his brilliance and what his loss meant to her. She wrote a piece that was published in *The Atlantic* and she was also quoted by several media outlets, including *The Globe and Mail*, *L'Express*, Radio Canada, CTV News, and CBC's "Quirks & Quarks." *The New Yorker* and *New Scientist*, among others, also cited Mialet.



A QUESTION OF ANTIMATTER

The Big Bang theory requires equal amounts of matter and antimatter to have been created at the beginning of time, but there is little antimatter in the universe now. What happened to it is the question scientists like **Scott Menary** (Physics & Astronomy) and the ALPHA Collaboration have been trying to answer. They came that much closer with the most precise direct measurement of antimatter ever. Menary spoke to *VICE's Motherboard* about the breakthrough.

STILL BUZZING

By sequencing the genome of the **yellow-banded bumblebee Amro Zayed** (biology), **Clement Kent** (Biology) and PhD student **Nadia Tsvetkov** found that inbreeding and disease are likely culprits in their rapid decline in North America. Zayed spoke to Reuter's UK about their research. *Yahoo News* and the *Japan Times* picked up the story, and *The Standard* in Hong Kong also ran a piece.



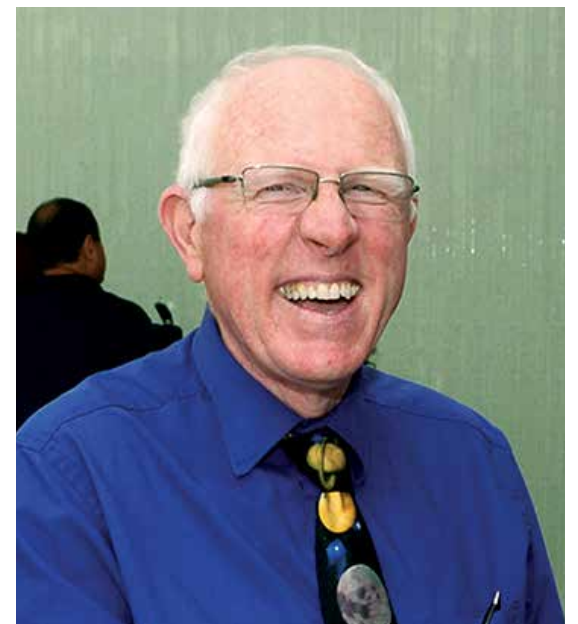
WHAT'S THE BUZZ?

Fifteen new species of the clandestine and sneaky cuckoo bee in the genus *Epeolus* were found by PhD Candidate **Thomas Onuferko** (Biology), supervised by **Laurence Packer**, nine of which were hiding in collections and museums across North America. Onuferko spoke about his findings to BBC journalist **Matt McGrath**, former York U Science Communicator in Residence, and Science Update, which is produced by AAAS.



OUTTA THIS WORLD

Paul Delaney (Physics and Astronomy) was on several radio and television shows, and in print media, talking about the Leonid meteor showers event at York, dark matter hurricanes, the alien spacecraft solar sail, gamma ray bursts, the NASA Insight landing, and more including CTV's *Your Morning*, AM640, NewsChannel, CTV-CFTO, CHML Scott Thompson, *Ottawa Citizen*, and Newstalk 1010 John Moore's show.



THREE NEW SCIENCE COMMUNICATORS IN RESIDENCE COME TO YORK

Following the highly successful launch of its one-of-a-kind York Science Communicator in Residence program in 2017, the Faculty of Science opened a second call for applications. Three impressive science communicators joined the Faculty for the 2018-19 year. Molly Segal was here in the fall, while Dan Falk and B.D. Colen are expected in the winter and fall of 2019, respectively.



MOLLY SEGAL

“Being curious is at the heart of what I do, so to get the chance to surround myself with people who are fundamentally curious about the world is a treat. It’s an honour to learn more about the research happening at York’s Faculty of Science in such an in-depth way. As a journalist producing science stories for radio and podcasts, I see a link between my work and the communication skills scientists can build to bridge their work to the public.”

Molly Segal, documentary and feature story producer for radio and podcasts, which have aired on many national radio programs, including CBC’s *Quirks & Quarks*.

“Once again, the program attracted high-calibre candidates from all over the world, reaffirming widespread interest and demand for opportunities that promote excellence in science communications and journalism,” said Ray Jayawardhana, dean of science at York University. “We are delighted to continue the program for a second year with three outstanding residents with a diverse range of talents in radio, photography and writing.”

The residents can learn about research as it’s happening at the Faculty of Science in the lab or out in the field with researchers, students and staff. At the same time, researchers are given the opportunity to learn more about how to communicate about their research.

B.D. COLEN

“Improving public understanding of, and respect for, the sciences and scientists is literally essential for humankind’s continued survival. I look forward to working with York’s researchers and students to help them find ways to communicate with an increasingly skeptical public.”

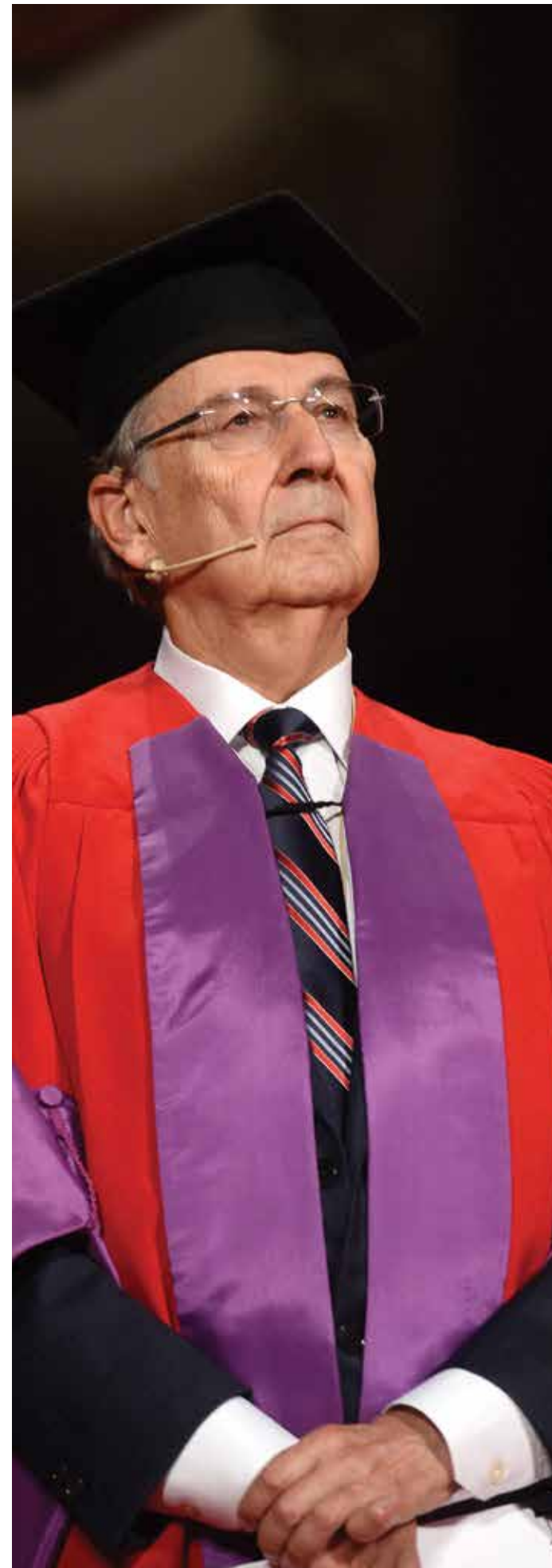
B.D. Colen, photographer, author, Pulitzer Prize recipient, and former reporter, editor and columnist for the *Washington Post* and *Newsday*.



DAN FALK

“I’m thrilled to have the chance to spend an extended period getting to know York’s Faculty of Science. The need for high-quality, responsible science journalism is greater than ever. During my residency, I’ll be speaking with faculty members from a range of scientific disciplines, searching for compelling stories while broadening my knowledge-base; as well, I’m keen on sharing what I’ve learned about the process of bringing science to the public.”

Dan Falk, award-winning science journalist and author of three popular science books.



EXPLORE ALL OPPORTUNITIES

HONORARY DEGREE RECIPIENT FOR THE FACULTY OF SCIENCE, JAMES TEMERTY, TOLD GRADS – BE BOLD AND DREAM

Speaking from the perspective of someone who has experienced success as a tech entrepreneur, honorary degree recipient James Temerty shared words of wisdom on life and achieving success during his address at York University’s 2018 Spring Convocation ceremony.

Temerty, who has extensive accomplishments in technology, clean energy development and community support, began his career at IBM. He moved from IBM to launch the entrepreneurial portion of his career with the retailer ComputerLand, which he expanded from a store into a world-wide franchise. He later founded Northland Power, which operates wind, solar and thermal electric power facilities and has an enterprise value exceeding \$10 billion.

He’s also active in philanthropic activities. He was named a Member of the Order of Canada and was honoured as Canada’s Entrepreneur of the Year in 2010 by Ernst and Young.

“I’m here today to speak to you about some life experiences – intuition, confidence through perseverance, and the power of perseverance in crisis and the nature of opportunity,” said Temerty.

Intuition is the fuel for success and by learning how to inform and acknowledge your intuition, you also set yourself up for confidence, he told graduands. He shared some of his own experience when he left IBM after 15 years to move to ComputerLand. He said that although he came up against many people who thought it was a bad decision, he trusted his own intuition – and it paid off.

“Learn to inform your intuition before you act on it. Develop the confidence to trust your intuition and then work like hell to make it happen,” he said.

When you believe in yourself, he said, you are more likely to stand up and seize the moment and persevere long after self-doubters have given up. He did this when he launched NorthLand Power and today it is a \$10-billion company that has a global presence. “The lesson is to persevere through crisis – be careful of the danger but look for opportunity,” he said. “You can become tomorrow’s leaders, create jobs, advance innovation and become socially conscious individuals right here in Toronto,” he said. “Be bold, dream, begin.”

AWARDING EXCELLENCE – FACULTY AND STUDENTS

SELECT FACULTY AWARDS

FSc Early Career Research Award	Jennifer Chen
FSc Established Research Award	Eric Hessels
FSc Excellence in Graduate Mentorship Award	Mark Bayfield
FSc Excellence in Teaching	Derek Jackson Patricia Lakin-Thomas

SELECT GRADUATE STUDENT AWARDS

CIHR Doctoral Frederick Banting & Charles Best CGS	Wonsuk Jahng
Dalton Pharma Services/Dr. Douglas Butler Award	Jordan Bentley
Nestmann Scholarship	Jennifer Porat Alexander Klenov
NSERC Alexander Graham Bell Canada Graduate Scholarship CGS-D – Doctoral	Alexander Klenov Tamari Chkuaseli Alyssa Murdoch
SSHRC Doctoral Fellowship	Catherine Duchastel De Montrouge
The Vernon Oliver Stong Graduate Scholarship	Gehrig Carlse Eleni Fegaras Brandon Khan Patrik Pirkola Farwa Sajadi Andre Williams Mingfu Wang Bushra Majeed
Provost Dissertation Scholarship	Anthony Leung Lina Pinto Garcia
VISTA Graduate Scholarship	Sohrab Salimian Domenic Au Gaelle Nsamba Luabeya

SELECT UNDERGRADUATE AWARDS

York University President's Scholarships	Nicholas Chrobok Katerina Disimino Greta Raffoul Jacob Fine Teresa Siewnarine Sophie Eisen Dayana Davoudi
Alumni Award of Distinction renewed	Julieta Rybnik Muzi Li
Dr. Robert Lundell Achievement Award	Sheza Qayyum
Gillian E. Wu Award in Biochemistry	Esther Wolf Mehakpreet Saini
Governors' Award of Distinction – John Proctor Scholarship	Laura Fallico
The Orgram Scholarship	Heba Alasali
The Professor Ruth Hill Memorial Award	Nicholas Chrobok Nadav Gasner Farzam Poorsoltanmohammadi
The Global Leader of Tomorrow Award for International Students	Oscar Castro Juhi Dawoodia
Provost's Scholarship	Ata Ahmadi-Yazdi Carley Amos Anna Vetlugina
Sally Murray Findley Memorial Scholarship	Jiyu Wang
Schulich Leader Scholarship	Rathesh Balendran Katrina Carver Nadav Gasner Kezia Johnson
York Science Scholars Award	Hila Akbari Annabelle Audet Dayana Davoudi Sophie Eisen Jacob Fine Pablo Gonzalez Hannah Gray Coral Hillel Stephanie Lo Sahib Madahar Davneet Parmar

NOTABLE RECOGNITIONS

SAPNA SHARMA

RECIPIENT OF THE YORK UNIVERSITY PRESIDENT'S EMERGING RESEARCH LEADERSHIP AWARD IN 2018

Sapna Sharma (Biology), a Tier 2 York Research Chair in Global Change Biology, received a 2018 President's Research Excellence Award for her leadership in understanding the impacts of climate change, invasive species and habitat alteration on lakes.

Her research focuses on predicting the effects of environmental stressors on lakes at broad spatial and temporal scales, and improving the scientific approaches used to generate these predictions.

Sharma is also committed to science outreach through her work with the Royal Canadian Institute for Science and is the founder of a science outreach program for refugee families called SEEDS (Science Enrichment and Educational Development for Syrians & Refugees).



NANTEL BERGERON

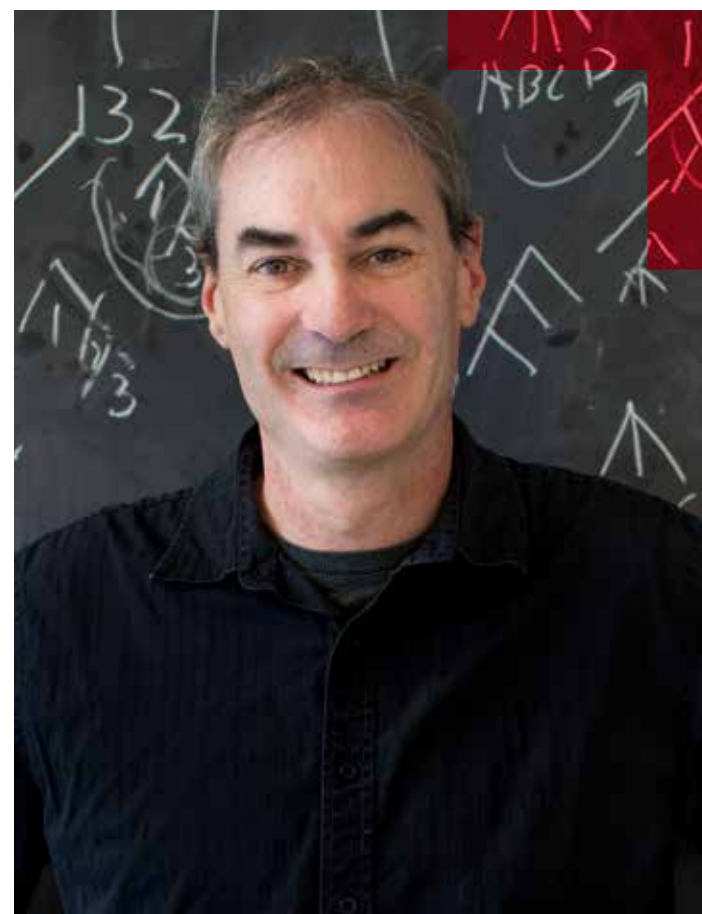
DISTINGUISHED RESEARCH PROFESSOR

Nantel Bergeron (Mathematics and Statistics) received the honour in recognition of his scholarly achievements in research.

Bergeron works in algebraic combinatorics and its applications. He has made substantial contributions in Schubert calculus, combinatorial Hopf algebras and in Coxeter-related combinatorics (descent algebras, peak algebras, polytopes etc). He studies the structure of algebra, combining algebraic objects and breaking them in various ways to understand how different operations relate to each other.

Bergeron holds a York Research Chair in applied algebra and has been the recipient of several honours and awards such as Fields Institute Fellow (2012), Canada Research Chair in mathematics (2001-11), Premier's Research Excellence Awards (2000-05) and more. He has also been involved with several professional and government organizations, including as a member of the Strategic Projects Opportunity Review Team (advisory committee to the VPRI York University), a panellist for the National Science Foundation and several positions with the Canadian Mathematical Society.

Bergeron has published more than 80 papers, and 2,000 Google Scholar citations with a h-index of 27. He has supervised 19 PhD students and 23 postdoctoral fellows.



NEW AND RENEWED RESEARCH CHAIRS

CANADA RESEARCH CHAIRS (CRCs)

The Government of Canada announced one new and one renewed CRC in the Faculty of Science. The CRCs were created to attract and retain the best minds and to make Canada one of the world's top countries in research and development. That brings the total of CRCs in the Faculty to eight:



PROF. STEVEN CONNOR
(Biology)
CRC in Neurophysiology
(Tier 2)



PROF. GEORG ZOIDL
(Biology)
CRC in Molecular and Cellular Neuroscience (renewed) (Tier 1)

YORK RESEARCH CHAIRS (YRCs)

York University's internal counterpart to the national CRC program recognizes outstanding researchers and is designed to build, support and intensify the world-renowned research already underway. Two faculty members were appointed as YRCs in 2018 for a total of nine in the Faculty of Science:



HUAIPING ZHU
(Mathematics and Statistics)
YRC in Applied Mathematics (Tier 1)



DEREK WILSON
(Chemistry)
YRC in Molecular Mechanisms of Disease (Tier 2)

RESEARCH FUNDING FACTS

\$14.1 MILLION
TOTAL NEW RESEARCH FUNDING FOR THE FACULTY OF SCIENCE

\$6.4 MILLION
NEW FUNDS FROM THE NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL OF CANADA (NSERC)

\$1.16 MILLION
NEW FUNDS FROM THE CANADIAN FOUNDATION FOR INNOVATION (CFI) AND THE ONTARIO RESEARCH FOUNDATION (ORF)

\$2 MILLION
NEW FUNDS FROM THE CANADIAN INSTITUTES OF HEALTH RESEARCH (CIHR)

\$2.2 MILLION
NEW FUNDS FOR CANADA RESEARCH CHAIRS AND EARLY RESEARCHER AWARDS

\$1.5 MILLION
NEW FUNDS FROM INDUSTRY

[1]

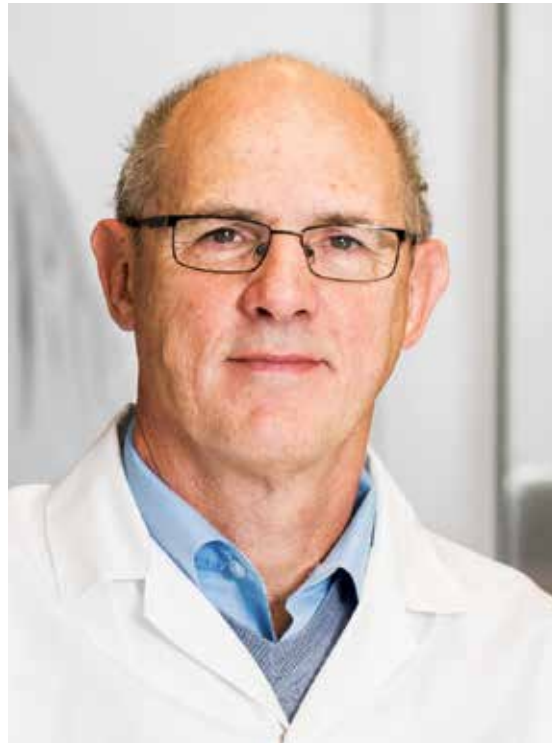


RESEARCH FUNDING HIGHLIGHTS

CANADIAN INSTITUTES FOR HEALTH RESEARCH

Gary Sweeney [1] (Biology) received \$661,725, John McDermott [2] (Biology) received \$661,726 and Arturo Orellana [3] (Chemistry) received \$573,750 in project grants from the Canadian Institutes for Health Research (CIHR) for their projects:

"Cardioprotective Effects of Adiponectin-Stimulated Autophagy," "Protein: Protein Networks in Regulation of Cardiomyocyte Gene Expression," and "Developing small molecules targeting LXRb for the treatment of glucocorticoid induced diabetes."



[2]



[3]

NSERC STRATEGIC PARTNERSHIP GRANT

Sergey Krylov [4] and Ryan Hill [5] (Chemistry) received \$952,217 in NSERC Strategic Partnership Grants for their project, "Technology to Enable Automated Manufacturing of Validated Pharmaceutical Hits."

EARLY RESEARCHER AWARDS

Jean-Paul Paluzzi [6] (Biology) and Ryan Hill [5] (Chemistry) received Early Researcher Awards from the Ontario Ministry of Research, Innovation and Science. In addition, Hill was selected for the Ontario-China Young Scientist Exchange Program.

[4]



[5]



[6]



[7]



JOHN CHARLES POLANYI PRIZE

Chris Caputo [7] (Chemistry) received the John Charles Polanyi Prize for chemistry awarded annually to five early stage researchers representing Ontario's next generation of innovators.

CFI-JELF/ORF-SIF

John McDermott [2] (Biology) and Gary Sweeney [1] (Biology) received at total of \$762,110 in awards from the CFI- JELF/ORF-SIF.

NSERC DISCOVERY GRANTS

Twenty-seven researchers in the Faculty of Science received more than \$5.2 million in NSERC Discovery Grants to pursue ideas and breakthrough discoveries.

HOFFMANN-LA ROCHE

Arturo Orellana [3] (Chemistry) also received a \$241,000 grant from Hoffmann-La Roche for sustainable drug manufacturing.

Tom Salisbury (Math and Stats) enjoys a good problem, one that will take him at least half a year to solve. He also likes variety. His work nowadays goes back and forth between theoretical probability puzzles and questions related to sustainable income in retirement.

"I work on theoretical, curiosity driven, we simple don't understand how this kind of random system works, problems. What ideas can we throw at it to try to figure out how it should behave?" says Salisbury. "There is a lot of interest these in days in combining randomness with disorder."

Materials scientists are dealing with material that has all kinds of variations inside of it. It is difficult to measure or know what will happen if you try to send electrons or oil through some disordered piece of rock. "There is going to be randomness in how it moves, but that randomness is influenced by the disordered nature of the material it's moving in," he says. "I've been working lately on a set of models called random walk in random environment. The random environment is this disordered geometry in which the randomness is taking place."

The finance work he does is of interest to a wider population. It still, however, involves probability and randomness, such as the stock market. The connection is that people in finance use the concept of Brownian motion, the mathematical theory of which is something Salisbury is an expert in. He also uses another mathematical toolkit called stochastic control theory to help deal with the random probabilities of how much to save or spend in retirement, or how to best use variable annuities or a recent alternative to them, tontines. What is the probability you will live to be more than 100 and how does your biological age, unlike your chronological age, affect that calculation? What about ever increasing lifespans. "I love working on both kinds of problems and there seems to be a never-ending supply of puzzles and challenges," he says.

RANDOM DISORDER, RETIREMENT PLANNING AND THEORETICAL PROBABILITY QUESTIONS

TOM SALISBURY



WORKING TOWARD MORE EFFICIENT MATERIALS FOR ALTERNATIVE ENERGY PRODUCTION AND STORAGE

The need for high performing materials in batteries, fuel cells and photo-driven water splitting to produce hydrogen for fuel has generated renewed interest in metal oxides. Sylvie Morin (Chemistry) and her group are trying to figure out the inner workings of these oxide materials using state-of-the-art techniques. This will pave the way for the implementation of future innovations of alternative energy production and storage.

Metal oxides use affordable starting materials and simple preparation methods, which allows the material to be put on a wide range of supports, which further broadens their applicability. "These are very low-cost materials compared to materials currently being used in fuel cell applications for example," she says. "The material is easily prepared, requiring relatively low temperatures with the result being a physically and chemically stable material. These combined features make for easy manufacturing."

Many groups have prepared similar materials, but there is little agreement on how and why they work. "It's quite puzzling because their preparation is not very complicated," she says. "So, we're trying to understand how their structure and composition relates to their performance."

Her approach involves two key studies. First, a detailed study of the material's surface structure. This is important because

these processes, such as water splitting, occur at the surface of the material not inside it. In the second, Morin will work with people of different backgrounds and expertise using X-ray Absorption Fine Structure to study how the components of the oxide material, which contains up to three different metals, are arranged inside of it. This powerful technique allows all the metals in her materials to be studied, providing information about the chemical environment of each one. The plan is to do these measurements at the Canadian Light Source in Saskatoon this summer.

"Using X-ray Absorption Fine Structure and other surface sensitive methods will allow us to understand these materials more deeply and explain the discrepancies between data reported from independent research teams," says Morin.

SYLVIE MORIN



BEAUTY IN LIGHT

OZZY MERMUT

Ozzy Mermut (Biophysics) saw the light. Like a switch flicking on inside her brain, she was struck by the beautiful nature of photons – particles and waves that constitute light – and their endless possibilities. As a biophotonic researcher harnessing the power of light, she is developing new techniques for early diagnostics of eye-brain disorders and, in particular, unlocking the mysteries of degenerative diseases that come with aging.

Shine light through the eye and it will hit the back of the retina illuminating it and sometimes the presence of undetected disease. “The eye is a beautiful window into the brain and aging. You can see early signs of degeneration from aging in the fine architectural layers of the retina,” says Mermut. “I use photons to literally shed light on biochemical processes and tissue level structure to find out how we can better manage age-related disorders, like cancer, macular degeneration, and immunological and neurological diseases.”

For example, the current treatment for age-related macular degeneration involves thermal burning of the retina, but the method also damages healthy tissue. Mermut believes there are ways to direct lasers to treat ocular diseases more effectively, limiting the damage and preserving healthy vision.

Scientists are now able to see retinal amyloid plaques – similar to those found in the brains of Alzheimer’s

patients – using high resolution, chemically sensitive optical imaging techniques. “That may lead to early diagnostics by optically imaging the eye,” Mermut says. “Through the eye, I think we will be able to piece together some of the puzzles of aging.”

Her other passion is delivering medicine to remote places, including to space, by creating photonic technologies, miniaturized portable labs, using fiber optics that can also monitor critical biomarkers on the go.

“This is one of the reasons I was attracted to York. There is a strong connection and convergence of biophysics with the astronomy physics program here,” she says.



THE CHALLENGE OF TREATING RARE DISEASES WITH AFFORDABLE DRUGS

CONOR DOUGLAS

Genomic technology is resulting in diagnoses of more rare diseases than ever before. While this leads to more treatment options, these are often expensive drugs for only a few people. As many of these diseases are chronic, it is expensive for patients and insurance providers, costing from \$100,000 to \$300,000 per patient per year.

“Prices on these drugs are not coming down, but the second challenge is, are they working?” says Conor Douglas (Science

and Technology Studies), who looks at the interconnections between science, technology and society.

With so few patients, it is not possible to do randomized, double blind studies. “It’s a different evidentiary ball game,” says Douglas. “Those two major challenges put together, small patient numbers and lack of evidence that the drugs are working, and that combined with the cost, are a cause for concern and a problem for coverage payers. They want to know what they’re getting for their dollars.”

This is where Douglas’s expertise comes in. Problems such as those facing drug companies, patients with rare diseases, and the health systems that regulate and pay for these drugs, are intertwined with social, political, cultural and historical issues as much as they are health services and economic dilemmas. He collaborates with researchers across disciplines, and with those making the decisions about pharmaceutical coverage to develop policy recommendations. While his current work has focused on pharmaceutical, the interconnections between science, technology and society that are of interest to the Department of Science and Technology Studies relate to a number of issues. Those include climate change, migration, challenges with information and communications technologies or food security.

“There is a real opportunity for us to work closely with colleagues across the Faculty,” says Douglas. “These issues don’t take place in a cultural, social, historic

and economic vacuum. I strongly believe we have a lot of value to add to projects that take a conventional, biomedical sciences approach. The more research teams can integrate in a meaningful way, the stronger the projects will be.”



USING STORYTELLING TO ENGAGE EVEN THE MOST RELUCTANT STUDENTS

VERA PAVRI

Vera Pavri (NATS/STS) does not just lecture, she tells stories. She weaves her lessons into relatable tales full of characters, themes, mystery, intrigue, and cliffhangers. The reason? She wants the students in her courses, such as NATS 1700 (Computers, Information and Society), NATS 1505 (Understanding Cyberspace) and NATS 1775 (Technology and Civilization) to stay engaged.

“Narrating a scientific discovery or technical invention as if it were a kind of mystery novel often gets students excited about what is coming next and creates a sense of anticipation that helps make the lecture material interesting and memorable,” says Pavri. Or, she might start with a question that may seem counterintuitive. When teaching about internet use and brain change, she asks students why more brain activity is not necessarily better brain activity. “It provides me with the opportunity to unravel the answer for them.”

Story-telling is becoming more popular as professors realize the cognitive benefits for students in areas such as motivation, memory recall, reading comprehension, pattern recognition and knowledge transfer.

Pavri also sees active learning as an important way for students to get more involved, including incorporating class debates on topics relevant to them. “I believe that active learning is a great complement to storytelling,” she says. “Student learning is a far more multi-layered process than I once thought – teaching is not equivalent to learning and learning is not just about absorbing content.”

She has also become interested in how do students learn and retain information, especially in digital environments, and uses a variety of self-assessment and self-reflection activities to get students thinking and learning.

It’s a big challenge. Most NATS students come into the class apprehensive of having to take a general education requirement in science. But Pavri is determined to show even the most reluctant student that the course will have relevancy to them, and that taking it might just enrich their lives in unexpected ways.

The components of cell phones, the battery in a car or fitness watch, the cells in the solar panels all have roots in chemistry. Most people don’t think about the chemists in their lab figuring out how to make their cell phone and its inner workings, for example, ever smaller, more flexible, foldable or transparent.

Nothing would happen without them. That’s fundamental science. The kind Thomas Baumgartner (Chemistry) does. “Basically, we’re providing the basis for next generation technologies in the sustainable energy realm,” he says. Most electronics are metals and silicon-based technology and that’s expensive and unsustainable. “We’re trying to make materials that can be turned into organic electronics.”

Chemistry is the beginning, and there needs to be a constant flow of knowledge. “If the source is not there, people downstream don’t get to fish,” says Baumgartner, Canada Research Chair in Sustainable Organomaterials. “That’s in a metaphoric way how fundamental science works.”

In his lab, they are now experimenting with materials for sustainable applications, such as light harvesting and energy storage. It is what he calls the building blocks of the future. They are looking to create

something with the properties of a plastic material, lightweight, flexible and reasonably cheap. Then incorporate an electronic function into it, whether that’s a light-emitting element, a solar cell or a battery.

Currently, they are halfway to developing a more sustainable battery using organic materials, but it’s still five to 10 years away from commercial viability. There is a prototype in his lab that’s charging and discharging its load. It has about 50 per cent of the charge storage capacity of a state-of-the-art lithium ion battery.

Thanks to chemistry, a cell phone may one day be as thin as a piece of foil and just as flexible. Or a solar cell could be comprised of transparent components in the form of paint that gets applied to a window.

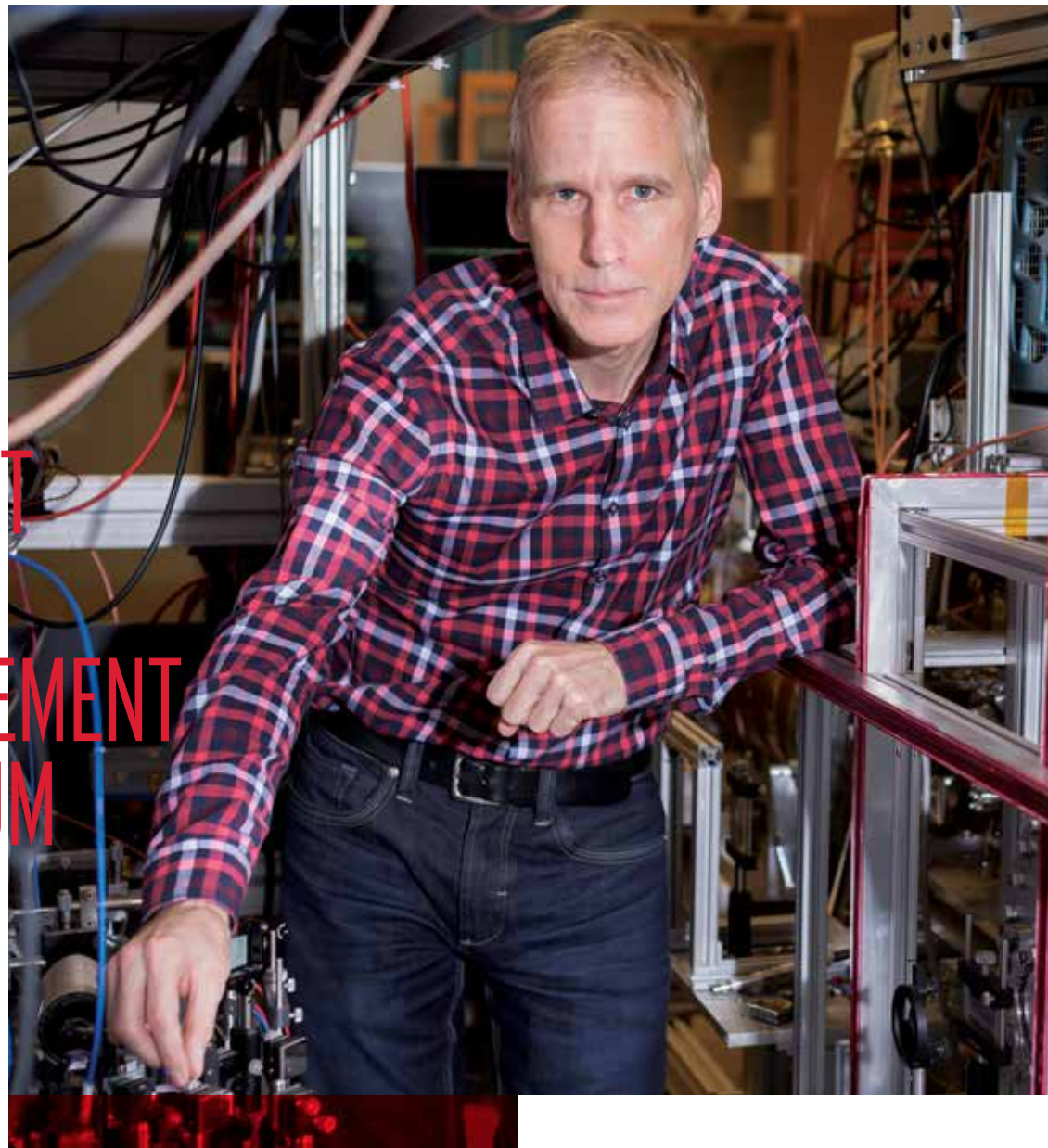
“We’re at the tipping point right now of climate change and we really need to change things,” says Baumgartner. He’d like to contribute by creating sustainable technologies. “We can help with this big demand. We need to reduce or eliminate our reliance on fossil fuels, so the next generations still have a planet to live on.”

THOMAS BAUMGARTNER



WAVE OF THE FUTURE IS IN ORGANIC TECHNOLOGIES

THE MOST PRECISE MEASUREMENT OF HELIUM



ERIC HESSELS

Researchers at York University have come up with the most precise measurement of the fine structure of helium ever measured. "It's important because there could be clues to some of the mysteries of physics lurking inside of these measurements, things like dark matter," says Distinguished Research Professor Eric Hessels (Physics and Astronomy).

Hessels and his graduate students Koskuke Kato and Taylor Skinner worked for eight years on the measurement. They were measuring the energy difference between two different, but closely related orbits of the helium atom, known as the helium fine structure intervals. "If you can measure these intervals in helium, you can determine the strength of the electric force between any two charged particles," says Hessels. "It measures a very fundamental constant of physics, the fine structure constant, which is important for understanding all electric and magnetic forces."

Hessels, Kato and Skinner measured the fine structure to nine digits of accuracy. Hessels credits their success in part to the use of a new technique he and a former post-doc, Amar Vutha, developed in his lab a few years earlier – the Frequency Offset Separated Oscillatory Fields (FOSOF) technique. This technique is a modification of the Separated Oscillatory Fields technique that has been around for almost 70 years and won Norman

F. Ramsey a Nobel Prize. Hessels believes their modified technique will become an important tool in the field of physics going forward.

"Quite a few people around the world have been trying to measure the fine structure of helium, but no one else was using this technique," says Hessels, York Research Chair in Atomic Physics. "The FOSOF technique led to a better way to determine the energy difference, and ultimately, a major improvement in precision for helium fine-structure measurements."

He also recently completed a measurement of the size of a proton and is now turning his attention to measuring the electron electric dipole moment.



MATHEMATICAL MODELLING: REAL WORLD, REAL MATH

HONGMEI ZHU

Out of all the hospitals within commuting distance, how do you know which provides the best non-emergency care? This may not sound like a math problem, but it is. It is a real-world computational modelling problem. It is exactly the kind of problem Hongmei Zhu (Mathematics and Stats) and her team want students in high school to learn how to solve.

Zhu knows many students are bored by what they see as repetitive calculations or consider themselves bad at math. They don't understand the real-world context or how math is relevant to them. The lament, "What do we need to learn this for," being all too familiar. However, Zhu and her team of volunteers – professors, graduate

students, teachers and even parents – are on a mission to change that.

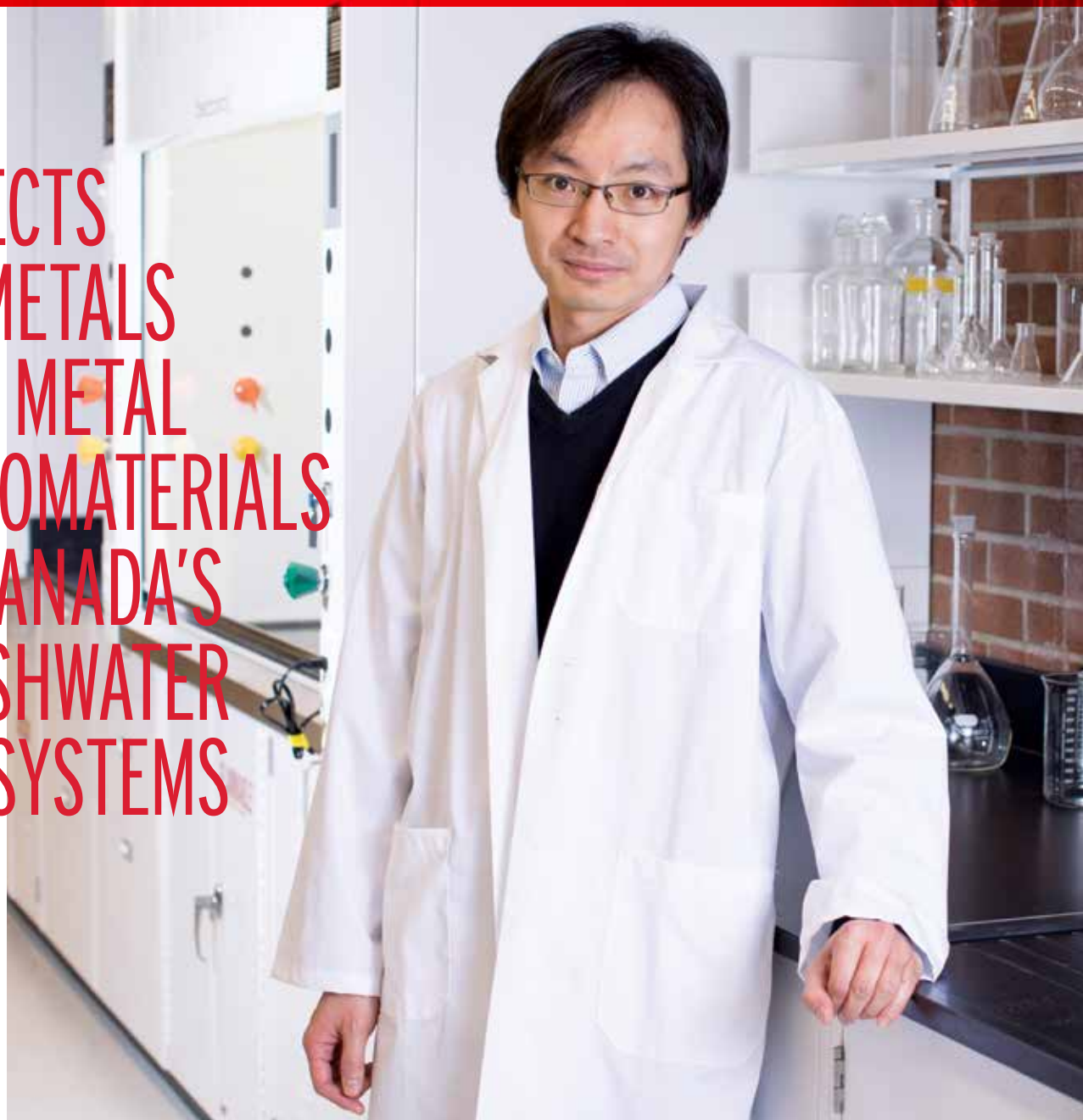
"We want to help increase math literacy for students from Kindergarten to Grade 12 so they can think critically and solve new real-world challenges innovatively in the future," says Zhu. "Math is a language and it provides a set of tools. It is not abstract. It's very relevant and constantly evolving because we need to create more math tools to solve new real-world problems."

To that end, in 2016 they held the first level of the International Mathematical Modeling Challenge (IM²C) at national and international levels for Ontario high school students with four participating teams. By 2018, with the help of a \$25,000 NSERC grant, 22 teams participated of which 13 successfully finished, including one from British Columbia. Still it is an uphill battle. Teachers are not familiar with computational modelling and its importance in teaching critical thinking, problem solving, communication skills and teamwork. The IM²C provides students with a deeper experience of how

mathematics can explain our world and what working with mathematics looks like. Math modelling engages students in mathematical reasoning, creative problem solving and team building.

The York team has also branched out beyond the competition to try to bridge the gap by offering teacher workshops, March Break and summer camps, and a Science Odyssey event focussed on fractals. For some students, it has been life changing. After the camps, they have gone on to pursue math biology or applied math at university, surprised by how interesting math can be.

EFFECTS OF METALS AND METAL NANOMATERIALS IN CANADA'S FRESHWATER ECOSYSTEMS



RAYMOND KWONG

Metals and metal-containing nanomaterials are indispensable components in our modern daily life and used in electronics, automobiles, cosmetics, chemical processing and even in the health care industry. Traces of those metals end up in aquatic environments, but just how they affect animals is something Raymond Kwong (Biology) is hoping to find out.

In particular, Kwong and his team want to understand how metals and metal nanomaterials are affecting the physiological function and behaviour of early life stage zebrafish. Knowing this would give him a snapshot of how they are affecting aquatic life in general.

"Canada is one of the world's leading mining countries, and metal contamination is a pressing issue in many Canadian freshwater ecosystems. While some trace metals are necessary for life, such as zinc, iron, and selenium, animals need only specific amounts," says Kwong, Canada Research Chair in Environmental Toxicology. "The window of essentiality for most metals is very narrow. Too much or too little and they can cause problems."

Kwong and his team are interested in understanding how aquatic animals regulate the homeostasis of metals. How do they maintain the amount of metals in their system within this very narrow window?

"Nanotechnology is arguably one of the fastest growing sectors in Canada, and there is an urgent need to understand their environmental and biological impacts in aquatic ecosystems," he says. He hopes to understand whether and how exposure to metal

nanomaterials affect neuro-physiological function.

"The ultimate goal is to develop next-generation biomarkers for assessing the effects of environmental contaminants, and to develop more relevant criteria for the protection of aquatic life and biodiversity," says Kwong.



INSPIRING STUDENTS THROUGH TECHNOLOGY

Until recently, the state of the Chemistry 1000 course labs were like walking into a time capsule, badly in need of a modern touch. Students worked in archaic, old school spaces. "It was like walking into a lab that was set up 50 years ago," says Derek Jackson (Chemistry). "Not only was it staid, it wasn't fun." He wondered how he could better prepare students for their future and do it in an interesting way.

Jackson is passionate about not only teaching, but also providing students with the tools and experiences they need to get the most out of their courses. He lobbied hard and got a redo of the labs. Gone are the irrelevant experiments and endless graph plotting and drawing, and the calculations.

With much help from Hovig Kouyoumdjian (Chemistry), Jackson ushered in new equipment, about 50 LabQuest instruments, one for every two

DEREK JACKSON

to three students, instead of the thermometers they were using until then. The LabQuests do the graphing and calculating. "It may sound counter-intuitive," says Jackson, "but I want students to spend their time predicting outcomes and analyzing data. That's where the real benefit comes in."

Through the technology, they can import their data and the lab tutor can pull that same data up on a TV screen, which allows them to see if an experiment is going wrong before the

students hand in their work. The advantage is that the students can understand where they have gone wrong and learn how to do it properly before leaving the lab. In addition, the lab tutor can show every student's ongoing lab results on the screen simultaneously, which gives them another teaching tool to help explain what is happening or not with the experiments.

Jackson also changed up what experiments students perform. Now

they dissolve in acid aluminum foil and magnesium to see which is more reactive, for instance.

As one lab director put it – "It's revolutionary what he did for the labs and students."

And Jackson has big ideas about organic chemistry labs as well.

THE SECRETS OF LAKE ICE AND THE EFFECTS OF THE BIG THAW

SAPNA SHARMA

Lake ice can tell a scientist a great deal about what's happening beneath the surface, but until recently, few researchers have been studying the impacts of ice loss, including Sapna Sharma, (Biology). Although most people are aware of melting glaciers, the loss of freshwater lake ice across the planet is a huge indicator of climate change. There are thousands of lakes tucked away in northern climes that are signals of big trouble ahead.

Sharma works on collecting data wherever she can on the climate history of lakes using information on ice seasonality. And whether it's monks in Japan recording dates of ice freeze for 575 years or a men's club in northern Ontario, she is all about the big picture. Charging ahead in broad strokes and bringing awareness to the warning signs of what ice, and its loss, is telling us.

It's working. Other researchers are realizing it's still a largely untapped area. "Winter limnology

has become a hot topic in the last year," says Sharma, York Research Chair in Global Change Biology. "There's now a lot of interest in ice and under-ice ecology because winter is warming rapidly in recent decades."

Her research has shown that as climate warms, the ice on lakes forms later in the season and breaks up sooner. This may be contributing to water temperatures, invasive fishes chasing out indigenous species, and lost revenues from cancelled ice fishing derbies.

One of Sharma's recent studies with her graduate students looks at the trends, drivers and projections of ice phenology in small lakes in northern Wisconsin, and around Dorset and Kenora in Ontario. Based on the data, they predict that by 2050 there will be 16 to 24 fewer days of ice cover and by 2070, 20 to 30 days less. "We know from earlier research that will mean warmer lakes," says Sharma. "Will that translate to poorer water quality? We think it will. Our future work will look at what that will mean ecologically. We only have about 12 years, maybe 15, to stabilize our greenhouse gas emissions and curb the impacts of climate change."

SEVEN EMERGING RESEARCHERS JOIN YORK SCIENCE FELLOWS PROGRAM

The Faculty of Science recruited seven emerging researchers from around the world in 2018 to its York Science Fellows program. Established thanks to a generous grant from Jim and Marilyn Simons, the program offers premier post-doctoral fellowships to talented, early-career scientists to pursue their research in collaboration with outstanding scientists in the Faculty of Science.



[1]



[2]



[3]



[4]



[5]



[6]



[7]

THE NEW RECIPIENTS

Colin Bridges [1] is focusing on redox flow batteries (RFBs), a promising energy storage technology for integrating intermittent renewable energy sources into grid-scale applications. Most current RFBs use solutions of heavy metals. Working under the supervision of Thomas Baumgartner (Chemistry), Bridges is exploring how carbon-based electro-active materials could improve the operating voltage and energy density of RFBs.

William Chen's [2] research is in mathematical logic and set theory with a particular interest in combinatorial questions about singular cardinals. Chen is working with Paul Szeptycki (Mathematics & Statistics) on questions involving density, mutual stationarity, and applications of the singular cardinal theory outside of logic, such as general topology, especially in constructing spaces that satisfy certain covering properties.

Dagoberto Contreras [3] is building on data analysis techniques developed during his doctoral research to probe data primarily from the cosmic microwave background (CMB) – light from the early universe – to explore the nature of inflation, dark matter, and dark energy and working with Matthew Johnson (Physics & Astronomy).

John Machacek's [4] research involves combinatorial mathematics and its applications in algebra, geometry, physics, and computer science. He focuses on some specific areas of mathematics, such as cluster algebras and Hopf algebras, which he has already been collaborating on with Nantel Bergeron (Mathematics & Statistics). He also has an interest in mathematical problems from physics and computer science. He will continue to work under the supervision of Bergeron.

Ramon Miranda-Quintana [5] is working under the supervision of René Fournier (Chemistry) and is focusing on devising methods to understand the behaviour of electrons in molecules and materials that have a complicated electronic structure (i.e. those known as "strongly correlated systems"). Some of these compounds play a vital role in modern chemical research.

Christopher Schafhauser [6] is focusing on the structure and classification of operator algebras; he recently introduced a novel approach to the use of ultrapowers in a classification program for C*-algebras. He was already collaborating with Ilijas Farah (Mathematics & Statistics) and continues to expand on his research working under the supervision of Farah and Paul Skoufranis (Mathematics & Statistics).

Jacob Lucero [7] is working with Christopher Lortie (Biology) to investigate the processes and mechanisms that drive patterns of biodiversity in ecosystems. Specifically, he will examine interactions between native plants, invasive plants, and herbivores to understand how biological invasions shape biodiversity at local and regional spatial scales.

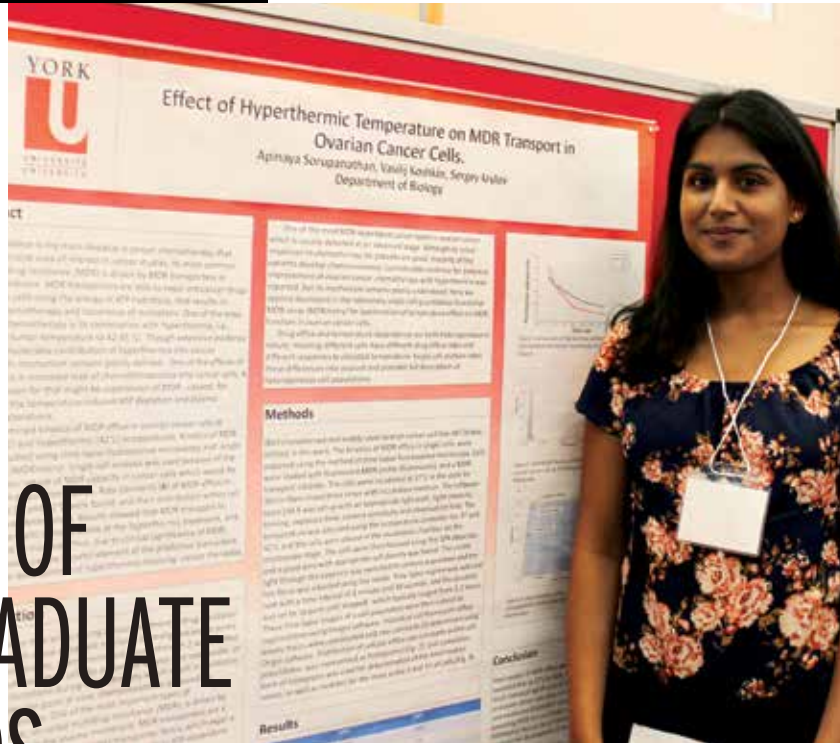
LARGEST COHORT OF DEAN'S UNDERGRADUATE RESEARCH AWARDS

In summer 2018, the Faculty of Science hosted its largest cohort of undergraduate research students, 25 of which were recipients of the Dean's Undergraduate Research Awards (DURAs), while 20 received NSERC Undergraduate Student Research Awards (NSERC USRAs).

The DURA program launched in 2016 to provide additional research opportunities for high-performing science students. The program quickly grew from six awards in the first summer to 25 last year. It gives students exposure to research and an opportunity to learn new skills.

"It's very exciting to see our program growing," says Sylvie Morin, associate dean of research and graduate education. "These awards are a great opportunity for students in science to gain meaningful research experience and contribute to cutting-edge research in our Faculty."

DURAs are 16-week research positions (paid, full-time) that allow undergraduate students to work in a York University research group over the summer. Topics of past projects have varied from studying the genetics of cancer



to investigating probability models to calculate insurance risk.

"For a number of students this may mark their first opportunity to experience research first-hand, which enables them to make informed decisions about whether they choose to pursue research-based graduate degrees or careers," said Andrew Donini (Biology). "It may also provide students with experience in working in a collaborative team environment and effectively communicating their research and its benefits. The paid DURA awards allow students to gain these experiences without financial burden or worry."

The research students were invited to the Faculty of Science's 2018 Undergraduate Research Conference in August to share their work through oral and poster presentations.

"The event is an excellent opportunity for students to present their summer research projects, practice science communication, and meet and learn from other students," said Jennifer Steeves, associate dean of Research and Graduate Education in the Faculty of Science.

DURAs are supported by funds from the Faculty of Science and donors. Last year, Berna Magnuson and Earle Nestmann committed \$100,000 over four years, through a tax-smart gift of stocks, to fund a total of 22 DURAs.

More information about eligibility and the application process for the DURAs is available by visiting science.yorku.ca/DURA



OPENING UP EXPERIENTIAL EDUCATION IN BIOLOGY



OUTSTANDING IN THE FIELD

Experiential education field courses take biology students outside of the lecture halls and indoor laboratories, sometimes as far away as China, Africa or South America, and are a vital part of today's university learning. However, financial constraints and part-time jobs mean not all students can participate. To accommodate all students, Dawn Bazely (Biology) and Scott Tarof (Biology), along with Rick Bello (Geography), the support of Biology Chair Robert Tsushima, and field course administrators, including Renata Magalhaes, developed an off-campus field course exclusively for York University students. This ran from 7am to 6pm daily in the summer to allow students to commute to their fieldwork.

That forward thinking saw a group of students literally in a field at the Kortright Conservation Authority in Woodbridge last summer measuring

soil infiltration rates, studying goldenrods and marshes, among other things. Faculty in biology and geography teach this environmental science course, Biodiversity and Watershed Management, in alternate years.

"Over the years, we have worked hard to provide field course options that are affordable, accessible and inclusive for all students seeking to experience ecology and environmental science field research," says Bazely.

There are also opportunities for students to live away from home and to participate in experiential education. The Ontario Universities Program in Field Biology (OUPFB) is a consortium of 15 Ontario universities, including York, that have collaborated for 30 years by sharing places on the field courses offered by different universities. In this way, students at one university have access to 25 to 30 field courses each year at diverse

locations with very different travel costs and affordability, yet each offering an authentic field research experience.

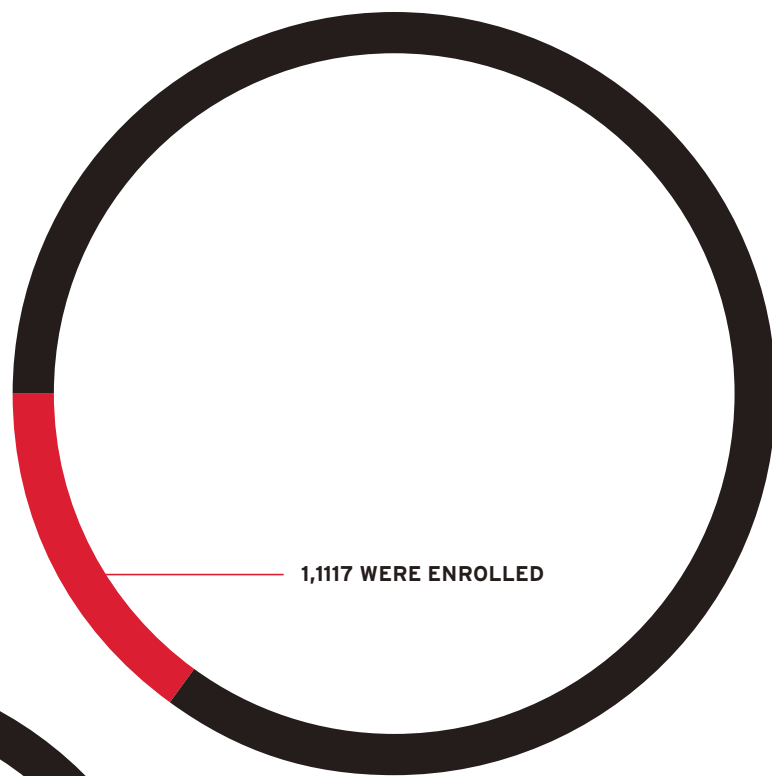
What's next? Bazely, with colleagues from across the consortium, are developing a field course that proposes to take biology students to the annual United Nations Climate Change talks to expose students to the science-policy arena.



BY THE NUMBERS

APPLICATIONS & ENROLMENTS¹

OF 7,506 UNDERGRADUATE APPLICANTS...



2018 TOTAL DEGREES GRANTED

516 UNDERGRADUATE (BA, BSc, BScT)

73 MASTER'S

- 27.4% Mathematics & Statistics
- 32.9% Biology
- 12.3% Chemistry
- 19.2% Physics & Astronomy
- 8.2% Science & Technology Studies

37 PHD

- 21.6% Mathematics & Statistics
- 32.4% Biology
- 16.2% Chemistry
- 16.2% Physics & Astronomy
- 13.5% Science & Technology Studies

ENROLMENTS BY MAJOR/PROGRAM²

UNDERGRADUATES

- 57.7% Biology
- 16.9% Mathematics & Statistics
- 12.9% Chemistry
- 4.2% Physics & Astronomy
- 1.5% Environmental Science & Geography
- 4.9% Undeclared
- 1.8% Science & Technology Studies

MASTER'S

- 35.1% Biology
- 35.1% Mathematics & Statistics
- 15.6% Chemistry
- 9.1% Physics & Astronomy
- 5.2% Science & Technology Studies

PHD

- 36.2% Mathematics & Statistics
- 27.1% Biology
- 15.5% Science & Technology Studies
- 11.6% Physics & Astronomy
- 9.7% Chemistry



ELEVEN NEW CARSWELL SCHOLARS CELEBRATE AND GIVE THANKS

THE FOLLOWING ARE THE 2018 FACULTY OF SCIENCE CARSWELL SCHOLARS:

Richard Bloch, Department of Physics and Astronomy; Yousif Hassan, Department of Science and Technology Studies; An Le, Department of Chemistry; Tansushree Tiwari, Department of Biology; Guanlin Zhang, Department of Mathematics and Statistics.

A new group of graduate students from the Faculty of Science and the Lassonde School of Engineering were inspired to push the limits of their research thanks to The Carswell Family Foundation.

The 11 new Carswell Scholars gave a snapshot of their research at a fall awards celebration at the Bergeron Centre for Engineering Excellence, honouring Professor Emeritus Allan Carswell (Physics and Astronomy) and the Carswell Family Foundation for funding the program. The Carswells were presented with a box of thank you letters, outlining how the opportunity to be a Carswell Scholar made a difference.

The foundation's \$1-million gift in May 2016 created a permanent endowment and expendable fund to establish the Carswell Scholarships for graduate students.

"It is thanks to this thoughtful and generous gift from the Carswell Family Foundation that we are here today to celebrate and demonstrate the impact this gift has had on nurturing the scientific potential of graduate students. Several of our graduate students have

been able to explore some deeply pressing scientific questions," said Interim Dean EJ Janse van Rensburg.

"This is only possible because of the vision and generosity of Allan and his family."



¹ Data reflects statistics for the 2018 calendar year

² Data reflects statistics as of Nov. 1, 2018



CELEBRATION OF HIGH SCHOOL STUDENT WINNERS OF BIOPHYSICS CONTEST

The Department of Physics & Astronomy hosted an awards celebration in June for its second edition of the biennial York University Biophysics Contest for high school students. The contest required individual students or groups of up to four people to create a poster that tied a physics concept to an issue in biology or medicine.

Out of 73 entries, there were two first-place awards:

- Grades 9 to 10 – Abiali Badani of Danforth Collegiate and Technical Institute in Toronto won for the poster, titled “The Physics and Biology of Flight in Animals.”
- Grades 11 to 12 – Kira Teramoto [1] of St. Mary Catholic Secondary School in Hamilton won for the poster “Waves > DNA?!”

Both students received \$1,000, as well as \$250 for their school's science department.

[1]



[2]

BIRDS AND THE BEES, AND CORMORANTS

What do birds, bees, polar bears, primates and even cormorants have in common? The importance of biodiversity [2]. In fact, the resilience of our planet and the future of humanity rely on it. It is the reason we have air, food, water and medicines, but it is also vulnerable, and in many cases in crisis around the world. The Faculty held its sixth public lecture series on the topic – Biodiversity Conservation in the Twenty-first Century – in partnership with the Toronto Public Library and Ontario Nature.

From the Department of Biology, Laurence Packer spoke about the beauty and importance

SCIENCE ENGAGEMENT PROGRAM RECEIVES FUNDS TO EXPAND KIDS' CODING CAMPS!

In February, the Faculty's Science Engagement Program received \$60,000 to expand hands-on coding and digital programming for kids. As a member of Actua, York Science was a recipient of Canada's federal CanCode funding distributed by the 35-member Canadian STEM outreach organization.

Our Science Engagement Program is designed to inspire children and youth to discover and maintain their passion for STEM. It offers innovative and engaging programs for Grades 3 to 12, including “Code with Kids!” camps for kids aged 8 to 13. The new funding is reaching even more students in the Greater Toronto Area. For more than four years, the Faculty has worked with Actua and its network to develop and exchange content that will inspire Canada's next generation of innovators.



[3]



MARS EXTRAVAGANZA

In July, the Allan I. Carswell Observatory team at York University hosted free public viewings of Mars [4] at opposition from the top floor of the Arboretum in William Small Centre, where rows of telescopes were set up. Mars is in “opposition” when it is on the opposite side of the Earth relative to the sun. This made Mars appear closer and brighter than it has in 15 years, and it will not be this close or bright again until 2035.

The team fielded questions and some visitors tried their luck at imaging Mars with their cell phones through the 40-cm telescope. The Red Planet is especially photogenic during opposition because it is fully illuminated by the sun.

A RENDEZVOUS WITH SCIENCE

York University and Markham Village Business Improvement Area (BIA) once again hosted Science Rendezvous [5],

of bees, while Bridget Stutchbury talked about migratory songbirds. Valerie Schoof of Glendon College looked at primates, conflict and conservation. Gregory Thiemann and Gail Fraser, both from the Faculty of Environmental Studies, spoke about polar bears and the bad reputation of cormorants, respectively.

EVOLUTION OF THE UNIVERSE

At the York Science Forum in March, keynote speaker, particle physicist and Nobel Laureate Arthur McDonald [3], took participants on a journey through the underground Sudbury Neutrino Observatory (SNOLAB) to measure the smallest and most elusive particles in the universe. McDonald also participated in a panel discussion with Faculty of Science Professors and physicists Sampa Bhadra and Scott Menary, moderated by Matt McGrath, BBC journalist and former York science communicator in residence.

A Canadian physicist, McDonald is professor emeritus at Queen's University and the director of the Sudbury Neutrino Observatory (SNOLAB) Collaboration. In 2001, McDonald and his colleagues at SNOLAB discovered that neutrinos change identities, or oscillate from one flavour (electron, muon, or tau) to another – proving that neutrinos have mass. The discovery changed our understanding of the innermost workings of matter and led to McDonald receiving the 2015 Nobel Prize in Physics, which he shared with Japanese physicist Kajita Takaaki.

[4]



[5]

Canada's largest celebration of science in May. The free family-friendly, all-day festival took science out of the lab and onto the streets. Thirty cities across Canada, including various locations in the GTA, hosted events on the same day. Visitors of all ages had a chance to meet with York University scientists and participate in hands-on activities.

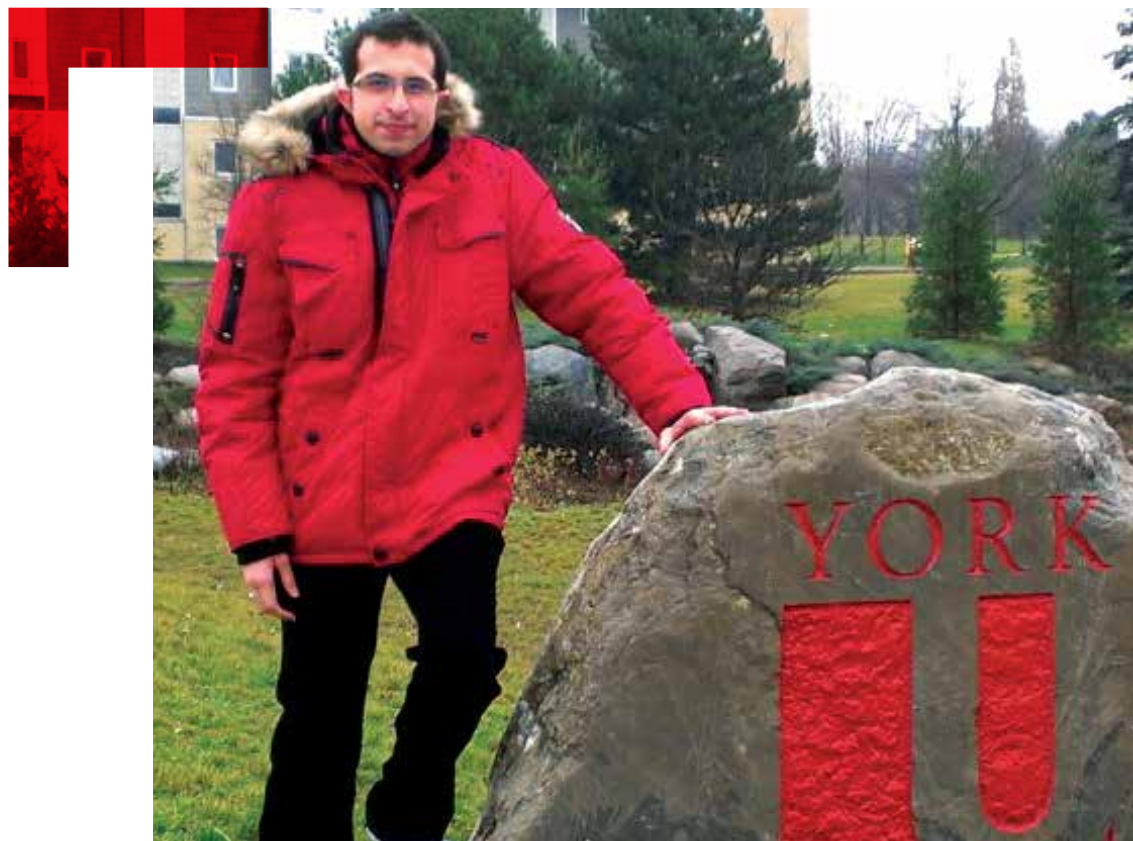
Highlights included stage demonstrations, constellation tattoos, making DNA necklaces, racing cars, playing a water piano, and planting a seed for Mother's Day.

BETHUNE COLLEGE AND THE FACULTY OF SCIENCE HOST SECOND ANNUAL TRI-SCI TOURNAY

The high school outreach event, Tri-Sci Tourney, once again hosted teams of Grade 11 students from Ontario, mostly in Toronto, but from as far away as Barrie, in February, following the great success of the inaugural event in 2017. Students enjoyed a competition where their science preparation skills were pitted against one another in a friendly format, including a hands-on component designed and delivered by the Let's Talk Science group we support at York. Short tours and a couple of brief Faculty talks added some spice to the event.

LEARNING FROM THE BEST

MOHAMMAD NAZARI



As a PhD student in the Department of Chemistry, Faculty of Science, Mohammad Nazari, working under the supervision of Sylvie Morin (Chemistry), had long been interested in working in the chemical industry in Germany to learn how they remain on top in their field.

When he found out about the German Academic Service Exchange (DAAD) and the competitive RISE Professional program, Nazari knew he wanted to do an internship in Germany. He attended a DAAD event in Toronto to check out the possibilities. "Through the list of the companies offering internships in Germany by this program, the name of BASF caught my eye as the world's largest chemical company on this planet," said Nazari, who applied for a position in the Global Marketing and Product Development Automotive Fluids department in BASF as he already had some personal experience in the field of engine coolants.

Shortly after, he was thrilled to be accepted by BASF as an intern in his department of choice. DAAD, through its competitive RISE Professional program, offers opportunities for science and engineering students from the United States, Canada, Great

Britain and Ireland to gain practical, career-building experience in Germany.

Nazari soon had several telephone meetings with his manager at BASF, Daneil Wilm, and his BASF mentor Masayuki Hirose, which helped orient him to what he would be working on when he arrived in Germany.

During his internship, Nazari helped research and develop new engine coolant fluids using some of the most automated and updated apparatus. He also got the opportunity to visit four different places inside BASF to learn more about the steam cracker factory, the agricultural research centre, the carbon dioxide factory and the wastewater treatment plant. That experience allowed him

to "obtain a broader and more diverse overview regarding how different segments of such a complex company operate," he said.

This was his second trip to Germany. In 2014, he visited the company WITec to characterize his PhD research materials using a new imaging spectroscopy technique.

His doctoral research focuses on the design and characterization of materials that can photodegrade pollutants in water using the sun's energy to drive the process, specifically the properties of modified titanium dioxide materials. Titanium dioxide is already found in some household products, such as sunscreen, because of its UV absorption qualities.

"I would recommend all graduate students who are eligible to apply for the DAAD, through the RISE Professional program, not to miss this life-changing opportunity," he said.

FINDING MATHEMATICS, A VISIT TO A PRESTIGIOUS SUMMER SCHOOL FOR WOMEN



GINA FARAJ

Undergraduate student Gina Faraj realized back in elementary school in Honduras that she had an affinity for numbers. Her teacher put her into the advanced math class and her classmates often came to her for help.

"I really liked to be able to solve things, especially difficult math problems," said Faraj.

She credits good teachers with inspiring her to continue her math studies at university and is now in her third

year in the Mathematics and Statistics program at York. With the help, guidance and encouragement of Amenda Chow (Mathematics and Statistics), Faraj applied for the prestigious Pacific Institute for the Mathematical Sciences' Diversity in Mathematics: Undergraduate Summer School. It is a two-week stint in British Columbia.

When the time came to find out if she had made the cut, she waited all day, eventually losing hope, but later that evening word came that she was going. "I was so excited," she said.

In August 2018, Faraj joined women from across Canada and the northwest part of the United States, most of them in the second or third year of math or a related subject, for a program that introduces women to the possibilities of math as a career. "It was great to be with so many young women interested in math and as excited about it as I am," said Faraj.

Each of the two weeks featured a mini-course by a different female instructor, group project and field trips to businesses who employ math graduates. "It gave me a look at the

kind of math that's taught in older years, which I'm just starting to learn now."

What Faraj realized is that there is a lot more she can do with her math degree than she previously thought, such as combining math with cancer modelling or math with finance, but her desire to get a master's degree, or higher, and teach math at a post-secondary institution is still what she wants to do. The summer school, where she also engaged with and mentored high school students, including doing a scavenger hunt with math riddles, helped her decide on that path.

"It confirmed what I was already thinking about doing," she says. "Teachers really make or break it for you. I would like to be just like one of my good teachers. I want to give back and make a difference to someone else."

AN UNCONVENTIONAL PATH, MOLECULAR BIOLOGY TO LAW



SELENA KIM

When Selena Kim (MSc '98) was studying molecular biology at York University, she was immersed in cell signalling research. A couple of decades later, she is now a partner in Gowling WLG's Toronto office, practising in the areas of patents and intellectual property litigation.

As a graduate student in the lab of André Bédard (Biology), Kim conducted laboratory research using chicken embryo fibroblasts as a model and studying transcriptional regulation and cell signalling. This work and study provided her with a sound technical background in molecular biology. She still relies on this technical background today in her work as an intellectual property lawyer.

"The subject matter that I studied at York, and that I still use today, is not something that you can realistically learn on your own as a practicing lawyer," says Kim.

Kim and her fellow York colleagues were close, spending a lot of time together in the lab in the Farquharson building – and at the local Tim Horton's in York

Lanes – discussing their research. She still keeps in touch with many of them, and they chose different paths to employ their science backgrounds. Kim's path was law.

She is certified by the Law Society of Upper Canada as a specialist in intellectual property (patent, trademark, and copyright), and is the first woman to have achieved this designation for patents in the Law Society's history. Her litigation experience includes work before all levels of court in Canada, involving patents for complex mechanical and chemical inventions. Most recently, she achieved a significant win and a permanent injunction for a patentee at trial involving a patented

manufacturing procedure for polymer pipes.

Kim is appreciative of the mentorship she received along the way. She is grateful to Bédard, currently of McMaster University, and other professors at York who made her time here fulfilling and special, including Ronald Pearlman (Biology) and Andrew White (Biology).

In addition to her work as an intellectual property lawyer, she is passionate about promoting women in leadership in the workplace.

Asked what advice she would give students today, Kim encourages them to ask many questions and to be flexible.



SAMER BISHAY

DREAMING BIG

With a penchant for disrupting and challenging the status quo, Samer Bishay, president and CEO of Iristel & Ice Wireless, Canada's leading provider of wireless and wireline IP services, is pushing boundaries.

He went up against the big players in telecommunications when he first started out and created space in the

market for his competitive local exchange carrier, Iristel, which he founded in 1999, a year after he received his Honours Bachelor of Science degree from York University's Space and Communications program.

At the time, he was lead systems engineer in the Canadian Space Agency's radarsat program, where he increased the performance of its satellite mapping. But, he had bigger, higher dreams.

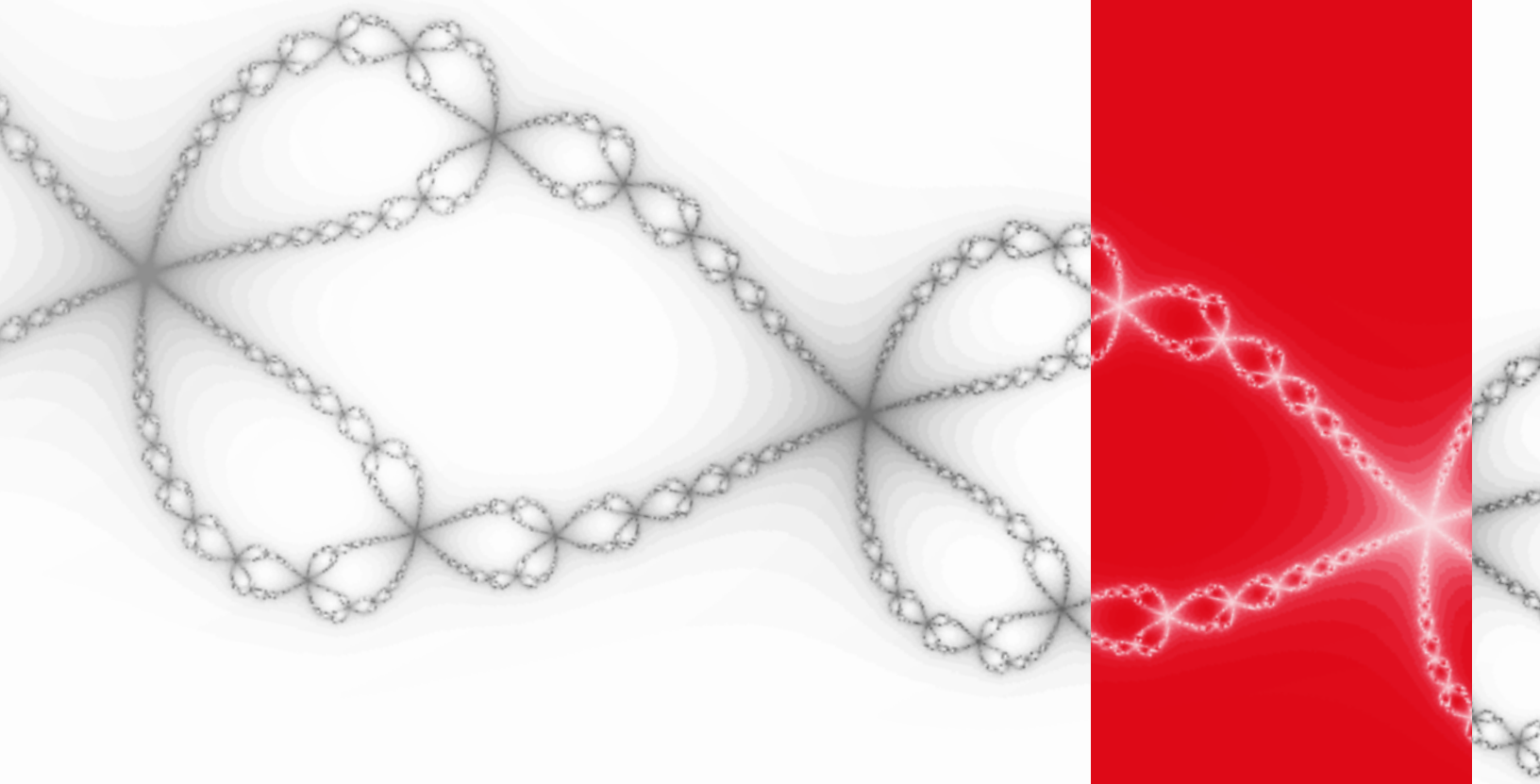
While poring most of his time into building Iristel, he was also pursuing his flying license. As Iristel expanded and grew, Bishay took to the skies. He still uses his small jet plane to ferry himself to business meetings around North America.

He got his first break in Africa in the Ivory Coast and he has not looked back, although his company is now run from Toronto. He led Iristel from a small startup to an international telecommunications service provider with domestic infrastructure licenses on three continents – North America, Europe and Africa.

He oversees global and domestic strategies for both Iristel and Ice Wireless to ensure business objectives are in line with telecommunications trending needs guaranteeing continued success in highly competitive markets.

He continues to help shape Canadian telecommunications broadband policy, participating in many public forums, that will significantly impact Canada's future in rural broadband development and advancement.

His hard work, innovative approaches and tenacity won him several awards and accolades, including being a recipient of Profit Magazine's Young Entrepreneur Award as the youngest CEO among the Top Profit 100 companies in Canada.






Images on the front and back covers are computer generated fractals.

Photos (pages 18-27) by Paola Scattolon

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