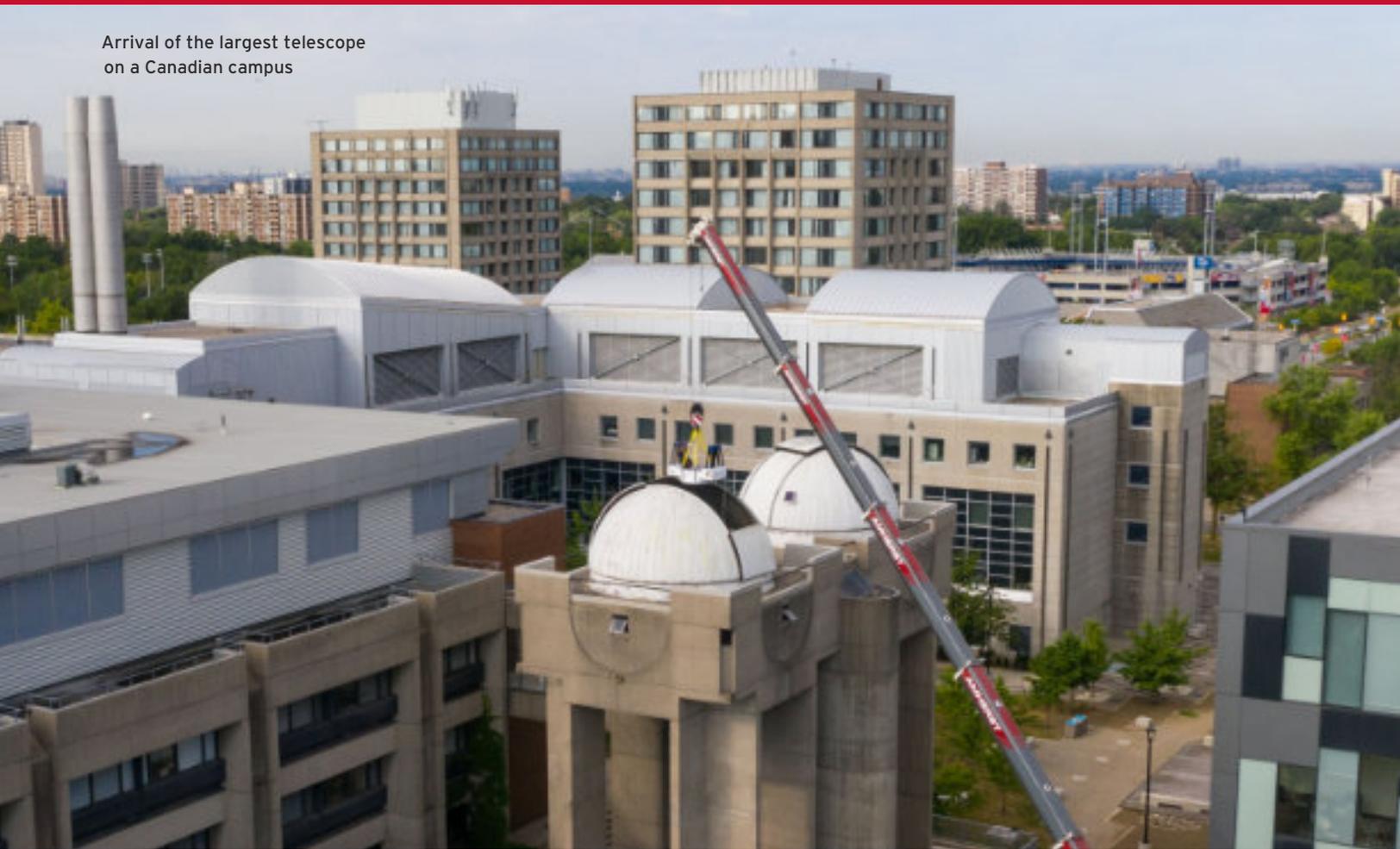


# FACULTY OF SCIENCE ANNUAL REVIEW

Arrival of the largest telescope  
on a Canadian campus



# 2019

**8 YORK SCIENCE HIGHLIGHTS**

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Image of the Crab Nebula (M1), taken by student Sunna Withers using the new one-metre telescope at the Allan I. Carswell Observatory at York University



## **Thank you**

**Professor EJ Janse van Rensburg in the Department of Mathematics and Statistics served as Interim Dean for the Faculty of Science throughout 2019. Under his leadership, the Faculty of Science recruited 15 new faculty members, attracted \$24 million in research revenue, strengthened and forged new connections with donors and alumni, hosted exciting science outreach events in the community, and much more. The Faculty of Science is grateful to Professor Janse van Rensburg for his service.**

## By the numbers<sup>1</sup>

**151**

Faculty members

**93**

Staff

**20**

Undergraduate programs

**11**

Graduate programs

**\$64.4 million**<sup>2</sup>

Total annual budget

**\$24.0 million**

Total research funding revenue

**\$738 thousand**<sup>3</sup>

Total fundraising amount

**3,825**

Undergraduate students

**732**

International students

**427**

Graduate students

**4**

Fellows of Royal Society of Canada, current

**9**

Fellows of Royal Society of Canada, emeriti

**10**

Canada Research Chairs

**10**

York Research Chairs

**5**

Departments: Biology, Chemistry, Mathematics & Statistics, Physics & Astronomy, Science & Technology Studies

**1**

Division: Natural Science

**10**

Student clubs and societies

**3**

Endowed Chairs

**6**

Organized research units: 2 based in Faculty of Science, and a member of 4 others

**5**

Faculty-based research facilities and equipment centres: 1 Core Analytical Facility (NMR Spectroscopy, Microscopy, and Mass Spectroscopy), 3 Technical Shops, 1 Science Store

<sup>1</sup>Data reflects metrics for the 2019 calendar year

<sup>2</sup>Amount is for 2019-2020 fiscal year

<sup>3</sup>Amount is for 2019-2020 fiscal year, as of April 13, 2020

## Dean's round-up of 2019

### JAN

Students and faculty members were recognized for their outstanding achievements at the Faculty's annual Honours and Awards Ceremony. York alumnus Samer Bishay, president and CEO of Iristel and Ice Wireless, delivered the keynote speech.

### FEB

The Faculty announced four new recipients of the York Science Fellowships. These premier postdoctoral fellowships are awarded to talented early-career scientists to pursue research in collaboration with outstanding scientists in the Faculty.

[MORE ON PAGE 41](#)

### MAR

The Faculty hosted a workshop titled Communicating Science in the Age of Fake News, which featured York Science Communicators in Residence Dan Falk and B.D. Colen, Biology Professor Dawn Bazely, and *The Globe and Mail* Science Reporter Ivan Semeniuk.



### APR

Cybersecurity in the Age of Espionage, the Faculty's fifth annual York Science Forum, featured former FBI undercover operative and cyber security expert Eric O'Neill and attracted hundreds of attendees from the community.

[MORE ON PAGES 44-45](#)

### MAY

The Faculty hosted a successful Science Rendezvous at the Markham Farmers' Market, featuring fun science experiments, hands-on activities and demonstrations performed by York Science researchers, students and staff.

[MORE ON PAGES 44-45](#)

### JUN

Jennifer Doudna, co-discoverer of the CRISPR-Cas9 genetic engineering technology, was the recipient of an honorary degree at the Faculty of Science's spring convocation ceremony.

[MORE ON PAGE 13](#)

The federal government announced two new Canada Research Chairs in the Faculty of Science: Professors Nikolaus Troje in the Department of Biology and Joel Zylberberg in the Department of Physics and Astronomy.

[MORE ON PAGES 24-25](#)

York Science Forum: Cybersecurity in the Age of Espionage

### JUL

Biology Professor Amro Zayed and his team received a \$10-million research grant from Genome Canada and Ontario Genomics for the project "BeeCSI: 'omic tools for assessing bee health."

[MORE ON PAGES 14-15](#)

The Allan I. Carswell Observatory held a three-day public celebration of the 50<sup>th</sup> anniversary of the Apollo 11 mission. The event was previewed on CBC Radio's *Here and Now* program.

[MORE ON PAGES 44-45](#)

Undergraduate Research Conference

### AUG

A new one-metre telescope was installed at the Allan I. Carswell Observatory. The telescope is the largest on a university campus in Canada.

[MORE ON PAGE 10](#)

The Faculty hosted its Summer Undergraduate Research Conference, where students in the Faculties of Science, Health, Environmental Studies and the Schulich School of Business presented their summer research projects.



### SEPT

Two York Science researchers published studies in the prestigious journal *Science*: Professor Eric Hessels in the Department of Physics and Astronomy reported a precise measurement of the size of the proton, and Professor Bridget Stutchbury in the Department of Biology found that white-crowned sparrows that consumed small doses of the insecticide imidacloprid suffered weight loss and delays to their migration.

[MORE ON PAGES 14-15](#)

### OCT

*Maclean's* magazine ranked York University's mathematics program among Ontario's top five and Canada's top 10.

[MORE ON PAGE 36](#)

### NOV

The Faculty wrapped up its public lecture series titled Feasting at the Table of Elements at the Toronto Public Library. The series celebrated the 150<sup>th</sup> anniversary of the table of elements and featured talks on the importance of chemical elements and how they affect all aspects of our lives.

[MORE ON PAGES 44-45](#)

### DEC

The Faculty hosted its annual holiday reception for faculty members and staff to celebrate the year's achievements and to recognize long-standing service.



Alumnus Samer Bishay



## Arrival of largest telescope on Canadian campus

York University is now home to a new one-metre custom telescope that will enhance hands-on learning experiences and undergraduate research opportunities for the York community and beyond.

Installed at the Allan I. Carswell Observatory in August 2019, the telescope is now the largest situated on a university campus in Canada.

A crane worked to hoist equipment into the air and then carefully lower each piece into the dome of the observatory. The equipment that was dangling over campus weighed about 4,400 pounds – almost as much as an elephant. Inside the observatory, workers assembled the telescope piece by piece. The

telescope was ready to use that same day and opened for public viewing in October.

The telescope is giving students, astronomers and members of the public a closer look at the wonders of the night sky. Its larger aperture provides a deeper view into space, distant galaxies and cosmic objects, and makes it easier to see Saturn's rings, the Great Red Spot on Jupiter and the polar caps on Mars.

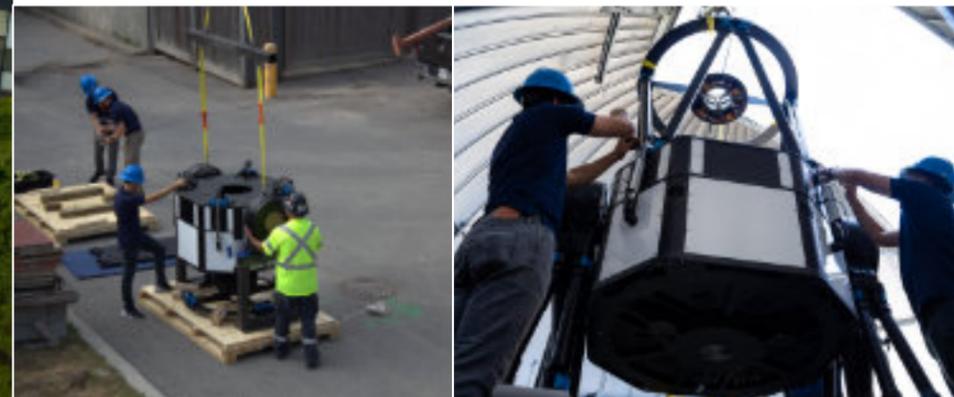
The project was funded through a \$500,000 donation from the Carswell Family Foundation, matched by York University and the Faculty of Science for a total investment of \$1 million. This gift is a part of Impact: The Campaign for York University, and supports

the campaign's pillars of building stronger communities and mobilizing new ways of thinking.

The Allan I. Carswell Observatory at York has been a prominent hub for science outreach to the broader community since 1969. About 5,000 visitors a year come for public viewing on Wednesday nights and there are online viewing opportunities for scores more on Monday nights, when York students and faculty host the popular *YorkUniverse* radio

show on astronomy.fm. That's when people from around the world can request the telescope be pointed to their favourite celestial target. In recent years, the observatory has also become a popular venue for marriage proposals.

The observatory is already home to a fleet of astronomical telescopes, including 60-centimetre and 40-centimetre Cassegrains, and five 20-centimetre telescopes.



Opposite and left: Telescope installation

Below centre: An image of galaxy NGC 7331, about 40 million light-years away, captured on the new telescope.

Bottom left: Professor Paul Delaney, York University President Rhonda Lenton, Professor Emeritus Allan Carswell

Below: Undergraduate student Sunna Withers



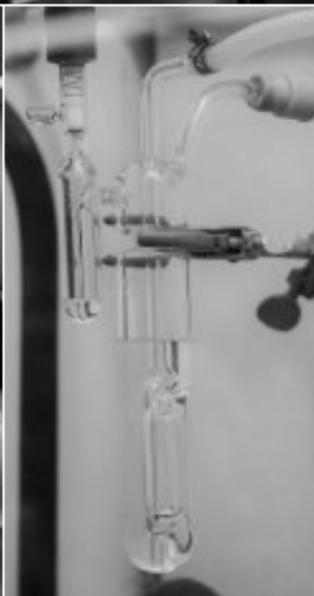
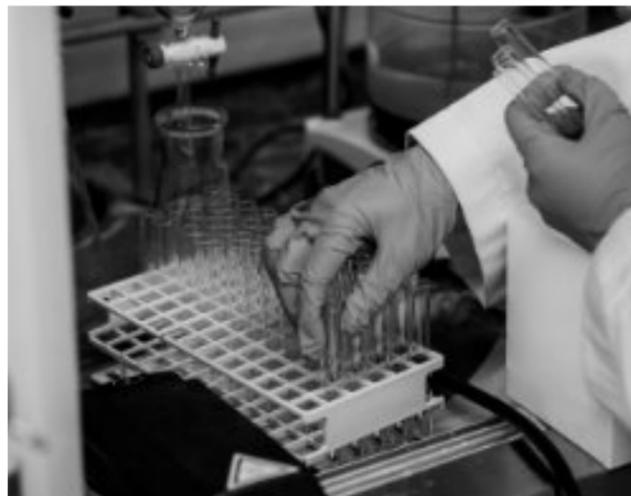
## Science Communicator in Residence Program continues to attract talent

The Faculty of Science was excited to see continued, strong global interest into the third year of its York Science Communicator in Residence Program.

The program aims to recognize outstanding science journalists and communicators and to promote excellence in science-related communications. Residents are immersed in an academic scientific setting where they get to know eminent researchers, who in turn learn from the residents about effective ways of communicating science stories.

The 2019-2020 program hosted independent science writer Patchen Barss and photographer B.D. Colen. Previous residents have included science journalists Kate Allen (*Toronto Star*) and Matt McGrath (*BBC*), and freelance journalists Molly Segal and Dan Falk.

The program welcomes applications from Canadian and international science journalists in all media (e.g., digital, print, radio, television, etc.) who are currently pursuing full-time or freelance careers, as well as scientists who are actively engaged in science communications.



**"I'm interested in messy, process-based, incremental research more than headline-grabbing breakthroughs. The York science communicator residency is a rare opportunity to watch scientists at work over time, pursuing questions they are most curious about, and whose answers tend to be complex and elusive. These are the stories I like to tell."**

– Patchen Barss

Photography by B.D. Colen in the Faculty of Science



## Co-discoverer of CRISPR technology receives honorary doctorate

At spring convocation for graduates of the Faculty of Science, Jennifer Doudna, biochemist and leading genomics researcher, received an honorary doctor of science degree from York University.

Doudna is the Li Ka Shing Chancellor's Chair and a professor in the Departments of Chemistry and Molecular & Cell Biology at the University of California, Berkeley. She is also an investigator of the Howard Hughes Medical Institute.

Her co-discovery of CRISPR-Cas9 genetic engineering technology with French scientist Emmanuelle Charpentier has changed human and agricultural genomics research forever. This genome-editing technology enables scientists to change or remove genes quickly, with a precision only dreamed of just a few years ago.

In an engaging convocation address, Doudna spoke to graduands about how her lessons in driving a car helped pave the path for future successes in life. She shared a story about learning to drive, and how after steering her father's car into a ditch, she was encouraged to take the wheel again and drive home.

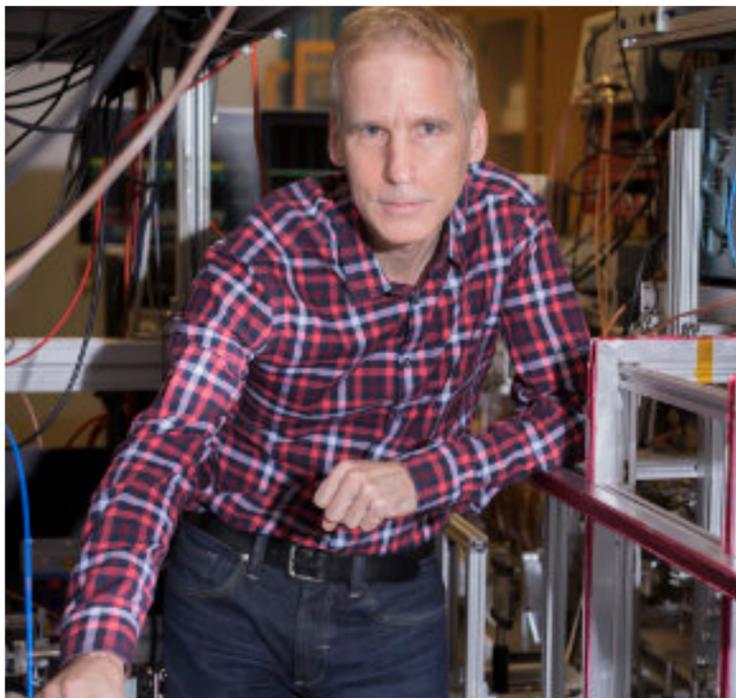
"Reluctantly I did," she said, "and we made it home safely. And in the process, I began to

see a path forward to learning the skills I would need to become a safe and competent driver, including trusting myself, acknowledging shortcomings while focusing on ways to improve and grow."

She learned the importance of picking herself up after a letdown, getting back to the task at hand and persisting even in the face of disappointment and discouragement. "[My father] showed me that success requires facing rather than running away from failure," said Doudna. "He taught me about the importance of perseverance in the face of challenges, and about the value of working through problems to achieve a goal, of not quitting in the face of adversity."

Those lessons have played out over and over again throughout the course of her career and her path to the discovery of the CRISPR technology. Labs worldwide have changed the course of their research programs to incorporate this new tool.

Doudna has received many prizes for her discoveries, including the Japan Prize (2016) and the Kavli Prize (2018), and in 2015 she was named by *Time* magazine as one of the 100 most influential people in the world.



Eric Hessels,  
Amro Zayed

## In the news

**Professor Eric Hessels** and his team in the Department of Physics and Astronomy – including graduate students Nikita Bezginov and Travis Valdez, Professor Marko Horbatsch, postdoctoral research assistant Alain Marsman, and former postdoctoral fellow Amar Vutha made a precise measurement of the size of the proton, a crucial step towards solving a mystery that has preoccupied scientists for the past decade. Their findings were published in *Science* and garnered global media attention, including by *The Economist*, *Scientific American*, *Quanta Magazine*, *New Scientist*, *Ars Technica*, and more.



An international study looking at vanishing northern lake ice led by **Biology Professor Sapna Sharma** was published in the journal *Nature Climate Change*. The research showed that within the next generation, an estimated 35,300 lakes are likely to lose annual winter ice cover if the climate warms by a projected two degrees Celsius. That figure jumps to 230,400 lakes without annual ice cover under an extreme warming climate scenario of eight degrees Celsius. This research was covered by *National Geographic*, the *BBC* in print, radio and TV, *The Globe and Mail*, and others.



The health of honeybees is declining, with more than a quarter of colonies dying each winter. These deaths have left beekeepers and government regulators struggling to find ways to quickly diagnose, manage and improve bee health. The solution could be a new bee health diagnosis tool being created as part of a research project co-led by **Biology Professor Amro Zayed**. He and his team have launched a \$10-million project to develop a new health assessment and diagnosis platform, supported by Ontario Genomics and Genome Canada. The project has attracted extensive media attention, including by *CBC News* and *CBC Radio*, *CTV News*, *The Weather Network*, and others.

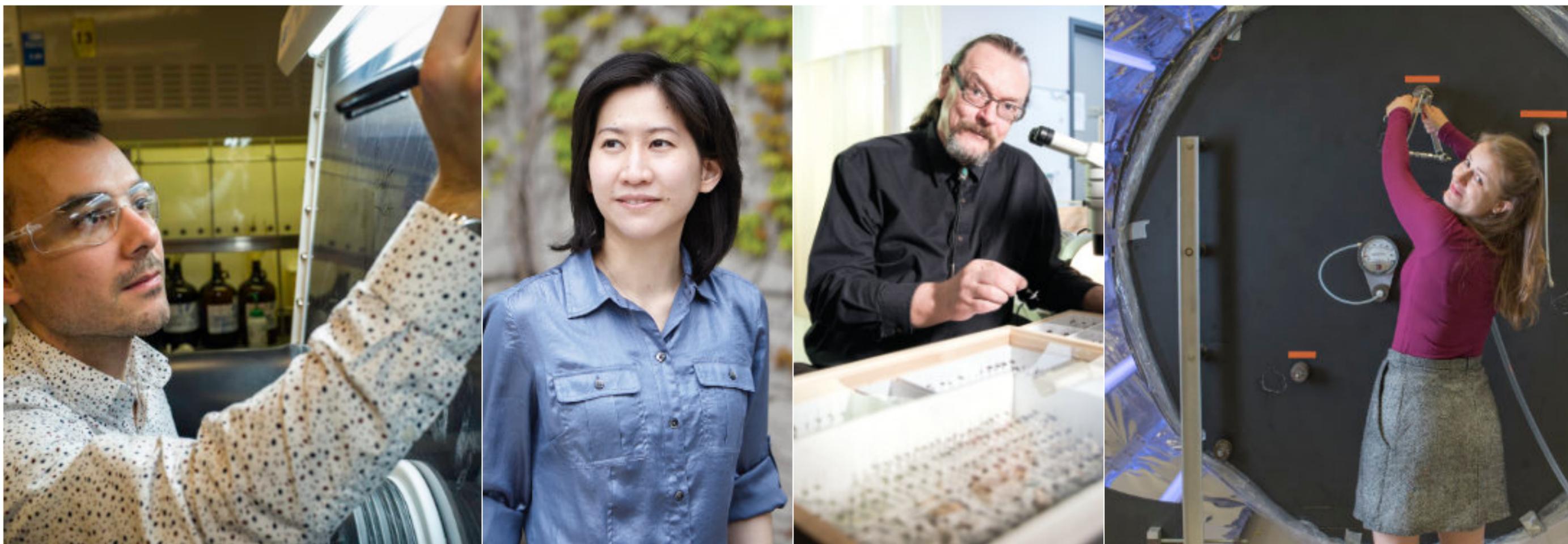


Neonicotinoids are widely used around the world as seed treatments. What happens when wild birds encounter these insecticides, which are proven neurotoxins? **Biology Professor Bridget Stutchbury** and a team at the University of Saskatchewan investigated the effects of neonicotinoids on migrating birds that forage for food in agricultural areas. Their study, published in the journal *Science*, found that white-crowned sparrows that consumed small doses of an insecticide called imidacloprid suffered weight loss and delays to their migration – effects that could severely harm the birds' chances of surviving and reproducing. Stutchbury spoke to various media outlets about these findings, including *CBC News*, *The Independent*, *The Telegraph*, *Smithsonian.com* and more.



Chronobiologists like **Biology Professor Patricia Lakin-Thomas** have been calling for an end to the antiquated practice of changing our clocks twice a year and a permanent adoption of Standard Time. They say that morning light is most important in resetting our biological clocks for the day. So when we were changing our clocks in November 2019, Lakin-Thomas was busy speaking to media across the country about how Standard Time is healthier for us than Daylight Savings Time. She co-authored an opinion piece in *The Globe and Mail* and spoke to *CBC News*, *CTV News*, *Toronto Sun*, and *CP24*, among other outlets.

White-crowned  
sparrow, photo by  
Wolfgang Wander;  
Patricia Lakin-  
Thomas, photo by  
Haydn Watters/CBC



## External honours and awards highlights

Christopher Caputo,  
Jennifer Chen

**Chemistry Professor Christopher Caputo** was one of five researchers to receive Ontario's prestigious John Charles Polanyi Prize, awarded to outstanding researchers in the early stages of their career. He received the Prize in Chemistry. Caputo's research program focuses on developing greener and more sustainable chemistry. His primary research focus is to develop new, low-cost catalytic materials derived from readily available main-group elements.

**Chemistry Professor Jennifer Chen** received the Fred Beamish Award from the Canadian Society for Chemistry. The award is presented to an individual who demonstrates innovation in research in the field of analytical chemistry, where the research is anticipated to have significant potential for practical applications. Chen's work focuses on tailoring the chemical and

physical properties of materials for applications in sensing, imaging, energy conversion and optoelectronics.

**Professor Neal Madras** in the Department of Mathematics and Statistics was one of 11 members chosen to be a part of the second inaugural class of Canadian Mathematical Society (CMS) Fellows. Fellowship recognizes CMS members who have made excellent contributions to mathematical research, teaching, or exposition and distinguished themselves in service to Canada's mathematical community.

**Biology Professor Laurence Packer**, a world-renowned scientist on wild bees, received the Nature Inspiration Award (Adult category) from the Canadian Museum of Nature. The Nature Inspiration Awards recognize individuals and organizations whose specific projects encourage

Canadians to take an interest in natural history, to create links with nature and to contribute to its preservation.

**Biology Professor Sapna Sharma** received the Science Promotion Award from the Canadian Council of University Biology Chairs. The award honours individuals who make an outstanding contribution to the promotion of biology in Canada, through activities encouraging popular interest in science or developing science abilities.

**Professor Jianhong Wu** in the Department of Mathematics and Statistics won the CAIMS-Fields Industrial Mathematics Prize in recognition of his many contributions to dynamical systems in mathematical epidemiology. In particular, he was honoured for his collaborative research with public health professionals in government and industry and the application of his research

to infectious disease mitigation strategies and preparedness.

**Chemistry Professor Cora Young** is a rising star in the world of chemical sciences. *Chemical & Engineering News*, the weekly news magazine of the American Chemical Society, named her to its Talented 12 list. The annual list, now in its fifth year, recognizes up-and-coming chemistry researchers and innovators who are tackling some of the world's most pressing issues.

**Professor Joel Zylberberg** in the Department of Physics and Astronomy was appointed as an Associate Fellow at the Canadian Institute for Advanced Research, a Canadian-based global charitable organization that brings the world's brightest minds together. Zylberberg joined the Information & Matter research theme in its Learning in Machines & Brains program.

Laurence Packer,  
Cora Young

# Internal awards and scholarships highlights

## SELECT FACULTY AWARDS

Petro-Canada Young Innovator Award	<b>Christopher Caputo</b>
Faculty of Science Excellence in Teaching Award	<b>Nicole Nivillac Chris Lortie</b>
Faculty of Science Excellence in Research Award	<b>Carol Bucking Thomas Baumgartner</b>
Faculty of Science Excellence in Graduate Mentorship Award	<b>Kathi Hudak</b>

## SELECT GRADUATE STUDENT AWARDS

Richard Jarrell Award of Excellence for Teaching Assistants	<b>Nicholas Bragagnolo Eleni Fegaras</b>
C.D Fowle Graduate Scholarship in Ecology	<b>Alexandra Israel Jenna LeBlanc</b>
CIHR Doctoral Frederick Banting & Charles Best Canada Graduate Scholarships	<b>Wonsuk Jahng</b>
Dalton Pharma Services/Dr. Douglas Butler Award	<b>Jordan Bentley Brandon Khan</b>
Elia Scholars Program	<b>Anita Buragohain</b>
NSERC Alexander Graham Bell Canada Graduate Scholarship–Doctoral	<b>Tamari Chkuaseli Nathan Gold Alexander Klenov Jacob O'Brien Alyssa Murdoch</b>
NSERC Alexander Graham Bell Canada Graduate Scholarship–Masters	<b>Steven Campbell Gehrig Carlse Elia Grieco Guardian Si Jia Hu Brandon Khan Aryan Lajevardi Sarah MacKell Neil McCall Fargol Nowghani Jennifer Porat Farwa Sajadi Emma Smith Matthew Wiebe</b>
Peter Moens/AGSBS Graduate Award	<b>Simon L'Allier</b>
Susan Mann Dissertation Scholarship	<b>Anita Buragohain Paige Whyte-Fagundes Thomas Onuferko</b>

## SELECT UNDERGRADUATE AWARDS

York University President's Scholarships	<b>Katerina Disimino Sophie Eisen Minoosh Fathi Jacob Fine Anita Misrop Sarah Pullano Greta Raffoul</b>
Alumni Award of Distinction	<b>Muzi Li Julieta Rybnik</b>
Chancellor Cory Entrance Scholarship	<b>Amanda Guerrieri</b>
Gillian E. Wu Award in Biochemistry	<b>Eden Teclmichael Esther Wolf</b>
International Excellence Scholarship	<b>Hyunjin Kim Lisha Li Ardalan Hosseini-Mansob Tofunmi Olowogorioye Parth Patel</b>
Schulich Leader Scholarship	<b>Rathesh Balendran Katrina Carver Nadav Gasner Kezia Johnson</b>
York International Internship Award	<b>Jasmin Joy</b>
York Renewable Entrance Athletic Scholarship	<b>Daniel Everton</b>
York Science Scholars Award	<b>Adeola Adeoba Alex Akhundov Ron Alesker Alyssa Duhon Jacqueline Duhon Celina Duong Alice Fours Sakina Hasnain Michael Krol Jarred Laganas Rachel Lysenko Dylan Martinez Anita Misrop Daniel Patolsky Aleeza Qayyum</b>

## Research funding numbers

# \$24.0 million

Total new research funding for the Faculty of Science:

**\$10.0 million**

Genome Canada and Ontario Genomics

**\$5.0 million**

Natural Sciences and Engineering research Council of Canada (NSERC)

**\$1.3 million**

Industry

**\$1.3 million**

Foundations

**\$2.5 million**

Canadian Institutes of Health Research (CIHR)

**\$1.9 million**

Canada Research Chairs

**\$1.1 million**

Canadian Foundation for Innovation and the Ontario Research Fund

**\$328 thousand**

Mitacs



## Research funding highlights

Derek Wilson

**Biology Professor Amro Zayed** received \$10 million from Ontario Genomics and Genome Canada to use genomic tools to develop BeeCSI, a new health assessment and diagnosis platform for bees powered by stressor-specific markers.

**Chemistry Professor Derek Wilson** was awarded a Collaborative Research and Development grant from NSERC worth just over \$1 million for the project "The Technology-Enhanced Biopharmaceuticals Development and Manufacturing (TEnBioDev) initiative." With additional funds from industry partners SCIEX, Sanofi Pasteur, Treventis and Immunobio, and in-kind contributions, the total funding for the project came to \$2.2 million over four years.

**Twenty-two researchers** in the Departments of Biology, Chemistry, Mathematics and

Statistics, and Physics and Astronomy received a total of \$3.7 million in Discovery Grants from NSERC. The Discovery Grants Program supports ongoing programs of research with long-term goals rather than a single short-term project or collection of projects.

**Biology Professor Chun Peng** received a Project Grant from CIHR totalling nearly \$900,000 for the project "Development of Novel  $\beta$ -Catenin Inhibitors as Potential Therapeutics for Ovarian Cancer."

**Professor Eric Hessels** in the Department of Physics and Astronomy received \$900,000 from the Alfred P. Sloan Foundation to work with the EDM<sup>3</sup> collaboration at York University on the project "EDM<sup>3</sup>: An Electron Electric Dipole Measurement Using Molecules in a Matrix."

**Chemistry Professor Christopher Caputo** received a Collaborative Research and Development grant of \$450,000 from NSERC and Toronto startup Inkbox to study molecules to improve semi-permanent tattoo technology.

**Biology Professor Steven Connor** received just over \$300,000 from the Canada Foundation for Innovation John R. Evans Leader Fund and the Ontario Research Fund for the project "Characterization and Targeted Reversal of Synaptic Mechanisms Contributing to Autism Spectrum Disorder."

**Chemistry Professor Sergey Krylov** received a Research Tools and Instruments grant from NSERC for nearly \$150,000 for the project "Capillary Electrophoresis Instrument for Development of Disruptive Bioanalytical Technologies."

**Professor Michael Chen** in the Department of Mathematics and Statistics received three Accelerate funds from Mitacs totalling more than \$100,000 for the projects "Optimization of Savings and Retirement for Canadians," "An Artificial Intelligence Algorithm for Creating Personalized Learning Journeys" and "Learning Jungle AI Recommender System for Enhanced Education." Mitacs Accelerate is a research internship program that connects companies with universities through graduate students and postdocs.

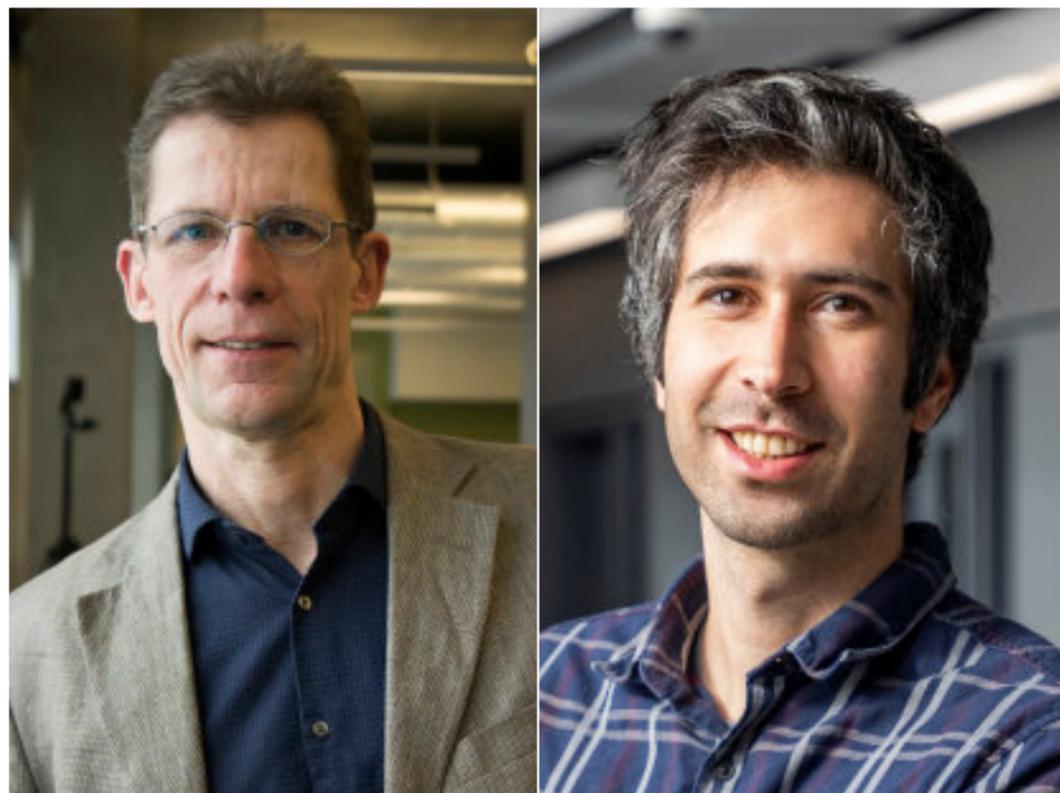
Steven Connor,  
Jane Heffernan

**Professor Jane Heffernan** in the Department of Mathematics and Statistics received an Accelerate fund from Mitacs totalling \$75,000 for the project "Prediction Models for Pain Volatility and Engagement Patterns of Mobile Pain App Users."

## Faculty of Science welcomes new research chairs

### CANADA RESEARCH CHAIRS

The Canada Research Chairs (CRCs) program was created by the Government of Canada to attract and retain some of the world's most accomplished and promising minds. In 2019, the Faculty of Science welcomed the appointment of two new CRCs, bringing the total number in the Faculty to ten.



**Biology Professor Nikolaus Troje** – Canada Research Chair in Reality Research (Tier 1)

Troje is a core member of the Vision: Science to Applications (VISTA) team within York's Centre for Vision Research. In his BioMotionLab, he uses motion capture and 3D scanning technology to generate individualized avatars to be used in mixed realities. Using virtual reality, he studies how we perceive objects and communicate with other people, experience and take ownership of our own body, and situate ourselves in the space that we seem to occupy.

**Physics and Astronomy Professor Joel Zylberberg** – Canada Research Chair in Computational Neuroscience (Tier 2)

Zylberberg is also a core member of VISTA. He studies the way the brain represents information about the outside world, and the way in which those representations are learned. His immediate goal is to build on his expertise in machine learning and sensory neuroscience to create a camera-to-brain translator that could restore sight to the blind and could be used in computer vision systems.

### YORK RESEARCH CHAIRS

The York Research Chairs (YRCs) program mirrors the national CRC program, with the goal to broaden and deepen the impact of research chairs at York. In 2019, two faculty members in Science were appointed as YRCs, bringing the total number in the Faculty to ten.



**Chemistry Professor Ryan Hili** – York Research Chair in Molecular Evolution (Tier 2)

Hili's research interests focus on using DNA to program and encode the synthesis of molecular libraries ranging from small molecules to synthetic biopolymers. By using the principles of Darwinian evolution, his lab can evolve these molecular libraries for desired function, yielding small molecule drugs to treat human disease or antibody mimetics for use in medical diagnostics.

**Biology Professor Gary Sweeney** – York Research Chair in Mechanisms of Cardiometabolic Diseases (Tier 1)

Sweeney is an expert on diabetes and cardiovascular disease. His work focuses on understanding the mechanisms of cardiometabolic diseases, such as heart failure, and is designed to advance knowledge that will facilitate our fundamental understanding of causes of these diseases. Thus, his research will result in informed decision-making and improved health care.



## The mathematical engine behind our financial markets

Hyejin Ku

In our modern world, it's hard to go through a week without hearing about the ups and downs of the stock market and our dollar, credit ratings and defaults, debt ratios and investment portfolios, and so on. The state of our financial markets permeates our lives, whether we like it or not.

What you don't hear much about though is the mathematics behind all of this – a field with its own name, mathematical finance – and the people dedicated to studying it. Some of these mathematicians are employed in the glass towers of the financial industry, while others are academics crunching numbers in the buildings of universities and publishing research papers that inform industry.

Professor Hyejin Ku in the Department of Mathematics and Statistics is among the latter group, with a particular interest in risk management in financial markets. Financial risks include credit risk (e.g., a bank

defaulting), market risk (e.g., losses on stocks and bonds due to a sudden drop in prices), liquidity risk (e.g., a company not being able to pay its debts) and more, all of which can cause systemic risk.

"Risk management is about quantifying and predicting the bad things that could happen," explained Ku. "So as mathematicians working in this field, we think of the worst case scenario, then we simulate and analyze."

Most recently, Ku has been using artificial intelligence methods, or machine learning techniques, to help predict credit risk or decision making in general. She uses data to train a good classifier, or algorithm, that can then be used to make good decisions. There is a big demand for artificial intelligence research in mathematical finance, and she is a pioneer and well-known scholar in this interdisciplinary, and challenging, field. Her research is bound to make huge waves in the industry.

## Making new molecules for medicine

Arturo Orellana

"The mentality of our research group is to focus on hard synthetic challenges that are actually going to provide solutions to real-world problems."

These are the words of Chemistry Professor Arturo Orellana, a synthetic organic chemist who makes molecules that could be used for drug development and manufacturing and make a positive impact on science and people's lives.

For instance, his lab develops reactions that create new compounds for drug discovery, prepares molecules that can be used as tools to understand the biological mechanism of diseases like Alzheimer's, and conducts medicinal chemistry research to advance potential therapies.

One of his most important projects – 10 years in the making – is focused on preventing diabetes in people who take glucocorticoids, such as prednisone and cortisone, which are

widely prescribed to treat arthritis, bowel disease and cancer, among other conditions. When someone takes glucocorticoids, their blood sugar levels increase because these drugs promote glucose production in the liver. Unfortunately, prolonged exposure to glucocorticoids leads to severe metabolic dysfunction and insulin resistance.

Orellana collaborates with Professor Carolyn Cummins at the University of Toronto, and together they have shown that the negative side effects of glucocorticoids can be dissociated from their beneficial effects by modulating the function of a receptor called LXR $\beta$  with synthetic small molecules. With funding from the Canadian Institutes of Health Research they aim to understand how these molecules modulate the function of LXR $\beta$ , and develop a therapeutic agent to prevent diabetes in patients that require extended use of glucocorticoids.





## Protecting our bees

Sandra Rehan

Meet Biology Professor Sandra Rehan, an internationally renowned faculty member and researcher focused on bees. Rehan studies native bees and in particular, small carpenter bees, which are among the most abundant wild bee species found across the globe. In fact, she has conducted research on them throughout North America, Asia, Africa, Australia and the South Pacific.

Despite their abundance though, and the fact that wild bee populations are declining drastically, very little is known about them.

“Wild bees are important pollinators and help maintain biodiversity, agricultural and ecosystem health, so their decline – and frankly lack of knowledge about them – is a huge concern for us,” said Rehan.

Rehan’s research program aims to help fill this knowledge gap. Her research focuses on the comparative genomics and molecular ecology of wild bees.

“By understanding the population genomics, microbial ecology, and physiological stressors of bees, scientists can then better understand how to protect them,” said Rehan. “Essentially you need to track their survival and experimentally assess habitat

requirements to help sustain the bees, and that’s what we do.”

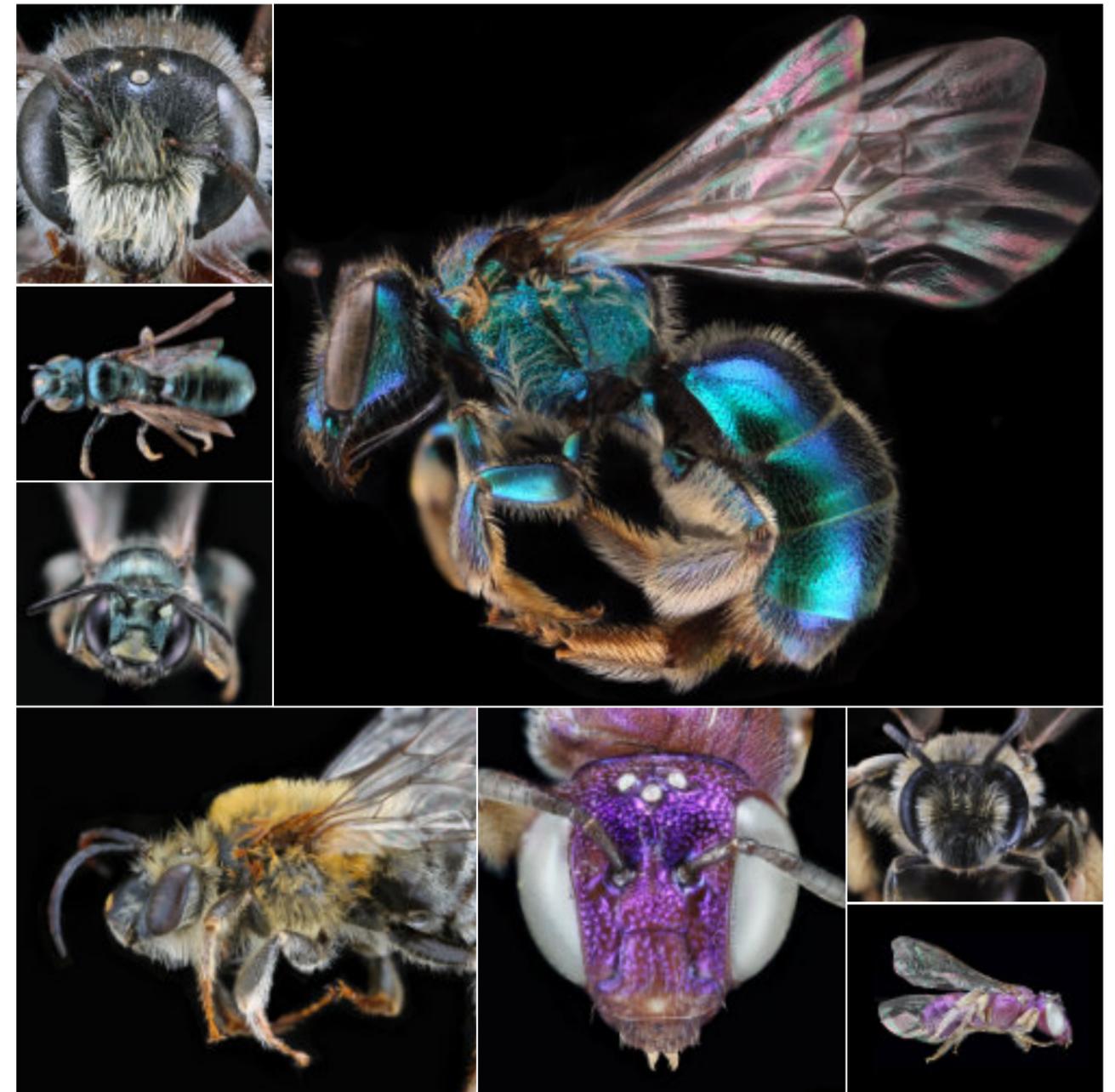
For instance, her integrative research on carpenter bees has found that the bees have different dietary breadths and microbiomes depending on where they live. Some plant species harbour probiotics essential for offspring development and survival while others carry potential pathogens that might compromise bee health. Having this kind of data can inform conservation policies and land use management specific to an area.

Rehan has published the first two carpenter bee genomes and is developing numerous additional genomic resources for wild bees. These are important for understanding the response of these essential pollinators to environmental stressors. Genomic tools also allow her team to document population demographics including responses to landscape fragmentation, climate change, and species declines.

“There is a lot of work to do in this area though,” added Rehan. “We are constantly developing new tools and integrating new techniques.”

Professor Sandra Rehan and her team study the genomics and conservation of wild bees. Wild bees are not only diverse in appearance, but also exhibit a wide range of nesting behaviour, foraging ecology, and habitat requirements. With an estimated 20,000 bee species worldwide and 800 across Canada, there is an urgent need to study and sustain these understudied, yet critically important, pollinators.

Here are few images of wild bees taken by Rehan.





## Seeing red

Adam Muzzin

No one at York University is more excited about the upcoming launch of the James Webb Space Telescope (JWST) than this man: Professor Adam Muzzin in the Department of Physics and Astronomy. Muzzin studies galaxies, and for the first time he will be able to see the very first galaxies formed in our universe when JWST launches in 2021. He is on the instrument team for the telescope, so he will have guaranteed access to observations.

JWST is an international collaboration between the National Aeronautics and Space Administration, the European Space Agency and the Canadian Space Agency. Costing about \$10 billion, it will be the most expensive and powerful telescope ever built because it will be in space and able to see infrared light (which is very difficult for earth-based telescopes to see).

“The universe is expanding, with everything moving away from us, and so the light coming from distant galaxies is stretching and shifting towards the red part of the

electromagnetic spectrum,” explained Muzzin. “If we want to see far-away galaxies from the early days of our universe, 13 billion light years away, we need to be able to see infrared.”

Because of the finite speed of light, looking at galaxies billions of light years away means looking at galaxies as they were billions of years ago. Muzzin will be using the telescope to explore when the very first galaxies formed, what those first galaxies looked like, and if they had stars like those in our Milky Way.

“It will be like getting baby pictures of galaxies, kind of like an ultrasound,” said Muzzin. “In a way the telescope will be a very powerful time travel machine for us to see the early universe.”

The larger goal of his research will be to connect the findings to our own galaxy, the Milky Way, to better understand how it formed and why it looks the way it does.



## When helping students leads to ‘risky’ industrial research partnerships

Edward Furman

Professor Edward Furman in the Department of Mathematics and Statistics is an actuarial scientist: he uses mathematics to study risk in insurance and finance. He works on problems relevant to insurance companies and banks, such as assessing the risks of adverse financial events, refining prices for insurance contracts and calculating capital reserve amounts.

“Beautiful mathematics married with social good make my heart sing,” said Furman, inspired by a famous quote by Steve Jobs.

Furman is also the founding director of the undergraduate Actuarial Science Program and the new Risk and Insurance Studies Centre at York University.

Companies like Sun Life Financial, Wawanesa Insurance and RBC Insurance, as well as non-profit organizations like the Society of Actuaries and the Casualty Actuarial Society regularly turn to Furman for his expertise. But these partnerships were not born out of thin air. After coming to York University a bit more than a decade ago and seeing students struggling to find jobs after graduation, he decided to do something about it.

“Being new to Canada and without any industrial links, I decided to advertise my research to professionals in the risk management and insurance industry,” explained Furman. “As a part of this process, I obtained a number of Mitacs Cluster grants, which helped graduate students in mathematics and statistics aspiring for a career in financial services to secure paid internships.”

These internships provided students with real-world industrial experience before graduation, increasing their chances of finding a good job afterwards. The acquaintance of the industry with York’s graduate students also raised the profile of the undergraduate actuarial science program at York, leading to more placements (and jobs) for students in this program.

Helping students succeed in their careers has had another benefit. Furman’s partnerships with industry have evolved and matured into trusting relationships – which also means he can stay on top of what industry is doing and what problems need solutions.

His recently published works have tackled questions like, “how do you measure variability with no variance?” and “how bad can the clustering of defaults really be in times of financial crises?” Another ongoing research project, which brings together expertise from actuarial science, economics and law, among other disciplines, is addressing the question of how inclusive insurance can promote the United Nations’ Sustainable Development Goals.



## Every breath you take

Trevor VandenBoer

We often worry about air pollution outdoors, caused by things like emissions from cars or dust. But what about the air we breathe indoors? We spend 90 percent of our time inside, and sometimes without great ventilation. It turns out scientists don't know much about the reactive chemistry of our indoor air.

But Chemistry Professor Trevor VandenBoer is working to change this. In particular, he is interested in studying reactive nitrogen compounds like amines, ammonia, and nitrous acid – all of which are in many household commercial products like surface cleaners or can be emitted by gas stoves and candles. These molecules are also produced by decomposing food, and pets.

Reactive nitrogen compounds are particularly important because of the reactions in which they can play a role. For instance outdoors, amines and ammonia are implicated in particle formation, and nitrous acid breaks down in the presence of light to

create hydroxyl radical, which can then rapidly react with other compounds to create new particles and chemically transform pollutants.

“We want to know if these nitrogen compounds are in our indoor air as well, how much there is, and how bad they actually are,” said VandenBoer.

While instruments have been developed to measure these compounds outdoors, nothing yet exists for indoor measurements. VandenBoer is now developing indoor tools with a grant from the Alfred P. Sloan Foundation. Unlike the outdoor instruments, the indoor ones will need to be practical for indoor spaces (i.e., safe, quiet and minimally intrusive given that they will be in people's homes) and easy to use by non-experts, among other requirements.

“The ultimate goal of this research is to improve people's lives by improving air quality,” he said.

## Getting under the hood of gene expression

Mark Bayfield

Biology Professor Mark Bayfield studies the molecular mechanisms behind gene expression – when it goes well, and when it goes awry.

“It's like getting under the hood of a car and figuring out how things work and what happens when things go wrong,” he said.

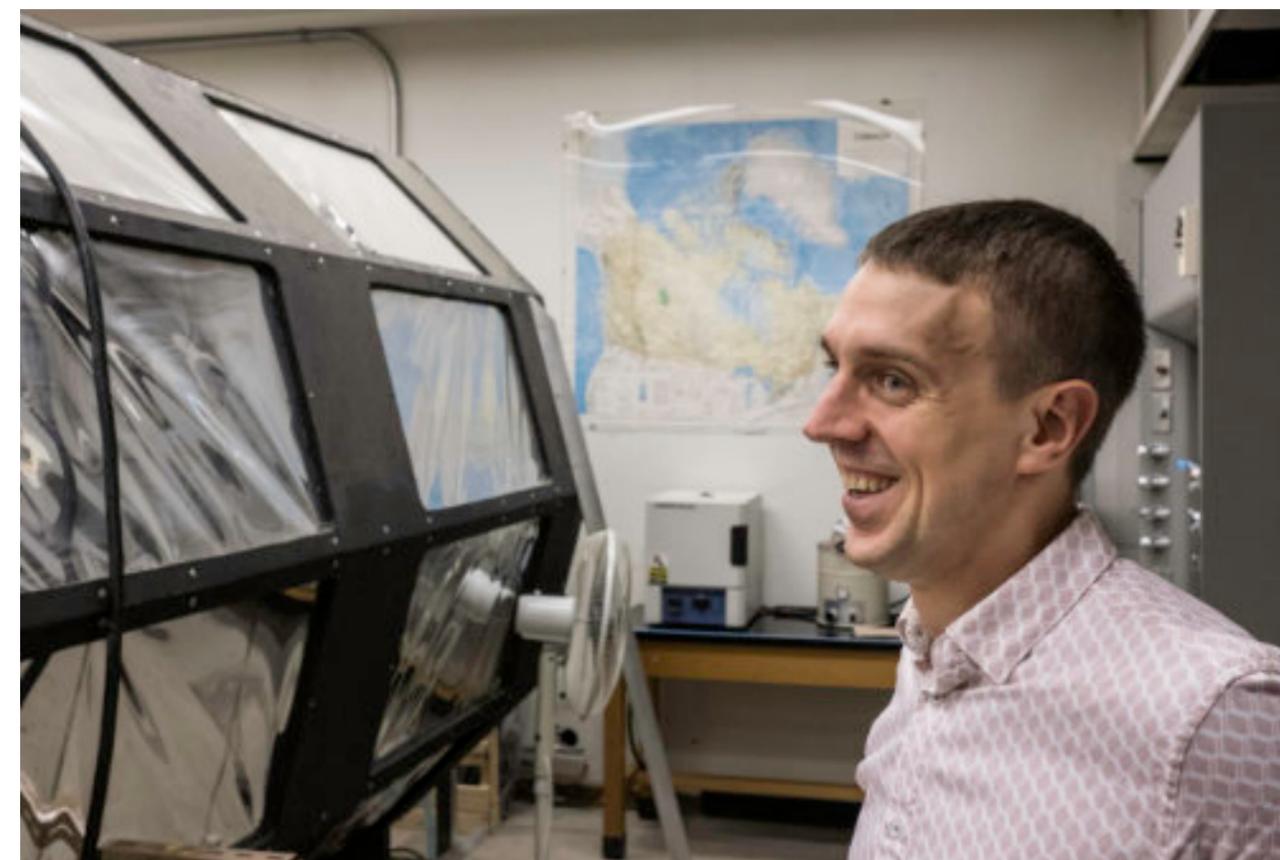
Bayfield's research focuses on an ancient family of proteins known as the La and La-related proteins (LARPs). La and LARPs play fundamental roles in cellular processes related to RNA function. When DNA is transcribed and translated into proteins, RNA is kind of like the pit stop in between. La and LARPs play a quality control function at this pit stop, making sure that RNA is synthesized correctly so that it can go on to make the right proteins. If La and LARPs are not working properly, problems can happen.

“It turns out many human viruses and cancers often rely on La too,” added Bayfield. “We know that La and LARP function in cells is

intimately linked to a number of challenges to human health. So by studying how these proteins work we are also studying how people can get sick.”

Bayfield's lab works with both yeast and human cells to understand human La, since La is so highly conserved across eukaryotes. Importantly, scientists cannot remove La from human cells without killing them, but this is possible in yeast. That makes some experiments testing for La function doable in yeast that would otherwise be impossible in human cells.

Bayfield's lab hypothesizes that La and LARPs help control how protein synthesis from RNA can be tuned in response to cellular growth and adaptation to stress, and his team is trying to figure out the mechanisms behind this by identifying the genes that rely on La and LARPs. This work could lead to a new understanding for many challenges to human health.



# Physics duo spawns Canadian collaboration on massive neutrino experiment

Deborah Harris, and Claire David (opposite)

The Deep Underground Neutrino Experiment (DUNE) at the Fermi National Accelerator Laboratory (Fermilab) is going to be the largest in the world to study neutrinos, the most elusive and mysterious subatomic particles in the universe. Set to begin operation in 2026, DUNE is expected to deepen scientific understanding of neutrinos and their role in the universe, as well as proton decay, and possibly the dynamics of the supernovae that produced the heavy elements necessary for life.

DUNE will consist of the world's most intense neutrino beam and two neutrino detectors. One detector suite, located at Fermilab, will record neutrinos shortly after they have been produced, while the second detector will record neutrinos from the same beam after they travel 1,300 kilometres.

Professors Deborah Harris and Claire David joined the Department of Physics and Astronomy in 2019 as the first two members of the newborn Canadian collaboration on DUNE. They are jointly appointed as York professors and scientists at Fermilab. While being both involved in DUNE, they will focus on different aspects of the project.

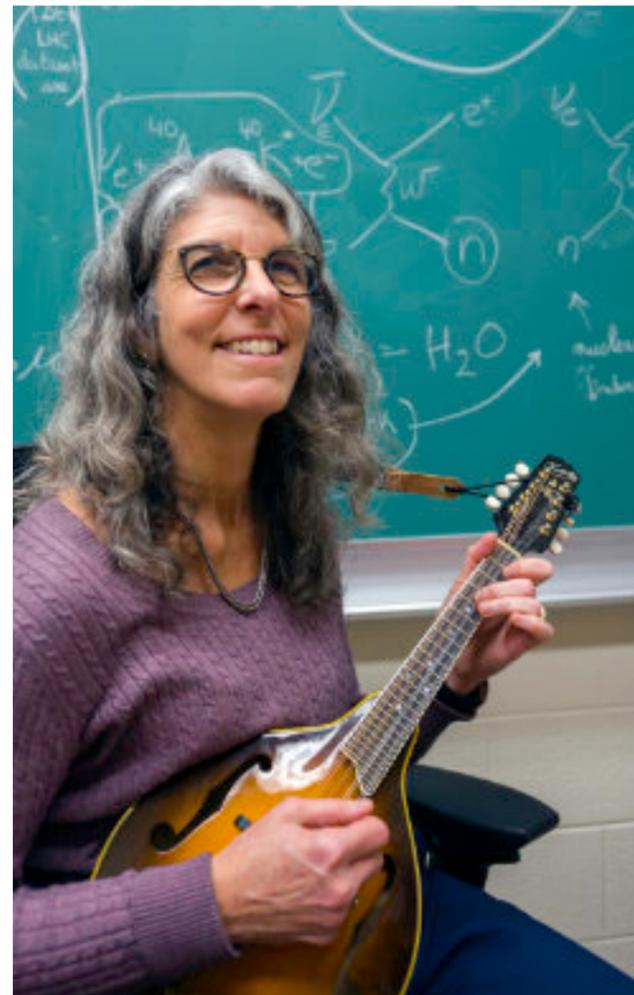
## DEBORAH HARRIS

Harris will focus on perfecting measurements of neutrino properties at DUNE's near detector (the best predictions for what the far detector will observe will come from an accurate description of how neutrinos interact in the same beam before they

travel). Her ultimate research plan is to measure neutrino oscillations.

"Neutrinos change, or oscillate, from one form to another," said Harris. "By shooting a neutrino beam from one detector to the other, we can measure how neutrinos evolve over time. We will also be able to see if neutrinos and antineutrinos behave differently."

While she prepares for DUNE, however, she is the co-spokesperson of MINERvA (also at Fermilab), the first neutrino experiment in the world to use a high-intensity beam to study neutrino reactions in fine detail at the DUNE neutrino energies. She is also collaborating on the T2K experiment, which has a long history of Canadian involvement and is currently producing world-leading neutrino oscillation results. The findings from these projects will inform DUNE's oscillation measurements.



## CLAIRE DAVID

David will contribute to the calibration program of DUNE and link it to the data acquisition system. She is also working with the computing consortium, bringing her expertise from being a member of the ATLAS collaboration, a multipurpose particle detector of the Large Hadron Collider hosted at the European Organization for Nuclear Research (CERN). The challenge is to make the DUNE detectors sensitive to both high-energy neutrinos from the beam generated at Fermilab and from cosmological events such as supernova, or exploding stars. This will enable scientists to understand more about neutrinos and

the cosmological phenomenon of core-collapsing stars.

"DUNE is in the design phase, so it's a really exciting time to join," said David. "There are a lot of testing and feasibility studies we need to do."

David is currently designing software requirements for DUNE, benefiting from her expertise in collider physics and the recent progress of ProtoDUNE, a prototype detector of DUNE located at CERN. ProtoDUNE is collecting data from particles and conducting pattern recognition using machine learning techniques. The algorithms will learn to read data and patterns in order to decipher if the detector is actually measuring signal from a neutrino versus something else.

"What we learn with ProtoDUNE will be bridged over to DUNE," said David.

David's goal is to extend the potential of the DUNE and ATLAS experiments by fostering collaboration between the neutrino and collider physics communities in their task to seek signal patterns in their respective detectors.



DUNE Experiment. Image by Sandbox Studios

## Math program among top 10 in Canada

In 2019, *Maclean's* magazine ranked York University for the first time ever among Canada's top 10 schools for mathematics programs. York's ninth place ranking was a stark improvement to just two years ago when it placed 17<sup>th</sup> nationally. For the second year in a row, York University also ranked in the top five provincially.

"Mathematics at York is gathering great momentum," said Professor Paul Szeptycki, chair of the Department of Mathematics and Statistics.

*Maclean's* bases its program rankings on program reputation, research reputation, fractional publications, fractional citations and field weighted citation impact.

The rise seen in program reputation can be linked to the increasing rank of the Actuarial Science program. The Department of Mathematics and Statistics has also augmented its programs with more internship and outreach experiences and put more time

and energy into its first- and second-year programming and streamlining degrees. With an Academic Innovation Fund grant, Professor Amenda Chow also created an Experimental Mathematics Space at York.

Szeptycki attributes York University's rise in mathematics research reputation, publications and citations to a few things. For instance, the Centre for Disease Modelling, led by Professor Huaiping Zhu, is second in Canada for publications in its field. And, York recently ranked second in North America and fifth in the world for cumulative number of papers published in leading actuarial and insurance risk journals for a non-business school.

"In pure math, we also have individuals at the top of their fields, such as Professor Ilijas Farah and Distinguished Research Professor Nantel Bergeron, who also attract top students and postdocs," said Szeptycki.

In addition, researchers in the Department have received several significant grants in the last few years, including the \$2.6-million NSERC/Sanofi Industrial Research Chair in Vaccine Mathematics, Modelling and Manufacturing, awarded to Distinguished Research Professor Jianhong Wu. The Department also has a few NSERC Discovery Accelerator Supplements (Professors Jane Heffernan and Xin Gao) and numerous MITACS and NSERC grants with industry.

"The energetic and innovative new faculty members that we are recruiting year after year will only elevate our programs," added Szeptycki.



## Faculties of Science and Health launch Neuroscience program

A brain or nervous system illness or injury will affect one in three Canadians in their lifetime. As such, understanding the brain and nervous system to address neurological and mental health disorders is one of the most pressing scientific challenges of our time.

That's why the Faculties of Health and Science have joined forces to create an interdisciplinary undergraduate Neuroscience program at York University, starting in fall 2020.

Former Associate Dean of Students Alex Mills (Faculty of Science) and Associate Dean of Learning, Teaching, and Academic programs Susan Murtha (Faculty of Health) worked collaboratively with chairs, undergraduate program directors, faculty members with expertise in neuroscience, and educational developers to build the program.

The program gives students access to renowned researchers working in many different areas of neuroscience. And the program's small size encourages collaboration amongst students, faculty members, and community partners as they investigate the development, structure, and function of the nervous system including the ways it can change.

After graduation, students will be prepared for a number of academic and career options, such as medical school, graduate school in the neuroscience field, and for a multitude of careers in clinical research, analytical laboratory work, medical devices and pharmaceuticals, science advocacy, and science communications.



"The Neuroscience program has several unique features," said Michael Scheid, current associate dean of students (Faculty of Science). "Based on their interests, students can choose one of three entry pathways by selecting Biology, Kinesiology & Health Science, or Psychology as their home program. Then, the adventure begins with a solid science curriculum in first year, including the keystone course *Frontiers of Neuroscience*."

Each year then builds on the successes of the prior year, advancing neuroscience knowledge and research skills. Following this foundation, students delve deeper into neuroscience fields by choosing courses from three streams: cellular/molecular, cognitive/behavioural, or systems neuroscience. Students then put it all together with a stimulating research-based capstone course in fourth year. Throughout the program, students will be immersed in experiential education.

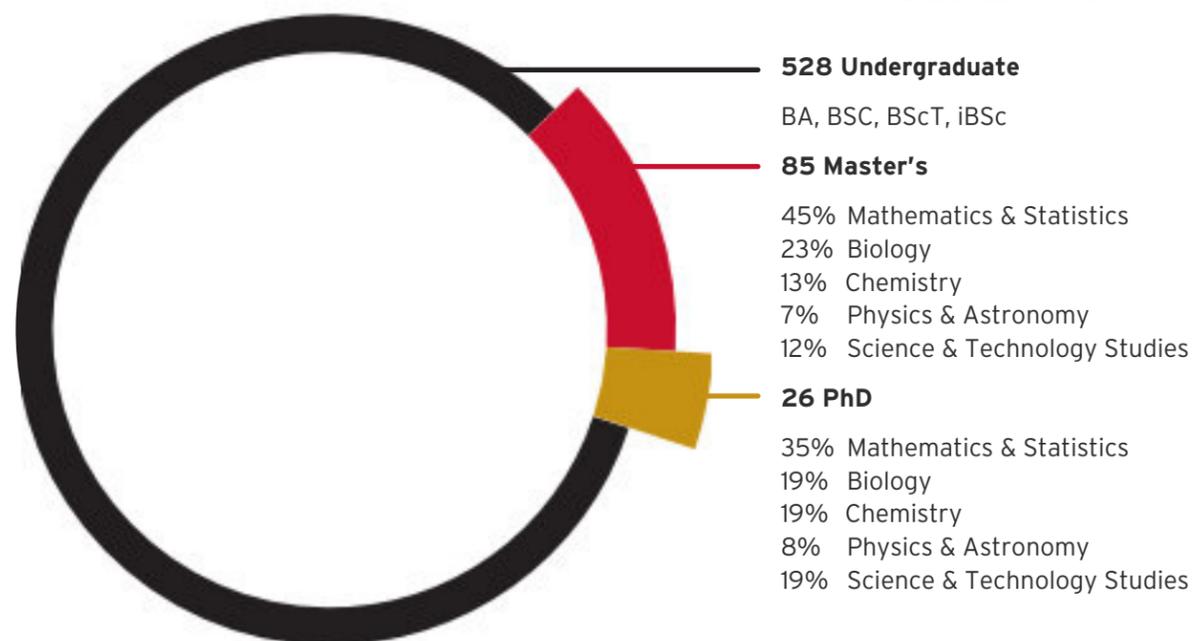
## Student numbers<sup>1</sup>

### APPLICATIONS & ENROLMENTS

Of **10,213** Undergraduate applicants, **1,241** were enrolled.



### 639 TOTAL DEGREES GRANTED

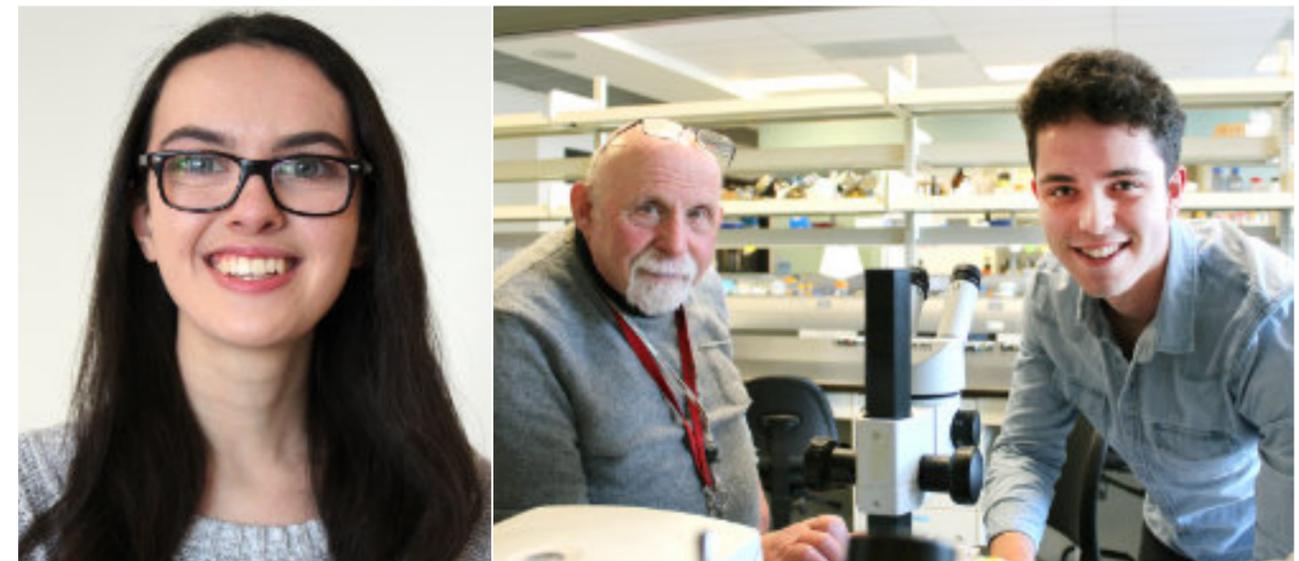


### TOTAL ENROLMENTS BY MAJOR/PROGRAM<sup>2</sup>

Undergraduates	Master's	PhD
62% Biology	43% Biology	29% Biology
18% Mathematics & Statistics	27% Mathematics & Statistics	33% Mathematics & Statistics
9% Chemistry	17% Chemistry	11% Chemistry
5% Physics & Astronomy	8% Physics & Astronomy	13% Physics & Astronomy
2% Environmental Science & Geography	5% Science & Technology Studies	14% Science & Technology Studies
3% Undeclared		
1% Science & Technology Studies		

<sup>1</sup>Data reflects statistics for the 2019 calendar year  
<sup>2</sup>Data reflects statistics as of Nov 1, 2019

## York Science Scholars Award program attracts students of exceptional promise



Sophie Eisen; and Jacob Fine with Ron Pearlman

Ten first-year undergraduate students were the first to be a part of the prestigious York Science Scholars Award (YSSA) program, which includes an entrance scholarship and a summer research placement. The program, now in its second year, is once again open to applications for the next cohort of bright students with a passion for science.

The YSSA program nurtures the intellectual and career development of first-year, high-achieving science students. It provides a

total award of \$10,000, consisting of \$5,000 as an entrance scholarship and an additional \$5,000 as a guaranteed summer research position following the first year of study.

For the summer position, the student is paired with a faculty mentor and conducts hands-on experiential research learning in leading-edge facilities. That research could be focused on sustainable energy, sensory information, perception, microscopic organisms, gene expression and much more.

**"Throughout my first year at York University, I have developed a passion for biological sciences and chemistry. This summer I look forward to engaging in hands-on, scientific exploration and learning fundamental laboratory techniques. I will work in a research lab that studies aptamers using biophysical techniques."**

– Sophie Eisen, Biomedical program

**"Ever since meeting him earlier this year, Professor Ronald Pearlman has been exceptionally generous with his commendable scientific wisdom. Professor Pearlman is someone who cares deeply about passing on the torch of scientific discovery to young students and future researchers. He continually serves as my source of guidance and support as I travel through university. I highly look forward to investigating gene expression with him in his molecular biology lab in the summer."**

– Jacob Fine, Biology program

## New group of Carswell Scholars could 'change the world'



Carswell Scholars with Allan Carswell and Deans of Science and Lassonde

Six PhD students from the Faculty of Science were among the new Carswell Scholars of 2019. Another six students were from the Lassonde School of Engineering. The scholarship will give this group of students an opportunity to delve further into their research, ranging from nanochemistry and self-driving cars to computer vision and the population genetics of bees.

The Carswell Scholars program was established in 2016 with a \$1-million gift from Professor Emeritus Allan Carswell and the Carswell Family Foundation. The scholarships are awarded to incoming PhD students in the Faculty of Science and Lassonde who demonstrate outstanding academic achievement.

The newest scholars were feted at a luncheon in fall 2019 where they had the chance to outline the scope of their research for Carswell and thank him and his family for their generosity.

### MEET THE NEW CARSWELL SCHOLARS IN YORK SCIENCE

**Katherine Akemi Odanaka** (Department of Biology), supervised by Professor Sandra Rehan, is investigating the evolutionary history and population genetics of the cleptoparasitic bee.

**Laura Farkas** (Department of Science and Technology Studies), supervised by Professor Kathryn Denning, is looking at planetary protection and environmental policies pertaining to space, potential extraterrestrial life, the implications of human expansion into the solar system and space governance.

**Víctor Flores Romero** (Department of Chemistry), supervised by Professor Gino Lavoie, is teaching nanochemistry and principles of organometallic, applying his

knowledge to industry, and facilitating an academic exchange.

**Laura Keane** (Department of Mathematics and Statistics), supervised by Professor Iain Moyles, is using applied math to help solve the global challenge of energy and, in particular, improve lithium-ion batteries.

**Emanuele Mendicelli** (Department of Physics and Astronomy), supervised by Professor Randy Lewis, is exploring the possibility of using quantum computing in particle physics.

**Farwa Sajadi** (Department of Biology), supervised by Professor Jean-Paul Paluzzi, is examining the cellular mechanism and crosstalk between hormonal regulators in *Aedes* mosquitoes.

## Outstanding postdocs join as York Science Fellows

Four top emerging researchers joined the Faculty as York Science Fellows, coming from as far away as Brazil and the United Kingdom to pursue research with some of the Faculty's exceptional scientists. York Science Fellowships are competitive postdoctoral positions awarded to talented, early-career scientists who have recently received, or who are about to receive, the doctoral degree.

The fellowships are possible through a generous grant from Jim and Marilyn Simons.

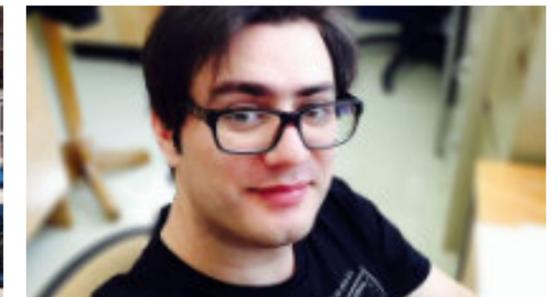
### MEET THE NEW YORK SCIENCE FELLOWS

"The York Science Fellowships give up-and-coming researchers the opportunity to further pursue their research interests with top experts in the field. They also enhance ongoing research at the Faculty by bringing new perspectives and experiences to the process."

– Jennifer Steeves, associate dean of research and graduate education in the Faculty of Science



**Leo Yvonne Alcorn**, supervised by Professor Adam Muzzin in the Department of Physics and Astronomy, is continuing her research on galaxy dynamics. Her focus will be on developing algorithms to measure complex and irregular dynamics in distant galaxies, which future adaptive-optics and space-based instruments will be able to resolve.



**Mohammad Naderi**, supervised by Professor Raymond Kwong in the Department of Biology, focuses on the effects of environmental contaminants on neuro-behavioural functions in animals. He is exploring how early-life exposure to endocrine disrupting chemicals interferes with and disrupts cognitive and social functioning, using zebrafish as the animal model.



**Mariana Bleker de Oliveira**, supervised by Professor Sergey Krylov in the Department of Chemistry, is focused on developing a highly reliable predictor of Multi-Drug Resistance to chemotherapy in ovarian cancer. She will be using a technology conceptualized by Krylov's team that can facilitate the development of such a predictor.



**Hanmeng Zhan**, supervised by Professor Ada Chan in the Department of Mathematics and Statistics, will continue working on the transport phenomena and algorithmic properties of quantum walks. Focused on spectral methods, her research will provide new combinatorial insights into problems raised by quantum information and quantum computation.

## Schmoozing with Nobel Laureates

“Magical” is how undergraduate student Tarnem Afify, biophysics major, described her experience at the prestigious 69<sup>th</sup> Lindau Nobel Laureate Meeting at Lake Constanze in Lindau, Germany, in July 2019.

Afify was one of 580 next generation scientists – undergraduates, PhD students and postdoctoral fellows – from 88 countries chosen to participate in the meeting along with 39 Nobel Laureates.



Nobel Laureate Gerard Mourou and Tarnem Afify

Professor Sean Tulin in the Department of Physics and Astronomy nominated her from York, followed by Nobel Laureate Arthur McDonald nominating her to the Lindau Meeting Selection Committee.

“Tarnem is an out-of-the-box thinker with huge ambitions, especially when it comes to breaking down barriers and under-representation in science,” said Tulin. “It’s just impressive and inspiring to me what she has done and what she wants to accomplish. I believe she may be the first attendee at this meeting ever from York.”

The goal of the meeting was to “share knowledge and spark passion for science,” said Afify, who was also a President’s Ambassador at York University in 2019. The meeting encouraged younger researchers to excel and strive to do their best. It also provided the opportunity to discuss current issues and explore new research with the Nobel Laureates.

A highlight of the event for Afify was her discussion with Nobel Laureate Gerard

Mourou about the boundaries of light and matter interactions, a topic that has grabbed her attention for a while. He spoke about the interconnections of the fields of optics and particle physics.

“Our conversation started with vacuum materialization and how ultra-relativistic light can produce particles and anti-particles to talking about how short laser pulses can shrink massive particle accelerators down to a chip-like size,” said Afify.

“Spending a week talking about everything related to physics with Nobel Laureates and top young scientists in the world felt just like being in the heavens,” she added. “The intergenerational and international dialogues that I was given the honour to be a part of sparked thousands of ideas and new projects that I am planning to implement in the research and outreach activities I do at York.”



Tarnem Afify (third from left at front) with Nobel Laureates Arthur McDonald and Donna Strickland (at back) and the Canadian group of young scientists



## Top marks lead to medal, and medical school

Nicholas Chrobok, biology major, received the Governor General’s Silver Medal at spring convocation.

“Achieving a distinction as rare and prestigious as a Governor General’s medal requires tenacity, dedication and perseverance,” said York University President and Vice-Chancellor Rhonda L. Lenton.

The Governor General’s Academic Medals are presented to students graduating with the highest average from approved university programs (gold medals at the graduate level and silver medals at the undergraduate level).

Chrobok was a stellar student who also received the York University President’s Scholarship throughout his time at York, as well as the Professor Ruth Hill Memorial Award and three NSERC Undergraduate Student Research Awards for summer projects.

He became involved in research at York University before he even became a student here though. During the summer prior to starting his undergraduate studies, he participated in the Spark Lab Program for high school students. And that early experience set the stage for his future time at York.

“From day one, I have been impressed by the welcoming and supportive environment that the university fosters towards students looking to get involved,” said Chrobok. “I also value the

diverse student body and feel fortunate to have had peers that helped broaden my perspectives both in and out of the classroom.”

Chrobok continued to pursue research experiences to enhance his learning, particularly in the labs of Professors Patricia Lakin-Thomas in the Department of Biology and Jane Heffernan in the Department of Mathematics and Statistics – whom he credits for playing an integral role in his growth as a student.

“Having taken BIOL 2021 (Cell Biology), multiple research practicums, and an honours thesis, and held Research at York positions with Prof Lakin-Thomas, I can say that she has always been an exceptional instructor who genuinely takes the time to get to know her students and fosters an environment that best promotes their growth,” said Chrobok.

Chrobok worked in Heffernan’s mathematical modelling lab during each summer of his degree too.

“Prof Heffernan was greatly accommodating of my goals and learning needs,” he said. “Her approach to answering questions made even the most challenging concepts surprisingly simple and intuitive.”

Chrobok is now a medical student at the University of Toronto.

# Inspiring the scientist in all of us

Every year, the Faculty of Science hosts numerous events and activities on campus and in the community to inspire people of all ages to engage with science. Here are a few highlights.



## HUNDREDS ATTEND PUBLIC EVENT ON CYBERSECURITY

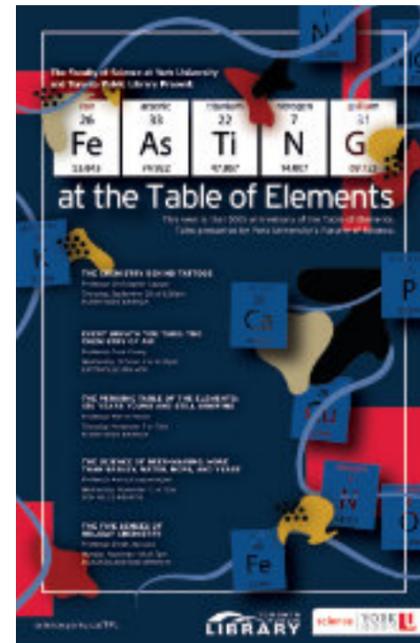
Catching spies, counter-intelligence and cyber theft were the focus of the fourth annual York Science Forum, Cybersecurity in the Age of Espionage. Held at the Toronto Reference Library, the free public event attracted hundreds from the community. Cybersecurity expert, author and former FBI operative Eric O'Neill told real-life spy stories and talked about how today's cyber spy is responsible for sophisticated and technologically advanced attacks targeting your data.

A panel discussion followed his talk with Professor Patrick Ingram in the Department of Mathematics and Statistics, and Kristin Ali, associate at Osler, Hoskin & Harcourt LLP; the conversation was moderated by Dan Falk, award-winning science journalist and York Science Communicator in Residence at the time.



## PUBLIC LECTURE SERIES CELEBRATES TABLE OF ELEMENTS

The Faculty celebrated the 150<sup>th</sup> anniversary of the periodic table of elements by hosting a chemistry-themed public lecture series at the Toronto Public Library. This series, Feasting at the Table of Elements, was free and open to everyone at library branches across the city and featured York Chemistry Professors speaking about the chemical elements in tattoos, in the air we breathe, in the scent of conifers, and more, as well as the science of beer-making. Professors Chris Caputo, Cora Young, Pierre Potvin, Hovig Kouyoumdjian and Derek Jackson participated.



## SCIENCE SPILLS ONTO STREET FOR SCIENCE RENDEZVOUS

Hundreds attended the fourth annual Science Rendezvous event at the Markham Farmer's Market, hosted by the Faculty of Science. York Science researchers, students and staff organized marvelous stage demonstrations, cool experiments and exciting hands-on activities that people of all ages could enjoy. Science Rendezvous is a family-friendly festival that takes place across Canada. It is Canada's largest celebration of science, with 30 cities across Canada, including various locations in the Greater Toronto Area, hosting events on the same day. All activities are free and open to the public.

## 50<sup>TH</sup> ANNIVERSARY CELEBRATIONS OF APOLLO 11

July 2019 marked the 50<sup>th</sup> anniversary of the first human walking on the Moon. The Allan I. Carswell Observatory team celebrated the lunar achievement by hosting three days of free public events that included a screening of the film "Apollo 11," presentations on lunar exploration and Moon gazing. Multiple telescopes were set up on top of the Arboretum Parking Garage at the William Small Centre for observing the Moon and other celestial objects at night. The event was previewed on CBC Radio's *Here and Now* program.



## HIGH SCHOOL STUDENTS PUT TO THE TEST AT SCIENCE TOURNAMENT

Sixty grade 11 students from six schools in Toronto and York Region participated in the third – and largest – annual Tri-Sci Tourney, a high school science competition in physics, chemistry and biology. Hosted by the Faculty of Science and Bethune College, the full-day event saw students vying for the most points and a chance to win a highly coveted trophy. Students used their science skills to compete in timed quiz rounds, including an activity round hosted by Let's Talk Science that featured RNA strand decoding, pH testing, and ocean acidification testing. Markville Secondary School was the winning team.





## Kimberly Badal, 'one to watch'

In 2019, Kimberly Badal (BSc '12) was the recipient of a Bryden Alumni Award from York University in the One to Watch category, reserved for alumni who have made a significant impact in their field or community within 15 years of a bachelor's degree or 10 years of a professional or graduate degree.

Badal is a cancer researcher and advocate working in the Caribbean region. In August 2016, she founded the Caribbean Cancer Research Initiative (CCRI), a non-profit organization focused on evidence-based solutions for cancer prevention and management. Badal believes that there will be radical improvement when she is able to shape her research agenda and measure success based on the patient experience.

CCRI is currently working on its flagship project: the introduction of cancer patient navigation in the Caribbean that will help guide patients and families through the cancer care system. They are also setting up genetic testing and counselling services for patients at high risk for cancer and other illnesses.

Badal earned an undergraduate degree in biomedical science at York University and a master's degree in biomedical science at St. Radboud University in the Netherlands. She is currently pursuing her PhD in molecular genetics at the University of the West Indies.

## Chris Scott aimed for the sky, landed on cloud nine

Chris Scott's (BSc '98) childhood fascination with weather led him to enroll in a combined honours degree in atmospheric science and atmospheric chemistry at York University. He is now one of Canada's leading weather experts and chief meteorologist and head of meteorology at Pelmorex Corp, the parent company of The Weather Network and a market leader in weather information in Canada and Spain.

"When I look back at my time at York, I'm essentially looking at the years I really 'grew up,'" said Scott. "Being in the atmospheric science and chemistry program was like attending a small and intimate university. At the same time, I was able to benefit from the resources and breadth of opportunities that a large university can offer."

Benefit he did. Scott counts his relationships with faculty members and fellow students as some of the most memorable aspects of his time at York. He worked for Chemistry Professor Donald Hastie for three summers, and had the opportunity to travel for field studies in Nova Scotia and Michigan.

After graduating from York Scott completed a master of science degree in atmospheric and space science at the University of Michigan. He then returned to The Weather Network, where he had worked previously as a part-time meteorologist. Over the next decade and a half, Scott took on more and more prominent roles, holding both on-air and behind-the-scenes positions including meteorologist and television co-anchor.

Now he leads a dynamic team of 30 meteorologists who produce millions of weather forecasts daily and who are developing the next generation of forecasting technology.

"My York education was the foundation for this future success," he said.



Photos on page 26-34 by B.D. Colen

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