



York University
FACULTY OF SCIENCE
Annual Review 2016

DEAN RAY JAYAWARDHANA'S ROUND-UP OF SELECTED HIGHLIGHTS



JANUARY

Bridget Stutchbury (Biology) received the 2016 President's Research Excellence Award.

FEBRUARY

Peter Backx (Biology) and Sean Tulin (Physics & Astronomy) received Canada Research Chairs (CRC), and Jianhong Wu (Mathematics & Statistics) had his CRC renewed.

Derek Wilson (Chemistry) received an Engage Grant from NSERC and Ontario Centres of Excellence to study a novel class of cancer drugs.



MARCH

We held our first **Science Unplugged**, a learning and networking event series that brings together faculty members, graduate students, postdocs and staff.

APRIL

A team led by Dean Ray Jayawardhana received an NSERC CREATE grant of \$1.65M for the Technologies for Exo-Planetary Science Program.

Staff members Cristalina Del Biondo and Howard Hunter received the President's Voice of York Award and the Ronald Kent Medal, respectively, at a special ceremony.

MAY

The Carswell Family Foundation made a \$1M gift to the Faculty of Science and Lassonde School of Engineering to support graduate student scholarships.

Nantel Bergeron (Mathematics & Statistics), Chun Peng (Biology) and Amro Zayed (Biology) were appointed as York Research Chairs (YRC) – making us the Faculty with the most YRCs.

JUNE

Paul Delaney (Physics & Astronomy) received the title of University Professor and Laurence Packer (Biology) was named a Distinguished Research Professor.

James Simons received an honorary Doctor of Science degree from York University.

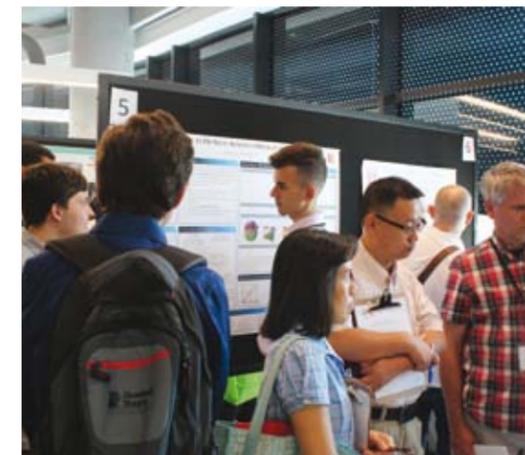
JULY

The Science Explorations Summer Camps and Helix Summer Science Institute attracted a record number of youth.



AUGUST

Summer research students in the Faculty of Science participated in and received top prizes at York's undergraduate research conference.



SEPTEMBER

We launched our innovative **Integrated Science Program** for first-year students.

OCTOBER

James and Marilyn Simons donated \$1.3M to establish a premier postdoctoral fellowship program at the Faculty of Science.

We launched an exciting, highly attended lecture series on infectious diseases in partnership with the Toronto Public Library.

NOVEMBER

About 500 people attended our second York Science Forum, Hacking the Genome: The Brave New World of Gene Editing, at the Design Exchange.

Jianhong Wu (Mathematics & Statistics) received a Doctor Honoris Causa from the University of Szeged (Hungary).

Alumna Catherine Zahn, CEO of the Centre for Addiction and Mental Health, received the York Alumni Bryden Award.



DECEMBER

We hosted a university-wide workshop to train researchers to use social media and media outreach to enhance their research impact.

James Simons receives honorary Doctor of Science

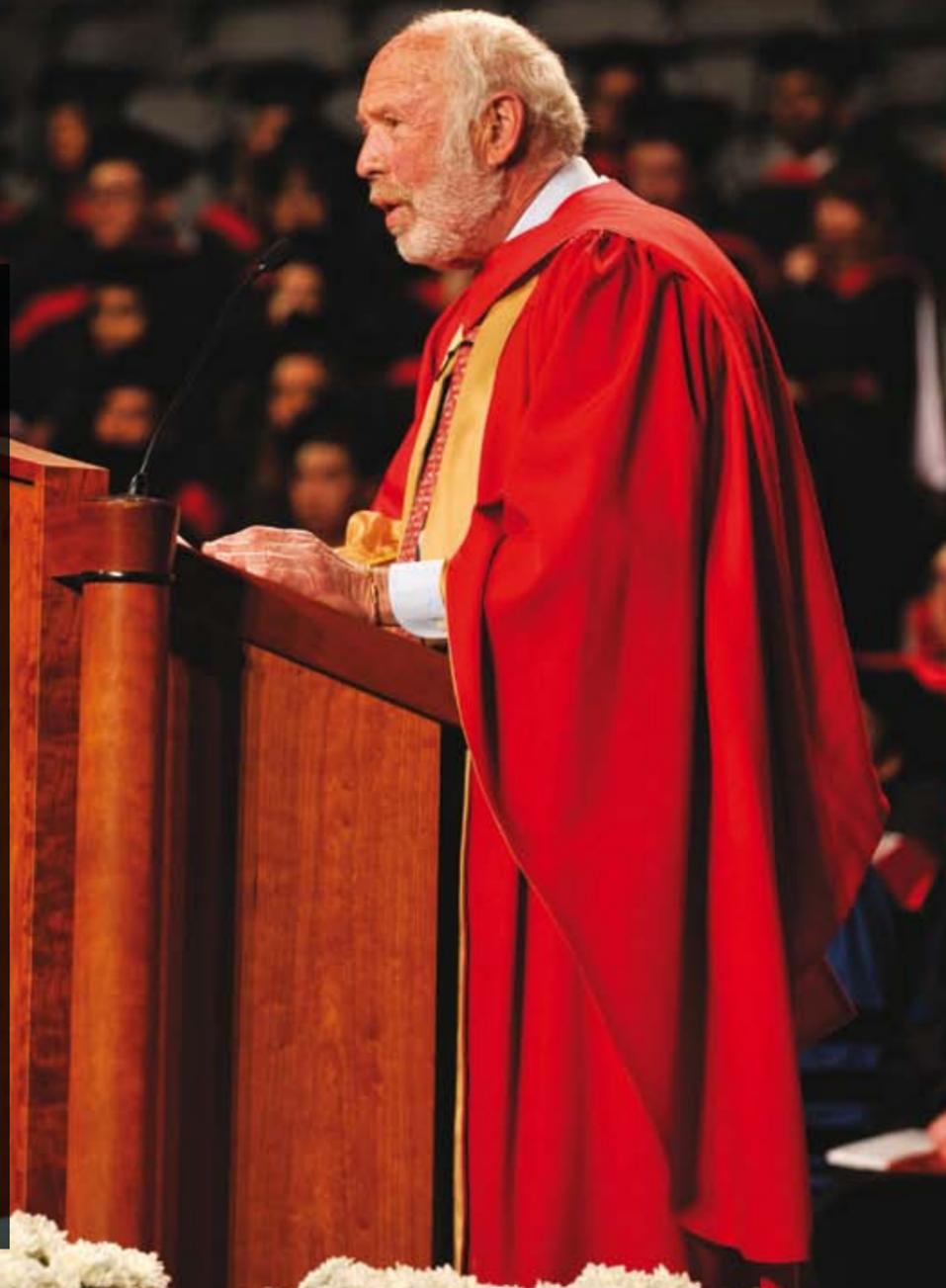
James Simons, a highly accomplished mathematician, financier and philanthropist, received an honorary Doctor of Science from York University at Spring Convocation.

In his speech, he reminded us all that inquiries into basic science are often the ones that change the world.

"The thing about basic science is, you don't know really where it's going to go, but you can hope that it's going to go far," said Simons, who is chair of the Simons Foundation, an organization dedicated to advancing the frontiers of research in mathematics and basic science.

He spoke about Oswald Avery, a Canadian-born American medical researcher who discovered that DNA makes up our genetic material. Avery repeated and perfected his experiments before publishing his findings in 1944. Nine years later, Francis Crick and James Watson discovered the structure of DNA, unleashing an evolution in science that has lasted to this day.

"Avery could not possibly imagine how transformative and far-reaching his discovery would be, nor even a fraction of its ultimate components and applications," said Simons. "He just wanted to know the answer to 'what is this stuff?' And that is really basic science at its best."



FACULTY MEMBERS RECEIVE HONORIFIC PROFESSORSHIPS

At Spring Convocation, Paul Delaney (Physics & Astronomy) was named a University Professor for the extraordinary and transformational contributions he has made to York University over three decades. He was recognized for his teaching excellence, leadership of the Division of Natural Science and the York Observatory, and his sustained and extensive contributions to science education and outreach.

Laurence Packer (Biology) received the title of Distinguished Research Professor for his outstanding contributions to the University's research culture and reputation. He has developed a renowned research program and provided international leadership on bee taxonomy, biodiversity and conservation. He has also fostered the development of an impressive number of students who have moved on to leadership roles in academia and elsewhere.

PRESIDENT'S RESEARCH EXCELLENCE AWARD

Distinguished Research Professor Bridget Stutchbury (Biology) received the 2016 President's Research Excellence Award for her research on the conservation biology and ecology of migratory songbirds in North America. She was recognized at the fourth annual York U Research Leaders Celebration, as well as at a special Science Unplugged event hosted by the Faculty of Science.

YORK RESEARCH CHAIRS

The York Research Chairs program serves as York University's internal twin for the Canada Research Chairs program. In 2016, three York Science professors were selected for chair positions:

- Nantel Bergeron (Mathematics and Statistics), Tier 1 York Research Chair in Applied Algebra
- Chun Peng (Biology), Tier 1 York Research Chair in Women's Reproductive Health
- Amro Zayed (Biology), Tier 2 York Research Chair in Genomics



Delaney (second from right)



Packer



Stutchbury (right)



Bergeron

Peng

Zayed

Our experts in the news

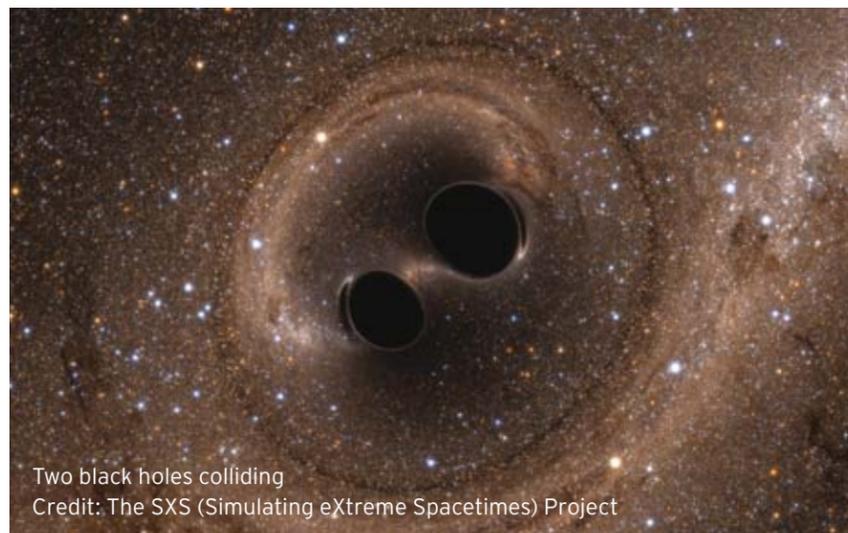
One of our major strategic priorities is to engage with the broader community and raise the visibility of Science at York through extensive media engagement. In 2016, we shared exciting research stories from the Faculty of Science and our experts were invited to comment on numerous events and issues in the media. Here are a few highlights.



Packer

PROTECTING BEES
Distinguished Research Professor Laurence Packer (Biology) is a renowned bee expert and has one of the world's most diverse (and Canada's largest) bee collections at York. His collection was profiled in a two-page feature in the *Toronto Star*. And media often seek him out for advice on how to protect bees. In 2016, his expertise was shared in *The Globe and Mail*, *Global News*, and *NOW Magazine*, among others.

GRAVITATIONAL WAVES
The detection of gravitational waves was one of the biggest discoveries in the history of space science. Although our physicists were not involved in the research, major media outlets across the country were calling our experts to hear what they had to say. Professors Matthew Johnson and Sean Tulin (Physics & Astronomy) spoke to outlets like the *Toronto Star*, *National Post* and the *Toronto Sun*.



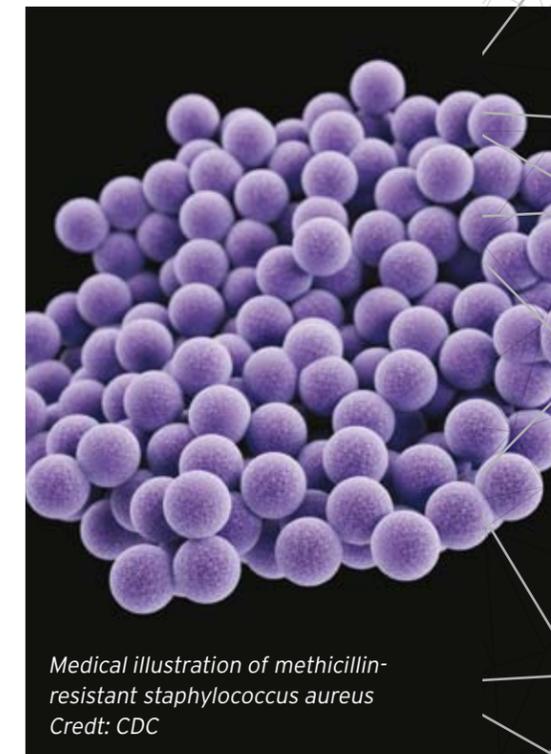
Two black holes colliding
Credit: The SXS (Simulating eXtreme Spacetimes) Project

THREAT OF SUPERBUGS
Superbugs – bacteria that have become resistant to antibiotics – kill more than 700,000 people each year globally. Their threat has many people talking, and journalists have been reaching out to Professor Dasantila Golemi-Kotra (Biology) for her expertise. Golemi-Kotra studies the biological mechanisms that trigger resistance in infectious bacteria. In 2016, she spoke to *Global News* and the *Toronto Sun* on the topic.

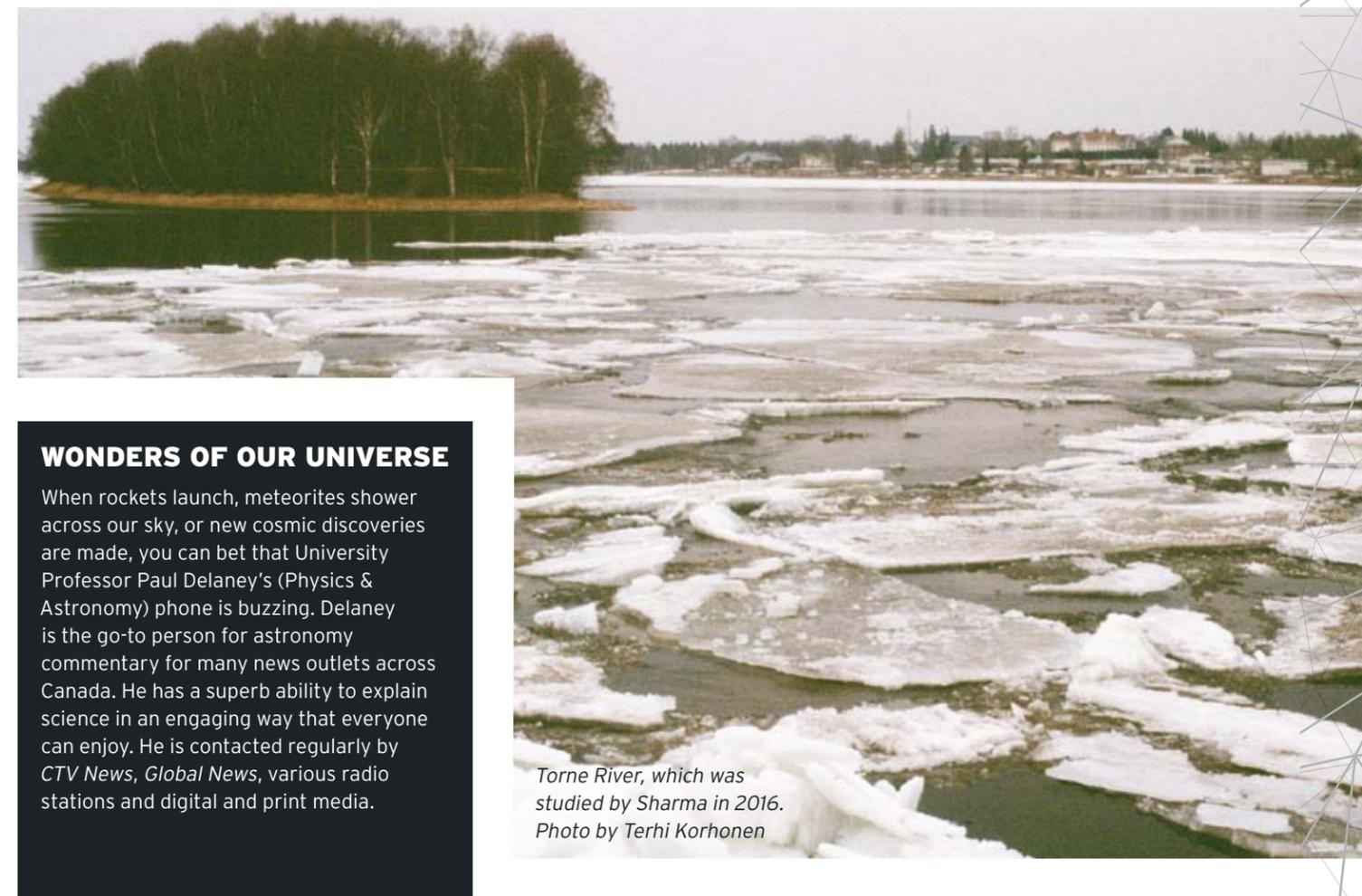


Golemi-Kotra

CLIMATE CHANGE
Professor Sapna Sharma (Biology) speaks to the media regularly about the impact of climate change on water quality, temperature and biodiversity. Outlets like *TVO*, *CBC Radio* and *Canadian Geographic* have invited her for panel appearances and commentaries. In addition, she co-led a study on the impact of climate change on ice cover that received international attention, including by *National Geographic*, *CBC News* and *CBC Radio*, and *Smithsonian*.



Medical illustration of methicillin-resistant staphylococcus aureus
Credit: CDC



Torne River, which was studied by Sharma in 2016.
Photo by Terhi Korhonen

WONDERS OF OUR UNIVERSE
When rockets launch, meteorites shower across our sky, or new cosmic discoveries are made, you can bet that University Professor Paul Delaney's (Physics & Astronomy) phone is buzzing. Delaney is the go-to person for astronomy commentary for many news outlets across Canada. He has a superb ability to explain science in an engaging way that everyone can enjoy. He is contacted regularly by *CTV News*, *Global News*, various radio stations and digital and print media.

Beating to the rhythm

PETER BACKX

Your heartbeat is triggered by electrical impulses that tightly control the contraction and relaxation sequences of the heart's chambers and ensure efficient pumping. When these electrical impulses become irregular, a condition called "cardiac arrhythmia," normal heart function can be disrupted and it can even lead to a sudden cardiac death.

"Cardiovascular disease is the leading cause of death in Canada, and arrhythmias cause about half of those deaths," says Professor Peter Backx (Biology), a cardiac physiologist who joined York in early 2016.

Backx, also a newly appointed Canada Research Chair in Cardiovascular Biology (Tier 1), is particularly interested in understanding, treating and preventing the most common type of cardiac arrhythmia, atrial fibrillation (AF). AF is most commonly seen in aging patients with heart disease. It not only impairs heart function, but also is a major cause of stroke and heart disease progression.

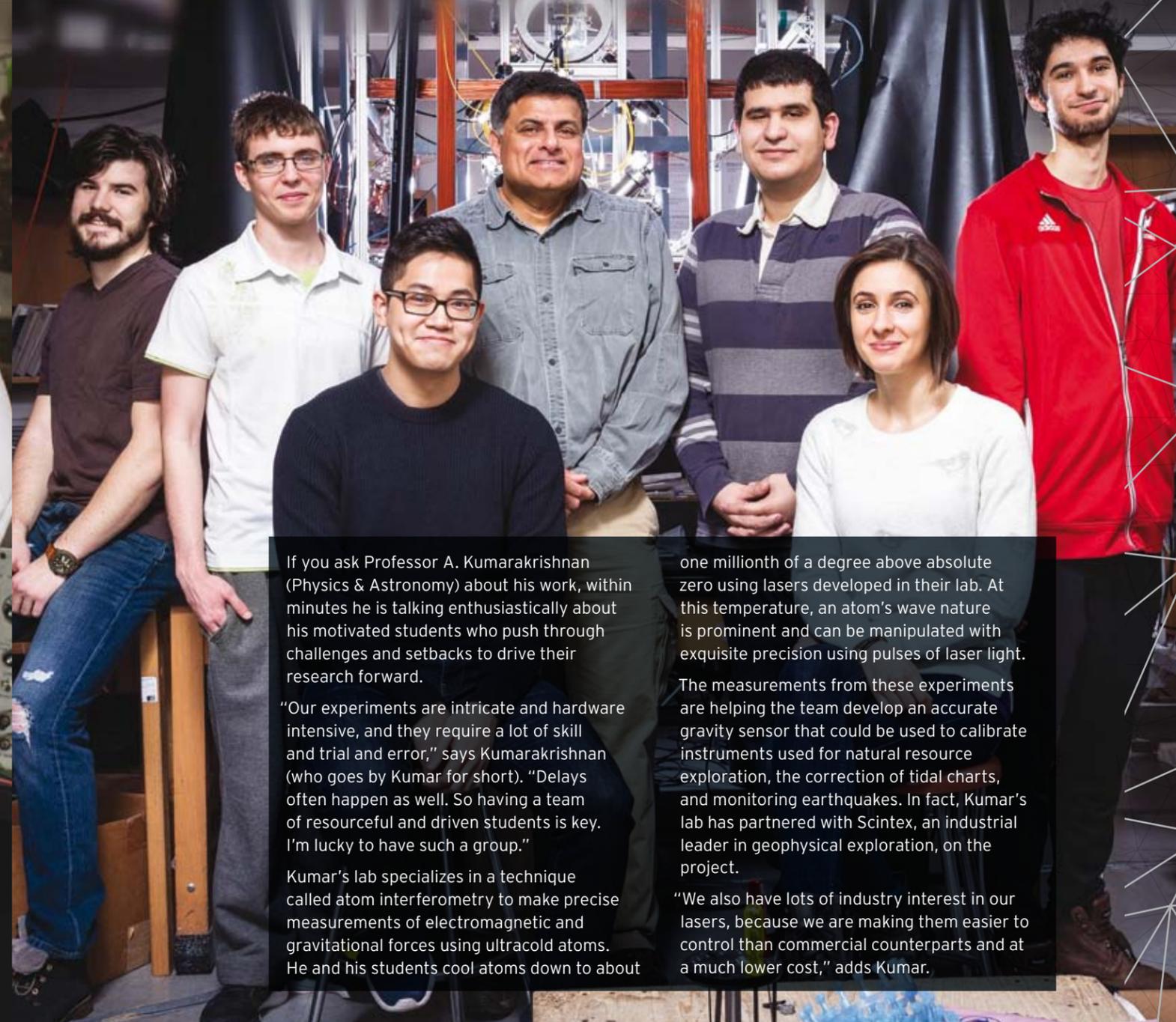
"Unfortunately the number of AF patients is expected to double over the next 40 years due to an aging population and the rapid increase in risk factors for heart disease like diabetes and obesity," explains Backx. "Current treatment options are expensive and relatively ineffective, forcing most to deal with its consequences."

Using genetic engineering and heart cells derived from human stem cells, Backx is exploring the cellular, electrical, molecular and genetic factors underlying AF. His recent studies focus on how exercise influences this condition. The ultimate goal of the research is to develop new strategies to prevent and treat AF.



Laser-like precision and perseverance

A. KUMARAKRISHNAN



If you ask Professor A. Kumarakrishnan (Physics & Astronomy) about his work, within minutes he is talking enthusiastically about his motivated students who push through challenges and setbacks to drive their research forward.

"Our experiments are intricate and hardware intensive, and they require a lot of skill and trial and error," says Kumarakrishnan (who goes by Kumar for short). "Delays often happen as well. So having a team of resourceful and driven students is key. I'm lucky to have such a group."

Kumar's lab specializes in a technique called atom interferometry to make precise measurements of electromagnetic and gravitational forces using ultracold atoms. He and his students cool atoms down to about

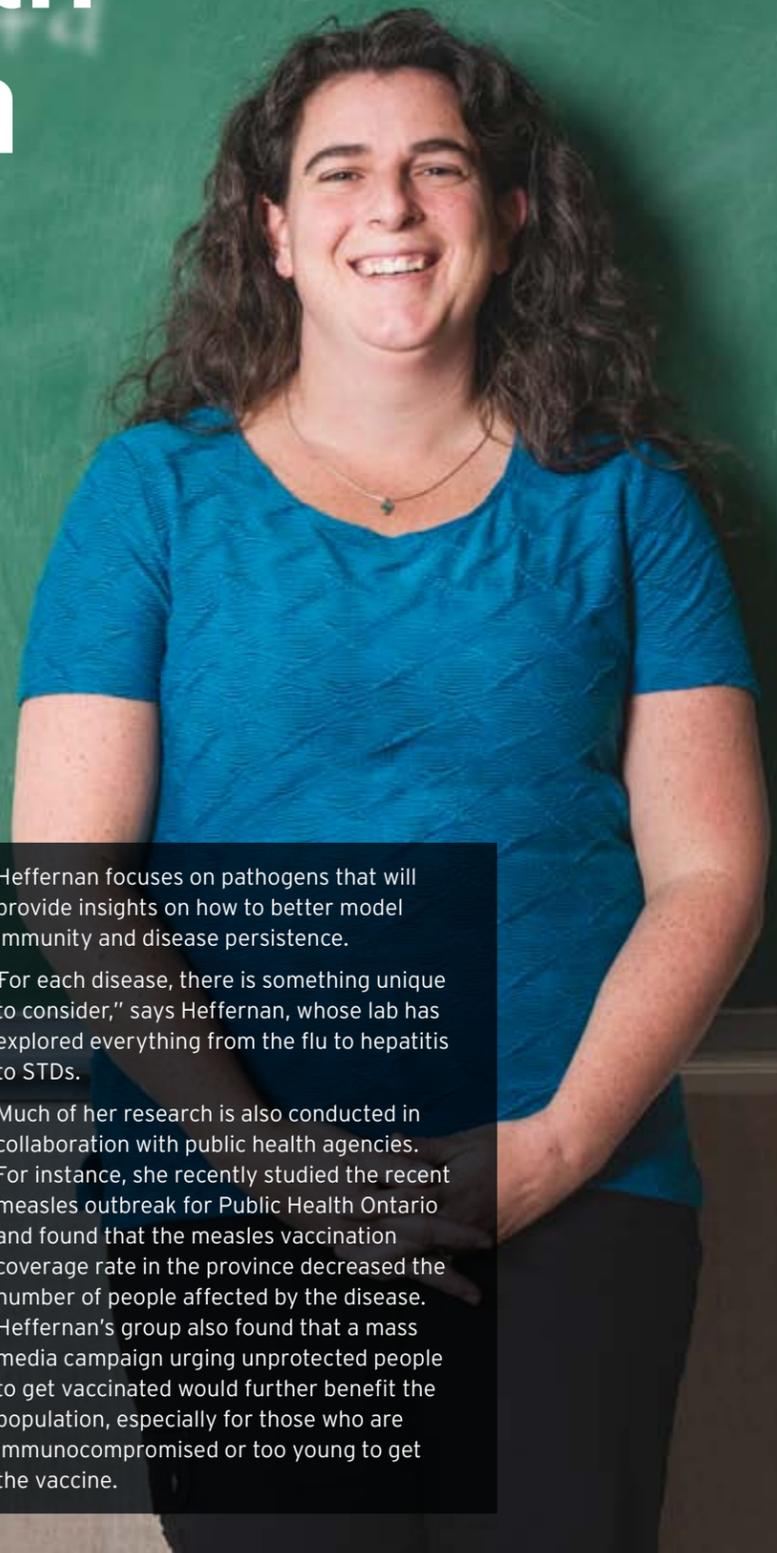
one millionth of a degree above absolute zero using lasers developed in their lab. At this temperature, an atom's wave nature is prominent and can be manipulated with exquisite precision using pulses of laser light.

The measurements from these experiments are helping the team develop an accurate gravity sensor that could be used to calibrate instruments used for natural resource exploration, the correction of tidal charts, and monitoring earthquakes. In fact, Kumar's lab has partnered with Scintex, an industrial leader in geophysical exploration, on the project.

"We also have lots of industry interest in our lasers, because we are making them easier to control than commercial counterparts and at a much lower cost," adds Kumar.

Mission possible: Using math to explain diseases

JANE HEFFERNAN



At the MI2 Lab at York, you won't find secret government operatives or run into Tom Cruise. Instead you will discover Professor Jane Heffernan (Mathematics & Statistics) and her students using math models and computer simulations to understand how infectious diseases spread and persist. MI2 – which stands for the Modelling Infection and Immunity Lab – is affiliated with York's Centre for Disease Modelling, which is also led by Heffernan.

"Many different and complex factors play a role in how an infectious disease spreads, such as the bug's characteristics, whether there is a drug therapy or vaccine, people's immunity, and even what is being said in the news," says Heffernan. "My goal is to use math modelling to understand those dynamics and bring them all together into one cohesive story."

Heffernan focuses on pathogens that will provide insights on how to better model immunity and disease persistence.

"For each disease, there is something unique to consider," says Heffernan, whose lab has explored everything from the flu to hepatitis to STDs.

Much of her research is also conducted in collaboration with public health agencies. For instance, she recently studied the recent measles outbreak for Public Health Ontario and found that the measles vaccination coverage rate in the province decreased the number of people affected by the disease. Heffernan's group also found that a mass media campaign urging unprotected people to get vaccinated would further benefit the population, especially for those who are immunocompromised or too young to get the vaccine.



Science communication: Lessons from history

JAMES ELWICK

At a time when scientists are asked to form their own brand and justify their research to the public, how should they do so while still retaining their credibility?

Science history hints at some good examples. John Tyndall (1820-1893) was a highly influential Anglo-Irish physicist best known for helping to discover that carbon dioxide is a greenhouse gas and explaining why the sky is blue. He had a productive career – publishing about 180 science papers, 50 popular articles, and 30 books and pamphlets – and outside of the laboratory he worked on reforming science education, made friends with scientists and cultural figures such as Louis Pasteur and Alfred Lord Tennyson, and lectured in sold-out theatres.

"Tyndall became one of the most famous scientists of the Victorian period – as famous as Charles Darwin – but was largely forgotten

after his death," says Professor James Elwick (Science & Technology Studies). "As a result, many of his letters to family, friends and colleagues went unpublished."

Tyndall's letters will be collected and brought to life again through the John Tyndall Correspondence Project, a collaborative project which aims to collect, transcribe and publish in print and online more than 7,800 letters to and from Tyndall. Elwick is coordinating the project, which was founded at York in 2006 by Professor Bernard Lightman in the Faculty of Liberal Arts and Professional Studies.

"The project will show the different ways in which science can be communicated to wider audiences," says Elwick. "It will also provide scholars with an important resource that is currently difficult to access and with new ways of undertaking historical research."

Chemistry of the night

ROBERT MCLAREN

From a lab on the roof of the Petrie building at York, Professor Robert McLaren (Chemistry) and his students study the chemistry of Toronto's atmosphere. One device, called a Differential Optical Absorption Spectroscopy (DOAS) instrument, faces a window and shoots out light that reflects off mirrors installed kilometres away and comes back into the instrument. The returning light can reveal the levels of specific gases in the atmosphere.

McLaren is particularly interested in using this instrument at night.

"During the day, the chemistry of our atmosphere is governed by a molecule called the hydroxyl radical, which oxidizes and removes pollutants from the air," says McLaren, who is also the director of the Centre for Atmospheric Chemistry at York. "But at night, the nitrate radical, or NO_3 ,

is generated and takes over atmospheric oxidation. We like to call it the vampire radical."

NO_3 is important because it reacts with chemical compounds released by plants and fossil fuel burning during the day and creates aerosols, which can be detrimental to human health and the environment.

McLaren's team recently used DOAS to look at how NO_3 is vertically distributed in Toronto's atmosphere at night. Although concentrations at ground level are known to be low, levels of NO_3 have been found to be quite high just 100 metres above the surface.

" NO_3 reacts with all of yesterday's pollution in the residual layer and then all that stuff mixes down the next morning," says McLaren. "By knowing how NO_3 is distributed vertically in the atmosphere, we can start to understand its impact on air quality and pollution the next day."

Molecular architect

LOGAN DONALDSON

Professor Logan Donaldson (Biology) uses state-of-the-art technologies to investigate how form meets function at the atomic level in the brain.

"The brain is made up of billions of cells that transmit signals to one another through specialized connections called synapses," says Donaldson. "Synapses need to be organized enough to function, but disorganized enough to be adaptable. This dynamic balance is pinned by protein architecture."

He is referring to the structure of a set of proteins called scaffolds, which glue together other proteins to transmit chemical and electric signals between brain cells. Scaffolding proteins have an adaptable molecular shape that allows them to bind to their partners at the correct place and time. By studying their structure, Donaldson's research group is learning more about how scaffolds cooperate to transmit signals, as well as their role in learning, memory and neurological disorders.

For instance, using nuclear magnetic resonance spectroscopy and X-ray crystallography, Donaldson's team determined the structure of several segments of a protein called AIDA1 along with its binding partners. Combining the structure with additional biochemical information helped his team define precisely how AIDA1 interacted with amyloid precursor protein, a major player in the progression of Alzheimer's disease.

"By understanding networks", Donaldson says, "we are better equipped to make potent and selective drugs."

This year he also teamed up with Biology Professors Georg Zoidl and Vivian Saridakis to understand how the structure and organization of another synaptic protein called CASKIN2 affects the transmission of chemical signals involved in nerve growth and nerve regeneration.

Projecting future climate change

HUAIPING ZHU

Globally, 2016 was the warmest year on record. As temperatures continue to rise and extreme weather events become more common due to climate change, it will become increasingly important to predict these changes so that we can mitigate and adapt to them and their associated impacts.

"Practitioners have expressed an urgent need for coordinated and easy-to-use projections for climate change risk assessment in Ontario," says Professor Huaiping Zhu (Mathematics and Statistics), who is director of the Laboratory of Mathematical Parallel Systems (LAMPS) at York University.

That's why the Ontario Ministry of Environment and Climate Change (MOECC) has been funding Zhu and his team for years to improve climate projections for the province.

Zhu's team is now working on consolidating a large number of existing climate projections into a common set of Ontario-specific scenarios using cutting-edge downscaling techniques developed in LAMPS. Many climate change indicators will be considered, including average and extreme variables, and the information will be shared through LAMPS's Ontario Climate Change Portal at www.yorku.ca/occp

"We will continue to develop downscaling methodologies to improve climate information at local scales," says Zhu. "Climate change has so many implications, such as for agriculture and how we build our homes and infrastructure, and having reliable climate predictions will enhance research and help to inform government planning and policies in Ontario."



The worlds beyond our solar system

Elodie Hébrard studies how planetary systems form and evolve. As a postdoctoral fellow in Dean Ray Jayawardhana's research group at York University, she is particularly interested in massive planets that orbit very close to their parent stars (also called hot Jupiters).

"Hot Jupiters have puzzled astronomers for the last 20 years," says Hébrard. "How did these giant planets get into orbits 100 times closer to their host stars than our own Jupiter is to the Sun?"

In a study published in *Nature* in 2016, Hébrard discovered a hot Jupiter orbiting a sun that was only two million years old – the stellar equivalent of a week-old human baby. The research demonstrated that it's possible for hot Jupiters to form early in a star's life.

"Our discovery revealed that a giant planet can not only form quickly, but also end up extremely close to its sun soon after the star is born," says Hébrard. "What's more, the presence of a giant planet so close and early in a star's life is likely to have a profound influence on shaping the overall architecture of the planetary system."

Her findings were covered by *CBC News*, *Radio Canada International* and the *Toronto Star*.



Hot Jupiter. Credit: Mark A. Garlick

Innovation and entrepreneurship in nanochemistry

Some heavy metals can wreak havoc in living organisms, with mercury and lead being among the most poisonous to humans. They can be released into our environment through human activities like fossil fuel burning and agricultural practices. And humans can easily be exposed to these metals by breathing, touching or ingesting them.

"If we can quickly and reliably detect heavy metals in the environment and in our bodies, we could prevent poisoning or diagnose it at an earlier stage," says Maryam Hariri, an MSc and PhD grad from York who now holds a York Postdoctoral Fellowship with Professor Sylvie Morin (Chemistry). "But the detection devices we have today are still not selective or sensitive enough."

Hariri is changing this. She is designing and developing more specific and stable sensors that can detect heavy metals in different biological and environmental samples, including drinking water, soil and food. During her PhD studies, she developed selective sensors for chromium and iron ions, and now she is focused on doing the same for more toxic metals, such as mercury and lead.

"We want to create devices that we can easily take out into the world and use to measure real samples," says Hariri, who plans on patenting her sensors and one day starting her own company.



Dean's Undergraduate Research Awards

Our labs are bustling in the summer with undergraduate students working diligently on research projects.

In 2016, about 20 science students received Undergraduate Science Research Awards from the Natural Sciences and Engineering Research Council to conduct research with a faculty member over the summer. And another six students were funded with a Dean's Undergraduate Research Award (DURA) from the Faculty of Science.

DURAs were created recently to provide more opportunities for undergraduate science students to gain hands-on, paid research experience. The Faculty of Science is committed to increasing the number of DURAs over time so that more students can participate in the program.

"When engaged students have early and frequent access to hands-on research, they have a better understanding of the value that the sciences offer to our society and are encouraged to consider a fulfilling career that ultimately helps others," said Scott Tanner, a York Science alumnus and adjunct chemistry professor who has provided financial support for the DURAs.

For more details, visit science.yorku.ca/DURA



Tanner

"I have learned not only a wide number of lab techniques and innovative ways of conducting research, but also the importance of asking questions, collaborating with peers and thinking outside the box."

- Miranda DiBiase, DURA recipient supervised by Professor Derek Wilson (Chemistry)

"Although classes during the year have been great and enjoyable, my experience doing mathematical research at York has allowed me to jump into the game and explore new territory."

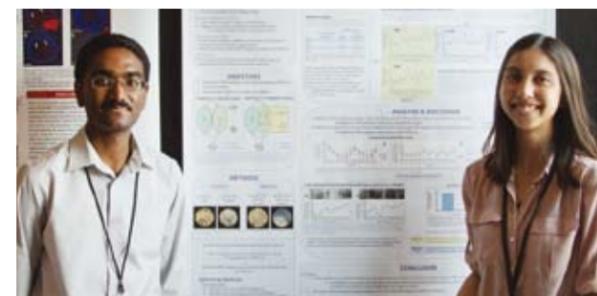
- Yosef Bisk, DURA recipient supervised by Professor Neal Madras (Mathematics & Statistics)

Summer Research Conference

Many of our summer students participated in York's undergraduate summer research conference, which brought together research students from across the University to showcase their projects. Congratulations to all of our students who participated in the conference and received recognitions:

FIRST PLACE (POSTER PRESENTATION)

Joel George and Amanda Jass, supervised by Professor Patricia Lakin-Thomas (Biology), for their presentation "Characterization of the FRQ-less Oscillator System in Neurospora Crassa Using Oxidation and Reduction Cycles of Peroxiredoxin as a Biological Marker of Circadian Rhythms."



FIRST PLACE (ORAL PRESENTATION)

Boris Barron, supervised by Professor A. Kumarakrishnan (Physics & Astronomy), for his presentation "Investigation of Allan Variances of Homebuilt Diode Lasers."



SECOND PLACE (POSTER PRESENTATION)

Yosef Bisk, supervised by Professor Neal Madras (Mathematics & Statistics), for his presentation "Monte Carlo Methods for Pattern-Avoiding Permutations."



HONOURABLE MENTION (POSTER PRESENTATION)

Ashraf Altesha, supervised by Professor Jean-Paul Paluzzi (Biology), for his presentation "Sequencing and Transcript Localization of GPA2/GPB5 in the Blacklegged Tick Ixodes Scapularis."



Research highlights

CFREF

York University received \$33.3M from the Canada First Research Excellence Fund to support the project Vision: Science to Applications (VISTA). The program – which brings together researchers from the Faculties of Science, Health, and Liberal Arts & Professional Studies, the School of the Arts, Media, Performance and Design, and Lassonde School of Engineering – is supported by \$69.1M in cash and in-kind contributions from York, as well as \$16.5M in partner contributions.



NSERC

Dean Ray Jayawardhana (Physics & Astronomy) and John Moores (Lassonde School of Engineering) received \$1.6M in funding from NSERC CREATE for a Training Program in Technologies for Exo-Planetary Science.

Credit: NASA/JPL-Caltech

CFI-JELF

More than \$749K in CFI-JELF and ORF funding was awarded to Chun Peng (Biology) for the Facility for Women's Reproductive Health Research and Demian Ifa (Chemistry) for the project Diagnosis of Squamous Cell Carcinoma Through Combined Mass Spectrometry Imaging, Metabolomics and Multivariate Analysis.



Ifa

NSERC

Andrew White (Biology) received \$142K from the NSERC Research Tools and Instruments Grants Program for the project Biomolecular Imager for Analysis of Cellular and Viral Proteins and Nucleic Acids.

CANADIAN CANCER SOCIETY

Peter Cheung (Biology) was awarded \$200K from the Canadian Cancer Society for Developing an Innovative Method to Study Histone Ubiquitylation and its Links to Cancer Biology.



J.P. BICKELL FOUNDATION

Scott Menary (Physics & Astronomy) received a donation of \$30K from the J.P. Bickell Foundation for the Southern Ontario Large-Scale Time Coincidence Array.

CANCER RESEARCH SOCIETY

Vivian Saridakis (Biology) was awarded \$120K from the Cancer Research Society for the Identification of Novel USP7-CTD Binding Proteins and Regulation of Catalytic Activity.

ONTARIO CENTRES OF EXCELLENCE

The Ontario Centres of Excellence VIP program awarded Derek Wilson (Chemistry) \$45K for the Development of a Mass Spectrometry-Enabled Assay for the Identification of New Cellular Targets for Antibody-Drug Conjugates that Utilize a Novel Payload Delivery Mechanism.

MINISTRY OF ENVIRONMENT

Huaiping Zhu (Mathematics & Statistics) was awarded \$180K from the Ministry of Environment for Developing a Common Set of High Resolution Probabilistic Regional Climate Projections Over Ontario Using a Large Ensemble of GCMS and RCMS Results.

MINISTRY OF ENVIRONMENT

Sapna Sharma (Biology) received two awards totalling \$97K from the Ministry of the Environment to study Climate-Algae Interactions: Past, Present and Future, and the Effects of Changing Ice Cover on Aquatic Ecosystems.



MITACS

Edward Furman (Mathematics & Statistics) received a combined amount of \$138K from Mitacs and Sun Life Financial to support post-doctoral fellow Dr. Jianxi Su's research on Multiple Shock Dependencies with Applications to Insurance Risks, and to study Quantitative Risk Measurement Techniques for Insurers.



ELI LILLY

Michael Organ (Chemistry) received \$138K from Eli Lilly for the project Catalyst for Flow.

IBM CANADA

IBM Canada awarded a \$1.8M in-kind gift to accelerate the Advanced Disaster, Emergency and Rapid Response Simulation (ADERSIM) – a program directed by Jianhong Wu (Mathematics & Statistics).

Research funding

\$13.8M

Total new research funding for the Faculty of Science

\$4.0M+

New funds from NSERC

\$2.1M+

New donations for research from private foundations

\$1.7M+

New funds from CFI and ORF

\$1.0M+

New funds from research foundations, government and industry contracts

\$277K

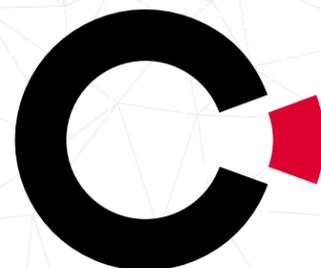
New funds from NSERC Engage and Mitacs for industry-partnered research

\$33M+

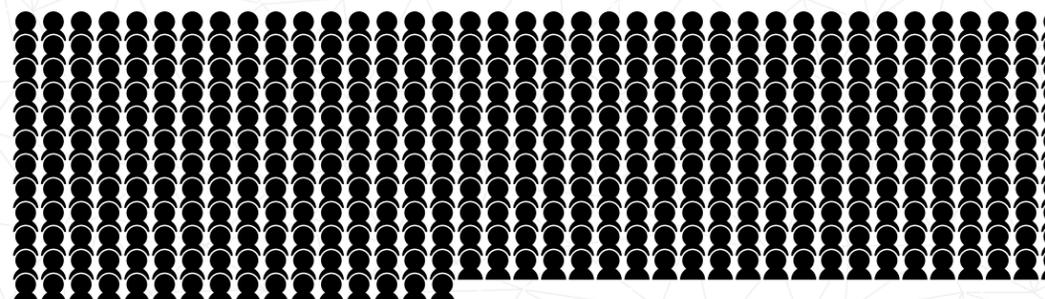
Largest single award from the Canada First Research Excellence Fund to support researchers from five Faculties, including the Faculty of Science, collaborating on the Vision: Science to Applications (VISTA) program

Students

APPLICATIONS & ENROLMENTS
OF 8,856 UNDERGRADUATE APPLICANTS,
983 WERE ENROLLED



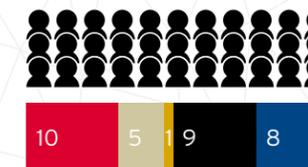
545 TOTAL DEGREES GRANTED
435 UNDERGRADUATE (BA, BSc, BScT, iBSc)



77 MASTER'S



33 PHD



ENROLMENTS BY MAJOR/PROGRAM*
UNDERGRADUATES



MASTER'S STUDENTS



PHD STUDENTS



- Biology
- Chemistry
- Mathematics & Statistics
- Science & Technology Studies
- Physics & Astronomy
- Environmental Science & Geography
- Undeclared

*Data reflects statistics from January 1-December 31, 2016

Individual honours and awards

SELECT FACULTY AWARDS

Petro Canada Young Investigator Award	Jean-Paul Paluzzi
FSc Early Career Research Award	Sapna Sharma
FSc Established Research Award	Ilijas Farah
FSc Excellence in Graduate Mentorship	Derek Wilson
FSc Excellence in Teaching Award	Paula Wilson

SELECT GRADUATE STUDENT AWARDS

Richard Jarrell Award of Excellence for Teaching Assistants	Uzma Nadeem David Miller
NSERC Alexander Graham Bell Postgraduate Scholarship - Doctoral PGS-D	Alyssa Murdoch Laura Newburn Marlee Ng Benjamin Voloh
NSERC Alexander Graham Bell Graduate Scholarship - Masters CGS-M	Jessica D'Angelo Julia Gauberg Seyed Hassani Travis Valdez
SSHRC Doctoral Fellowship	Angela Cope Megan Youdelis Dacia Douhaibi
Nestmann Scholarship	Camille Diaz
Ontario Trillium Scholarship Program	Yana Boeva Chaya Erika Go Soma Tripathi
CIHR Frederick Banting & Charles Best Canada Graduate Scholarship	Jessica D'Angelo
C.D Fowle Graduate Scholarship in Ecology	Jenna Braun
Joseph-Armand Bombardier CGS Doctoral Scholarships	Danielle Belsky Margaret Chiappetta Paul Bocking Amardeep Kaur Devin Holterman Yolanda Weima
Elia Scholars Program	Anita Buragohain
Harold I Schiff Graduate Award in Atmospheric Chemistry	Csilla Csukat

SELECT UNDERGRADUATE AWARDS

York University President's Scholarship	Nicholas Chrobok Joel George
York University President's Honour Roll	Avani Abraham Usman Akhtar Joshua Altman Asmarah Amin Danica Chaharlangi Carolyn Ewins Joshua Fletcher Noah Gasner Yaakov Green Nathan Haspel Salma Jetha Dominique Lee Daniel Ng Sabrina Nguyen Shaili Perez Jennifer Porat Sameer Safi Chanhee Seo Catherine Spagnuolo Gil Yerushalmi
Cragg Scholarship for Academic Excellence	Yaakov Green Shaili Perez
Prof. Ruth Hill Memorial Award	Joshua Altman Luke Chung Joshua Fletcher
Gold Medal	Vijay Kumari Sandhu
Silver Medal	Bach Kim Nguyen
NSERC Undergraduate Summer Research Award	Joel George Joshua Altman Daniel Ng M-Ashraf Altesha Zhengyang (Edward) Zhou Adeela Ahmed Amanda Jass Simona Yakobov Nour Wasfy Taylor Martin Justin Kim Karim Botros Boris Barron Neil McCall Gehrig Carlse Balchev Stanislav Semenikhine Vadim Dasilva Barbosa Keegan Liang Rui
Dean's Undergraduate Research Awards	Monica Pizzardi Amy Wajchendler Miranda Di Biase Prethipan Sakthivel Bisk Yosef Sepehr Sadeghi

SELECT POSTDOCTORAL AWARDS

York Postdoctoral Award	Maryam Hariri
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Teaching the wonders of math

AMENDA CHOW

In 2016, Amenda Chow was appointed as an alternate stream professor in the Department of Mathematics & Statistics.

"I am grateful to work at an institution that values innovation in teaching and developing mathematical thinking in young minds," she says, reflecting on her teaching at York. "Students will be using what I teach them for the rest of their lives. Teaching is a noble profession, and I am honoured to play a role in this responsibility at York University."

Chow plans to continue enhancing the department's programs by applying the theories of mathematics in tandem with providing students with experiential learning.

"I want students to appreciate that mathematics is interdisciplinary and practical," says Chow. "To me, it's about teaching not only the foundations of mathematics, but also the skills necessary for after graduation."

Building trust in the classroom

HOVIG KOUYOUMDJIAN

"Teaching is my passion," says Hovig Kouyoumdjian (Chemistry), who joined York University as an alternate stream professor in summer 2016. He has been teaching since graduate school, and early on he quickly realized that teaching science is more than just informing students on a certain topic.

"To me, it's a process that involves presenting a scientific observation, interactively scaffolding the concepts to explain it, supporting them with examples that relate to our everyday life, and drawing conclusions from them," says Kouyoumdjian.

One of the most important first steps for him as an educator is to build trust between him and his students. Many students have preconceptions about chemistry, and Kouyoumdjian tries to tackle these apprehensions from day one.

"Once that barrier is surmounted, only then can you guide students through the learning process and stimulate them to use the reasoning acquired in chemistry in their own academic disciplines and in everyday life. After all, chemistry is everywhere."

Kouyoumdjian also conducts evidence-based education research to unpack students' conceptions of chemical concepts and principles.

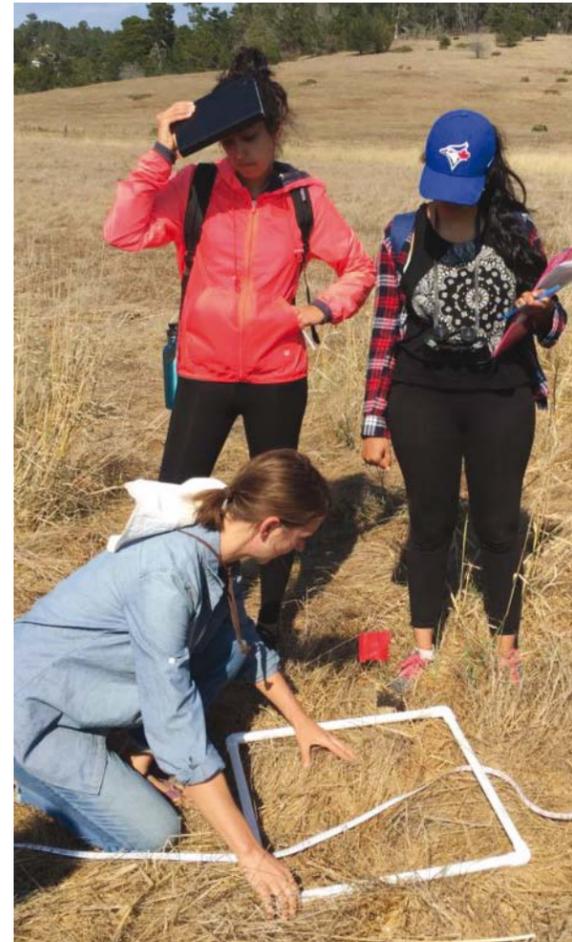
California dreaming

In summer 2016, Professor Christopher Lortie (Biology) took an undergraduate ecology class to the University of California Rancho Marino Reserve, which is home to multiple ecosystems and habitats, including rocky beaches and coastal grasslands and shrubs. He and his students camped there for two weeks and woke up bright and early every day to do research on native and invasive grasslands.

"A really important component of research and education is experiencing not just the challenges, but also the beauty and the dynamic nature of these ecosystems," says Lortie, who runs the field course every two years.

The purpose of the course is to teach experimental design and the principles of field ecology research, and to collect meaningful evidence associated with major ecological issues. During their recent trip, Lortie and his students explored the impact of an invasive grass species on other plants, insects, and animals in the region.

"If only every course could be this experiential," adds Lortie. "For ecology and environmental sciences, environmental studies, even organismal work, if you can get outside, that's the best thing."



A stroll through Toronto's history of public health

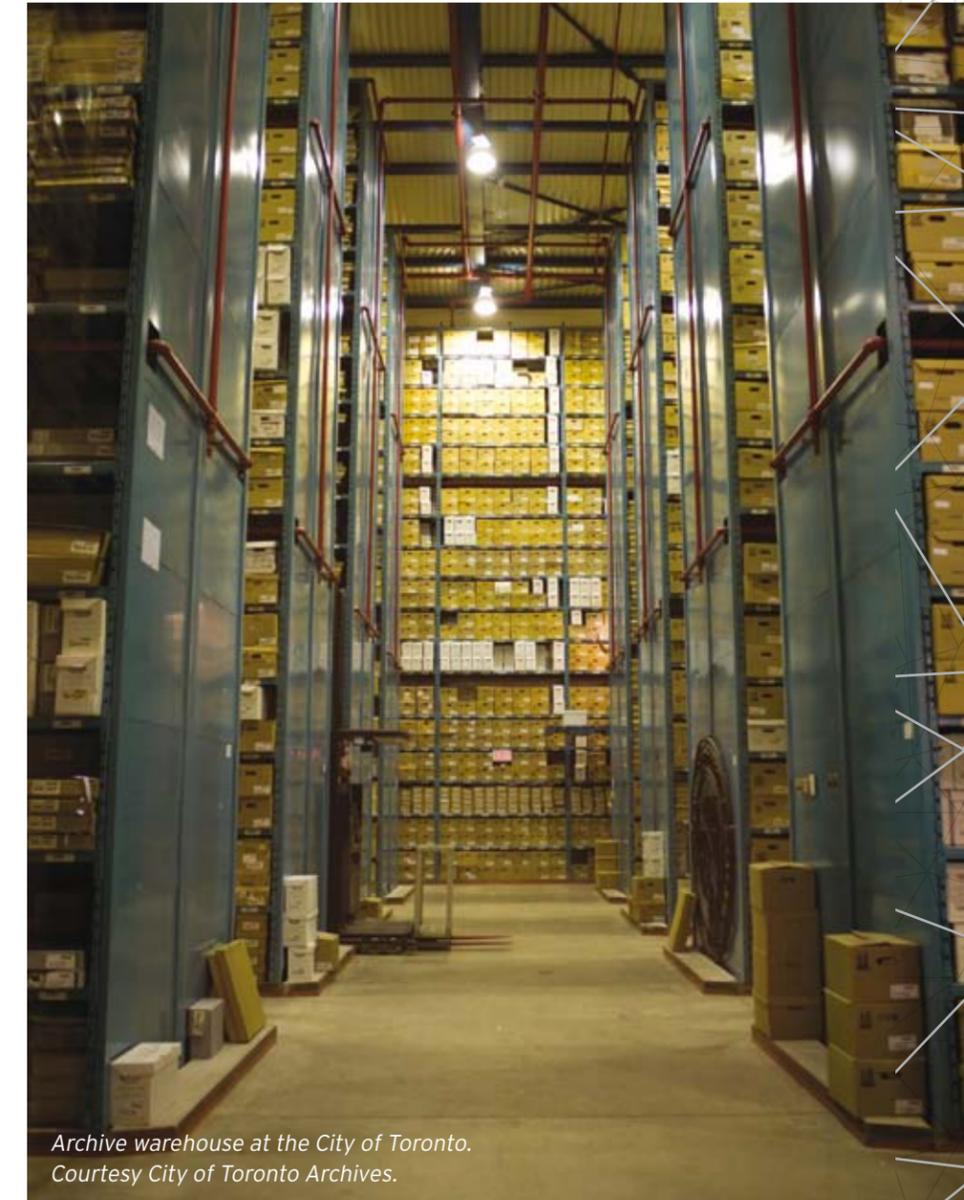
For two years Professor Kenton Kroger (Science & Technology Studies) has arranged a guided tour of the City of Toronto Archives for his undergraduate class Epidemics and the Modern World. The course explores the changing interaction between epidemic diseases, governance and scientific knowledge since the nineteenth century. And the Toronto Archives is a great place to do this.

In winter 2016, archive staff led Kroger and his class on a tour through the vast collection of documents, images and artifacts related to Toronto's public health history.

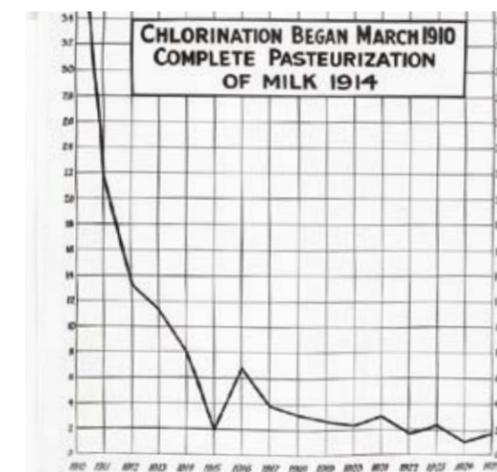
"I am still amazed at the enormous effort and expertise that is required to archive our city's past," says Kroger. "Their staff has to wear climbing harnesses to get at some of this material."

Among the many artifacts that the group explored were placards used to identify homes infected with smallpox, photographs from the city's impoverished "Ward" district, and letters written by soldiers describing the horrors of influenza in 1918-1919. The students also learned how to use archival materials to frame research projects.

"Most of the students I surveyed afterwards thought the tour was both illuminating and important," adds Kroger. "I don't think I could have asked for a clearer mandate."



Archive warehouse at the City of Toronto. Courtesy City of Toronto Archives.



Typhoid fever mortality, Toronto, 1910-1925. Courtesy of City of Toronto Archives.



Vaccination clinic, September 19, 1945. Courtesy of City of Toronto Archives

Integrated Science



In 2016, the Faculty of Science launched the Integrated Science Program, York University's first interdisciplinary program for first-year science students.

Connecting concepts in biology, chemistry, physics and mathematics, the program promotes active participation, collaboration and inquiry in small classes. Science professors and an educational development specialist work closely to integrate and deliver interdisciplinary content. They use evidence-based approaches to teaching and learning science so that the students learn not only science, but also how to learn effectively and think critically.

"Scientific and technological developments that transform society are often the product of new knowledge found at the boundaries of traditional disciplines," said Dean Ray Jayawardhana. "We're excited to offer a new program that starts students on this path of learning and discovery from day one of their university education."

By integrating four key science disciplines, students experience how each area contributes to solving problems that matter to the world. In fall 2016, students explored the habitability of Mars – investigating topics in rocket science, life and planet essentials, and the future prospects of sending humans to the red planet. In the winter term, the program turned its focus to viewing sustainability from different perspectives, including global population dynamics, health, transportation, energy, and food and water systems.

The development of the Integrated Science Program was funded through the Academic Innovation Fund. Twelve professors from all five departments in the Faculty of Science, as well as the Associate Dean of Students and an educational development specialist contributed to the creation of the program.

For more details, visit science.yorku.ca/IS



JESSE ROGERSON: PASSIONATE SCIENCE COMMUNICATOR

Jesse Rogerson is a recent PhD graduate in astrophysics. Under the supervision of Professor Patrick Hall (Physics & Astronomy), his doctoral research focused on understanding the winds generated by supermassive black holes at the centres of massive galaxies. These winds are particularly interesting to scientists because they play an important role in galaxy formation.

Although Rogerson enjoyed being a researcher, he was also drawn to science outreach and communication. Fortunately, at York he found a way to merge his two passions into science communication.

"The world of science is an amazing place full of unbelievable phenomena, and there is no shortage of people who want to know about it," says Rogerson. "I hope to make a career out of informing and engaging people with science."

During his PhD, he was an active team member of the York University Observatory, where he managed, co-produced, and co-hosted the Observatory's weekly radio program, York Universe, among other public outreach endeavors.

He also engaged with media to answer questions about astronomical events like rocket missions, meteor showers and the Northern Lights. News channels like *CTV News* and *CBC Radio* were contacting him regularly, and they continue to call on him after he has graduated.

CATHERINE SPAGNUOLO: GOVERNOR GENERAL'S SILVER MEDAL RECIPIENT

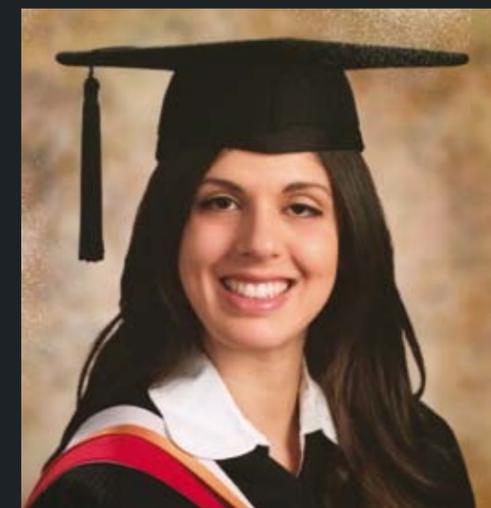
At Spring Convocation, BSc Honours graduate Catherine Spagnuolo received one of three Governor General's Silver Medals awarded each year by York University. The medals are presented to undergraduate students with outstanding scholastic achievements, and Spagnuolo received hers for having the highest average in the sciences. She also graduated First Class with Distinction and is a three-time recipient of the York University President's Scholarship.

As she reflects back on her time at York, one of her fondest memories revolve around teaching fitness classes on campus at Tait McKenzie.

"I really enjoyed helping people become and stay active and healthy," says Spagnuolo.

It was at York that she also discovered her passion for medicine. After taking a breadth of science classes in her first and second years, she found that courses in health and wellness, such as kinesiology and psychology, excited her the most and that it was inevitable she would one day become a physician.

She has now started a Master's in epidemiology at Queen's University.



Acknowledging excellent service

MARLENE CAPLAN

To Marlene Caplan, administrative and graduate program assistant for the Department of Physics and Astronomy, her workplace and colleagues are like her second home and family. She even brought her large owl collection from home and displays it in her office.

Caplan has worked at York for more than 44 years, including 36 years in her current department. Her first full-time job was at York and she has never left.

"Our department is supported by only one administrative assistant, Marlene, and one secretary," says Professor Marshall McCall, the department chair. "What Marlene manages to cope with on a daily basis boggles the mind. Yet, through thick and thin, she greets everyone with warmth and humanity. She is quite frankly one of the most important reasons why any faculty member would even consider becoming the chair."

The best part of her job, Caplan says, is working with students and helping them navigate their studies from start to finish.

"I feel like a mother hen, and all of the students are my little chicks," says Caplan. "I'm like a proud parent when I see them succeed and honoured to know that I was a part of it."

And the students in her department feel the same way about her. She was thrilled when a student initiated her nomination for the Ronald Kent Medal from the Office of the President, which she received in 2002. A framed plaque proudly hangs in her office.

DEBORAH FREELE

Deborah Freele has been a laboratory technician for the Department of Biology since 1981. With her team, she carefully prepares undergraduate biology labs, trouble shoots when there are problems with the equipment, and cleans up after the students have left.

"I like to joke that I am the chef, waitress and busboy for the labs I prep," says Freele. "But I love it."

She is usually responsible for setting up the botany and ecology lab courses – which she enjoys the most and fondly remembers during her time as a student at York. She studied biology in her undergrad at York, and completed a Master's in environmental studies here as well.

"Debbie is a great treasure of our Biology Department," says Ming Jiang, operations manager for the Department of Biology. "You would never have guessed that she has been here for 35 years, as she is so humble, always eager and willing to learn new things and ready for any challenges coming her way. Her smile and good sense of humor has warmed so many hearts and her positive attitude towards life and work has inspired so many."

Although Freele's first job out of school was at a geotechnical company, it was only a few years later that she came back to York for good.

"York has been good to me in many ways, and I work with a great group of people," says Freele. "It's very collegial, and we all look out for one another."

Getting the community revved up about science



BRINGING CANADA'S LARGEST SCIENCE FESTIVAL TO MARKHAM

In spring 2016, York Science joined forces again with Markham Village BIA to bring Science Rendezvous – Canada's largest celebration of science – to the Markham Farmers' Market.

Hundreds of visitors of all ages had the chance to meet with York University scientists and students and participate in exciting science demonstrations and hands-on activities. Highlights included making slime, racing solar cars, digging for dinosaurs, learning the art of aging, planting a seed for Mother's Day and much more.

Science Rendezvous is an annual, all-day festival that takes science out of the lab and onto the streets. Thirty cities across Canada, including various locations in the Greater Toronto Area, hosted events on the same day. All activities were free and open to the public.



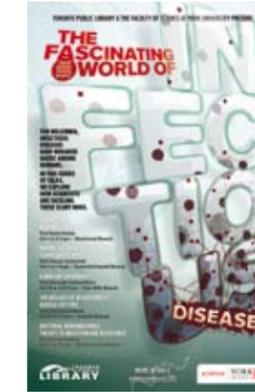
Credit: snapd Markham

MAKING AN 'ASTRONOMICAL' IMPACT ON COMMUNITY

The York Observatory is a beacon of community engagement, welcoming thousands of visitors each year to take tours through the facility and peer through its telescopes to observe the wonders of our universe. The Observatory also hosts online public viewing sessions and produces a weekly student-led radio show, York Universe, which has a global online audience of over 30,000.

Among the highlights of 2016 was a public viewing event hosted by the Observatory and the Astronomy Club at York to watch planet Mercury transit across the face of the Sun. Since the orbit of Mercury lies inside of Earth's orbit, Mercury passes between Earth and the Sun about 13 times per century. From Earth, we see this as a small black dot moving slowly in front of the Sun.

The Observatory set up telescopes and a live feed at York Lions Stadium and invited the entire community to come out and watch.



PUBLIC TALK SERIES EXPLORING THE WORLD OF INFECTIOUS DISEASES

Continuing a recently forged partnership with the Toronto Public Library, York Science launched a new public lecture series titled

The Fascinating (and Sometimes Scary) World of Infectious Diseases. More than 200 people attended the talks, which were held at library branches across the city.

Five York Science professors discussed a range of topics, including harnessing plants' natural defences, the statistics behind infectious diseases, superbugs, disease vectors like mosquitoes and ticks, and nanomachines that enable bacterial infection and resistance. The presenters included Professors Kathi Hudak (Biology), Hanna Jankowski (Mathematics & Statistics), Dasantila Golemi-Kotra (Biology), Jean-Paul Paluzzi (Biology) and Gerald Audette (Chemistry).

SOLD-OUT PUBLIC EVENT ON GENE EDITING

In November 2016, we hosted our second York Science Forum at the Design Xchange in partnership with the Gairdner Foundation. The Forum is an annual public event that explores today's most fascinating mysteries and discoveries in science.

Titled Hacking the Genome: The Brave New World of Gene Editing, the sold-out event explored the new gene editing technology CRISPR-Cas9 and how it is transforming the world of bioengineering. The event was moderated by Paul Kennedy, host of Ideas on CBC Radio, and featured a keynote talk by Feng Zhang, bioengineer at the Broad Institute of MIT and Harvard. A panel discussion followed the keynote and also included York Biology Professors Mark Bayfield and Ron Pearlman.



Planting the seeds of science

The Faculty of Science is proud to offer an assortment of innovative and engaging programs in science, technology, engineering, and mathematics (STEM) for youth. All of our programs are fun, accessible and enriching and are designed to inspire young minds to pursue science education, scientific thinking, and STEM careers. In 2016, we reached more than 2,000 youth.



HELIX SUMMER SCIENCE INSTITUTE

Helix is a science enrichment program for high-performing high school students. The Institute provides a series of week-long, non-credit intensive courses throughout July. In summer 2016, more than 200 students attended – nearly double the number we had in 2015.

“My child had an amazing time at Helix. She was in the Fundamentals of Neuroscience program at Helix, and there she was able to learn undergraduate neuroscience materials, which will be very helpful for her in University, especially since she will be majoring in Neuroscience.”

SCIENCE EXPLORATIONS SUMMER CAMPS (SciX)

SciX are week-long educational day camps that run from July to August for students in grades three to eight. In summer 2016, registrations increased by more than a third compared to the previous year, totalling nearly 600 kids.

“My daughter was thrilled to learn more about computers. It gave her a new sense of confidence to sit down and compose a game that she could then play. I was blown away by the ‘work’ notes she brought home, and by her enthusiasm for learning something during the holidays. ‘It’s like school in the summer, but way more interesting!’ she said.”



MARCH BREAK CAMPS

Our March Break Camp is a one-week version of our Summer Explorations Camps. In 2016, 80 eager kids attended.

“It is a well-organized, fun program run by very enthusiastic mentors. My son learned that science is all around us on a daily basis and could not stop telling us what he had learned each day. This camp is a fantastic way to open young minds to science while having fun at the same time.”

YORK SCIENCE SATURDAYS

York Science Saturdays are multi-week STEM programs available for students in grades three to eight. They run from October to January, and there are even some programs just for girls.

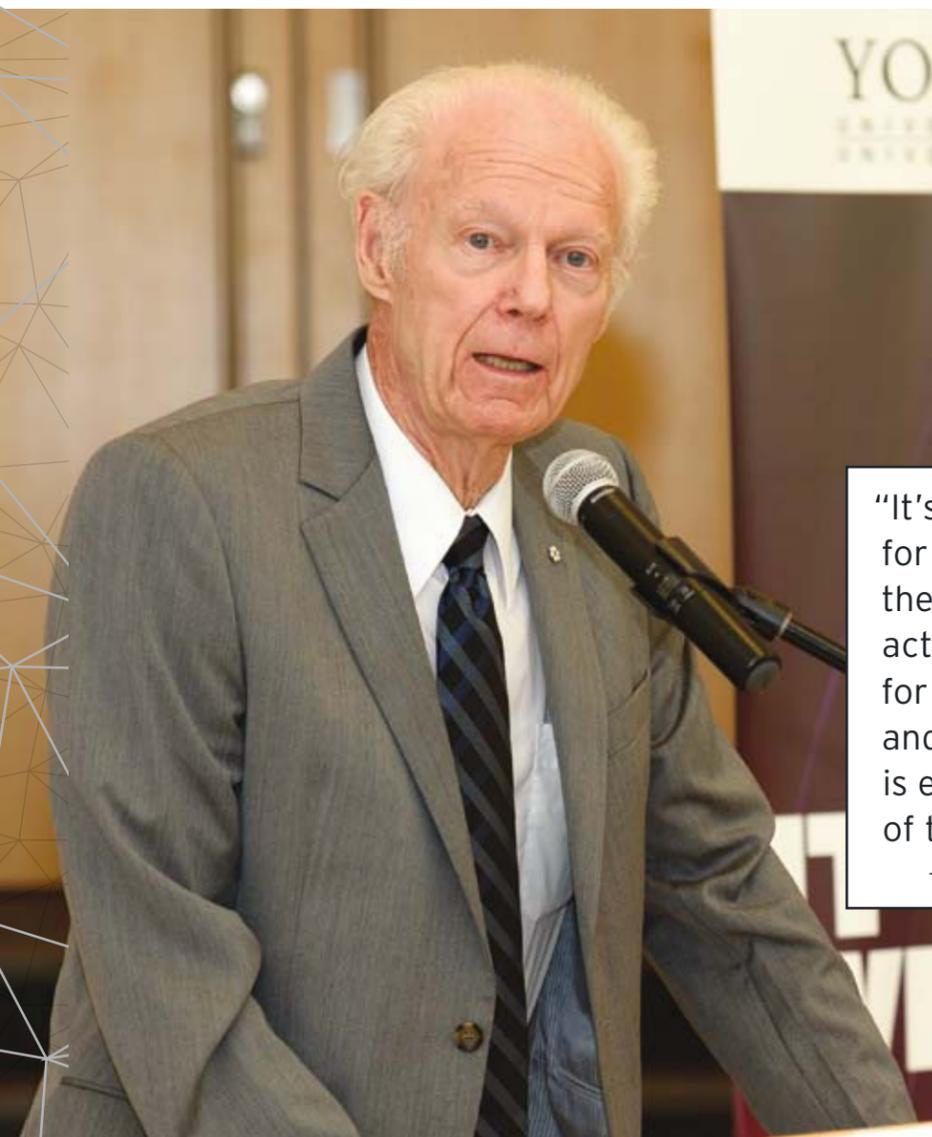
MISSISSAUGA WORKSHOPS

York University Science Workshops in Mississauga are made possible due to the generous support of Amgen Canada. They are held at various library branches throughout the summer.

Learn more about these exciting programs at science-explorations.info.yorku.ca/



Carswell Family Foundation establishes graduate scholarship program



Professor Emeritus Allan Carswell (Physics & Astronomy) and the Carswell Family Foundation made a \$1M gift to establish Carswell Scholarships for graduate students in the Faculty of Science and the Lassonde School of Engineering. The donation created an expendable fund so that York could start awarding the scholarships immediately, as well as an endowment to permanently establish the prestigious Carswell Scholars Program at the University.

At the gift announcement, Carswell noted that it was a very special occasion and opportunity for the Carswell Family Foundation:

"It's a win-win-win situation: a win for not only students, but also for the professors and their research activities, as well as more broadly for the advancement of science and engineering. The Foundation is extremely pleased to be a part of this."

- Allan Carswell

This is not the first gift that Carswell and his family have made to York University. In 2004, Optech, a global company founded by Carswell during his tenure at York, donated \$125K to establish what is now called the Optech Lab at York. To this day, the Optech Lab continues to stage a course on laser physics and atom trapping that is unique to Canada.



James and Marilyn Simons establish new program of postdoctoral fellowships

A \$1.3M gift from James and Marilyn Simons has created the York Science Fellows program in the Faculty of Science. The program will fund at least 12 two-year postdoctoral fellowships, each valued at \$72K per annum, including contributions from the Faculty and supervisors.

Postdoctoral fellowships are essential research opportunities that enable early-career scientists to pursue exciting science and establish themselves as independent researchers. Fellowships are critical to the success of the scientific enterprise by fostering new discoveries and enhancing collaborations.

Patricia Weisenfeld, vice-president of special initiatives at the Simons Foundation, attended the gift announcement on behalf of the Simonses and passed along the following words from them:



"York is first rate. The science is outstanding and they have a world-class faculty. When I visited I was really impressed by the diversity of the student body, many of who are first in their family to go to university. This is an encouraging phenomenon – and it is especially uplifting in these times."

- James Simons

"We all know the importance of the postdoc and mentoring experience and we are pleased to help expand the opportunities for young scientists and researchers at York. York is a place that embodies our values of excellence and aligns with our belief that when we invest in talented young scientists, we invest in our understanding of our world. It is our hope that such knowledge will shape a future that is beneficial to people and our planet."

- Marilyn Simons



A spotlight on outstanding alumni



BOYANA KONFORTI

Boyana Konforti (York BA 1984) has worn multiple hats throughout her career – as a scientist, writer, editor and professional speaker – but has always been committed to communicating science effectively to a wide range of audiences, the scientific community and the public.

After receiving her BA from York, she completed a PhD in biochemistry at Stanford University, followed by postdoctoral fellowships in RNA splicing at Columbia University and Rockefeller University.

Passionate about science communication, she launched her career as an editor in the science publishing world. She was chief editor of *Nature Structural & Molecular Biology* and the launch editor of *Cell Reports*, and contributed broadly to the success of these publishing groups by providing strategic and editorial leadership and forming strategic partnerships and collaborations. She also co-authored the textbook *The Molecules of Life: Physical and Chemical Principles* (Garland Science/Taylor & Francis Group, LLC, 2012), which is currently being used at the undergraduate and graduate levels.

Konforti is now the first director of education and outreach at the Simons Foundation, a private foundation in the United States dedicated to advancing research in basic science and mathematics. In this role, she is building and leading initiatives to engage the public with the process of science. Specifically, she and her team have launched an initiative called Science Sandbox (sciencesandbox.org), which seeks to unlock scientific thinking in all people so that science becomes a more integral part of our culture.

JAMES O'SULLIVAN

James O'Sullivan (York BA 1986, JD/MBA 1990) is a senior leader in Canada's banking sector and someone that York University is proud to call its very own. His interests in mathematics and finance were cultivated at York, where he earned a BA in mathematics followed by a joint JD/MBA degree from Osgoode Hall Law School and the Schulich School of Business.

James is currently the group head of Canadian banking at Scotiabank, where he directs all retail, small business, commercial banking, wealth management and insurance operations in Canada, as well as the bank's administrative function of shared services. He has been with Scotiabank since 1990, and has held several senior leadership roles in investment banking, mergers and acquisitions, finance and asset management. Most recently, he served as the executive vice president of global wealth management.

A community-active graduate, O'Sullivan is past chair of the Board of Directors at Humber River Hospital, a current board member of Soulpepper, Toronto's largest not-for-profit theatre company, and has recently engaged with the Faculty of Science as a volunteer participant on alumni career panels for students studying mathematics and statistics.

He is an alumnus of Canada's Top 40 Under 40 awards.



The Horsehead Nebula and the Flame Nebula. They are part of the Orion Molecular Cloud Complex, a huge collection of nebulae and young stars in the constellation Orion.

Photo taken by recent York Science student Richard Bloch.

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