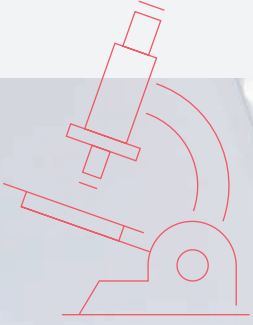


Faculty of Science

2018
YEAR IN REVIEW





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**Graduate
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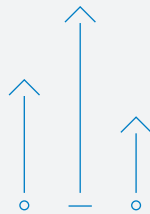
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Dean's Message

GREETINGS, RYERSON FACULTY OF SCIENCE (FOS) COMMUNITY MEMBERS! I SINCERELY HOPE YOU ENJOY READING THIS REPORT OF OUR ACTIVITIES AND SUCCESSES OVER THE PAST YEAR. I'VE BEEN A PROUD MEMBER OF FOS SINCE OCTOBER 2018 AND HAVE COME TO UNDERSTAND THE GREAT STRENGTH AND PASSION OF OUR FACULTY. AND I'D LIKE TO TAKE THIS MOMENT TO CONGRATULATE OUR INAUGURAL DEAN, DR. IMOGEN COE, FOR BUILDING THIS FACULTY AND LEAVING IT IN A VERY STRONG POSITION. I WISH HER MUCH SUCCESS IN HER FUTURE ENDEAVOURS.

The Faculty of Science has much to celebrate, as you will see on the pages to come. I also have a few additional highlights to offer here. The official opening of the Centre for Urban Innovation has brought some beautiful and much needed research and educational space online for us. Situated at 44 Gerrard Street East, the space houses the activities of Ryerson Urban Water, the Science Discovery Zone, and the Food and Soft Materials Research Group. Other spaces in the Physics and the Chemistry and Biology Departments renovated by the federal Strategic Research Fund were also completed and opened over this past year. We thank the federal government and Ryerson University for their commitment to research and education.



2018 has been a year of growth for the faculty. We welcomed 892 new undergraduate students into our programs. An additional 70 graduate students joined us this year, adding to our research strength. We brought in a total of over \$5 million research dollars. And, building on those strengths and looking forward, we are currently in the process of hiring 13 new faculty members.

In the Faculty of Science, we continue to draw inspiration from the diversity of our people, connection with our community, and commitment to impactful education and research.

I hope you enjoy reading our stories of success in this year in review.



“

We draw inspiration from the diversity of our people and connection with our community.”



PHOTO: MIKE FORD



Undergraduate Studies



Our undergraduate students belong to a diverse community of thinkers, leaders, teachers and researchers who are excited about scientific discovery that reaches across disciplines and industries to create new knowledge, solve problems and make a change. From the first year through to graduation, science undergrads engage with real-world issues while pursuing excellence in our classrooms, labs, centres and workplaces, which foster learning and professional growth. Supported by professors and mentors, our students are asking questions, testing solutions and making an impact in their fields.

The Power of One

CAN ONE PERSON MAKE A DIFFERENCE? BIOMEDICAL SCIENCES STUDENT SADIA MEHMOOD THINKS SO.

Mehmood has been a project facilitator for RySciMatch, a leader in the Ryerson Science Society, an organizer of Faculty of Science orientations and a co-founder of two science student groups. She has also worked on three projects at Mount Sinai Hospital as a research intern and is currently the Lead Science Mentor with Ryerson's Tri-Mentoring program.

"Mentoring means so much to me," she says. "I had a tough time adjusting in first year, so now I help new science students make the transition. The Faculty of Science is such a tight-knit community with individualized support and great opportunities for leadership. I help new students see and access all of that."

Having grown up in a financially unstable environment and actively involved in the care of her mother who has chronic health conditions, Mehmood is particularly interested in health equity and the social determinants of health. "I want to work in healthcare with marginalized communities. As a member of a medical team, I can advocate for those who need better access and support – just as a doctor once advocated for my family and changed our circumstances."



PHOTO: SANJEEV KUGANESAPILLAI

“

The Faculty of Science is such a tight-knit community with great opportunities for leadership.”

Voyage of Discovery

SCIENTIST OR MUSICIAN. CHEMIST OR CHEF. CAMPUS VOLUNTEER OR LAB SUPERVISOR. IF YOU'RE NICK JAMKHOU, THE ANSWER IS "ALL OF THE ABOVE!" JAMKHOU BEGAN HIS UNDERGRADUATE STUDIES IN BIOLOGY AND THEN SWITCHED TO CHEMISTRY – DESPITE HAVING EARNED HIS LOWEST GRADE IN THAT SUBJECT IN FIRST YEAR.

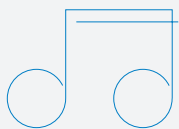
Opposite: Sadia Mehmood, biomedical sciences undergraduate and lead science mentor with a passion for health equity.

Below: Nick Jamkhau, chemistry undergraduate, musician and aspiring chef.

"I was looking to be challenged," he says. "I've always been interested in the interface between biology and chemistry – for example, drug design or molecular probes. Using chemistry to solve biological problems. But I wandered away from chemistry, really for the wrong reason. You've got to study what you love. For me, that's chemistry and everywhere it can take you."

In addition to having served as co-president of the Chemistry Course Union, volunteering at orientations and serving on the Ryerson Science Society, Jamkhau has also helped shape the curriculum for chemistry and biology as a student ambassador on curriculum committees. "It's so important to have a student's perspective. I loved that my voice was heard."

If that wasn't enough, there are also the tracks he has released on Apple Music and Spotify and his passion for cooking. Where is this journey headed? "First, graduate studies in molecular science. And then maybe running my own chemistry-lab-inspired Michelin-starred restaurant. That's the dream."



APPLE MUSIC +
SPOTIFY:
NICK JAMKHOU

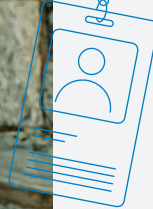


PHOTO: MARK BLINCH



“
The co-op program made so much difference to my career and expertise as a programmer.”

Winning in the Workplace



WHEN BENJAMIN PINHORN ATTENDED A UNIVERSITY FAIR AS A GRADE 12 STUDENT, THE MOST PERSONABLE COMPUTER SCIENCE PROFESSOR THERE WAS FROM RYERSON.

“He took an interest in me and made a great case for Ryerson being on my list. And he was right. Because of the co-op program here, I now work as a software developer at the Royal Bank of Canada, modernizing and adding new features to their online platform.”

A Dean’s List student and third-place finisher at the 2018 RU Hacks (“I’m coming back for first place!”), Pinhorn can’t say enough about the computer science co-op option. “It’s made so much difference to my career and expertise as a programmer. I found a few people at RBC in Omni Channel Development to mentor me, and I work with them to overhaul client-facing applications.”

Pinhorn is also a peer advisor for Ryerson’s Career and Co-op Centre, promoting its benefits and helping younger students find success. “I chose Ryerson to help me find exactly the job I’ve ended up in, and I’ll be working there full-time when I graduate. My goal is to become a tech lead of my own squad inside Omni. After that, who knows what’s possible.”

Science for the People

IT'S NOT HARD FOR FOURTH-YEAR BIOLOGY MAJOR KAUSAR PANCHBHAYA TO EXPLAIN ONE OF THE BEST PARTS OF HER LIFE AS A RYERSON STUDENT: "I LOVE MAKING SCIENCE ACCESSIBLE TO PEOPLE. MY PASSION IS SHARING WHAT I'VE LEARNED WITH OTHERS AND APPLYING IT IN THE REAL WORLD."

As a Science Outreach and Communication Lead at SciXchange, Panchbhaya does exactly that in Toronto and abroad. For example, she travelled during the summer to Barbados to attend and promote the final project presentations of four youth SciXchange sponsored to participate in the Student Program for

Innovation in Science and Engineering (SPISE) at the University of the West Indies Cavehill campus. The program offers gifted high school students the chance to participate in university-level courses like calculus and hands-on projects in areas such as underwater robotics and renewable energy.

Panchbhaya has coordinated events for Science Literacy Week, organized Ryerson's Eureka! summer day camp, held three positions on the Ryerson Science Society and is a mentor in the Tri-Mentoring program. She is also a passionate advocate for inclusivity in STEM education. "As a self-identified Muslim woman in STEM, I want to help break down the stigma around under-represented groups."

Opposite: Benjamin Pinhorn, computer science co-op, shares how Ryerson has made him career ready.

Below: Kausar Panchbhaya, biology major and STEM inclusivity advocate.



PHOTO: IAN PATTERSON

Not Just a Number



AT THE END OF HIGH SCHOOL, ANNY-AYSEL INEZA KNEW THAT SHE WANTED TO STUDY “SOMETHING RELATED TO MATHEMATICS.” THE FINANCIAL MATHEMATICS PROGRAM AT RYERSON BECAME THE FRONT-RUNNER FOR ITS FLEXIBILITY AND BREADTH. “YOU GAIN A PERSPECTIVE THAT A DEGREE JUST IN FINANCE OR JUST IN MATH DOESN'T PROVIDE. THE PROGRAM PREPARES YOU TO ENTER SO MANY IN-DEMAND FIELDS OR TO PURSUE GRADUATE STUDIES.”

Now in her final year, Ineza views Ryerson as a place where every student gets to tailor and define their experience. She has certainly shaped hers. She is a member of the Zone Learning Analytics School at the Ted Rogers School of Management. She served as the Vice-President of Finance of the Ryerson Science Society and is currently the president of the Financial Mathematics Course Union. She co-founded the Ryerson Women in Mathematics Group, which works to increase retention rates for women and other equity groups. And on the athletics front, she is a member of the Women's Ultimate Frisbee team.

Opposite: Anny-Aysel Ineza, financial mathematics undergraduate and student leader.



It's not easy to juggle academics and activities. But when you pull off a great event for students or have a positive impact on others, you see the bigger picture. It's worth it, and it's important.”

It has also been important for Ineza to stretch herself in unique challenges. One was the Rotman International Trading Competition (RITC), which she joined in her first and second years, competing against graduate students from schools like Princeton. “That gave me confidence to step into the finance world, with hands-on experience and technical knowledge that has put me at an advantage.” Another was competing in the Oxford Global Challenge with her friend Paula, winning the regionals and then attending the nationals in Calgary. Competing required extensive research on her topic of choice: the under-reporting of gender-based violence. “I discovered my passion at this challenge, which is the intersection of my technical background and international development.”

Whatever Ineza's ultimate destination – in Canada or around the world – her next stop is a full-time position at TD Bank in analytics and data science. She interned at TD in the summer of 2018, summarizing research, suggesting machine learning models and developing descriptive statistics tools.

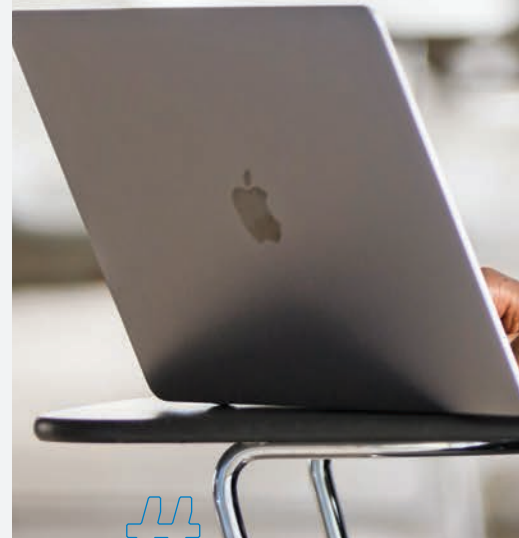




PHOTO: MARK BLINCH



Seeing the excitement that young students have for mathematics has been one of my most rewarding experiences!”



Back to Science

SOME STUDENTS ARRIVE TO RYERSON WITH A DEGREE OR DIPLOMA ALREADY COMPLETE. SOFYA CHERNYAVSKAYA IS ONE OF THEM.

Though she was interested in sciences, she first pursued a college business diploma. After some work experience in the financial industry, she enrolled at Ryerson as a mature student in the Mathematics and its Applications program. Now in her final year, with a job as an analyst in a technology consulting company secured after graduation, Chernyavskaya offers an informed perspective on her Ryerson experience.

“Ryerson has enabled me to gain broader work experience,” she says. “My first co-op was a 16-month internship at IBM Canada as a financial analyst. Working in a company of such enormous scale really expanded my view on STEM careers. On top of that, I have been able to contribute to the STEM4Girls initiative. Seeing the excitement that young students have for mathematics has been one of my most rewarding experiences!”

Chernyavskaya is also president of the Ryerson Women in Mathematics group and is committed to empowering marginalized students on their way to earning a bachelor’s in mathematics. Putting this program into the broader context, she says, “Ryerson is a supportive community where every student is offered the flexibility to shape their own path.”

Small Scale, Big Impact



PHOTO: IAN PATTERSON

YOU MAY SEE TINY BUBBLES IN YOUR SODA, BUT FOURTH-YEAR MEDICAL PHYSICS STUDENT NILOUFAR ROSTAM SHIRAZI VIEWS MICROBUBBLES AND NANOBUBBLES AS A WAY TO IMPROVE CANCER DIAGNOSIS AND THERAPIES.

Winner of a 2018 National Science and Engineering Research Council of Canada (NSERC) award and two Physics Faculty Scholarships, Shirazi's research is making it more possible to provide the most efficient clinically used microbubbles and nanobubbles as contrast agents for ultrasound and in drug delivery.

"As the number of Canadians diagnosed with different types of cancer increases every day, the need for better diagnostics and treatments with minimum radiation damage to patients also increases," she says. "I'm grateful for the opportunities I've had to conduct research at St. Michael's Hospital and at iBEST research facilities, as I've been able to contribute to the cancer research community."

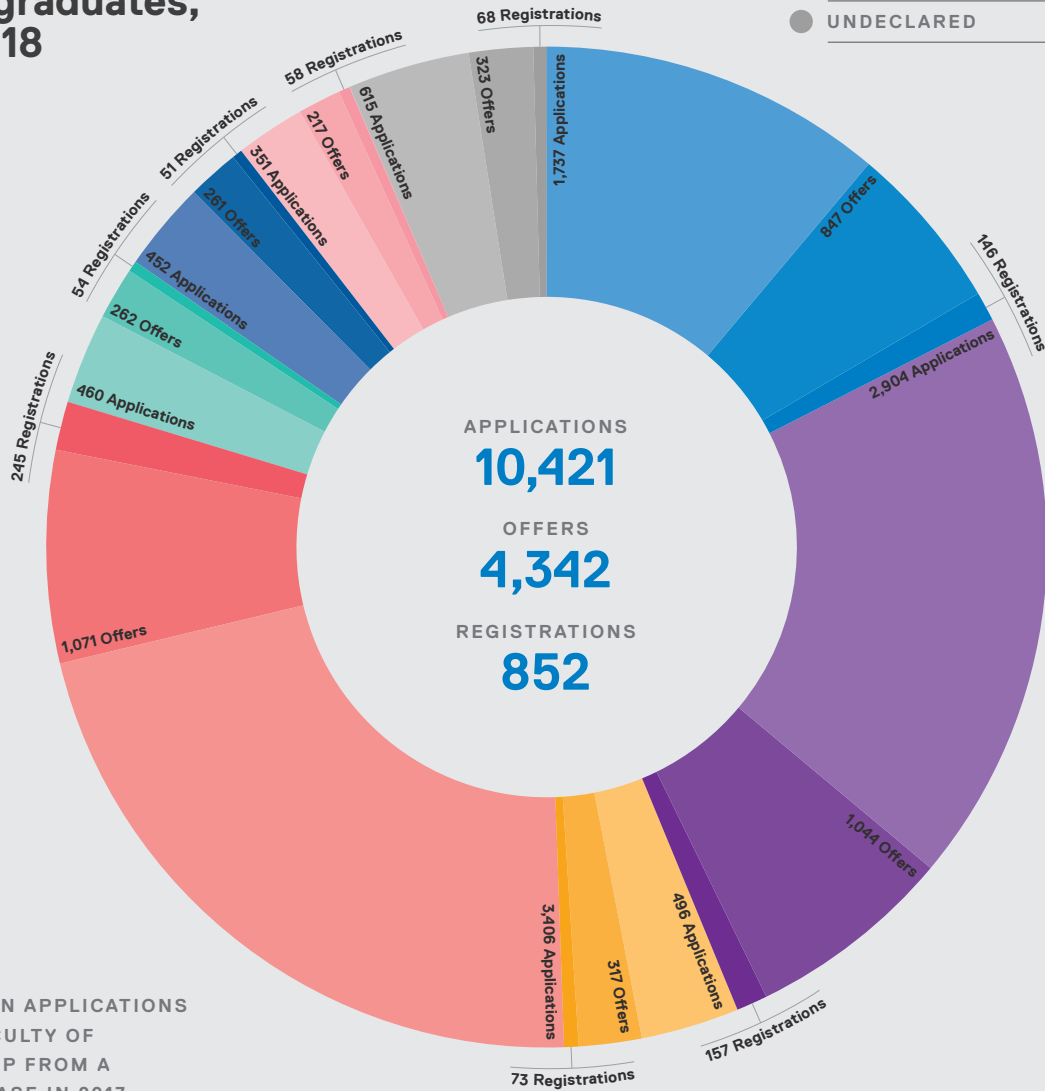
Opposite: Sofya Chernyavskaya, mathematics student, reflects on her Ryerson experience.

Above: Niloufar Rostam Shirazi, medical physics undergraduate student, cancer researcher and award winner.

Undergraduate Studies By the Numbers

Applications, Offers and Registration of First-Year Domestic Undergraduates, Fall 2018

- BIOLOGY
- BIOMEDICAL SCIENCES
- CHEMISTRY
- COMPUTER SCIENCE
- FINANCIAL MATHEMATICS
- MATHEMATICS
- MEDICAL PHYSICS
- UNDECLARED



17% [△]

INCREASE IN APPLICATIONS TO THE FACULTY OF SCIENCE, UP FROM A 1.1% INCREASE IN 2017

28% ^{^^}

INCREASE IN APPLICATIONS TO THE MATHEMATICS PROGRAM FROM 2017

89% [△]

THE INCOMING AVERAGE TO THE BIOMEDICAL SCIENCES PROGRAM FROM ONTARIO SECONDARY STUDENTS

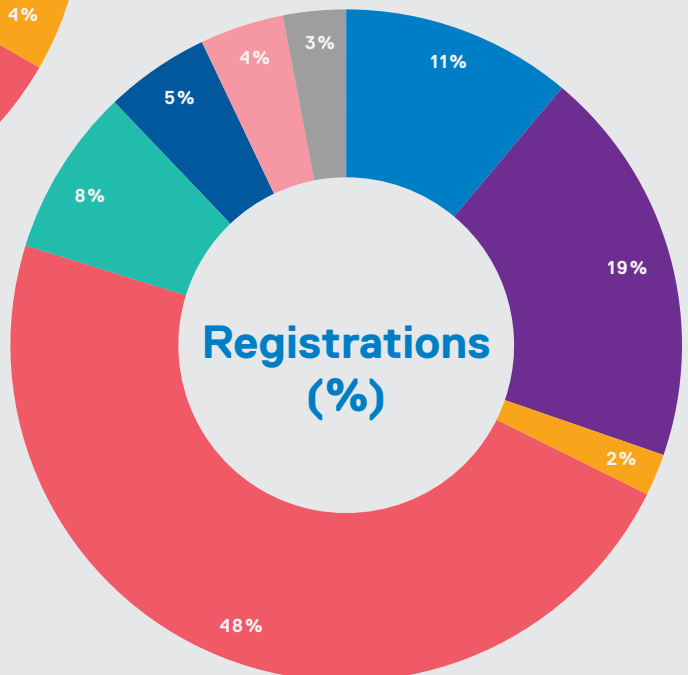
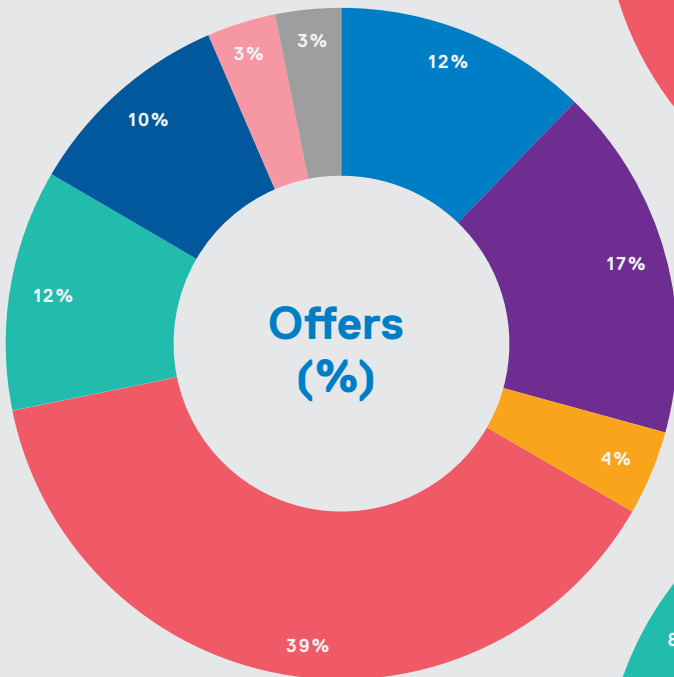
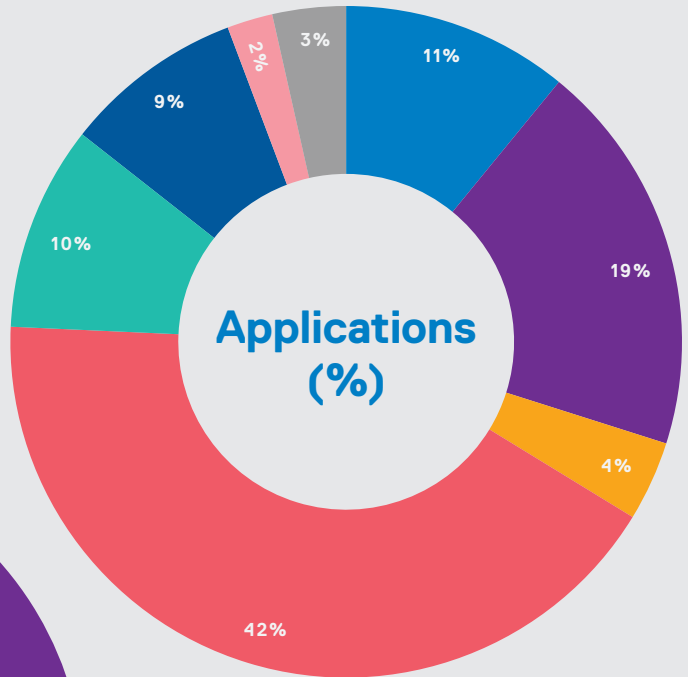
55% ^{^^}

OF FINANCIAL MATH STUDENTS ENTERED WITH AN 80% OR HIGHER AVERAGE, UP FROM 44% IN 2017

27% [△]

INCREASE IN APPLICATIONS TO THE COMPUTER SCIENCE PROGRAM FROM 2017

Applications, Offers and Registration of First-Year International Undergraduates, Fall 2018



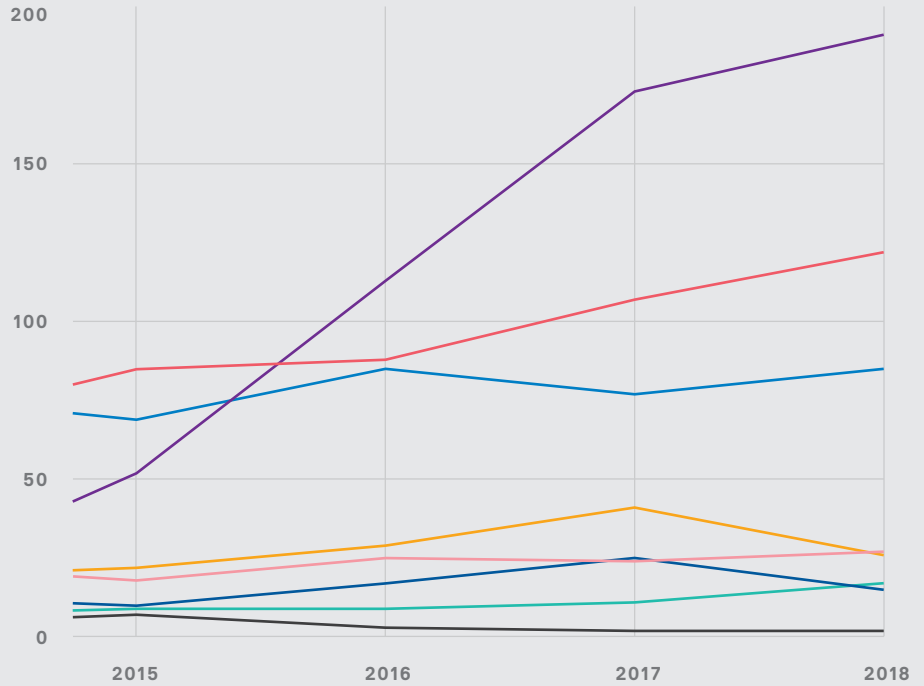
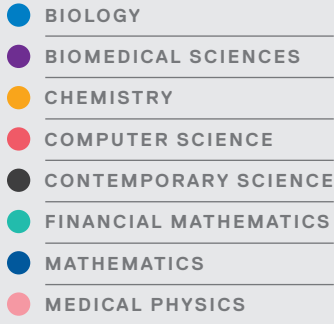
98% ^{^^}

OF COMPUTER SCIENCE STUDENTS ENTERED WITH AN 80% OR HIGHER AVERAGE, UP FROM 90% IN 2017

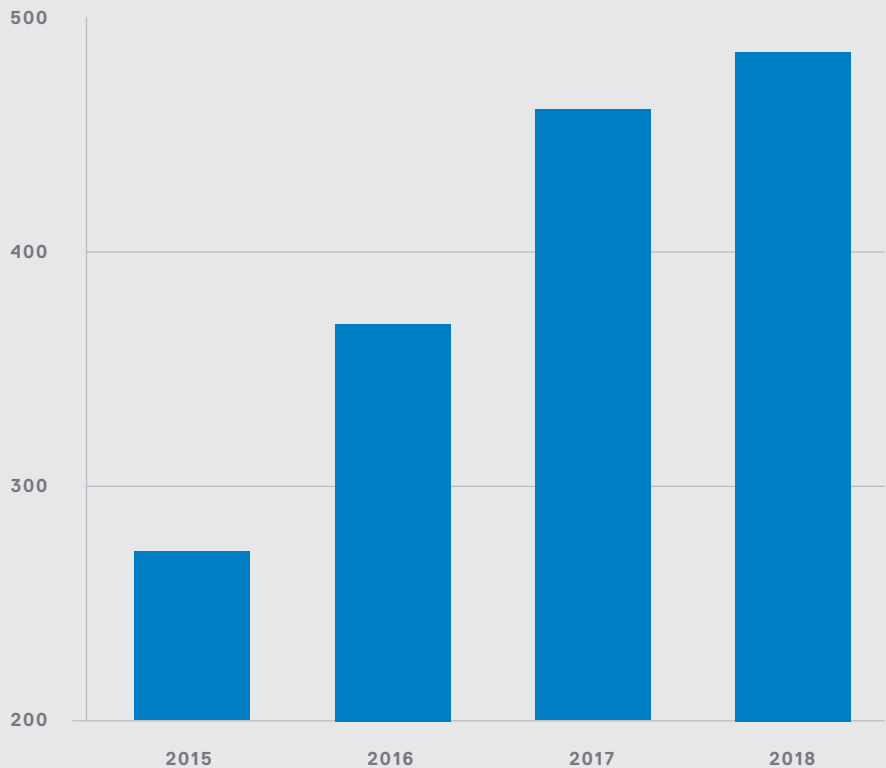
27% [△]

INCREASE OF INTERNATIONAL APPLICATIONS FROM 2017

Dean's Honour List by Program, 2015–2018



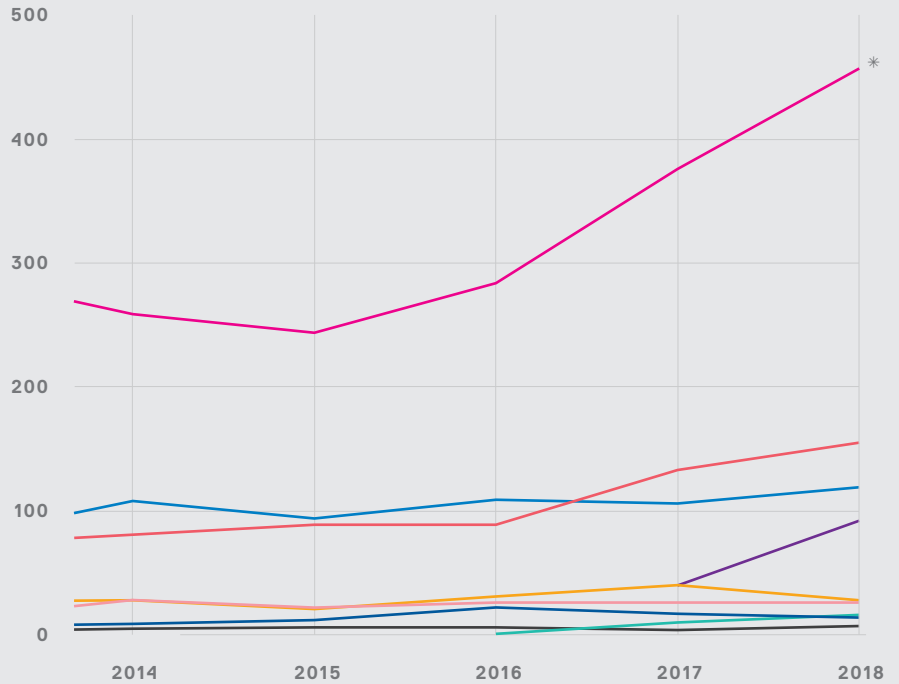
Total Dean's Honour List Distribution, 2015–2018



Undergraduate Degrees Awarded by Program, 2014–2018

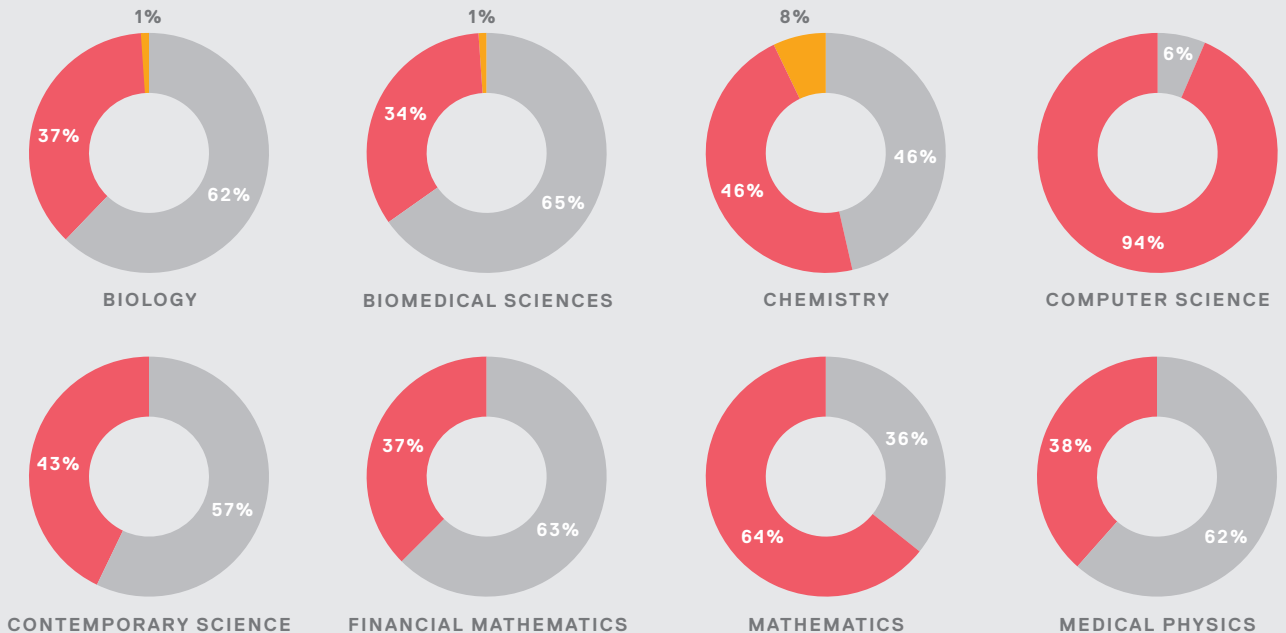
- FACULTY OF SCIENCE
- BIOLOGY
- BIOMEDICAL SCIENCES
- CHEMISTRY
- COMPUTER SCIENCE
- CONTEMPORARY SCIENCE
- FINANCIAL MATHEMATICS
- MATHEMATICS
- MEDICAL PHYSICS

*TOTAL FACULTY OF SCIENCE UNDERGRADUATE DEGREES AWARDED



Undergraduate Degrees Awarded by Program and Gender, 2018

● FEMALE ● MALE ● UNDETERMINED





Graduate Studies



Our commitment to connected science provides graduate students with the knowledge, perspective and experience they need to advance their field and career. Making connections between the lab and the real world, our diverse student body – half of whom are women – is producing noteworthy achievements in research, competitions and collaborations with external partners. Interdisciplinary and cross-industry projects also help generate novel solutions to complex problems. In addition, we design and facilitate graduate student career development programming to better prepare our students for the workforce.

BioMath vs. Infectious Disease

MATHEMATICAL MODELLING IS COMMONLY USED TO UNDERSTAND AND PREDICT THE SPREAD OF INFECTIOUS DISEASE, SUCH AS EBOLA, HIV AND MEASLES. ONE OF THOSE MODELS IS CALLED SIR, FOR SUSCEPTIBLE PEOPLE, INFECTED PEOPLE, RECOVERED PEOPLE. MANY VARIATIONS OF THE SIR MODEL EXIST WITH HORIZONTAL OR VERTICAL TRANSMISSION RATES – BUT NOT WITH A LINEAR TREATMENT RATE.

Enter Marvin Hoti, a PhD candidate in Mathematical Modelling and Methods with an interest in mathematical biology – or BioMath – and a deep interest in infectious disease modelling. Working under the supervision of Dr. Kunquan Lan and, in the past, alongside former Ryerson post-doctoral fellow Dr. Xi Huo, who is now an associate professor at the University of Miami, Hoti conducted novel investigations with a SIR model. “Implementing a linear treatment rate to an epidemic model and studying its qualitative behaviour was one of the main contributions of our research,” he says. That implementation makes it possible to determine how treatment affects the interaction between disease and populations and, crucially, what level of treatment is needed to eradicate the disease.

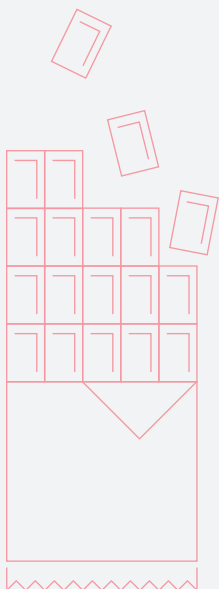


Hungry for Food Science Innovation

PHOTO: MALEK EL-ACOITI



AS 2018 DREW TO A CLOSE AND THE FINISHING TOUCHES WERE BEING PUT ON RYERSON'S NEW CENTRE FOR URBAN INNOVATION (CUI), SECOND-YEAR MOLECULAR SCIENCE PHD STUDENT JESSICA PHULCHAND WAS FULFILLING A VISION THAT HAD DRAWN HER TO RYERSON.



“When I was deciding where to pursue my doctoral work, I was very interested in Dr. D errick Rousseau’s research, because it focuses on projects that can be applied in the food industry,” she says. “When I heard his lab would be moving into the CUI and acquiring state-of-the-art equipment like a scanning electron microscope and confocal Raman microscope, I knew this was where I wanted to be.”

Since arriving, Phulchand has been conducting research into the effects of emulsifiers on chocolate microstructure and rheology while pursuing a second interest that drew her to Ryerson: entrepreneurship. In 2016, she co-founded Better Start Naturals Inc., a startup that develops and creates probiotic cold-press juices and snack bars. The experience made her hungry for startup culture. “As soon as I arrived at Ryerson, I signed up at the Science Discovery Zone,” says Phulchand.

I wanted to surround myself with people who love science and also have a business mindset.”

Opposite: Marvin Hoti, Mathematical Modelling and Methods PhD candidate studying infectious diseases.

Above: Jessica Phulchand, PhD student in Molecular Science, passionate entrepreneur and startup co-founder.



Compassionate Computing

DURING THE SECOND YEAR OF DAVID TENTY'S MASTER'S DEGREE IN COMPUTER SCIENCE, HE RECEIVED A 2018 TEACHING ASSISTANT/GRADUATE ASSISTANT AWARD FROM RYERSON'S LEARNING AND TEACHING OFFICE.

At one level, the award was a recognition of Tenty's efforts to enhance the quality of the undergraduate student experience at Ryerson. It also spoke to a broader theme in Tenty's approach to life: a fundamental commitment to helping people. "Whether I'm applying my technical knowledge or taking on a leadership role, I enjoy doing my part to make people's lives easier and more efficient," says Tenty.

Supervised by Dr. Ali Miri, Tenty's research investigated ways of easing the development process and optimizing applications in cloud computing systems. He also previously worked on a variety of projects, such as building a video streaming application using Google Glass to improve surgical training at St. Michael's Hospital. Meanwhile, Tenty actively contributed to the Ryerson community. He was Course Union Director at the Ryerson Students' Union, helped form the Computer Science Graduate Student Association (CSGCU), served as the master's student representative on the Computer Science graduate program council, and is currently Chief Steward representing academic assistants at Ryerson.

Above: David Tenty, Computer Science master's student, awarded for his outstanding teaching and mentorship work.

Opposite: Humza Nusrat, Biomedical Physics PhD student is a cancer radiotherapy expert and MAX All-Star Scholarship winner.

Radiating Success

FOR BIOMEDICAL PHYSICS PHD STUDENT HUMZA NUSRAT, 2018 WAS A YEAR OF ACCOMPLISHMENTS THAT ADDED TO HIS ALREADY IMPRESSIVE RECORD.

An expert in cancer radiotherapy, Nusrat works with his supervisor Dr. Arman Sarfehnia and close collaborator Dr. Geordi Pang at Sunnybrook Health Sciences Centre where both are medical physicists and adjunct professors in Ryerson's Department of Physics. Nusrat's diverse research interests include his thesis research, developing a novel radiation detector that will transform how cell death is measured and improve cancer treatment. He also has side projects related to water calorimetry and the application of cutting-edge MR-linac technology.

This year, Nusrat published a paper about his thesis research in the journal *Biomedical Physics and Engineering Express*. He achieved a rare feat for a graduate student when he was invited to co-author a chapter on water calorimetry in the book *Recent Advances and Applications in Dosimetry*. Additionally, he presented at several major conferences, which led him to win two prestigious awards: The Anthony J. Mackay Radiation Protection Award for best paper presentation at the Canadian Radiation Protection Associate (CRPA) conference in May, and the MAX All-Star Scholarship, awarded by MAX Gala at the Muslim Awards for Excellence.

Reflecting on his year, Nusrat is quick to give credit to the supportive culture in the Faculty of Science. "As a graduate student, you are made to feel like a colleague working with very smart people to solve real-world problems. I have felt cared for and valued here."

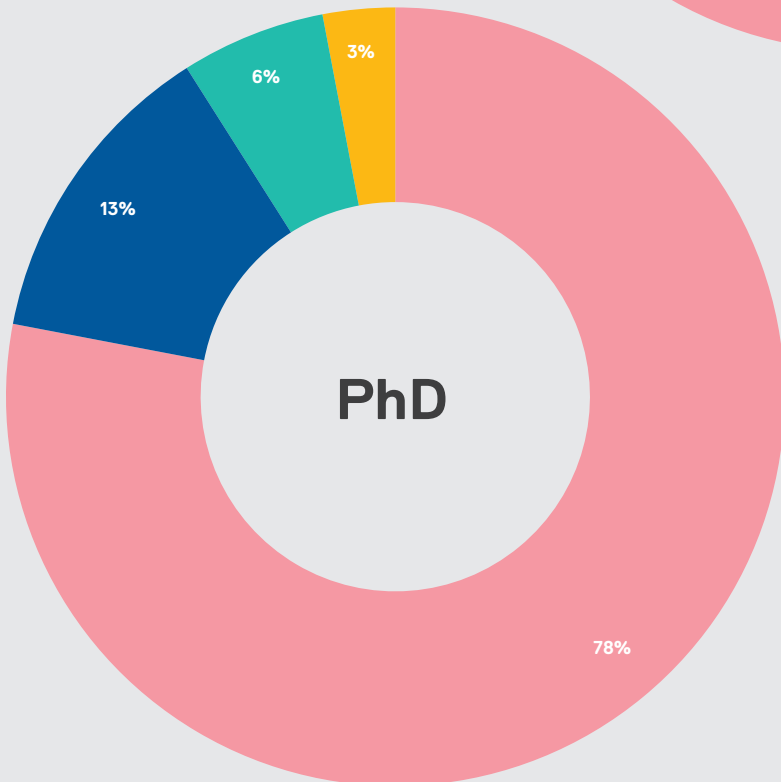
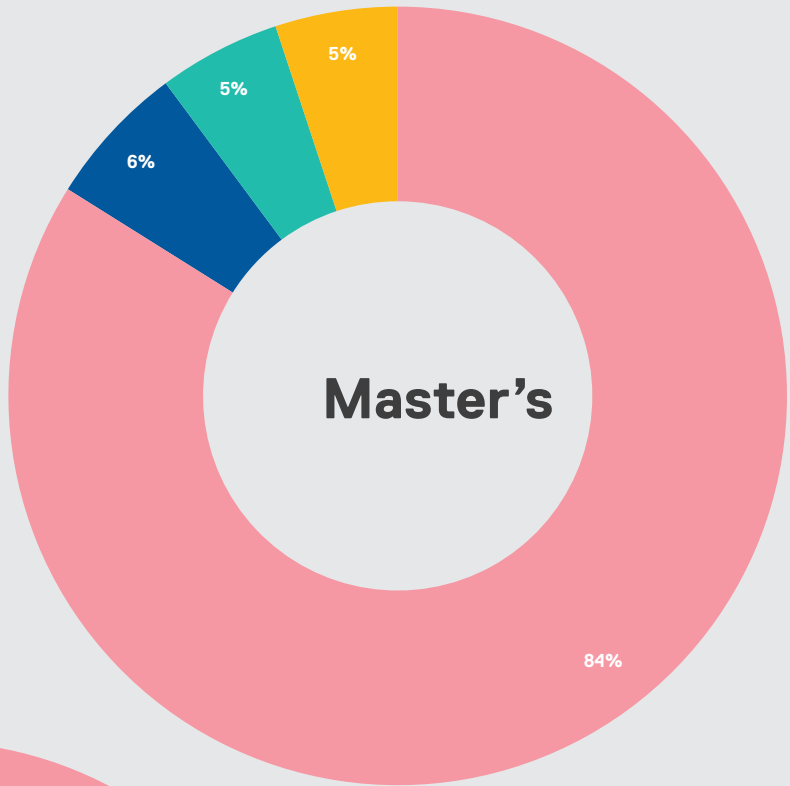


PHOTO: SARAH MCINTYRE

Graduate Studies By the Numbers

Applications & Enrolment Total Headcount by Location, Fall 2018

- GREATER TORONTO AREA
- OTHER ONTARIO MUNICIPALITIES
- OTHER PROVINCES
- INTERNATIONAL



220

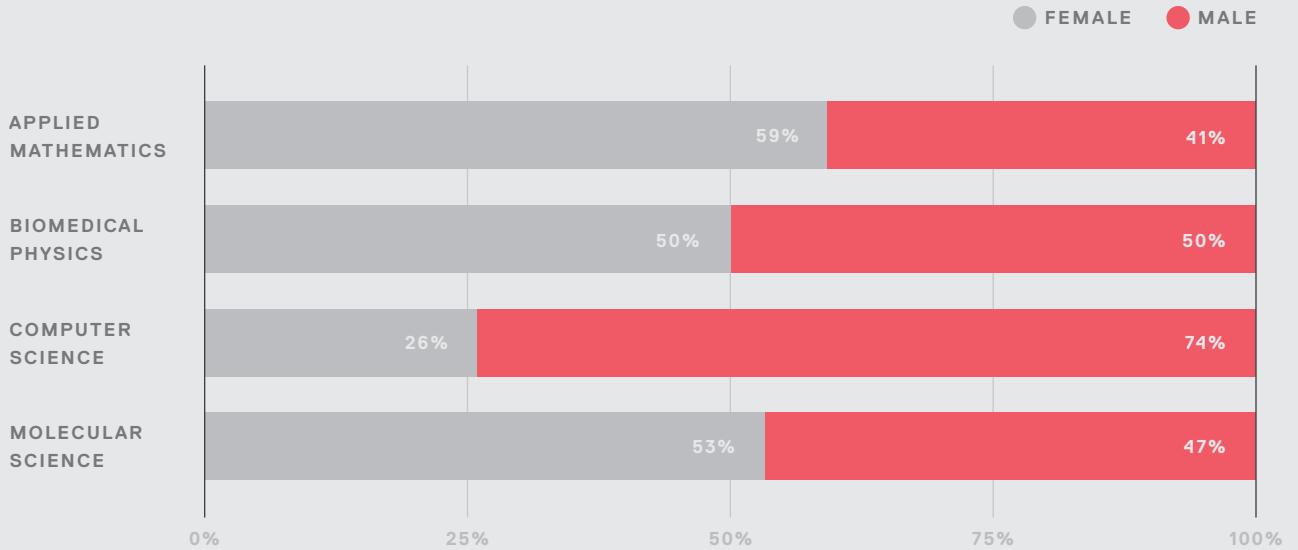
FALL 2018 MASTER'S &
PHD TOTAL ENROLMENT
HEADCOUNT

Total Headcount by Master's Program & Gender, Fall 2018

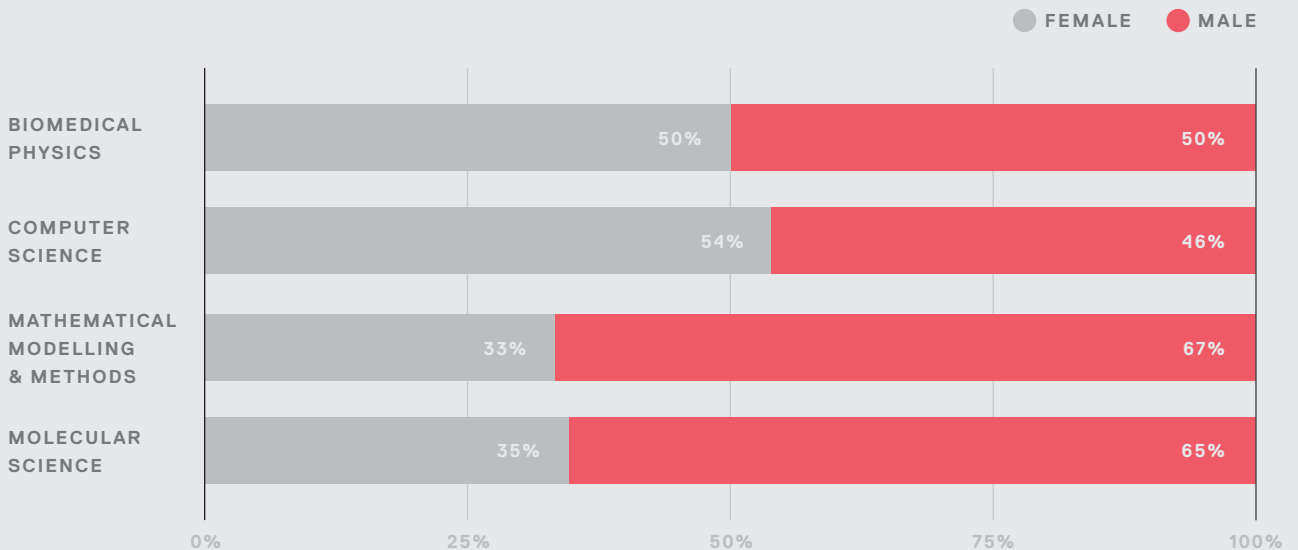
47%[△]

INCREASE IN FEMALE ENROLMENT TO MASTER'S PROGRAMS COMPARED TO 2017 (42%)

THE APPLIED MATHEMATICS MASTER'S PROGRAM INCREASE 59% FROM 2017 (48%)



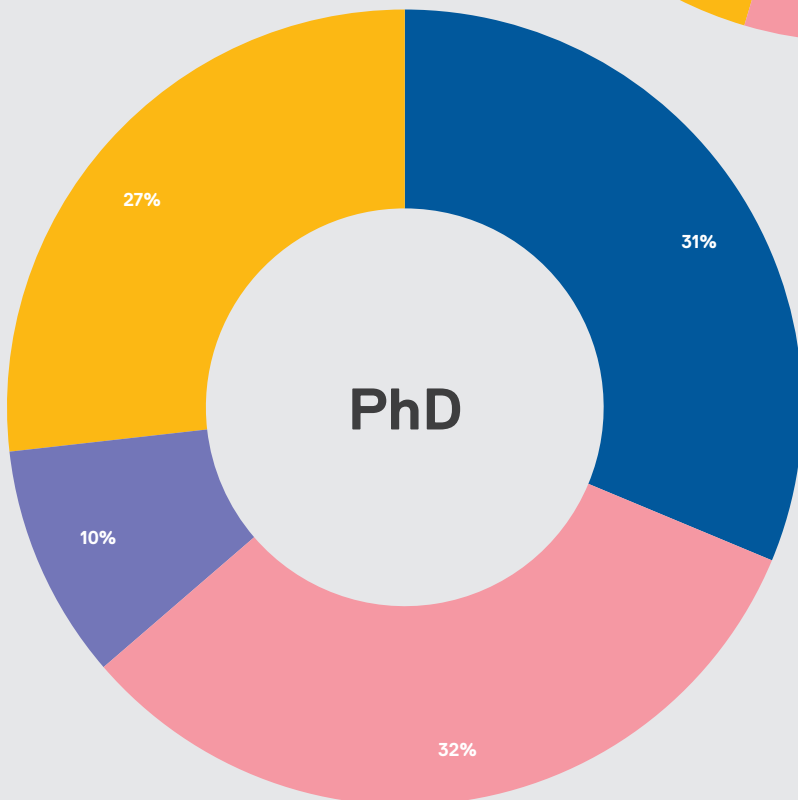
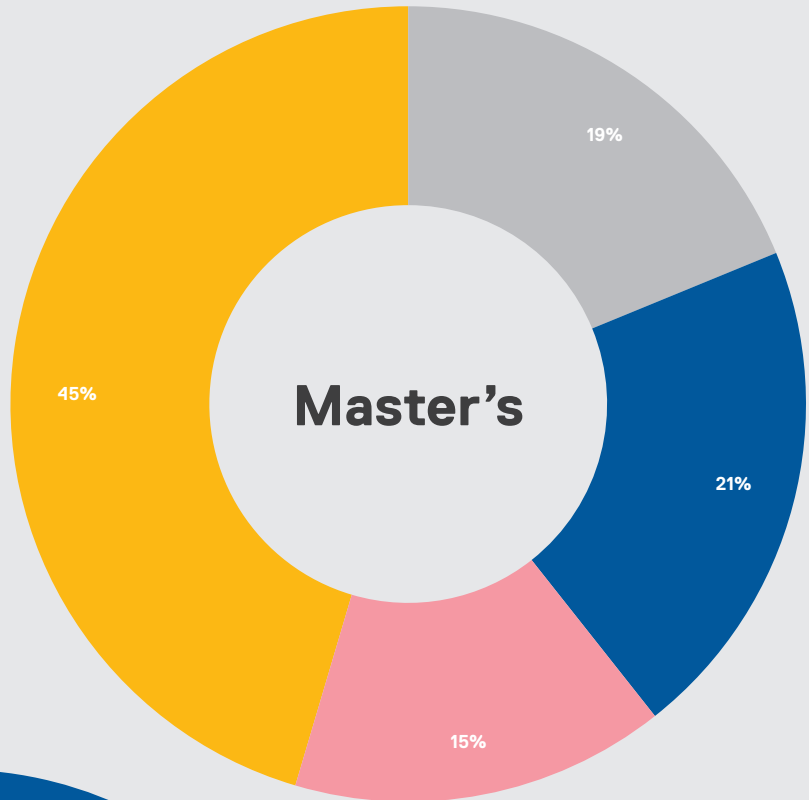
Total Headcount by PhD Program & Gender, Fall 2018



Total Funding Distribution by Program, 2017–2018*

*SEPTEMBER 2017–
AUGUST 2018

- APPLIED MATHEMATICS
- BIOMEDICAL PHYSICS
- COMPUTER SCIENCE
- MATH MODELLING & METHODS
- MOLECULAR SCIENCE

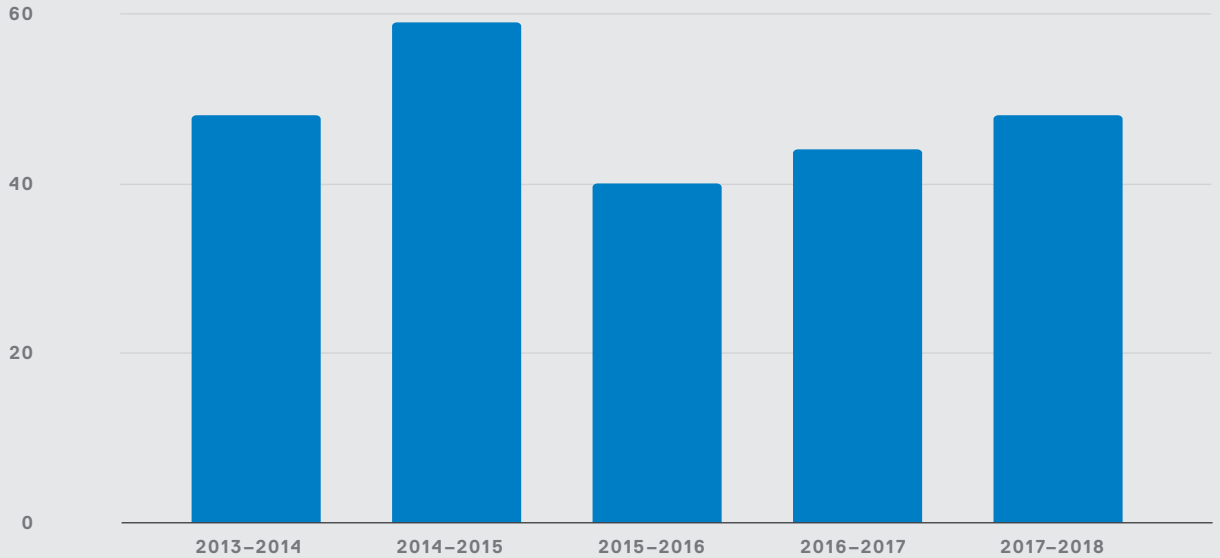


\$5M+

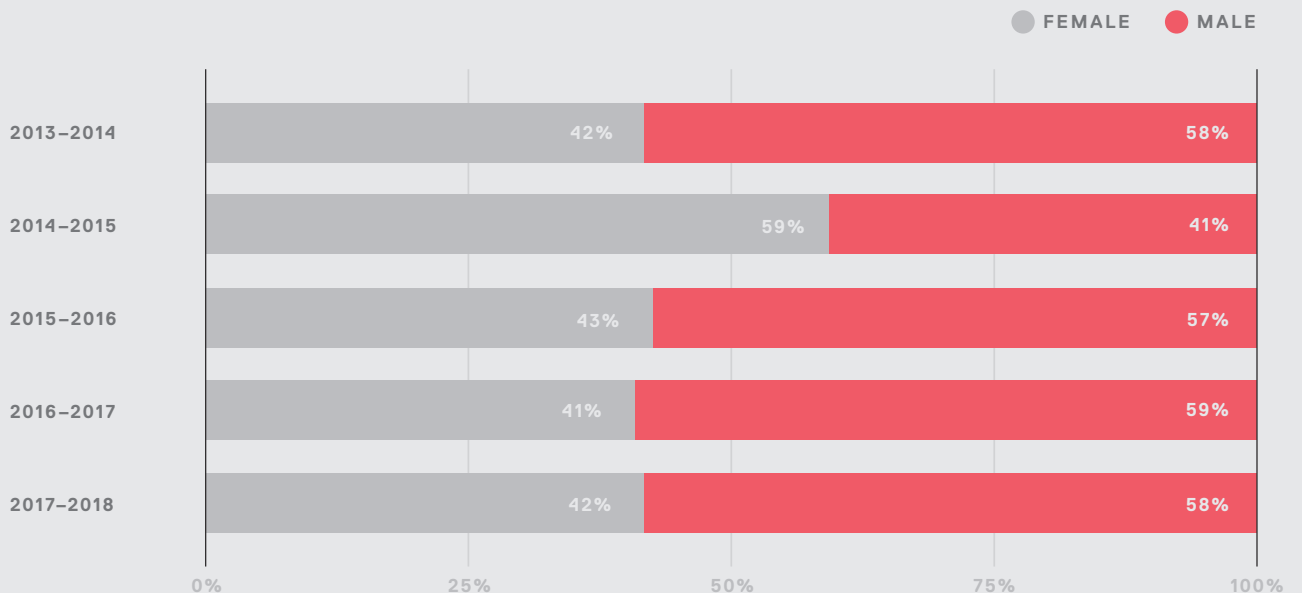
IN TOTAL FUNDING,
2017–2018



Total Master's Degrees Awarded, 2013–2018

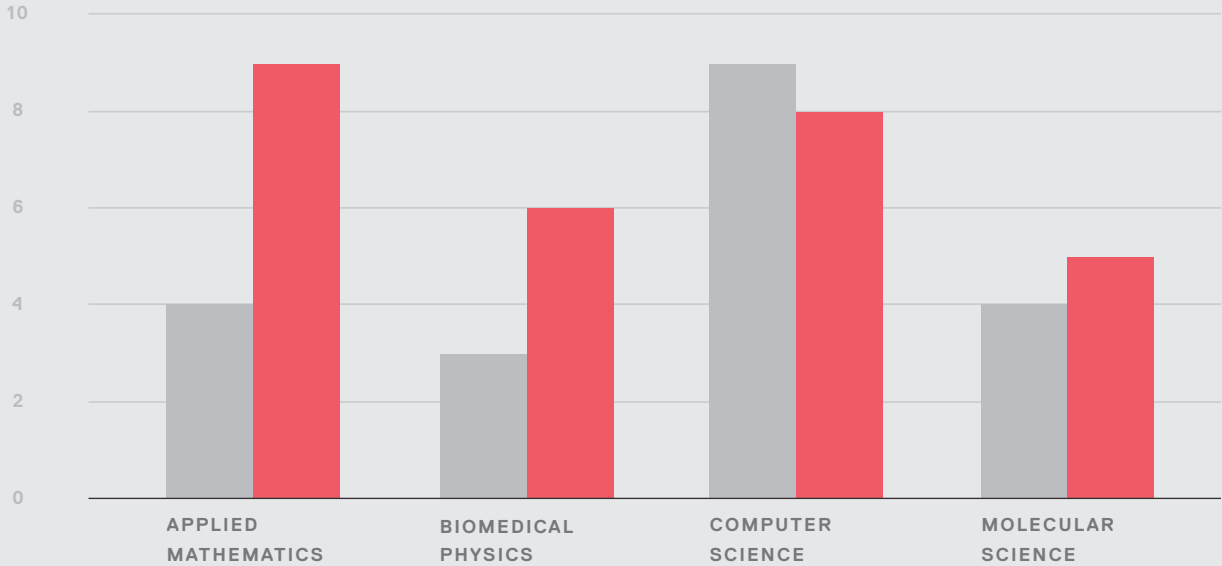


Master's Degrees Awarded by Gender, 2013–2018

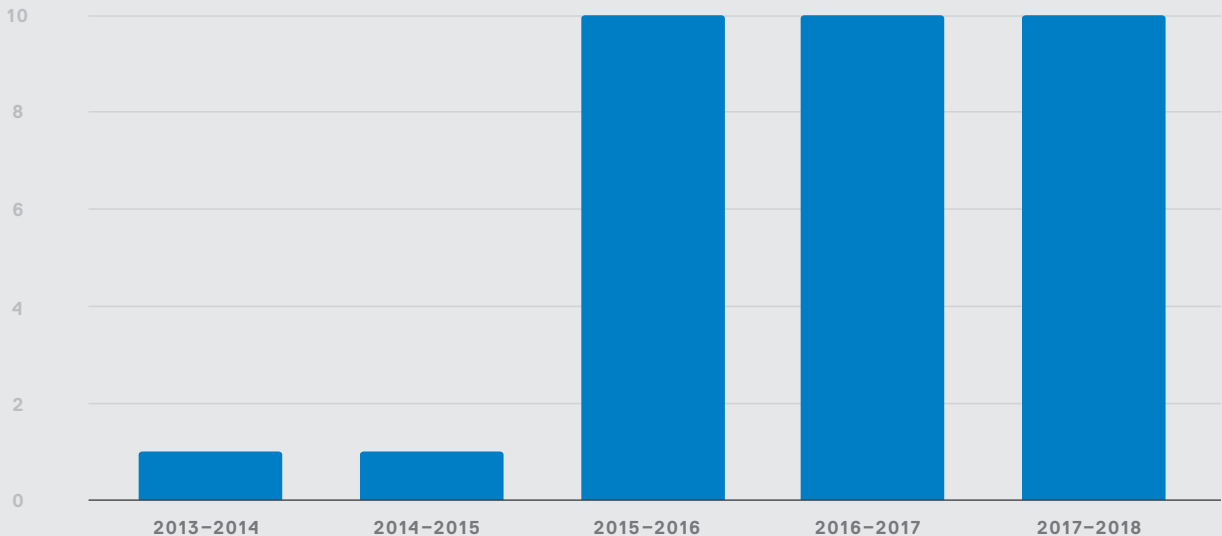


Master's Degrees Awarded by Program and Gender, 2018

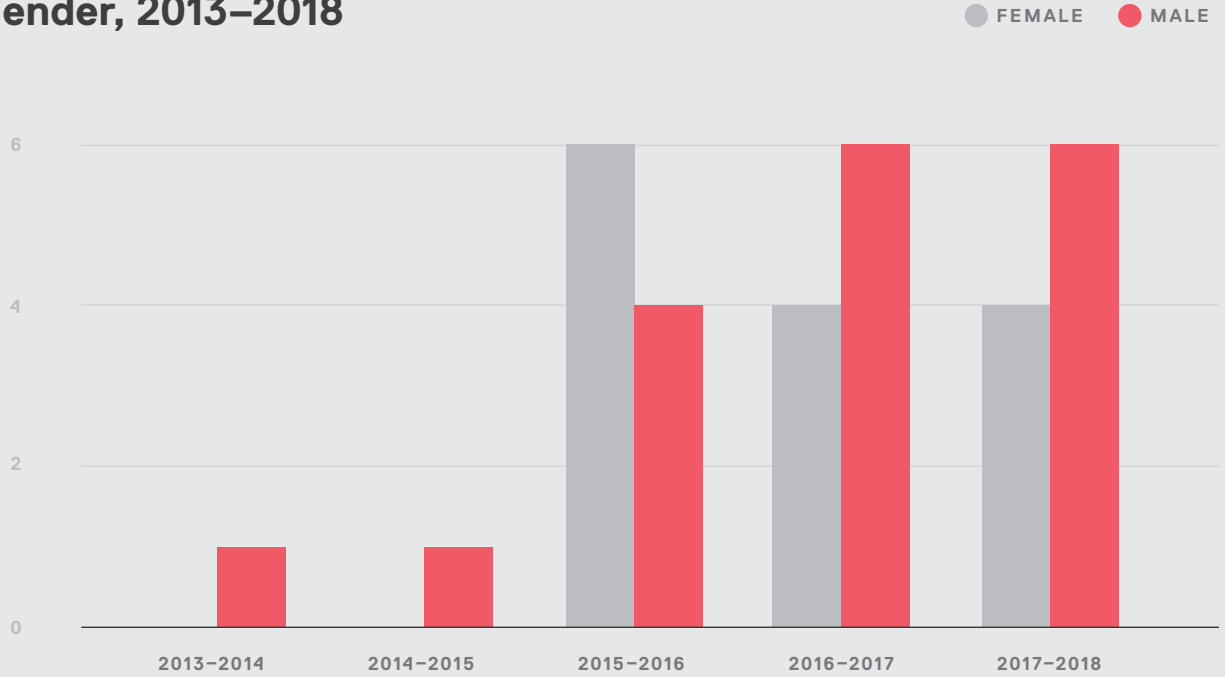
● FEMALE ● MALE



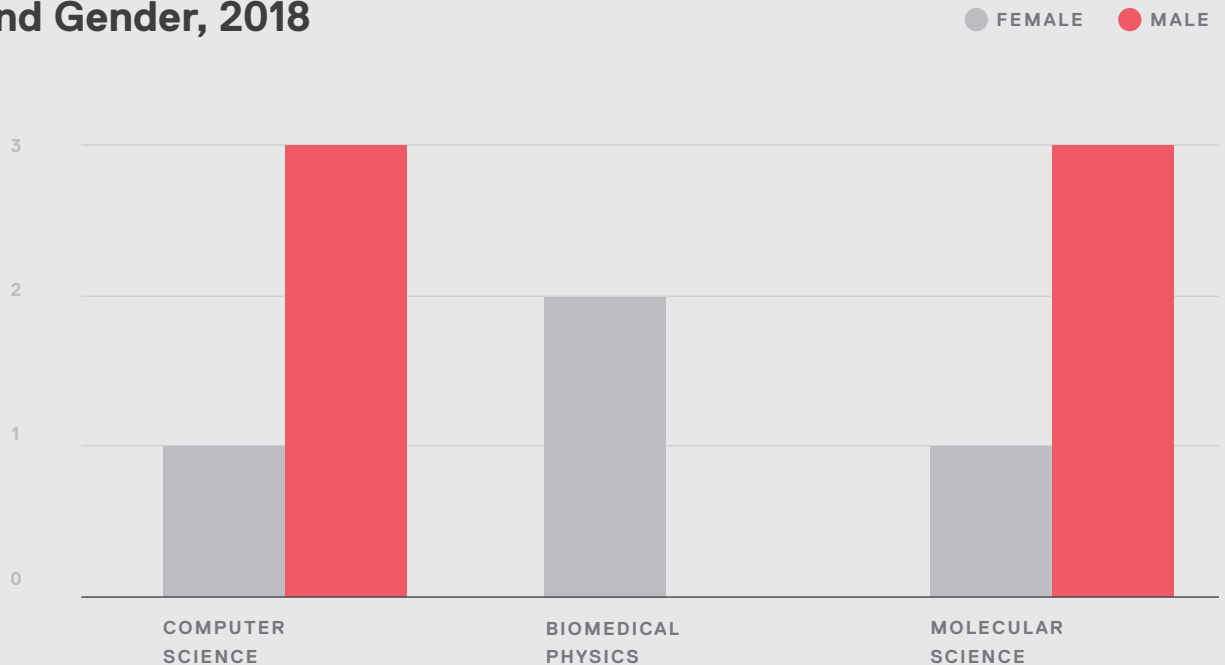
Total PhD Degrees Awarded, 2013–2018



PhD Degrees Awarded by Gender, 2013–2018



PhD Degrees Awarded by Program and Gender, 2018





Research



The Faculty of Science's reputation as a leader in research continues to grow. Industry partners seek out our expertise and our access to state-of-the-art facilities, such as at the Institute for Biomedical Engineering, Science and Technology (iBEST) at St. Michael's Hospital, our laboratories at the MaRS Discovery District and the new Centre for Urban Innovation (CUI). Our vibrant research culture and collaborative mindset allow us to build innovative partnerships both within the academy and across business sectors. As a result, our researchers both advance scientific knowledge and generate societal impact.



Cells on the Move

AS A KID GROWING UP IN EDMONTON, DR. MICHAEL OLSON LIKED TO TAKE THINGS APART TO SEE HOW THEY WORKED. NOW, AS A LEADING MOLECULAR CELL BIOLOGIST, HE TAKES APART CANCER CELLS AND THE TISSUES SURROUNDING THEM.



“My research focuses on how cells define their shape, and how they control changes to their shape, which has important implications for their ability to migrate around the body,” he says. “We are trying to understand metastasis, the process by which cancer cells move away from a primary tumour and establish secondary tumours.”

Olson spent 13 years at the Cancer Research UK Beatson Institute in Glasgow, Scotland before joining Ryerson’s Department of Chemistry and Biology in May of 2018 to fill a prestigious Tier 1 Canada Research Chair in Molecular Cell Biology. With his interest in the mechanics of cells and their migration, Olson’s work overlaps with engineering, chemistry and physics. “I was thrilled to return to Canada and join Ryerson University because the opportunities presented for multi-disciplinary research spanning many fields are exceptional. It is a significant benefit to work in a large urban centre with abundant resources to draw upon for collaborations.”

Ryerson’s reputation for transferring ideas into action also appealed to Olson because his work bridges the gap between basic and translational science, taking ideas from lab bench to bedside. “One objective of my work is to identify new cancer drug targets. In collaboration with medicinal chemists, we have discovered novel drug-like chemical compounds that are currently in pre-clinical testing for skin, breast and brain tumours. Our hope is to improve the properties of these compounds with the ultimate goal that they could be used to treat cancer patients.”



PHOTO: IAN PATTERSON

OFTEN, AN INTRACTABLE PROBLEM REQUIRES A NOVEL APPROACH. THAT'S EXACTLY WHAT MOLECULAR BIOLOGIST DR. SARAH SABATINOS HAD IN MIND WHEN SHE EMBARKED ON A BOLD NEW PHASE IN HER INVESTIGATIONS OF HOW CANCER CELLS ADAPT AND BECOME RESISTANT TO CHEMOTHERAPY DRUGS.

Big Picture DNA

Sabatinos and the molecular science graduate students she supervises entered into a collaboration with Dr. Ali Mazalek and her team at Synlab, an innovation hub at Ryerson's Faculty of Communication and Design. Together, they developed a tangible-based visual analytics software suite that uses an interactive tabletop and wall-mounted displays to enable Sabatinos and her team to conduct advanced analysis of DNA replication models.

In addition to helping generate publishable study results, the Synlab technology is one more step toward an ambitious goal that fuels Sabatinos' work. "If we can understand what causes mutant cells to replicate – or not – we can potentially prevent a problem like cancer from developing in the first place."

"We're trying to figure out the molecular complexes and changes that happen within an individual cell and across a population, then see if we can detect patterns," says Sabatinos. "The technology amplifies our work because the display is so big. We can easily move images and data around, and several people can contribute at the same time."



Above: Dr. Sarah Sabatinos in her lab at the Ryerson research facility in the MaRS Discovery District.

Opposite: Dr. Michael Olson, multi-disciplinary researcher and Tier 1 Canada Research Chair in Molecular Cell Biology.



Turning up the Heat on Cancer

DR. GHOLAM PEYMAN IS NO STRANGER TO SCIENTIFIC BREAKTHROUGHS. THE OPHTHALMOLOGIST AND INVENTOR OF LASIK EYE SURGERY, WHO HAS BEEN BASED AT THE UNIVERSITY OF ARIZONA FOR THE LAST 10 YEARS, IS SUCH A PROLIFIC INNOVATOR THAT HE HAS SECURED 194 US PATENTS AND RECEIVED A 2012 NATIONAL MEDAL OF TECHNOLOGY AND INNOVATION FROM PRESIDENT BARACK OBAMA.

Currently, Peyman is pursuing a potentially revolutionary form of cancer therapy through a collaboration with three researchers in Ryerson's Department of Physics: Drs. Michael Kolios, Jahan Tavakkoli and Carl Kumaradas.

The story of how they met, and what they are trying to invent, is one of degrees – both temperature and separation.

Some years ago, while investigating whether blood glucose could be measured by shining a laser into the eye, Peyman had a thought: perhaps it was possible to non-invasively measure the temperature of particular tissues by using photoacoustics (PA), sound waves released when tissues expand in response to an increase in temperature inside the body.

From that original supposition, Peyman conceived of a cancer treatment unlike any other based on a simple fact: tumour cells don't like heat, even relatively low temperatures of 41-43 degrees Celsius.

He began developing a technique that uses thermally activated nanoparticles to swarm a tumour cell, forcing it to overheat and open pores on its surface, thereby rendering it vulnerable to the targeted delivery of chemotherapy drugs that would not otherwise be able to permeate the tumour cells. Peyman's ultimate goal? Enable localized thermo and drug therapy that targets and destroys tumours anywhere in a body with minimal or no damage to the surrounding normal cells.

Pursuing his idea, Peyman founded a startup, Cancer Rx, and secured help from Brian Stuglik, a biotech

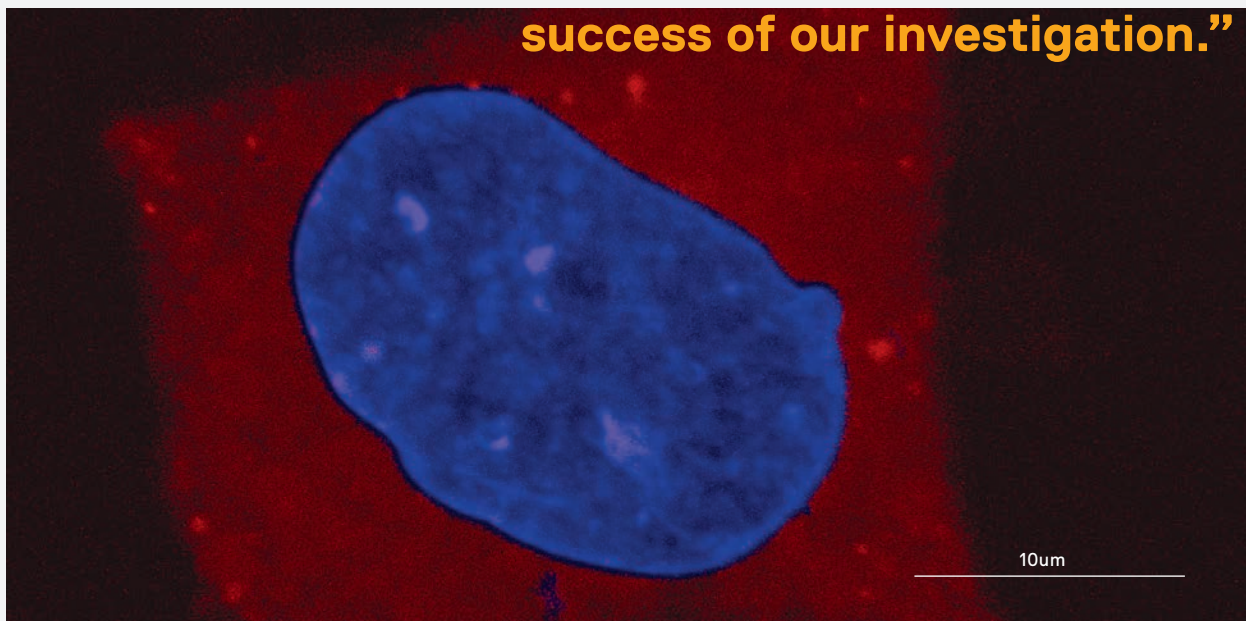
consultant who spent 33 years working for pharmaceutical giant Eli Lilly and Co. Together, they set out to prove Peyman's theory.

"The real challenge is whether we can non-invasively measure and control the temperature of a tumour inside a patient's body photoacoustically or thermoacoustically," says Stuglik. "If we can do that, we can achieve the dream of precision medicine that Dr. Peyman envisions, including selectively heating a tumour and releasing medicines exactly when and where they are needed."

When Peyman and Stuglik began searching for experts in medical applications of PA technology, they described what they were looking for to Peyman's industry partners at VisualSonics, a world leader in imaging systems. Ryerson's name came up immediately.

Below: Thermosensitive liposomes loaded with anti-cancer drug, doxorubicin, are accumulated in BT474 breast cancer cells. The nucleus of the cell is stained with Hoescht 33342 shown in blue, and the accumulation of the doxorubicin in cells are shown in red.

“The scientists at Ryerson have the spirit of collaboration rather than competition, which has contributed to the success of our investigation.”



The Cancer Rx team discovered that Ryerson had everything they needed, including researchers who specialized in nanoparticle synthesis (Kolios and Dr. Celina Yang), nano-particle bio-distribution (Yang), photoacoustics (Kolios, Kumaradas and Dr. Hisham Assi), ultrasound thermometry (Tavakkoli and Mr. Elyas Shaswary), ultrasound heating (Tavakkoli), magnetic heating (Kumaradas), laser heating (Kumaradas) and control systems (Kumaradas).

“Nowhere else in the world could one find scientists with expertise in all of these areas under one roof,” says Peyman. “That was a huge benefit to our project. More importantly, I found that the scientists at Ryerson have the spirit of collaboration rather than competition, which has contributed to the success of our investigation.”

Stuglik explains that Ryerson’s emphasis on research with impact was a huge draw. “Ryerson’s end goal is not science for the sake of science. They want to make treatment easier and better for patients.”

Two years on, Peyman and his team are thrilled by the collaboration. “It’s a great scientific relationship,” says Peyman. “The people with whom I’ve worked at Ryerson are top experts in their fields while being very friendly, open minded and cooperative. We feel lucky to have such collaborators.”

The team from Ryerson is equally positive about the collaboration. “Dr. Peyman is a visionary scientist with a deep passion for advancing the current state of the art in cancer treatment,” says Tavakkoli. “Implementing his ideas could potentially lead to major breakthroughs in cancer treatment.”

Just what will that breakthrough be? “If we are successful, we will have a cancer treatment that adaptively targets just the tumours, reducing the side-effects found in current treatments,” says Kumaradas. “In addition, the treatment would be visualized in real-time, allowing for automatic or manual control of the delivery.”

Speaking to the possible impact of the project, Peyman points out that if successful, the technology could be used to treat a significant portion of the 1.6 million new cases of cancer that occur in the United States every year. “The number of potential applications for this technology make it a very exciting endeavour,” he says.

Connected Classrooms

IN KEEPING WITH RYERSON'S LONG-STANDING RECORD OF IMPACTFUL COLLABORATIONS, DR. ALI MIRI IS HELPING THE ONTARIO MINISTRY OF EDUCATION ACHIEVE AN ESSENTIAL AND AMBITIOUS OBJECTIVE: ENSURING EVERY CLASSROOM IN ONTARIO IS CONNECTED.

Historically, Ontario's school boards have managed their information technology systems independently, which has led to capacity constraints on their ability to handle procurement, training, innovation and support. Recently, the Ministry changed their approach, by working with several school boards to establish six regional Broadband Internet Innovation Centres. Known as BIICs, these centres accelerate technology implementation by serving as test labs, training centres and catalysts for collaboration for teams from across the province.

The Ryerson BIIC is unique. Thanks to Miri's suggestion, research was added to the core functions of the centre. "Rather than being limited to what they hear from vendors, teams can work with us to explore the application and impact of various technologies, such as SD-WAN, 5G communication, Internet of Things, Big Data and cybersecurity."

Since it opened, the Ryerson BIIC has been a successful collaboration.

Right: Dr. Ali Miri collaborates with the Ministry of Education to help schools across Ontario.

Opposite: Dr. Alexey Rubstov is developing financial models to incentivize green business policies.

“

This collaboration allows Ontario's schools to bring modern technology into every classroom.”



PHOTO: IAN PATTERSON

PHOTO: IAN PATTERSON



The Mathematics of Green

SOMETIMES, THINGS THAT DON'T SEEM RELATED ARE ACTUALLY HIGHLY CONNECTED. SUCH IS THE CASE WITH AN NSERC DISCOVERY GRANT PROPOSAL SUBMITTED IN 2018 BY DR. ALEXEY RUBTSOV TITLED "A FINANCIAL MATHEMATICS APPROACH TO CLIMATE CHANGE RISK."

Not only did the proposal successfully secure funding for five years, it represents a growing field of research that uses financial mathematics to address pressing environmental concerns.

An expert in asset allocation, Rubtsov wants to make climate change risks an essential consideration in decision-making by companies and the investors who purchase their stocks. "We are working to develop financial models that incentivize companies to implement green policies and reduce their carbon footprint," he says. For example, he points out that if demand for a company's stock was tied to how green it was, that would influence its decisions.

Aside from his research, Rubtsov actively promotes student growth. He is a member of the department's undergraduate curriculum advisory committee, has developed a robust series of speakers and networking events that expose students to industry leaders, and regularly encourages students to publish their research in leading journals.



Rising Stars



Marc J. Adler

DEPARTMENT OF
CHEMISTRY AND BIOLOGY

Dr. Marc Adler is a synthetic organic chemist whose MJA Lab makes – and develops new ways to make – carbon-based molecules. “The molecules we make are designed for a specific function, for example catalysis, energy, or biological activity,” he says. The team is particularly interested in hypercoordinate organosilanes and protein-protein interactions (PPIs); disruption of the latter affects cell communication and can be used to effectively attack diseases, including cancer and neurodegenerative disorders.

Before arriving at Ryerson, Adler received student-led teaching awards at both Northern Illinois University and Duke University. “Our students are the future of science and deserve the best in their classrooms and labs.”

Neil Bruce

DEPARTMENT OF
COMPUTER SCIENCE

Dr. Neil Bruce specializes in computer vision, the development of systems that enable machines to process complex visual information in a manner similar to the human brain. “Where we direct our eyes has a significant impact on our understanding of the world around us. So, part of my work is to explore the nature of how visual information is encoded, compressed and routed through our brain and, equally, a machine vision system.”

An accomplished researcher with over 50 published contributions, Bruce also actively collaborates with industry partners. “Computer vision will help to facilitate technological developments in phone technology, web-based applications, autonomous vehicles – almost every field and industry.”

Qinmin (Vivian) Hu

DEPARTMENT OF
COMPUTER SCIENCE

Dr. Vivian Hu’s major research activities are searching and analyzing in question answering, social network analysis, recommender systems, information retrieval, applied artificial intelligence, and applied machine learning problems. “The long-term goal of my research is cognitive search, the artificial intelligence version of enterprise search engines, which aims to find the most relevant information and also provide further analyzed knowledge.”

Hu’s research will contribute to many diverse domains, from intelligent medical search to advertising strategy. “My main interest is in developing algorithms and systems to support the real-time processing of massive data for high performance – and making sense of that data.”





Stefania Impellizzeri

DEPARTMENT OF
CHEMISTRY AND BIOLOGY

Dr. Stefania Impellizzeri's innovative and interdisciplinary research program combines classic organic chemistry with nanomaterials of the latest generation. "The goal of my research is to pioneer the field of molecular nanochemistry for applications in catalysis, bioscience, information technology and advanced functional materials such as nano-enhanced textiles," she says.

The potential applications of Impellizzeri's work are wide-ranging, from uncovering new strategies in chemistry, to the writing of data beyond current limits for computer technology and memory storage devices, to providing super-resolution imaging for cell biologists to probe cell structure and function.



Miranda Kirby

DEPARTMENT OF
PHYSICS

Dr. Miranda Kirby's research focuses on the use of medical imaging to help improve outcomes for patients suffering from lung disease, including chronic obstructive pulmonary disease (COPD). "My lab is developing new ways to extract information from medical imaging technologies that can tell us about the underlying disease in the lung, where it is located, and how severe it is," she says. "There is potential for earlier diagnosis, more personalized treatment and the discovery of new drugs and therapeutics."

The imaging analytic tools developed in Kirby's lab can be incorporated into commercial software solutions to maximize the impact of her research.



Jesse Tanguay

DEPARTMENT OF
PHYSICS

Dr. Jesse Tanguay's research group is working to improve the quality of x-ray images. "We collaborate with other researchers and also with industry to identify the next-generation techniques and technologies that will enable better diagnosis and management of cancer, cardiovascular disease and respiratory disease," he says. Given the high number of x-rays performed every year, Tanguay's research has the potential to touch millions of lives through better visualization of disease and disorder in nearly every organ.

Tanguay earned his PhD in Medical Biophysics from Western University before holding post-doctoral fellowships at the University of British Columbia and then joining UBC as an Assistant Professor of Medical Physics.



Research By the Numbers

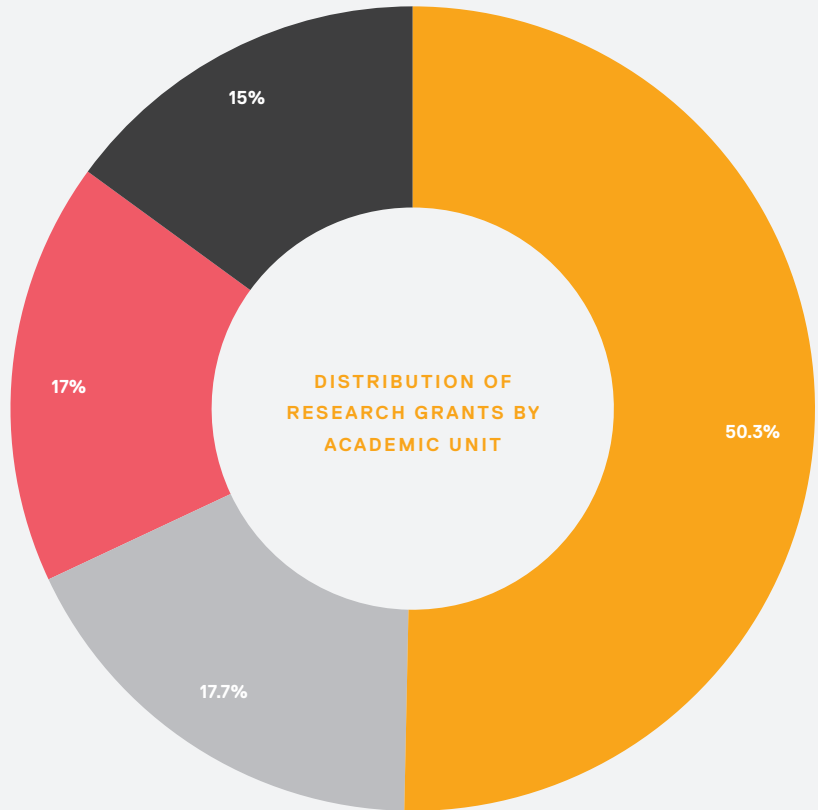
\$5M+



OVERALL RESEARCH FUNDING FOR THE FACULTY OF SCIENCE, AN 18% INCREASE FROM 2017

\$850K+

RECEIVED BY DR. COSTIN ANTONESCU FROM CIHR FOR HIS PROJECT ENTITLED "CONTROL OF EPIDERMAL GROWTH FACTOR RECEPTOR SIGNALING BY CLATHRIN SIGNALOSOMES"



42%



INCREASE IN NEW RESEARCH PROJECTS FOR THE DEPARTMENT OF MATHEMATICS

76



NEW FUNDED RESEARCH PROJECTS STARTED IN THE FACULTY OF SCIENCE



- CHEMISTRY & BIOLOGY
- COMPUTER SCIENCE
- MATHEMATICS
- PHYSICS

285

PUBLICATIONS



8,118

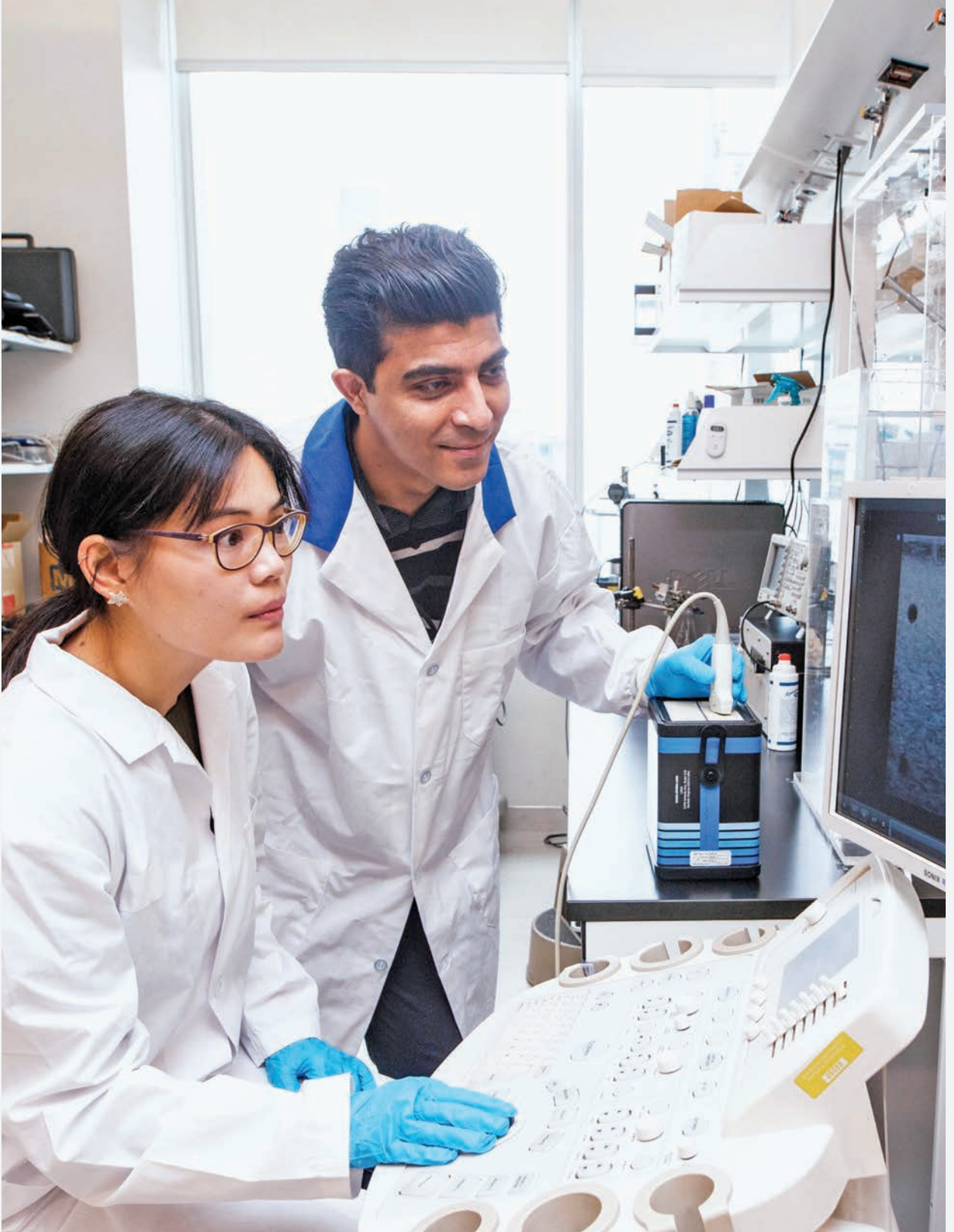
CITATIONS



2x

ONTARIO CENTRES OF EXCELLENCE VOUCHER FOR INNOVATION & PRODUCTIVITY 2 (VIPII) FROM PREVIOUS YEAR







International Initiatives



Making global change requires developing a global perspective. This is what our students and faculty do when they teach, work, research and study abroad with expert partners. Our students have the opportunity to immerse themselves in the international science community and extend their learning, which prepares them for both further studies and career opportunities. Our faculty develop innovative international collaborations that enrich the Ryerson community, extend the university's impact well beyond our campus, and generate solutions that benefit the global community.

Science Citizens of the World

WHY TRAVEL ABROAD TO THE UNIVERSITY COLLEGE LONDON (UCL) SCHOOL OF PHARMACY FOR A SEMESTER? THE REAL QUESTION FOR THREE RYERSON STUDENTS WHO PARTICIPATED IN THE GLOBAL SCIENCE CITIZEN PROGRAM LAST SUMMER IS, WHY WOULDN'T YOU? BETWEEN LIVING IN A NEW COUNTRY, WORKING WITH LEADING ACADEMICS AND GAINING INVALUABLE RESEARCH EXPERIENCE, THE TRIO DESCRIBE THEIR INTERNATIONAL EXPEDITION AS LIFE-CHANGING.

Biomedical student Abinethaa Paramasivam focused on the incidence and prevalence of retinal vascular occlusion in the UK population so as to evaluate the impacts of cardiovascular drugs on patients with this type of vision loss. Supervised by Dr. Li Wei, her work involved analyzing a data set of 15 million people. "Dr. Wei allowed me to carry the research project independently and also gave me valuable career advice," Paramasivam says. "I learned how much I love research and also the array of career options available to me."

Fellow biomedical student Oluwadara Akerewusi also found her supervisor, Dr. Gary Parkinson, to be an exceptional mentor. "He taught me everything I needed to know about his research in pharmaceutical crystallography, cancer research and anticancer agents," she says. Specifically, Akerewusi was responsible for setting up new experimental conditions that would support crystal growth so as to better

understand how atoms are arranged in crystalline structures. "It was through this experience that I knew I wanted to pursue a career in cancer research," she says.

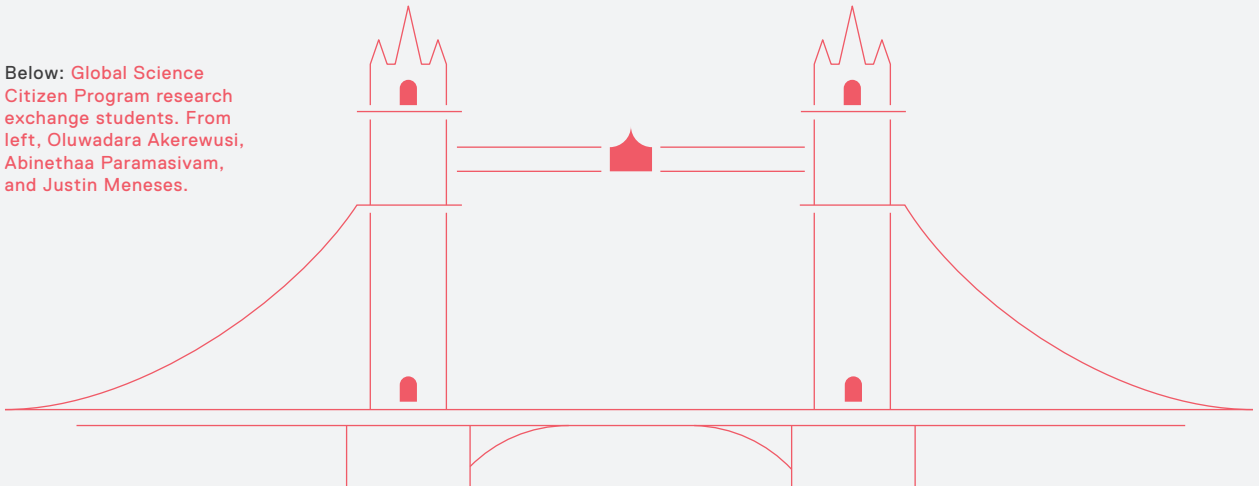
In a change from his previous co-op experience at Sanofi Pasteur, chemistry student Justin Meneses worked in microbiology at UCL's School of Pharmacy. Under the supervision of Dr. Peter Taylor, he conducted a research project to see whether there was a relationship between antibiotic-resistant strains of bacteria and the presence of a certain acid on their polysaccharide capsule. "Working in an academic lab was quite a shift for me," he says. "I was glad to add that experience to the industrial setting I was more familiar with."

What else does Meneses value about the international adventure? "Meeting so many amazing people, making new friends and travelling in Europe. I would do it all again in a heartbeat."

“
Meeting so many
amazing people,
making new friends
and travelling in
Europe. I would
do it all again in a
heartbeat.”



Below: Global Science Citizen Program research exchange students. From left, Oluwadara Akerewusi, Abinethaa Paramasivam, and Justin Meneses.



11

STUDENTS PARTICIPATED IN THE FACULTY OF SCIENCE EXCHANGE PROGRAM

7

ACADEMIC EXCHANGE COUNTRIES:
UK, NETHERLANDS,
SINGAPORE, CHINA,
INDIA, FRANCE,
GERMANY

An Image of Excellence

FULL-TIME RESEARCH ASSISTANT SUPERVISED BY RYERSON MEDICAL PHYSICS RESEARCHER DR. MICHAEL KOLIOS. INTERNATIONAL INTERN AT THE INSTITUT LANGEVIN IN PARIS, DESIGNATED A "LABORATORY OF EXCELLENCE" BY THE FRENCH GOVERNMENT. RESEARCH AIDE TO WORLD-RENOWNED PHYSICISTS WORKING AT THE LEADING EDGE OF ULTRASOUND IMAGING.

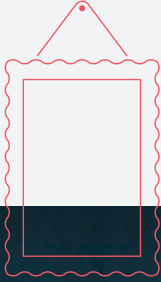


PHOTO: IAN PATTERSON

It's rare to conduct such advanced research at the undergraduate level, but biomedical engineering and physics student Joseph Sebastian is an outlier. Funded by a Mitacs Globalink Research Award, he spent 12 weeks at the Institut Langevin under deputy director Dr. Mickaël Tanter, research director Dr. Mathieu Pernot and research associate Dr. Clément Papadacci. The experience gave Sebastian experience with innovative techniques and experimental design in ultrasound imaging.

"My work was focused in the field of cardiology, specifically a technique that would enable early detection of diastolic heart failure. Dr. Tanter's lab recently developed a new method for the quantitative and non-invasive assessment of heart muscle elasticity during the cardiac cycle based on ultrafast ultrasound imaging and shear wave elastography."

Sebastian is now adding his implementation of the principles of shear wave elastography and measurement of myocardial stiffness at one of the best ultrasound-focused imaging groups in the world to his ongoing work at Ryerson in photoacoustic imaging.

Left: Joseph Sebastian, biomedical engineering and physics student discusses his international internship experience at one of the top ultrasound imaging institutes.

Opposite: Dr. Pawel Pralat is leading a team of local and international researchers at the new Fields-CQAM lab.

Model of Innovation



IN APRIL 2018, THE FIELDS INSTITUTE FOR RESEARCH IN MATHEMATICAL SCIENCES, A TORONTO-BASED INTERNATIONAL RESEARCH CENTRE, ANNOUNCED THAT THE PROVINCE OF ONTARIO WAS INVESTING \$4 MILLION IN A TWO-YEAR PILOT PROJECT TO ESTABLISH THE FIELDS CENTRE FOR QUANTITATIVE ANALYSIS AND MODELLING (FIELDS-CQAM).

The initiative fosters innovation in the mathematical sciences, particularly related to quantitative analytics, by establishing partnerships that enable efficient transfer of knowledge between industry, government and research scientists.

Fields-CQAM has 11 university-based labs in Ontario, with the vast majority featuring international collaborations. The Ryerson-based Computational Methods in Industrial Mathematics lab is a perfect example. The team features several Ryerson researchers, including team lead Dr. Pawel Pralat, Associate Professor in the



Department of Mathematics, along with Dr. Ayse Bener (Mechanical and Industrial Engineering, Faculty of Engineering and Architectural Science), Dr. Konstantinos Georgiou (Mathematics, Faculty of Science), and Dr. Atefeh Mashatan (Information Technology Management, Ted Rogers School of Management). There are also several researchers from other countries on board, including Dr. Bogumil Kaminski and Dr. Przemyslaw Szufel of the SGH Warsaw School of Economics and Dr. Andrei Raigorodskii of the Moscow Institute of Physics and

Technology. In addition, the project's industry partner is NXM Labs Inc., an American leader in autonomous security software solutions based in San Francisco, California.

“Our lab will focus on addressing demand for the complex mathematical models to power data analytics tools and enable advanced simulation or optimization techniques to handle vast quantities of industrial data,” says Pralat. “Ranging from new theorems to algorithms and their computer implementations, we will develop models and tools for non-standard industrial applications.”



The Future of Math

WHEN A PROFESSOR WALKS INTO A CLASSROOM OR COLLABORATES WITH STUDENTS, THEY ARE SHAPING THE FUTURE. BUT FOR DR. ANTHONY BONATO, THIS ROLE TOOK ON A WHOLE NEW DIMENSION IN MARCH 2018 WHEN HE BECAME THE FIRST RYERSON FACULTY MEMBER TO TEACH A COURSE AT THE AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES (AIMS).

Opposite Top: Dr. Anthony Bonato and doctoral student Erin Meger with students at the AIMS centre in Cameroon.

Opposite Bottom: View of the mountains outside of Limbe, Cameroon.

Below: Exterior of the AIMS centre in Limbe, formerly the Jagemn Palace Hotel.



Established in 2003 by Dr. Neil Turok, director of the Perimeter Institute for Theoretical Physics, AIMS is Africa's first network of centres of excellence in mathematical sciences. Focused on developing the nation's mathematics capacity, the institute brings professors from North America and Europe to teach graduate math courses at one of its six sites: South Africa, Ghana, Senegal, Rwanda, Tanzania and Cameroon.

Reflecting on the institute's mission before he left, Bonato wrote, "There is an understanding behind AIMS that mathematics is fundamental, and no society can progress without a critical mass of mathematicians."

Bonato travelled to Cameroon to deliver an accelerated three-week intensive graduate course called "Modelling and Searching Networks," which he had previously taught at the National University of Ireland in Maynooth and Dalhousie University in Halifax.

Bringing along one of his doctoral students, Erin Meger, to act as a teaching assistant, Bonato taught 30 students from 13 countries across Africa who had travelled to AIMS to pursue a master's degree. The students left an indelible positive impression on Bonato.



"For many of them, it was the first time they had ever learned about network science and graph theory," he says. "They were incredibly capable and passionate. It's really just a lack of opportunity that is standing in their way."

The conditions at the Cameroon site were challenging, including daily power outages, limited Internet access and persistent health risks, none of which deterred the students. "Their resilience was incredible," says Bonato. "One student was admitted to hospital with a severe case of malaria but tried to keep up with the course. Another had only started speaking English six months before she arrived at AIMS. They were inspiring."

Reflecting on the potential for the collaboration, Bonato is optimistic. "I think the future is very much open," he says. "Ryerson's emphasis on applied mathematics research is a good fit with AIMS. They are very interested in our areas of expertise, such as discrete maths, networks, biomathematics and financial mathematics."



Science Education



Guided by principles of diversity and inclusivity and led by director Dr. Emily Agard, SciXchange is dedicated to increasing science literacy and community engagement. Hands-on activities, discussion and programs developed and led by the SciXchange team and volunteers make science captivating and accessible for all.



Roll Out the Science!



From September 17 to 23, SciXchange celebrated all things science during Science Literacy Week while highlighting this year's theme: space. Each day saw different events, from free public talks to a book club night, interactive activities in the SLC and Soapbox Science at the Word on the Street Festival. Now in its second year of outreach, Soapbox Science offers public learning activities while promoting female scientists.

The Ryerson community and general public enjoyed learning about life on other planets, the body's immune system and microbiome, DNA and computer codes, whale conservation, astronomy and many other topics. There was also great fun making clouds and tasting space ice cream. As always, the week was engaging for all while fostering a more accessible and inclusive science community.

Future Leaders and Innovators



Canada's first female nuclear physicist, Harriet Brooks (1876–1933), had to battle discrimination throughout her whole education and career to participate in scientific research. Inspired by her dedication and incredible discoveries, the Harriet Brooks Internship (HBI) offers a diverse group of high school youth the opportunity to develop their science and leadership skills.

In its second year this past summer, the HBI provided a one-week program of science spotlights, leadership skills and activity development while also exposing interns to underrepresented members of the scientific community as relatable role models. By the end of the program, interns became activity leaders for the young campers of Camp SoSci – many of whom said their favourite part of camp was the intern-led activities.

Science Days and Summer Nights

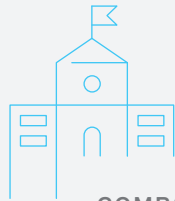
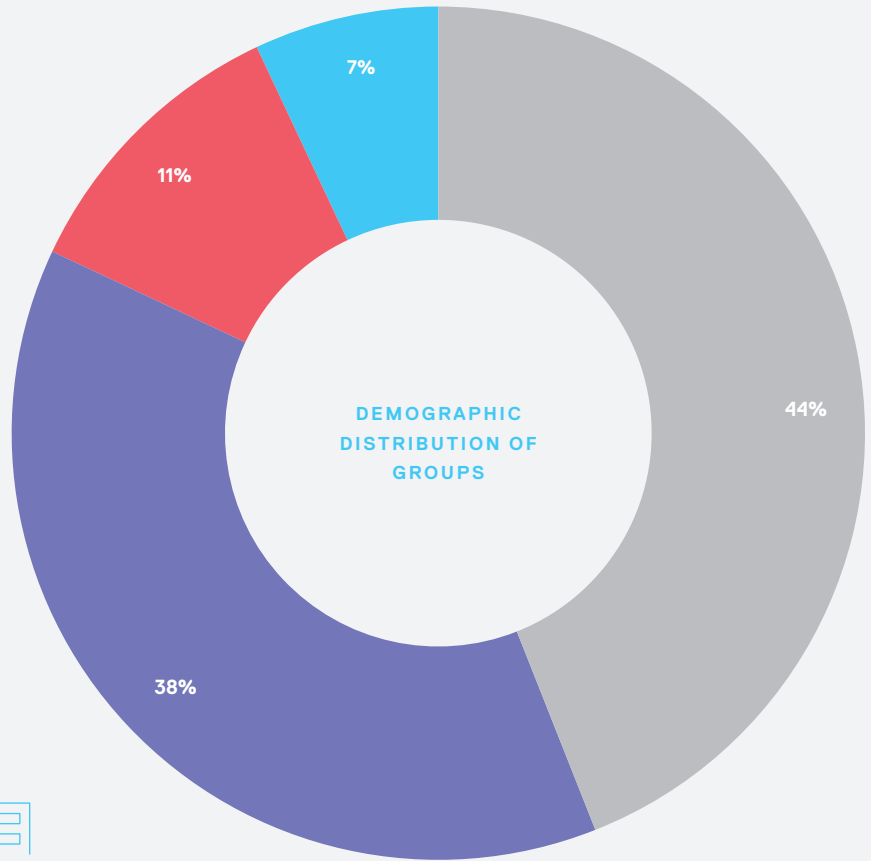


Now in its sixth year, Camp Eureka hosted 136 campers aged 8 to 13. A collaboration between the Faculty of Science, the Faculty of Engineering and Architectural Science and Ryerson Athletics, Eureka provides the chance for campers to work in a real-life university lab as scientists and problem-solve as engineers while also playing sports.

Campers enjoyed exploring our four themes: Destination Earth, I Like To Move It, Machines 'R' Us and Wonders of the World. They also learned about scientists Rosalind Franklin and Dorothy Vaughan among many others, appreciating the diversity within all fields of science and engineering. Counsellors and campers alike had a blast exploring, observing, building and playing together.

SciXchange By the Numbers

- HIGH SCHOOL STUDENTS
- ELEMENTARY STUDENTS
- GENERAL PUBLIC
- ADULTS



2018
NUMBERS

COMPARED
TO 2017

5,562

TOTAL NUMBER OF
PEOPLE ENGAGED

40% [△]

MORE SCHOOLS
REACHED

31



ELEMENTARY SCHOOL
CLASSROOM VISITS

91% [△]

MORE EVENTS
ORGANIZED

38

HIGH SCHOOL
ACTIVITIES HOSTED

67% [△]

MORE STUDENTS
REACHED

Our collaboration reached as far as a high school in **La Loche, Saskatchewan** and the Caribbean Science Foundation in **Barbados**

187

VOLUNTEERS
REGISTERED

1,628



VOLUNTEER
OPPORTUNITY HOURS



Advancement



We continue to find new ways for alumni to engage with students and researchers in the Faculty of Science. Alumni give back by offering their time, experience and financial support. They create transformational opportunities for our students that have a positive impact for years to come. Together, the generosity and commitment of alumni, donors, friends, faculty and staff help to create exceptional student experiences, foster innovation, generate impact in research and build even stronger ties with the greater Toronto community.



2017 Noel Award in Science recipient David Jardine with alumnus and donor Fern Noel.

Perpetual Impact: Fern Noel Endows Award



THERE'S NOTHING LIKE SEEING THE IMPACT OF YOUR ACTIONS FIRSTHAND. FOR FERN NOEL, CHEMICAL TECHNOLOGY '57, THIS HAPPENS EVERY YEAR WHEN HE ATTENDS THE ANNUAL SCIENCE AWARDS NIGHT TO PRESENT THE NOEL AWARD IN SCIENCE.

When he established the award five years ago, Noel's goal was to recognize students who make a contribution to the university and have a financial need. After a successful 33-year career as a chemical researcher at Imperial Oil Limited, he wanted to give back to the Faculty of Science by supporting students whose circumstances are similar to his own experience at Ryerson.

Meeting the award winners has had a powerful impact on Noel. "They are all incredibly appreciative," he says. "They tell me about their involvement, their aspirations and how the money helped them through some difficulties. It is very gratifying to be able to lend my support."

Inspired by the students, Noel decided to create an endowment so the award can be given out in perpetuity. His gift will support an annual award for a deserving recipient. The stories of past Noel Award in Science recipients illustrate the importance of this gift.

David Jardine, a fourth-year computer science student who won the award in 2017, has held six different on-campus

jobs, including his current role as a residence advisor. He also belongs to several student groups such as the department course union. Coming from a single-parent home, the financial support was a relief. "The award gives you a chance to stress about things like assignments instead of worrying about whether you are going to be able to pay tuition or how big your debt will be when you graduate," he says.

For 2015 recipient Ana Sofia Barrows, Medical Physics '17, the award came at a crucial time in her life. In addition to her studies, she was balancing several part-time jobs, involvement in student groups and taking care of her three younger siblings after her mother suffered a stroke. "There's really no word for how helpful it was," she says. "When I got the call that I had won, I just cried. It was kind of a life-saving situation."

Thanks to the generosity of Fern Noel, students like Jardine, Barrows and other award recipients Nathan Battersby, Biology '17 (2016) and Sadia Mehmood, Biomedical Sciences '19 (2018) will continue to be supported in their efforts to make an impact.

SCHOLARSHIPS & AWARDS



PHOTO: CLIFTON LI

This year, the Faculty of Science continued to increase the number of scholarships & awards available to students.

In 2018, several awards were given out for the first time:

15%[^] INCREASE OF UNDERGRADUATE RECIPIENTS OF AWARDS AND SCHOLARSHIPS

- FINLAYSON INNOVATION IN USER EXPERIENCE AWARD
- IMOGEN R. COE AWARD IN EQUITY, DIVERSITY AND INCLUSION
- FIRST ENTRANCE AWARDS
- GEOFF BOYES INTERNATIONAL STUDENT LEADERSHIP AWARD
- GEOFF BOYES GRADUATE AWARD

Alumni Involvement

FACULTY OF SCIENCE ALUMNI CONTINUE TO ENGAGE IN A VARIETY OF WAYS, INCLUDING ESTABLISHING SCHOLARSHIPS AND AWARDS, MENTORING STUDENTS, RETURNING TO CAMPUS TO SPEAK, SUPPORTING THE FACULTY'S ANNUAL FUND PRIORITIES AND CREATING CO-OP OPPORTUNITIES FOR STUDENTS.

Below: Patrick Cheung (middle) accepting his Raymond Chang Outstanding Volunteer Award.

Opposite: 2018 Faculty of Science award winners.

THE FACULTY OF SCIENCE IS PROUD OF THREE ALUMNI WHO WERE RECOGNIZED FOR THEIR CONTRIBUTIONS TO THE UNIVERSITY COMMUNITY AT THE ANNUAL G. RAYMOND CHANG OUTSTANDING VOLUNTEER AWARDS ON JUNE 21, 2018.



PHOTO: CLIFTON LI

Greg Leaver

COMPUTER SCIENCE '13

Since graduating from Computer Science in 2013, Leaver has been an important participant in career mentoring and recruitment events, volunteering his time and expertise to help students pursue opportunities at Google, where he is a software engineer. Leaver's guidance has helped many students make important career decisions.

Sully Syed

COMPUTER SCIENCE '05

As one of the founding members and the current president of the Computer Science Alumni Association, Sully Syed has shared his knowledge and expertise with the Faculty of Science and the wider Ryerson community for over a decade. His commitment to strengthening and engaging the community of Computer Science alumni encourages a culture of participation and helps educate current students about possibilities for their future careers.

Patrick Cheung

CIVIL ENGINEERING '82

A 1982 Civil Engineering graduate, Cheung has volunteered with the Ryerson Urban Water program for close to a decade. In addition to his service on steering committees for research projects, workshops and conferences, Cheung has been a speaker at numerous symposia, a judge at several events and a valuable mentor for students studying water management.

It All Started Here

Two recent alumni look back on their time at the Faculty of Science



Daniel Cardenas

BSC MEDICAL PHYSICS '15
MSC MEDICAL PHYSICS '17

Though starting out as a chemistry major, Daniel Cardenas switched into Medical Physics after first year when he realized that was his passion. Then, after taking a course in Radiation Protection and Dosimetry during his master's, Cardenas decided to pursue a career in radiation safety. He began working at the Sunnybrook Health Sciences Centre and is now the Radiation Safety Officer at the University of Victoria in British Columbia.

Looking back on his time at Ryerson, Cardenas reflects on how rewarding it was, especially when he had opportunities to conduct research

abroad at the Institute for Atomic and Subatomic Physics in Vienna, Austria and also at the Canadian Light Source in Saskatoon. "My experience at Ryerson has directly contributed to putting me where I am now," he says. "The skills and knowledge essential to obtaining my dream job were all gained during my degrees. The quality of the professionals and mentors who guided me at Ryerson was a big part of what enabled me to succeed in my field."

Cardenas is a donor to the Faculty of Science who gives back in order to support the next generation of science students.

Rosha Pashang

BSC BIOLOGY '12,
MSC ENVIRONMENTAL
APPLIED SCIENCE AND
MANAGEMENT '16

“
My career was enriched by the counsel and mentoring of my professors and their dedication to share their experience and knowledge with me.”

Rosha Pashang's time at Ryerson was full of interesting and challenging projects. Her undergraduate thesis investigated the process of cellulolytic degradation fermentation products of a mixed community culture and a pure culture of *Clostridium thermocellum*. As a master's student, her thesis investigated bacterial survival at solid-air interfaces under the supervision of Dr. Gideon M. Wolfaardt.

Along with this research, Pashang participated in a project funded by NSERC and the Nuclear Waste Management Organization (NWMO) to help ensure Canada's used nuclear fuel will continue to be managed according to the highest scientific standards in the decades to come. She also worked with Dr. Kimberley Gilbride as a lead researcher investigating the role of urban environments on bacteria communities and detection of antibiotic-resistant bacteria. She also founded her own company, Rosh Inc.,

in 2015, which collaborates with industry and public sector partners globally to help them transition to sustainable practices.

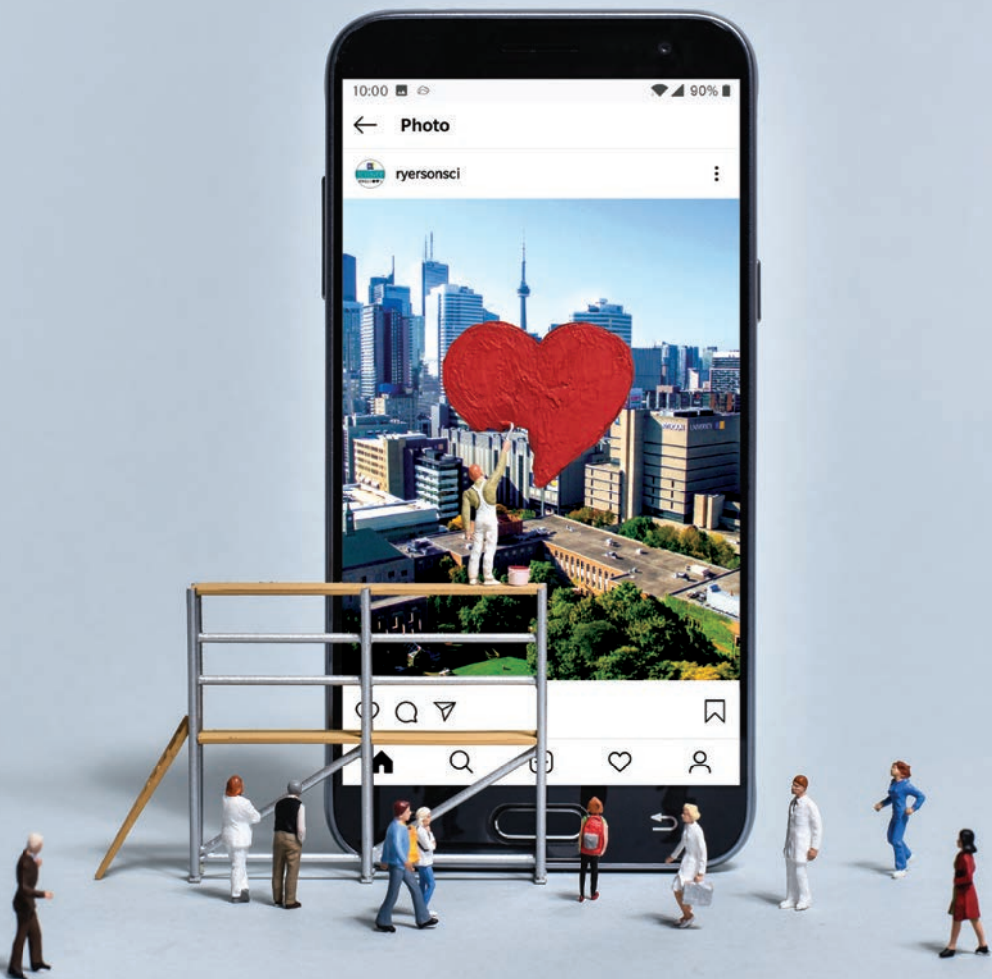
Now a PhD candidate in Chemical Engineering at the University of Bath in the United Kingdom, Pashang appreciates the foundation she built at Ryerson. "My career was enriched by the counsel and mentoring of my professors and their dedication to share their experience and knowledge with me," she says. "The learning environment also played a role in enhancing my skills, including opportunities to build a network of scientists and participate in projects that prompted my interest in consulting."

Along with her research, Pashang regularly participates in team-based challenges that involve creating a new venture, solving problems with a startup, and empowering youth to pursue careers in STEM fields.

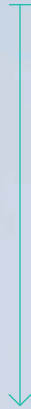


Opposite: Daniel Cardenas credits the Faculty of Science at Ryerson for getting him where he is today.

Right: Rosha Pashang was empowered by Ryerson's counselling and mentoring services to pursue a career in STEM.



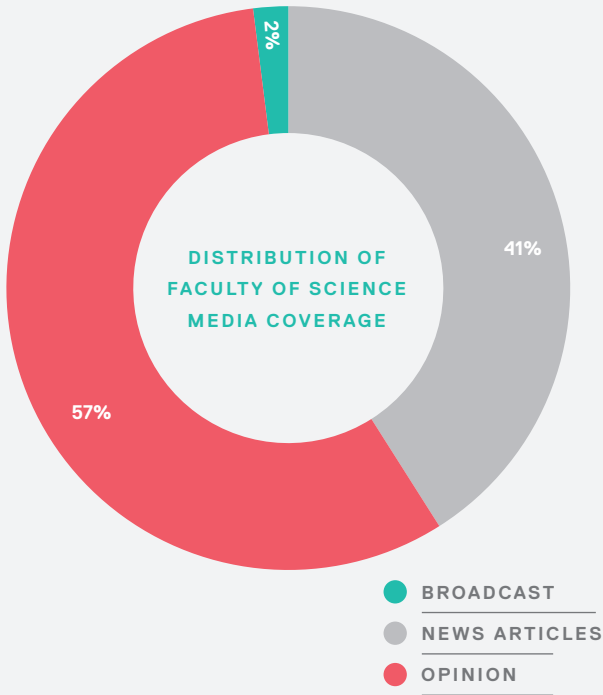
Communications



Communications plays a vital role in the competitive post-secondary market, which is why our award-winning Communications and Web Office works hard to enhance and promote the reputation of the Faculty of Science.

Telling great stories about innovative research and academic excellence across multiple channels keeps the university and greater community informed. Those stories are also critical for building meaningful and lasting relationships with alumni, donors, industry and government, delivering value well into the future.

Select Communications Projects



Media Coverage

Ryerson Today is the university's daily online news source, publishing stories about and related to the Ryerson community, including students, staff, faculty and alumni.

25,000+
UNIQUE PAGEVIEWS
OF SCIENCE
STORIES FEATURES

14%[^]
INCREASE
IN UNIQUE
PAGEVIEWS

Online Activity

As the reputation of the Faculty of Science continues to grow, online activity on our webpages has similarly increased and improved.

240,000+
PAGEVIEWS

2 Mins
AVERAGE TIME
ON PAGE

57%[△]
INCREASE IN
UNIQUE PAGEVIEWS

3%[▲]
IMPROVEMENT
IN THE BOUNCE RATE



Digital Campaign

The Faculty of Science ran one digital campaign in 2018: multi-channel (Google Ads, Facebook, LinkedIn) digital advertising to support the Biomedical Physics graduate program. Using the outcomes of previous campaigns to inform the media and content strategy, this campaign saw significant performance improvements and increased efficiencies. With 33% less budget investment, we reached more people and drove more website visits and OUAC clicks than the previous year at a lower cost-per-site visit and cost-per-conversion.

2.1M

AD IMPRESSIONS



3,350

BIOMEDICAL PHYSICS
GRADUATE PROGRAM
WEBPAGE VISITS

77

SOCIAL
ENGAGEMENTS



62

OUAC GRAD
APPLICATION
LINK CLICKOUTS



13

OPEN HOUSE
RSVP CLICKS

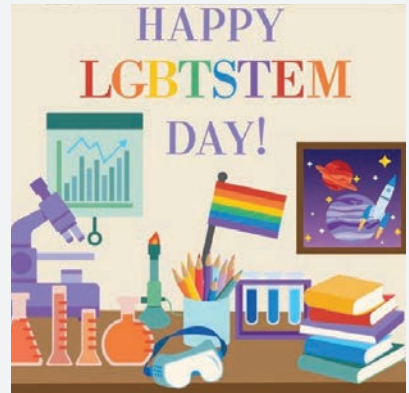
Social Media

The Faculty of Science predominantly uses Twitter and Instagram to reach our audience.



@RYERSONSCI

With Twitter, our approach remained consistent in 2018, and we saw steady growth in engagement. We continue to tailor and refine our strategy and messaging for our Twitter audience, which prefers this channel over others.



24%[△]

INCREASE IN FOLLOWERS

46%[△]

INCREASE IN MENTIONS

27,000+

AVERAGE MONTHLY REACH



@RYERSONSCI

With Instagram, we shifted our focus to include more Faculty of Science community members sharing their unique stories. We had many individuals and groups take over the account to showcase life as a science student. Both undergraduate and graduate students took the viewer to the first day of school, behind the scenes of university events, to job shadowing opportunities, and other happenings.

2x[△]

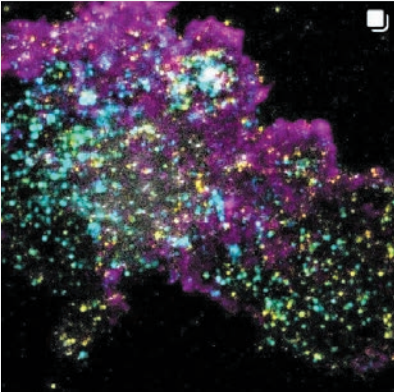
INCREASE IN MENTIONS

78%[△]

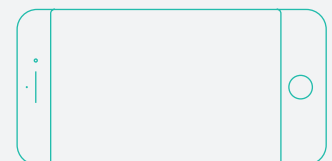
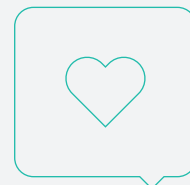
INCREASE IN STORY VIEWS

61%[△]

INCREASE IN CLICK-THROUGHS



The IINN job shadowing takeovers proved to be an especially engaging strategy. Piloted in 2016 by the Faculty of Science, the Yeates School of Graduate Studies and Ryerson's Career Centre, Industry Insights and Navigating Networks (IINN) is a graduate-specific career education program now available to science students. It offers an immersive learning experience in a variety of industries and illustrates the diverse career paths available. Our 2018 IINN Instagram takeovers gave current graduate students a glimpse into career opportunities after the completion of their degrees.





“

**Science is the acceptance
of what works and the
rejection of what does not.
That needs more courage
than we might think.”**

JACOB BRONOWSKI

EDITORIAL DIRECTOR

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ANDORA GRAPHICS

MINIATURE ART
& PHOTOGRAPHY

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PHOTOGRAPHY

MARK BLINCH

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