

FACULTY OF SCIENCE

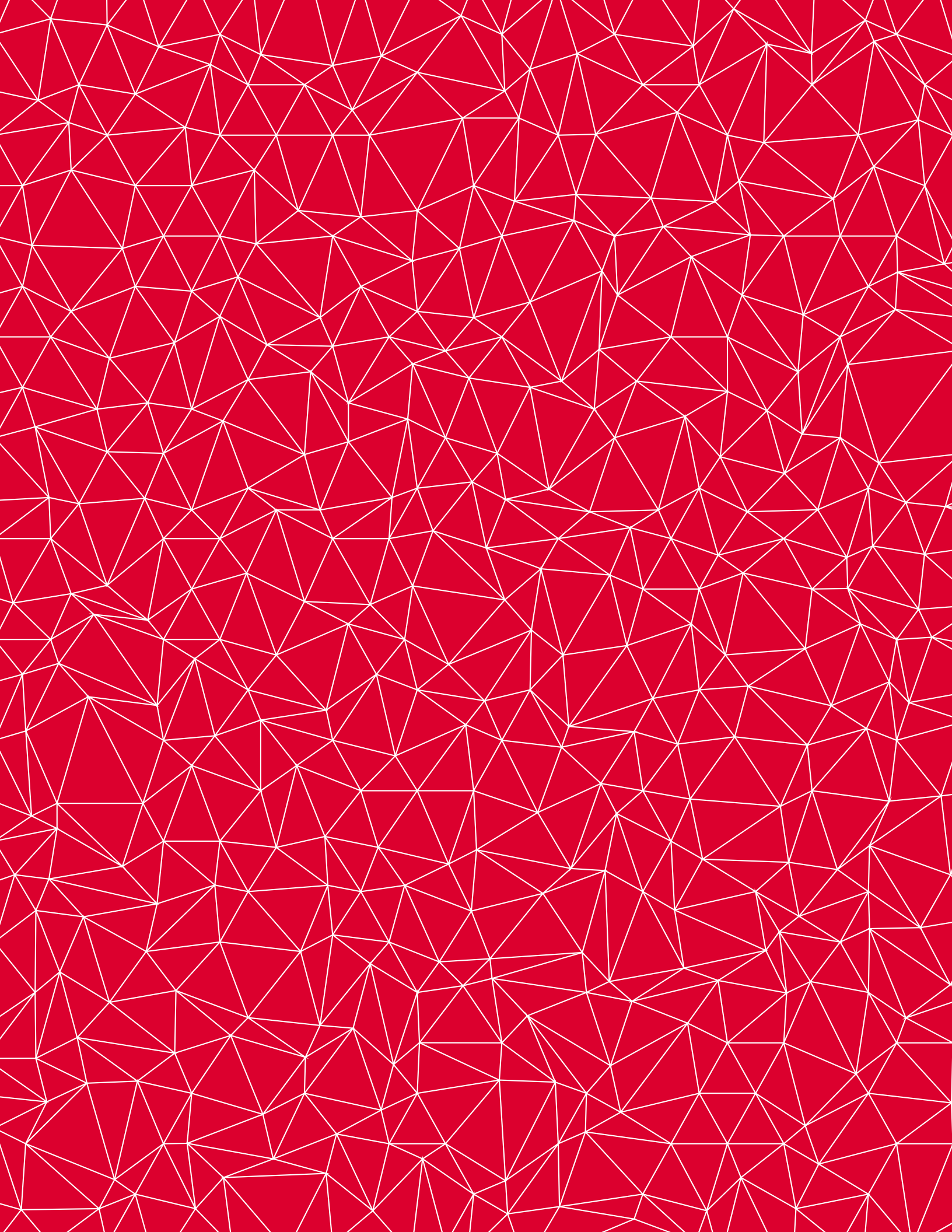
2014

ANNUAL REVIEW

science

YORK  
UNIVERSITÉ  
UNIVERSITY







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JUL



FEB



MAR



AUG



NOV



DEC

2014 WAS A TERRIFIC YEAR FOR

## RAY'S ROUND-UP OF SELECT HIGHLIGHTS FROM 2014

JAN

Biology PhD Scott McIvor examined how bees adapt to urban living

FEB

York Observatory hosted its first-ever wedding proposal

MAR

Pi Day - Teamed up with Club Infinity, an undergrad math and stats club, to offer free slices of pie to over 150 people in less than 20 minutes

APR

Life Sciences Building received Silver certification for Leadership in Energy and Environmental Design (LEED)

MAY

Department of Science & Technology Studies was established

JUN

Physicist Scott Menary and biologist Dawn Bazely were featured on CBC's *Quirks & Quarks Big Questions* show

York Observatory broadcast its 200<sup>th</sup> radio episode

JUL

Ray Jayawardhana became the FSc Dean  
Biology PhD Emily McKinnon put backpacks on songbirds and found differences between juvenile and adult Wood Thrush migration patterns

AUG

Biology undergraduate researchers April Kong, Fojan Talaei and Lisa Shim, working with sessional lecturer Kyle Belozarov, found potential new therapies to treat severe epilepsy

Hosted BeeCon3, a Southern Ontario bee researchers symposium

Physicist Sean Tulin joined the Faculty

SEP

Faculty of Science 50<sup>th</sup> anniversary celebrations kicked off at York Homecoming

Biologist Amro Zayed was featured in *Red Alert*, a short documentary on the recent reports of redheads going extinct

OCT

Chemist Derek Wilson and mathematician Jane Heffernan contributed to the *Mathematical Modelling of Zombies* book

Mathematician Huaixiong Huang was appointed associate director for industry liaison at the Fields Institute for Research in Mathematical Sciences

NOV

Physics and Astronomy Day, part of our Science@50 activities, hosted 200+ high-school teachers and students for a showing of the *Interstellar* film followed by a panel discussion featuring professors Pat Hall and Sean Tulin

Biologist Sapna Sharma gave a York Circle lecture on the effects of climate change on lakes around the world

DEC

Physicist Matthew Johnson was awarded 3<sup>rd</sup> place for the 2014 Buchalter Cosmology Prize

Chemistry Day, part of our Science@50 activities, hosted 100+ high-school students, teachers, parents and others for an evening dedicated to showcasing chemistry at York. The event included student presentations on research, a career panel and a magic show

Launch of the York University Science Alumni Network (YUSAN)



## RESEARCH BY THE NUMBERS

**100%**

Faculty of Science first-time new faculty received an NSERC Discovery grant - for the third consecutive year

**\$8M+**

Total new funds from NSERC

**\$1.8M+**

Total new funds from CIHR

**\$650K+**

Total new funds from Mitacs for student and postdoc internships, research assistant support and more

**\$1.3M+**

Total new funds from other sources

**\$11.9M+**

Total new research funding in the Faculty of Science

## HIGHLIGHTS

Over \$1.6M in funding from NSERC CREATE to **Diethard Bohme** <sup>C</sup> and **Derek Wilson** <sup>C</sup> for Training Program in Mass Spectrometry-Enabled Science and Engineering (MS-ESE).

**Arthur Forer** <sup>B</sup> received an NSERC Discovery grant totalling over \$225K for Mechanisms of Chromosome Movement During Cell Division; continuously funded since 1973.

Over \$195K in NSERC Research Tools and Instruments funding to **Kathi Hudak** <sup>B</sup> for Liquid Scintillation Analyser and **Sergey Krylov** <sup>C</sup> for Instrumentation for Label-Free Solution-Based Kinetic Analysis of Biomolecular Interactions.

Over \$450K in NSERC/CIHR CHRP funding to **Sergey Krylov** <sup>C</sup> for Technology for Analysis of miRNA Signatures: A Novel Tool for Personalized Cancer Medicine.

Over \$717K in NSERC Strategic Project funding to **Sergey Krylov** <sup>C</sup> for FLOWSTREAM, a technology that integrates continuous-flow micropurification with continuous-flow microsynthesis to streamline small-scale chemical manufacturing.

**Anantharaman Kumarakrishnan** <sup>PA</sup> was awarded \$169K from the NSERC Idea to Innovation program and Ontario Centres of Excellence Voucher for Commercialization, in partnership with Scintrex Ltd, to develop engineering prototype laser systems for commercial applications.

\$375K from the NSERC Collaborative Research and Development program to **Jianhong Wu** <sup>MS</sup>, in partnership with Infersystems Corp., for Enterprise Software for data analytics.

Mitacs Accelerate Cluster project to **Logan Donaldson** <sup>B</sup>, **Sergey Krylov** <sup>C</sup>, **Yi Sheng** <sup>B</sup> and **Derek Wilson** <sup>C</sup>, in partnership with Sanofi Pasteur, Biomolecular Structure Analysis to Accelerate Development of New Vaccines and Monoclonal Antibodies.

Over \$580K from CIHR to **Peter Cheung** <sup>B</sup> for Elucidating the Functional Roles of the Different H2A.Z Isoforms in Mammalian Cells.

**Huaiping Zhu** <sup>MS</sup> was awarded over \$202K as part of a CIHR-funded collaborative project with Beate Sander from Public Health Ontario, for the Cost-Effectiveness of West Nile Virus Mitigation Strategies: A Computer Simulation Model.

**Gary Sweeney** <sup>B</sup> was awarded over \$520K from CIHR for Mechanisms Regulating Metabolic Effects of Adiponectin in Obesity and Diabetes.

**Mark Bayfield** <sup>B</sup> received over \$190K for the Ontario Early Researcher Award for La and La-Related Protein Function in Cellular Metabolism and Human Disease.

**Arturo Orellana** <sup>B</sup> received over \$63K seed funds from MaRS Innovation for Developing Novel LXRΒ Antagonists for the Treatment of Glucocorticoid-Induced Side Effects.

**Emanuel Rosonina** <sup>B</sup> was awarded the Banting Research Foundation Discovery Award for Regulation of Transcription and Splicing Factors by Sumoylation.

Over \$119K from the Ministry of Environment to **Sapna Sharma** <sup>B</sup> for the Study of Nutrient and Benthic Algae Issues in Lake Huron and **Huaiping Zhu** <sup>MS</sup> for Updating the High Resolution (45 km x 45 km) Probabilistic Climate Projections over Ontario via Statistical Downscaling using the New IPCC AR5 Data.

\$248K in funding from CFI and ORF to **Jennifer Chen** <sup>C</sup> for Infrastructure for Nano Materials lab that supports research in biodiagnostics tools and clean energy technologies.

**Sampa Bhadra** <sup>PA</sup> was awarded \$124K from NSERC Subatomic Physics Project grant as co-investigator for Canadian Participation in the T2K Neutrino Oscillation Experiment.

**B**  
BIOLOGY

**C**  
CHEMISTRY

**MS**  
MATHEMATICS  
& STATISTICS

**PA**  
PHYSICS &  
ASTRONOMY

**STS**  
SCIENCE &  
TECHNOLOGY  
STUDIES

## SELECT RESEARCH FUNDING

Researcher	Project Name
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**SELECT NSERC DISCOVERY**

Gerald Audette	<b>C</b> Structural and Functional Studies of Bacterial Adhesins and Protein Nanotubes
Mark Bayfield	<b>B</b> Mechanisms of Regulation of the Unfolded Protein Response
Carol Bucking	<b>B</b> Physiological and Behavioural Effects of Digestion In Aquatic Vertebrates
Rene Fournier	<b>C</b> Computational Methods for the Exploration of Potential Energy Surfaces With Applications to Nanoalloy Materials
Ed Furman	<b>MS</b> Quantitative Methods for Modelling and Pricing Dependent Insurance Risks
Scott Kelly	<b>B</b> The Endocrine Regulation of Salt and Water Balance In Aquatic Organisms
Tom Kirchner	<b>PA</b> Collision-Induced Few-Body Dynamics of Atomic and Molecular Systems
Anantharaman (Kumar) Kumarakrishnan	<b>PA</b> Ultrasensitive Measurements of Forces Using Laser-Cooled Atoms
Chris Lortie	<b>B</b> Unpacking the Trophic Effects of Shrubs in Arid and Semi-Arid Systems to Inform Restoration and Management
Jean-Paul Paluzzi	<b>B</b> Neuroendocrine Systems Regulating Physiological Processes In Blood-Feeding Arthropods
Ron Pearlman	<b>B</b> Molecular Analysis of Genome Stability/Meiosis-Chromatin Transactions
Emanuel Rosonina	<b>B</b> Mechanisms of Transcription Reinitiation
E.J. Janse van Rensburg	<b>MS</b> The Statistical Mechanics and Combinatorics of Self-Avoiding Walk and Directed Path Models of Polymers
Derek Wilson	<b>C</b> Conformational Disorder in Protein Function and Pathogenic Aggregation
Hongmei Zhu	<b>MS</b> Applied Time-Frequency Analysis

**SELECT NSERC CANADIAN AQUATIC INVASIVE SPECIES NETWORK**

Norman Yan	<b>B</b> Strategic Network Enhancement Initiative - Summer Teaching Institutes
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**SELECT NSERC ENGAGE & ENGAGE PLUS**

Gerald Audette	C	Developing an Efficient Bacterial Production of the Gellan Hydrocolloid
Alan Hopkinson	C	Density Functional Theory Calculations for Improving the Chemical Selectivity of Explosives Detection
Demian Ifa	C	Electrospray Chemical Synthesizer
Seyed Moghadas	MS	An Agent-Based Decision Support Tool for Master Data Management
Derek Wilson	C	Development of Differential Mobility Spectrometry (DMS) Technology for Applications in Phosphoproteomics

**SELECT MITACS ACCELERATE**

Ed Furman	MS	Economic Capital Modelling by Using Copulas
Ed Furman	MS	Economic Capital and Capital Allocation Modelling
Huaxiong Huang	MS	Credit Rating/Estimates for Small and Medium Enterprises
Hanna Jankowski	MS	Evolution of Digital Access Modes in Employee and Family Assistance Programs
Seyed Moghadas	MS	Impact of Early Vaccination During Influenza Outbreaks
Seyed Moghadas	MS	ExomeAnnotator: Developing a System Biology Approach to Genome Annotation for Disease Risk Assessment
Jianhong Wu	MS	Evaluate the Impact on Transmission Dynamics and Cost-Effectiveness of Pertussis Booster Vaccine for Canadian Adolescents and Adults

**SELECT MITACS GLOBALINK**

Marshall McCall	PA	Why Galaxies Spin
Asia Weiss	MS	Consistent Colourings of Polytopes Facets
Jianhong Wu	MS	Data Fitting to Dengue Fever
Jianhong Wu	MS	Determining the Force of Infection From a Dynamic Model
Jianhong Wu	MS	Economic Optimization of Visceral Leishmaniasis Control
Huaiping Zhu	MS	Flocking Behaviour Research

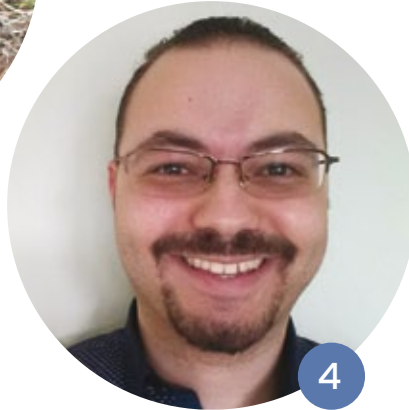
## OUR EARLY CAREER RESEARCHERS ARE



1

**1. SAPNA SHARMA** B

Led an international effort with over 80 researchers from 20 countries to develop a database of lake surface water temperatures for more than 290 lakes worldwide. This study was published in *Nature Scientific Data*.



4

**2. CHRIS BERGEVIN** PA

Appointed to organize the 2017 Mechanics of Hearing workshop. This international event, which only happens every three years, will help raise both the university's and the country's science reputation.

**4. YOUNESS LAMZOURI** MS

Published three papers on analytic number theory, more precisely on the distribution of prime numbers, L-functions and character sums, in top-tier journals: *Proceedings of the American Mathematical Society*, *Mathematics of Computation* and *International Journal of Number Theory*. Was also invited to speak at two international conferences.

**5. JAMES ELWICK** STS

Launched the first volume of the *John Tyndall Correspondence Project*. There will be 18 volumes in total, one every six months.

**6. JENNIFER CHEN** C

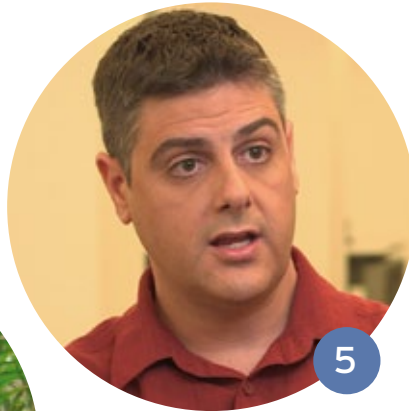
By integrating designed bio-molecules with nanomaterials, developed, together with her team, two novel optical sensing platforms for detecting small molecules and biomarkers such as microRNA.



2

**3. EMANUEL ROSONINA** B

Demonstrated that a protein modification system called SUMO acts to keep gene expression in check.



5



3



6



## RAPIDLY EMERGING AS LEADERS IN THEIR FIELDS

### 7. THILO WOMELSDORF <sup>B</sup>

Made a major breakthrough in understanding how single brain cells contribute to the formation of dynamic brain networks during attention-demanding activities. These findings were published in *Nature Neuroscience* and *Current Biology*.

### 8. SEAN TULIN <sup>PA</sup>

Working together with experimentalists, Sean developed new strategies at particle colliders to discover new forces of nature beyond our current understanding.

### 9. MATT JOHNSON <sup>PA</sup>

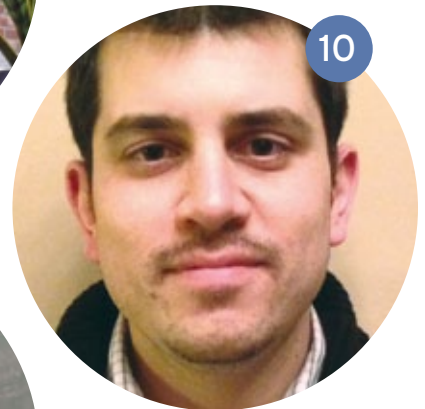
Using the shadows of galaxies on the cosmic microwave background radiation (light from moments after the Big Bang) and detailed computer simulations, determined a way to both predict and detect new physical properties near the time of the Big Bang.

### 10. JEAN-PAUL PALUZZI <sup>B</sup>

With his team, established that a peptide hormone expressed in the nervous system and gut of adult mosquitoes elicits anti-diuretic activity on the Malpighian (renal) tubules, which could reveal novel targets for endocrine disrupting compounds useful for the control of mosquitoes.

### 11. DEMIAN IFA <sup>C</sup>

Published papers in top-tier journals: two in *Analytical Chemistry* reporting improvements in the technique of desorption electrospray ionization, and two in the *Journal of the American Society for Mass Spectrometry* introducing applications of this technique to map small molecules in plants and fungi.







DAWN BAZELY



BIOLOGY

## REVEALING NEW TRENDS IN CLIMATE AND PLANT-ANIMAL INTERACTIONS

Dawn Bazely, biologist, has gained international recognition for her plant-animal interactions research - from the temperate to the arctic region. She is also the "go-to" person on topics such as invasive species, climate change impacts, forest dynamics and fungal endophytes of grasses. Her research has included studies on the effect of grazing by lesser snow geese on sub-arctic salt-marshes, foraging behaviour in sheep, plant anti-herbivore defences, and the effects of deer grazing and browsing in Carolinian forests in southern Ontario.

In 2014, Bazely found that moose and reindeer saliva fight toxic fungus found in plants that could be dangerous or fatal to their existence.

"Our moose saliva research was a good example of the challenges of communicating science research, which is 99 per cent tedious and aims for precision and reproducibility," notes Bazely.

"It was the spit that tickled the interest of journalists, the public, and even other colleagues, and not our many other (boring) papers about grass leaves!"





SAMPA BHADRA

“What can be more thrilling than studying a particle that may hold the clue to our very existence?”

## DO ELUSIVE NEUTRINOS HOLD THE KEY TO OUR EXISTENCE?

Sampa Bhadra, particle physicist, and her Canadian colleagues from the University of Toronto and TRIUMF, Canada’s lab for particle and nuclear physics, made a major breakthrough in the understanding of the elusive neutrino particles. Neutrinos in flight should morph in identity back and forth between three different types - electron, muon and tau.

Muon neutrinos produced at an accelerator in Tokai travel to a huge underground detector in Kamioka. Bhadra and her collaborators on the international T2K (Tokai to Kamioka) experiment in Japan observed for the first time the transformation of muon neutrinos into electron neutrinos in flight.

This sealed the measurement of the last unknown parameter related to neutrinos, bringing T2K one step closer to solving how our material world came into existence.

“One of the urgent questions in physics and cosmology is how matter has survived annihilation,” says Bhadra. “We are made of matter particles, so sometime after the Big Bang the physics of matter must have been different from the physics of anti-matter, allowing matter to win. We now think neutrinos are the key to understanding this puzzle. What can be more thrilling than studying a particle that may hold the clue to our very existence?”



PHYSICS &  
ASTRONOMY



PETER CHEUNG



BIOLOGY

## GETTING A BETTER GRIP ON THE GATEKEEPERS

Molecular biologist Peter Cheung studies how mammalian cell gatekeepers, also known as histones, work. Recognized for his chromatin and cancer research, Cheung focuses on a specific histone variant (H2A.Z) known to be critical for controlling gene expression.

A long-time puzzle has been why this variant functions to turn some genes on, but other genes off. Cheung's group plays an important role in identifying the key molecular steps that switch this function in controlling gene expression, especially in the context of regulating cancer-causing genes.

"We now know that histones play critical roles in keeping the genome working properly in

many biological processes, and mistakes in these pathways can drive cancer development," explains Cheung.

"Understanding H2A.Z's key functions in normal and cancer cells could identify disease-causing steps that can then be targeted by future drug discovery work."





KENTON KROKER

## LOOKING AT THE FUTURE OF EPIDEMICS... THROUGH THE REARVIEW MIRROR

Kenton Kroker studies the historical and social structures that have helped shape contemporary biomedical practice. His interests are generally confined to the 19<sup>th</sup> and 20<sup>th</sup> centuries, with a particular focus on laboratory-clinic interactions. Kroker's first book, *The Sleep of Others*, showed that it took almost 80 years before sleep apnea made the sleep laboratory an integral part of clinical practice.

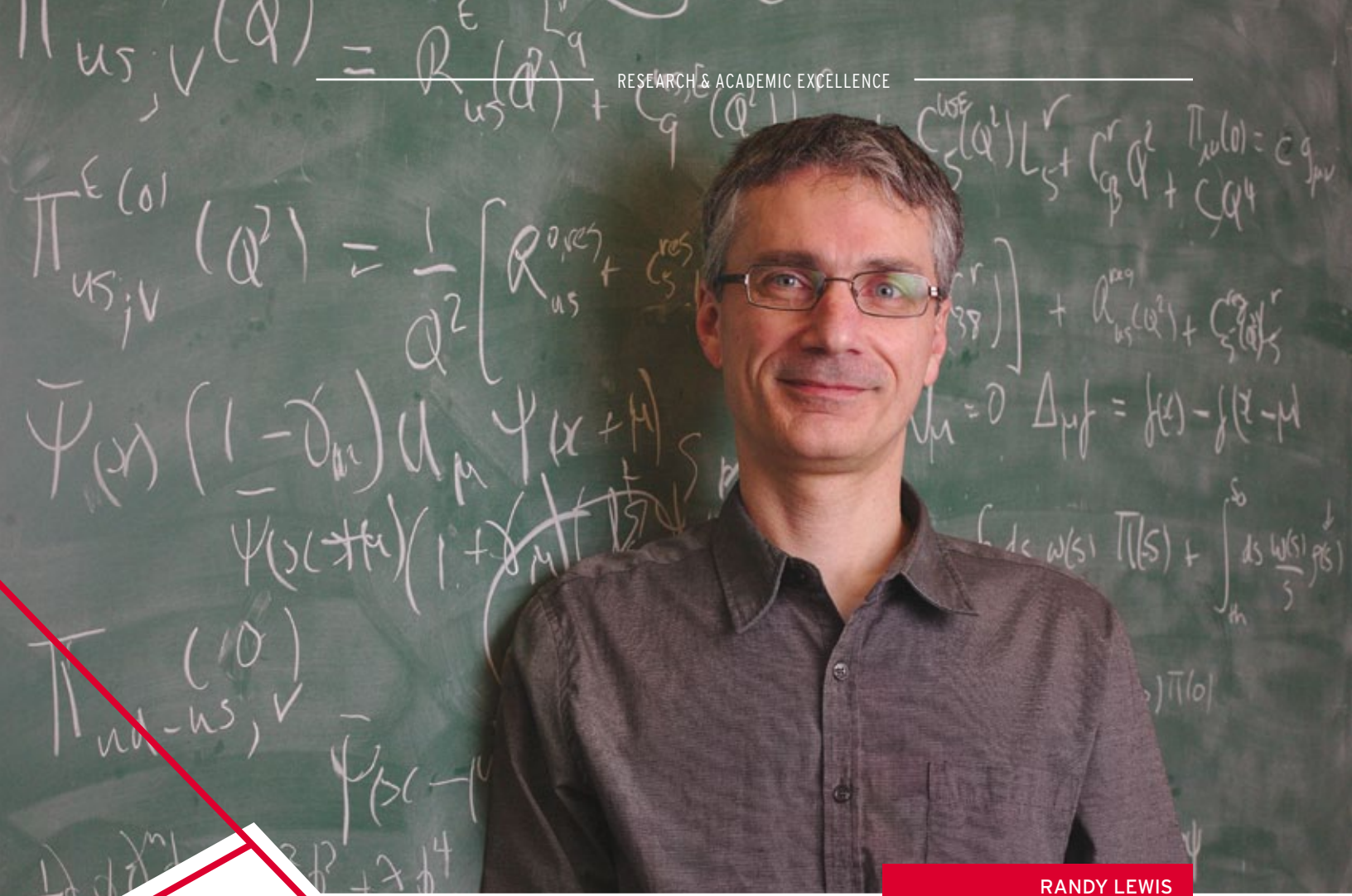
Kroker's current project reconstructs the history of epidemic encephalitis, a mysterious neurological disease that affected tens of thousands of people worldwide during the 1920s, and then suddenly disappeared. There is plenty of speculation about what the disease really was: a variant strain of influenza, or perhaps a virus yet-undiscovered.

For Kenton though, the real mystery is why there were thousands of scientific papers published on an obscure disease that affected so few people. Kenton's research findings will help us better understand this pivotal turning point in disease research.

"Epidemic encephalitis was what we would now call an 'emerging infectious disease.' Scientific interest in it was strategic, symbolic, global and highly interdisciplinary. My aim is to help us better understand the interrelationship between emerging disease research and social structures."



SCIENCE &  
TECHNOLOGY STUDIES



RANDY LEWIS

PHYSICS &  
ASTRONOMY

## DISCOVERIES AT A SUBATOMIC LEVEL

Physicist Randy Lewis' prediction for the masses of two previously unseen subatomic particles were confirmed by Europe's CERN lab for nuclear research. Lewis, along with colleague Richard Woloshyn of Canada's TRIUMF lab, theorized the properties of these two particles by using supercomputer methods in a paper published in 2009. The particles - called  $\Xi_b^-$  and  $\Xi_b^0$  - will be added to the family of baryons, which includes the familiar protons and neutrons that make up most of the mass of the visible universe. This finding offers a new perspective on the smallest building

blocks that make up our world, and helps to clarify our understanding of the universe we live in.

Lewis says, "If we want to make brand-new, unexpected discoveries, we need to prove to ourselves and to everyone else that we really understand this quantum physics. Now we have confidence moving ahead to other predictions and maybe even stranger physics."

Lewis and Woloshyn's finding will pave the way to newer innovations in the quantum physics of elementary particles.





HÉLÈNE MASSAM

## MAKING THE IMPOSSIBLE POSSIBLE

Hélène Massam is a statistician who works on graphical models methodology and, more generally, in statistical learning. Graphical models are designed to uncover and estimate dependence relationships between variables. They are particularly useful when the number of variables they represent is very high. Thus graphical models play an important role in a range of applications. These span from studying the relationship between the genes of a patient and their disease status to analyzing financial data and optimizing investors' portfolios.

Massam's research not only includes her methodological work in graphical models and statistical learning, but also more theoretical work such as the characterization

of distributions used in relation to graphical models or the convergence properties of some estimators.

In 2014, Massam and her graduate students were able to determine whether, with a given sample size, the strength of a large network such as a WiFi relay network could be estimated by splitting it into smaller networks. They were rendering possible a task that was previously impossible due to the size of the calculations.

They also developed a new way to estimate the covariance structure of graphical models with the additional constraint that some groups of variables have the same relationship.



MATHEMATICS  
& STATISTICS



Maria Mazzurco,  
Ronald Kent  
Medal recipient

MARIA MAZZURCO



BIOLOGY

## ENHANCING AND IMPROVING LAB OPERATIONS

Maria Mazzurco, biology lab technician, was awarded the Ronald Kent Medal, one of the York University President's Staff Recognition Awards. She was recognized for her efforts in promoting and strengthening collegiality, going above and beyond what is required of her in her daily job, and advancing the spirit and goals of York University.

The smooth operation of every teaching lab section is critical to the great success

of the Department of Biology's undergraduate program. As the technical team leader, with years of domain expertise, Mazzurco has played a pivotal role in keeping more than 120 lab sections running seamlessly. She has consistently helped review undergraduate program requirements and available resources, and where necessary remapped these resources to better match the needs of each program.

"Maria always goes the extra mile when it comes to her work as a lab technician. As a result of her efforts, the quality and effectiveness of the teaching labs have improved, which in turn has enhanced the student experience," says supervisor and operations manager for the Department of Biology, Ming Jiang.



MARSHALL MCCALL

## UNDERSTANDING OUR PLACE IN THE UNIVERSE

Marshall McCall, astronomer, led the charge when it came to mapping out bright galaxies within 35 million light years of Earth, providing us with insight into what is out there, how it is organized, and how we fit in.

“The Milky Way and our neighbour Andromeda, which are the dominant members of the ‘Local Group’ of galaxies, are embedded in a ‘Local Sheet’ of galaxies whose thickness is only one-twentieth of its extent,” says McCall.

“They are encircled by 12 large galaxies in the Sheet arranged in a ring about 24 million light years across. This ‘Council of Giants’ stands in gravitational judgment of the Local Group by restricting its range of influence.”

Because of a gravitational tug of war, the galaxies surrounding us stole a lot of matter that might otherwise have ended up in the

Milky Way. At the same time, winds exhaled by two elliptical giants on either side of us may have shepherded material towards the Milky Way, enhancing the growth of the region in which we find ourselves today. It is possible that the unusual configuration of giants was gravitationally responsible for our pairing with Andromeda and for our present pickle of being on a collision course towards it.

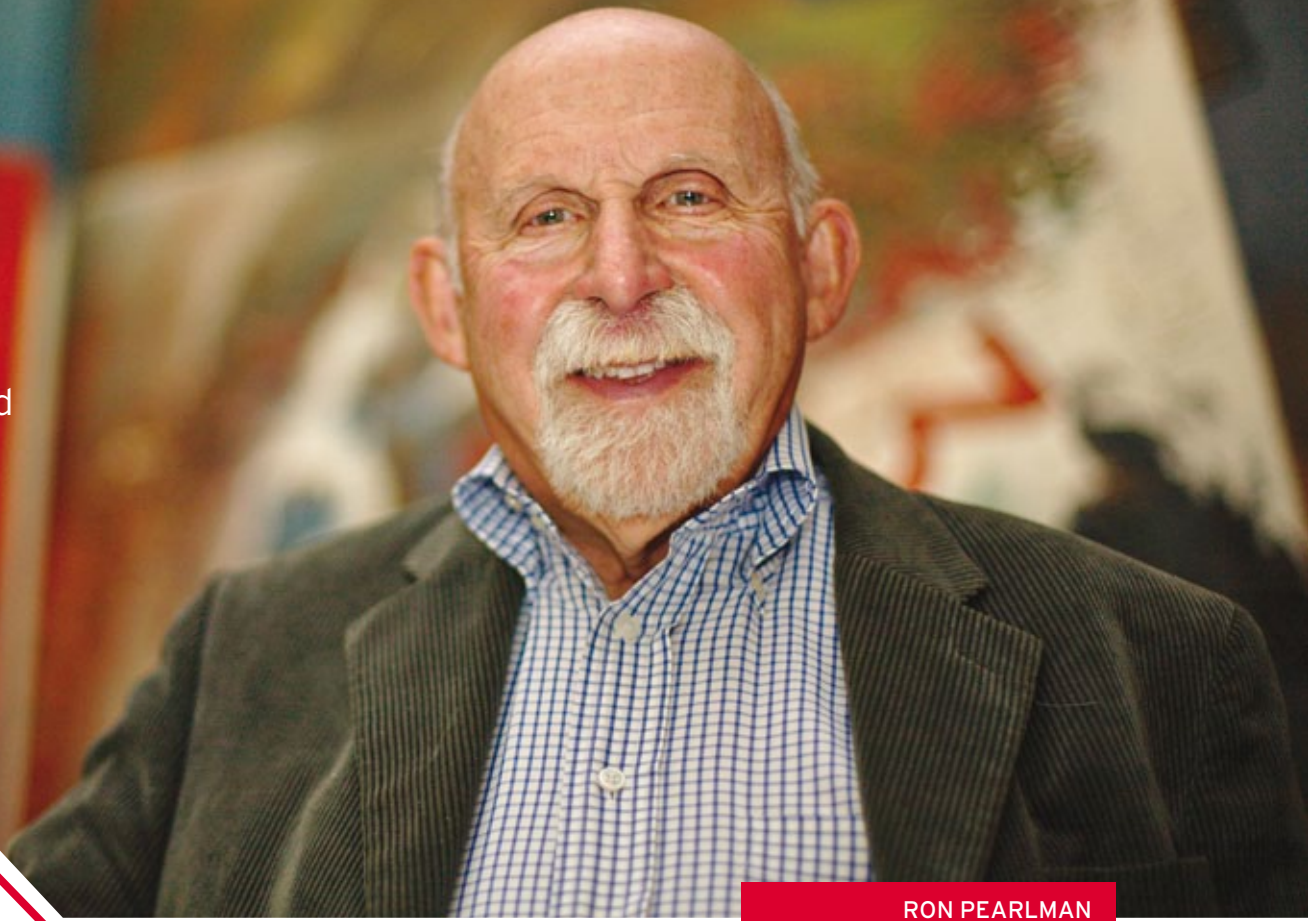
We have learned from McCall’s work that our destiny has been shaped by an environment with a scale heretofore unimagined. The next step is to figure out just how unique our situation is and what factors have been most important in controlling birth and development. To that end, McCall and PhD student George J. Conidis are seeking out analogues of the Local Sheet of galaxies and its Council of Giants in the greater Universe.



PHYSICS &  
ASTRONOMY



Life Sciences  
Ontario 2014  
Community  
Service Award  
winner Ron  
Pearlman



RON PEARLMAN



BIOLOGY

## ADVANCING THE KNOWLEDGE OF SCIENCE

Ronald (Ron) Pearlman, biologist, has dedicated more than 50 years to developing Ontario's life sciences community. As a researcher, Pearlman and his team use molecular biology and genetics, including the new 'omics' technologies, to address questions relating to gene organization and the regulation of gene expression. Outside the lab, Pearlman is an award-winning teacher and served as director of the graduate program in biology, as well as associate dean and dean of the Faculty of Graduate Studies.

Building on his scientific accomplishments, Pearlman has devoted himself with passion to advancing science culture, science literacy and community outreach. In his own words, he does this to "foster a scientifically literate and well-informed Canadian public which embraces

science as part of its culture and decision making, contributing to civil society."

As one of the founders of Science Rendezvous' science engagement program, Pearlman has worked hard to inspire the next generation of young scientists and advance science literacy in the general public. He has also served the Gairdner Foundation, and is currently its associate scientific director, with responsibility for coordinating the Foundation's outreach program to high-school students. As well, Pearlman served as president of the Royal Canadian Institute for the Advancement of Science. To acknowledge his outstanding contribution to Ontario's life sciences community, Life Sciences Ontario chose Pearlman as the 2014 Community Service Award winner.



DEREK WILSON

## HARNESSING SPECIAL POWERS IN MASS SPECTROMETRY

Derek Wilson, chemist and director of the Centre for Research in Mass Spectrometry, spearheaded an NSERC CREATE that provides student trainees in mass spectrometry with opportunities for meaningful hands-on experience with seven industry partners. This experience encompasses a range of applications, including instrument development, gas-phase ion chemistry, bioanalytics and imaging and environmental analysis and proteomics.

Wilson's research team uses mass spectrometry to characterize the structures of the Alzheimer's-linked protein, Tau, as well as the cancer-related protein, STAT3, and potential drug inhibitors. He has also developed a new model for how enzymes

catalyze biochemical reactions. Additionally, Wilson and his mathematics colleague, Professor Jane Heffernan, conducted research that looked at how to create a model to predict the outcomes of a zombie plague and determined how one would fight it.

"When I was young, my daydreams involved gathering together a group of friends, each with special powers, to battle an evil beast," says Wilson. "Many years later, I was putting together a group of researchers, each with their individual strengths, to undertake the CREATE application and it struck me - I was doing pretty much the same thing! Building powerful teams to tackle daunting science questions."



CHEMISTRY





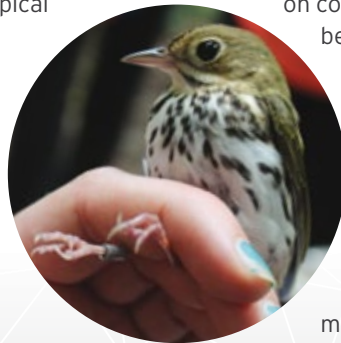
## AN UN-BELIZE-ABLE EXPERIENCE

Alex Mills considers himself lucky to be able to teach the third-year field course in biology. With Postdoctoral Fellow Kevin Fraser, he ran the latest York offering (Tropical Ecology) in Belize in February 2014. This two-week course introduced 14 students to Neotropical rainforest behavioural ecology and reef ecology. The group collaborated with the Belize Foundation for Research and Environmental Education (BFREE), a non-profit organization with a biological field station in southern Belize.

Students travelled by school bus and on foot to BFREE, located in the Bladen River Valley at the base of the Maya mountains where three large rainforest reserves intersect. Eight days were spent exploring lowland tropical rainforest, and engaging in a variety of activities such as mist-netting and handling Neotropical birds and bats, studying major features of tropical vegetation, learning about sustainable agriculture at a shade forest cacao plantation and exploring tropical freshwater rivers. Collectively, students also conducted an on-site field research project. The final two days were spent at a reef education facility on an island off the coast, where students snorkelled in several different marine ecosystems.



ALEX MILLS



Mills notes that learning is enhanced in the field: "Although it is vital for students of biology to learn in lecture halls, labs and libraries, there is nothing like the real thing to put flesh on the bones of those more conventional ways of learning."

Students kept field journals throughout the course, and one student ended hers this way: "At times, I thought I was going to explode with happiness because I was in such awe of nature's beauty. To be honest, I will most likely not remember the species' names or calls years (or possibly days) from now. I will remember how theory is important but really is just complementary to the hands-on component. I will remember the beauty of all the species I was lucky to see. I will remember to be as patient with myself as my professors were with me when learning something new. I will remember scientific research isn't always treacherous and is in fact enjoyable! Most of all, I will remember that when I throw myself into new situations, be it in my personal life or in my 'scientist' life, I can stay afloat. I will never sink as long as I work hard, try my hardest and stay extremely open to learning. I can't wait to start my next adventure as a biologist!"



## ON THE ROAD TO THE ALGONQUIN RADIO OBSERVATORY

In August 2014, seven students from the York Observatory Team joined astronomy Professor Paul Delaney in a three-day trip to the Algonquin Radio Observatory (ARO), where Professor Ben Quine hosted an extensive tour of the facility and afforded the team a lot of dark sky observing opportunities.

The 46 metre telescope has had a long and distinguished history and with its ongoing refurbishment continues to provide astronomers with numerous research opportunities. The students were able to see the interior workings of the telescope and learn about possible student-led radio-based research projects, a collaborative effort between the ARO and the York University Astronomical Observatory.

Such collaborative efforts are already underway as field testing of a CCD-equipped, remotely operated 30 cm telescope at the ARO continues.

The dark skies also afforded some detailed sky observations. It is often hard to see all aspects of the night sky visible to the naked eye from light-polluted city locations. Algonquin Park has no such issues and the students received thorough briefings on what can be seen. This information will be passed along to the thousands of visitors that attend the Observatory's public viewing nights every Wednesday of the year.

Finally, astrophotography was on tap with some amazing images being collected, some of which appear in the Observatory's annual calendar.

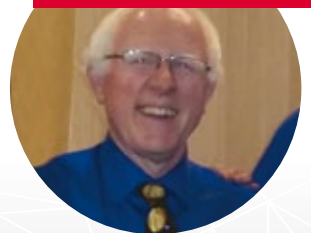
*"There is no substitute for a dark sky. To really appreciate the breadth and beauty of the universe you must have field trips to remote locations."*

– Paul Delaney

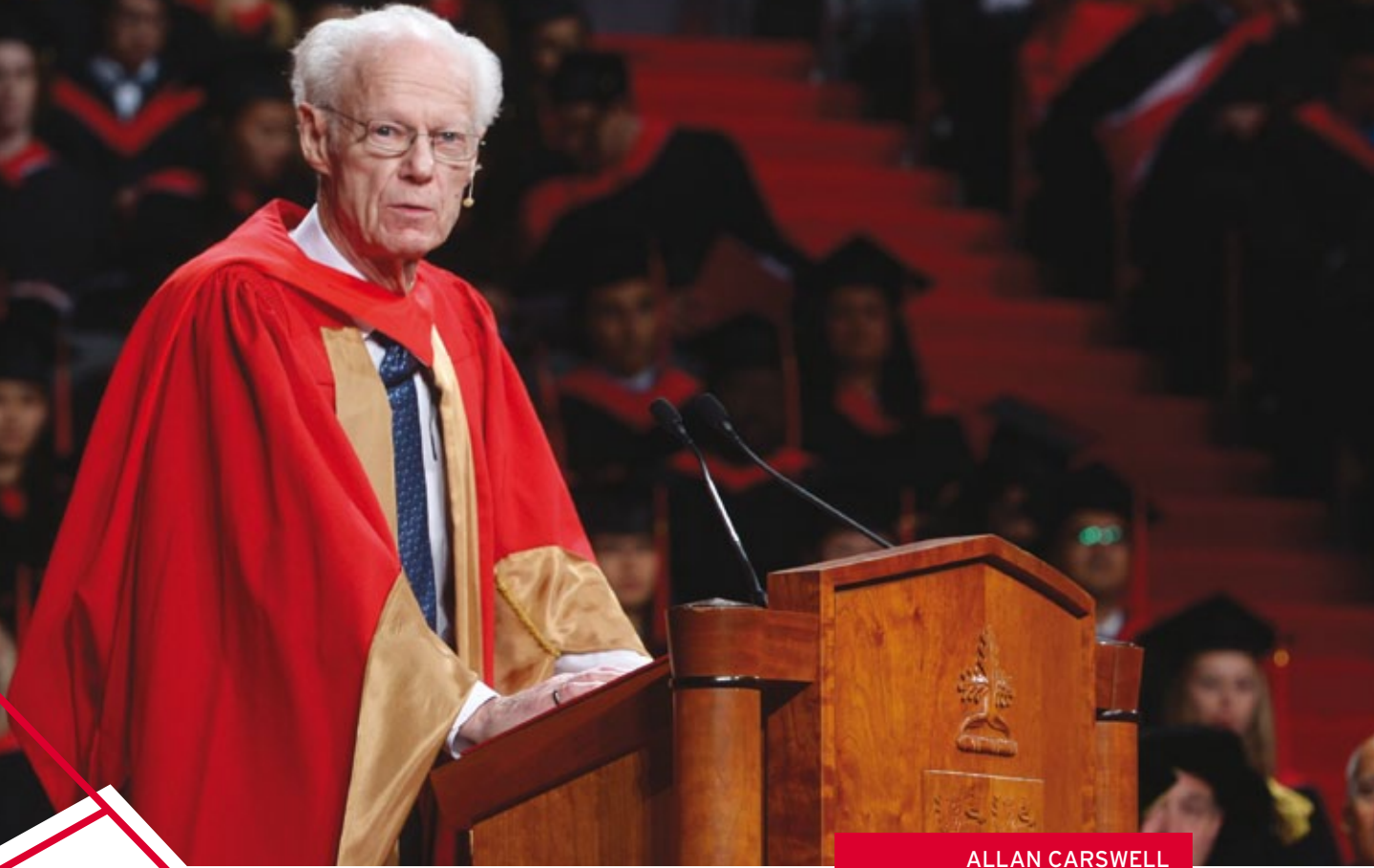
**BEN QUINE**



**PAUL DELANEY**







ALLAN CARSWELL

PHYSICS &  
ASTRONOMY

## ENRICHING OUR WORLD THROUGH REVOLUTIONARY THINKING

### HONORARY DOCTOR OF SCIENCE

Allan Carswell (DSc '14), professor emeritus of physics and astronomy, received an honorary doctor of science degree at York's fall convocation. Carswell is a visionary scientist who has advanced knowledge in the areas of physics, space and our environment. His research on the properties and applications of high-power lasers for remote sensing and environmental diagnostics, known as lidar (laser radar), transformed our ability to explore and learn about the atmosphere. In 2007, Carswell joined the team to send NASA's Phoenix mission to Mars and applied lidar to examine the Martian atmosphere. His analysis and results led to the discovery of the existence of snowfall on Mars.

Carswell is also the founder of the technology company Optech Incorporated.

Optech develops and produces lidar systems and camera solutions. It contributes to the Canadian economy and highlights Canada as a world leader in laser imaging systems. Carswell has made and will continue to make advancements in technology that transform our knowledge and understanding of the universe.

He supports a variety of philanthropic initiatives in health care and education. In 2005, Optech provided a gift of \$125,000 to the Faculty of Science and Engineering. Matching funds from the University led to the development of two state-of-the-art laboratory courses in physics for upper level students. The courses, which focus on laser spectroscopy and atom trapping, continue to be maintained thanks to the gift from Optech.



NIGEL LOCKYER

## TAKING THE LAB TO THE GLOBAL FOREFRONT OF PARTICLE AND NUCLEAR PHYSICS



PHYSICS &  
ASTRONOMY

### 2014 BRYDEN ALUMNI AWARD - PINNACLE ACHIEVEMENT

York alumnus Nigel Lockyer (BSc Spec Hons '75) received a 2014 Bryden Alumni Award for Pinnacle Achievement. Lockyer is widely recognized as a leader in the field of particle physics, particularly for his work on a subatomic particle known as the bottom quark. During his six years as director of Canada's TRIUMF laboratory for particle and nuclear physics, the lab's operations expanded by 25 per cent and formulated a vision for using rare-isotope beams to address some fundamental questions in science and medicine.

Lockyer is now director of the Fermi National Accelerator Laboratory (Fermilab), a global

research powerhouse in the United States. He oversees the operations of this leading research facility, used by thousands of physicists from around the world. He has also chaired and served on numerous committees, boards and scientific review panels, including for the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Canada Foundation for Innovation (CFI), earning a reputation as a visionary leader and a team builder. Prior to this appointment, Lockyer spent more than two decades as a professor at the University of Pennsylvania, where his research focused on high-energy particle physics, including medical applications of physics.

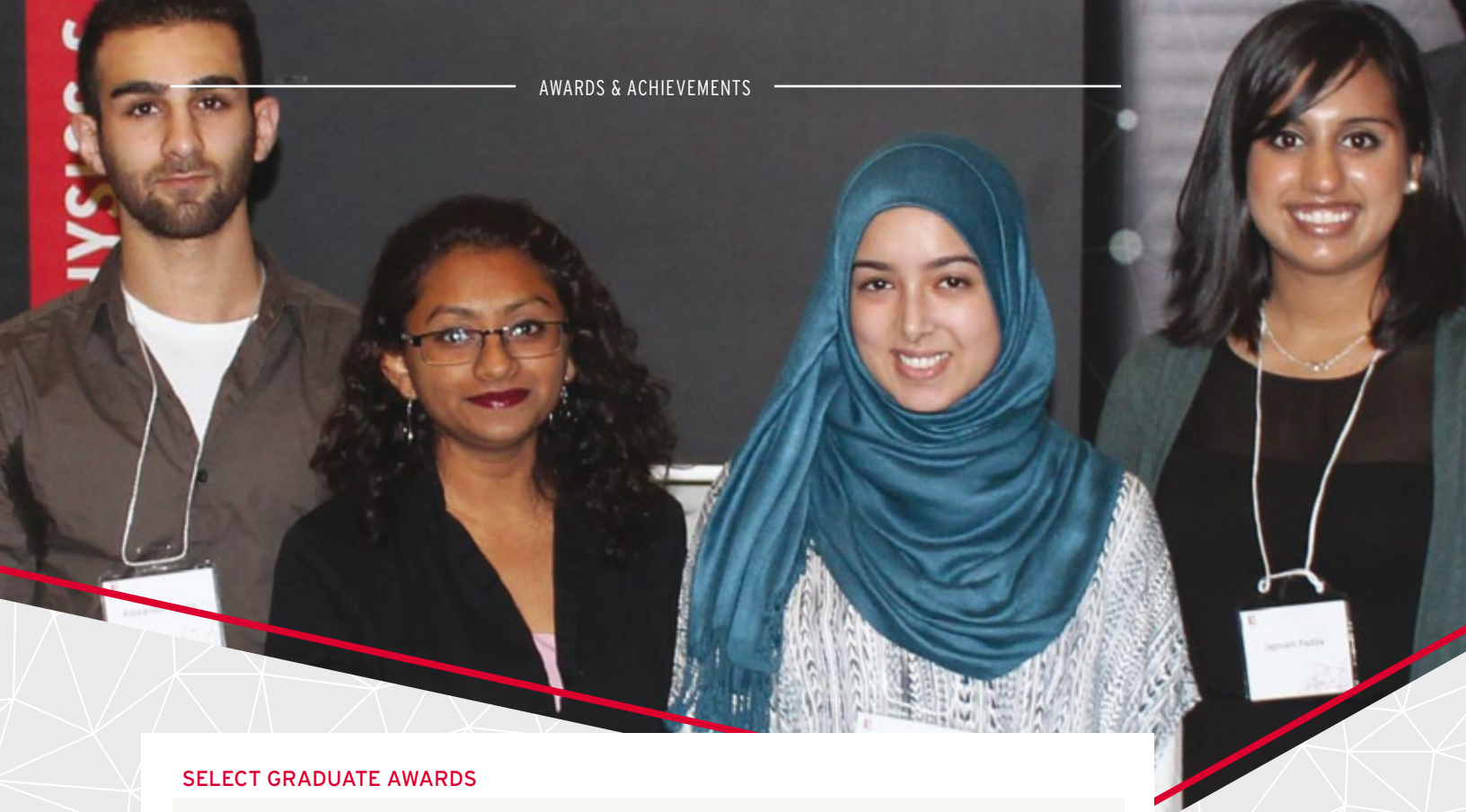




## SELECT INDIVIDUAL AWARDS & ACHIEVEMENTS

### SELECT FACULTY AWARDS

Canadian Society for Chemistry E.W.R. Steacie Award	Barry Lever
Canadian Society for Chemistry Maxxam Award	Sergey Krylov
NSERC John C. Polanyi Award	Scott Menary
John Simon Guggenheim Memorial Foundation Fellowship	Ray Jayawardhana
Ontario Confederation of University Faculty Associations (OCUFA) Teaching Award	Tamara Kelly
Petro-Canada Young Innovator Award	Thilo Womelsdorf
Faculty of Science Early Career Research Award	Amro Zayed
Faculty of Science Established Research Award	Scott Menary
Faculty of Science Excellence in Teaching Award	Alex Mills
Faculty of Science Graduate Mentorship Award	Gerald Audette



**SELECT GRADUATE AWARDS**

Charles Hantho Award in Atmospheric Chemistry

Amanda Jameer  
Kevin Nikelshi

Dalton Pharma Services/Dr. Douglas Butler Award  
in Organic Chemistry

Jennifer Farmer

Nestmann Scholarship

Adilya Rafikova

NSERC Alexander Graham Bell Canada Graduate  
Scholarship - Masters

Kira Neller  
Laura Newburn  
Antoine Dumont  
Christopher Lombardi

NSERC Alexander Graham Bell Postgraduate  
Scholarship - Doctoral

Brock Harpur  
David Wegman  
Mirzo Kanoatov

Vanier Canada Graduate Scholarship

Alexandra Terrana





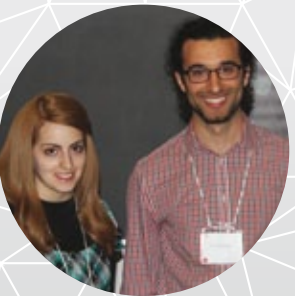


**SELECT UNDERGRADUATE AWARDS**

Alumni Award of Distinction Scholarship	Menal Huroy (renewed) Atiyya Leah Gabrielle Bacchus
Carey Risman Memorial Scholarship	Daniel Tsoy
C. D. Fowle and B. Rozario Trust Fund	Anam Qudrat
Faculty of Science Gold Medal for Academic Excellence	Jeremy Halpern
Faculty of Science Silver Medal for Academic Excellence	Anam Qudrat
Governor General's Silver Medal	Jeffrey Kay
Schulich Leader Scholarship	Sherry Wong
The A. Saber M. Saleuddin Biology Scholarship in Animal Physiology	Ayaat Hassan
The Embleton Award	Rachel Giblon
York University President's Honour Roll	Mihai Alboiu Michal Sheinis Sepideh Mohajeri Robert Micieli Jeffrey Kay Nickan Motamedi Shaili Perez Lior Krimus Serena Kay Yaakov Green Silvio Pacitti Daniel Ng Aylin Ovaisy-Moakhar
York University President's Scholarship	Shaili Perez Antonette Spagnuolo Catherine Spagnuolo (renewed)

**SELECT POSTDOCTORAL AWARDS**

Banting Postdoctoral Fellowship	Alexander Stasheuski
Science In Society - The Branco Weiss Fellowship	Amar Vutha





## SELECT NSERC UNDERGRADUATE STUDENT RESEARCH AWARDS HIGHLIGHTS

### NSERC USRA

#### BREAKDOWN BY DEPARTMENT & UNIT

Total:	<b>41</b>
Biology:	<b>9</b>
Chemistry:	<b>3</b>
Earth & Space Science & Engineering:	<b>2</b>
Electrical Engineering & Computer Science:	<b>7</b>
Kinesiology:	<b>5</b>
Mathematics & Statistics:	<b>3</b>
Mechanical Engineering:	<b>1</b>
Physics & Astronomy:	<b>3</b>
Psychology:	<b>7</b>
Schulich School of Business:	<b>1</b>

SHIRA JACKSON



#### FREE-SPACE OPTICAL TWEEZERS

Shira Jackson, along with her supervisor, Professor Anantharaman (Kumar) Kumarakrishnan, developed a free space optical tweezers experiment for trapping liquid droplets. The experiment relies on a laser beam that traps ink droplets easily and reliably for several minutes. A camera is used to create an image of the scattered light from the trapped droplets, at a right angle to the laser beam. The motions of the trapped droplets are then tracked and analyzed.

Jackson's experiment has been introduced into an upper level lab course on laser spectroscopy and has proven to be an immensely popular replacement for a traditional tweezers experiment. Her oral presentation on this project was awarded first place in the category of Engineering and Applied Physics at the 2014 Canadian Undergraduate Physics Conference (CUPC) held at Queen's University.

BACH KIM NGUYEN



#### PLASMONIC NANOPARTICLE ASSEMBLIES FOR BIOMARKER DETECTION

Along with her supervisor, Professor Jennifer Chen, Bach Kim Nguyen helped develop a sensing platform based on dynamically linked gold nanoparticle dimers for detecting biological molecules. Her project explored the detection of biomarkers such as micro-RNA, which are important in the diagnosis of pregnancy-related diseases.

*"Actively engaging in undergraduate research has shown me that thorough planning, a meticulous work ethic and perseverance can lead to the materialization of new ideas and scientific innovations," says Nguyen.*

SANDEEP SAJU



#### MONTE CARLO METHODS AND THEIR APPLICATIONS IN FINANCE

Sandeep Saju, along with his supervisor, Professor Alexey Kuznetsov, worked on the application of Multi-Level Monte Carlo (MLMC) methods in finance. Monte Carlo simulation is a very powerful numerical technique that uses repeated sampling to compute the answer. MLMC method uses a number of levels of resolution with carefully chosen numbers of simulations at each level. This results in a very efficient algorithm, which is both very fast and accurate. A key application of MLMC is to compute the price of complex financial products more efficiently.

*"Through this experience I have gained valuable insights into the process of performing literature reviews, implementing existing models in mathematical finance, and innovating on them. Overall, I had a very positive experience and I would highly recommend this program to all students who are interested in a research career," says Saju, who is currently pursuing a master of engineering degree (specializing in financial mathematics) at Cornell University.*

## SELECT MITACS HIGHLIGHTS

### IMPACT OF EARLY VACCINATION DURING INFLUENZA OUTBREAKS

Vaccination is an important preventive measure that can protect individuals from acquiring infections, or mitigate disease outcomes if infection occurs. Mitacs Accelerate award recipient Marek Laskowski aimed to understand the effect of early vaccination during influenza outbreaks to minimize health burden and hospitalization, based on age and other demographic variables of the population.

In partnership with Medicago Inc., Laskowski, along with his supervisor, Professor Seyed Moghadas, measured the effectiveness of various vaccination strategies for minimizing disease transmission and hospitalization.

“Ultimately, our goal was to find a vaccination strategy that has the best outcomes depending on the spread of disease, time for start of vaccination, and vaccine effectiveness,” says Laskowski.

The results of this exciting project will be used to inform vaccination policies and improve medical practices across Canada.

“The work performed by Dr. Moghadas’ group confirms that the earlier a vaccine can be delivered to a population, the more impact it will have in mitigating the disease. It reinforces the importance of developing a rapid technology like Medicago’s virus-like particles manufacturing platform, (which is) capable of delivering the first vaccine doses 19 days after a new influenza strain sequence is identified,” says Andy Sheldon, CEO of Medicago.

MAREK LASKOWSKI



### VALIDATING MODELS OF A COMPANY'S RISK PORTFOLIO

A strong and stable insurance industry is important to the economic wellbeing of countries. Mitacs Accelerate recipient Jianxi Su, along with his supervisor, Professor Edward Furman, intend to build, implement and validate quantitatively, sophisticated state-of-the-art models of a financial institution’s risk profile. For life insurers, this yields a better quantitative and qualitative understanding of a company’s exposure to distinct risk factors.

Su worked at Sun Life Financial, the industry partner for his internship, as an actuarial/financial model validator in its Risk Management division. During his four months at the company, Su independently produced validations and successfully proposed meaningful improvements and alternatives for various modelling approaches. The validations pertained to a number of models that Sun Life employed in its annual Own Risk and Solvency Assessment report, which it submits to its primary regulator, the Office of the Superintendent of Financial Institutions.

Su enjoyed the opportunity to apply himself in an industry setting and Sun Life appreciated Su’s contributions to its risk management program.

JIANXI SU







LIDIA, ANDREA AND TARANOM

## FUTURE LEADERS

These science students exemplify how a York U degree is preparing them to achieve their visions and make an impact in the future.

### **LIDIA KAZAKOVA**

Biology, undergraduate, Winner of 2014 “This Is My Time” free tuition contest

“My research in stem cells and regenerative medicine helps make Parkinson’s and other neurodegenerative diseases a thing of the past” – Lidia was the top choice among some 3,000 entries.

### **ANDREA ZUBAC**

Mathematics & Physics, undergraduate

Zubac is passionate about fractals. As an applied mathematics major with a minor in physics, she’s surrounded by professors and students who share her passion. One day soon she’ll use fractal geometry to revolutionize CGI animation in the film industry.

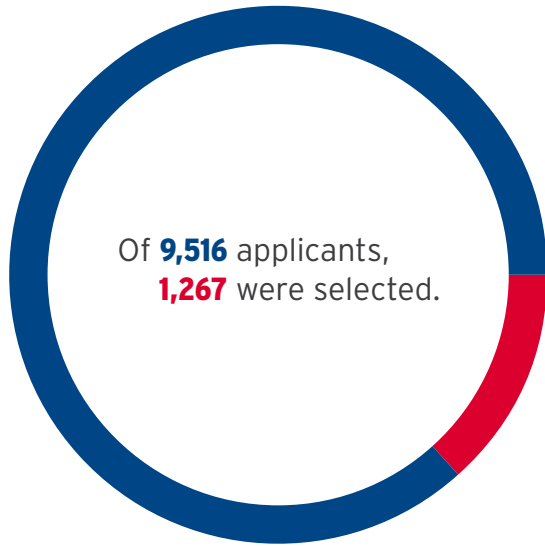
### **TARANOM MOVAHEDI**

Biochemistry, undergraduate

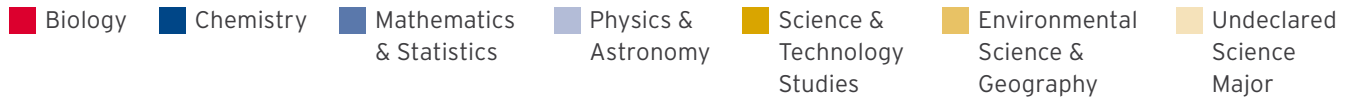
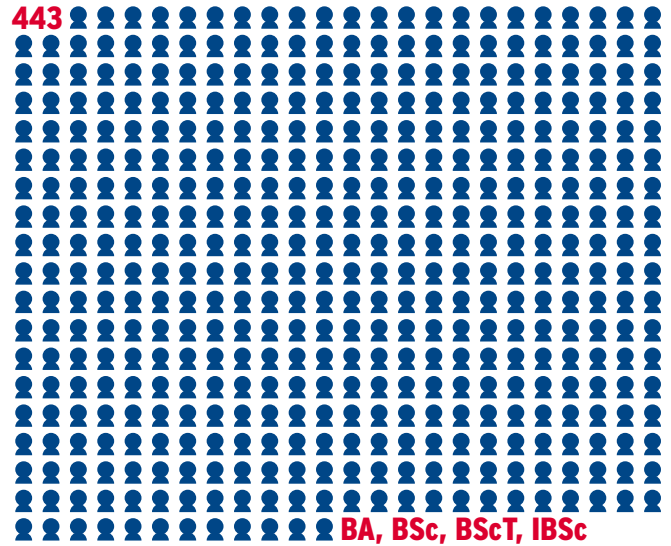
What could be more fascinating than exploring the chemistry of life? For Taranom, absolutely nothing. The spectrum of effects that chemicals can have on living systems is exactly what she’s always wanted to study. And doing it alongside some of the world’s foremost researchers in a fully equipped, state-of-the-art lab is a dream come true. Her aim is to design new molecules that target and repair the genes that cause schizophrenia.

## GRADUATE AND UNDERGRADUATE NUMBERS

### 2014 UNDERGRADUATE APPLICANTS\*



### TOTAL UNDERGRADUATE DEGREES GRANTED IN 2014



### UNDERGRADUATES BY MAJOR



### TOTAL GRADUATE STUDENTS ENROLLED BY DEPARTMENT\*

#### Master's



#### PhD



### DEGREES GRANTED IN 2014 BY MAJOR

#### Master's



#### PhD



\* As of November 2014





RON AND DIANE WATSON

## ALUMNI GIVING BRINGS IMPACT TODAY

“How much do you need to be happy?” Asking this simple rhetorical question, Ron Watson (BSc '72) sums up his philosophy, shared with his wife Diane, on personal finance and giving.

Watson was a biology undergraduate student, rugby player and swimmer for York University in the early 1970s. In the intervening years he has shown a knack for wise investments and an eye for good deals. Now a senior member of the Thunder Bay “Share Club,” Watson mentors dozens of members on smart investing, specializing in dividend reinvestment plans (DRIPs). His “get rich slow” program has put him in a position where he and his wife can now help others - and they do!

The Watsons generously support their respective alma maters (York University and Lakehead University) as well as community projects in their hometown of Thunder Bay.

At York, the Diane and Ron Watson Awards in Science were established in 2000. One York student, an aspiring actuary and one of many recipients of the Diane and Ron Watson Award, thanks the couple for their “tremendous support.” The chief benefit the award offered its recipients, he says, was the opportunity to focus on their studies.

The Watsons are not finished yet. Last year they began setting up a new bursary fund for struggling science students, as well as a fund to help offset travel costs for York athletes competing in northern Ontario.

So, how much do the Watsons need to be happy? It turns out the answer is not a number, but an attitude that says: “If we can help, and if it’s a good cause we believe in, we’re happy to support it.” Happiness, it turns out, was found by the Watsons on the other side of the ledger, through their many contributions in the community and beyond.





## CITIZEN SCIENCE

### HARNESSING THE POWER OF ORDINARY PEOPLE

“FreshWater Watch is an exciting endeavour that raises York’s profile as we connect to scientists and citizens in the broader community and, together, learn more about ecological resources around the world,” says Sapna Sharma.

Sapna Sharma, biologist, teamed up with Paul Frost, a biology professor at Trent University, and Earthwatch to offer citizen science training sessions on York University’s Keele campus for employees of HSBC Bank. The FreshWater Watch training is part of the HSBC Water Programme, a five-year, \$100-million partnership funded by HSBC Bank and involving three non-governmental organizations: Earthwatch, WaterAid and the World Wildlife Fund.

HSBC employees learned about water quality and assessed the ecological health of Stong Pond, which serves as a catchment area for storm water and prevents flooding during heavy rains. Once trained, these citizen scientists collected water quality data from storm water ponds in their communities. Their samples were sent to Trent University for analysis and are included in a global database.

The data collected will help Sharma and Frost learn more on how water quality in the Greater Toronto Area improves or degrades with urban catchment use. Further, scientists will be able to better understand the variation and factors influencing water quality in urban environments globally - HSBC employees in 32 cities around the world conducted data sampling in the same way.

“Citizen science empowers ordinary people to connect with the vision behind the research and allows scientists to tap into alternative sources of funding. Connecting people with hands-on science opportunities also helps demystify science and makes it accessible to everyone,” says Larry Mason, EarthWatch CEO. “It is a cost-effective approach to research that allows scientists to obtain vast amounts of information on land, water and species, which is used to build our understanding of how humans are impacting the planet.”

SAPNA SHARMA







## REACHING OUT

### INTRODUCING HIGH SCHOOL STUDENTS TO YORK SCIENCE RESEARCH

The Science Engagement Office within the Faculty of Science at York University has had yet another successful year. The Helix Summer Science Institute, which hosts week-long programs held in July, concluded its inaugural summer with resounding success, reaching over 240 high school students.

Developed and delivered by graduate students, faculty and postdoctoral fellows, high school students were introduced to pioneering research at York University. They also had the opportunity to experience innovative and

cutting-edge undergraduate science facilities. Students performed experiments resembling undergraduate and graduate level research in subjects such as biomedical science, astronomy and applied mathematics.

The Science Engagement Office offered many other programs for elementary school children, reaching over 6,500 students with its In-School Workshops, March Break Science Camp, York Science Saturdays and its flagship program, the SciX: Science Explorations Summer Camp.

## SCIENCE RENDEZVOUS

### TAKING SCIENCE OUT OF THE LAB AND ONTO THE STREET!

Every year, 40 of Canada's top research institutions and over 75 community partnerships host Science Rendezvous - a series of science festivals and programs spread out across the country. Dubbed a "coast-to-coast open house," Science Rendezvous currently encompasses more than 300 exciting events in 30 cities. Each year, it successfully engages a curious public in the cosmic wonders of science and engineering.

Once again, York University joined forces with Main Street Markham in May to present a Science Rendezvous festival in that city with a host of mind-blowing activities. Top scientists and student volunteers were on-site all day answering a number of burning science

questions and presenting hands-on science experiments. Along with live entertainment, attractions included the Mars Rover, A-Mazing Minds and Crater Ejections. There were many new activities developed by Heyam Hader, Stefanie Bernaudo and Jelena Brkic from Let's Talk Science and Justin Chan and the Science Engagement team. These included catchy activities such as Walk-On-Water, Smart Phone Microscopes and Exploding Elephant Toothpaste.



As well, back by popular demand (and just in time for Mother's Day), biology Professor Roger Lew and Chantal Blanchard from Carl Zeiss Canada Ltd. presented Fern Babies for Mother's Day.

Dubbed a "coast-to-coast open house," Science Rendezvous currently encompasses more than 300 exciting events in 30 cities.





