It Starts
HERE

Annual Report 2020-21

UNIVERSITY
of GUELPH

IMPROVE LIFE.

Contents

About the College

The University of Guelph (U of G) has been focused on impactful research, comprehensive teaching and community building for more than 150 years. Our community is driven to improve life on our planet.

The College of Engineering and Physical Sciences (CEPS) at U of G has cutting-edge research and education in chemistry, computer science, engineering, mathematics and statistics, and physics.

We are home to a vibrant community of more than 150 faculty and 80 staff, nearly 3,900 current students and 13,000+ alumni. Our world-class research institutes, facilities and centres convene leading experts to solve global challenges.

We extend our gratitude to the faculty, staff and students who study and work in our College, as well as the extensive network of collaborators, partners, funding bodies and other University colleagues who enable our success.

Acknowledgments

With great respect, we acknowledge that U of G is located on the treaty lands and territory of the Mississaugas of the Credit. Additionally, CEPS has research and learning on other Indigenous lands across Canada.

We recognize that this land is and has been home to First Nations, Inuit and Métis peoples for centuries. Acknowledging them reminds us of our collective responsibility to truth, reconciliation, and to this planet. We offer our respect to our Indigenous neighbours as we strive to strengthen our relationships with them.

We affirm our commitment to an inclusive campus and workplace that respects, acknowledges and celebrates the diversity of our community.

We recognize the need to improve the persistence and representation of equity-seeking groups in our disciplines.

Message from interim dean of CEPS 2020–21

Dr. Gerarda Darlington
Interim Dean, CEPS, 2020–21

In my role as interim dean, I spent much of the past year getting to meet with our faculty, staff, students, alumni and partners. I heard inspiring stories about the innovative ways that our people pivoted in response to the challenges we've faced, embraced innovation in distanced teaching and learning, and are pursuing research programs that promise to benefit our global community.

The theme of this year's annual report, it starts here, is testament to the role that our people play in training the next generation of STEM leaders, entrepreneurs and champions; and the discoveries that happen behind our walls.

I can proudly say that the College of Engineering and Physical Sciences (CEPS) responded to unconventional work environments with action. We delivered on key promises in our strategic plan while building on the University's shared purpose to improve life.

We are leading in learning. We launched a new Master of Data Science program, with unique emphasis in spatial-temporal data and ethics, and awarded nearly $20,000 to advance education research through the Physical Science & Engineering Education Research Centre.

We are enhancing our research and discovery capacity. In 2020–21, we saw a four per cent increase in PhD students. Our external research funding also climbed from $17.2 million in 2019 to $20.6 million in 2020.

We are boosting our profile. Top students are attracted to U of G by our reputation in teaching and research, driven in part by the growth of our faculty complement— we hit our 2023 target of 152 full-time faculty in 2021.

We are creating a strong community. We are committed to fostering an inclusive environment where everyone feels welcome. Each year, we present members of our college with awards that acknowledge faculty excellence in research, teaching, and student supervision; and the exceptional contributions of our staff.

We are fostering diversity. We welcome the diversity of thought, creativity and breadth of academic talent that comes from international students. We have grown from 12.7 per cent international students in 2019–20 to 13.3 per cent in 2020–21.

We are making connections and translating research into impactful outcomes. In 2021, CEPS faculty submitted nine new reports of inventions, applied for 18 new patent applications, and entered two license agreements.

I encourage you to read through this report for highlights of how our talented faculty and staff are supporting our extraordinary students, making pioneering advancements, and giving back to the community.

Groundbreaking research advancements start here

Dr. Leonid Brown
Associate Dean (Research and Graduate Studies)

In 2020−21, College of Engineering and Physical Sciences (CEPS) researchers made diverse advancements that contributed to our collective knowledge and had practical impacts to improve our health and wellbeing.

A computer science professor leveraged blockchain technology to guard our privacy.

An engineering professor and their team studied how to leverage waste to pull carbon dioxide from the atmosphere and curb climate change.

A chemistry professor and her students are exploring antigens for new insights that could inform the development of novel anti-cancer therapeutics.

One of our mathematics professors and her postdoctoral fellow used a mathematical tool called the decomposition method to solve for the Nash equilibrium—the optimal solution of a non-cooperative "game" involving multiple actors.

A physics professor is advancing our understanding about sustainable nanoparticles, which may unlock new technologies in application areas ranging from biomedicine to energy storage.

Our researchers achieved stellar success rates in Tri-Agency funding competitions. In the 2021 Natural Sciences and Engineering Research Council of Canada (NSERC) Discovery Grant competition, our success rate (70 per cent) was above the national average (66 per cent).

Dr. Peter Tremaine received more than $3 million from NSERC and his partners: the University

Network of Excellence in Nuclear Engineering; the CANDU Owners Group; the Nuclear Waste Management Organization; and the Electric Power Research Institute; to continue work formerly supported by his Senior Industrial Research Chair.

Dr. Leanne Chen received a grant from the New Frontiers in Research Fund Exploration Competition.

Our students were recognized for their critical contributions to our research advancements. Seven CEPS graduate students received NSERC funding to support their research; and three master's students, one student from the Department of Mathematics and Statistics and two from the School of Engineering, secured Vector Institute scholarships in AI.

The above examples illustrate the College's stimulating research environment that fosters innovation and prepares the next generation of leaders in engineering and physical science disciplines. Congratulations to everyone in our research community for a successful year.

566

Total CEPS grad students 2020−21

38%

Percentage of CEPS grad students who are international students

77%

Percentage of CEPS grad students who are thesis-based

Environmental engineering students doing field work. Photo taken prior to March 2020 | Photo credit: Hillary Rooyakkers

Impactful research from start to finish

Last year, College of Engineering and Physical Sciences (CEPS) faculty published their work in peer-reviewed articles, conference proceedings, letters, and reviews. Research publications in CEPS are on a growth trajectory. In the past five years, **our annual growth rate was 12.37 per cent (7.49 per cent when data are normalized by** number of faculty). Between 2016 and 2020, our faculty published **20 Highly Cited Papers**—papers that performed in the top one per cent in their year of publication, based on the total number of citations that they received when compared to all papers published in the same fields.

Publications by CEPS Faculty
2016–20
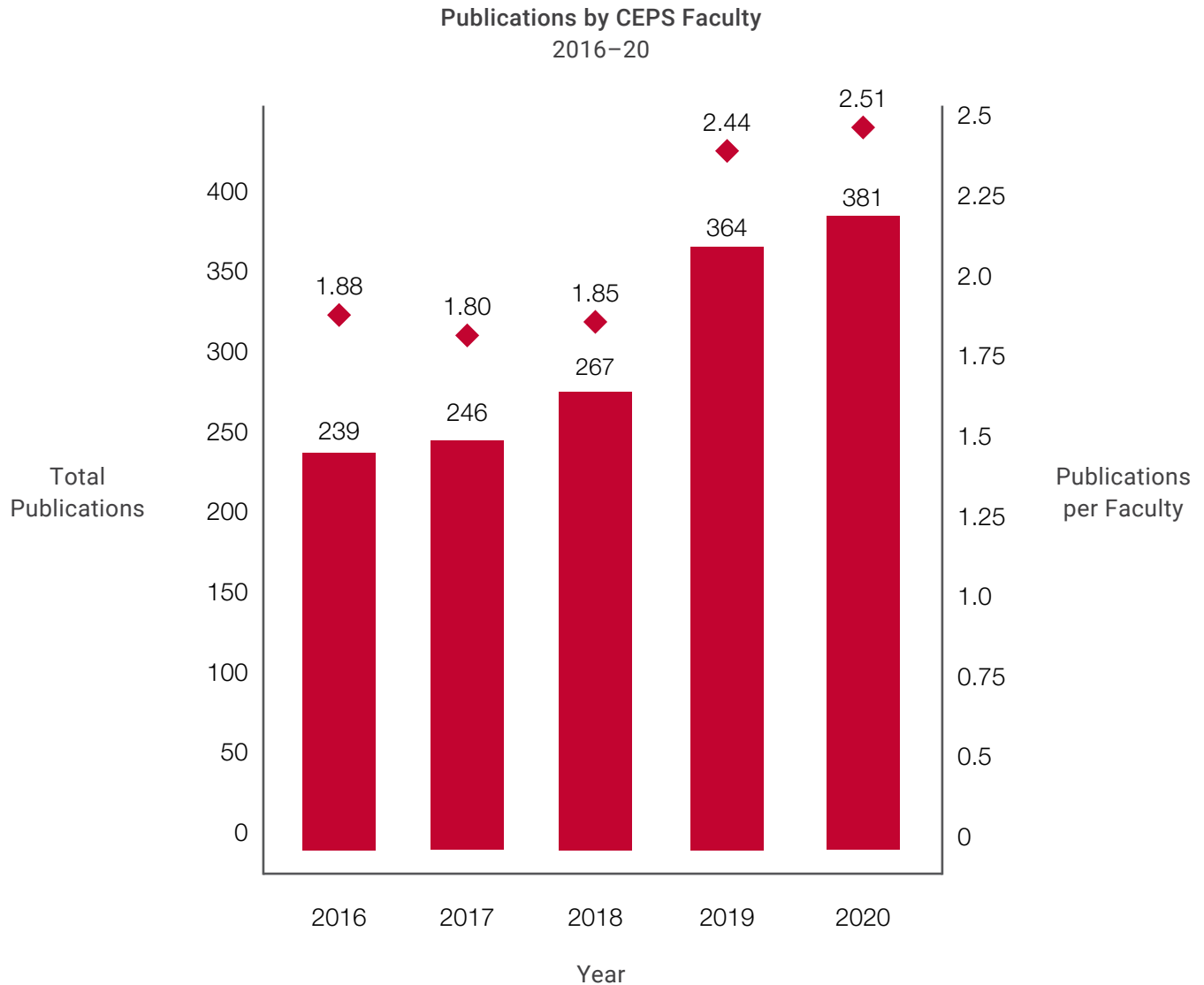
Disclaimer: These data represent the total number of publications produced in the 2016–20 calendar years by the tenure-track or tenured faculty members affiliated with CEPS in each calendar year. Note that the methods used to calculate these data are different than those used for last year's report, to provide a more accurate representation of a faculty member's productivity while affiliated with CEPS. Publications include articles, proceedings, letters, meeting abstracts, and reviews. Data were pulled from Web of Science; they are current as of August 23, 2021.

Research priorities: The starting point for innovation

We pulled the top 25 research focus areas for 2020 based on the subject categories of all CEPS faculty-authored papers archived in Web of Science. Our College's researchers explored a myriad of topics this past year, including Materials Science, Telecommunications, Mechanics, Environmental Sciences and Ecology, and Water Resources. There are clear contributions to the University's areas of research strength and signature areas, including Agriculture, Food, and the Environment.

Visualization of Top Research Areas in CEPS
2020

MATERIALS SCIENCE WATER RESOURCES MECHANICS NUTRITION AND DIETETICS ASTRONOMY AND ASTROPHYSICS OPTICS ENVIRONMENTAL SCIENCES AND ECOLOGY TELECOMMUNICATIONS FOOD SCIENCE ACOUSTICS AGRICULTURE BIOPHYSICS AUTOMATION CONTROL SYSTEMS MEDICAL INFORMATICS EDUCATIONAL RESEARCH POLYMER SCIENCE NUCLEAR MEDICINE AND MEDICAL IMAGING METEOROLOGY AND ATMOSPHERIC SCIENCES METALLURGY AND METALLURGICAL ENGINEERING ENERGY AND FUELS IMAGING SCIENCE AND PHOTOGRAPHIC TECHNOLOGIES BIOCHEMISTRY AND MOLECULAR BIOLOGY POLYMER SCIENCE INSTRUMENTS AND INSTRUMENTATION ELECTROCHEMISTRY

Global collaborations kickstart knowledge and creativity

Collaboration fosters creativity, innovation, healthy debate, and the exchange of academic knowledge. Our College's researchers value international collaborations across disciplines, institutions and countries. In 2020, College of Engineering and Physical Sciences researchers engaged in successful collaborations, publishing their work alongside colleagues around the globe.

90 project collaborations within North America, with 85 in the United States

6 project collaborations within South America, with 4 in Brazil

84 project collaborations within Europe, with 24 in the United Kingdom

84 project collaborations within Asia, with 32 in China and 18 in Iran

4 project collaborations within Africa, with 2 in South Africa

2 project collaborations with Australia

A social change legacy with tech beginnings

Rachel Décoste
BA '01 (Computer Science)

Rachel Décoste can point to a defining moment during her convocation ceremony at the University of Guelph (U of G) in June 2001. She sat among her peers, set to celebrate the years of hard work it took to achieve her BA in Computer Science.

As Décoste waited for her name to be called, she watched then-Chancellor Lincoln Alexander seated in an ornate chair handing each student their degree parchment. Then in his late 70s, Alexander had broken significant barriers for Black Canadians. He was the first Black Member of Parliament (MP) and first Black federal Cabinet Minister, among other firsts.

When the moment came for Décoste to cross the stage, Alexander did something unexpected as she walked towards him. He stood slowly, and handed Décoste her degree

parchment. He sat back down.

Though the gesture may seem unremarkable, it was anything but: Décoste recalls she was the only student Alexander stood for, and that she was the only Black female student in her cohort.

Décoste says she was too young to fully appreciate the event when it happened, but as she became more informed of Black Canadian history, she understood Alexander's role.

This was one of many moments in Décoste's life that would shape her path to becoming an anti-racism activist and equity, diversity and inclusion (EDI) advocate who would alter Canada's public policy sphere.

"I have had a side gig doing EDI in some form or another for more than 15 years. My 'after work' activities evolved from activist to

oft-solicited media pundit, to EDI workshop facilitator," Décoste said.

Décoste's activist journey began in earnest at U of G when she joined the West Indian Students' Association (WISA). She started responding to racial incidents, supporting Black, Indigenous, People of Colour (BIPOC) women, and writing opinion editorials in the student newspaper.

On the technical side, U of G provided Décoste the opportunity to innovate in and outside the classroom. This included her final project on neural networks and AI, as well as the skills to undertake a unique endeavour (at the time): creating a website. More specifically, a website devoted to her idol: Whitney Houston.

"At one point, the website consumed half the bandwidth of the U of G web server. It was huge! But there was no information about Whitney on the Internet then, so I was filling a gap for fans. The site became bigger than life."

Décoste reports receiving hundreds of emails each day. Her work garnered international acclaim, receiving a feature in a 1997 edition of Us Magazine (see right photo).

She began at U of G in a different program, but Décoste would shift to a BA in Computer Science to align with her growing interest in website development.

She credits several of her women engineering and computing professors as impacting her career path, including then-professor (and recent Member of Provincial Parliament) Liz Sandals and Dr. Deborah Stacey.

Décoste held a role in Air Traffic Control at NAV Canada in Ottawa after graduation, finding her stride with a group of developers who created a runway scheduling system from scratch and using concepts she learned at U of G.

She then worked in varying technical roles as a developer, analyst, and in management, before moving into politics and volunteering to support Obama's 2008 campaign.

Décoste says that people often reference her work on Barack Obama's successful presidential campaigns in 2008 and 2012.

"My thirst for representation was so deep that I was willing to get it wherever I could find it, even if it meant crossing the border and driving from Ottawa to Detroit, and without knowing if he [Obama] would even win in 2008," says Décoste. "Little did I know then that my work would garner me national media attention."

Décoste emphasizes the importance of having minority representation at the decision tables. While she's thrilled to have been involved in Obama's successful campaigns, she says she is even more proud of her work closer to home, which resulted in the first Black City Councillor in the cities of Gatineau, Ottawa, and London, among other "firsts" for BIPOC

politicians.

She has influenced political representation at the highest levels in Canada and the United States – all while building a respected career in tech, including work in public sector technology roles.

"I've been told that my 'tech-phile' nature has been an asset in (seemingly) non-tech environments because data analytics and scripting languages are integrated into everything these days. I'm still a techie, just in corporate clothing," she says.

Décoste's advancements for BIPOC and immigrant Canadians broke barriers, but not without obstacles: She describes her race and gender as a "lightening rod" in early 2000s tech, followed by a slow climb up the public sector ladder, and a lonely journey to infuse better representation in government (she lost by 10 votes to the opposition as a federal MP candidate in '06).

Décoste has been recognized for her efforts to change the Canadian political landscape on the path to becoming an accomplished writer, educator and social policy expert.

In 2006, Décoste was named the fourth most influential political blogger in Canada. In 2010, she was recognized as one of the Top 50 Personalities in Ottawa Life Magazine. In 2018, she made the list of Canada's Top 100 Accomplished Black Canadian Women.

Over the years, she has penned approximately 170 opinion editorials about Canadian

multiculturalism, history, race and bias, and how those intersect with Canadian culture. She has also engaged in philanthropic efforts, such as raising funds for Black students' education and for Haiti following the devastating 2010 earthquake.

Décoste is moving onto a new challenge as the Director of Equity, Diversity and Inclusion at the National Film Board of

BILLY CORGAN   KEANU REEVES
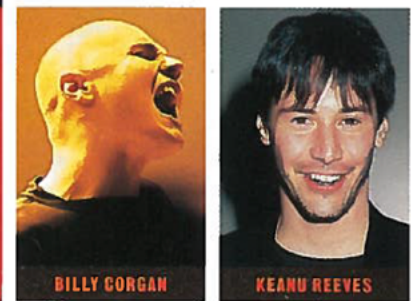
Internet surfers, like the beach variety, are still largely male and white. Rachel Décoste, a black 20-year-old computer-engineering major at the University of Guelph, in Canada, who runs the Whitney Houston Worship Page (http://www.uoguelph.ca/~rdecoste(), is something of a pioneer. Décoste is a self-professed Houston fanatic who even sports a "Whitney Houston Forever" tattoo on her ankle. The popularity of Décoste's site has become daunting.

Canada (NFB), aiming to lead the organization in its mission to combat systemic racism and become more transparent and diverse. She will lead strategic EDI initiatives and guide all levels of the NFB to build inclusion into its culture.

"So many elements of my career started at U of G," says Décoste. "Activism, writing and tech innovation. I will continue advocating for equity-deserving Canadians in my work and using the skills I gained in Computer Science to improve BIPOC representation in Canada."
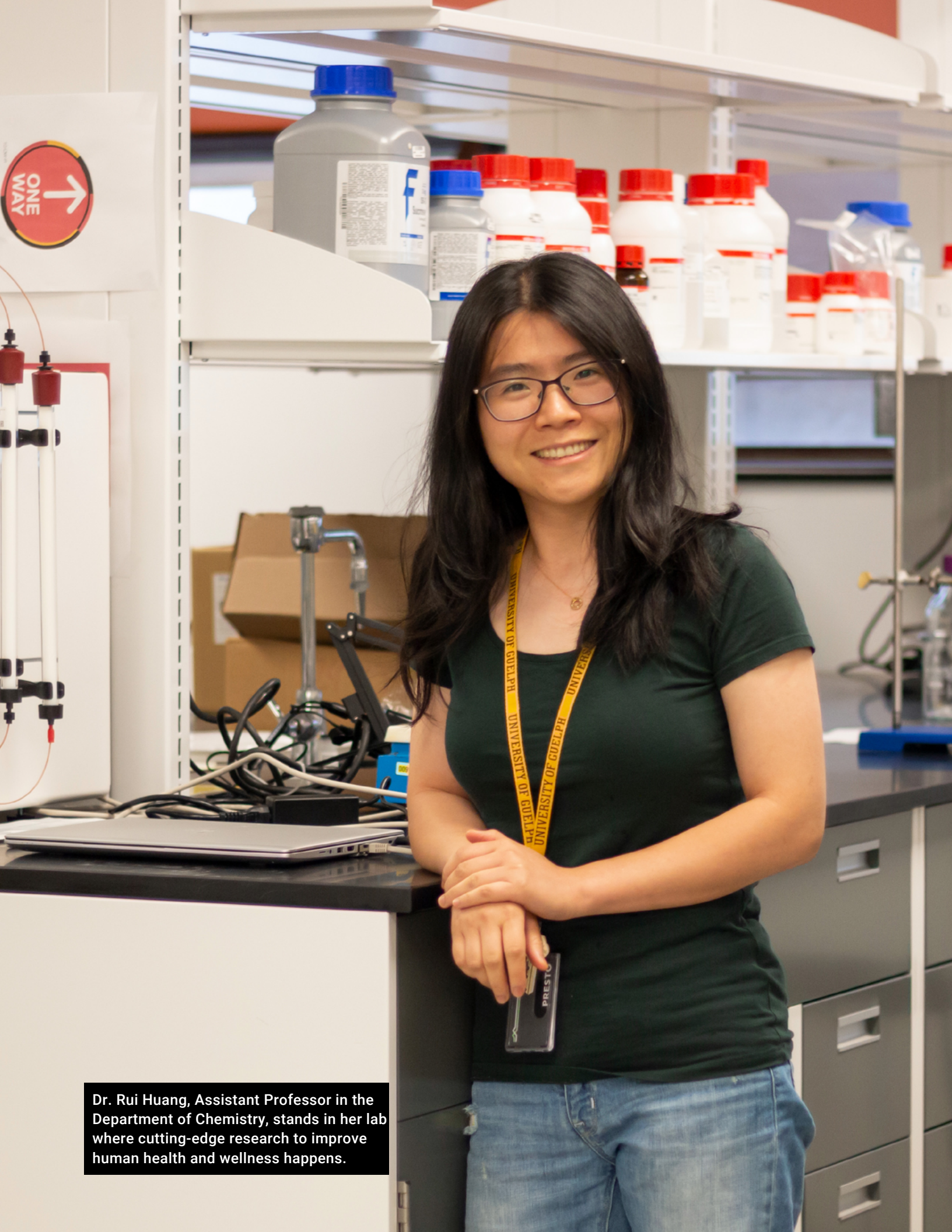
Dr. Rui Huang, Assistant Professor in the Department of Chemistry, stands in her lab where cutting-edge research to improve human health and wellness happens.

Molecular research sheds light on disease

Examining working mechanisms of protein machineries in our body could inform future disease research

The human body is a complex machine, and proteins are the molecular engines. Made up of amino acids, proteins are a category of biological macromolecules, which perform a plethora of functions in the body. For example, proteins help build and repair tissues and can act as chemical messengers in communication between your cells, tissues, and organs.

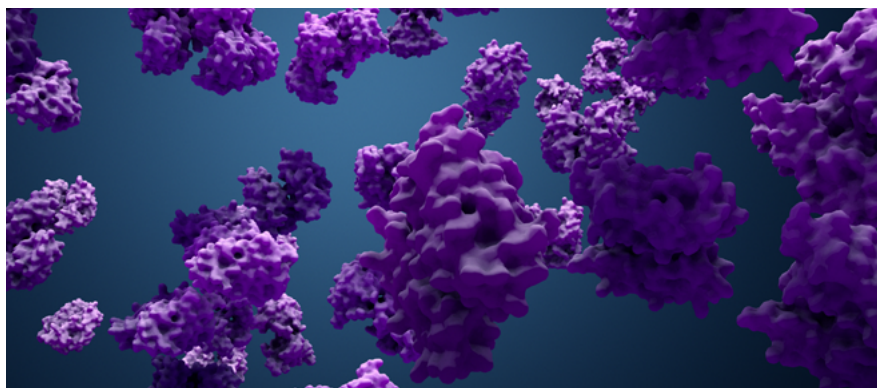Protein homeostasis, a network that maintains proteins in the correct concentrations and configurations, ensures protein function and cell health. Protein homeostasis is maintained by a large network of molecular machineries, which are involved in protein synthesis, folding, unfolding and degradation. When mutations occur, protein homeostasis can be disrupted, and diseases, such as Alzheimer's or Parkinson's, may arise. Understanding how protein homeostasis is maintained is critical to identify how and why some diseases occurs.

Protein Machines

University of Guelph chemistry professor Dr. Rui Huang is investigating an important protein machine called p97, a versatile enzyme that participates in several cellular functions in humans. Mutations to p97 can lead to diseases that affect muscle, bone and the brain. Huang and collaborators assessed the structure and dynamics of protein machine p97 and its disease-related mutants. They determined how complex formation between p97 and its partners as well as the cooperativity within p97 itself affected its cellular function.

State-of-the-art Techniques

The researchers applied "nuclear magnetic resonance (NMR) spectroscopy" and "single-particle cryo-electron microscopy (cryo-EM)." With NMR spectroscopy, proteins are labelled with specific isotopes, providing structural and dynamic information at the atomic level. In cryo-EM, protein particles are flash frozen and trapped in a thin film of ice, enabling researchers to view the protein's structure at the time of freezing. Using an advanced algorithm,

the team observed 14 unique arrangements of a mutant form of p97 and determined the populations of all conformers.

The Big Picture

Although the study found that there was no cooperation in the conformational (positional arrangement) change of a certain domain between neighbours in this p97 mutant, these results are due to the homogenous composition of the p97 subunits under study. Each unit carried the disease mutation. However, many real patients carry just one copy of the mutation alongside a non-mutated gene, which means there are different interactions at play. A previous study by Huang and team showed that there is a high level of cooperation between neighbours in a p97 complex with heterogenous subunit composition.

"There are synergies between data gleaned from cryo-electron microscopy and NMR spectroscopy," explains Huang. "By considering results born out of both techniques, we have shown that the protein composition impacts whether or not cooperation occurs between neighbours. These insights will inform studies of disease."

This work was supported by the Canadian Institutes of Health Research grants FDN-503573 and PJT-162186.

Read the full study in Angewandte Chemie International Edition

A generous community propels us forward

Dr. Bill Van Heyst
Outgoing Associate Dean (External Relations)

On campus, you often hear the faculty, staff and students laud the community feel that the University of Guelph (U of G) provides. However, our supportive culture reaches far beyond the campus boundaries; it includes all our alumni, who make important contributions to STEM disciplines around the world.

In 2020–21, our current and former faculty, alumni and partners continued to support the professional development and personal growth of a new generation of students—not only by providing generous financial contributions, but also their time.

A Record-breaking Gift

In 2021, we received a record-breaking $10-million gift—the largest in College of Engineering and Physical Sciences (CEPS) history—from Edward (Ted) Morwick. The gift will be used to invest in people and infrastructure to facilitate groundwater research and training. These investments include renovating the newly named Morwick Groundwater Research Centre; establishing the Morwick Chair in Sustainable Groundwater Research (held by Morwick G360 Institute Director Dr. Beth Parker, a professor in the School of Engineering and NSERC Industrial Research Chair in Fractured Rock Hydrogeology); and launching an innovation fund to support groundwater research projects. Also, $2 million will be used by CEPS and the College of Biological Sciences to support summer student research assistantships in water and climate change research.

This gift will help solidify the

13,000+
CEPS alumni improving life around the world

$1.05M
In philanthropic donations in 2020–21

$7.69M
Provided to CEPS students in 2020–21

University as an international leader in groundwater research and training, which will attract top researchers and trainees.

Visiting Speaker Fund for Women in Science

Chemistry professor Dr. Peter Tremaine and his wife Karin co-established the Tremaine Visiting Speaker Fund for Women in Science in 2021. The fund will enable the College to bring the world's brightest women scholars and policy makers to campus.

The Departments of Chemistry, Mathematics and Statistics, and Physics, as well as the School of Computer Science will each choose a speaker and plan activities for their speaker's week-long visit. Besides discipline-specific activities and talks, the Tremaines envision each speaker to take part in at least one campus-wide public event.

Bringing inspirational women to U of G will provide the next generation of female students with the opportunity to interact with role models—examples of what they can accomplish by pursuing careers in STEM.

Peter Chisholm Engineering Student Leadership Scholarship

For a class project, the '76, '77 and '78 graduating Engineering classes set a fundraising goal among their peers to establish a student leadership award, named after former U of G engineering professor Dr. Peter Chisholm. In 2021, they achieved their goal of $37,500—an incredible milestone.

One award will be handed out each year to an engineering student who best demonstrates outstanding leadership skills in the University's School of Engineering and/or community.

In addition to a scholarship of $5,000, the award recipients are provided a unique opportunity to build connections within the professional engineering community; they will receive mentorship and career advice from the Engineering alumni who established this award.

Our U of G community helps foster a teaching and learning environment where careers can flourish. Our donors' generosity not only enables us to reach for greater heights, but also inspires us to find creative ways to give back.

Four million dollars of the generous gift to U of G from Ted Morwick will support renovations and capital improvements to the Bedrock Aquifer Field Facility, which will be renamed the Morwick Groundwater Research Centre. Construction is planned for 2022 to build a state-of-the-art groundwater research facility, providing innovative research potential and hands-on training for students. More information can be found on the CEPS website and at G360group.org.

Alysha Cooper pursued a master's degree in statistics at U of G with the addition of a <u>Collaborative Specialization in AI</u>, a Vector Institute-affiliated program designed to provide top master's students in Ontario with a diverse and comprehensive knowledge base in AI and prepare them for careers in AI.

A journey to improve Canadians' mental health begins at U of G

Alysha Cooper
B.Sc. '18 (Psychology), M.Sc. '20 (Applied Statistics + AI), PhD (Statistics, in progress)

The intersection of healthcare, mental health and AI is where PhD student Alysha Cooper's passions lie, first explored through her unique master's research using neural networks to predict an individual's risk of developing bipolar disorder.

Neural networks are a subfield of AI that work by mimicking operations of the human brain to recognize relationships between data. These networks create opportunities to answer complex AI questions.

When applied to healthcare and mental health, neural networks have enormous potential to improve the wellbeing of Canadians.

While a master's student at the University of Guelph (U of G), Cooper compared several mathematical models to assess their ability to predict the time it would take to diagnose at-risk individuals with bipolar disorder. An article co-authored by her faculty advisor, Dr. Julie Horrocks, and collaborators, was recently published.

"Alysha's research demonstrates the potential for neural networks to improve our mental health systems," says Horrocks.

"Finding the best models and methods for predicting complex mental health disorder diagnoses over

time is important, as early diagnoses could lead to earlier intervention for at-risk individuals."

Cooper's interest in youth mental health began long before she came to Guelph. Starting in high school and continuing through her undergraduate degree in psychology at U of G, she participated in Best Buddies Canada, a program to create lasting friendships between people with and without an intellectual or developmental disability.

She also became a Peer Counsellor for the Student Support Network to lend a supportive ear to fellow students on campus.

Through her master's studies, Cooper developed skills in research, as well as technical skills and ethical AI knowledge, which she applied shortly after graduation in a data analyst role at Homewood Research Institute (HRI).

"I was responsible for organizing and analyzing data collected through HRI's research, and for translating the findings into solutions—including the potential of machine learning—which can be applied to mental health and addictions," says Cooper.

Cooper's work at HRI included looking at associations between

individuals' impulsivity, mental health and substance use.

Cooper felt the itch to turn a lens towards her physical health interests and returned to U of G in fall 2021 to pursue her PhD, for which she received an Ontario Graduate Scholarship.

Working with Drs. Ayesha Ali and Zeny Feng in the Department of Mathematics and Statistics, Cooper will leverage advanced computational and mathematical methods alongside machine learning to examine bacteria in the gut.

"I have always been fascinated by both genetics and the gut microbiome. The gut microbiome has been found to be linked to more than just diseases and is now being studied for its connection to mental health," says Cooper.

"I hope to learn more about analyses of the gut microbiome so that I could one day potentially work on research for its connection to mental health. In doing so, I also plan to further my skills in complex statistical techniques and solving problems with statistical models."

Read "[Predicting the risk and timing of major mood disorder in offspring of bipolar parents: exploring the utility of a neural network approach](#)" in the International Journal of Bipolar Disorders.

Have you seen my keys?

An experimental approach helps researchers assess the accuracy of indoor location systems.

Dr. Petros Spachos (left) and U of G graduate student Sebastian Sadowski presented their work at a tech conference in Vancouver in 2019.

From the "Find my Friends" feature on your phone to the global positioning system (GPS) in your vehicle, we have come to rely on location technologies. But imagine your mobile phone could tell you precisely which room in your home you left your car keys. Or, for business owners, help keep track of inventory. This functionality is possible with indoor location systems. Cutting-edge research into the accuracy of such systems begins at the University of Guelph (U of G)

Locating Devices Indoors

U of G engineering professor Dr. Petros Spachos used an experimental approach to assess the technology behind indoor localization systems. To calculate the position of an unknown device, a localization system requires real-time location information from devices with known positions. Outside, localization systems use GPS technology, but inside, GPS

signals are not easily received. In addition, varying room layouts, sizes and obstacles can make accuracy even more challenging.

An Experimental Approach

Spachos and his collaborators, including U of G graduate student Sebastian Sadowski, who is also a former U of G undergraduate student, explored the accuracy of indoor location techniques in the context of different wireless technologies and within different types of indoor environments.

The researchers set up three scenarios. The first was a small meeting room with tables and chairs, representing low interference. The second, a high-interference environment, consisted of a small meeting room with tables, chairs and transmitting devices. The third scenario was an average interference environment: a large computer lab with tables and WiFi-enabled computers. The researchers compared

the accuracy, precision and complexity of two localization techniques in each scenario.

The most accurate technique for all scenarios was the "k-nearest neighbour," which is rooted in a method called "fingerprinting." Fingerprinting creates a radio map of an area by measuring a received radio signal from several access points and storing that information in a database.

An algorithm compares signal values from an unknown location with values from known locations in the database. The k-nearest neighbour algorithm calculates distances between all the points in the database and selects the nearest matches to estimate the receiver's unknown location.

The k-nearest neighbour technique was not only more accurate but also simpler: Calculations could be easily modified to suit any dataset.

"Our dataset is available in an open-source format for future research," says Spachos. "Further exploration could lead to improved indoor localization technologies with everyday practicality, just like we see outdoors with GPS and 'Find my Friends'."

This work was supported by NSERC.

Celebrating College of Engineering and Physical Sciences faculty and staff

Five members of the CEPS community have been awarded for their exceptional contributions.

The past two years have provided monumental challenges as a result of the COVID-19 pandemic. The College of Engineering and Physical Sciences (CEPS) community has continued to showcase its dedication to teaching, learning and research—even under exceptional circumstances.

The annual CEPS Awards provide the College with an opportunity to celebrate and recognize each other's achievements. They also provide us with a chance to reflect on our community's contributions. This year, five faculty and staff received CEPS Awards.

Dr. Eran Ukwatta, a professor in the School of Engineering, received the CEPS Assistant Professor Research Excellence Award. The award is given to the assistant professor who best demonstrates enhanced research productivity and the potential for research program growth.

Awarded to the faculty member who best exemplifies sustained excellence in graduate student supervision, Dr. Marcel Schlaf, a professor in the Department of Chemistry, received the CEPS Graduate Supervision Award.

Dr. Ed McBean, a professor in the School of Engineering, received the CEPS Undergraduate Supervision Award, given to the faculty member who best exemplifies sustained excellence in undergraduate supervision.

Awarded to the faculty member who best exemplifies sustained excellence in undergraduate teaching, Dr. William Tam, a professor in the Department of Chemistry, received the CEPS Excellence in Undergraduate Teaching Award.

Awarded to the staff member who has provided exceptional

contributions towards fulfilling the College's mission and mandate, Lisa O'Dwyer, Graduate Program Assistant in the Department of Chemistry, received the CEPS Staff Excellence Award for going above and beyond the requirements of her role in mentoring graduate students.

"I am thrilled to recognize the outstanding faculty award recipients who continue to nurture our student community and lead innovative research projects. They are highly deserving members of CEPS," says Dr. Gerarda Darlington, interim dean of CEPS 2020–21.

"I am constantly impressed by the tireless dedication of our staff to our students and faculty, and to each other. The staff award recognizes one of the many exemplary staff members in our community, including our research and technical staff who enable our research activities, as well as our administrative staff who form an essential backbone for our College."

Read the CEPS Faculty and Staff Awards story on uoguelph.ca/ceps

A momentous year in teaching and learning

Dr. Karen Gordon
Associate Dean (Academic)

We know that for many students their educational journey starts within our classroom walls.

In 2020, those walls suddenly became virtual. In the face of immense challenges, our students, faculty and staff pivoted, demonstrating resiliency as they adapted to remote teaching and learning.

It was thrilling to see the teaching innovations that were born out of the pandemic-related challenges. Our instructors found new ways to teach and assess students remotely. We saw a shift to higher-level cognitive and application-based questions, as well as open-ended project-based assessment methods.

For example, Dr. Kate Stuttaford, Chemistry Lab Coordinator, and Dr. Matthew Demers, Professor in the Department of Mathematics and Statistics, amongst others, created unique assessments better suited to distanced learning.

These assessments will likely be implemented in future in-person classrooms, enriching learning opportunities for our undergraduate students.

The School of Engineering provided computers on loan to undergraduate students, facilitating their ability to complete their coursework remotely.

Feedback from students indicated that they appreciated the flexibility of remote delivery during the pandemic.

As we move forward, instructors are being mindful of these advantages and incorporating the innovative teaching capabilities from both distanced and in-person learning.

In the summer of 2021, we rolled out the second iteration of our online platform called The Quad.

The Quad provides virtual opportunities for our first-year students to engage with faculty, staff and upper year students. It is important to us that—no matter the format—our students can come together as a community.

For Fall 2021, we were pleased to launch two inaugural College of Engineering and Physical Sciences (CEPS) dean's office scholarships to celebrate excellence and community: The CEPS Leadership Scholarship and the CEPS Diversity Scholarship. The awards recognize outstanding CEPS students making a difference for the U of G (and broader) community.

There is no doubt that 2020-21 presented unique challenges. We are grateful to our faculty, staff and students for their tireless efforts and look forward to the academic journey ahead.

3,313
Total CEPS undergraduate students 2020−21

139
Scholarships, bursaries, and awards for students

13.3%
Percentage of CEPS students who are international students

Industry partnerships drive leading-edge learning experiences

Industry partners play an integral role in helping the College of Engineering and Physical Sciences (CEPS) achieve its mission to become a national leader in student experience and impactful research. Our course-based Master of Cybersecurity and Threat Intelligence (MCTI) is an example of what can be accomplished when industry and academia come together.

Established in 2019, the MCTI program is headed by Dr. Ali Dehghantanha, associate professor in the School of Computer Science and Tier 2 Canada Research Chair in Cybersecurity and Threat Intelligence.

From day one, it was Dehghantanha's vision to partner with industry and provide real-world learning experiences for students.

"We strive to provide every student with a blend of practical and theoretical learning experiences that equip them with

the leading-edge skills required to fill the global cybersecurity skills gap," explains Dehghantanha.

"Our state-of-the-art cybersecurity teaching infrastructure, diverse faculty complement, and strategic partnerships with private industry and governmental organizations are features that set our program apart from similar cybersecurity programs in Canada and abroad."

The MCTI program has an advisory board comprised of key influencers from technology companies such as Bruce Power, eSentire and ISA Cybersecurity.

"We are thrilled to participate on the MCTI advisory board," says Rob McLeod, VP Threat Response, eSentire. "It enables us to inform the program's curriculum committee about shifting priorities and emerging knowledge gaps in industry."

The curriculum committee weighs the advisory board feedback before deciding whether program changes are required to ensure that MCTI students are well-equipped to meet market demands and fill job openings in the rapidly evolving cybersecurity field.

In 2020, the MCTI program entered a memorandum of understanding (MOU) with Mitacs, a national research organization that partners with academia, industry and government to accelerate research and development.

The MOU establishes nearly 100 internships over the next

five years for students in the MCTI program. The internships are co-funded by Mitacs and MCTI's industry partner network. Through this first-of-its-kind partnership at the University, nine MCTI students engaged in paid internships in 2020–21.

"The interns from the University of Guelph's MCTI program represent the next generation of cybersecurity talent," says Niranjan Mayya, Chief Technology Officer, Innovation, Arctic Wolf. "We provide them with hands-on learning opportunities that prepare them for how to recognize and respond to real-world cyberattacks."

The internships also help to advance our faculty's research programs. Leopoldine Vassiliou, MCTI student, completed a research internship with ISA Cybersecurity in Spring/Summer 2021 under the supervision of Dr. Charlie Obimbo, professor in the School of Computer Science.

"The support from ISA Cybersecurity and Mitacs enabled me to gain valuable research experience, learn from experts in academia and industry, and expand my professional network—all while receiving financial support," says Vassiliou.

MCTI's industry partners are also making cybersecurity education more accessible by funding scholarships, some of which are reserved for female students.

The gender stipulation is aimed at boosting the representation of women in the program and,

Dr. Ali Dehghantanha

ultimately, the cybersecurity industry. Bringing more diverse perspectives into the program will enhance the learning environment and lead to more innovative thinking.

"ISA Cybersecurity is proud to partner with U of G's MCTI program," said Gleb Yevtushenko, Associate Director, Cybersecurity Intelligence & Operations Center at ISA Cybersecurity.

"We're passionate about fostering the next generation of cybersecurity experts and supporting education initiatives. That's why we provide scholarships and internship opportunities to MCTI students. In turn, these students become some of our most promising employee prospects and help advance our vision to create a world in which everyone is safe from cyber threats."

College of Engineering and Physical Sciences Research Chairs

CANADA RESEARCH CHAIRS

Dr. Aicheng Chen
Tier 1 Canada Research Chair in Electrochemistry and Nanoscience

Dr. Ali Dehghantanha
Tier 2 Canada Research Chair in Cyber Security and Threat Intelligence

Dr. Manju Misra
Tier 1 Canada Research Chair in Sustainable Biocomposites

Dr. Carl Svensson
Tier 1 Canada Research Chair in Gamma-Ray Spectroscopy and Rare Isotope Physics

Dr. Graham Taylor
Tier 2 Canada Research Chair in Machine Learning

UNIVERSITY RESEARCH CHAIRS

Dr. Eric Poisson
Research Leadership Chair

Dr. Kathryn Preuss
Research Leadership Chair

CEPS COLLEGE RESEARCH CHAIRS

Dr. John Dutcher
CEPS Research Chair in Novel Sustainable Nanomaterials

ENDOWED AND EXTERNALLY FUNDED RESEARCH CHAIRS

Dr. Kevin Keener
Barrett Family Foundation Chair in Sustainable Food Engineering
The Barrett Family Foundation

NSERC INDUSTRIAL RESEARCH CHAIRS

Dr. Beth Parker
NSERC Industrial Research Chair in Fractured Rock Contaminant Hydrology

Dr. Peter Tremaine
NSERC/UNENE Senior Industrial Research Chair in High-Temperature Aqueous Chemistry

Nareshri Babu is a fourth-year software engineering student at the University of Guelph. When she graduates in 2022 with her degree in software engineering, she will miss the University's greenhouse, which became her "tropical haven" between classes even in the winter.

Inspired by family, U of G student pursues degree in software engineering and wins national team competition

Nareshri Babu
B.Comp. (Software Engineering, in progress)

When Nareshri Babu began considering her postsecondary education, she knew she had an interest in technology and software. What she didn't know then was that the four years of hard work in her degree would culminate in winning a national competition and an internship with a top tech company.

"Something I was drawn to when I was applying to postsecondary schools was the potential to help people and make a difference. I want to find ways to make technology more helpful and accessible to people," says Babu.

Babu's sister, with whom she has always been close, also encouraged her to pursue a degree in technology. As a teenager, Babu was constantly fiddling with her sister's phone software.

A second familial motivator pulling Babu to a career in technology was her uncle, who has a visual impairment that has caused some day-to-day challenges for him.

Babu realized the integral role that technology plays in increasing accessibility and equal opportunity, so decided to dedicate her interest in software technology toward improving these gaps.

Babu wanted to contribute her knowledge to improve the lives of people like her uncle and others experiencing similar challenges.

Babu was initially intimidated by the idea of enrolling in a technology degree, but after taking an exploratory coding course, she knew it was the right fit. Putting aside her doubts, she applied to the University of Guelph's Software Engineering program.

"I chose U of G because of its welcoming community, supportive faculty and beautiful campus," says Babu, adding that her professors inspired her to believe in herself and pursue her goals throughout her educational journey.

Babu has enjoyed all the courses she has taken at U of G so far because they allowed her to develop skills and techniques transferrable for the workplace. She is particularly proud of completing the challenging course CIS 2750 – Software System Development and Integration with a grade of 100 per cent.

In January 2021, Babu joined a team of four U of G students to participate in <u>Elle Hacks, Canada's largest two-day hackathon</u> where women and non-binary individuals collaborate to solve real-world challenges and present technological solutions to judges.

"Our team decided to focus on improving financial literacy among youth to support responsible, informed financial decisions. We created an interactive banking game called 'Kiddy Bank' that educates children about budgeting, spending, investing, saving and loans."

The concept of Kiddy Bank was inspired by a personal experience Babu had as a child: "My parents designed a system where they would assign me chores and if I finished them within a certain time frame, I would get points. I could exchange these points for prizes," she said.

Kiddy Bank was successful and resulted in her team winning the Bell Custom Award in the Financial Literacy Category, sponsored by Bell Canada.

Babu was soon after approached for a summer 2021 internship position at Bell Canada as a Data Science Intern on the Network Big Data and AI team.

Through the summer, Babu worked on projects with various teams while gaining hands-on experience in data science and machine learning.

During her internship, Babu enjoyed learning about and applying machine learning concepts.

She is excited to pursue her future career in software engineering.

It starts with our youth

On a Saturday in February 2021, over 60 Girl Guides of Canada dove into the world of science for a unique event with the University of Guelph (U of G) called the "Science Experiment," where they engaged in remote workshops doing experiments with Guelph Women in Science and Engineering (WiSE) for the afternoon.

When they finished the activities, each participant received a unique U of G patch (right).

The partnership between Girl Guides and U of G continued through a coding event hosted by Guelph Women in Computer Science, and an AI event hosted by Creative Encounters with Science. The College of Engineering and Physical Sciences (CEPS) plans to grow the partnership for 2021-22.

The collaboration between U of G and Girl Guides represents just one of dozens of initiatives from the past year, aimed at engaging school-aged children and the community in STEM.

From 2020–21, more than 2,000 children and youth participated in CEPS outreach activities.

"Introducing school-aged children to STEM from a young age builds their confidence and reduces barriers to entering these disciplines," said Jean Hein, Outreach Manager for the CEPS dean's office. "It creates a connection between them and STEM concepts, and between the community and the University."

There were also virtual initiatives through CEPS such as Go CODE Girl and Go ENG Girl, adds Hein, aimed at connecting with girls and equity-seeking groups underrepresented in these subject areas. Activity kits were created and mailed to participants.

A Collaborative Approach

Faculty and staff in the College's five academic units – Chemistry, Computer Science, Engineering, Mathematics and Statistics, and Physics – as well as the CEPS dean's office worked together to execute outreach and community initiatives over the past year.

Volunteers, staff and student leaders in Creative Encounters with Science, WiSE, Guelph Women in Computer Science, the Math & Stats Club, the Physics and Astronomy club, also led dozens of high-impact outreach programs.

Highlights From the Year

ChemEd, the largest conference in North America for high school and early-year postsecondary educators, happened in July with the help of CEPS staff on its steering committee. Conference planners shifted to a modified remote approach for this year, which attracted more than 1,700 registrants from 54 countries over three days. The in-person conference is rescheduled for 2023 in Guelph.

In August, Creative Encounters welcomed 140+ campers from grades 2-6 to campus for a safe return to in-person camps with reduced capacity. Approximately 40 per cent of camp spots were provided free of charge to the Guelph Children's Foundation.

Other Outreach Initiatives

Creative Encounters classroom visits, workshops, and clubs

Physics Guelph Civic Museum Exhibit

Pets Explain Pi with Math and Stats

Science Olympics

STEM Week with Physics

Multimedia engagement, including Ask Me Anything: Science Edition

Gillian Conley, co-director of <u>Creative Encounters with Science</u> and U of G grad, holds the U of G STEM patch for Girl Guides. Creative Encounters is an education outreach program led by CEPS that promotes learning in STEM among youth, primarily staffed by U of G students and grads. Their initiatives include summer camps, classroom workshops, after school clubs, teacher tech training, and community outreach events. Creative Encounters is a member of the Actua Network.

50 years of Computer Science
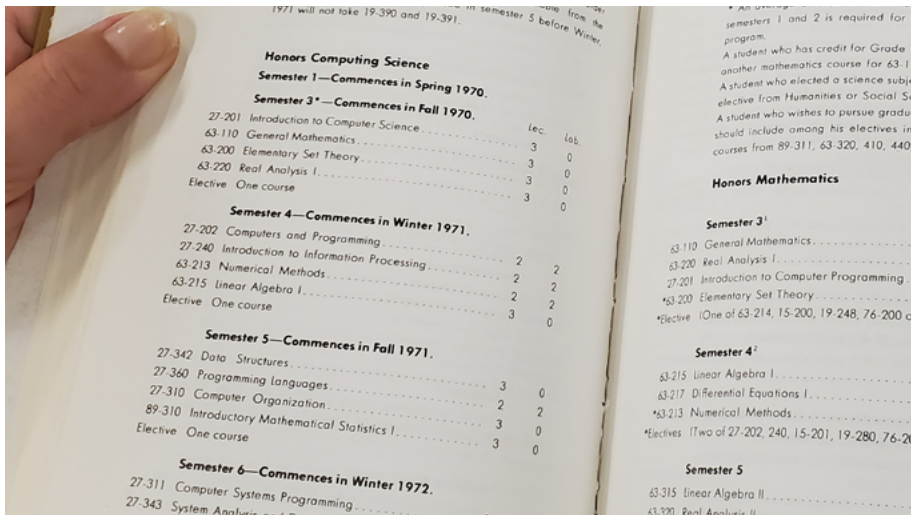
One of the first offerings of a Computer Science major at U of G from 1970.

Since its inception in 1971, the School of Computer Science (SoCS) has been a key contributor to Canada's tech transformation.

In the 1970s, what was then-called the Department of Computing and Information Science (CIS) launched with a user-centred approach to focus on people's skills, not just advancing technology. The first Computer Science degree courses were offered by CIS in 1971.

In the 1990s, CIS would enter the supercomputing age with much more faculty and the ability to do large-scale research computations.

From improving technology for crowd counting to using social media for tracking COVID-19 waves and mitigating biases in AI, the people in SoCS today are leaders that contribute to our world's wellbeing.

Graduates from the School of Computer Science improve life

in organizations spanning the world's top tech companies to impactful, community-driven startups and local businesses.

The University of Guelph (U of G) is focusing on two pressing developments in the field: AI and cybersecurity.

In recognizing the growing gap in data and cybersecurity expertise in Canada, U of G

and SoCS established the Master of Cybersecurity and Threat Intelligence. The School is also an integral partner to the Centre for Advancing Responsible and Ethical AI and the new Master of Data Science program

A virtual 50th anniversary celebration during Alumni Week captured the impressive achievements from the School in June 2021, also featuring alum and globally-renowned tech leader Tim Bray.

Celebrations continued through the year. SoCS interviewed retired Computer Science faculty including Dr. Dilip Banerji, who was named one of 90 Pioneers of Computing by the IBM Center for Advanced Studies in 2005. They posted a "50 Days of SoCS" anniversary series on their Instagram, @uofgcomputing.

Photograph from a computer course taught in 1984.

125(+1) years of Physics

A lot has changed since 1878, the first year that physics was taught at what is now U of G.

Back then, physicists at Guelph focused on how our understanding of the natural world could improve life on the farm by studying soil, the environment and the relatively new field of electricity and electrical machinery.

Evolving from its rural roots, the Department of Physics has since established itself as a scientific centre for transformative research. Guelph physicists now study soils on distant planets, subatomic particles inside every atom, and physical processes of every scale in between.

The Department is also known for its physics education, with colleagues across Canada recognizing the pioneering approach to curriculum and pedagogy that is the hallmark of our students' experience.

As one of the only Canadian universities to have three instructors awarded the Canadian Association of Physicists' Medal for Excellence in Undergraduate Teaching, students can expect to learn modern physics from instructors who engage in innovative teaching through flipped classrooms, experiential learning, and hands-on labs.

In 2021, the Department's impactful history was recognized by the Guelph Civic
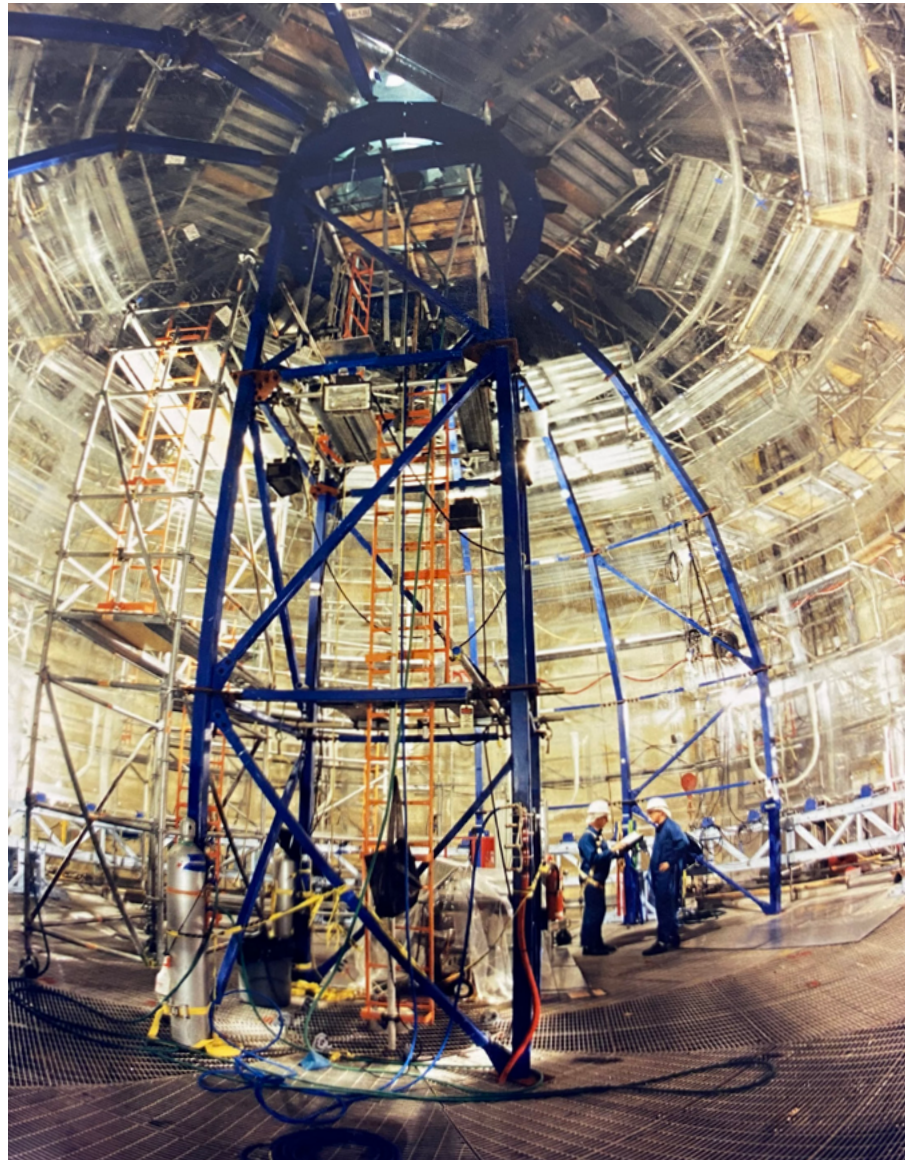
The former Sudbury Neutrino Observatory (SNO – now the SNOLAB), seen here being constructed here in the late 1990s, was designed to advance physics research through the study of neutrinos—subatomic particles with a small mass. It was built two kilometres underground near Sudbury, ON, and is the size of a 10-storey building. Guelph scientists, led by SNO co-founder Dr. John J. Simpson, were integral to breakthrough findings in the study of neutrinos. The research conducted by Simpson and the Guelph team contributed to the body of work that led to the 2015 Nobel Prize in Physics for an international team of researchers.

Museum through an exhibit. The Department celebrated its 125(+1) year anniversary with a virtual event in June with faculty, staff, students and alumni and continued to celebrate throughout the year with an ongoing live stream series, found on their YouTube channel, Guelph Physics.

Nuclear Magnetic Resonance (NMR) spectroscopy allows researchers to see a molecule's structure. Above, two PhD candidates work in the NMR Centre at the University of Guelph.

Proteins offer insights into Parkinson's

Examining proteins could lead to important breakthroughs for treating Parkinson's disease.

More than 100,000 Canadians live with Parkinson's disease, a progressive and long-term brain disorder that impacts the central nervous system.

There is no cure for Parkinson's but understanding what is happening at the molecular level may help provide insight into the disease's progression. This information could enable early intervention and treatments, providing hope for thousands of people.

The Role of Proteins

Dr. Vladimir Ladizhansky, a professor in the Department of Physics, Dr. Scott Ryan, a professor in the Department of Molecular and Cellular Biology, and collaborators are examining alpha-synuclein, a small presynaptic protein believed to play an important role in the development of Parkinson's Disease.

Under normal conditions, alpha-synuclein exists in the soluble and membrane-bound forms. In

Dr. Vladimir Ladizhansky

Parkinson's Disease, it can also form toxic aggregates called fibrils.

Advanced Imaging Techniques

The researchers used "magic angle" spinning Nuclear Magnetic Resonance (MAS NMR) to examine the structure and dynamics of the C-terminus of alpha-synuclein in the membrane-bound and the fibrillar forms.

In MAS NMR, a sample is placed in a strong magnetic field and is rapidly rotated around an axis pointing at the "magic angle," a precisely defined angle of approximately 54.74 degrees with respect to the magnetic field.

This angle is deemed magic because it results in increased signal intensity, and helps to improve resolution and structural information content. With this technique, researchers can examine the structure and motions at the atomic scale without interfering with the material itself.

Basis for Future Research

The team examined three protein samples. By comparing carbon

chemical shifts, the researchers found that although C-terminus is more dynamically constrained in fibrillar forms, it remained flexible and unstructured in all three of the samples they examined.

"The information obtained in this project will serve as a basis for further studies of interactions between the proteins and the lipid membranes," says Ladizhansky. "By better understanding the protein characteristics and how they change under different conditions, we hope to learn more about the protein's role in Parkinson's disease. This information is critical for the development of future treatments."

Read the full study in Biomolecular NMR Assignments

News stories

A look back at several top stories in the College of Engineering and Physical Sciences that represent many key achievements and outcomes from the year. These stories were chosen to showcase just a few of the many ways our faculty, staff and students improve life, advance research and contribute to a vibrant community.

Molecular Research Could Bring Cancer Vaccine

Around 225,000 Canadians are diagnosed with cancer each year. That staggering statistic drives the pursuit of therapeutic cancer treatment vaccines, such as the one chemistry professor Dr. France-Isabelle Auzanneau is working on. Her team is exploring antigens that could lead to the development of novel anti-cancer therapeutics.

Read the full story at uoguelph.ca/ceps

U of G Awards Research Leadership Chairs

Chemistry professor and chair Dr. Kathryn Preuss and physics professor Dr. Eric Poisson were named University Research Leadership Chairs for 2021. The program recognizes mid- to late-career researchers who have made significant contributions to their field and national and international recognition for their outstanding research.

Read the full story at uoguelph.ca/ceps

Engineering Student Helps Save Wetlands

Ally Zaheer, Environmental Engineering (B.Eng.) student, has always had a passion for helping the planet. She was actively engaged in lobbying to save environmentally-significant wetlands in Ontario. After several successes in early 2021, Zaheer will focus on other legislation aimed at preventing development on significant lands.

Read the full story at uoguelph.ca/ceps

Welcome to three new CEPS faculty in 2020–21!

Dr. Derek O'Flaherty
Assistant Professor,
Department of Chemistry

O'Flaherty's research connects chemistry and biology and focuses on nucleic acid chemistry.
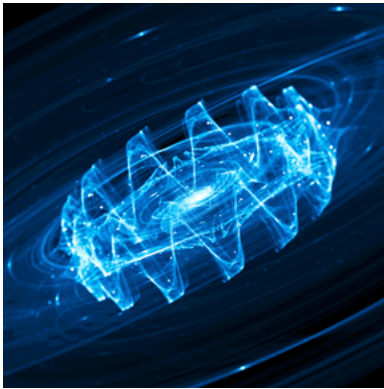

Dr. Sheng Yang
Assistant Professor, School of Engineering

Yang's interests are in enhancing manufacturing processes and technology.

We also welcomed three new faculty in 2020–21 in Chemistry and Engineering. They will strengthen our research and teaching capabilities in areas spanning biological chemistry, manufacturing sectors, and machine learning.

New Truth About Cosmic Objects

Since Albert Einstein, scientists have been fascinated by the gravitational waves that result from the collision of supermassive black holes. Physics professor Dr. Huan Yang and colleagues are developing new equations to help researchers study massive black holes and understand their interactions with other cosmic objects.

*Read the full story at uoguelph.ca/ceps*

Crowd Counting Tech has Key Societal Impacts

A group of U of G researchers led by Dr. Minglun Gong, a professor in the School of Computer Science, are enhancing our crowd counting capabilities through a novel AI-based approach. The research outcomes will support better traffic control, public security, social distancing enforcement and even precision agriculture.

Read the full story at uoguelph.ca/ceps
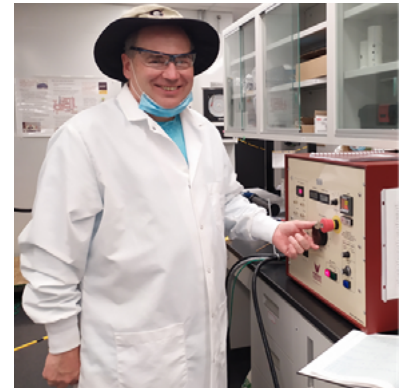
Barrett Funding Makes Food Industry Greener

Thanks to the Barrett Family Foundation's generous $5-million dollar contribution to U of G, we are seeing critical advancements toward sustainability in the food industry take shape: Contaminated food, food waste, greenhouse gases, and non-recyclable plastic packaging are all targets of the funded research projects.

Read the full story at uoguelph.ca/ceps

**Dr. Fattane Zarrinkalam
Assistant Professor, School of Engineering**

Zarrinkalam's interests are in mining social media data using machine learning.

Untangling the mysteries of quantum theory

Using math to explore quantum entanglement theory could lead to incredible technologies.

Imagine a hack-proof system that could rapidly accelerate developments in AI. A system that could solve problems that would take a computer billions of years to crack. That system is a quantum computer, which leverages the behaviour of particles at the subatomic level to perform computations.

Dr. David Kribs, a professor in the Department of Mathematics and Statistics, knows that for quantum computers to work, we need to understand the mathematical foundations of quantum theory. In a recent

Dr. David Kribs

article Kribs and colleagues, including mathematics professor Dr. Rajesh Pereira, postdoctoral fellow Dr. Jeremy Levick, student Katrina Olfert, and collaborator Dr. Miza Rahaman are taking a deep dive into quantum entanglement.

Mind-boggling Math

The researchers applied mathematical principles to understand what happens when quantum entanglements break. It sounds complex, and in fact, quantum entanglement theory is considered one of the toughest concepts in science. In everyday life, objects exist in a specific place and at a specific time, like that coffee cup on our desk. However, at the subatomic scale, our understanding of how things move and exist no longer applies. Quantum particles can behave like particles, found in a single place, or like waves, found throughout space in several places at once.

A quantum entanglement occurs when there is a correlation between two subatomic bits of matter. Measuring one instantaneously identifies

the outcome of a similar measurement in the other. Information is sent between the two objects faster than the speed of light. This concept is so mind-boggling that Albert Einstein described it as "spooky." Quantum entanglement is generally poorly understood, and a particular challenge comes with knowing what happens when entanglement is broken.

Mathematical Maps

Kribs and the team used mathematical arguments to describe the structure of entanglement breaking channels, like drawing a mathematical map. They developed a way to test the behaviour exhibited during entanglement breaking and identified applications within quantum information science, such as data encryption.

"Our work brings us one step closer to understanding how quantum operations behave when acting on entangled states," says Kribs. "In addition to generating some interesting new mathematics, we think this work can contribute to moving new technologies like quantum computing and quantum cryptography forward."

This work was supported by NSERC and a University Research Chair at U of G.

Read "Nullspaces of entanglement breaking channels and applications" in the Journal of Physics A: Mathematical and Theoretical

Awards and recognitions September 2020–August 2021

We celebrate and congratulate College of Engineering and Physical Sciences faculty and staff who received awards, honours, and recognitions in 2020–21, including the following:
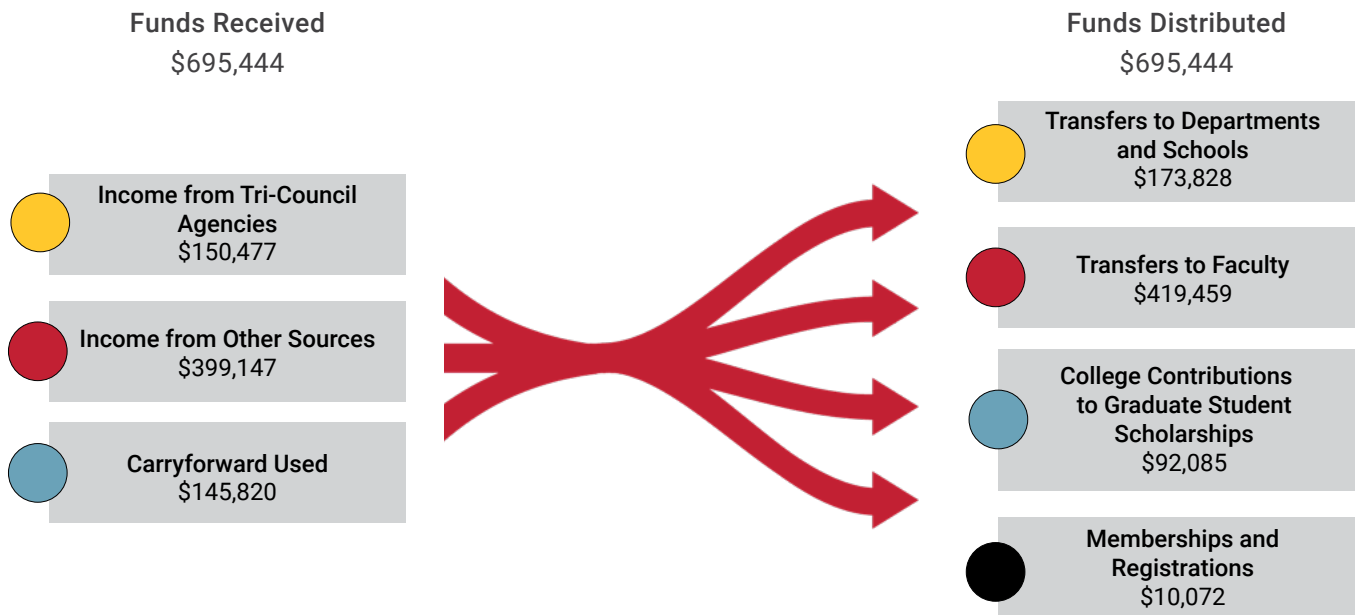
Dr. Andrea Bradford	UGFA Award for Innovation in Teaching
Dr. Aicheng Chen	Electrochemical Society 2020 Canada Section R. C. Jacobsen Award
Dr. Prasad Daggupati	Canadian Society for Bioengineering 2020 Young Engineer Award
Dr. Ali Dehghantanha	Tier 2 Canada Research Chair in Cyber Security and Threat Intelligence
Dr. Bob Dony	Professional Engineers of Ontario Companion, Order of Honour
Dr. Kevin Keener	2021 Fellow, Institute of Food Technologists
Dr. Xiaodong Lin	2021 Communications and Information Security Technical Recognition Award, IEEE Communications Society
Dr. Jacek Lipkowski	Frumkin Memorial Medal
Dr. Ed McBean	American Academy of Water Resources Engineers 2021 Outstanding Research & Innovation Award
Dr. Keriann McGoogan	Writers' Trust of Canada 2021 Rising Star
Dr. Manju Misra	Tier 1 Canada Research Chair in Sustainable Biocomposites
Dr. Manju Misra	Fellow, the American Institute of Chemical Engineers (AIChE)
Dr. Manju Misra	Fellow, Society of Plastics Engineers
Dr. Manju Misra	Women's Executive Network Top 100: Manulife Science and Technology
Dr. Manju Misra	Lifetime Achievement Award, BioEnvironmental Polymer Society
Dr. Amar Mohanty	2020 Fellow, Royal Society of Canada
Dr. Beth Parker	Fellow, Canadian Academy of Engineering
Dr. Beth Parker	International Association of Hydrogeologists Robert N. Farvolden Award
Dr. Eric Poisson	U of G Research Leadership Chair
Dr. Kathryn Preuss	U of G Research Leadership Chair
Dr. Stacey Scott	Computer-Supported Cooperative Work 2020 Lasting Impact Award
Dr. Petros Spachos	UGFA Award for Excellence in Teaching

Financials at a glance

The below diagram shows how the indirect costs of research recovered by the dean's office from College of Engineering and Physical Sciences (CEPS) faculty grants and research contracts were utilized to support the College's research enterprise. In the 2019–20 fiscal year, the indirect costs of research provided to the CEPS dean's office from the University of Guelph were $549,624. represented below within incomes from Tri-Council Agencies and from other sources. The funds distributed were greater than the funds received, so the College used its carryforward to cover the balance.
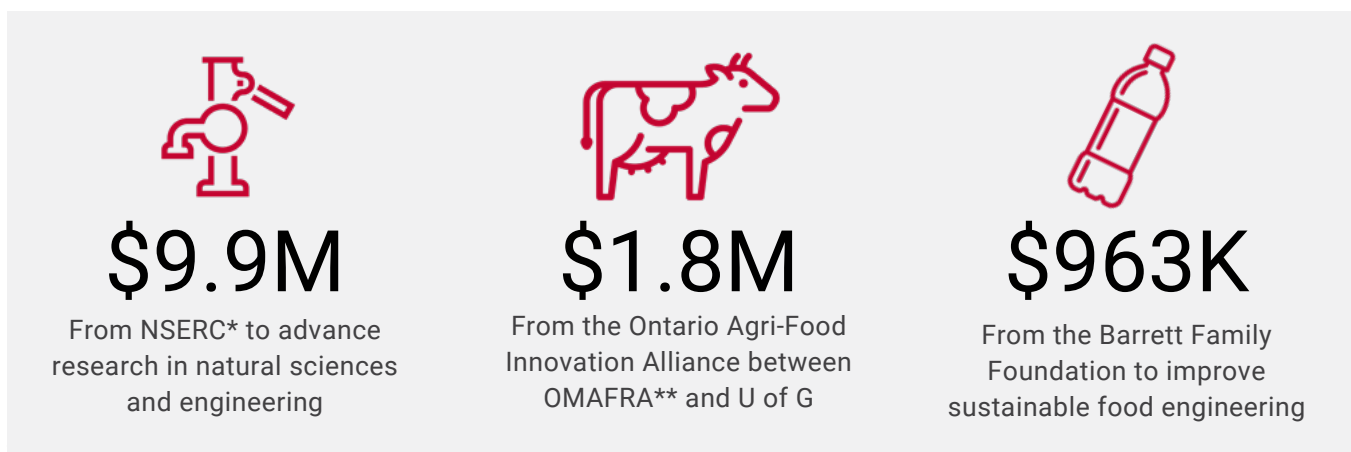
Research Support Funding in CEPS

Funds Received
$695,444

Funds Distributed
$695,444

Income from Tri-Council Agencies
$150,477

Income from Other Sources
$399,147

Carryforward Used
$145,820

Transfers to Departments and Schools
$173,828

Transfers to Faculty
$419,459

College Contributions to Graduate Student Scholarships
$92,085

Memberships and Registrations
$10,072

Disclaimer: The indirect costs of research recovered are calculated based on a percentage of the direct research expenses incurred in the 2019–20 fiscal year. The values distributed by CEPS represent the costs incurred by the College in the 2020–21 fiscal year.

Funding with Big Impact

$9.9M
From NSERC* to advance research in natural sciences and engineering

$1.8M
From the Ontario Agri-Food Innovation Alliance between OMAFRA** and U of G

$963K
From the Barrett Family Foundation to improve sustainable food engineering
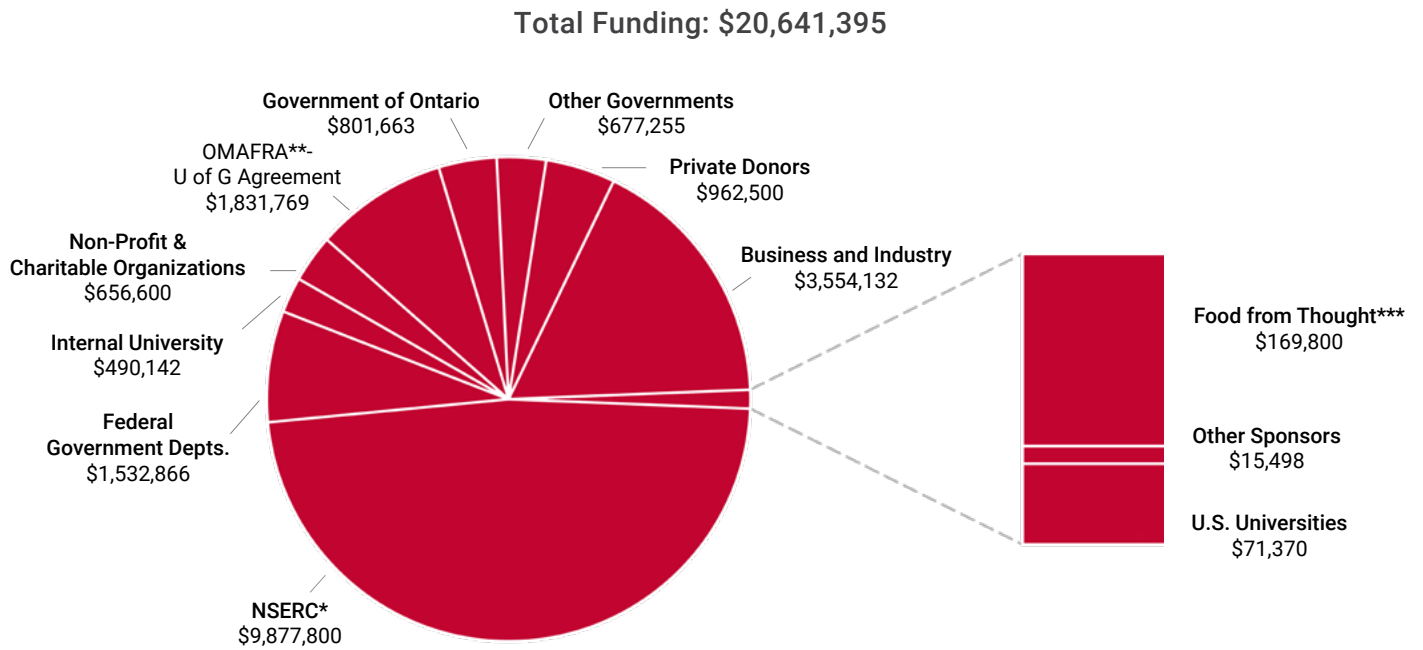
Research funding awarded in CEPS 2019−20

The research funds secured by CEPS in the 2019−20 fiscal year include all research projects with start dates falling in the University's fiscal year May 1, 2019, through April 30, 2020. For ongoing projects, the funds secured include project installments with start dates in the same period. The figures represent award or installment values, without reference to when research revenues or funds were received. The data used in the 2019−20 report are up to date as of November 2020.

Total Funding: $20,641,395

- Government of Ontario $801,663
- Other Governments $677,255
- OMAFRA**- U of G Agreement $1,831,769
- Private Donors $962,500
- Non-Profit & Charitable Organizations $656,600
- Business and Industry $3,554,132
- Internal University $490,142
- Federal Government Depts. $1,532,866
- NSERC* $9,877,800
- Food from Thought*** $169,800
- Other Sponsors $15,498
- U.S. Universities $71,370

Research Funding Awarded in CEPS
2016−20 ($, Millions)

Year	Amount
2016	$17.3
2017	$14.6
2018	$23.0
2019	$17.2
2020	$20.6

*Natural Sciences and Engineering Research Council of Canada
**Ontario Ministry of Agriculture, Food and Rural Affairs
***Food from Thought at U of G is funded in part by the Canada First Research Excellence Fund

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IMPROVE LIFE.