



UNIVERSITY OF TORONTO
LESLIE DAN FACULTY OF PHARMACY

2021-22
Dean's Report

“As we continue to grow in our aspirations and impact, [...] we will be building new initiatives to further support our success and help us achieve our full potential.”



Photo by
Tobi Asmoucha

Message from the Dean

The Leslie Dan Faculty of Pharmacy continues to lead as one of the top-ranked faculties of pharmacy in the world. We have met the challenges of the past few years with the resilience, compassion, and creativity that are fundamental to our individual and collective success.

As we begin a new academic year, I want to take this opportunity to reflect on our achievements of the past year and celebrate the outstanding work that happens across our Faculty. This year's Dean's Report highlights the many ways in which the teaching and research we lead fits together to move the profession and science forward to improve patient care and create better health systems.

In particular, this year's feature story shows how the breadth of our expertise in drug therapy, from the earliest stages of drug development to real-world medication use, is contributing to better care for patients and improving health outcomes.

As we continue to grow in our aspirations and impact, and as we look ahead to the launch of our next five-year plan, we will be building new initiatives to further support our success and help us achieve our full potential. This past year, the *Equity, Diversity, and Inclusion (EDI) Working Group* delivered a Strategic Plan to the Dean's Office that will serve as a roadmap for our Faculty in this area.

The EDI Working Group was co-chaired by **Dr. Lachmi Singh**, Director of Education Programs and Administrative Services and **Dr. Jillian Kohler**, Professor and Director of the WHO Collaborating Centre for Governance, Transparency and Accountability in the Pharmaceutical Sector.

The group also included members of our faculty, staff, students, and alumni who came together between July and November 2021 to create the EDI Strategic Plan. I have accepted the recommendations made in the EDI Strategic Plan and they have been incorporated into the Leslie Dan Faculty of Pharmacy's Academic Plan (2022-2027) to be launched in September 2022. I would like to thank the members of the Working Group and others across the Faculty and University for their contributions to creating this plan and for helping to provide a foundation from which our EDI initiatives will grow and evolve.

I invite you to learn more about our achievements of the last year and draw renewed inspiration as we begin a new year full of opportunity.

Lisa Dolovich
Professor and Dean
Leslie Dan Faculty of Pharmacy
University of Toronto

From lab bench to pharmacy shelves: medications are cornerstone of health care

Leslie Dan Faculty of Pharmacy experts are discovering new drugs and building a pharmacy profession to provide better patient care

Written by Eileen Hoftyzer
Photos by Steve Southon

Pharmacy shelves are stocked with thousands of different drugs that can save lives, help patients manage chronic conditions, and alleviate symptoms of illness. Health Canada has approved roughly 14,000 drugs, each one having been uniquely discovered and extensively tested. Pharmacists take responsibility for assessing effectiveness, safety and use, and educate their patients to receive the most benefit. And researchers continue to look for ways to improve existing treatments and discover new drugs.

Researchers and pharmacists at the Leslie Dan Faculty of Pharmacy are leaders in every step of this cycle. From the earliest stages of drug development to real-world medication use, they are contributing to better care for patients and improving health outcomes.

“In my experience, research at the Leslie Dan Faculty of Pharmacy tends to focus on ideas that can eventually be translated to the clinic,” says **Carolyn Cummins**, associate professor at the Leslie Dan Faculty

of Pharmacy and director of the Pharmaceutical Sciences program. “We have researchers with so many different areas of expertise all under one roof, and this is a huge advantage in moving research forward.”

Finding the target

Developing a new drug starts with finding a target – a molecule whose activity can be changed to affect a disease or condition. Finding a new drug target requires a strong understanding of molecular biology and molecules’ activities.

Carolyn Cummins is studying the biology of cells and molecules to look for new drug targets. Her team studies nuclear receptors and their role in metabolic disease, particularly diabetes, to look for potential molecular targets for new drugs to treat these conditions.



Bowen Li
Research Lab

“I find it very exciting to discover new biology,” says Cummins. “Observations that don’t fit with anticipated results or the current paradigm often take me in new directions. The pharmaceutical industry is excellent at developing new drugs, but they need well-validated targets to know where they should invest in drug development. My lab works on understanding how different proteins contribute to metabolic disease and validating whether these proteins can serve as drug targets.”

A major focus of Cummins’ research is finding drug targets to prevent glucocorticoid-induced diabetes. Glucocorticoids are often taken to treat chronic inflammation, but these drugs act on a cell receptor in the liver that also increases glucose production and increases the risk of developing diabetes. Her team studies whether the cell receptor liver X receptor (LXR) could be targeted with drugs to decrease the risk of glucocorticoid-induced diabetes and other negative side effects of glucocorticoid therapies.

In another line of research in collaboration with colleagues in Brazil, her team is examining whether a compound found in a by-product of Brazilian cashew shells can activate another nuclear receptor involved in metabolism called PPAR. While this research is still in early stages, they hope that this compound could be used as a drug for conditions such as hyperlipidemia and insulin resistance at a much lower cost than current therapies.

“A lot of the foundational work to find new drug targets happens in academia,” says Cummins. “This fundamental science has to happen first.”

A formula for success

Once a drug has been developed to hit its molecular target, researchers need to find a way to deliver the drug where it needs to go. After all, a drug could be highly effective against its target in a petri dish, but if it can’t reach it’s target in the body, it’s essentially useless.

Finding the right delivery system or formulation – whether it’s an oral capsule, an IV-delivered chemotherapy drug, a skin patch, or any of the other potential delivery methods – is a key part of a drug’s life cycle.

Ping Lee, professor at the Leslie Dan Faculty of Pharmacy, leads research to tackle the challenge of low bioavailability of oral medications that are poorly water soluble, which is the majority of new chemical entities emerging from drug discovery.

Oral formulations are preferred for most drugs but developing a formulation that ensures a drug can reach the bloodstream and its target after a patient swallows a pill is challenging. It is especially difficult for drugs that have a crystal structure that limits its solubility and absorption into the blood.

“Our research brings new insights into how drugs are released from amorphous solid dispersions, which is an important strategy to enhance the solubility and bioavailability of poorly soluble drugs, and provides guidelines for the design of such delivery systems,” says Lee.

Lee’s team uses physicochemical techniques to convert a poorly soluble drug crystal into an amorphous state and stabilizing it in a unique polymer matrix that forms the “amorphous solid dispersion” or ASD, which is more soluble and allows the drug to be absorbed and reach the bloodstream more easily.

They have developed approaches using ASDs that have improved the delivery and absorption of several drugs that were nearly abandoned due to their poor solubility. They have also investigated drug release and drug crystallization in ASDs during storage, both affecting their stability and enhancement in bioavailability. “It’s the scientific and technical challenges that keep us interested. We’re trying to solve a real-world problem that could be beneficial to patients,” says Lee.

Optimizing patient medications

After a drug’s approval, a whole new set of questions may emerge about its safety and effectiveness in real-world settings, which may be different than the optimal conditions of a lab or trial.

For one, many patients aren’t taking a single drug for a single condition. In fact, 40 per cent of adults over age 65 are prescribed five or more drugs, an issue known as polypharmacy.



Naomi Steenhof, assistant professor, and Viktoriya Bardal, a fourth-year Doctor of Pharmacy (PharmD) student.

Pharmacists and other health care professionals are often focused on getting a patient started on the right drug for their condition, but perhaps just as important is assessing when a patient should stop taking a medication.

Lisa McCarthy, associate professor and clinician scientist at the Leslie Dan Faculty of Pharmacy, focuses her research on medication management and helping patients get the most benefit from their medications. A significant part of her research looks at deprescribing – a planned and supervised process to help patients stop taking medications that are no longer benefiting them.

“We have powerful medications and access to lots of medication options. The research that I lead focuses on how we help people get the most benefit from their medications and make sure that they’re taking what they need, no less and no more, and for the right amount of time,” says McCarthy.

The more medications a patient takes, the greater the risk of drug interactions or adverse events, but those drugs could also be critical to a patient’s care. As medication experts, pharmacists play an important role in helping other health care professionals and patients understand the changing risk-benefit ratio of

each drug as their health changes over time. “There is a momentum and growing awareness of this problem now,” says McCarthy. “There is still a lot of work to do to address this problem, but we can find ways to help pharmacists and prescribers support patients all the way through the medication continuum, knowing that a patient’s medication needs will change.”

McCarthy’s research work has been incorporated in national and global deprescribing guidelines that help clinicians identify patients who would benefit from deprescribing and what approach would be best for them.

McCarthy says that deprescribing medication that is no longer beneficial to patients, and may even be harmful, can be life-changing for patients.

“I’ve seen people at risk of falls become steadier on their feet and able to regain some independence. I’ve seen the lives of people who were not able to make their own care decisions or do activities they once valued essentially transformed when able to think more clearly,” says McCarthy. “I keep doing this work because I’ve personally seen the benefits for so many people.”

Training experts in a changing field

The pharmacy profession has changed significantly in recent years: a greater number and more complex medications are being offered, new drugs are being approved at an impressive pace, and the scope of practice has expanded, with pharmacists providing vaccinations and other public health services.

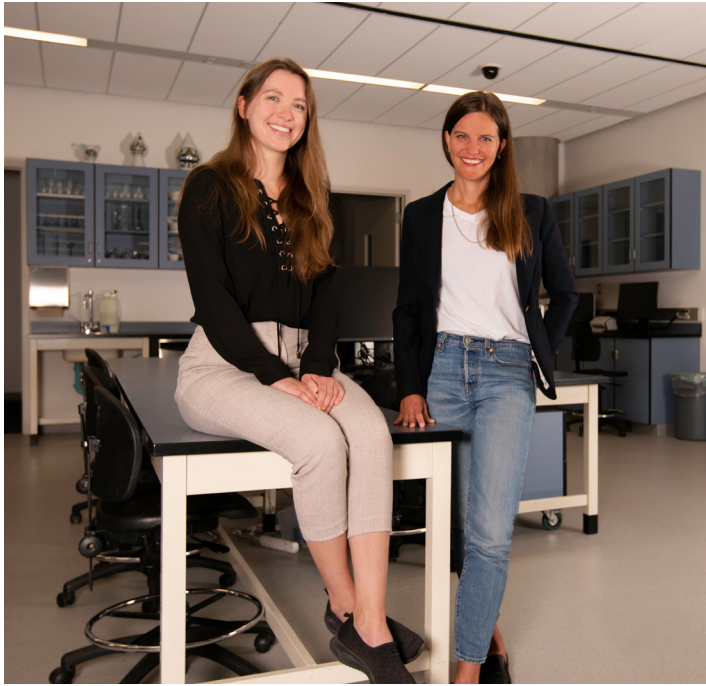
For even seasoned pharmacists, the amount of information they need to know can be overwhelming. Teaching and training new pharmacists in this environment is a significant task.

Naomi Steenhof, assistant professor at the Leslie Dan Faculty of Pharmacy, leads research focused on pharmacy education and has studied how pharmacy students and practising pharmacists learn. She investigates the importance and applicability of concepts known as productive struggle and adaptive expertise in training future health care providers.

Adaptive expertise is a conceptual framework that develops experts to be creative problem-solvers and apply their knowledge to new situations and contexts, instead of expecting them to learn and remember huge amounts of information. The adaptive expertise approach allows students to experience struggle as a way to encourage learning, understand not just what they are doing but why, and exploring “what if” scenarios to uncover important concepts. It’s an approach that recognizes and encourages the diverse experiences of learners.

“All of our learners, whether novices or through continuing professional development, come to the table with a vast amount of knowledge and personal experience. As educators, we can recognize and value the knowledge and experiences that they bring,” says Steenhof. “Sometimes we feel like we have to separate our personal experiences from professional learning, but adaptive expertise allows us to value that experience and bring it to the forefront.”

Viktoriya Bardal, a fourth-year Doctor of Pharmacy (PharmD) student at the Leslie Dan Faculty of Pharmacy, says courses in the PharmD program required her use more problem-solving skills than during her undergraduate degree in science. In some classes, she and her classmates would be presented



with patient cases to make recommendations about medications, adverse reactions, and other important details with minimal information.

“It was challenging and more work to go through the process of finding this information, but our instructors were teaching us how to apply what we’ve learned to find the information we need,” says Bardal. “In our future practices, we won’t always be presented with all the information we may need. We need to learn how to learn so that we can do it in the future.”

Steenhof agrees that the adaptive expertise approach is particularly important to prepare future pharmacists in an ever-changing profession.

“Our education needs to help our students become more adaptive, because in 30 years, who knows what types of medications and therapies will be out there and what our roles will be,” says Steenhof. “We want to make sure that we’re preparing our students to serve society in a way that’s going to be useful as our context continues to shift and change.”

New horizons in drug discovery

One way that the pharmacy profession may change in the future is in the types of drugs available, as new classes of drugs are being discovered and approved.

For example, in the last two years, mRNA-based therapies have become the focus of intense research interest after being successfully used in Pfizer-BioNTech and Moderna’s COVID-19 vaccines.

Bowen Li, assistant professor at the Leslie Dan Faculty of Pharmacy, says that vaccines are just the beginning of what mRNA technology could be used for. “The mRNA technology is still very young, and we haven’t reached the full potential of mRNA therapeutics yet,” says Li. “This platform could be used to address many different diseases including cancer and autoimmune diseases, as well as techniques for vaccines and gene editing. We’re looking forward to the benefits that mRNA technology can bring to us in the future.”

Li’s cutting-edge research program is developing new delivery platforms for mRNA vaccines and therapies. While mRNA therapies offer significant advantages over conventional drugs, particularly the speed at which they can be developed and their relatively low costs, delivering the mRNA to its target tissue is currently the biggest barrier to broader use.

For example, the current mRNA vaccines are only delivered intramuscularly to reach the blood; while this application produces a protective immune response, a vaccine that could be delivered directly to the target



Bowen Li, assistant professor, with Tiana Young and Kevin Wang, Pharmaceutical Sciences graduate students.

organ (for example, in the case of COVID-19, the nose or mouth) would provide better protection at a lower dose.

This is particularly important if mRNA is to be used to treat various forms of cancer and other diseases.

Li’s team is developing formulations to deliver mRNA drugs directly to the relevant organs. They use advanced automated techniques that allow them to quickly synthesize thousands of different lipid nanoparticles, which are used to deliver mRNA, and find the best candidates to study further. “Our focus is to provide a toolbox of lipid nanoparticle formulations for mRNA so that we can facilitate wider applications for other diseases,” he says.

Tiana Young will be starting her master’s degree in Pharmaceutical Sciences this fall in Li’s lab. Having just completed a degree in pharmaceutical chemistry at U of T with a thesis projects focused on immunology and bionanotechnology, she is looking forward to working in a lab that is at the forefront of the research field.

“I really wanted to join a lab where I could apply what I learned through pharmaceutical chemistry related to the drug industry but also develop novel delivery systems and investigate how the body interacts with new formulations. This research is really at the crosshairs of all the things I was interested in,” says Young. “Dr. Li’s lab is at the forefront of new drug development in a very relevant field of mRNA vaccines, and he has a lot of new ideas and is very open-minded to new technology and developments. It’s very exciting to be a student in a lab like this.”

Li says that being based at the Leslie Dan Faculty of Pharmacy provides opportunities for collaborations that lead to innovative solutions to highly relevant clinical problems.

“Our faculty is interdisciplinary, and our lab is kind of in between fundamental scientists and clinical scientists,” says Li. “We can bridge the gap between the fundamental scientists and clinicians to solve clinical problems and bring people together to do highly impactful research.”

New Registrar to provide student support in and beyond the classroom

Gustavo Luna brings interests in student wellness and technology to create new services to help students realize full potential

Written by Eileen Hoftyzer

Photo by Steve Southon

Gustavo Luna, Registrar and Director of Student Services, joined the Leslie Dan Faculty of Pharmacy's Registrar's Office in June 2022 after serving as Associate Director for the Global Executive MBA for Healthcare and the Life Sciences at U of T's Rotman School of Management. However, he is not new to the Faculty, having previously worked with the post-baccalaureate PharmD program that evolved into the PharmD for Pharmacists.

Luna spoke with writer Eileen Hoftyzer about his new role and his priorities.

What inspired your interest in the Registrar role at the Leslie Dan Faculty of Pharmacy?

The portfolio of the Registrar and Director of Student Services combines many of my professional interests, including the possibility to support students to help them realize their potential. The capacity to effect change at a larger scale through the creation and delivery of student services was also very attractive to me. I also have a background in technology, and there is an opportunity to deploy solutions to optimize processes that sounded appealing to me.

How does a Registrar support student experience?

Our team supports students in many ways. Admissions is part of the portfolio, so the Registrar's Office team supports students from the time they are candidates seeking admission and continues

with them in their journey until graduation. I see the Registrar's Office as a driver of excellence in student support to match and leverage the academic and research excellence at the Faculty. The excellence we can bring comes from helping students overcome barriers so they can focus on their learning and instructors can focus on their teaching and research.

What are your main priorities for student-focused support?

My priority is operational excellence, so the students receive effective and efficient support in every interaction with the Registrar's Office. My vision is to provide holistic support that goes beyond what learners need in the classroom to include wellness and promoting an inclusive environment and a sense of belonging for everyone in the community.

What keeps you motivated in your role?

At the core, I think it is the genuine drive to develop and enhance services for students and a personal commitment to helping them realize their full potential. I truly have an interest in helping people and helping them become the best they can be.

"I see the Registrar's Office as a driver of excellence in student support to match the academic and research excellence at the Faculty."



Research and education embedded in Discovery Pharmacy patient care



Pharmacists and pharmacy students help U of T community navigate campus health care services

Written by Eileen Hoftzyer
Photo by Steve Southon

During the Discovery Pharmacy's first year in operation, pharmacy staff and students worked to help meet its goal of being a place where research and education lead to innovations that provide better care within an interdisciplinary and increasingly integrated health care system. They have also succeeded in providing positive health care experiences for their patients and have helped many members of the U of T community navigate campus health care services.

"Accessing healthcare can be confusing for anyone, but there are definitely additional barriers for patients from outside of Canada, even for something as simple as getting a COVID-19 vaccination," says **Jonathan**

Nhan, lead pharmacist at the Discovery Pharmacy. "I'm proud that the Discovery Pharmacy team is engaged in putting services together to help U of T's international student community and excited to provide services that can enhance the quality of life for the whole U of T community."

As part of the on campus health care ecosystem, the Discovery Pharmacy is a fully accredited pharmacy, with a medication dispensary and pharmacy-based services including medication consultations, opioid overdose prevention training, and other services. In the first two months alone, more than 1,900 patients were enrolled at the pharmacy.

Education and research are embedded in daily functions and work in unison at Discovery Pharmacy.

Students are learning alongside practising pharmacists in an active clinical setting based right in the Leslie Dan Faculty of Pharmacy building. Pharmacists educate patients and train other health care professionals about opioid overdose prevention and other interventions. Pharmacists and students undertake research projects to evaluate and improve their services and the broader profession, including evaluating a student-led vaccination clinic and a student-led naloxone training program.

Launched only a few months before the Omicron wave hit Toronto, vaccinations were a significant focus of operations. In December 2021, U of T President Meric Gertler visited the Discovery Pharmacy to receive a COVID-19 booster dose and to learn more about the work of students, faculty and staff providing vaccines to the U of T community.

"It was really uplifting to have President Gertler at Discovery Pharmacy," says **Dean Lisa Dolovich** who administered the vaccination. "We had been working to immunize as many people as possible and it was very meaningful to be able to provide this service to President Gertler and so many others across U of T."



U of T President Meric Gertler visiting the Discovery Pharmacy in December 2021.

The Discovery Pharmacy team has also collaborated with U of T's Health and Wellness service and the Centre for International Experience to help meet the

needs of the U of T community. "Looking at innovative pharmacy service really starts with the patient and considering the impact a new approach could have in their life," adds Nhan. "These opportunities provide learners with the opportunity to understand the many components of patient care and apply the theory into practice. The environment also fosters collaboration and innovative ideas from our students so we can move the profession forward in a way that puts patient care at the centre of everything that we do."

In the last year, 15 pharmacy students worked part-time in the Discovery Pharmacy, while another 11 completed advanced pharmacy practice experience (APPE) rotations at the pharmacy in non-direct patient care, including participating in the pharmacy development process and research.

"My research project helped narrow down the technology options that bring the most benefit to the Discovery Pharmacy and its patients," said **Christy Mak** who completed her PharmD in 2021. "Staying up to date on innovative technologies helps us build a more efficient pharmacy system and promotes better patient care."

One of the key goals for the upcoming year is to expand the pharmacy's operations, moving into their permanent space on the first floor of the Leslie Dan Faculty of Pharmacy building and opening locations in other areas at U of T. They also hope to enhance virtual pharmacy care to improve person-centred care in a digital environment.

Ernie Avilla, executive director of the Discovery Pharmacy underscores that one of the Discovery Pharmacy's goals is to help improve the benefit pharmacy can bring as part of our interdisciplinary health system by advancing research into pharmacy-based innovations. "Everything we test and learn at the Discovery Pharmacy is through the lens of wanting to be able to share these learnings with our community," he says. "We want to make sure that what we develop at the Discovery Pharmacy doesn't live in an incubator but is actually able to expand to real community settings."



Equity Diversity and Inclusion Strategic Plan delivers roadmap for new initiatives

Dean Lisa Dolovich accepts recommendations from the first EDI Working Group

In June 2021, Dean Lisa Dolovich established the Equity, Diversity, and Inclusion Working Group at the Leslie Dan Faculty of Pharmacy. The Working Group was tasked with developing a strategy from which to build EDI initiatives at the Faculty and to draft terms of reference for a standing committee that will be integrated into governing Faculty Council.

Co-led by Dr. Lachmi Singh, Director, Education Programs and Administrative Services and Dr. Jillian Kohler, Professor and Director of the WHO Collaborating Centre for Governance, Transparency and Accountability in the Pharmaceutical Sector, the EDI Working Group submitted the Equity, Diversity, and Inclusion Strategic Plan 2021 to the Dean's Office in December 2021. The plan laid out recommendations on how to support a healthy and inclusive learning and work environment for everyone at the Faculty.

Specifically, the recommendations provide evidence-based guidance on how we can:

- Develop more EDI training opportunities for all members of our community to address issues of unconscious bias, mistreatment, and implementation of EDI into practice
- To create an environment where the principles of EDI have been realized in the recruitment, retention, and career development at LDFP
- To ensure the composition of LDFP committees and decision making bodies are inclusive and diverse, and its members are well educated in EDI principles
- To ensure that our programs and curricula prepare our graduates to meet the EDI needs of the communities they will serve in their careers in Canada and globally
- Develop/implement a data strategy to collect, maintain, interpret, report, and communicate data on EDI to improve effectiveness, accountability and transparency.
- Develop a mechanism or framework for feedback and complaints processes within the Faculty
- Incorporate EDI considerations into space planning and decision making

"I have received and accepted the recommendations of the EDI Working Group and thank the Working Group members for their thoughtfulness and dedication to building this roadmap for our Faculty," said Dean Lisa Dolovich, Leslie Dan Faculty of Pharmacy.

"It was crucial that we have input and engagement from across our community so that we can start to set priorities and move ahead in this important area."

The development of the EDI Strategic Plan coincided with final stages of the academic planning process, in which key priorities are identified and laid out as part of a five-year plan to guide efforts across the Faculty. This provided a significant opportunity to align priorities and resources for future implementation of new initiatives.

"The recommendations from the Equity, Diversity, and Inclusion Strategic Plan have been incorporated into our new, five-year Academic Plan which will be released in September 2022," said Dean Dolovich. "I look forward to continuing to make progress in our EDI work and to the future collaborations and initiatives we will build to achieve an even more dynamic and inclusive environment at the Leslie Dan Faculty of Pharmacy."

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The Leslie Dan Faculty of Pharmacy is grateful to our donors for their generous and ongoing support. Your continued donations are critical to advancing the Faculty’s top priorities each year and help ensure that our students continue to succeed.

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RANKED TOP 10 QS World Rankings (2021)

Office of Experiential Education

- **1,083** Preceptors
- **467** Rotation sites
- 2,585** Rotations
- **2,155** Direct patient care
- **430** Non-direct patient care

487,720

total rotation hours

- **1853** APPE rotation placements
- **732** EPE rotation placements
- **370,600** APPE rotations
- **117,120** EPE rotations

Our Programs

PharmD

- **942** Enrolled
- **234** Graduated

PharmD-MBA

- **1** Graduated

PharmD for Pharmacists

- **144** Enrolled
- **50** Graduated

International Pharmacy Graduate Program

- **182** Enrolled
- **167** Graduated

Undergraduate Summer Research Program

- **14** Students enrolled from Universities from across Canada

Pharmaceutical Chemistry

- **62** Enrolled
- **14** Graduated

Pharmaceutical Sciences

- MSc**
- **49** Enrolled
- **9** Graduated
- MScPhm**
- **4** Enrolled
- **2** Graduated
- PhD**
- **95** Enrolled
- **12** Graduated

Faculty and Staff

- **61** Staff
- **39** Continuing faculty (Teaching and Tenure)
- **6** Assisting Professors, Teaching Stream
- **104** Community-based and Affiliated Faculty

Discovery Pharmacy (DRx)

- **2,898** New patients
- **546** vials of flu vaccine administered
- **1,327** vials of COVID-19 vaccine administered
- **16** APPE students completed in-pharmacy rotations

Our Research

\$13.4M+

in total research funding awarded to Faculty researchers

- **\$7M+** Tri-Agency (CIHR, NSERC, and SSHRC)
- **\$2.6+** Private Sector
- **\$1.4+** Non-for-Profit Sector (including foundations)
- **\$2.3+** Government
- 103** Active Grants
 - **49** Tri-Agency
 - **26** CIHR
 - **15** NSERC
 - **2** SSHRC
 - **6** Other
 - **18** Government
 - **26** Not-for-profit
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- **10,500+** Alumni
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