

FACULTY OF SCIENCE  
ANNUAL REVIEW

# Rising to the Challenge



# 2020



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## A Message from Dean Rui Wang

I joined the Faculty of Science in 2020, at the beginning of a year like no other. Throughout the challenges created by COVID-19, the Faculty of Science continued to excel. This success was due to the efforts of every member of our community.

What did we achieve in 2020? Our leading researchers contributed to Canada's fight against COVID, with dozens of critical papers published that will further our understanding of the virus, and contribute to our recovery. Faculty members joined government task forces, held virtual seminars, helped inform government policy, and undertook media commentary educating the public about the virus. I could not be prouder of these efforts.

During this time, our faculty continued to publish groundbreaking research in the areas of Physics & Astronomy,



Chemistry, Biology, Mathematics & Statistics, and Science & Technology Studies. Many received recognition for their work through awards and funding for their research. In fact, in 2020, the Faculty of Science achieved a \$1.1 million increase in research funding compared to our average funding level over the last five years. We were also the driving force behind a new Organized Research Unit at York University – the Centre for Bee Ecology, Evolution & Conservation, a home for interdisciplinary bee research.

In 2020, our undergraduate student enrolment increased. Faculty members supported students through the transition to remote learning, innovating to deliver programming in a fully online format. This included virtual field courses, digital lab work, and a bridging program to help first year students transition to university remotely. Our talented and hard-working students were resilient through this all –



maintaining high standards of academic excellence and finding creative ways to support each other through this time.

Though challenging, we continued to strengthen our community outreach. Our Science Engagement Programs transitioned to a fully virtual format, using Zoom to deliver programming for thousands of elementary and high school students. Our observatory launched new online programming, spreading a love for astronomy across the globe. Audiences for its weekly live broadcasts from its one-metre telescope at times topped 15,000 viewers.

Diversity is also an important part of our Faculty of Science community. In 2020, we furthered our efforts surrounding Equity, Diversity & Inclusion (EDI), facilitating EDI and accessibility workshops and working to establish an EDI subcommittee of Faculty Council.

Amidst the challenges brought about by COVID-19, the Faculty of Science was determined and persistent in its vision and strategic direction. We developed the Faculty's five-year plan for strategizing

physical space requirements and priorities for space creation and optimization with short, medium, and long-term goals. We also developed a 10-year Advancement plan to map out our philanthropic efforts and objectives.

Last but not least, we undertook our Faculty-wide strategic planning process for 2021–25, “Science for the Future.” This plan will guide our mission and success, enhancing our academic and research excellence, and ensuring our faculty is a diverse, welcoming, and encouraging community for our students, faculty, researchers, and staff.

The Faculty of Science is a community, and in 2020, when we were tested, we rose to the challenge. I know we will continue to reach even greater heights as we work together to build a better future for our communities and the world at large.

**Rui Wang**

Dean, Faculty of Science  
York University

By the numbers

**160**

Faculty members  
(Full-time)

**99**

Staff

**20**

Undergraduate  
programs

**11**

Graduate programs

**37**

Postdoctoral Fellows  
& Visitors

**4,295**

Undergraduate students  
64.2% Canadian  
35.8% International students

**418**

Graduate students  
67.5% Canadian  
32.5% International  
students  
Includes Full-Time and  
Part-Time students

**5**

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

**1**

Division:  
Natural Science

**10**

Student clubs & societies

**\$70.9**  
**million**  
Total annual budget

**\$17.8**  
**million**  
Total research funding revenue

**\$16.7**  
**million**  
5-year average research  
funding revenue (2015–2019)

**\$847.6**  
**thousand**  
Total fundraising amount  
\*Based on Advancement fiscal year:  
May 1, 2020–April 30, 2021

**5**

Fellows of Royal Society  
of Canada, current

**9**

Fellows of Royal Society  
of Canada, emeriti

**10**

Canada Research Chairs

**10**

York Research Chairs

**3**

Endowed Chairs

**5**

Organized Research Units

**4**

Faculty-based research  
facilities and equipment centres:

1 Core Analytical Facility (NMR Spectroscopy,  
Microscopy, and Mass Spectroscopy),  
2 Technical Shops, 1 Science Store)

# The Fight Against COVID-19

*Faculty of Science researchers at the forefront of Canadian and international efforts to help control the virus and prevent future outbreaks*

**I**n his home office, under lockdown, Mathematics & Statistics Professor **Jianhong Wu** peered at his computer screen and looked at a complex read-out of projections. Wu, Canada Research Chair and Director of York's Advanced Disaster, Emergency and Rapid Response Simulation initiative (ADERSIM), leads a national network of infectious disease modellers. Their goal: to develop mathematical technologies to assess transmission risk of COVID-19 and project outbreak trajectories.

What he saw concerned him deeply. "All our data told us, early on, that COVID-19 was going to be an incredibly challenging scenario to manage – both here at home,

and internationally," Wu says. "We had to marshal all our resources." Over the course of the pandemic, Wu, along with other Faculty of Science professors, joined with researchers across York and beyond in an interdisciplinary effort to research key aspects of the pandemic, inform government policy, and communicate vital information to the public. They published dozens of critical research papers, joined government task forces, organized online events, and engaged in frequent media commentary about the virus.

Building off his pivotal role during the 2003 SARS outbreak, Wu took on the role of co-leading the Fields Institute for Research in Mathematical Sciences –





*“All our data told us, early on, that COVID-19 was going to be an incredibly challenging scenario to manage – both here at home, and internationally.”*

a national COVID-19 math modelling team – advising public health officials assessing the transmission risk of COVID-19 and the trajectory of potential future outbreaks. Wu and fellow Mathematics & Statistics professors **Huaiping Zhu** and **Jane Heffernan** received federal funding as co-applicants with the Fields Institute to mobilize this national network.

All three professors received CIHR COVID-19 rapid research grants, as did Mathematics & Statistics professor **Seyed Moghadas**. Their work included a highly publicized contact tracing study, projections surrounding the scope of disease transmission, and research around vaccinations and effectiveness of interventions, including an analysis that found Ontario government measures had a substantial effect on mitigating virus transmission in the first wave. In September 2020, Professor Wu was honoured with a Minister’s Award of Excellence from the Ontario government for his contributions during the pandemic.

Professor Huaiping Zhu, a Tier 1 York Research Chair and Director of York’s Canadian Centre for Disease Modelling (CCDM), took on the important task of working with Toronto Public Health to help inform their decision-making with COVID-19 predictive modeling and forecasting.

“Our team began working with and supporting Toronto Public Health in summer 2020,” says Zhu. “As a result,

the City of Toronto’s forecasting and predictions have been largely based on our modelling results.” Zhu is also the Director of the Laboratory of Mathematical Parallel Systems (LAMPS), leading an initiative surrounding Ontario climate change data; you can read more about his work in this area on page 31.

**O**ther Faculty of Science researchers also played leading roles in informing policy surrounding the pandemic: Professor Wu was appointed to join Canada’s COVID-19 Vaccine Modelling Task Group for the National Advisory Committee on Immunization, and Ontario’s COVID19 Modelling Consensus Table. He and Professor Moghadas also joined the Expert Group on Modelling Approaches of the Office of the Chief Science Advisor of Canada. Professor Heffernan was appointed to the COVID-19 National Dashboard with Health Canada, used to inform key decisions regarding personal protective equipment supply and demand. She was also recently appointed as a Scientific Advisor to the COVID Immunity Task Force, along with Professor Zhu. And, York modellers have all been invited to the Public Health Agency of Canada Modelling Expert Group for COVID-19.

Professor Heffernan, co-director of CCDM, was also among a core group of Faculty of Science researchers interviewed regularly by local and national media.

## York Science highlights

“Public outreach was crucial from the outset,” Heffernan says. “As new information arrived, we had to assess it and act quickly. We had a limited window to try and inform policymakers and the public about the interventions most likely to mitigate the virus’ spread.”

**D**asantila Golemi-Kotra, Associate Professor in the Department of Biology, commented widely in the media on issues related to COVID-19.

“There was such a groundswell of information out there, and a lot of it was competing or contradictory,” she says. “My goal was to deliver the scientific rationale for public health interventions in a manner the layperson could understand. I wanted to help make these important health decisions – around mask-wearing, social distancing, what to worry about when it comes to new variants of COVID – more accessible for the general public.” Golemi-Kotra is currently engaged in research surrounding microbial infections. To read more about her work, see page 27. Golemi-Kotra also received a Minister’s Award of Excellence from the Ontario government for her contributions to the fight against COVID-19.

**R**esearchers’ efforts to understand, predict, and control the virus also extended beyond Canada’s borders.

An international collaboration focused on controlling COVID-19 in Africa, led by **Jude Kong**, Assistant Professor in the Department of Mathematics & Statistics, received \$1.25 million in funding from the Government of Canada International Development Research Centre (IDRC). Kong is founding director of the Africa-Canada Artificial Intelligence and Data

Innovation Consortium and a member of CCDM. In this project, researchers from York collaborate with organizations across Africa to predict the spread of COVID-19 and provide modelling that will help policymakers manage the virus. Professor Wu is also a key collaborator. To read more about this project, see page 26.

Professor Zhu’s CCDM research team also published an important analysis of shelter hospitals in Wuhan, China during the COVID-19 epidemic that received international profile in the Bulletin of the World Health Organization. They organized a weekly distinguished lecture series on “Mathematics and COVID-19” which featured leading international speakers discussing how mathematics can contribute to the understanding of SARS-CoV-2 to inform public health policy decision-making.

Researchers’ efforts also helped inform policymakers south of the border: Professor Heffernan presented work on COVID-19 vaccination program modelling to the Gates Foundation and the US CDC in December. Professor Moghadas and colleagues published important research surrounding hospital utilization during COVID-19 outbreaks in the United States.

**I**n the Department of Chemistry, faculty members added to our understanding of how to better detect the virus and mitigate its transmission.

Distinguished Research Professor **Sergey Krylov** received federal funding for a project to develop rapid and accessible COVID-19 diagnostics, based on detection of viral coat proteins. The tests will be used not only in hospitals but also in other points of need such as airports. His team

*“Our strength through this pandemic has been our research and critical mass of expertise – but it has also been demonstrated in our capacity for collaboration and community outreach.”*

is also working on creating a simple test for self-application.

“The standard method for diagnosing COVID-19 has been based on detection of viral RNA. It is sensitive and specific but slow and requires highly specialized facilities,” says Krylov. “To deal with the pandemic, and prevent future outbreaks, we need to deliver COVID testing that is reliable, fast, and accessible.” You can read more about Krylov’s research on page 33.

Where personal protective equipment (PPE) is concerned, antimicrobial agents currently in use present health risks and potential environmental toxicity.

**Jennifer Chen**, Associate Professor in the Department of Chemistry, received funding to research modifications to textiles and non-woven materials with antimicrobial properties that would increase the protection of cloth-based PPE. Her research also tapped the expertise of aerosol scientists within the Department to examine the filtration efficiency of materials to provide evidence-based guidelines for cloth-based masks.

**I**n the Department of Biology, Professor and York Research Chair **Chun Peng**’s team studied the influence of sex, age, and estrogens in determining who contracts COVID-19.

“Our research suggests that estrogen has a protective effect against COVID-19,” says Peng. The study found a significant decrease in the incidence rate of COVID-19 among females of reproductive

age compared with males in the same age group.

**Vivian Saridakis**, Associate Professor in the Department of Biology, along with her collaborator, **Gillian E. Wu**, Professor Emeritus and former Dean of the Faculty of Science and Engineering, delved into the influence of genomics on COVID-19. They hypothesize that variations in the genomic sequences of the virus may play a pivotal role in geographic differences in rates of COVID-19 infection, transmission, and deaths. Using bioinformatics approaches, they are analyzing genomic variations and their resulting structural changes, in order to establish the roles of these variations in COVID-19 infection.

The Faculty of Science’s research prowess and impact on public policy is evident in its approach to the COVID-19 pandemic, notes Professor Wu.

“Our strength through this pandemic has been our research and critical mass of expertise – but it has also been demonstrated in our capacity for collaboration and community outreach,” Wu says. “Although we have all been socially distanced during the pandemic, we worked together across departments and faculties, with our community in the GTA, and more broadly on the national and international stage to help understand this virus and mitigate its impact. We can be proud of our collective contributions to the fight against COVID-19, and the level of impact we achieved.”

# Innovating the Transition to Remote Learning

*With in-person classes moving to virtual platforms in Spring 2020, the Faculty of Science rapidly innovated to deliver a top-tier remote learning experience to its students during COVID-19. Beyond moving all in-person courses fully online, faculty and staff devised creative pedagogical methods of enriching remote learning and research.*



PROFESSOR  
DAWN BAZELY

**Biology professor Dawn Bazely transformed her Biodiversity & Watershed Management field course** into a fully remote format, assembling and mailing out lab kits to help students learn experientially from their own homes.

The kits included items such as cardboard microscopes, macro lenses to turn their smartphone cameras into dissecting microscopes; symbiotic cultures of bacteria and yeast (SCOBY); pH strips; soil to grow plants; seeds, and more. Bazely's remote fieldwork project was featured in a highly-publicized global JoVE webinar in their series, Remote Learning: Findings from a Crisis Period.

When it comes to pedagogical innovation, Bazely believes open communication with students is key.



"[The students] were the knowledge co-creators and collaborators with me in this pedagogical journey," Bazely told JoVE Journal's blog.

**The Faculty of Science's Advanced Light and Electron Microscopy Facility** went fully remote in Summer 2020, enabling graduate students and faculty to use lab microscopes via Zoom.

The facility, part of YSciCore, provides researchers in the Faculty of Science, as well as researchers from other York faculties, with instrumentation to view their samples in high resolution.

Users are supported remotely by staff on webcams using Zoom or Microsoft Teams; screen sharing is used to operate instruments.

"Our graduate students and faculty have remarked on the ease of using the remote facility and the capacity to achieve high resolution images they may not have captured otherwise," says Robert Tsushima, Chair of the Department of Biology.



Where on-site work is required, the lab has adhered to stringent protocols surrounding cleaning, contact tracing, and personal protective equipment; electronic bookings are mandatory and spaced to avoid contact with other researchers.

**The Faculty of Science offered a virtual Science Summer Transition Program** in Summer 2020 to help incoming students with the transition from high school to university, during a time when they could not be on campus.

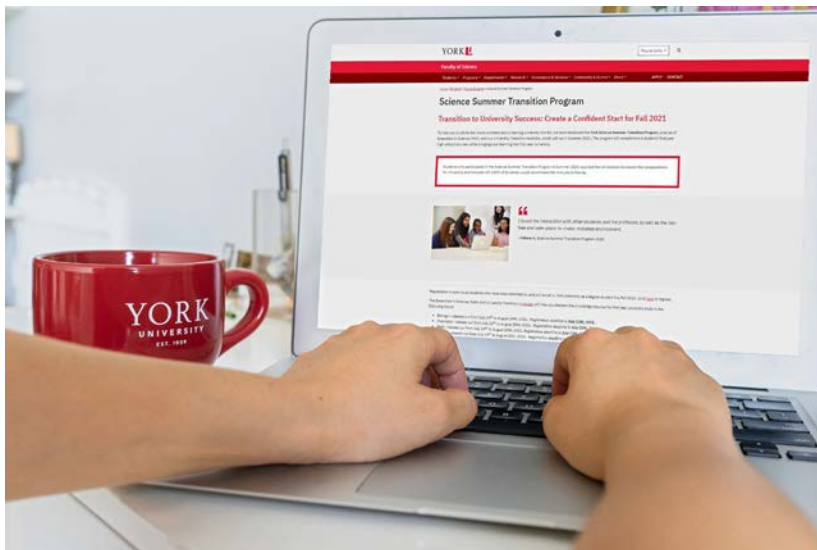
The program offered a series of Essentials in Science, Math, and University Transition modules, taught by full-time York University instructors. Each summer module course consisted of five weeks of online learning.

The fifth module, “The University Experience” offered strategies for success at university. Students had the opportunity to discuss material and chat with their

future university classmates, as well as gain a feel for the university class experience. Students received several hours of live discussion each week with instructors, as well as practice assignments and quizzes to provide feedback on their progress.

Registration was open to all students who had been admitted to and planned to enrol in York University as a degree student in Fall 2020. The modules were all non-credit courses; the \$50 cost for each was reimbursable as a credit upon successful completion of the course.

Students who participated in the Science Summer Transition Program in Summer 2020 reported that all modules increased their preparedness for University and between 89-100% of students would recommend the modules to friends. The program is scheduled to run again in Summer 2021.



*Each summer module course consisted of five weeks of online learning.*

# Dean's Round Up 2020

## January

The Faculty hosted its annual Honours & Awards Ceremony on January 29 to celebrate the hard work and achievements of faculty and students. More than 400 students, family members, faculty members and staff attended the event.

## February

Our Science Communicators in Residence organized a variety of training opportunities for our researchers, including a photography workshop series taught by B.D. Colen and a seminar about collaborating with museums presented by Patchen Barsz.

## March

Department of Mathematics & Statistics professors Seyed Moghadas, Jianhong Wu, Jane Heffernan, and Huaiping Zhu received funding from the Government of Canada for COVID-19 rapid research projects.

## April

The Faculty launched a new \$50,000 Science Summer Student Success Fund (S4F) to help students succeed in remotely delivered summer courses.

## May

Twenty researchers in the Faculty of Science received NSERC Discovery Grants totaling approximately \$4 million. Of note, Jennifer Chen (Chemistry) and Amro Zayed (Biology) received the Discovery Accelerator Supplement valued at \$120,000 over three years.

## June

The Faculty launched the York Science Summer Transition Program for high school students starting university this fall. The program consisted of five summer module courses which ran from July 20 to August 24.

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The Centre for Bee Ecology, Evolution & Conservation (BEEc) became an Organized Research Unit. It brings together biologists, mathematicians, engineers, social scientists, and economists to tackle pressing environmental problems contributing to the bee crisis.

*Read more on page 29.*





## July

The York Observatory's public viewings on YouTube gained in popularity during COVID-19, with a substantial increase in viewership. This increase in online viewers means the program reaches a wider audience than ever before.

*Read more on page 40.*

## August

The Faculty's one-metre telescope celebrated its one-year anniversary on August 19 with a YouTube stream featuring Physics & Astronomy Professor Paul Delaney and special guest, Dr. Allan Carswell, Physics Professor Emeritus and philanthropic supporter of the Faculty of Science.

## September

Student enrolment (FFTE) for the Summer 2020 term increased by 32.3%, versus enrolment for Summer 2019.

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The Faculty of Science welcomed nine new faculty members: Kyle Belozarov, Christine Le, Kevin McGregor, Pavlos Motakis, Jesse Rogerson, Carly Rozins, Pam Sargent, Ryan Schott, and Mark Vicari.

## October

The Faculty hosted a Graduation Reception on October 28 attended by approximately 100 participants, including graduates and their families, faculty, staff, and alumni.

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Two \$25,000 scholarships for undergraduate and graduate mathematics students at York University were founded in memory of the late Dr. Sara Maghdoori.

*Read more on page 38.*

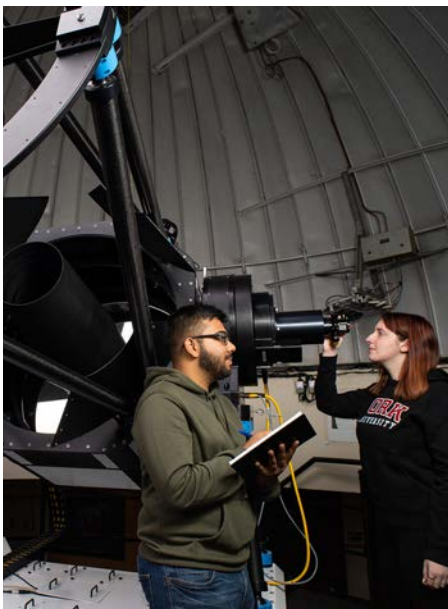
## November

A study on lake ice, warming temperatures, and winter drownings led by Biology professor Sapna Sharma put Faculty of Science researchers in the spotlight, with widespread international media coverage.

*Read more on page 17.*

## December

The faculty of Science held its holiday party on December 17, 2020 via Zoom. More than 90 Science faculty and staff members attended this annual celebration, which featured a virtual quiz game and York U bookstore prizes.



## In the Media

Physics & Astronomy Professor **Paul Delaney** continued his long-standing public engagement work, completing approximately 150 media interviews in 2020. Delaney is a regular and popular commentator on astronomical events on TV, radio, and in print media. Some of the many topics Delaney delved into include the supermoon, habitability on Mars, the planetary conjunction, NASA and SpaceX missions, asteroids, blackholes, supernovas, and space junk. His commentary was featured in outlets including *CTV News*, *AM 640*, *AM1010*, *Sirius XM*, *Global News*, *CBC Toronto*, *CityNews*, *Breakfast Television*, and many more.



Research on wild bee declines by **Sandra Rehan**, Associate Professor in the Department of Biology, showed linkages to plant-pollinator network changes and plant species introductions. The study, “Wild bee declines linked to plant-pollinator network changes and plant species introductions,” was published in the journal *Insect Conservation and Diversity*. The paper was featured in approximately a dozen news outlets, and has received extensive social media attention. Media coverage included a live interview on *CTV News*, a story in *American Association for the Advancement of Science (AAAS) Eureka Science News*, and a mention in *Newsweek*.





In a paper in the distinguished journal *Nature*, the ALPHA collaboration, including Physics & Astronomy Professor **Scott Menary**, detailed the first-ever documentation in antihydrogen of a phenomenon called the Lamb shift.

The phenomenon was first observed in hydrogen by Willis Lamb and Robert Retherford in a Nobel-prize winning experiment in 1947. In a critical next step in the study of the physical properties of antimatter, the ALPHA group measured the Lamb shift in antihydrogen to be consistent with values for the Lamb shift in hydrogen, highlighting yet another key symmetry between matter and antimatter.

The story was covered widely by national and international media outlets, including *Nature News and Views*, *Wired*, *Scientific American*, *New Scientist* and more.



Image: Maximilien Brice, CERN

A study on lake ice, warming temperatures, and winter drownings led by Biology Professor **Sapna Sharma** put Faculty of Science research in the spotlight internationally. Sharma and her co-authors analyzed 4,000 drownings in 10 countries, including Canada, Russia, Finland, Germany, Sweden, and the United States, and found warming winter air temperatures were a good predictor of the number of drownings. The story garnered coverage in *The New York Times*, *The Washington Post*, *Scientific American*, *BBC News*, *CTV News*, *Reuters*, *Forbes*, *CBC News*, *The Globe and Mail*, *National Post*, *Toronto Star*, *City News*, *Global News*, *680 News*, *The Conversation*, *The Weather Network*, *Gizmodo*, *Phys Org News*, *Radio Canada International*, *Weather.com*, *Science Daily*, *UPI*, and *Smithsonian Magazine*, as well as numerous regional newspapers and broadcast outlets across Canada and the US.



# External Honours & Awards Highlights



**Physics & Astronomy Professor Eric Hessels** received the prestigious 2020 CAP Medal for Lifetime Achievement in Physics from the Canadian Association of Physicists. It is the first time in the association's history that it has gone to a York Department of Physics & Astronomy professor. The annual medal recognizes distinguished service to physics over an extended time or a recent outstanding achievement.



**Mathematics & Statistics Professor Jianhong Wu** and **Biology Professor Dasantila Golemi-Kotra** each received a Minister's Award of Excellence from the Ontario government for their contributions to the fight against COVID-19. The awards were announced by the Ontario Ministry of Colleges & Universities in September 2020.

**Biology Professor Paula Wilson** was recognized with a President's University Wide Teaching Award, in the category of full-time tenured faculty with 10 or more years of full-time teaching experience. Wilson's nominators highlighted her dedication to students and her support of teaching and learning broadly in the Department of Biology and the Faculty of Science.





**Chemistry Professor Sergey Krylov** was awarded the title of Distinguished Research Professor. The title is given to active members of the academy in recognition of their scholarly achievements in research. Krylov's nominators highlighted his international leadership and sustained, globally recognized excellence in the field of analytical chemistry, benefitting the health and well-being of communities nationally and internationally.

**Faculty of Science Dean Rui Wang** was appointed as a Fellow of the Royal Society of Canada (RSC). Fellows of the RSC are distinguished Canadians from all branches of learning who have made remarkable contributions in the arts, humanities, and sciences, and Canadian public life.



**Mathematics & Statistics Professor Jane Heffernan** and **Chemistry Professor Derek Wilson** were awarded prestigious Research Fellowships at the University of Bordeaux. Heffernan's fellowship focused on mathematical models of in-host dynamics to quantify the development of immune system memory after vaccination. Wilson's fellowship focussed on new methods to analyze interactions between RNA and proteins.

**Physics & Astronomy Professor Saeed Rastgoo** was selected to represent York University as a member of the European Cooperation in Science & Technology (COST), as part of the CA18108 – Quantum Gravity Phenomenology in the Multi-Messenger Approach. COST's main objective is to gather representative theoretical and experimental working groups to investigate the prediction and possibility of detection of physical phenomena characteristic from quantum gravity theories.



**Postdoctoral Fellow Nicola Luigi Bragazzi** in the Laboratory for Industrial and Applied Mathematics (LIAM) received a 2019 Mosaic of Autoimmunity Award, a bi-annual award established to encourage progress in autoimmunity research. The ceremony for the award was held during the International Congress on Autoimmunity in May 2020.

# Internal Honours & Awards Highlights

## Select Faculty Awards

Established Researcher Award	Derek Wilson
Early Career Research Award	Ryan Hili
Excellence in Teaching Award – Senior Tenure Stream	Michael S. Chen
Excellence in Teaching Award – Junior Tenure Stream	Hovig Kouyoumdjian
Excellence in Graduate Mentorship Award	Andrew Donini

## Select Post Graduate Awards

NSERC Alexander Graham Bell Canada Post Graduate Scholarship	Eleni Fegaras
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## Select Graduate Student Awards

Richard Jarrell Award of Excellence for Teaching Assistants	Olga Andriyevska Gurnoor Brar
CIHR Doctoral Frederick Banting & Charles Best Canada Graduate Scholarships	Wonsuk Jahng
Dalton Pharma Services/Dr. Douglas Butler Award	Brandon Khan
Elia Scholars Program	Deniz Sadighbayan
NSERC Alexander Graham Bell Canada Graduate Scholarship – Doctoral	Gehrig Carlse Tamari Chkuaseli
NSERC Alexander Graham Bell Canada Graduate Scholarship – Master’s	Krstina Banyameen Alessia Colussi
Peter Moens/AGSBS Graduate Award	Simon L’Allier
Susan Mann Dissertation Scholarship	Anita Buragohain Paige Whyte-Fagundes

## Select Undergraduate Awards

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York University President's Scholarships

Katerina Disimino  
Sophie Eisen  
Minoosh Fathi  
Jacob Fine  
Anita Misrop  
Sarah Pullano  
Greta Raffoul

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Chancellor Cory Entrance Scholarship

Amanda Guerrieri

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International Excellence Scholarship

Sibei Qin  
Chloe Reno

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Schulich Leader Scholarship

Rathesh Balendran  
Katrina Carver  
Nadav Gasner  
Kezia Johnson

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York International Internship Award

Firas Baroodi

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York Renewable Entrance Athletic Scholarship

Daniel Everton  
Samantha Henneberry

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York Science Scholars Award

Sara Ava  
Sahill Bajwa  
Sabrina Brusco  
Natalie Casola  
Lomesh Choudhary  
George Cieszynski  
Ahmed Dar  
Claire Del Zotto  
Devon Haas  
Darah Kerr  
Zena Khadour  
Aaiza Khan  
Lorna Krelove  
Jade Lew  
Nhu Nguyen  
Amen Okungbowa  
Satnam Purewal  
Ailiya Rizwan  
Elizaveta Yakubovskaya

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# \$17.8 million

Total funding awarded in 2020

\$6.3 million

Canada Foundation for Innovation

\$5.6 million

Natural Sciences and Engineering Research Council of Canada

\$1.4 million

International Development Research Centre

\$1.9 million

Foundations

\$483 thousand

Industry

\$128 thousand

Mitacs

**\$693**  
**thousand**

Canadian Institutes  
of Health Research

**\$276**  
**thousand**

Social Sciences and Humanities  
Research Council

**\$500**  
**thousand**

Canada Research Chairs

**\$48**  
**thousand**

Fields Institute

**\$36**  
**thousand**

Ontario Genomics Institute /  
Genome Canada

**\$220**  
**thousand**

Subgrants

**\$203**  
**thousand**

Other

# Research Funding Highlights

**Chemistry Professor Derek Wilson** received an NSERC Collaborative Research and Development Grant worth \$1,040,000 for his project, “The Technology Enhanced Biopharmaceuticals Development and Manufacturing (TEBioDev) initiative.” With additional cash and in-kind contributions from industry, the total funding for this project will amount to \$2.2 million over four years.

**Mathematics & Statistics Professor Jude Kong** received over \$1.2 million in funding from the International Development Research Centre (IDRC) for an international collaboration focused on controlling COVID-19 in Africa, which he is leading. Researchers from York are joining with organizations across Africa to predict the spread of COVID-19 and provide modelling that will help policymakers manage the virus.

**Physics & Astronomy Professor Eric Hessels** received \$888,000 from the Gordon and Betty Moore Foundation for the project “EDM3: an electron Electric Dipole Measurement using Molecules in a Matrix.”

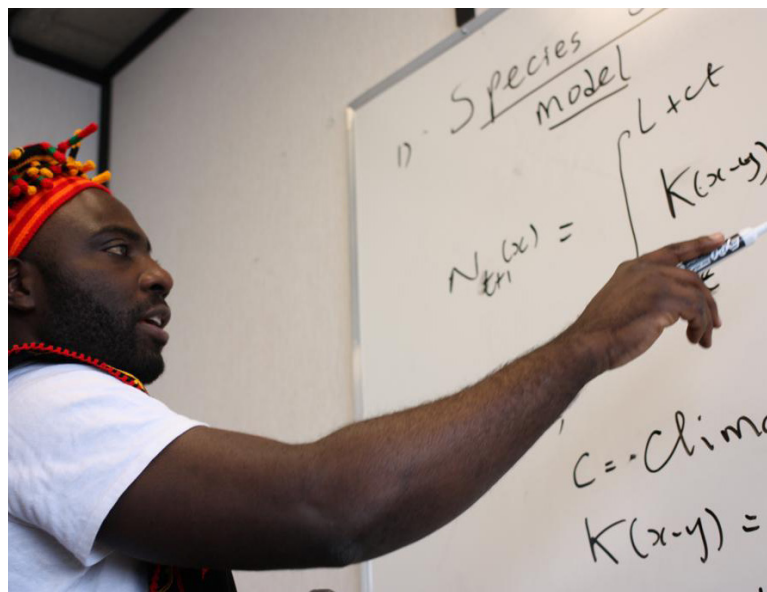
**Mathematics & Statistics Professor Seyed Moghadas** was awarded \$264,000 from Canadian Institutes of Health Research (CIHR) for “Evaluation of Intervention Strategies in Response to the COVID-19 Outbreaks.”

**Chemistry Professor Sergey Krylov** received \$225,000 from Canada Foundation for Innovation (CFI) for “Development of Rapid and Accessible Diagnostics of COVID-19 using Small-molecule Probes Binding SARS-COV-2 Coat Proteins.”

**Biology Professor Georg Zoidl** is a co-PI on a New Frontiers in Research Fund – Exploration program grant totaling \$250,000 for the project “A Fully-Implantable mm-Scale Neuro-Stimulator for Temporally-Precise Single-Cell-Resolution Optogenetics.”



PROFESSOR DEREK WILSON



PROFESSOR JUDE KONG



**Physics & Astronomy Professor Joel Zylberberg** is a co-PI on a New Frontiers in Research Fund – Exploration program grant totaling \$250,000 for the project “Training AI systems with brain activation patterns of human experts during vision-based tasks.”

**Twenty researchers in the Faculty of Science** received NSERC Discovery Grants totaling approximately \$4 million. Of note, Jennifer Chen (Chemistry) and Amro Zayed (Biology) received the Discovery Accelerator Supplement valued at \$120,000 over three years.

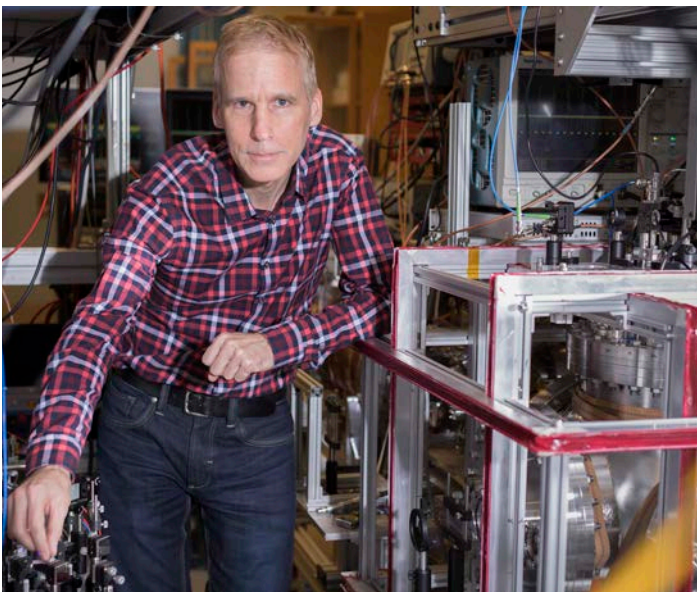
The recipients in Science include: Mark Bayfield, Nassim Bozorgnia, Jennifer Chen, Claire David, Edward Furman, Dasantila Golemi-Kotra, Deborah Harris, Scott Kelly, Nikola Kovicich, Sergey Krylov, Anantharaman Kumarakrishnan, Neal Madras, Ozzy Mermut, Jean-Paul Paluzzi, Chun Peng, Sapna Sharma, Sean Tulin, Trevor VandenBoer, Karl White, and Amro Zayed.



PROFESSOR  
JOEL ZYLBERBERG



PROFESSOR  
JENNIFER CHEN



PROFESSOR ERIC HESSELS



PROFESSOR GEORG ZOIDL

## Predicting and preventing COVID-19 in Africa

Faculty of Science researchers are joining with organizations across Africa to predict the spread of the COVID-19 pandemic and provide modelling that will help policymakers manage the virus in real time.

**Jude Kong**, an assistant professor in the Department of Mathematics & Statistics, Faculty of Science, and a member of the National COVID-19 Modelling Rapid Response Task Force at York, is leading an interdisciplinary team of more than 50 researchers from key academic and government institutions in nine African countries and Canada.

“In this research collaboration, we’re working with organizations in Africa to develop mathematical models and simulations of COVID-19 for specific regions,” says Kong. “Our aim is to give national and municipal policymakers practical knowledge and tools

that they can apply to predict, suppress, and mitigate the impact of the virus.”

The project, *Predictive modeling and forecasting of the transmission of COVID-19 in Africa using Artificial Intelligence*, received funding of more than \$1.2 million from the International Development Research Centre (IDRC). It is one of nine projects selected for funding through the Global South AI4COVID Response Program, focused on low and middle-income countries.

The project will also examine ways to address the spread of misinformation about COVID-19 prevention and treatment.

“Part of our work is to measure the effectiveness of current public health interventions surrounding COVID-19,” says Kong. “In this manner, we can understand whether a particular intervention is appropriate, equitable, feasible, and cost-efficient.”

The collaboration joins the Faculty of Science’s research strengths in disease modelling with experts in global health, artificial intelligence and emergency management. Professors from three faculties and four major research centres and laboratories at York are contributing their expertise to the project, including Distinguished Research Professor and Canada Research Chair Jianhong Wu, Department of Mathematics & Statistics.

In conjunction with the project, the Africa-Canada Artificial Intelligence and Public Health Data Modelling Consortium has been established and will be co-chaired by Wu and Professor Bruce Mellado of University of the Witwatersrand, South Africa. The Consortium will examine the disproportionate impact of the pandemic on marginalized populations such as women, rural communities, informal workers, and others.



# Fighting infectious diseases one bug at a time

**Dasantila Golemi-Kotra**, Associate Professor in the Department of Biology, is delving into how viral and bacterial infections become resistant to treatment, and what we can do about it.

Infections caused by either viruses or bacteria involve interactions between a variety of biomolecules such as DNA, RNA, proteins, and metabolites.

“A primary goal of current medical treatments out there is figuring out how to tamper with these biomolecular interactions in the most efficient way,” Golemi-Kotra says. “Now, the million-dollar question becomes, ‘can we find a way to inhibit bacterial or viral infections, without giving rise to resistance?’”

Golemi-Kotra notes that bacteria have developed resistance to almost all antibiotics currently in use, leading to an escalating health crisis.

“We can keep making new antibiotics and resistance will keep developing,” Golemi-Kotra says. “We urgently need innovative strategies to address this.”

She notes that bacteria have the potential to develop antibiotic resistance fairly easily due to the high mutation rate of its genome and “genetic cross-talking” among bacteria.

“With respect to bacterial infections, we are interested in understanding the evolution of antibiotic resistance factors,” she says. In particular, her group is studying signaling mechanisms involved in antibiotic resistance in pathogenic bacteria, especially methicillin-resistant *Staphylococcus aureus* (MRSA). This strain has acquired resistance to almost all clinically used antibiotics including vancomycin, an antibiotic of last resort.



“If we can prevent bacteria from sensing and responding to antibiotics, we may be able to put a break into the evolution of antibiotic resistance.

Of course, the first line of defense is to stop people from getting sick at all – we have certainly seen that with the pandemic,” Golemi-Kotra says. “But on the flip side, when they do get sick, we need effective interventions that can treat the disease.”

# Building better vaccines faster

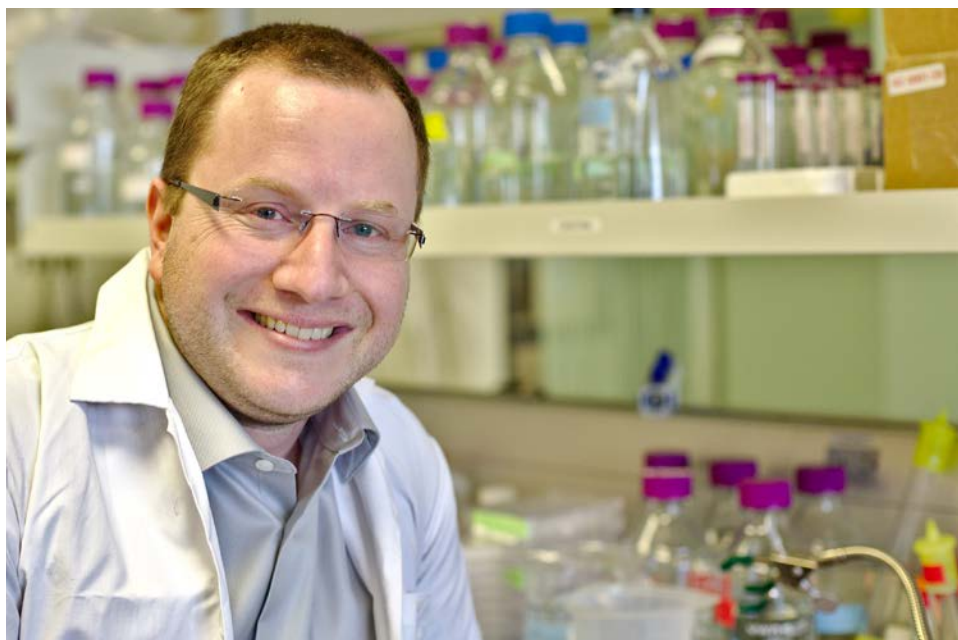
How can we develop effective vaccines while accelerating their safe clinical application? The COVID-19 pandemic brought this question into the spotlight as researchers raced to develop vaccines to combat the virus.

Chemistry professor **Derek Wilson** (above), post doctoral researchers **Jessica Duprez** and **Mike Cohen**, together with Sanofi Principal Scientist **Andrew James** have developed a platform that allows researchers to skip animal testing of vaccines and move them more rapidly (and safely) to human trials.

“Essentially, we apply the vaccine to donated blood samples instead of injecting it into people, and then use a technology called ‘mass cytometry’ to get a very detailed picture of how the immune system has responded to vaccine/adjuvant exposure,” Wilson says.

His team has published research using the mass cytometry approach on classical vaccines, including diphtheria, tetanus, and pertussis. Preliminary results revealed an expansion and changes in the immunophenotype of naive, effector, and memory T-cells, as well as other immune cells including B cells, monocytes, and NK cells.

“The need for vaccines that can be developed both safely and rapidly has always been pressing,” Wilson says. “In 2020, with the COVID-19 pandemic, we unfortunately saw a real-time example of just how crucial this is. COVID-19 vaccines were developed impressively fast – in a year’s time,” he says. “Can we develop vaccines even faster in future? We believe so, yes.”



Wilson’s project, “Characterizing the Immune Response to Novel Vaccine Candidates in a Human Whole Blood Assay Using High-Dimensional Single Cell Proteomics,” is funded by Mitacs and carried out in partnership with Sanofi Pasteur.

“Our research has the potential to transform the way new vaccines can be assessed before and throughout clinical development to anticipate and considerably de-risk vaccine strategy,” Wilson says.

In 2019, he was the recipient of a major, four-year NSERC grant for his Technology-Enhanced Biopharmaceuticals Development and Manufacturing (TEBioDev) initiative. The project creates new bioanalytical technologies to accelerate pre-clinical development and enable precision manufacturing of protein therapeutics. The initiative links platforms developed by Canadian instrument manufacturer SCIEX, through unique technologies, methods and expertise held primarily at York University to the drug development pipelines of Canada’s research-active biopharmaceuticals companies Sanofi Pasteur, Treventis and Immunobiochem.

Wilson is Vice President of the Canadian Society for Mass Spectrometry, Director of the Technology-enhanced Biopharmaceuticals Development and Manufacturing Initiative, and is presently a Visiting Scholar at the prestigious Bordeaux IDEX program.

# World-leading bee research takes flight in Centre for Bee Ecology, Evolution & Conservation

Bees play an important role within our ecosystems. As pollinators, they create vital food sources for animals and one third of the food we consume. Biology Professor **Amro Zayed**, Tier 2 York Research Chair in Genomics, is leading York University's new Centre for Bee Ecology, Evolution & Conservation (BEEc) to help bees flourish.

"Our aim is to understand and protect our bees and the vital services they provide to our ecosystems," says Zayed. "To achieve this goal, we bring researchers into an interdisciplinary, collaborative environment to help develop policies and environmental management for the long-term sustainability of bees."

The BEEc, which officially became an Organized Research Unit (ORU) in 2020, brings together biologists, mathematicians, engineers, social scientists, and economists to tackle the pressing environmental problems contributing to the bee crisis.

Recently, Zayed's team studied African hybrid honey bees (AHB), also known as killer bees, to understand why they are defensive and hyper-aggressive.

"AHB's are a genetics experiment gone wrong," says Zayed, a co-author on the research led by former Department of Biology PhD student Brock Harpur.

In the 1950s, researchers in Brazil imported a honey bee subspecies from South Africa and bred them with European-derived honey bees. They escaped and mated with the local bees. New AHB colonies rapidly reproduced and spread across Brazil, South and Central America, and the southern

United States. The resulting bees were highly invasive and aggressive.

"The genetics causing this hyper defensiveness were not well known, but the prevailing wisdom was that killer bees are aggressive because South African bees are aggressive," Zayed says.

Their findings showed that the most defensive colonies in the study were more related to South African honey bees, with the exception of several regions of their genome that influence aggression. Here, they were more related to honey bees from Western Europe. "That is – it was the mixing of these two honey bee subspecies that led to hyper aggression," says Zayed.

The study was published in the journal *Genome Biology and Evolution*.

PROFESSOR AMRO ZAYED IN HIS FACULTY OF SCIENCE LAB



# Probing the dark matter in our galaxy

**Nassim Bozorgnia**, Assistant Professor in the Department of Physics & Astronomy, is studying the distribution of dark matter, with the aim of helping identify what it's made of, how it came to be, and what this can tell us about our universe.

Understanding the nature and distribution of dark matter in the Milky Way has long been a fundamental problem in astroparticle physics that has stymied researchers.

“In particular, uncertainties in the dark matter distribution in our galaxy represent a significant problem,” says Bozorgnia. “It obfuscates the interpretation of direct and indirect dark matter detection data, and prevents us from making a precise determination of the particle physics properties of dark matter.”

Dark matter is composed of particles that cannot be directly observed or detected through electromagnetic activity as they do not absorb, reflect, or emit light. The long-term goal of Bozorgnia's research is to identify the particle nature of dark matter through its distinct signatures on the galactic dark matter distribution.

In pursuit of this goal, Bozorgnia employs different approaches to probe the distribution of dark matter in the Milky Way, including the use of high resolution cosmological simulations and recent high precision astronomical data.

In one such approach, Bozorgnia studies the properties of Milky Way-like halos in state of the art hydrodynamical simulations of galaxy formation and their implications.

“I start by identifying simulated galaxies that are similar to the Milky Way,” Bozorgnia says. “The next step is to extract their dark matter



density and velocity distribution. I then use these distributions in the analysis of data from dark matter experiments.”

In another approach, Bozorgnia studies the interaction of dark matter subhalos with stellar streams. Stellar streams are an association of stars orbiting a galaxy that was once a cluster or dwarf galaxy, that has been torn apart and stretched out along its orbit by tidal forces. Analyzing the features created by these interactions in stellar streams can lead to a measurement of the dark matter subhalo mass spectrum, and provide important information on the particle nature of dark matter.

“We have this cloud of mystery surrounding dark matter,” says Bozorgnia. “This is largely because we have so much yet to learn about it. I hope my research can further this understanding, help shed light on the nature of dark matter, and piece together its puzzle.”

# Open sustainability: Bringing climate change data to policymakers and the public

A provincial climate data portal launched by Faculty of Science researchers in 2018 has scaled into a success, providing accessible climate change projections to 10,000 users to date.

The portal was developed by the team at the Laboratory of Mathematical Parallel Systems (LAMPS), led by Mathematics & Statistics Professor **Huaiping Zhu**. It hosts 120 years of Ontario climate data displayed in an easily understandable format that's accessible on a range of devices, including mobile phones.

"In developing this portal, we were motivated by a conviction that our response to climate change can only be as strong as the data we have available to fight it," says Zhu, a Tier 1 York Research Chair who is also the Director of York's Canadian Centre for Disease Modelling (CCDM).

"Policymakers, analysts, and private sector consultants responsible for input into climate change policy need authoritative, actionable information. Our goal was to create something that was accessible for them, and also for members of the public," Zhu says.

The portal's climate projections are being used to assess risk and guide climate change policy and adaptation plan development. Prominent users include the former Environmental Commissioner of Ontario and the spokesperson for Environment and Climate Change Canada.

Zhu and his collaborators recently published a paper in *Nature Scientific Data* detailing the inner workings of the portal. It outlines how the portal provides a super ensemble of projections under various greenhouse gas concentration trajectories adopted by the Intergovernmental Panel on Climate

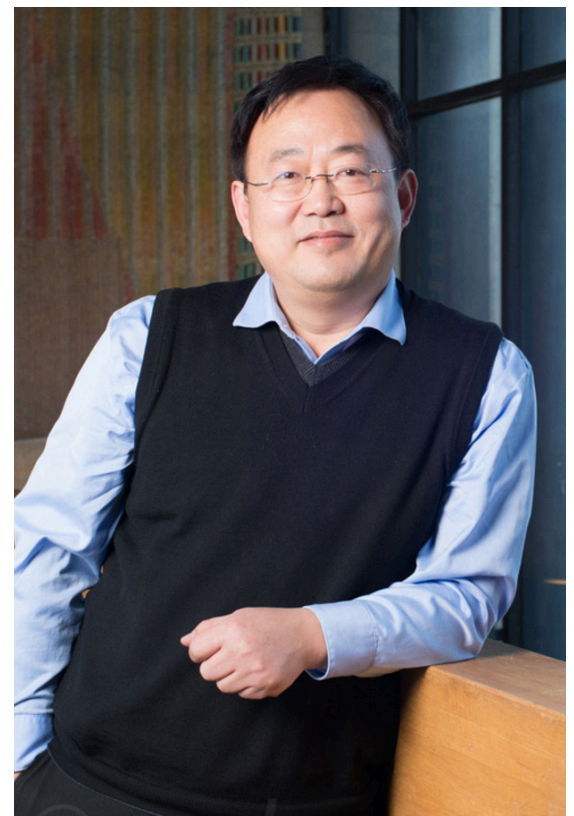
Change, offering users thousands of static and interactive maps, trend lines, summary tables, reports and downscaled data.

Projections were developed from a range of sources, including conventional weather station observations, comprehensive reanalysis, and downscaled data.

"We also discuss how we are striving to improve the portal to expand its capacity, like the inclusion of historical analyses and enhancing its functionality for those accessing the portal through mobile devices," says Zhu.

In addition, the portal will fill an important gap by serving as an invaluable source of data and training for undergraduate and graduate students.

Co-authors on the *Nature Scientific Data* paper include other York colleagues in LAMPS, Lassonde School of Engineering, and the Faculty of Environmental and Urban Change, along with SLR Consulting (Canada).



## One step closer to solving antimatter puzzle



Where did all the antimatter in the universe go, and why have we been left with such an abundance of matter?

Physics & Astronomy Professor **Sampa Bhadra** is part of the international T2K collaboration that is unravelling this mystery by studying the behaviour of sub-atomic particles called neutrinos.

Neutrinos were produced in huge numbers following the Big Bang; researchers create them in high-energy particle accelerators in order to study them. As the project leader for T2K's Optical Transition Radiation (OTR) detector, Bhadra examines the behaviour differences between neutrinos (matter) and antineutrinos (antimatter) to help illuminate this unsolved fundamental question of physics.

"My research role in T2K involves looking at the difference in the behaviour of muon neutrinos and muon antineutrinos in

flight as they change states into electron neutrinos and electron antineutrinos respectively, in a phenomenon known as neutrino-oscillation," Bhadra says. "Any clear difference in the behaviours will shed light on the observed asymmetry and will be a leap forward in our field."

Bhadra explains that the laws of physics should be symmetric or the same for matter and antimatter – but this doesn't appear to hold true in nature. This is fortunate as otherwise the universe would be bathed only in energy – and we would not exist," Bhadra says.

For this condition of matter-antimatter imbalance to hold, the theoretical condition of "Charge-Parity" (CP) symmetry, which relates the behaviour of matter versus its counterpart, had to have been violated. Many researchers believe this was effected by neutrinos in the early universe.

The T2K team has found the strongest indication yet of this violation of Charge-Parity symmetry between neutrinos and antineutrinos; their results were published in the journal *Nature*.

"This is a critical step forward in our understanding of what caused the imbalance between matter and antimatter, and in turn, the origins of our universe, but more work is needed to definitively prove it," says Bhadra, who is also a TRIUMF affiliate scientist.

"Neutrino transformations are a beautiful way to study the matter-antimatter asymmetry in the universe. What can be more exciting than studying a particle that may hold the clue to our very existence?"

The T2K collaboration consists of close to 400 scientists from 12 countries, including Canada.



# Developing rapid testing for COVID-19

In order to prevent the spread of COVID-19, accuracy and speed of diagnostics are crucial.

**Sergey Krylov**, Distinguished Research Professor in the Department of Chemistry, is developing a faster COVID-19 test based on detection of viral coat proteins.

Currently, viral RNA detection is used to diagnose COVID-19, a process that is specialized and can be time-consuming.

“The current process for diagnostics requires specialized facilities – the tests are sensitive and specific, but slow,” says Krylov.

Krylov’s interdisciplinary team is developing rapid diagnostics facilitated by small-molecule probes (SMPs) selected from DNA-encoded libraries (DELs) for their ability to bind viral coat proteins. This work is being done in collaboration with two other chemistry groups led by Faculty of Science researchers Ryan Hili and Chris Caputo.

“Prior to the COVID-19 outbreak, we were focussed on utilizing this platform for cancer diagnostics and drugs,” Krylov says. “Once the pandemic began, we quickly pivoted the research to apply it to the development of tests for SARS-CoV-2.”

Krylov’s interdisciplinary research team is partnering with COVID-19 testing facilities at two Toronto hospitals and with several private sector labs. The tests will be used not only in hospitals but also in other points of need such as airports. They are also working on creating a simple test for self-application.

The project, “Development of Rapid and Accessible Diagnostics of COVID-19



using Small-molecule Probes Binding SARS-COV-2 Coat Proteins,” received \$225,000 from Canada Foundation for Innovation (CFI); the funding was used to acquire an analytical system for characterizing DELs and SMPs.

“Our plan is that this equipment will become a long-term component of our research program that can benefit the health of Canadians throughout the pandemic and beyond,” Krylov says.

In 2020, York University awarded Krylov the title of Distinguished Research Professor. In bestowing the award, York University President and Vice-Chancellor Rhonda Lenton cited Krylov’s “international leadership and sustained, globally recognized excellence in the field of analytical chemistry...[that has] benefitted the health and well-being of communities nationally and internationally.”

## York Science Scholars Award supports high-achieving students

The York Science Scholars Award (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.

The program, now in its third year, is once again open to applications for the next cohort of bright students with a passion for science. Both Canadian and international students are eligible.

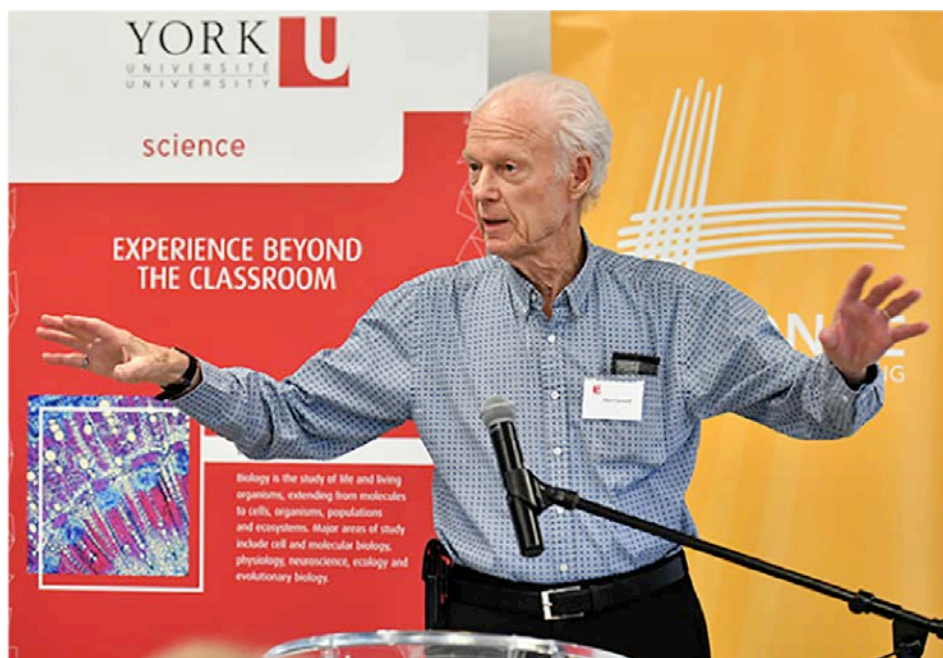
For the summer position, the student is paired with a faculty mentor and conducts hands-on experiential research learning in leading-edge facilities. That research could be focused on sustainable energy, sensory information, perception, microscopic organisms, gene expression and much more.

### **The York Science Scholars Award Winners for 2020 are:**

Sara Selina Ava; Lomesh Choudhary; Sahill Bajwa; Sabrina Laura Brusco; Natalie Sophia Casola; George Alexander Cieszynski; Ahmed Dar; Claire Del Zotto, Devon Haas, Darah Patena Kerr, Zena Khadour; Aaiza Khan; Lorna Maureen Ferguson Krelove; Jade Ariel Lew; Nhu Thao Nguyen; Amen Okungbowa; Satnam Singh Purewal; Ailiya Rizwan; Ethan Myles Sooklal, and Elizaveta Yakubovskaya.



# Carswell Scholars one step closer to realizing their dreams



Seven PhD students – five from the Faculty of Science and two from the Lassonde School of Engineering – are this year’s new Carswell Scholars.

The award provides this group of high-achieving students – the fifth class of Carswell Scholars – with the opportunity to delve further into their research, from nanochemistry and self-driving cars to computer vision and population genetics of bees.

The new scholars were celebrated during an online Zoom event highlighting their achievements and thanking Dr. Allan Carswell, Physics Professor Emeritus, and his family, for their generous gifts to York.

The Carswell Scholars program was first established in 2016 with a \$1-million gift, which created a permanent endowment and expendable fund for Carswell Scholarships.

“Our Carswell Scholars represent the very best among our graduate students in the Faculty of Science and the Lassonde School of Engineering,” says Faculty of Science Dean Rui Wang. “This exceptional group of talented young PhD candidates are pioneering research that is creating positive change in our society.”

The research conducted by this year’s Carswell Scholars confront pressing challenges, surrounding sustainable energy, biodiversity, genetics, the health impacts of particular chemical compounds, and mitigating the effects of natural disasters like earthquakes.

## Students & Trainees

### Meet the new York Science Carswell Scholars

#### JENNA BRAUN

PhD candidate, Biology

“I am a community ecologist and the overarching focus of my research is understanding how positive interactions between plants and insects support biodiversity in dryland ecosystems. Insect-plant interactions are a diverse set of mechanisms that support ecosystem function globally but have been largely neglected in the design of restoration projects. My hope is that this research will improve our understanding of resiliency in dryland communities and the success of ecosystem restoration projects.

This award will enable me to focus more closely on my research. So far, this gift has made it possible for me to obtain memberships for scientific associations

which will enable me to network with professionals. In the coming year I plan to use these funds to attend a beetle taxonomy course hosted at the University of Arizona which will greatly improve my identification abilities. My career goal is to manage a research lab in academia or the government, where I can contribute to ecosystem research and management.”



#### GEHRIG CARLSE

PhD candidate, Physics

“I am currently working on performing precise measurements of gravitational acceleration using ultracold atoms. This experiment involves using lasers to cool a gas of rubidium atoms to one hundred

thousandth of a degree above absolute zero. While researching these measurements, I have also developed a new technique for characterizing the magnetic moment and sublevel populations of such ultracold gases using direct imaging. This research has been made possible by the new class of high-

power diode laser systems that I helped develop as part of an industrial project. I have also investigated the kinematics of micro-particles confined by a free-space

optical tweezers on timescales at which diffusive motion transitions to ballistic motion. Through these studies, I have developed a new technique to rapidly characterize and measure the masses of trapped particles on a scale of 10-14 kg with a precision of 2%.

The Carswell Scholarship has been an incredible boost to my graduate studies, and I am sure that I am not unique in this regard. The award is really allowing me to concentrate more on my studies without having to worry as much about my financial situation. Additionally, having this increased level of financial support, has allowed me to be more selective in the teaching opportunities that I am pursuing. So far, I find myself enjoying and putting more thoughtful preparation into my teaching, and an increased level of engagement. Both of these factors are helping me to become a better communicator and instructor, skills that will benefit me moving forwards in my studies and my career thereafter, in academia or otherwise.”



## **MOLLY HU**

### **PhD candidate, Chemistry**

“My research in DNA-encoded libraries (DELs) attempts to tackle current issues in disease processes. Through combining nature-based systems with chemical synthesis, DELs advance current drug development capabilities by focusing resources on a select number of promising scaffolds. My work focuses on improving the application of DELs. One of my current projects aims to develop new methods to diversify currently druggable targets, such as cell surface proteins, and evolve effective small molecules for advancing the development of suitable treatments. To date, DELs have yielded many effective small molecule drugs, and are widely regarded as an effective tool in the pharmaceutical industry.

This gift encourages me to pursue my

passion, and provides me with the opportunity to focus my time and energy on my research here at York, by alleviating financial burdens and living expenses. I longed to have the opportunity to be in an environment where I am able to push the boundaries of science through research, and have the opportunity to distill that information to inspire future generations of researchers. I look forward to having the opportunity to use my leadership and mentorship abilities to engage students and foster their ambitions for research, and collectively contribute to advancement in the scientific field.”



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## **DANIEL PERSAUD**

### **PhD candidate, Chemistry**

“My research is focused on using atmospheric deposition to better understand per and polyfluoroalkyl substances (PFAS). These anthropogenic compounds have been used since the 1950s in the non-stick and fire suppressant industry. However, PFAS are known to result in adverse health effects such as endocrine disruption and have carcinogenic properties. Another issue is the persistence in the environment. Once released, these compounds do not undergo any degradation process and can be subsequently transported to remote locations including the high Arctic. The mechanism that facilitates this transport is unknown. To investigate this, we use ice cores (dating 1967–2016) to obtain a temporal record and precipitation at different latitudes to determine the spatial distribution of PFAS.

Growing up in a less privileged society presented many financial and academic

difficulties, however, it also revealed the importance of obtaining a quality education. This scholarship will assist in my goals by reducing the teaching assistantship burden and allowing me to exclusively focus on my current research projects. I would like to personally express my gratitude to the Carswell Family Foundation for ensuring a level playing field for applicants, and supporting international students.”



## Students & Trainees

### JENNIFER PORAT

PhD candidate, Biology

“Non-coding RNAs undergo a number of processing steps, including post-transcriptional chemical modifications. My work is focused on investigating the role of these modifications in RNA stability and functionality. I study the tRNA methyltransferase Trm1p, which is responsible for catalyzing the dimethylation of nuclear and mitochondrial tRNAs at G26. Using an assay our lab has developed to monitor tRNA processing, I have demonstrated that Trm1p has a role in tRNA maturation independent of catalysis, suggesting a novel function for Trm1p that does not rely on its ability to modify substrates. We hypothesize that Trm1p may therefore function as an RNA chaperone and use this function to promote tRNA structure by resolving misfolds. Current experiments involve looking at tRNA structure and function in the presence and absence of Trm1p to further our knowledge of how tRNA modification enzymes function in RNA quality control. I hope that my work can inform the way we approach future treatment options.



This generous scholarship has provided me with the funds and extra time to devote to focusing on my research, for which I am extremely grateful. Working in the lab and puzzling over experiments has become a passion of mine, and I am thrilled to have this support in continuing to pursue my studies. After my PhD, I would like to pursue post-doctoral training (preferably still studying RNA, but I'm open to any interesting topics I may happen across!), with the hopes of one day getting a faculty position and opening my own research lab.”



## \$50,000 gift to Faculty of Science by family of late Dr. Sara Maghdoori



**T**wo \$25,000 scholarships for undergraduate and graduate mathematics students at York University have been founded in memory of Sara Maghdoori, by her family.

Sara Maghdoori was a Graduate Research Associate and Teaching Assistant in the Faculty of Science's Department of Mathematics and Statistics. She passed away in February 2020 after a battle with cancer.

The scholarships, which total \$50,000, are intended to help support ambitious students for years to come, in an academic field of pursuit that Sara considered the language of universe – mathematics.

“We wish to extend our sincere appreciation and gratitude to Dr. Maghdoori's family for this generous gift,” says Dean Rui Wang. “Sara exemplified our faculty's values of community engagement and dedication to excellence in research. This talented and vibrant young woman touched many in our community – especially students. This scholarship will help keep that spirit of giving alive.”

# Spreading a love for astronomy across the globe

The Allan I. Carswell Observatory took its in-person viewings online in 2020, furthering its reach to astronomy lovers around the world.

Pre-COVID-19, about 5,000 visitors annually attended the Observatory's Wednesday night public viewings.

During the pandemic, the Observatory transitioned to a weekly YouTube livestream, broadcasting images from its one-metre telescope to audiences that at times topped 15,000 viewers. Many astronomy

enthusiasts also tuned into the popular "YorkUniverse" radio show hosted by York students and faculty on Monday nights on astronomy.fm online.

"The Observatory has been an incredible vehicle for public engagement and outreach since its inception in 1969," says

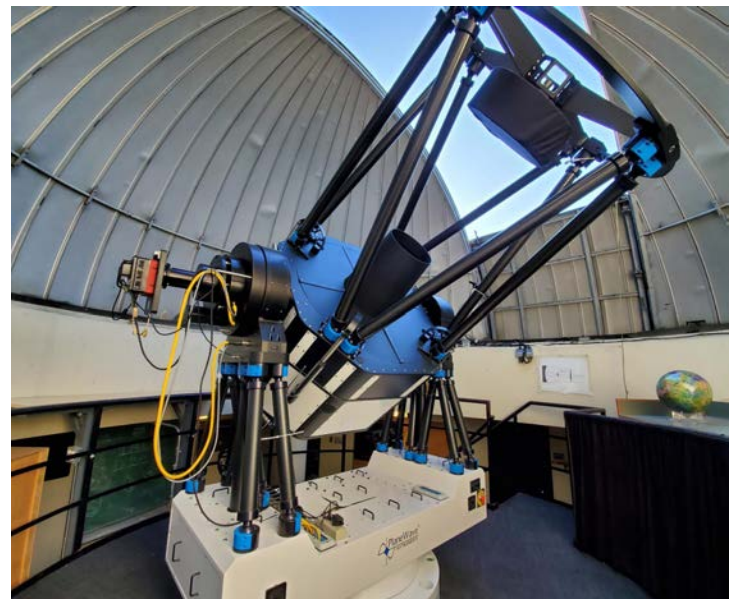
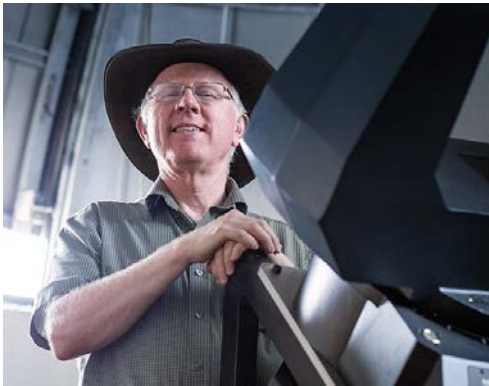
**Paul Delaney, Professor of Physics & Astronomy, Observatory Director and Allan I. Carswell Chair for the Public Understanding of Astronomy.** "During the pandemic, we knew we had to keep our public viewings accessible. What we did not perhaps anticipate was such an enormous surge in interest during this time."

The one-metre telescope was established as a result of a 2017 donation from **Emeritus Professor Allan I. Carswell** and the **Carswell Family Foundation**. It is the largest telescope on a Canadian university campus. The observatory was renamed the Allan I. Carswell Astronomical Observatory in recognition of this donation.

Delaney notes that observatory colleague **Elaina Hyde, Assistant Professor of Physics & Astronomy**, played a key role in the transition to online viewings and the program's success.

"I want to underscore the great success Professor Hyde has generated with the online YouTube activities," Delaney says.

"The view statistics I think are simply amazing and show the power of the observatory's reach. We have also developed a significant social media presence, so expect more great numbers in the months and years to come."





# Science Engagement Programs go virtual

York's Science Engagement Programs offer innovative and engaging programs designed to inspire youth and discover exciting topics in science, technology, engineering, and mathematics (STEM), for students in grades 3 to 12.

In 2020, in response to the COVID-19 pandemic, the program transitioned to a fully virtual format, using Zoom to deliver STEM Clubs, Digital Literacy Workshops, and summer camps. These efforts were led by **Kimberly Tran** and **Cora Reist**, managers for the Science Engagement Programs.

**Virtual STEM clubs**, hosted during Fall and Winter 2020, offered elementary and high school students the opportunity to meet with instructors once or twice a week over Zoom for 1.5 hour sessions. The classes were live, instructor guided, and featured hands-on activities for participants using materials available in their homes or for purchase at minimal cost. The classes were developed and taught by undergraduate and graduate science and engineering students, Teacher Candidates, or Ontario Certified Teachers.

During Summer 2020, Science Engagement Programs offered **online camps and programs** to more than 350 youth. Elementary summer camp programs included Active Anatomy, Animal Kingdom, Code with Kids!, Digital Literacy, Climate Catastrophes, Awesome Astronomy, Mathematical Computation, and Molecular Gastronomy, among others.

High school summer programming allowed students to delve into topics including Python I, Python II, Chemical Cuisine, and Big-Time Bio-Chem.

Select programming within York's Science Engagement Programs is supported by **Actua Canada**, a national charity preparing youth to become innovators and leaders by engaging them in STEM experiences that build confidence and critical employability skills.



## Driving community change with data science

It was curiosity that led **Bo Cheng** (BSc '17, MMAI '20) to enrol in the specialized honors degree in biophysics at York University. He's currently a data scientist at Rogers, where he leverages machine learning and artificial intelligence (AI) to solve real world problems for millions of Canadians.

Cheng, who graduated in 2017 with a Bachelor of Science, and went on to achieve a Master of Management in Artificial Intelligence from York's Schulich School of Business, says his time at the University helped him to grow both personally and professionally. Now, he's paying that back into his community.

"When I look back at my time at York, I not only learned math and physics, I also learned what it means to take responsibility for my own actions, to grow up," says Cheng. "Being in the biophysics program was like attending a small and intimate university. You become lifelong friends with your peers and professors, who are like a family that help each other to grow professionally, and personally."

Cheng participates in AI events where he applies his skills in AI and machine learning to build solutions for the benefit of society.

In the summer of 2019, he implemented a flood warning application to help Canadians nationwide monitor natural disasters, supported by Environment and Climate Change Canada. He helped to promote and drive traffic to underutilized Toronto community stores through the Data for Good initiative. And, in the midst of the COVID-19

pandemic, he collaborated on an app to help elderly people cope with social and physical isolation. The app enables volunteers to assist with daily errands without risking exposure to the virus.

Cheng is the recipient of a Top 30 Under 30 Award from York University, reserved for alumni who are exemplary leaders in creating positive change, at home and abroad.

"My education at York gave me confidence and served as a great opportunity for my future success," Cheng says.



# Aiming for the sky – and becoming a star

If you live in the GTA – or anywhere in Canada – you’re likely to recognize Faculty of Science alumna **Natasha Ramsahai** (MSc 2001) as a familiar face or voice from your TV or radio. Ramsahai is the on-air meteorologist for 680 News and CityNews, and can also be seen on Breakfast Television.

“I came to York University to get another Bachelor of Science degree, but was encouraged to aim higher,” Ramsahai says. Specifically, she was persuaded by the Chair of the Department of Earth & Space Science at the time to pursue an MSc in Earth and Space Science/Meteorology.

Ramsahai, who was born and raised in Scarborough, graduated from York in 2001 and went on to carve out a career in media that has spanned key positions at local and national broadcasters.

Prior to CityNews she was a Senior Meteorologist at the CBC News Weather Centre. She was instrumental in the creation of the CBC National Weather Centre from 2004-2005. After it launched, she specialized in national, international and local Toronto coverage for CBC News, as well as weather reports for travellers at some of Canada’s largest airports. She was also the sole meteorologist on CBC Radio One’s *Metro Morning* with host Andy Barrie. In between CBC radio and television, Natasha leapt to Toronto1 as the meteorologist for its morning show, *Toronto Today*.

Ramsahai says that her time in the Faculty of Science helped inspire her to aim for her dreams, and prepare her for a career that is multi-faceted.



“This degree opened doors for me in my field ranging from Operational Meteorology to Project Management in Meteorology, to my current position as an On-Air Meteorologist. It allowed me to learn different aspects of Meteorology and combine them into what I do now.”

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