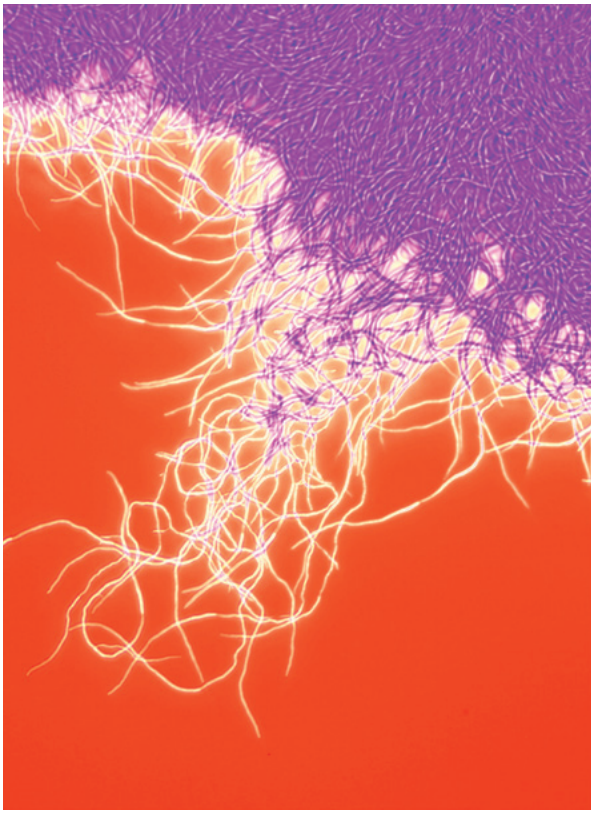
2021 IN REVIEW

BRIGHTER WORLD | science.mcmaster.ca

SCIENCE | McMaster University

McMaster University recognizes and acknowledges that it is located on the traditional territories of the Mississauga and Haudenosaunee nations, and within the lands protected by the Dish With One Spoon wampum agreement.

31



CONTENTS

4 From the Dean's Desk
- Our grand experiment

6 By The Numbers

7 Leadership Team

8 Field Notes

13 Commentary
- High-intensity exercise improves memory and wards off dementia
- Researchers share their knowledge with the world

16 Facts & Figures

18 Cover Story
- Discovery
- Research group maps Canada's massive carbon reservoir
- Planting a carbon sink forest

22 Feature Stories
- Learning
- Reinventing how to teach during a pandemic
- Equity, Diversity and Inclusion
- Beyond consultation – students collaborate on rolling out strategic plan
- Student Leadership
- Student leaders deliver master class in community building
- Engagement
- Bringing science to life for everyone

32 Roll Call
- Awards & Accolades 2021

35 The Last Word

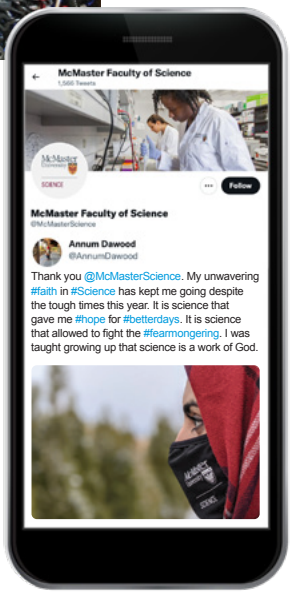
10

Faculty of Science, McMaster University
Burke Science Building Room 102, 1280 Main St. West
Hamilton, ON CANADA L8S 4L8
(905) 525-9140 ext. 22616 | science.mcmaster.ca
Printed in Canada May 2022, Media Production Services

13

9

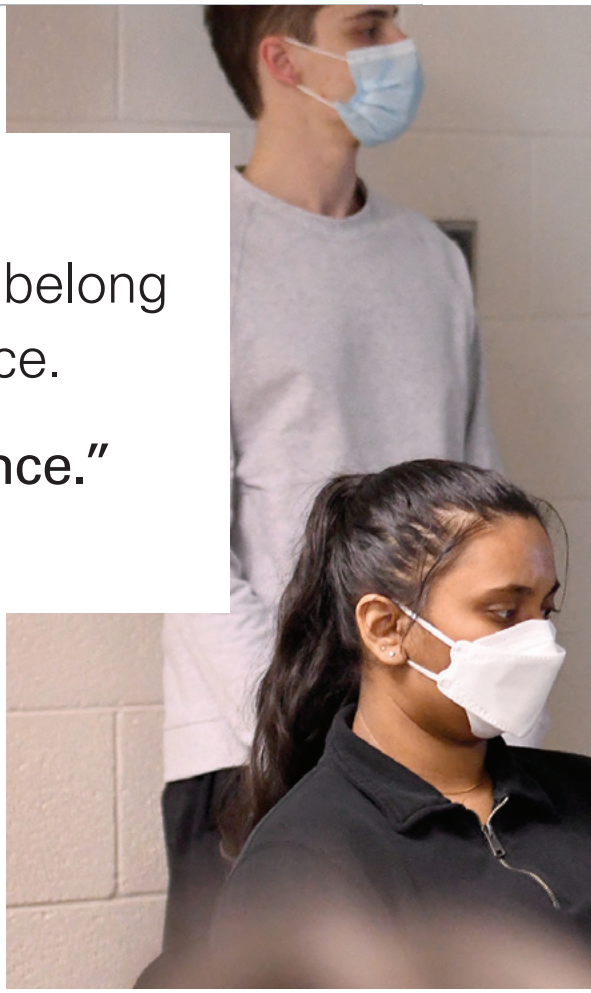
35


McMaster Faculty of Science
1,560 Tweets
Follow
McMaster Faculty of Science
@McMasterScience
Annum Dawood
@AnnumDawood
Thank you @McMasterScience. My unwavering #faith in #Science has kept me going despite the tough times this year. It is science that gave me #hope for #betterdays. It is science that allowed to fight the #fearmongering. I was taught growing up that science is a work of God.

“

It’s essential that everyone feels they belong and are valued in our Faculty of Science.

Diversity always leads to better science.”



FROM THE DEAN’S DESK

We run thousands of experiments every year in our Faculty of Science. The biggest and boldest is also our most important.

What happens when you bring more than 9,000 students together with nearly 350 faculty and staff, add hundreds of academic, industry, government and community partners, and put everyone in an environment that’s research-focused, student-centred and inclusive for all?

We believe these connections, collaborations and conditions will spark the innovation and creativity that leads to a brighter world.

Transforming our world through science is our shared vision, and we’re proud to highlight in this annual report some of the remarkable students, faculty and staff who made that vision a reality in 2021. Instead of making the best of a difficult year, they upped their game and took learning, discovery and engagement to a whole new level.

These are the three strategic pillars in our strategic plan launched in 2020. Our students played an integral role in developing that plan. We then invited a team of students to help us implement it. We tell you how in our annual report.

We also share stories of an exciting research collaboration that generated international attention, a dedicated instructor who found innovative ways to teach during the pandemic, and science champions who are connecting with the community and sharing their passion for science and research. Finally, we recognize the student leaders who played a pivotal role in maintaining a sense of belonging among fellow students during many months of remote learning.

Diversity always leads to better science so it’s essential that all of our students, faculty and staff feel they belong, have a voice and are valued. It's why we begin every public event – and our annual report – with an act of reconciliation that shows respect for Indigenous peoples and their enduring connection with their traditional territories and its histories. And it's why we are currently recruiting for our first ever Associate Dean of Equity, Diversity, Inclusion and Indigeneity to support vitally important EDII work happening across all of our Departments and Schools by our students, postdoctoral fellows, faculty members and staff.

In the year ahead, we will continue moving forward with the learning, discovery and engagement priorities in our strategic plan.

We’ll be fostering even more collaborative research, with a new Dean’s Distinguished Professorship with the Fields Institute for Research in Mathematical Science. We will also be welcoming Avis Favaro as our inaugural journalist in residence.

We will continue our largest ever faculty renewal, welcoming

OUR GRAND EXPERIMENT

^
Along with serving as Dean, Maureen MacDonald supervisors and mentors nearly two dozen undergraduate and graduate students in her Vascular Dynamics Lab.

<
Assistant professor Joseph Okeme is joining the Department of Chemistry & Chemical Biology in July 2022 from Yale University. Joseph is among 11 new faculty members joining Science in 2022.

new Black colleagues through an important McMaster hiring initiative that will add 12 emerging and established Black academics and scholars across the University.

We will begin construction on a new biology greenhouse as part of our efforts to renew the places where we teach, conduct research, and connect with the community.

As always, we will continue drawing on our core strength – the intelligence, curiosity, collaborative spirit, excellence and brilliance of our students, faculty and staff – as we transform our world through science.

M. MacDonald

Maureen MacDonald
Dean, Faculty of Science

BY THE NUMBERS

Number of undergraduate students who completed research placements and thesis courses: 917

Number of new faculty members recruited over the past five years: 56

Average age of full-time faculty members: 52.8

Average number of years full-time faculty members have been with McMaster: 18.1

Undergraduate domestic tuition in 2016-17: $6,329

Undergraduate domestic tuition in 2020-21: $6,043

Percentage of undergraduate students in the Faculty of Science who are women: 64

Total amount of research funding awarded to Faculty of Science researchers over the past 5 years: $103,253,208

Of the 15 McMaster Students Union Teaching Awards given out in 2021, the number won by Faculty of Science instructors: 8

Number of postdocs who've completed the McCall MacBain Postdoctoral Fellows Teaching and Leadership Program: 34

Number of undergraduate and graduate students in the Faculty of Science: 9,058

Number of bachelor degrees awarded: 1,607

Number of master's degrees awarded: 101

Number of doctoral degrees awarded: 55

Percentage of faculty members with PhDs: 98.6

Mean admission average for incoming students in Integrated Science: 95.1

Rank of the Faculty of Science among Faculties and Schools at McMaster based on the number of undergraduate students: 1

Total number of alumni: 44,154

Number of community members who worked out in virtual exercise classes offered by the Physical Activity Centre of Excellence: 220

Total views of Faculty of Science websites in 2021: 2,800,000

Number of McMaster researchers collaborating with the Faculty of Science's five Research Centres & Institutes: 180

Percentage increase in the number of undergraduate student applications over the past five years: 24

Number of undergraduate students to receive academic awards: 328

Number of academic awards given to undergraduate students: 463

Total value of academic awards given to undergraduate students: $357,000

Number of paid co-op work terms completed by students: 491

Amount earned by students from their paid co-op work terms: $3.5 million

Number of new employers to offer co-op placements to students in 2021: 50

Percentage of undergraduate students who graduate from the Faculty of Science: 88.95

Number of Canada Research Chairs, Faculty of Science Chairs and endowed Chairs: 34

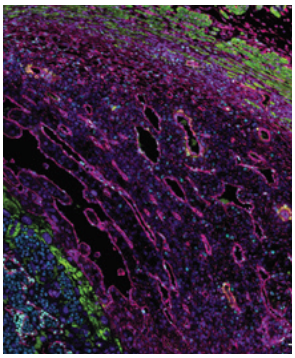
ABOUT THE FRONT COVER

Camryn Hardaker-Schabauer is a second-year Bachelor of Fine Arts student at McMaster University from Lindsay, Ontario.

Title: *It's Time to Restore the Earth*

"This artwork emphasizes the understanding and necessity of togetherness as a way of achieving the much needed healing of the earth, and humankind as a whole. It takes effort and collaboration to get where we need to be, and with a devoted mindset, progress can be made."

ABOUT THE BACK COVER



Embryonic day 10.5 (E10.5) pregnant mouse uterus stained with DAPI, alpha smooth muscle actin, Vimetin and Ki-67, taken in the McMaster Centre for Advanced Light Microscopy by PhD candidate Christian Bellissimo with the Sloboda Lab in the Department of Biochemistry & Biomedical Sciences at the Health Sciences Centre at McMaster University.

LEADERSHIP TEAM

DEAN

Maureen MacDonald

ASSOCIATE DEANS

Juliet Daniel, Research & External Relations

Michael Farquharson, Academic

Bhagwati Gupta, Graduate Studies

ACADEMIC CHAIRS AND DIRECTORS

Altaf Arain, McMaster Centre for Climate Change

John Brennan, Biointerfaces Institute

Ana Campos, School of Interdisciplinary Science

Marie Elliot, Department of Biology

Gillian Goward, Department of Chemistry & Chemical Biology

Matheus Grasselli, Department of Mathematics & Statistics

Bruce Newbold, School of Earth, Environment & Society

Gianni Parise, Department of Kinesiology

Stuart Phillips, Physical Activity Centre of Excellence

Mel Rutherford, Department of Psychology, Neuroscience & Behaviour

Alison Sills, Department of Physics & Astronomy

Jonathon Stone, Origins Institute

Laurel Trainor, McMaster Institute for Music and the Mind

ADMINISTRATIVE DIRECTORS AND MANAGERS

Greg Atkinson, Manager of Information Technology

Dylan Bailey, Administrator, Faculty Affairs

Jamie Barnes, Managing Director, Research Centres & Institutes

Kathleen Blackwood, Director of Finance & Administration

Seanna-Lin Brodie-Keys, Director, Research & Planning

Heather Colwell, Associate Director of Development

Debbie Marinoff Shupe, Manager of Strategic Initiatives & Special Projects

Alice O'Carroll, Director, Career Development and Cooperative Education

Sarah Robinson, Assistant Dean, Academic

Jay Robb, Manager of Communications

DEAN'S ADVISORY BOARD

Richard Black (B.Sc. '81 – Chemistry, B.Sc. Hon. '85 - Psychology & Ph.D. '90 – Psychology)

Susan Cunningham (B.A. Hon. '79 – Geography)

Margaret Gadsby (B.Sc. Hon. '78 – Biology)

Elise Herzig

William Ho (B.Sc. Hon. '98 – Biochemistry)

Allan Jackson (B.Sc. Hon. '73 – Chemistry & Ph.D. '77 – Chemistry)

Patricia Moser (B.Sc. '80 – Psychology & B.Sc. '81 – Chemistry)

Brendan Seale (B.A. Hon. '05 – Communications Studies)

Dan Wayner (B.Sc. '80 – Chemistry)

FIELD NOTES

Canada's first sustainable chemistry program

The Department of Chemistry & Chemical Biology launched the first Honours Sustainable Chemistry program ever offered at a Canadian university. Based on the 12 principles of green chemistry developed by American chemists Paul Anastas and John Warner, the program prepares students to become leaders in a zero-carbon economy. "Chemists need to practice environmental stewardship," says Michael Brook, Faculty of Science Research Chair in Sustainable Silicone Polymers, who helped develop the program. "Our stewardship needs to start in labs and classrooms and continue into industry." The Hamilton Industrial Environmental Association established an endowed HIEA Scholarship in Sustainability Chemistry to be awarded to undergraduate students in their second to fourth years in the program.

Celebrating science trailblazers

Honorary doctoral degrees in science were awarded during McMaster's Spring and Fall Convocations to three remarkable women. Julie Angus is a molecular biologist, adventurer, writer and filmmaker who earned her undergraduate degree from McMaster University. She is also the first woman to row across the Atlantic Ocean from mainland to mainland. Anne Innis Dagg is a trailblazing scientist, author and advocate whose work has been transformative in fields from zoology to gender equality. In the 1950s, between earning her Master's degree in genetics and her PhD in animal behaviour, Anne went to Africa to study the behaviour and ecology of giraffes. Tebello Nyokong, who graduated from McMaster with a Master's of Science in Chemistry, currently serves as the director of the Nanotechnology Innovation Center at Rhodes University in South Africa.

Making science accessible for all

The Faculty of Science delivered 23 webinars, workshops and training sessions about accessibility to faculty, staff and students on a range of topics from presentation techniques to Word and PowerPoint documents, course outlines and social media.

Prevent, Prepare and Protect

Faculty members Marie Elliot, David Earn, Katie Moisse and Jianping Xu became members of a new international nexus to fight biological threats and avert future pandemics. Based at McMaster, Canada's Global Nexus for Pandemics and Biological Threats is an international network of scientists, clinical health and medical specialists, engineers, social scientists, history and policy researchers, economics and business experts focused on the shared goal of achieving global health security.

New fund bolsters EDI efforts

Faculty support for equity, diversity and inclusion (EDI) continued with the creation of a new fund for EDI scholarships and research awards. The Dean's Supporting Equity, Diversity and Inclusion for Scientific Excellence Fund provide students from historically underserved backgrounds with development, training and mentorship opportunities.

Honoring the legacy of Dr. Douglas Davidson

The Dr. Douglas Davidson Technology Training Fund was established by his family to support graduate students in the Department of Biology. Dr. Davidson joined the department in 1969 and served as Chair from 1974 to 1977, then Acting Dean of the Faculty of Science from 1980 to 1981. A world traveler, Dr. Davidson donated his extensive art collection to the McMaster Museum of Art. While Dr. Davidson retired in 1988, he remained actively involved in the department until his passing in 2019.

Professor Emeritus honors wife with gift to students

Ming-Ko Woo, Professor Emeritus in the School of Earth, Environment & Society, established the Caroline Woo Bursary to support undergraduate students in financial need. Caroline, who passed away in 2016, earned her undergraduate degree in mathematics from Simon Fraser University and a master's degree in operations research from the University of British Columbia. She worked at the McMaster Medical Centre, a consulting firm and the Bank of Nova Scotia and, in her retirement, volunteered as an interpretive guide at the Toronto Zoo. In her travels to all seven continents, Caroline developed an interest in environmental well-being and conservation.

Curating research-inspired playlists

Student ambassadors who volunteer with the McMaster Institute for Music & the Mind stayed busy even after the pandemic shuttered the Institute's LIVELab performance hall and forced the cancellation of concerts and events. Students first compiled research summaries of how music impacts the brain. They then created research-influenced playlists on Spotify and YouTube delving into a range of topics from sleep and exercise to creativity and meditation.

Masking up

In a concerted effort to get people to mask up, faculty and staff donned branded face masks, took indoor and outdoor selfies of themselves, and posted them on social media to encourage others to mask up for the protection of their community.

Research institute assembles all-star symposium

The Origins Institute and Consulat Général de France à Toronto brought together leading astrobiologists for a two-day trans-Atlantic public symposium. The all-women panel of experts included University Scholar Laura Parker and Canada Research Chair in Extragalactic Star Formation Christine Wilson from the Department of Physics & Astronomy, along with PhD candidates, graduate and undergraduate students.

New award empowers BIPOC students

The Physics and Astronomy Research Experience Award will open doors for racialized, Black and/or Indigenous, and other students who identify as people of color to conduct research with faculty members. The award also creates additional opportunities for historically marginalized students to forge meaningful peer and professional networks that will help advance their research interests and career aspirations. The Dean's Office matched a contribution from an anonymous donor to provide initial funding for the award.

Scholarship established for female BIPOC students

Established by her family and friends, the Philippa Heritage Scholarship supports female undergraduate students in the Faculty of Science who identify as racialized, Black or Indigenous. Philippa, who was an accomplished scientist, a proud two-time McMaster graduate, and dedicated yogi, passed away in 2020. Her daughter, Samantha Heritage, and close friend Marilyn McDermott led the fundraising campaign for the scholarship.

Grasselli plays key role in pandemic problem-solving

Mathematics & Statistics Chair Matheus Grasselli served on the organizing committee for the Symposium on Systemic Recovery hosted by the Fields Institute for Research of Mathematical Sciences. Global experts in economics, mathematics and epidemiology came together to discuss pressing challenges in the wake of the COVID-19 global health crisis. Panelists identified the pandemic as a unique chance to redefine social and economic norms for individuals, companies and governments.

Mathematics & Statistics Chair Matheus Grasselli.

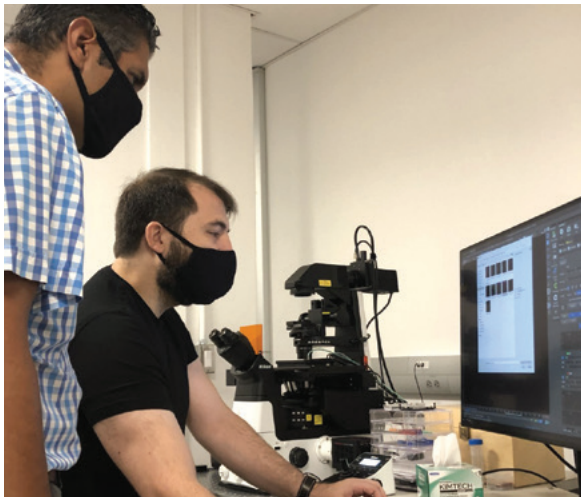
Some assembly required

When teaching labs closed during the pandemic, the Biology and Physics & Astronomy Departments recruited teams of faculty, lab techs, students and staff from across McMaster to create lab kits for students. They sourced, assembled and shipped kits to more than 320 students around the world. Each kit was filled with supplies for three at-home experiments. Students completed their DIY experiments with livestreaming help from teaching assistants.

Physics lab kits were shipped to students around the world.

Keep CALM and research on

The Faculties of Science, Engineering and Health Sciences celebrated the opening of the Centre for Advanced Light Microscopy (CALM), a new core research facility providing faculty and students with reliable and affordable access to top-tier microscopes and leading-edge research technologies like photo-patterning and light-assisted 3D printing. Created with Nikon as the first strategic partner, it will serve as a hub for interdisciplinary collaboration and technical training. McMaster is the only Canadian university to establish centres for both light and electron microscopy across from one another in the same building.



CALM's Scientific Director Jose Moran-Mirabal (standing) with Facility Manager Joao Pedro Bronze de Firmino.

Faculty members launch online research training series

When the pandemic restricted in-person lab time, Kinesiology assistant professors Trevor King, Jeremy Walsh and Baraa Al-Khazraji established a virtual, interactive training series for graduate students. "The students really brought the magic," says Baraa. "They fully engaged with the material and generously shared their thoughts and perspectives." The trio plans to introduce more sessions on cardiovascular physiology critical thinking and communication to boost proficiency in engaging with scientific literature.

Neutron Beam Lab secures major funding

The McMaster Nuclear Reactor's Neutron Beam Lab is getting three new neutron beamlines thanks to a $14.25 million boost from the Canada Foundation for Innovation. Bruce Gaulin (Physics & Astronomy) was awarded the funding for his Building a Future for Canadian Neutron Scattering project. The Beam Lab is the sole source of neutrons for more than 40 Canadian research institutions. Bruce and his team are also leveraging their nuclear research to facilitate developments in clean energy, cancer research, antibiotic resistance and quantum technology software.

Appointments to key leadership positions

Juliet Daniel was appointed Associate Dean, Research & External Relations. Three new Chairs were also appointed: Alison Sills in the Department of Physics & Astronomy; Gianni Parise in the Department of Kinesiology; and Mel Rutherford in the Department of Psychology, Neuroscience & Behaviour. Jonathan Stone was appointed Director of the Origins Institute.

From top New Department Chairs Alison Sills, Mel Rutherford and Gianni Parise.

New program matches co-op ambassadors with students

Science Career and Cooperative Education launched a program to connect seasoned co-op students with students just starting their co-op work terms. The co-op ambassadors answer questions and share their experiences working with employers. Students connect with the ambassadors at events and can reach out directly for one-on-one advice.

New lab store lowers cost of research supplies

To meet the growing need for affordable and reliable access to essential lab supplies and chemicals, the Faculties of Science and Engineering, together with the Provost's Office, opened the new Lab Stores on campus. Available to all McMaster faculty and student researchers, the facility buys supplies in bulk to help lower costs while eliminating delivery wait times for researchers and freeing up space in labs where supplies were previously stockpiled.

Faculty members benefit from $2.25 million investment in research

Juliet Daniel with the Department of Biology together with Katherine Bujold and Sarah Styler with the Departments of Chemistry and Chemical Biology were among nine McMaster researchers to receive New Frontiers Research Fund Exploration Awards. The fund was created by the Government of Canada to support world-leading interdisciplinary, international, high-risk/high-reward, transformative and rapid-response Canadian-led research, with awards of up to $250,000 over two years.

Four new Canada Research Chairs

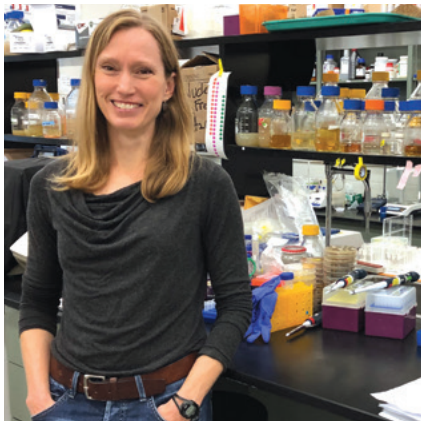
Alemu Gonsamo (Remote Sensing of Terrestrial Ecosystems), Jennifer Heisz (Brain Health and Aging), Gita Ljubicic (Community-Engaged Research for Northern Sustainability) and Gabriel Xiao (Perceptual Development) each received five years of government funding for their breakthrough research initiatives, with the potential to renew their grants for a second five-year term. The Canada Research Chairs Program invests up to $311 million each year to attract and retain some of the world's most accomplished and promising minds.

Three Science Research Chairs awarded

David Earn (Mathematical Epidemiology), Altaf Arain (Environmental Sustainability and Climate Change) and Marie Elliot (Microbial Development and Natural Product Control) are the latest faculty members to be awarded Faculty of Science Research Chairs. Each Chair receives a three-year research grant dedicated to funding graduate student help and supplies, as well as a one-term teaching sabbatical to focus on their respective research projects. Nine Faculty of Science Research Chairs have been awarded since 2019.

The Faculty of Science's newest Canada Research Chairs from top left, clockwise: Gita Ljubicic, Alemu Gonsamo, Gabriel Xiao and Jennifer Heisz.

Newest Science Research Chairs, from top: David Earn, Altaf Arain and Marie Elliot.



From Northern Ontario to McMaster with Canada's most coveted STEM scholarship

Seventeen-year-old Nadia Breault was emptying trash cans on the shoreline of Timiskaming when she looked at her phone and found an email telling her she was a Schulich Leader and the recipient of an $80,000 scholarship. Nadia immediately called her mother. "I could barely speak, but between my gasps for air and shrieks of glee, she soon figured out the great news," says Nadia. "I continued cleaning the beach for the rest of the day in a state of shock."

Nadia is studying mathematics at McMaster. With a passion for entrepreneurship and environmental sustainability, she hopes to develop a solution to single-use plastics. She joins Erin Rebello, Daniel Sampson, Alexander Vicol and Nethra Wickramasinghe in receiving the largest scholarships awarded in the Faculty of Science in 2021.

Schulich Leader Nadia Breault

commentary

<

Jennifer Heisz, associate professor (Kinesiology), Canada Research Chair and author of *Move the Body, Heal the Mind.*

HIGH-INTENSITY EXERCISE IMPROVES MEMORY AND WARDS OFF DEMENTIA

By Jennifer Heisz, first published in *The Conversation*

For the first time in human history, older people outnumber younger people.

This has created unique health challenges. Dementia may be one of the scariest — a debilitating condition that erases memories; a condition without a cure.

But dementia does not have to be your fate. Exercise protects our memories from being erased and our latest research shows that it is never too late to start.

As an associate professor in the department of kinesiology at McMaster University, I direct a team of researchers in the NeuroFit Lab, where we've shown that physical inactivity contributes to dementia risk as much as genetics.

Our latest research suggests that the intensity of the exercise matters. We enrolled sedentary seniors in a new exercise program and in just 12 weeks their memories improved. But this only happened for those who walked at a higher intensity, and their memory gains were directly related to their improvements in physical fitness.

Our next step is to understand how exercise alters the brain — so we can establish personalized exercise prescriptions for brain health in aging.

One of the greatest modifying risk factors is physical inactivity. **This gives us the opportunity to train for a healthier brain.**

Train for a healthy brain

In our growing aging population, we are all at some risk of developing dementia. This is because a certain amount of our fate is predetermined by biological factors. Aging is a critical risk factor for dementia and certain genes also increase our risk.

Recently, however, we have begun to appreciate the role that lifestyle plays. New evidence reveals decreasing dementia rates despite an increasing aging population. The reason? Improvements in living conditions, education and health care.

One of the greatest modifying risk factors is physical inactivity. This gives us the opportunity to train for a healthier brain!

Physical activity lowers risk

A study from my lab examined the interaction between genetic and physical activity in a group of more than 1,600 older adults who were part of the Canadian Study of Health and Aging.

Within our sample, around 25 per cent had a genetic risk factor for dementia but the majority (around 75 per cent) did not. This is representative of the population at large. All participants were dementia-free at the start of the study and we followed up with them five years later.

Here is what we found: 21 per cent of the people with a genetic risk developed dementia and physical activity had no effect on this group. In contrast, for people without a genetic risk, those who were active had a significantly lower risk of developing dementia than those who were inactive.

Critically, those who were inactive were at a similar risk to those who were genetically predisposed for dementia, suggesting that physical inactivity can negate a healthy set of genes. You can't change your genes but you can change your lifestyle!

Exercise acts like a fertilizer

It turns out that exercise does something that helps the brain regenerate itself: it grows new neurons in the hippocampus, and this improves memory.

Although we don't fully understand exactly how this works, we do know that exercise increases brain-derived neurotrophic factor (BDNF), which acts like a fertilizer to promote the growth, functioning and survival of the newborn cells.

Newborn neurons fit together like the pieces of a puzzle, where each neuron represents a different aspect of a memory. If we have more newborn neurons, then we can create memories that are richer in detail and less fallible to error. For example, you will remember correctly whether you took your medication today or yesterday, or where you parked your car in a busy parking lot.

We have shown that neurogenesis-dependent memory improves with exercise in both young and older adults.

It matters how much you sweat

The seniors participated in three sessions per week. Some performed high-intensity interval training (HIIT) or moderate-intensity continuous training (MICT) while a separate control group engaged in stretching only.

The HIIT protocol included four sets of high-intensity exercise on a treadmill for four minutes, followed by a recovery period. The MICT protocol included one set of moderate-intensity aerobic exercise for nearly 50 minutes. All exercises were tailored to the seniors' current fitness levels.

Only seniors in the HIIT group had substantial improvements in neurogenesis-dependent memory. There was no improvement in the MICT or control groups.

The results are promising because they suggest it's never too late to get the brain health benefits of being physically active, but if you are starting late and want to see results fast, our research suggests you may need to increase the intensity of your exercise.

You can do this by including hills into your daily walk and picking up the pace between light posts. This will help keep dementia at bay to keep the ever-growing number of seniors healthier longer.

RESEARCHERS SHARE THEIR KNOWLEDGE WITH THE WORLD

Jennifer Heisz topped the list of most-read *Conversation* op-eds from Faculty of Science researchers in 2021.

Jennifer's column "High-intensity exercise improves memory and wards off dementia" was read more than 123,000 times and republished by media outlets around the world. An associate professor in Kinesiology, Jennifer is a Canada Research Chair and author of *Move the Body, Heal the Mind.*

The six other most read *Conversation* columns from the Faculty of Science in 2021 were:

- Professor David Shore's "Our brains perceive our environment differently when we're lying down".
- Assistant professor Alex Peace and postdoctoral fellow Jeremy Rimando's "Contrary to popular belief, Eastern Canada is more at risk of earthquakes than perceived".
- Professor Rama Singh's "Medical schools need to prepare doctors for revolutionary advances in genetics".
- Professors Juliet Daniel and Ingrid Waldron's "Environmental racism: New study investigates whether Nova Scotia dump boosted cancer rates in nearby Black community".

- Postdoctoral fellow Leanne Grieves' (pictured right) "Birds sniff out potential mates who are genetically different".
- Postdoctoral fellow Rodrigo Narro Pérez's "How scientists are using drones to lower the risk of catastrophic flooding from large glacial lakes".

Go to **theconversation.com** to search and read these stories.

THE CONVERSATION

Launched in 2017, The Conversation is an independent source of news and views, from the academic and research community, delivered direct to the public.

FACTS &

8

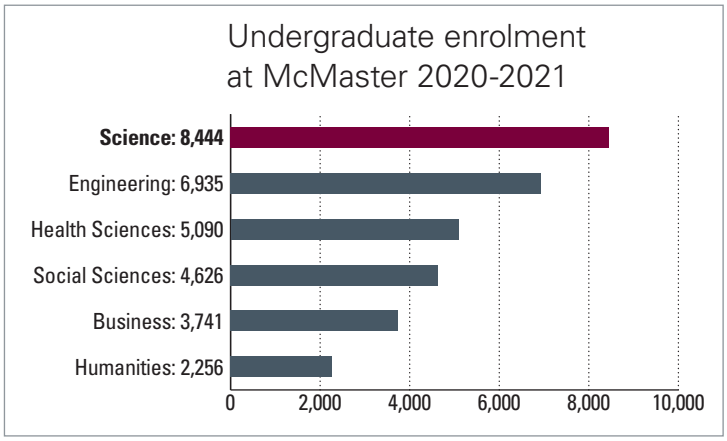
Departments and Schools

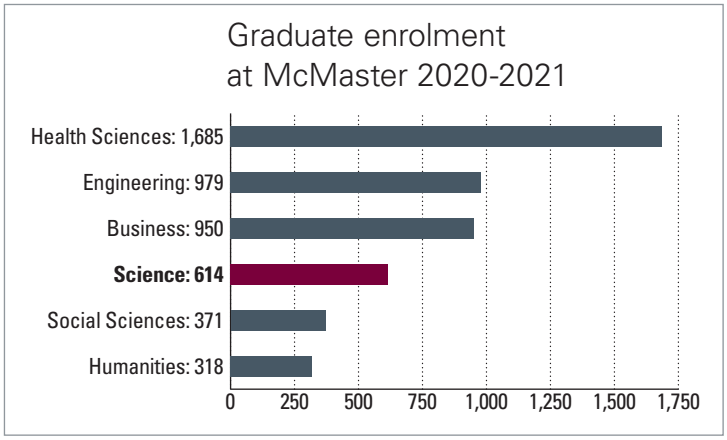
- Biology
- Chemistry & Chemical Biology
- Earth, Environment & Society
- Interdisciplinary Science
- Kinesiology
- Mathematics & Statistics
- Physics & Astronomy
- Psychology, Neuroscience & Behavior

5

Research Centres and Institutes

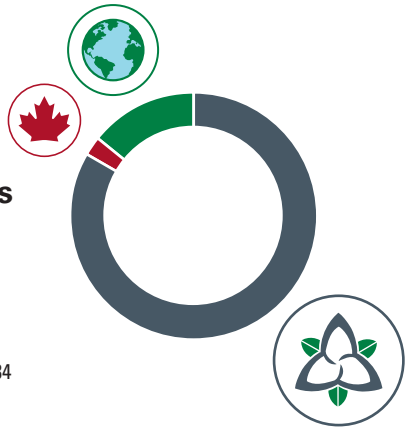
- Biointerfaces Institute
- McMaster Centre for Climate Change
- McMaster Institute for Music and the Mind
- Origins Institute
- Physical Activity Centre of Excellence





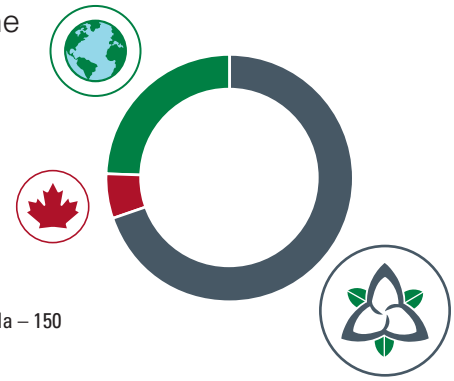
Where in the world do **science undergraduates** call home?

- Ontario – 7,055
- Canada – 205
- Outside of Canada – 1,184



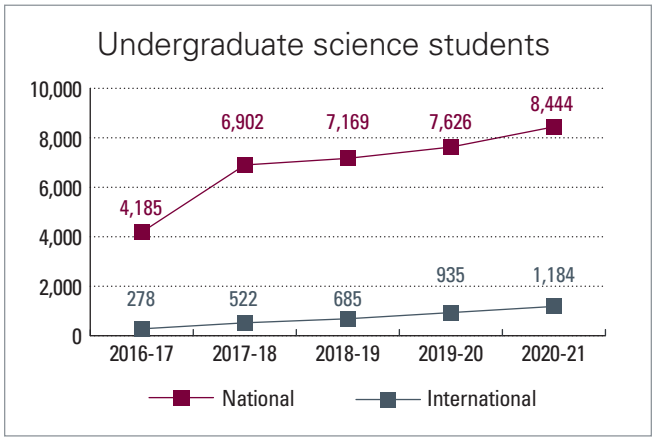
Where in the world do **science graduates** call home?

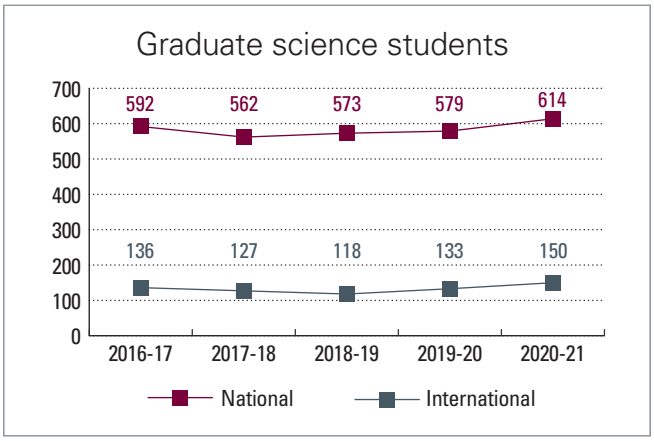
- Ontario – 429
- Canada – 35
- Outside of Canada – 150

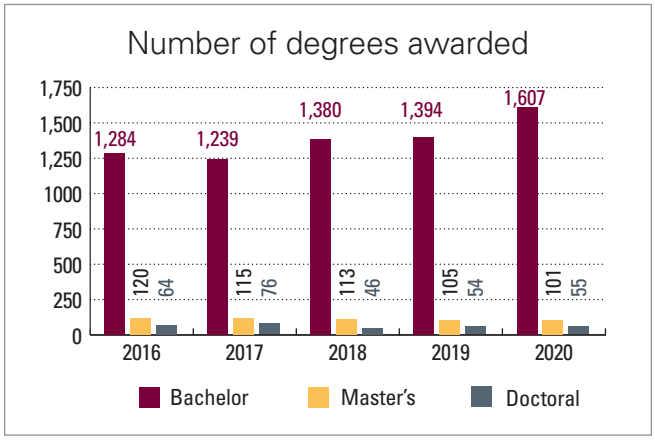


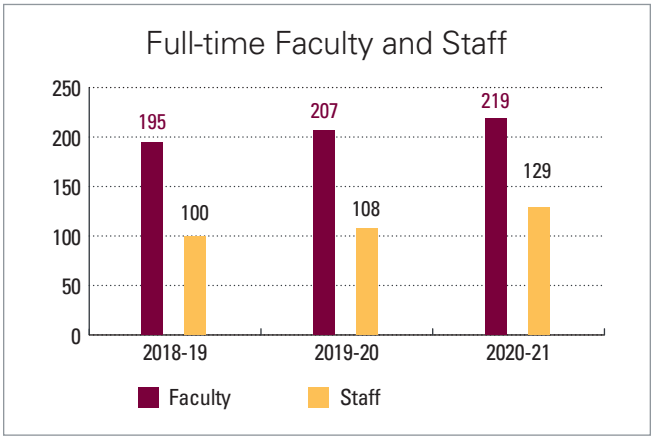
*Enrolment numbers provided by McMaster University's Office of Institutional Research & Analysis Fact Books

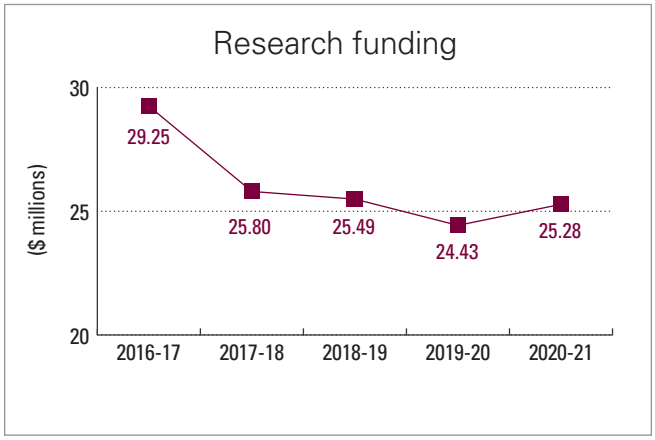
FIGURES

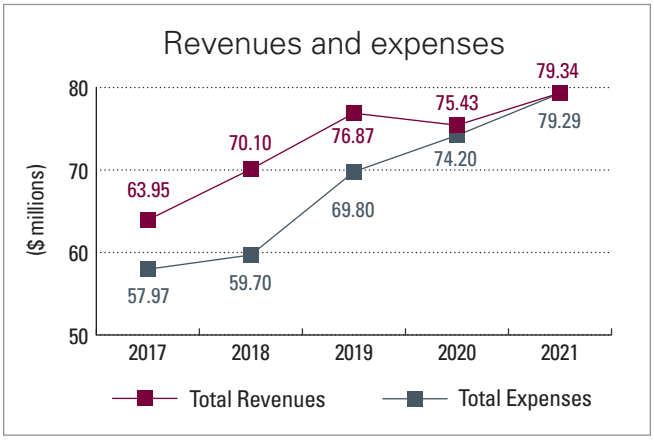

Undergraduate science students
10,000
8,000
6,000
4,000
2,000
0
4,185
6,902
7,169
7,626
8,444
278
522
685
935
1,184
2016-17
2017-18
2018-19
2019-20
2020-21
National
International


Graduate science students
700
600
500
400
300
200
100
0
592
562
573
579
614
136
127
118
133
150
2016-17
2017-18
2018-19
2019-20
2020-21
National
International


Number of degrees awarded
1,750
1,500
1,250
1000
750
500
250
0
1,284
120
64
1,239
115
76
1,380
113
46
1,394
105
54
1,607
101
55
2016
2017
2018
2019
2020
Bachelor
Master's
Doctoral


Full-time Faculty and Staff
250
200
150
100
50
0
195
100
207
108
219
129
2018-19
2019-20
2020-21
Faculty
Staff


Research funding
($ millions)
30
25
20
29.25
25.80
25.49
24.43
25.28
2016-17
2017-18
2018-19
2019-20
2020-21


Revenues and expenses
($ millions)
80
70
60
50
63.95
70.10
76.87
75.43
79.34
57.97
59.70
69.80
74.20
79.29
2017
2018
2019
2020
2021
Total Revenues
Total Expenses

DISCOVERY

RESEARCH GROUP MAPS CANADA'S MASSIVE CARBON RESERVOIR

Postdoctoral fellow Camile Söthe led a two-year study in Alemu Gonsamo's Remote Sensing Laboratory, creating the first ever map that shows where, and how much, carbon is stored in Canada's ecosystem. Turns out there are billions of tonnes, making this country pivotal in the fight against climate change. The lab partnered with the World Wildlife Fund Canada and presented their findings at the annual United Nations climate change conference.

World Wildlife Fund (WWF) Canada reached out to Alemu Gonsamo and his research team in 2019 with a huge coast to coast to coast request.

The country's largest international conservation organization wanted to know how much organic carbon is stored in Canada's land ecosystems.

"They were looking for specific data that would inform their conservation activities," says Alemu, assistant professor in the School of Earth, Environment & Society and a Canada Research Chair (Tier 2) in Remote Sensing of Terrestrial Ecosystems. "Unfortunately, I had to tell them that existing data was not sufficient to develop conservation policies on a national scale. That's where our collaboration all began."

Last November, Alemu and the team in his Remote Sensing Laboratory presented Canada's first carbon map to overwhelmingly positive reception at the COP26 United Nations Climate Change Conference in Glasgow, Scotland. Coverage in the Globe and Mail and CBC News underscored the importance of their research for the movement against climate change as well as Canadian conservation efforts. The team received a flood of emails from potential collaborators after the conference.

In the beginning, though, the success of the Mapping Canada's Carbon Landscape study was not a foregone conclusion. Camile Söthe, the postdoctoral fellow in Alemu's lab who led the study, faced the daunting challenge of compiling and analyzing tens of thousands of field measurements to create a comprehensive map of the carbon stored in Canada's plants and soils.

"Knowing where carbon is stored in Canada allows us to strategically protect and manage the right places to prevent billions of tonnes of carbon from being released into the atmosphere," says Megan Leslie, WWF-Canada President and CEO.

"Protecting these areas will also benefit wildlife by safeguarding habitat for important species at risk."

The Remote Sensing Laboratory was a natural partner for WWF-Canada because of its ability to process vast quantities of data — in the case of Canada's carbon stocks, more than five terabytes worth of data collected from nine million square kilometers of diverse land ecosystems.

To make sense of all this data, Camile and a handful of student assistants used a machine learning algorithm to estimate carbon content based on satellite data. In addition to the final carbon stocks,

> Alemu Gonsamo, assistant professor, School of Earth, Environment & Society and postdoctoral fellow Camile Söthe.

"Our project lays the groundwork for future studies to understand how vulnerable carbon stocks are to decomposition, harvesting, fires and other carbon removal actions."

“

Our work demonstrated that Canada’s soils hold one-fifth of the world’s soil carbon stock. Decisions made here can impact the entire world.”

they produced uncertainty maps that spatially indicate confidence intervals of their estimates.

“We never had doubts about our technical capacity to see this project through to the end,” says Camile. “From the beginning, the greatest challenge was finding the data we needed.”

After launching the project in January 2020, they spent the next eight months scouring the World Soil Information Service and other publicly available sources for soil data. Unfortunately, much of the data they were seeking was held privately by government entities and researchers. Canada’s peatlands, carbon-rich wetlands that account for more than 12 per cent of the country’s surface area, were particularly underrepresented in available data. After months of digging, they were able to fill in the missing pieces through a data source created by Lehigh University in Pennsylvania.

The team then turned to Canada’s National Forest Inventory for plant data before realizing that none of this data came with location information more specific than a 10-kilometer radius. To identify data with precise location information, they connected with provincial authorities with more open data policies.

After two years of painstaking work, supported by Maple Leaf Foods and the Metcalf Foundation, the Mapping Canada’s Carbon Landscape study produced a comprehensive map indicating 327 billion tonnes of carbon stored in Canada’s ecosystem. The map will inform WWF-Canada’s 10-year plan to restore one million hectares of lost complex ecosystems, protect 100 million hectares of habitat and reduce carbon emissions by 30 million tonnes. At a local level, it will drive action on WWF projects like carbon preservation in the Wolastoq/Saint John River watershed by quantifying the amount of carbon saved by protecting the area.

“Our project lays the groundwork for future studies to understand how vulnerable carbon stocks are to decomposition, harvesting, fires and other carbon removal actions,” says Camile.

Since unveiling their carbon map, the team has been approached by organizations such as U.S. Global Forest Watch, Woodwell Climate Research Center, Canada Nature Conservancy and the Food and Agriculture Organization of the United Nations with offers to help them refine their data or use it to build a case for more robust conservation activities. “Now that we have presented our findings to the [Canadian] Minister of Environment and Climate Change, in addition to other policymakers, we expect to see more policies regarding industrial activities in carbon-rich areas,” says Alemu.

As Camile continues to refine the carbon map with the help of a growing list of supporters, she has high hopes for the map’s potential to spur tangible action. “Our work demonstrated that Canada’s soils hold one-fifth of the world’s soil carbon stock,” she reflects. “Decisions made here can impact the entire world. I’m looking forward to continuing work on this project as a strategy to fight climate change.”

PLANTING A CARBON SINK FOREST

Researchers, students and community partners are growing a carbon sink forest near McMaster University to aid in the global fight against climate change.

The carbon sink forest is the latest initiative from the McMaster Centre for Climate Change, one of five research centres and institutes in the Faculty of Science.

<

McMaster Centre for Climate Change Director Altaf Arain

In 2002, the Centre's Director and Faculty of Science Research Chair Altaf Arain established the Turkey Point Observatory in Southern Ontario. Its five research sites measure the impact of climate change and extreme weather on carbon uptake, storage and water use in diverse forest ecosystems.

The observatory is an integral part of major international networks studying the Earth's energy, carbon and water cycles. More than 100 peer-reviewed papers have used observatory datasets created by Centre researchers in collaboration with international research groups.

The carbon sink forest will add to that research. Work began in late 2021 to plant 1,000 trees, with support from Trees for Hamilton, Nature at McMaster and the McMaster Academic Sustainability Program. The growth and health of each tree will be tracked and reported.

The carbon sink forest will be used to answer fundamental research questions:

- How much carbon will the 1,000 trees absorb, and at what age?
- At what age will the trees maximize their carbon uptake?
- How will changing environmental conditions affect forest growth and carbon uptake?
- What mix of plant species will promote the most carbon uptake and develop a forest resilient to climate change?

Altaf and his team will share their research findings with any organizations interested in planting forests that absorb and store carbon out of the atmosphere to mitigate climate change.

<

Canada Research Chair and Mathematics & Statistics professor Megumi Harada.

LEARNING

REINVENTING HOW TO TEACH DURING A PANDEMIC

The pandemic forced an overnight pivot to virtual learning. Faculty members like Megumi Harada were quick to adapt, pouring their heart and soul into finding new ways to engage and educate students online with help from McMaster's MacPherson Institute. The result was an even stronger connection with students.

Following the COVID-19 outbreak in March 2020, instructors at the Faculty of Science anticipated teaching remotely for no more than a week or two. As weeks stretched into months and years, they invented ways to keep their students feeling engaged and supported online.

Megumi Harada, Professor and Canada Research Chair (Tier 2) in the Department of Mathematics and Statistics, was one of many who found the prospect daunting.

"I'm very much an in-person kind of person, and I've never been great with technology," she says. "The whole idea of teaching online had me shaking in my boots."

The winner of a McMaster Students Union teaching award, Megumi is known for her devotion to her students. Her students' first assignment is always the same: on a single sheet of paper, share a personal story and attach a photo. By the first midterm, she has memorized them all.

"It's a way of humanizing each student instead of letting them remain anonymous," she explains. "The worst thing about the pandemic is that I can't match names and faces in the same way over Zoom."

When she realized remote learning was not about to end, Megumi poured her "heart and soul" into learning best practices for teaching first-year calculus. Her first move was to hold an online drop-in event two evenings a week. "Many students took advantage of it. I could tell they really appreciated the effort," she says. She went on to adapt course content and format to individual student needs for learning online. In response to student feedback on a mid-semester questionnaire, she scrapped some unpopular assignments and reworked tests and exams.

A key role was also played by the Paul R. MacPherson Institute for Leadership, Innovation and Excellence in Teaching, a campus-wide resource dedicated to helping everyone achieve the exceptional teaching of instructors like Megumi. From graduate students learning to be effective teaching assistants to tenured professors wanting to keep their methods sharp, anyone can find a course, workshop or module that improves their teaching practice.

"Everything we do is geared toward helping teachers engage and assess their students," says Kris Knorr, an educational developer at the Institute. Topics include creating a course syllabus, building exams that assess real-world knowledge, and leveraging technology to enhance the student experience.

Throughout the pandemic, Kris has marveled at the willingness of instructors in the Faculty of Science to master the art of remote teaching. "They have stepped up to the plate to teach in a way that they never signed up for," he reflects.

In the early stages of the pandemic, the Institute focused on creating workshops and resources to help instructors choose and navigate the best platform for their classes. The focus has since shifted to developing and sharing best practices that help build stronger connections with students. "It's become apparent that remote teaching is here to stay, so we have incorporated effective practices for remote teaching into all our programs instead of treating it like a separate topic," says Kris.

The McCall MacBain Postdoctoral Fellows Teaching and Leadership Program shares the MacPherson Institute's aim to nurture excellence in teaching. "Postdoctoral fellows are set up to fail when they are hired as faculty members if they've never received any teaching instruction," says Constance Imbault, Program Manager & Research Coordinator for the program. "Our program exists to set them and their future students up for success."

The 2021-22 class includes 10 postdoctoral fellows, five of which hail from the Faculty of Science. For eight months, the fellows develop their instructional skills in several ways. To build a solid theoretical foundation for learning, they read and present research papers on education cognition. They then apply what they have learned by designing syllabi, lectures and curricula in a series of workshops — all virtually.

"By investing in these future faculty members now, we equip them to motivate and inspire future generations of students," says Constance. "This mission is more than worth our while."

"By investing in these future faculty members now, we equip them to motivate and inspire future generations of students."

> Strategic Plan Project Team member Sage Hartmann

EQUITY, DIVERSITY AND INCLUSION

BEYOND CONSULTATION – STUDENTS COLLABORATE ON ROLLING OUT STRATEGIC PLAN

Students played an integral role in developing the Faculty of Science's five-year strategic plan. A team of students were then recruited by the Dean's Office to help implement that plan. It's a partnership that delivers on the Faculty of Science's promise to be student-centred and welcoming for all.

In December 2020, the Faculty of Science unveiled a bold plan to chart the next five years. The plan had a clear vision for the future – transform our world through science.

The plan was built through extensive consultations. Special attention was paid to the insights and aspirations of students – the next generation of scientists who'll transform our world.

The students' work didn't stop there. They're now directly involved in bringing that five-year plan to life.

Ten undergraduate students were recruited to work on the Strategic Plan Project Team. Their assignment? Implement key parts of the plan and do that work from the perspective of students. Starting in May 2021, they began turning high-level objectives into six major projects, each with its own set of goals and metrics.

"We knew that directly involving students in the work of implementing our strategic plan would take us somewhere amazing," says Debbie Marinoff Shupe, Manager of Strategic Initiatives & Special Projects in the Dean's Office. Debbie supervised the student group with her colleague and project coordinator Maggie Cockburn.

"We told the team to imagine that the initiatives in our strategic plan were like balloons that had filled an entire auditorium," says Maggie. "The students' job was to reach up and pull down the balloons they were most passionate about and then come up with specific ways of making those ideas a reality."

Sage Hartmann, a fifth-year Indigenous student majoring in psychology, neuroscience and behavior (PNB), was the ideal candidate to lead the first project. It involved developing a framework for advancing and incorporating Indigenous knowledge, wisdom and culture into the Faculty of Science curriculum.

"As students, it can sometimes feel like we're yelling into a void," says Sage. "What appealed to me about joining the project team was the opportunity not only to voice my concerns but to have those opinions validated and transformed into action."

Over the course of 2021, Sage led her team in developing and presenting a comprehensive framework to the Dean's Advisory Board. From closing gaps in admissions and advancing mentorship programs to integrating Indigenous ideas into curricula, the framework takes a holistic approach to making the Faculty more accessible and inclusive.

"In Western science, there is typically no representation or celebration of Indigenous success or Indigenous Ways of Knowing and Being," says Sage. But those who dismiss Indigenous Science receive an incomplete education, she believes.

"Western science is typically categorical, breaking everything down into its component parts, while Indigenous science focuses on the interconnectedness of bodies and systems. The two worldviews are complementary."

While it will take time and sustained effort to put this framework into action, Sage was encouraged by the advisory board's positive response to her team's ideas.

For her first project, Simran Dhami, a second-year biology and PNB student, undertook the task of creating a comprehensive resource list for students in the Faculty.

"As a first-year student, I felt like there were a lot of resources available to students, but they weren't necessarily promoted well," she says. Thanks to her, science students will soon be able to filter a resource list by category to meet a wide range of academic, professional and personal needs.

<

Student Strategic Plan Project Team member Simran Dhami

Simran also worked with the Science Career and Cooperative Education Office (SCCE) on a project that will expand the realm of possibility for a diverse pool of co-op candidates, especially those who fell slightly short of the historic grade point average threshold because of unique circumstances. The result is a new co-op application process that includes an optional supplementary application for students to share more about their background.

"As a student from a visible minority, I really connected with the Faculty's efforts to advance equity, diversity and inclusion principles," says Simran. "We had the opportunity to achieve something concrete through projects like the co-op application."

Rodrigo Narro Pérez is a postdoctoral fellow who guides and facilitates various equity and anti-racism initiatives within the Faculty of Science and Provost's Office. "I'm heartened by all the students driving change," Rodrigo says. "They recognized the need to embed equity, diversity and inclusion principles into every part of the strategic plan and not just treat it like a box to check."

While Sage, Simran and the other members of the Strategic Plan Project Team have made great strides in the past year, there is still work to be done. "There are excellent ideas sitting on the shelf that didn't make the cut this year but will be revisited in the years ahead," says Maggie.

While the team tackles new ideas, the Faculty of Science will implement existing ideas in a way that advances equity, diversity and inclusion for everyone. "The strategic plan is aspirational in some ways, but it's also a contract with, and a promise to, our students," says Debbie. "With the help of our student team, we'll continue working toward creating the best possible environment for advancing scientific learning and discovery."

Rhea Desai, President of the Science Graduate Students Association, and Sahil Karnani President of the McMaster Science Society, for the 2021-22 academic year.

STUDENT LEADERSHIP

STUDENT LEADERS DELIVER MASTER CLASS IN COMMUNITY BUILDING

All of us want to feel like we belong. That need for community among students was never more important, or more put to the test, than during the pandemic. Three student-led groups went above and beyond in serving, supporting and bringing together more than 9,000 undergraduate and graduate students in the Faculty of Science.

Everyone needs to feel like they're part of something bigger than themselves. At the Faculty of Science, student-led organizations offer a vital lifeline of connection for classmates who want to make the most of their university experience.

Although the isolation of the COVID-19 pandemic and the move to a virtual campus tested and frayed those ties in 2021, student leaders managed to do more than hold their organizations together throughout the year. Across the board, they successfully found new ways to deliver essential services while also creating new opportunities for their fellow students to connect online.

Rhea Desai is student president of the Science Graduate Students Association (SciGSA), which works to break down siloes within the Faculty of Science by hosting

Julie Bannon (left) and Stefania Cerisano, Co-Presidents of Women in Science and Engineering Initiative for the 2021-22 academic year

social and professional events for graduate students from diverse fields. She earned her bachelor's degree in biology at McMaster and has been enrolled in a postdoctoral biology program since 2018.

"I felt isolated in my first year of graduate school," she remembers. "There's always so much happening for undergraduate students, but graduate students have to look a little harder for social activities." She joined SciGSA to help students like her feel less alone.

Stefania Cerisano and Julie Bannon, both PhD candidates in psychology, neuroscience and behavior, found the community they were searching for in the Women in Science & Engineering Initiative (WISE). Over time, they found so much value in the organization's mission to support and advocate for diversity and equity at the Faculty of Science that they became co-presidents.

At the undergraduate level, fourth-year student Sahil Karnani leads the McMaster Science Society (MSS). It's a student-run organization that improves the university experience through a wide range of activities, from tutoring and webinars to social events like the annual Formaldehyde formal that sells out as fast as a Harry Styles concert.

In 2021, the unpredictability of the COVID-19 pandemic made it challenging for student leaders to maintain morale among their ranks. "People were excited to attend virtual events at the beginning of the pandemic, but by the second year, everyone was tired and stressed out," says Rhea. "Being part of a student organization wasn't on the front burner for them anymore."

Sahil, Stefania and Julie echo Rhea's thoughts, pointing to the ongoing reality of Zoom fatigue for students who spend most of their days attending classes from a screen.

Fortunately, these student leaders persevered. "Nothing about leading this year has been straightforward or easy," says Dean Maureen McDonald. "Yet I've been so impressed with their continued dedication to making our Faculty of Science even better for all students."

Before the pandemic, SciGSI hosted an annual spring event that invites alumni to speak on a panel about their industry experiences. It's also a valuable networking opportunity that highlights careers beyond academia. While Rhea and her team converted the event to a virtual space with some trepidation, they found unexpected value in the new format. "It gave us the opportunity to invite alumni

who wouldn't have been able to attend in person," she says. "That was a silver lining for a lot of the virtual talks and seminars we have hosted recently."

Julie and Stefania have experienced the same unexpected benefit from moving WISE mentoring events online.

"We have a dedicated team that is focused on providing support and mentorship opportunities to the McMaster graduate community," says Julie. "Our team members have worked hard during the pandemic to continue our monthly talks from inspiring mentors in STEM while also expanding our mentorship program."

Sahil says the dean and her leadership team in the Faculty have been a "saving grace" throughout the pandemic. "One of the things that I have had to learn as a leader is how to effectively prioritize student needs," he says. "The Faculty provided the guidance my team needed to get through this year."

While Sahil and his team continue to invest hundreds of hours in planning and running successful events, they also spent the past year preventing students from falling behind both academically and financially. As the demand for tutoring spiked duringCovid, they devoted more resources to recruiting tutors. They also created new scholarships to provide a fresh source of funding to recognize students with outstanding character or achievements.

"Leading during a pandemic has been a roller coaster," says Sahil, "but we will continue to do everything we can to help the McMaster Science Society become even stronger and more connected than it was before."

ENGAGED AND COMMITTED – STUDENTS MADE THE DIFFERENCE

Science Graduate Students Association (SciGSA):

- Going virtual: Successfully converted its annual Alumni Social into a virtual event. Event organizers invited alumni panelists who would not have been able to travel and attend in person.
- EDI advocacy: Engaged in various conversations on campus and with the Dean's Office on equity, diversity and inclusion (EDI) issues that impact graduate students and post-doctoral fellows. To advance these efforts, SciGSA hosted a "Let's Talk About Science & Race" session with the Race, Racialization and Racism Working Group of the President's Advisory Committee on Building an Inclusive Community and held its first annual general meeting focused on understanding and vocalizing ongoing EDI struggles.
- Shining a spotlight on Indigeneity: Hosted a talk with Chief Stacey Laforme from the Mississaugas of the Credit First Nation.

Women in Science & Engineering Initiative:

- Mentor of the Month talks: Brought in several community members to speak about their experiences working in science, technology, engineering and mathematics (STEM). Common themes addressed included transitioning between academia and industry, following non-traditional career paths, and the role that quality mentors and networks play in supporting career goals.
- Generation STEM: Teamed up with other groups in the McMaster and Hamilton communities to host a variety of STEM-related workshops, panels and lab tours for local high students.
- Current Research in Engineering, Science and Technology (CREST): Last year's annual CREST conference included a keynote talk by the Honourable Kirsty, Deputy House Leader of the Government, plus workshops on open science, gender inclusivity and professional development as well as academia and industry panels.

McMaster Science Society:

- Tutoring and Mentorship: Offered tutoring and mentorship services to all first-year students in the Faculty of Science in 2021.
- Formaldehyde: Hosted a virtual version of the biggest student society formal night on campus in 2021 and planning an in-person this year.
- MSS Scholarships: Established a slate of new scholarships for students, recognizing individual achievement and character.
- Social Media Overhaul: A major marketing overhaul featuring Discord Servers, a newly designed website (macsci.ca) and a new promotions campaign expanded the organization's digital presence.

> Katie Moisse, assistant professor of science communications with the Faculty of Science's School of Interdisciplinary Science.

ENGAGEMENT

BRINGING SCIENCE TO LIFE FOR EVERYONE

How do you recruit the next generation of scientists? Make the case for research? Build science literacy to guard against misinformation and denialism? Our science champions are equal to the challenge. They're students, faculty and staff who all share a passion for engaging with the community one school visit, workshop, talk, tour and media interview at a time.

"There is no better way to connect people to science than through the craft of storytelling," says Katie Moisse.

As a science journalist, Katie speaks from experience. Armed with a PhD in pathology and a journalism degree from Columbia University, she has mastered the art of communicating complex scientific knowledge to a general audience in a time of rising science denialism and misinformation.

Now, as an assistant professor of science communications at the Faculty of Science's School of Interdisciplinary Science, Katie teaches classes in outreach and advocacy, basic communications and media relations to undergraduate students. She also serves as the School's associate director of curriculum and pedagogy, and is spearheading development of a graduate program to meet rising employer demand for people with advanced media and communications skills.

"Some of these students will go on to become journalists, while others will work in knowledge translation roles within biotech companies or nonprofit organizations," says Katie. "Being able to discover information and craft an argument for a target audience is a valuable skill in any path they pursue."

Not long after joining the Faculty in 2018, Katie created the Science Stories Speaker Series. The series invites science journalists, filmmakers, photographers and artists to share their work with students and members of the wider Hamilton community.

"It's never been more necessary or more challenging to engage folks with science," she reflects. "The vision for this series is to help people feel like science is for them, not against them."

Katie's Science Stories series is one of many ways in which the Faculty is delivering on its strategic priority of transforming the world through communication and community engagement.

A dedicated group of 300 students comprises the McMaster chapter of Let's Talk Science, a national organization that sends volunteers into schools and community centres to deliver learning presentations on science and technology.

Hamza Khattak, a graduate student in physics & astronomy, who coordinates outreach for the group, points to the value of doing, and not just telling students, about science. "I became a volunteer because I remember how much I enjoyed hands-on learning activities as a student," he says.

"It's never been more necessary or more challenging to engage folks with science. The vision for this series is to help people feel like science is for them, not against them."

Throughout 2021, Hamza and his fellow volunteers adapted to pandemic lockdowns by offering virtual and hybrid events to students throughout Hamilton. Over time, they have designed activities that only use materials students can easily access at home. For example, a Let's Talk Science volunteer may teach basic physics concepts to younger students by having them build catapults and bridges using popsicle sticks and rubber bands.

Volunteers may also leverage their own experiences during presentations. To explain his own ongoing research related to electromagnetics, Hamza recently delivered a presentation that involved microwaving grapes and watching them spark. "If students are having fun doing science, they're less likely to be intimidated by it and more likely to think about careers in science and technology," he says.

Other Faculty outreach programs are designed to engage specific audiences:

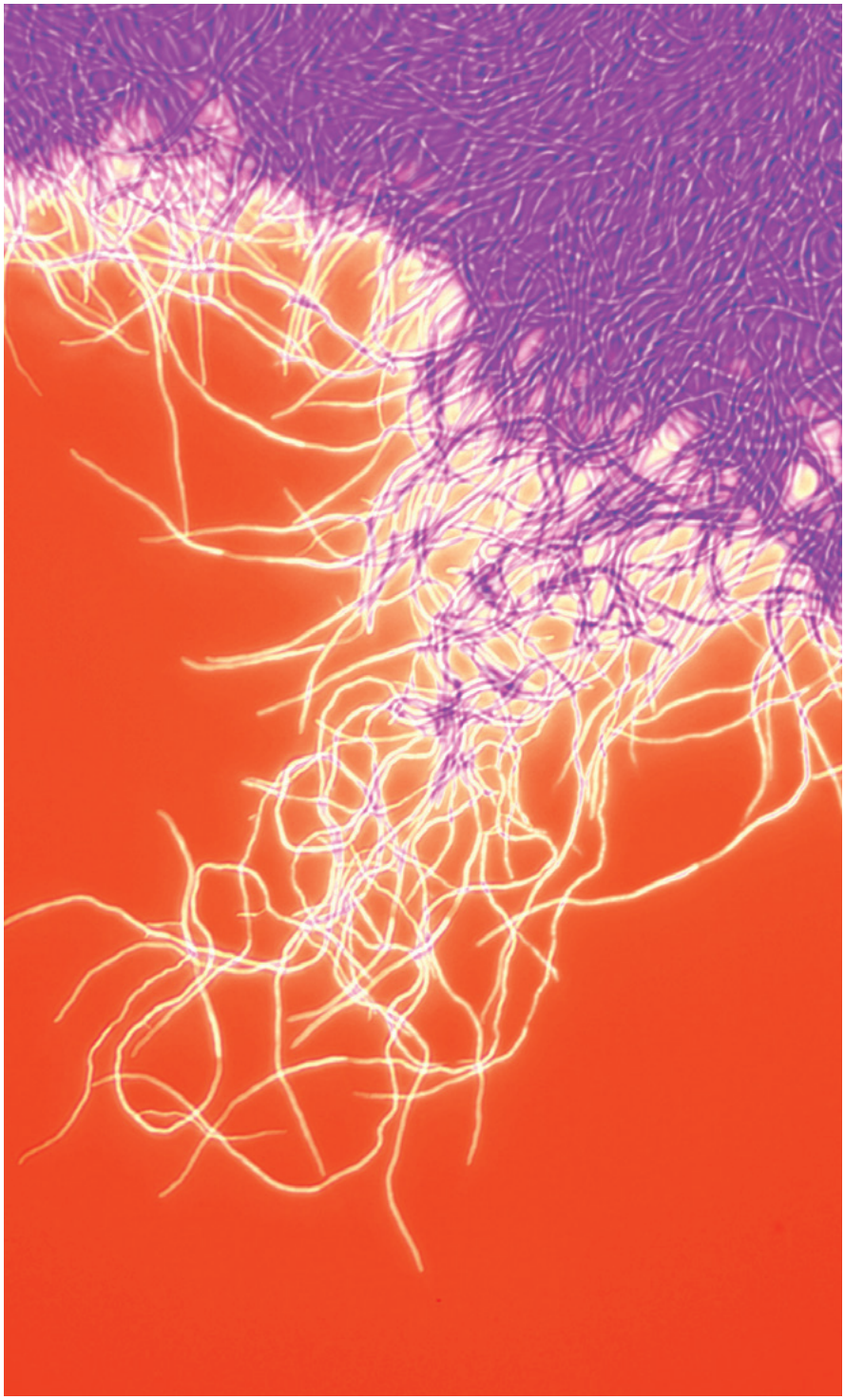
- Chemistry & Chemical Biology faculty and staff stage a Magic with Molecules Show for children and families, complete with flashes, bangs and chemical reactions.
- High school students expand their knowledge of neuroscience at events like the Canadian National Brain Bee and the Annual Hamilton Brain Bee, both hosted by the Department of Psychology, Neuroscience & Behaviour, and organized by professors Nikol Piskuric and Judith Shedden.
- And for equity-seeking students looking to build confidence and knowledge, a McMaster group called Promoting Inclusion in Physics and Astronomy led by instructional assistant Sara Cormier and graduate student Carmen Lee host an annual outreach event called Elevate: A Day for Inclusion in Science.

The lifting of pandemic restrictions means more opportunities to engage with the community. Physics and Astronomy professor Robert Cockcroft is eager to welcome back visitors of all ages to McMaster's William J. McCallion Planetarium, the first in Ontario to offer public shows when it opened in 1950. Robert is also working with local Indigenous communities to develop an Indigenous astronomy course and Indigenous astronomy outreach program at McMaster.

The broad range of outreach activities offered by students and educators speaks to the boundless diversity of interests and passions across the Faculty of Science. From isolation to misinformation, the challenges of the COVID-19 pandemic have only reinforced the shared commitment to making science relevant and accessible to as many people as possible.

"Our world needs people who have the skills to bring science to life," says Katie. "I'm thrilled to be part of a group of people at McMaster who are innovating in this space. There is endless opportunity to grow and explore."

THE ART OF SCIENCE



> *"Spaghetti Attack"*
PhD candidate Matt Zambri with the Elliot Lab in the Department of Biology used fluorescence microscopy to understand how the antibiotic-producing bacterium Streptomyces venezuelae grows when exposed to environmental stressors. Matt captured the image in McMaster's Centre for Advanced Light Microscopy using a Nikon inverted confocal A1R HD25.

ROLL CALL

AWARDS & ACCOLADES 2021

Anas Abdallah (Mathematics & Statistics) received an Outstanding Service Award from the McMaster University Faculty Association and a McMaster Students Union Teaching Merit Award.

Richa Alvares (Life Sciences) received a Faculty of Science Co-op Student of the Year Award from the Science Career and Cooperative Education Office.

Altaf Arain (Earth, Environment & Society) was named one of the world's most cited and influential researchers by Clarivate. Altaf was also appointed Faculty of Science Research Chair in Environmental Sustainability and Climate Change.

Julia Azzi (Medical & Biological Physics) won both the 2021 Canadian Astroparticle Summer Student Talk Competition and the SNOLAB Spring Student Talk Competition.

Alumnus **Richard Black** (Psychology & Chemistry) was inducted into the McMaster University Alumni Gallery.

Michael Brook (Chemistry & Chemical Biology) was awarded the 2021 D'Arcy McGee Beacon Fellowship by the Ireland Canada University Foundation.

Katherine Bujold (Chemistry & Chemical Biology) received a New Frontiers Research Fund Exploration Award from the federal government and an award from the Canada Foundation for Innovation's John R. Evans Leaders Fund.

Clifford Burgess (Physics & Astronomy) was appointed Scientific Associate at CERN and received the PROSE prize from the American Association of Publishers for the best chemistry and physics book.

Alyssa Burrows (Biology and Pharmacology) received a Faculty of Science Co-op Student of the Year Award from the Science Career and Cooperative Education Office.

Daniel Cameron (Psychology, Neuroscience & Behavior) received a Natural Sciences and Engineering Research Council of Canada Postdoctoral Fellowship Award.

Robin Cameron (Biology) was elected President of the Canadian Society of Plant Biologists.

Mohammad Chaposhloo (Psychology, Neuroscience & Behavior) received a 2021 MacData Fellowship.

Katrina Choe (Psychology, Neuroscience & Behavior) received an award from the Canada Foundation for Innovation's John R. Evans Leaders Fund.

Patrick Clancy (Physics & Astronomy) received a Small Teaching and Learning Grant and Virtual Learning Strategy funding from the McPherson Institute.

Sara Cormier (Physics & Astronomy) received a President's Awards for Outstanding Service to McMaster University.

Erica Dao (Medical Physics – Radiation Sciences) received the 2021 Dean's Award for Excellence in Communicating Graduate Research.

Wilson Leadership Scholar **Elise Desjardins** (Life Sciences) received a Community IMPACT Award from the McMaster Alumni Association.

David Earn (Mathematics & Statistics) received the Canadian Applied and Industrial Mathematics Society's Research Prize and delivered the Research Prize Lecture during the CAIMS annual meeting. David was also named a Faculty of Science Research Chair in Mathematical Epidemiology.

Marie Elliot (Biology) received the President's Award for Excellence in Graduate Supervision from the McMaster School of Graduate Studies, was elected a Fellow of the American

Academy of Microbiologists and was named a Faculty of Science Research Chair in Microbial Development and Natural Product Control.

Turlough Finan (Biology) received the CSM Murray Award for Career Achievement from the Canadian Society of Microbiologists.

Rachael Finnerty (Psychology, Neuroscience & Behavior) received a 2021 Dean's Award for Excellence in Communicating Graduate Research.

Mihaela Georgescu (Biology) received a President's Awards for Outstanding Service to McMaster University.

Oishee Ghosh (Biology) was awarded the Ernest Robert Mackenzie Kay Scholarship.

Martin Gibala (Kinesiology) received a 2021 President's Award for Excellence in Graduate Supervision.

Alemu Gonsamo (Earth, Environment & Society) was named Canada Research Chair in Remote Sensing of Terrestrial Ecosystems (Tier 2).

Leanne Grieves received the Alice Wilson Award from the Royal Society of Canada.

Ian Hambleton (Mathematics & Statistics) was appointed a 2021 Fields Institute Fellow.

Megumi Harada (Mathematics & Statistics) received a McMaster Students Union Teaching Award.

Shawn Hercules (Biology) received the Mary Keyes Award for Outstanding Leadership and Service to McMaster from the McMaster Graduate Students Association.

Jennifer Heisz (Kinesiology) was named Canada Research Chair in Brain Health and Aging (Tier 2).

Audrey Hicks (Kinesiology) received an Outstanding Service Award from the McMaster University Faculty Association.

William Ho (Biochemistry) was inducted into the McMaster University Alumni Gallery.

Catherine Ivy (Biology) received the T.W.M Cameron Award from the Canadian Society of Zoologists for the most outstanding PhD thesis in zoology in Canada.

Julie Jenkins (Mathematics & Statistics) received a McMaster Students Union Teaching Award.

Karen Kidd (Biology) received the Frank H. Rigler Award from the Society of Canadian Limnologists and the Canadian Ecotoxicity Workshop Award for Outstanding Contribution to Canadian Exotoxicology.

Trevor King (Kinesiology) received a McMaster Students Union Teaching Award.

Dylan Kobsar (Kinesiology) received the Banting-CANSSI Ontario Discovery Award in Data Science.

Krista Howarth (Kinesiology) received a McMaster Students Union Teaching Award.

Daniella Lato (Biology) received the Therese Quigley Award of Excellence for Graduate Student Leadership in Athletics from the Graduate Students Association.

Yarden Levy (Psychology, Neuroscience & Behavior) received the Wilson Leadership Scholar Award.

Darko Ljubic (Chemistry & Chemical Biology) received a President's Award for Outstanding Service to McMaster University.

Gita Ljubicic (Earth, Enviroment & Society) was named Canada Research Chair in Community-Engaged Research for Northern Sustainability (Tier 2).

Jim Lyons (Kinesiology) was named the 2021 Wilberg Memorial Lecturer by the Canadian Society for Psychomotor Learning and Sport Psychology.

Sulayman Lyons (Biology) won the G.F. Holeton Prize for the most outstanding student poster presentation at the Annual Conference of the Canadian Society of Zoologists.

Megan MacKenzie (Psychology, Neuroscience & Behavior) received a McMaster Students Union Teaching Award.

John MacLachlan (Earth, Environment & Society) was awarded Virtual Learning Strategy funding from the McPherson Institute.

Narayanaswamy Balakrishnan (Mathematics & Statistics) was elected a Fellow of the Royal Society of Canada, received the Professor C.R. Rao Lifetime Achievement Award from the Indian Society of Probability and Statistics and was chosen to deliver the inaugural Theophilos Cacoullos Memorial Lecture by the Greek Statistical Institute.

Juliet Daniel (Biology) received the Inclusive Excellence Prize from the Canadian Cancer Society, an Honorary Doctorate of Science from the University of West Indies Cave Hill Campus and a New Frontiers Research Fund Exploration Award from the federal government.

Krista Madsen (Kinesiology) received a Priority Areas for Learning and Teaching Grant from the McPherson Institute.

Paul McNicholas (Mathematics & Statistics) received the 2021 John. L. Synge Award from the Royal Society of Canada.

Katie Moisse (Interdisciplinary Science) received a Leadership in Teaching and Learning Fellowship, a Priority Areas for Learning and Teaching Grant, a Small Teaching and Learning Grant and an Inclusion, Diversity, Equity, Accessibility and Sustainability Grant from the MacPherson Institute.

Pallavi Mukhergee (Chemistry & Chemical Biology) won the Dean's Award for Outstanding Leadership and Contributions to the International Graduate Student Community from the McMaster School of Graduate Studies.

Julia Nomikos (Biology) was awarded the Louise Milligan Award for best undergraduate student presentation at the 2021 Comparative Physiology and Biochemistry Workshop.

Elli Papangelakis (Earth, Environment & Society) was appointed the Fairley Gadsby Research Chair in Fluvial Geomorphology.

Alex Peace (Earth, Environment & Society) received Virtual Learning Strategy funding and an Open Educational Resources Grant from the McPherson Institute.

Rodrigo Narro Pérez (Office of Dean of Science) received an Inclusion, Diversity, Equity, Accessibility and Sustainability grant from the MacPherson Institute.

Stuart Phillips (Kinesiology) was named one the world's most cited and influential researchers by Clarivate.

Christina Pizzola (Kinesiology) won an Outstanding Research Award at the 21st annual Bertha Rosenstadt National Undergraduate Research Conference in Kinesiology and Physical Education.

Cayleih Robertson (Biology) won the T.W.M. Cameron Outstanding PhD Thesis Award from the Canadian Society of Zoologists.

Kalaichevi Saravanamuttu (Chemistry and Chemical Biology) received an Inclusion, Diversity, Equity, Accessibility and Sustainability grant from the MacPherson Institute.

Graham Scott (Biology) was named a 2021 University Scholar by McMaster University.

Judith Shedden (Psychology, Neuroscience & Behavior) received an Outstanding Service Award from the McMaster University Faculty Association.

Rosa da Silva (Biology) received a 2021 Ontario Confederation of University Faculty Association Teaching Award.

Sarah Styler (Chemistry & Chemical Biology) received a New Frontiers Research Fund Exploration Award from the federal government.

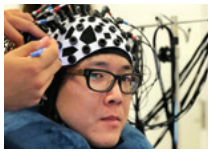
Sarah Symons (Interdisciplinary Science) was awarded the R.S. Webster Lectureship by the Archaeological Institute of America.

Jeremy Walsh (Kinesiology) received an award from the Canada Foundation for Innovation's John R. Evans Leaders Fund

Allison Williams (Earth, Environment & Society) received a McMaster Students Union Teaching Award for Community Engagement.

Jennifer Williams (Kinesiology) was named Teaching Assistant of the Year by the McMaster Students Union and received a graduate student poster award from the Canadian Society for Exercise Physiology.

Emily Wood (Psychology, Neuroscience & Behavior) received the Alexander Graham Bell Canada Graduate Scholarship – Doctoral.

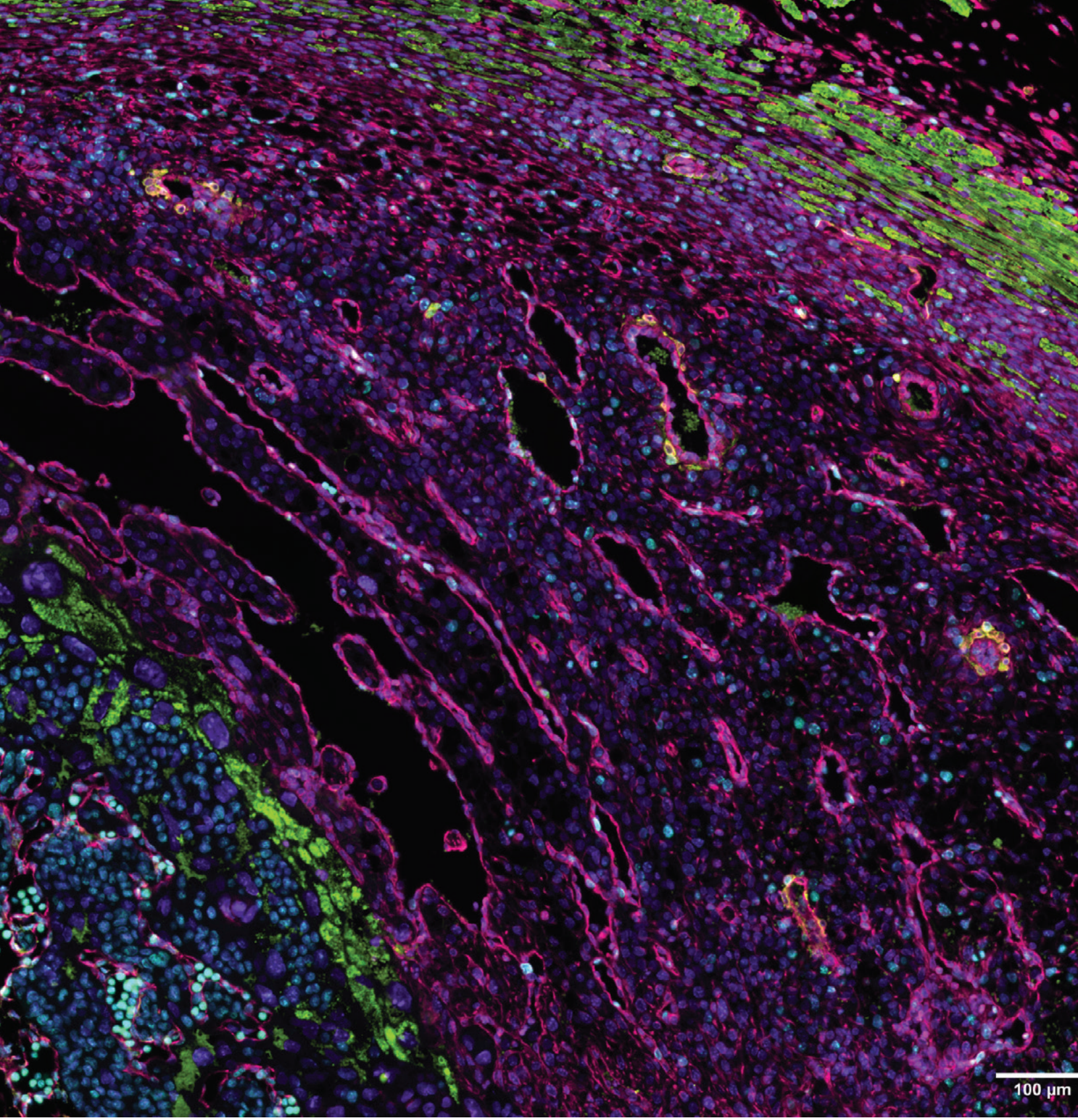


Gabriel Xiao (Psychology, Neuroscience & Behavior) was named Canada Research Chair in Perceptual Development (Tier 2) and received an award from the Canada Foundation for Innovation's John R. Evans Leaders Fund.

The last word

<

Annum Dawood graduated in 2021 with her Master's degree in Radiation Biology. She was photographed during the pandemic by her husband Irfan Siddiqui.



BRIGHTER WORLD | science.mcmaster.ca

SCIENCE | McMaster University