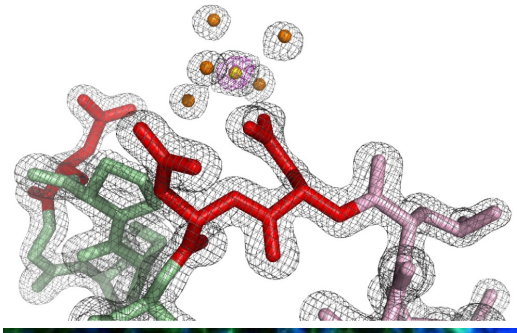
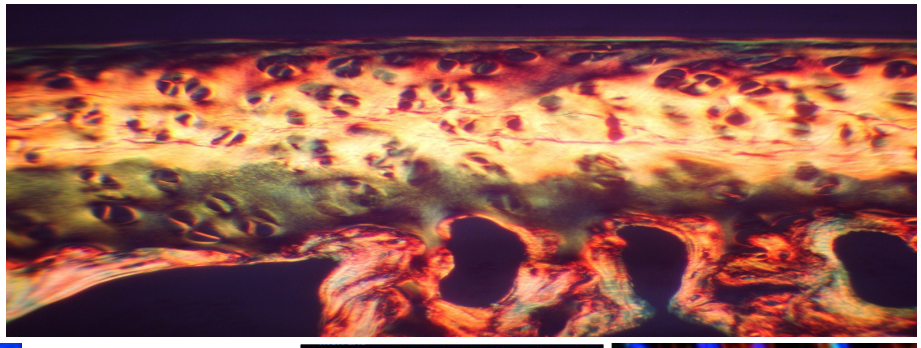
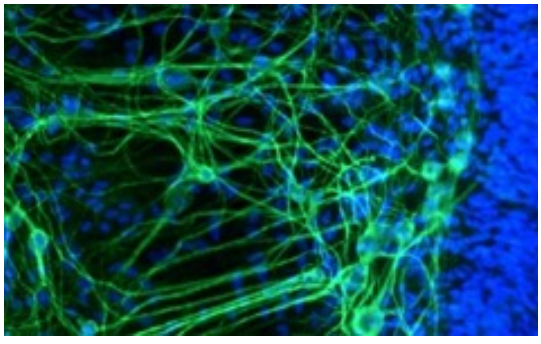
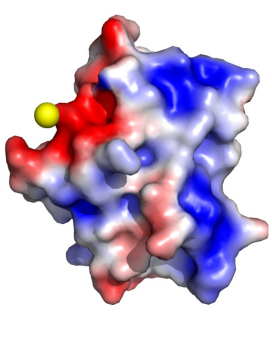
Department of Physiology and Pharmacology

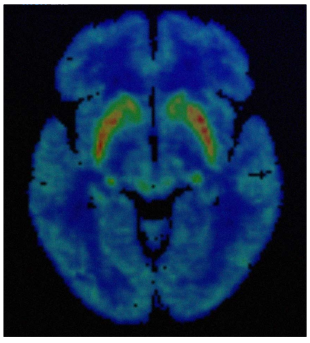
Self Study Report May 2022

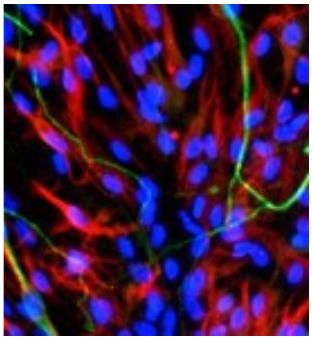












Schulich MEDICINE & DENTISTRY

Western

EXECUTIVE SUMMARY

The Department of Physiology and Pharmacology is the largest basic science Department in the Schulich School of Medicine & Dentistry. We are committed to represent both disciplines in teaching and research and have been focusing on further integration of our Physiology and Pharmacology programs over recent years. The Department carries a large teaching load in Western's BMSc curriculum and is responsible for additional course delivery across various programs (Medicine, Dentistry, Nursing, Kinesiology, Nutrition etc.). At the same time, the Department is heavily engaged in basic, translational, and clinical research with strong impacts demonstrated at the national and international levels. In addition, the Department remains strongly invested in graduate education, making important contributions to our own and in other graduate programs across campus.

Currently, the Department consists of 43 faculty members with their primary appointment in Physiology and Pharmacology, as well as 8 Basic Scientists in Clinical Departments (one of whom will retire in June 2022, reducing the total to 7). We also have 23 cross-appointees (most of them clinicians) who contribute to our activities, in particular on the research and graduate education side. The Department is supported by an outstanding administrative and technical team, and our facilities are in general appropriate for our research and teaching missions.

Undergraduate Teaching

Our Department currently operates 32 different courses for the BMSc and various other programs, and is by far the greatest contributor to undergraduate teaching in Schulich. Collectively, these courses have an enrollment of approximately 5,000 students per year, which has been fairly stable over the last 5 years. While we have seen a small decrease in 4th year course enrollment recently, this is due to termination of some courses because of faculty departures and will very likely be temporary. Our courses are highly desired by students; for example, we could only accept 46% of applicants for our 4th year thesis course module in 2020/2021.

One of our current priorities is further integration of our Physiology and Pharmacology curriculae. The success of these efforts is demonstrated by the HSP (Honours Specialization) modules chosen by our students. Our Progam was dominated by Physiology for the longest time, but we made a conscious effort promoting the combined Physiology and Pharmacology module. This has been impactful, with 70 % of our students choosing the combined module in the last year surveyed. We continue the update of our curriculum in this direction, for example by introducing a new combined Physiology and Pharmacology 2nd year course this coming Fall.

After graduation, approximately 40% of our students enter Medical or Dental School, 30% go on to graduate school, and 10% choose other professional programs. Thus, the vast majority of our graduates continue their education in fields highly relevant to our disciplines.

It is worth noting that in addition to our core teaching in BMSc, we contribute to many other programs including Medicine, Dentistry, Nursing (for both Western and Fanshawe College), Kinesiology, and

Nutrition. Individual faculty members also teach in courses offered by other programs, including Neuroscience and Interdisciplinary Medical Science.

Graduate Teaching

Our combined Physiology and Pharmacology Graduate Program continues to flourish. While enrollment has declined over recent years (from 87 in 2016/2017 to 66 in 2020/2021), this is partially offset by the larger number of students transferring to the PhD program. Reasons for the decline are likely multifactorial and include: a) declining research funding rates from both federal agencies and charities; b) a 20% reduction in the number of faculty members in the Department; c) effects of the Covid-19 pandemic; and d) competition from other graduate programs, including new course-based MSc programs as well as, for example, the Neuroscience Graduate Program at Western. With regards to the Neuroscience Program, it should be noted that Physiology and Pharmacology Department members supervise 37 graduate students in this program, in addition to the aforementioned 66 in our own program. Again, individual faculty members supervise additional graduate students in programs in Schulich, Health Sciences, Science, and Engineering.

Despite the lower student numbers, our program remains highly successful. Most notably, publications with our graduate students as authors have increased from 54 in 2016 to 94 in 2021. Our graduate students remain highly successful with regards to external and internal scholarships. The vast majority of our graduates stay within the medical/STEM field, including professional schools, postdoctoral training, and industry.

Similar to our undergraduate program, we are currently focusing on further integration of our two disciplines in graduate training. Another focus of our efforts is to increase the diversity of our students, for example through the creation of our new *Physiology and Pharmacology Graduate Opportunity Scholarship* aimed at members of underrepresented groups. In addition, we realize that our graduate students are increasingly interested in non-academic careers, and we make efforts to incorporate relevant elements into our training (much of it in conjunction with similar initiatives being implemented by Schulich and SGPS).

Research

Our Department maintains a diverse and highly successful research operation, with a focus on systems and translational research at multiple levels, from molecules to organisms. Areas of particular strength are: clinical and basic pharmacology; bone and joint; cell, stem cell and cancer; heart, blood vessels and lungs; reproduction, development and metabolism; neuroscience, neurodegeneration and cognition.

From 2016 to 2021, members of the Department received $46M in external research funding, including $36M in operating grants. These funds also include $5M for research chairs, including 5 current and 4 previous CRCs. In addition, department members obtained an extra $5.6M through internal competitions. Department members were also awarded many additonal internal and external salary awards, collectively demonstrating strong recognition of our research excellence. In line with these accomplishments, department members hold multiple leadership roles in funding agencies, scientific journals, research

societies and conference organization at national and international levels. Maybe most impressive is the large and growing number of peer-reviewed publications from the Department. The total number of these publications steadily grew over the last years, from 181 in 2016 to 330 in 2021 – an 82 % increase!

Although research activities in and beyond the Department face a number of serious challenges, we are confident that these patterns will continue, through a focus on excellence in interdisciplinary and collaborative research.

Challenges

While we are confident that the Department is performing extremely well in undergraduate and graduate teaching as well as in research, we are challenged by a number of substantial risks.

Most notably, with the retirement of Dr. Watson in June of 2022, we are experiencing a 20% decline in faculty contingent compared to 2016, when we had 49 faculty members with a primary appointment and 11 Basic Scientists in Clinical Departments (as opposed to 43 and 7, respectively, this coming July). Moreover, 60% of our faculty members have reduced teaching loads due to higher allocation of time for research and/or service. While we have managed to continue providing the highest quality of contributions despite the gradual loss of faculty contingent over the last years, this has come at the expense of work-life balance for many key contributors and in some cases at the expense of research time. Furthermore, our teaching demands will increase drastically over the next few years during the ongoing expansion of our BMSc program. Without additional recruitment, faculty engagement in undergraduate teaching will have to increase substantially, which in turn will result in reduced research success and/or reduced quality of our teaching. Collectively, this 20% decrease in faculty contingent while facing a 50% or higher increase in teaching demands is the biggest challenge our Department is facing.

One particular aspect of our faculty contingent that requires solutions is the lack of diversity, with a paucity of female faculty members and members of other underrepresented groups. We are committed to address this serious problem and have initiated steps in this direction, but ultimately this can only be solved through recruitment of additional faculty.

A second challenge is uncertainties in the research environment, for example with low success rates for peer-reviewed operating funds from Tri-councils and charities as well as issues around core and animal facilities at Western. These challenges are not unique to our Department, but as a heavy user of, for example, rodent and primate facilties, they affect us disproportionally. Since our research and graduate programs are so closely linked, all these issues also directly affect the number of graduate students we can accept and the quality of their training.

Both of these challenges have been amplifed by the Covid-19 epidemic. Given the size of our teaching program, multiple switches between in-person and virtual teaching, and parallel preparation of multiple teaching formats, became extraordinarily taxing on all of our faculty and staff. Similarly, research restrictions have affected all of us, but in particular researchers relying on animal or human subject research, e.g. the vast majority of our Department members. Managing all of these challenges, while looking out for the well being of our students, staff, colleagues and families, have taken a large toll and

delayed important initiatives. For example, we have put the development of our strategic plan on hold because of all the other demands on our time, but we will resume this essential activity this summer. Similarly, several updates to our undergraduate and graduate curriculae and further integration of research activities were delayed, but we are ready to move forward now.

In closing, we believe the Department has performed extremely well over the last years. We are confident that we can continue along this path and further develop all of our initiatives, but we need support with faculty recruitment and research in facing the key challenges outlined.

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ADMINISTRATION

Overview

The administrative structure of the Department of Physiology and Pharmacology has undergone substantial evolution since its creation in 2002 when the Department of Physiology and the Department of Pharmacology and Toxicology merged. We started with a "blank-slate" and developed our own model that has now evolved into a vibrant, well-respected and highly-productive academic Department.

Governance

Leadership in our Department comes from the Chair, the Chairs of the working committees on undergraduate studies, graduate studies, and research, the administrative and technical officers, and the Executive Committee (**Figure 1**). Support and development of new leaders is always kept in mind, with aspects of this done through executive groups on undergraduate and graduate studies to train the next committee Chairs.

Attention is given to encouraging professional development for faculty members and staff. Faculty members are supported in planning sabbatical leaves to invigorate their research; typically one to two faculty take sabbatical each year. Staff are encouraged to participate in courses offered by the University or outside of the university to increase their ability to carry out elements of their work and to promote leadership and workplace skills. Our Manager, Administration and Finance and our Research Administrator have both completed the Canadian Institute of Management (CIM) designation bringing new expertise to their positions. We are also fortunate to have an exceptional staff member in the role of Laboratory and Facilities Manager. The leadership of our Managers has brought Department staff together as a productive and efficient unit that supports our key missions in teaching and research.

Communication and engagement is a challenge for our large, geographically-dispersed Department. To facilitate this, the Chair sends a monthly newsletter to all members that contains updates from the various committees, upcoming events, awards won by Department members and information relevant to our disciplines. Academic and social events bring Department members, and often their families, together for shared experiences. While the Covid-19 pandemic has limited these opportunities, we are now ready to reengage in gatherings and in-person interactions. The Chair meets yearly for lunch with graduate students, postdoctoral fellows and research technical staff as separate groups to allow each to raise and discuss issues of interest to their membership. These lunches are productive for addressing concerns or for the generation of new ideas. The Chair has an annual meeting with each faculty member to discuss issues that the individual would like to raise and progress and plans for the coming year. For these meetings, the Chair generally goes to the faculty member's office, thus being on the faculty member's "turf" to facilitate openness in communication and make the meeting less formal. Again, the pandemic required to move these meetings to Zoom, but in person meetings will resume in the next cycle.

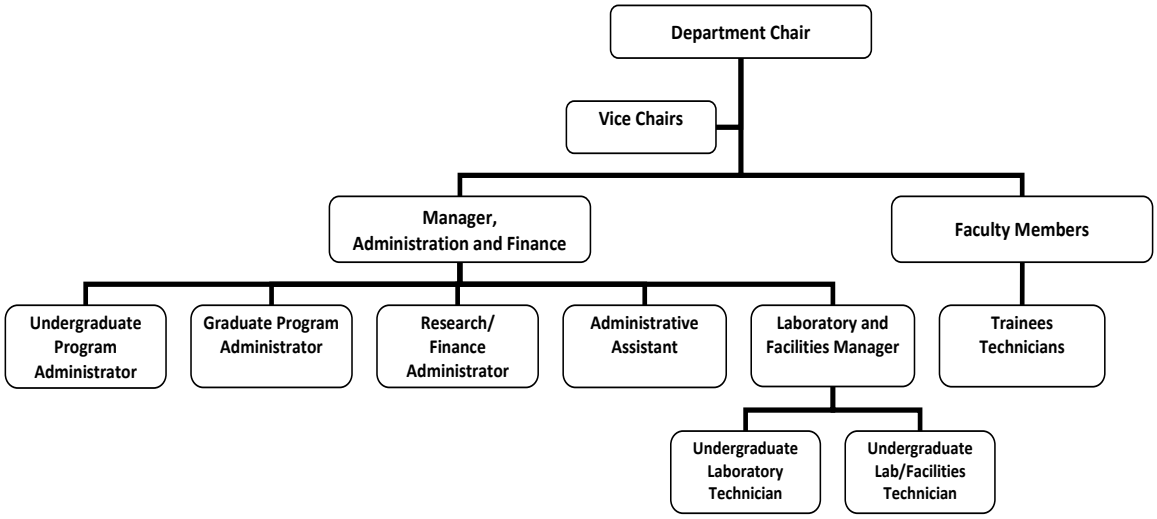

Figure 1: Organizational Chart of Administrative Structure

Administrative and Technical Staff

The Department's administrative and technical staff provide support to our faculty and students and ensures the effective and efficient implementation of our Department's plans. The key areas of focus are teaching, research, and administration. For example, administrative staff members provide support for student enrollment, new course offerings, recruitment of new faculty members, new research collaborations, and expanded space and facilities.

The administrative staff are challenged by a constantly changing environment and are faced with multiple tasks, competing deadlines, dynamic changes in priorities, and new initiatives. Members of our Department are spread-out in various physical locations on campus and across the city. To promote interaction and collegiality, effective, timely, and appropriate communication is essential. The administrative functions of our Department also encompass a broad scope of activities that impact many different areas and departments at the University.

Working closely as a team, the administrative staff are aware of each other's responsibilities and are able to job share as the need arises. They are also encouraged to take initiative and to participate in professional development opportunities. The result is an administrative team that is very successful at supporting the strategic and operational needs of our Department.

Manager, Administration and Finance: *Sue-Ann Becker*

The *Manager, Administration and Finance*, is accountable for the effective and efficient operation of our Department and leads the administrative team to ensure that the Department's strategic and operational needs are met. In addition, Sue-Ann oversees all human resources and budgetary processes in the Department. The position is accountable to the Department Chair and acts in an advisory role to the Chair on all aspects of the administrative operations of our Department. Sue-Ann was awarded the *Schulich Dean's Award of Excellence, Staff* in 2008.

Undergraduate Program Administrator: *Michele Grigg*

The *Undergraduate Program Administrator* is responsible for the management of all aspects of our Department's undergraduate education program and acts as liaison between the students, the Undergraduate Chair, course managers, Registrar's office, and the Faculty of Science. Responsibilities include coordinating the preparation of course outlines, lecture schedules, and timetables; overseeing all functions of OWL; organizing and conducting course evaluations; preparation of examinations, proctoring exams, special permissions,

student exam review and the compilation of marks. The position also provides support to the Undergraduate Studies Committee, and coordinates the appointment process for teaching assistants, work-study students, summer students, and volunteers. Michele was awarded the *Schulich Dean's Award of Excellence, Staff* in 2011.

Graduate Program Administrator: *Olga Krougly*
The *Graduate Program Administrator* is responsible for the management of all aspects of the graduate program within our Department and acts as a liaison between the students, the Graduate Chair, course managers, graduate supervisors, and the School of Graduate & Postdoctoral Studies. Responsibilities include overseeing the online application and admission process; preparation of an annual financial package for each student; processing all student stipends, scholarships, and awards; monitoring student progress; coordinating course enrollment and submitting grades; and advises students on examination and thesis submission process. In addition, the position provides support to the Graduate Studies Committee, coordinates the appointment process for postdoctoral scholars, and tracks vacation/sick days for departmental administrative and research personnel.

Research and Finance Administrator: *Penny Sim*
The *Research and Finance Administrator* is responsible for the management of all administrative processes associated with the research activities of faculty members in our Department. This includes overseeing the ROLA process for submission of grants; ensuring tri-council grant expenditures meet required guidelines; purchasing, accounts receivable, and purchasing cards; expense claims, and cash advances. In addition, the position provides administrative support to our Department's Research Committee; coordinates all aspects of the annual promotion and tenure process; and assists the Manager, Administration and Finance with monitoring operating budget expenditures. Penny was awarded the *Schulich Dean's Award of Excellence, Staff* in 2015.

Administrative Assistant: *Vacant (recruitment in progress)*
The *Administrative Assistant* provides administrative support in the department office for daily operations and provides back up for other members of the administrative team as required. Specific duties include organizing the Department's seminar series; scheduling meetings for the Department Chair and committees (e.g. APE); travel arrangements and itineraries for guest speakers and faculty recruitment; coordinating all aspects of our Department's Research Day, Lectureship, and social events; and scheduling of the department boardrooms. In addition, the position provides administrative support to the Chair and the Manager, Administration and Finance on special projects, and to various departmental committees. Olga Krougly held the position from September 2016 to April 2022 at which time she was promoted to Graduate Administrator. We are in the process of recruiting a replacement.

Laboratory and Facilities Manager: *Christie Vanderboor*
The *Laboratory and Facilities Manager* is responsible for overseeing all aspects of our Department's technical operations and resources, including Health & Safety; communication equipment and videoconferencing; IT and website; security; purchasing; core equipment and facilities; emergency preparedness; chemical inventory management; and special assignments (e.g. building renovations). The Laboratory and Facilities Manager leads the technical staff to ensure that our Department's strategic and operational needs are met. Christie was awarded *The Vice-Provost Team Award for Excellence in Online Teaching and Learning* in 2021.

Undergraduate Laboratory Technician: *Hailey Hunter*
The *Undergraduate Laboratory Technician* is responsible for all technical aspects of our undergraduate teaching laboratories including training teaching assistants; scheduling of all faculty, staff, and students in multiple labs and classrooms; purchasing equipment, in consultation with the Laboratory and Facilities Manager; equipment maintenance; the purchasing and care of experimental animals; purchasing and inventory control of all supplies; and the management of online teaching modalities. We offer two laboratory courses each academic year, and these involve approximately 300 undergraduate students, 15 graduate students, 45 teaching assistants, 25

faculty members, and 2 full-time technicians. In addition, Hailey oversees the shipping/receiving of all departmental equipment, supplies and chemicals. This position requires special expertise in both physiology and pharmacology laboratory techniques.

Undergraduate Laboratory and Facilities Technician: ***Vacant (recruitment in progress)***
The *Undergraduate Laboratory and Facilities Technician* is responsible for the shipping/receiving of all departmental equipment, supplies, and chemicals including recording and tracking of receivables, and troubleshooting with suppliers. The position is also responsible for the daily upkeep, monitoring, and troubleshooting of core departmental facilities and equipment, and works closely with the Undergraduate Laboratory Technician to ensure that the technical challenges of offering a large and diverse undergraduate teaching laboratory are met. This position requires special expertise in both physiology and pharmacology laboratory techniques.

Faculty Members

The Department of Physiology and Pharmacology was formed in 2002 by 23 faculty members with their primary appointment in the Department of Physiology and 8 faculty members in the Department of Pharmacology & Toxicology. This was brought to a total of 32 faculty with the recruitment of a new Department Chair.

Our Department has grown substantially in subsequent years, with 49 faculty members holding their primary appintment here in July 2016 (**Table 1**). In addition, our Department had 11 Basic Scientists in Clinical Departments in 2016 (**Table 2**). These Scientists contribute to our teaching and research mission, while we are responsible for their mentoring, promotion and/or tenure, annual performance evaluation, and other activities as outlined in our collective agreement. Unfortunately, due to retirements, departures, and one untimely death (without ability to hire to replace all of these individuals) the number of faculy members with primary appointments in our Department has declined from 49 to 43 since 2016, and the number of Basic Scientists in Clinical Departments has declined from 11 to 8 (with one additional retirement [A. Watson] in June of 2022). Thus, the number of faculty contributing to our mission changed from 60 in 2016 to 50 by the summer of 2022, a decrease of 20%. This decline is of grave concern since it comes at a time where our undergraduate enrollment, and thus the demand on our teaching, is about to increase drastically due to the expansion of the BMSc program, where the majority of our teaching occurs. It should be noted that despite the steady decline in faculty numbers over the last 5 years, the number of students taught by us remained at the same level, and the number of our peer-reviewed publications increased markedly. However, with the dramatic increase in undergraduate enrollment starting this fall, this level of productivity is not sustainable.

Two additional factors aggravate the described faculty shortage, in particular for our teaching mission. First, several department members hold significant leadership positions outside of (Rylett, CIHR Institute Director; Hill, LHRI Director) or within (Urquhart, Drysdale, Regnault, decanal positions; Gross, Animal Care; Saksida, BrainsCAN) Western University. While these leadership roles speak to the status and accomplishments of our faculty members, their increased service workloads reduce their contributions to our teaching programs. Second, many of our faculty members have a research-intensive workload (typically 60 % research) based on their initial contracts (e.g. those hired as Robarts Scientists or as Basic Scientists in Clinical Departments) or because they received CRCs or other research chairs. Again this speaks to the research excellence of our department, but also reduces their contributions to teaching. As of July 2022, no less than 30 of our 50 department members have teaching workloads lower than the usual 40 %, most commonly 20 %.

Currently we also have 23 Cross-appointees, 14 of them clinicians (**Table 3**). These individuals generally contribute little to our classroom teaching, but they facilitate interdisciplinary and translational research and enhance the training experience of our Honors and graduate students as well as postdoctoral fellows. In addition to these individuals, we typically have between 3 and 5 limited-duties faculty members appointed in

our Department to carry out specific teaching responsibilities, and we currrently have 7 Adjunct Professor appointees (e.g. recent retirees who maintain research activities).
Faculty complement in the Department is not reflective of the diversity in our population and student body. Only 16 faculty members of 50 are female (32%); 6 of these 16 are education-focused faculty, resulting in even lower representation of females amongst faculty with 40 % (or higher) research workloads (23%). Only 14% of our faculty members represent visual minorities. Data on other under-represented groups are missing but likely very low.

Analysis of Faculty Complement

Primary appointees

- Between 2016 and 2022, 15 faculty members have left the department due to new appointments, retirements, and death, with one additional retirement this summer (Watson).
- Over the same six years, we have recruited 6 new faculty members (Bell, Birceanu, Domnik, Grol, V. Lu, Schmitz), resulting in a net loss of 10 faculty members (20 %). Please note that N. Domnik, who was hired to teach in the IMS program in 2021 and has left earlier this year, is counted under both recruitments and departures.
- 60 % of our faculty have reduced teaching workloads, most typically 20 %.
- Faculty complement in the Department is not reflective of the diversity in our population and student body.
- Looking forward, 8 faculty members with primary appointments in our Department and 3 Basic Scientist in Clinical Departments will reach their regular retirement age over the next 5 years.

Table 1: Primary Appointees for the years 2016 - 2021

#	Name	Rank	Tenure	Joint Appoint	Cross-Appoint	Institute-Hospital	Start Year	Normal Retire-Depart
1	Donglin Bai	Professor	Yes				2002	2025
2	Frank Beier	Professor	Yes			CHRI	2001	2031
3	Christine Bell	Assistant Prof	Limited Term				2021	2023*
4	Dean Betts	Professor	Yes		ObsGyn, Biology	CHRI, LHRI	2008	2034
5	Angela Beye	Assistant Prof	Limited Term				2012	2024*
	Moshmi Bhattacharya	Associate Prof	Yes		Oncology		2005	Depart 2017
6	Oana Birceanu	Assistant Prof	Limited Term				2021	2026*
7	Nica Borradaile	Associate Prof	Yes				2012	2038
8	Tim Bussey	Professor	Yes			Robarts	2015	2027
9	Nicole Campbell	Assistant Prof	Limited Term		BMSUE		2015	2023*
10	Peter Chidiac	Professor	Yes		Biology		1998	2026
	John Ciriello	Professor	Yes				1980	Retired 2020
11	Brian Corneil	Professor	Yes	Psychology		Robarts	2003	2037
12	Sean Cregan	Associate Prof	Yes			Robarts	2007	2033
13	Fabiana Crowley	Assistant Prof	Limited Term				2015	2023*
14	Lina Dagnino	Professor	Yes		Oncology	CHRI, LHRI	1998	2025
15	John Di Guglielmo	Associate Prof	Yes				2005	2035
	Jeffrey Dixon	Professor	Yes		Dentistry		1987	Retired 2018
	Nicole Domnik	Assistant Prof	Limited Term		BMSUE		2021	Depart 2022
16	Stefan Everling	Professor	Yes		Psychiatry, Psychology	Robarts	2000	2033
17	Qingping Feng	Professor	Yes		Medicine	CHRI, LHRI	2005	2028
18	Mel Goodale	Professor	Yes	Psychology			1999	2008
19	Paul Gribble	Professor	Yes	Psychology			2000	2037
20	Matthew Grol	Assistant Prof	Probationary				2020	2051
21	Robert Gros	Associate Prof	Yes		Medicine	Robarts	2007	2033
22	David Hess	Associate Prof	Yes			Robarts, CHRI, LHRI	2007	2036

23	Wataru Inoue	Associate Prof	Yes			Robarts	2014	2043
	Douglas Jones	Professor	Yes				1977	Retired 2019
	Morris Karmazyn	Professor	Yes				1989	Depart 2016
24	Marlys Koschinsky	Professor	Yes		Biochemistry	Robarts	2015	2024
	Jamie Kramer	Assistant Prof	Probationary	Biology			2014	Depart 2019
	Stan Leung	Professor	Yes		Clinical Neuro Sci		1980	Retired 2020
	Stephen Lomber	Professor	Yes	Psychology			2006	Depart 2019
25	Van Lu	Assistant Prof	Limited Term				2021	2045
26	Wei-Yang Lu	Professor	Yes			Robarts	2009	2022
	Edmund Lui	Associate Prof	Yes				1980	Retired 2017
	Sarah McLean	Assistant Prof	Limited Term	ACB	BMSUE		2012	Depart 2021
27	Julio Martinez-Trujillo	Professor	Yes		Psychiatry	Robarts	2014	2032
28	Adrian Owen	Professor	Yes	Psychology	Clinical Neuro Sci		2010	2031
29	Chris Pin	Professor	Yes		Oncology, Paediatrics	CHRI	2000	2035
	Michael Poulter	Professor	Yes		Clin Neur Sci	Robarts	2007	Deceased 2019
30	Marco Prado	Professor	Yes	ACB		Robarts	2008	2030
31	Vania Prado	Professor	Yes	ACB		Robarts	2008	2029
32	Andrew Pruszynski	Associate Prof	Yes	Psychology	Comp Sci, Biomed Eng	Robarts	2014	2047
33	R. Ramachandran	Associate Prof	Yes				2015	2045
34	Jane Rylett	Professor	Yes			Robarts	1982	2018
35	Lisa Saksida	Professor	Yes			Robarts	2016	2035
36	Taylor Schmitz	Assistant Prof	Probationary				2021	2046
37	Cheryle Séguin	Associate Prof	Yes			CHRI	2009	2042
38	Peter Stathopulos	Associate Prof	Yes				2014	2038
	Thomas Stavraky	Lecturer	Limited Term				1998	Retired 2021
39	Rommel Tirona	Associate Prof	Yes		Medicine		2005	2033
40	Brad Urquhart	Associate Prof	Yes		Medicine, Paediatrics	LHRI	2009	2043
41	Rennian Wang	Professor	Yes		Medicine	CHRI, LHRI	2000	2022
42	Don Welsh	Professor	Yes			Robarts	2015	2029
43	Anita Woods	Assistant Prof	Limited Term				2008	2024*

*Limited Term appointment end date – rolling appointments

Table 2: Basic Scientists in Clinical Department Appointees for the years 2016 - 2021

#	Name	Rank	Tenure	Primary Appoint	Institute-Hosp	Start yr	Normal Retire-Appt End Date
	Andy Babwah	Associate Prof	Yes	ObsGyn	CHRI	2005	Departed 2017
1	Thomas Drysdale	Associate Prof	Non-tenure	Paediatrics	CHRI	1995	2022*
2	Sean Gill	Associate Prof	Non-tenure	Medicine	LHRI	2012	2026*
3	Daniel Hardy	Associate Prof	Yes	ObsGyn	CHRI, LHRI	2008	2038
4	David Hill	Professor	Non-tenure	Medicine	LHRI	1998	2025*
5	Timothy Regnault	Associate Prof	Yes	ObsGyn	CHRI	2005	2030
6	Ute Schwarz	Assistant Prof	Non-tenure	Medicine	LHSC	2013	2022*
7	Ruud Veldhuizen	Associate Prof	Non-tenure	Medicine	LHRI	1997	2025*
8	*Andrew Watson*	*Professor*	*Yes*	*ObsGyn*	*CHRI*	*1992*	2025##
	Kaipang Yang	Professor	Yes	ObsGyn	CHRI	1996	Retired 2020

*Non-tenure appointment end date – rolling appointments

Will retire June 30, 2022

Table 3: Cross-Appointed Faculty Members for 2021

#	Name	Rank	Tenure	Primary Appoint	Institute-Hospital	Cross Appt End Date
1	Tom Appleton	Assistant Prof	Clinician	Medicine	LHSC	2022
2	Samuel Asfaha	Associate Prof	Clinician	Medicine	LHSC	2026
3	Arthur Brown	Professor	Yes	Anatomy-Cell-Biol	Robarts	2025
4	W. David Colby	Associate Prof	Clinician	Micro-Immunology	LHSC	2025

5	Douglas Fraser	Associate Prof	Clinician	Paediatrics	LHSC, CHRI	2025
6	Jeff Frisbee	Professor	Yes	Medical Bio-Physics		2025
7	Rishi Ganesan	Assistant Prof	Clinician	Paediatrics	LHSC	2022
8	F. Garcia-Bournissen	Associate Prof	Clinician	Medicine	LHSC	2024
9	Jayne Garland	Professor	Yes	Health Sciences		2022
10	Laksham Gunaratnam	Associate Prof	Clinician	Medicine	LHSC	2025
11	Janine Hutson	Assistant Prof	Clinician	Obs/Gyn	LHSC	2024
12	Greg Kelly	Professor	Yes	Biology		2024
13	Richard Kim	Professor	Clinician	Medicine	LHSC	2024
14	Dale Laird	Professor	Yes	Anatomy-Cell-Biol		2025
15	John McGuire	Associate Prof	Yes	Medical Bio-Physics		2025
16	Penny MacDonald	Associate Prof	Clinician	Clinical Neurol Sci	LHSC, Robarts	2023
17	Ruth Martin	Professor	Yes	School Comm Sci		2023
18	Jamie Melling	Associate Prof	Yes	Kinesiology		2022
19	Stephen Pasternak	Associate Prof	Clinician	Clinical Neurol Sci	LHSC, Robarts	2022
20	Michael Rieder	Professor	Clinician	Medicine	LHSC,CHRI,Robarts	2024
21	Kevin Shoemaker	Professor	Yes	Kinesiology		2025
22	Aze Wilson	Assistant Prof	Clinician	Medicine	LHSC	2023
23	Cory Yamashita	Associate Prof	Clinician	Medicine	LHRI	2024

Clinical Pharmacology

A strong, mutually beneficial association exists between the Department of Physiology & Pharmacology and the Division of Clinical Pharmacology & Toxicology in the Department of Medicine. Based on the number and expertise of its members and their internationally-acclaimed research accomplishments, Western's Clinical Pharmacology Division is the strongest in Canada and one of the top in North America. The main areas of clinical and research expertise in the Division of Clinical Pharmacology and Personalized Medicine, Pediatric Clinical Pharmacology, Adverse Drug Reactions and Toxicology, and Hypertension and Vascular Health. The Division consists of a critical mass of clinical [Drs. Alfonsi, Dresser, Gryn, Hackam, Kim, Mackenzie, Railton, Rieder, Schwarz, Spence, Van Uum] and basic [Drs. Gros, Tirona, Urquhart] scientists. Recently, Dr. Facundo Garcia-Bournissen, a pediatrician-scientist, was recruited to become the Chair of the Division of Pediatric Clinical Pharmacology and Dr. Janine Hutson was recruited as an expert in maternal-fetal medicine in the Department of Obstetrics and Gynaecology. In addition, Dr. Aze Wilson, a gastroenterologist, recently received her Ph.D. under the supervision of Dr. Kim, and is now cross-appointed to the Division. Drs. Kim, Rieder, Garcia-Bournissen, Hutson and Wilson hold cross-appointments with the Department of Physiology & Pharmacology.

The Personalized Medicine program is lead by Dr. Kim, a world-leading expert in in pharmacogenomics. Dr. Kim opened Canada's first personalized medicine clinic at University Hospital in 2008, where patients are treated based on genetic make-up. Dr. Kim's clinic and research focuses on specific therapies including cancer treatments, oral anticoagulants, immunosuppressives and cardiovascular medications. The Pediatric Clinical Pharmacology program is led by Dr. Garcia-Bournissen who runs the FRAME (Fetal Risk Assessment from Maternal Exposure) clinic and Dr. Rieder, the pediatrician-scientist leading the ADR (Adverse Drug Reaction) clinic and Drug Safety Laboratory (DSL). The Hypertension and Vascular Health program is supported by clinics run by Drs. Dresser, Gryn and Hackam. Dr. Spence leads the Stroke Prevention & Atherosclerosis Research Centre (SPARC) at Robarts Research Institute.

Members of the Clinical Pharmacology Division are active participants in the undergraduate and graduate teaching programs of our Department. They are popular mentors for M.Sc. and Ph.D. students, and are involved in the Clinical Pharmacology, Human Toxicology and Pharmacokinetics courses of our undergraduate and

graduate student curricula, and participate in the BMSc Honor's Specialization in Physiology & Pharmacology program.

Department Committees

Current Committee Mandates

There are nine Standing Committees and four UWOFA-mandated elected Committees in the Department. https://www.schulich.uwo.ca/physpharm/about_us/committees.html

- An Executive Committee oversees operations in the Department and advises the Chair. The mandate is to bring issues forward so that they can be dealt with in an expedient manner, or given to a Department working committee for discussion and implementation after approval by our faculty members at large. The Executive Committee is comprised of the Chair, Vice-Chairs, the chairs of the undergraduate, graduate, research, and EDID committees, the Manager of Administration and Finance, and the Laboratory and Facilities Manager.
- Four UWOFA-mandated Committees with the composition determined by election from Members in the unit according to procedures laid out in the Collective Agreement. These Committees: (1) carry-out annual performance review of all UWOFA members appointed in our Department, (2) are involved in assessment of current and potential faculty members for appointments, (3) evaluate promotion and tenure, and (4) develop guidelines for workload distribution and evaluation for faculty members.
- Five major working committees are responsible for implementation and oversight of (1) undergraduate and (2) graduate student education programs, (3) advice on changes to the research environment, coordination of joint aplications (e.g. NSERC-RTI) and organization of research activities such as our Department Research Day and lunch-and-learn sessions, (4) organization of our seminar program, and (5) oversight of space utilization and the development and management of multi-user facilities.
- We recently formed a new EDID (Equity, Diversity, Inclusion and Decolonization) committee to identify barriers to EDID in the Department and develop strategies to overcome these barriers.
- Two additional committees: (1) are responsible for ensuring that health and safety requirements and regulations are brought to the attention of Department members in a timely manner and advising on special needs, and (2) organize our Department's social activities and outreach events.

Assessment of Current Committees and Additional Needs

- The function of our large Undergraduate and Graduate Studies Committees is facilitated by Executive Committees. These Executive Committees meet as needed, as well as once per month with the Department Chair to manage issues as they arise. The full Committees meet at approximately bi-monthly intervals to carry out the normal work of the Committees. In this way, the Executive Committees are more responsive to the many issues that arise requiring short timelines for action without the need to engage the entire Committees.
- We participate in a range of outreach and recruitment activities, such as Open Houses for prospective undergraduate and graduate students, and engagement of high school students in higher education. We also distribute monthly an electronic newsletter to Department members and students. The Departmental Twitter account (https://twitter.com/westernuPandP) provides real time updates on events, awards, publications etc.; it currently has more than 700 followers. Based on the increasing flow of information and need for co-ordination of activities, we need to reactivate our former **Communications Committee** to monitor our needs related to outreach and to coordinate the preparation of promotional materials and activities.

- All current Department Committees are fulfilling their mandates.

Operations

Our Department strives to offer its members consistent and informative outlines of policies and procedures. For faculty members, this is demonstrated by the use of a set of documents describing functions such as, APE proceedures, cross appointments, mentoring committee and normal workload, which can be accessed on our Faculty Resources page.

Research Laboratory Support

Our Department has developed many standardized policies and procedures to simplify routine tasks for our members. These include: a Purchasing Guidelines document, a document on how to place an expense claim, an Emergency & Non-Emergency UWO Contact list, and essential Occupational Health and Safety information.

These procedures are available on our Department's website and are also provided to faculty members and research staff to post in their laboratories. A goal of these documents is to assist our researchers by providing service that reduces time spent by grant-paid research staff in administrative functions. Another objective is to ensure that current procedures are clearly articulated so they can be followed uniformly.

Resources

Physical Facilities

Department Administrative Offices and Teaching Laboratories

The Administrative home of our Department is housed in the Medical Sciences Building, in a space comprised of four workspaces, two manager's offices and the Chair's office. Our undergraduate student teaching laboratories are situated in the adjacent Dental Sciences building, providing us with wet and dry laboratory facilities, three meeting rooms and a cell culture room; the modular layout can be tailored to the needs of the specific courses offered within this space. The wet lab holds 80 students, while the dry lab side holds 50 students. Each meeting room is equipped with a projector and screen and can hold 15 people. This dynamic space is central to our department and is multifunctional, servicing several departments within Schulich.

Research Laboratory Locations

Our Department Faculty members lead research programs at sites throughout London. Major allocations of research space have been made to our researchers and their trainees at the following sites:

- Western Medical / Dental Sciences Complex: Medical Sciences Building 2nd floor, Dental Sciences Building 2nd floor Dental Sciences Building (Lower Ground) and Dental Science Addition [Lower Ground and Lower Lower Ground floors]

- Robarts Research Institute
- Brain and Mind Institute [Natural Sciences Centre] and the Western Interdisciplinary Research Building
- London Health Sciences Centre and Lawson Health Research Institute, including Victoria Research Laboratories, University Hospital and St. Joseph's Hospital

Many faculty members in our Department have their laboratories located within collaborative research groups, such as the Skeletal Biology Labs [associated with the Bone and Joint Institute], thus creating opportunities to share common interests and research infrastructure. This proximity enhances the interaction around research themes and also serves to promote effective co-supervision of trainees in interdisciplinary environments.

Our faculty and student members are spread across campus and across various sites in the city, which had historically limited the frequency with which individuals can be present at Department meetings and seminars. We have overcome this barrier by increased use of videoconferencing and networking technologies, such as Zoom and Teams, which became routine during the pandemic. We have recently updated the audiovisual technology in one of our three board rooms to enable hybrid in person and remote meetings. In addition, we have received capital investment from Schulich for similar upgrades to our additional two board rooms which are currently underway. These infrastructure improvements increase accessibility for our department members and the increased use of videoconferencing has increased seminar and meeting attendance.

Space and Facilities

Members of the Department of Physiology and Pharmacology have taken leadership roles in establishing and maintaining many shared research facilities within our Department and the Schulich School of Medicine & Dentistry. These represent the successful outcome of initiatives led by faculty members, including CFI/ORF infrastructure grants, NSERC Research Tools and Instruments grants, and other joint grants that have enabled the purchase and use of shared equipment. As such, housed within our department we have several shared facilities and specialized equipment.

- Immunofluorescence microscopy and cell manipulation suite
- Optical and fluorescence imaging laboratory enabling high-speed imaging of living cells
- Echocardiography laboratory
- Common radioisotope laboratory
- Agilent Seahorse analyzer for mitochondrial investigation
- Mass spectrophotometer
- Bioreactor and biomechanical testing suite
- Microscale Thermophoresis unit for studying biomolecular interactions
- Autoclave, dishwasher, ultrapure water, ice room, 2 walk-in cold rooms, freezer and centrifuge room
- Green Room suite with light board for online teaching recordings.

In addition, members of our Department benefit from first-class research core facilities in Schulich and at Western, such as those for genomics, proteomics, animal care and imaging. Importantly, these core facilities allow researchers from across the city to access state-of-the-art equipment on a user-fee or sometimes fee-for-service basis, often with training available for students and research staff, and facility staff to assist with experimental design and data analysis. Details on these core facilities are linked below:

Schulich core facilities
Biotron Integrated Microscopy facility
ACVS Managed Facilities
Research Facilities at Robarts
Research Hubs

Research and Academic Computer Support

Centralized computer support exists from the Network Services group in Schulich. This team administers and maintains network services such as email, file and print sharing, file backups, security and anti-virus software, and file servers. A help desk for clients on the Schulich network provides video-conferencing and solutions to problems involving hardware, software and networks. Through Schulich and Western Information Services, our department members have access to; Office 365, Microsoft Teams, Zoom, Qualtrics and various site licensed software.

Health, Safety and Security

Our Department has a long-standing Health and Safety Committee dedicated to facilitating and maintaining a safe and healthy work environment for all members. This committee regularly reports at Department Meetings regarding health issues, safety updates, and laboratory inspections. During the pandemic, the Department also initiated a committee to implement a "Safe Return to Campus Plan" for all laboratories. Important components of our commitment to health and safety include:

- Co-operative interaction with Western Occupational Health and Safety
- Familiarity and compliance with Health and Safety Legislation
- Safety training, signage and documentation as required (WHMIS, Laboratory, Biohazard, Radiation, etc.)
- Facilitating regular safety inspections
- Fire wardens and First Aid responders for each work area
- Building and workspace security according to Schulich School of Medicine & Dentistry policies

Assessment of Physical Space and Facilities

Physiology and Pharmacology is the largest basic science Department in the Schulich School of Medicine & Dentistry in terms of the numbers of faculty members and students. This large critical mass of research and teaching personnel, along with the associated facilities and support, fosters an extremely productive intellectual environment. The proximity of scientists from many disciplines in the Medical/Dental Science core and Research Institutes, as well as Clinical collaborations in the teaching hospitals, is a tremendous strength of our Department. Common needs are met by sharing equipment in specialized facilities throughout the city. The continued growth and productivity of our Department depends on the maintenance and renewal of our physical space and facilities through the following strategies:

- Success in obtaining CFI/ORF infrastructure, NSERC RTI and other grants
- Maximizing the research cooperativity that has been facilitated by recent laboratory renovations, and planning for future renovations that will serve as a catalyst for new research groupings
- Communication ensuring that existing equipment and facilities are used and supported efficiently
- Avoid unnecessary duplication of infrastructure

Budget and Financial Resources

The operating budget for our Department for the period 2016-17 to 2020-21 is provided in **Table 4**. The total amount for 2020-21 is $7,029,263, with more than 90% [$6,500,197] covering salaries for faculty members and staff. Total salaries are very similar between 2016-17 and 2020-2021, reflecting the fact that annual salary increases through the collective agreement and specific retention efforts are balanced by savings from faculty departures. Operating expenses (e.g. office costs, seminar series, etc.) are also similar, although there is considerable year-to-year fluctuation based on costs such as start up funds for new recruits. Undergraduate

teaching support has been stable to purchase supplies and animals for our PhysPharm 3000 labs. Graduate student support was received in the first two years, but these funds are now distributed directly by Schulich. Other expenses include funds from the Mogenson Trust ($10,000 annually) to support student awards, and from the annual Science Student Donations to update the infrastructure for our 3rd year laboratories.

Table 4: Department Operating Budget per Annum

	2016-17	2017-18	2018-19	2019-20	2020-21
Salaries	$ 6,503,638	$ 6,286,043	$ 6,122,875	$ 6,522,831	$ 6,500,197
Operating	$ 439,113	$ 369,555	$ 279,986	$ 181,704	$ 438,463
Undergrad Teaching Laboratories	$ 55,000	$ 56,695	$ 58,000	$ 58,000	$ 58,000
Graduate Student Support	$ 216,351	$ 222,933			
Other	$ 40,268	$ 17,293	$ 24,736	$ 29,063	$ 32,603
Total Operating Budget	$ 7,392,219	$ 6,952,519	$ 6,485,597	$ 6,791,598	$ 7,029,263

The Mogenson Trust

"The Mogenson Trust in Physiology" was established to honour Dr. Gordon J. Mogenson. The Board of the Trust was established in 1990 to oversee the endowment and to support activities complementary to the objectives of the Trust, with the following mandate:

> *The Department of Physiology, University of Western Ontario, has established one of the finest teaching, research, and scientific training programs in physiology in North America. Because of this, the Department enjoys an enviable national and international reputation and attracts students and faculty of the highest calibre. Although this achievement by the Department of Physiology has not been the work of any one individual, nevertheless Professor Gordon J. Mogenson has made a major contribution in the recent two decades. His career has been distinguished as Chairman of the Department, Dean of the Faculty of Graduate Studies, Vice-President of the Medical Research Council, and Fellow of the Royal Society of Canada. Because of this record and his outstanding contribution to the Department and University with respect to original research and teaching, the Department wished to honour him with the formation of a Trust, with the view that its primary mandate will be to provide continued academic enrichment for the Department of Physiology. The Board may undertake from time to time support of other activities complementary to objectives of the Trust. Endowment has been named The Mogenson Trust in Physiology.*

Formation of the Department of Physiology and Pharmacology presented the opportunity to bring under the umbrella of the Mogenson Trust several funds established to provide for academic enrichment of the two founding Departments, and to enhance the ability of the Trust to support programming for academic enrichment of the Department. To support its new mandate, the name of the Trust was changed to "**The Mogenson Trust"** in 2002, and funds from the Department of Pharmacology & Toxicology were brought to the Mogenson Trust. In 2017, with the additional merger of the graduate programs into the new Graduate Program in Physiology and Pharmacology, several of the smaller funds were also combined to provide consistent undergraduate and graduate awards. The names attached to the awards are retained but the funds are

combined in to undergraduate and graduate funds: the Blanche Box; the Abe & Shirley Wilensky; the George W. Stavraky; the G. Murray Fraser; the W. A. Bottom; the Esme Walker; the Mogenson; the Margaret Moffat and the Hari & Gundrun Sharma awards.

Funds of the Trust [as of the April 2021 fiscal reporting year, investments held totalled $587,100]

1. The Mogenson Trust Physiology and Pharmacology fund
2. The Mogenson Trust Physiology and Pharmacology Graduate Scholarship fund*
3. The Mogenson Trust Physiology and Pharmacology Undergraduate award fund*
4. The Mogenson Trust Physiology and Pharmacology Anne Ferguson Memorial Award fund*
5. The Hugh B. Anderson Award in Physiology fund*
6. The Marilyn Robinson Teaching Award fund

The Department receives tangible benefits from the Trust. Since inception of the Mogenson Trust in Physiology in 1990, funds have accrued with investments and are provided to the Department for support of guest speakers, as well as providing several Student Awards[*]. As of April 2021, the funds have provided $244,213 for Student Awards and $338,140 for Department Enrichment totalling $582,353**.** [Note: there was no reporting of the Pharmacology & Toxicology funds prior to 2002]**.**

Concluding Remarks - Administration

The Department of Physiology and Pharmacology is a large and geographically-dispersed academic Department. Faculty members and staff deliver popular undergraduate and graduate student training programs and engage in well-funded research programs. The administrative structure of the Department is continually refined to offer its members with a high level of service; this is in part due to the leadership of our Manager, Administration and Finance and our Laboratory and Facilities Manager. In spite of the successes of our Department, there are several challenges. The biggest challenge is a 20 % loss in the number of faculty members carrying our large teaching program. This challenge is amplified by the anticipated substantial growth of our undergraduate program due to the BMSc expansion. This will result in substantially increased teaching loads on faculty members, possibly at the expense of both quality of teaching and time available for research.

UNDERGRADUATE PROGRAM

Program Overview

The Department of Physiology and Pharmacology has a strong commitment to undergraduate teaching throughout the University. We are devoted to the educational mission of our Institution and contribute to teaching our disciplines of Physiology and Pharmacology to students from a variety of faculties. We offer 31 courses, taught by a total of 48 faculty members, to approximately 4,800 – 5,000 students each year.

Scope of Our Program

We currently teach human physiology to:

- Medical and Dental Students
- 1st year nursing, kinesiology and foods and nutrition students
- 2nd year students from all faculties, the majority from general science & medical science
- 3rd year medical science and science students
- 4th year medical science and science students

Pharmacology is taught to

- Medical and Dental Students
- 2nd year nursing
- 2nd year students from all faculties, the majority from general science & medical science
- 3rd year medical science and science students
- 4th year medical science and science students

We offer seven modules in the Bachelor of Medical Sciences [BMSc]:

- Honours Specialization in Physiology
- Major in Physiology
- Honours Specialization in Pharmacology
- Major in Pharmacology
- Minor in Pharmacology
- Honours Specialization in Physiology and Pharmacology
- Major in Physiology and Pharmacology

In addition, our faculty members teach in multiple other programs such as the Neuroscience and Interdisciplinary Medical Sciences Undergraduate and Graduate Programs.

Undergraduate Course Enrollment Data

Enrollment in our undergraduate courses has remained high, over the past six years. Although our courses in Physiology have always been highly subscribed (**Table 5**), we have focused on improving our Pharmacology offerings in recent years. Total enrollment in Pharmacology courses has increased by 10% in 2021 compared to 2016 (**Table 6**). We have also aimed to expose students to both disciplines in our 3rd year Physiology and Pharmacology laboratory course, which was first offered in 2017-2018. We have subsequently converted and added courses in the combined discipline area of Physiology and Pharmacology and observed increases in interest by student enrollment (**Table 7**). Although our enrollment has remained stable overall, with a shift to more students enrolling in pharmacology courses, we have observed a decrease in the total enrollment in our fourth-year courses in recent years compared to 2016-2017 (**Table 8**, **Figure 2**). We have had to close

registration in five 4th year courses through faculty retirements and reassigning faculty around to replace gaps in teaching. However, we have also replaced 4th year course offerings with the addition of two new 4th courses in our new discipline area of Physiology and Pharmacology. Despite these efforts, we have still observed a 25% decrease in enrollment at the 4th year level, which doesn't seem to be solely due to total seat availability (**Figure 3**). Despite this challenge, we still maintain approximately 4900 total students enrolled in courses offered by our Department.

Table 5: Enrollment in Undergraduate Courses in Physiology 2016-2021

Physiology	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
1020 - *Human Physiology online (for nursing)*	275	267	356	269	478	258
1021 - *Human Physiology (for kinesiology)*	373	343	335	468	481	466
2130 - *Human Physiology*	583	614	601	599		
2130 - *Human Physiology online*	300	210	263	305	749	896
2130 – *Human Physiology online Summer term*	225	226	223	253	248	192
3120 - *Mammalian Physiology*	485	466	436	406	493	433
3130Y – *Physiology Laboratory*	186					
3140A - *Cellular Physiology*	456	385	374	316	400	322
4200B - *Current Topics in Respiratory Physiology*	23	24	24	24	25	24
4420A - *Exercise Physiology*	26					
4510A - *Understanding Pluripotency: The Physiology of Stem Cell Fate & Function*	27	31	29	35	42	42
4520B - *Fundamental Concepts in Stem Cell Biology and Regenerative Medicine*	62	79	39	77	73	42
4600A - *Diseases of Ion Channels and the nervous System*	10	36	36	17	35	28
4610B - *Cardiovascular Physiology*	17	17	30	17	30	50
4620A - *Reproductive Endocrinology*	60	58	51	57	63	55
4630B - *Motor Physiology*	22	17	10			
4640A - *Organogenesis in Mammals*	18	21	10			
4650A - *Regulatory and Integrative Neurophysiology*	13	32	27	41	24	30
4680B - *Cellular and Molecular Neurobiology*	35	30	25	22	18	36
4700B - *Fetal Physiology*	87	81	77	61	81	54
4710A - *Physiology of the Senses*	68	70	60	61		
4710A - *Physiology of the Senses online*	133	122	96	98		
4730B - *Advanced Cellular Physiology*	44	41	33	31	25	36
Total Enrollment	**3528**	**3170**	**3135**	**3157**	**3265**	**2964**

**grey cells – course not offered*

Table 6: Enrollment in Undergraduate Courses in Pharmacology 2016-2021

Pharmacology	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
2060B - *Introductory Pharmacology and Therapeutics Online*	649	665	657	660	542	696
2060B - *Introductory Pharmacology and Therapeutics Online Summer*	159	152	133	121	148	148
3580Z - *Principles of Drug Action Lab*	39					
3620 - *Fundamentals of Pharmacology and Therapeutic Principles*	165	214	283	332	398	359
4320A - *Cardiovascular Pharmacology*	50	27	50	26	39	36
4350A - *Clinical Pharmacology*	36	35	35	36	36	48
4360B - *Mechanisms of Cancer Chemotherapy*	51	44	39	40	44	38
4370B - *The Pharmacology of Drugs of Abuse*	30	31	30	30	30	30
4380B - *Neuropharmacology*	18	21	12	19	24	20
4620A - *Molecular Mechanisms of Drug Action*	21	13	23	22	24	21
4660A - *Human Toxicology*	118	91	88	131	99	98
Total Enrollment	**1336**	**1293**	**1350**	**1417**	**1384**	**1494**

**grey cells – course not offered*

Table 7: Enrollment in Undergraduate Courses in Physiology & Pharmacology 2016-2021

Physiology & Pharmacology	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
3000E - *Physiology and Pharmacology Laboratory*		183	192	187	240	220
4100B - *Digestion and Related Metabolism*	50	54	51	53	55	60
4440B - *Animal and Cell Modelling of Development and Disease*						9
4530B - *Biological Basis of Skeletal Health and Disease*	60	71	44	32	34	25
4800A - *Selected Topics: Endocrinology with a Specific Focus on the Pituitary Gland*						19
4980E - *Seminar and Research Project*	71	69	74	72	69	73
Total Enrollment	**181**	**377**	**361**	**344**	**398**	**406**

grey cells – course not offered

Table 8: Enrollment in Undergraduate Courses Separated by Year of Study

Year of Study	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
1st Year Courses	648	610	691	737	959	724
2nd Year Courses	1916	1867	1877	1938	1687	1932
3rd Year Courses	1145	1248	1285	1241	1531	1334
4th Year Courses	1150	1115	993	1002	870	874
TOTAL	**5045**	**4840**	**4846**	**4918**	**5047**	**4864**

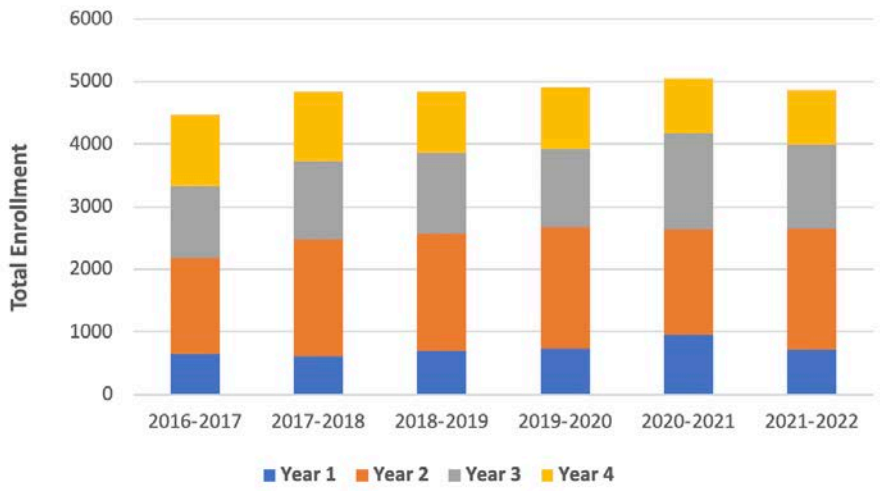

Figure 2: Total Enrollment in Undergraduate Courses by Year of Study

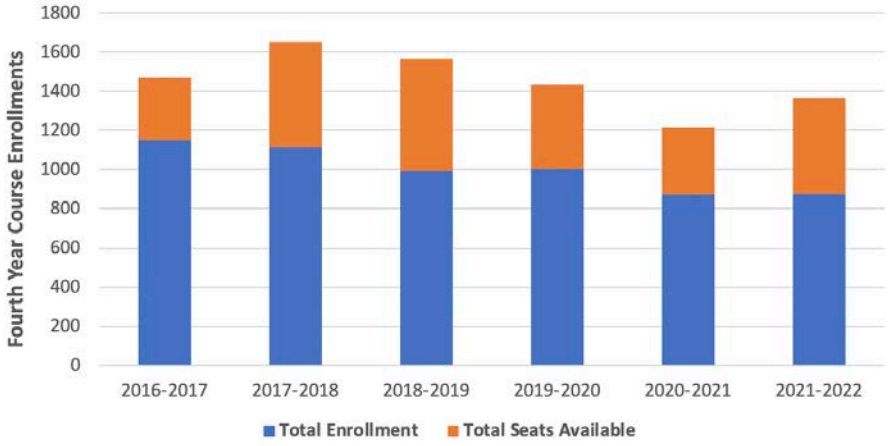

Figure 3: Fourth Year Course Enrollment and Course Capacities

Objectives of Our Undergraduate Program

The overall objective of our undergraduate program is to provide students with an understanding of how the human body works [in Physiology] and an understanding of the mechanisms of action of drugs on biological systems [in Pharmacology]. Given the wide selection of courses that we deliver and the diverse group of students that we teach, we have defined different teaching objectives to fit each level.

Bachelor of Medical Sciences [BMSc] Program

The majority of our teaching occurs in the BMSc program, in our 2nd, 3rd, and 4th year courses. The BMSc program is currently undergoing a rapid expansion, with an approximately 50 % increase in students entering their third year in the upcoming academic year (2022/2023) and further growth anticipated in future years. This will affect all our courses and greatly increase demands on our 3rd year laboratory, 4th year Honours projects, and 4th year courses in general. In addition, the BMSc Program is undergoing a major curriculum overhaul, which will affect several of our offerings over the coming years (including major efforts in course design).

Objectives of our 1st and 2nd year introductory lecture courses

Our introductory courses, delivered to first students in kinesiology, foods and nutrition and nursing, and second-year students from all faculties, are designed to give students:

- General knowledge and understanding of the key concepts in physiology and/or pharmacology.
- Ability to gather, review, evaluate and interpret information relevant to physiology and pharmacology.

Objectives of our 3rd year lecture courses

Our advanced courses, delivered to 3rd year students, provide students with the skills needed to:

- Develop knowledge and critical understanding of the key concepts, methodologies, current advances, theoretical approaches in physiology and pharmacology.
- Apply underlying concepts and principles, both within and outside of the discipline and, where appropriate, use this knowledge in the creative process.

Objectives of our 3rd year laboratory course

We offer one 3rd year laboratory course, that combines both the disciplines of physiology and pharmacology. Although students in our laboratory course are taught technical skills and are exposed to several experimental methodologies over the duration of the courses, this is not the main objective for our combined Physiology and Pharmacology laboratory. The main purpose of the lab course is to make physiological and pharmacological concepts concrete, to introduce students to the principles of scientific inquiry and to provide an opportunity for students to develop as ethical scientific problem solvers.

The main educational objectives of these laboratories include learning to:

- Use questions to develop hypotheses, and to design experiments that adequately test hypotheses. Perform the experiment including controls, analyze the data, form conclusions, and present the findings.
- Set up and conduct physiological and pharmacological experiments.
- Understand the importance and skill of careful biological dissection or surgery.
- Make precise measurements of physiological systems or drug pathways.
- Make the conceptual connection between what is happening biologically during the experiment and what can be measured quantitatively with scientific equipment.
- Develop scientific presentation skills. Results are presented as written laboratory reports, journal-style articles, poster presentations with live demonstrations, or formal talks in front of their peers and supervisors.

Objectives of our 4th year lecture courses

Our advanced 4th year courses provide students with an opportunity to:

- Develop knowledge and critical understanding of the key concepts, methodologies, current advances, theoretical approaches in physiology and pharmacology.
- Develop the ability to communicate information and data analyses accurately and reliably, orally and in writing to a range of audiences.
- Develop the ability to critically evaluate qualitative and quantitative information.
- Apply underlying concepts, principles, and techniques of analysis, both within and outside of the discipline and, where appropriate, use this knowledge in the creative process.

Objectives of our 4th year Honours Research - Thesis and Communication course

Of the courses offered by the Department of Physiology and Pharmacology, the 4th year research thesis course is one of the highlights for many students. A graduation requirement for students in the Honors Specialization programs is completion of a research project in the laboratory of one of our faculty members. Spaces in the

course are limited due to laboratory training capacities. Applicants are selected based on academic performances in their 2nd and 3rd years of study. The average thesis class size is approximately 74 students, reflecting the combination of successful students requesting an HSP in Physiology, Pharmacology, or Physiology and Pharmacology (**Figure 4**). Note that the marked increase in the number of students selecting our combined Physiology and Pharmacology module reflects our conscious effort to integrate the two disciplines further. Unfortunately, however, we have much higher demand for seats in the thesis program than we can accommodate (due to limited number of participating faculty members) and must decline approximately 50% of the interested students (**Figure 5**).

For our 4th year Honors Specialization students, working in a research laboratory and learning directly from a faculty member can be an exceptional experience. Regardless of the career goals of our students or the programs that they pursue after graduation, the skills acquired in our research-thesis course are invaluable for any future endeavor, but particularly for graduate school. The educational objectives are to develop:

- Knowledge and critical understanding of the key concepts, methodologies, current advances, and theoretical approaches in physiology and pharmacology
- The ability to generate a hypothesis, design and perform an experiment, critically evaluate data, interpret data, and make conclusions.
- The ability to review, present and critically evaluate qualitative and quantitative information.
- The ability to communicate information and analyses accurately and reliably (both verbally and in writing) to a range of audiences.

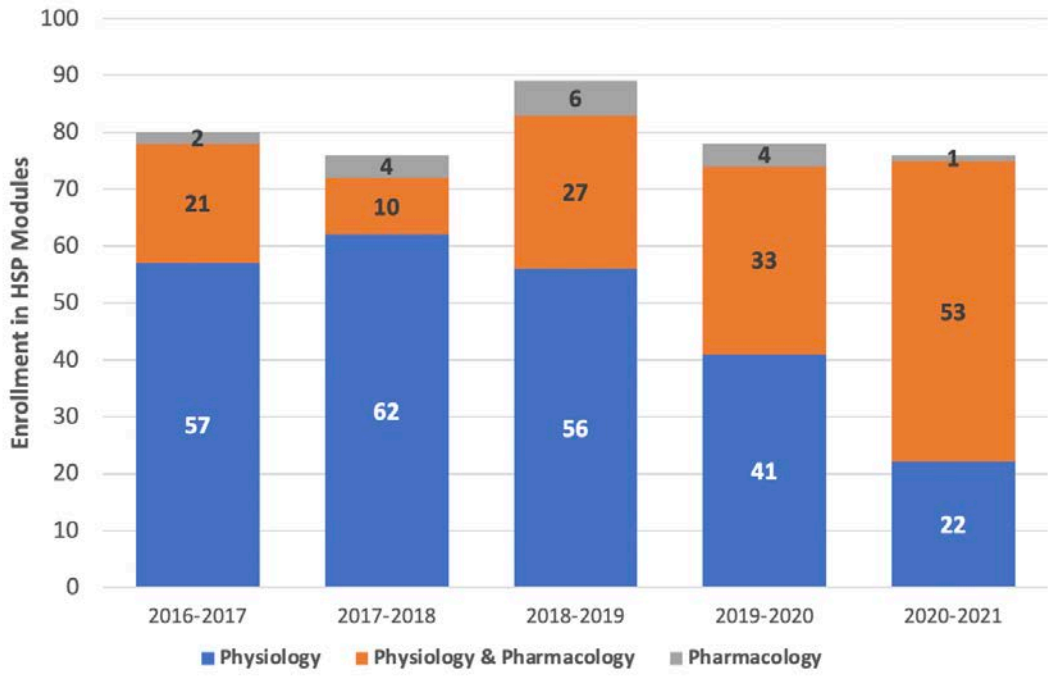

Figure 4: Thesis Course Enrollment by HSP Module

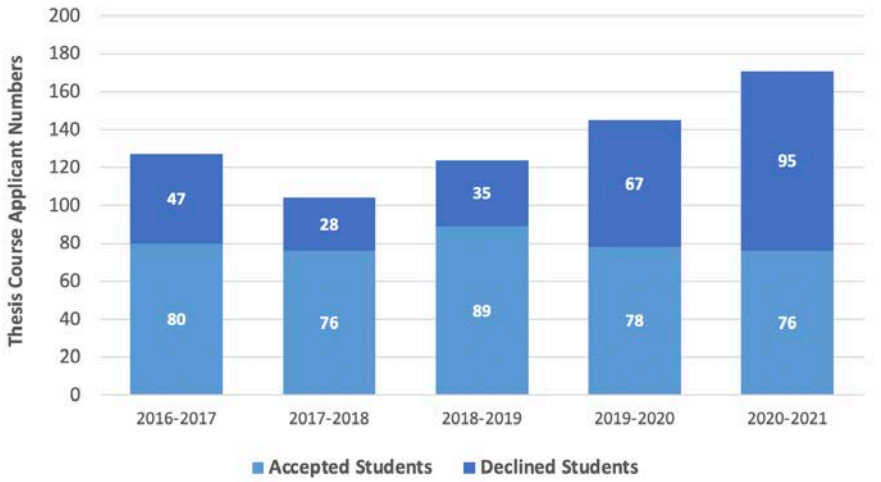

Figure 5: Applicant Success Rate in the Fourth Year Thesis Course Module

Involvement in the Medical Curriculum

Objectives of our Medical Doctor program

As with our other undergraduate programs, the educational objectives for the Medical Curriculum are to provide students with a basic understanding of how the human body works [in Physiology] and an understanding of the mechanisms of action of drugs on biological systems [in Pharmacology], but to extend this to enable appropriate diagnosis of pathophysiology and selection of appropriate therapeutic regimes. Physiology is the basis of all medical underpinning of function. Pharmacology is the basis of therapeutics. As such these two disciplines are vital to any medical program.

Organization and oversight of Medical Physiology and Pharmacology courses

Until 2019, the medical curriculum was organized into system-based courses, with Physiology and Pharmacology being taught sparsely within the blocks. The foundational knowledge in these disciplines were briefly taught in the "Introduction to Medicine" course and the systems-based Physiology and Pharmacology were taught in subsequent courses. In some courses, the content was taught by clinicians without consultation with our Department. In 2015, our Department created a position focused on undergraduate Medical and Dental education with the key role of acting as a liaison between these programs and our Department. Since this position has been filled by Dr. Fabiana Crowley, our Department has regained presence in the Medical and Dental curricula. This individual is the subject lead for the medical curriculum and assists with the development and delivery of content as well as the overall Medical curriculum development.

In 2019, the MD program shifted to a competency-based model. The curriculum is now organized in clinical presentations rather than in systems. This change aimed to promote transdisciplinary integration between the disciplines and to better prepare learners for future medical practice. Our Department had a fundamental role supporting this transition. Our faculty lead Dr. Crowley worked in collaboration with clinicians to create and deliver clinically relevant, integrated Physiology and Pharmacology content. We have gained many hours back in the new curriculum, including a full week dedicated to basic & clinical Pharmacology and therapeutics in the *Foundations of Medicine* course. Having an individual dedicated to the professional programs at Schulich has allowed our Department to better oversee and represent our disciplines in the Medical and Dental curricula.

Involvement in the Dental Curriculum

Major changes to the teaching of basic medical sciences to first year Dental students were implemented in 2009 when this portion of the Dental curriculum moved to a 10-week integrated systems-based structure. Several new courses were introduced, including Dentistry 5161- Human Physiology and Dentistry 5102 – Pharmacology for Dentistry, along with similar courses given by the Departments of Anatomy & Cell Biology and the Department of Pathology. During each week of the academic year, course materials related to a major biological system are covered, for example, the cardiovascular system or gastrointestinal system. On Mondays, students receive information about the relevant anatomy of the system, followed by instruction on the Physiology on Tuesdays, Pathology on Wednesdays and Pharmacology on Thursdays. Each weekly module culminates on Fridays with a discussion on the general medicine of the system with the delivery of relevant case studies. This method of teaching the basic medical sciences has received good reviews from the students.

There are currently also a small number of Internationally Trained Dentists (ITD-1) who attend the pharmacology portion of the modules described above. Although the clinical skills of these ITD students are quite good, their background in basic medical sciences is not as strong as the other first year Dental students.

Although the structure of the Dental curriculum has not changed in many years, our faculty make continuous efforts to improve the Dental Physiology and Dental Pharmacology courses. In 2021, our faculty initiated a discussion with the other basic science Departments and the general medicine lead of the Dental program to promote better alignment between our disciplines. Many positive changes were made because of this initiative. The content of both courses was reviewed to ensure clinical relevance of current content. New topics were added, and the assessment format was changed to emphasize clinical application questions. In addition to the courses we lead, our faculty contribute to other Dentistry courses such as *Core Biology* and *Advanced Facial Growth*.

Distance Education Courses

We deliver 3 courses on-line through distance education – one in introductory Physiology for nursing, another introductory Physiology course for students from any program, and one in introductory Pharmacology.

Physiology 1020 provides nursing students from both the Fanshawe College program and Western's program with their first year of human physiology. The course content is delivered online with asynchronous modules for each organ section. However, in person tutorials are offered to both sites, for student interactions with the course instructor and teaching assistants.

Physiology 2130 is similarly offered online with course content being organized by asynchronous modules that permit students to complete material in a self-directed way. This course can be taken by any student across Canada and is offered twice a year, in the fall/winter term and compressed in the summer term. Students often access this course to fulfill degree requirements at other institutions, and to satisfy admission requirements to professional schools, particularly Dentistry.

Pharmacology 2060B is offered twice a year as well, in the fall/winter term and in the summer term. The course has served both to fulfill the pharmacology course requirement for students in nursing at both Western and Fanshawe College. The course has also been offered in parallel to student wishing to take an introductory course in Pharmacology, which can be from anywhere in Canada, from any degree program. Although this course continues to be very popular with students, we will be restricting it to Nursing students only in the upcoming academic year, to be able to refocus the material to best suit the needs of the Nursing program.

Academic Counselling

- Three faculty members in our Department act as Academic Counsellors advising students on program requirements and courses offered predominantly by the Department of Physiology and Pharmacology. One of these Academic Counsellors is typically the Chair of our Undergraduate Studies Program.
- Our Department Undergraduate Program Administrator deals with some academic counselling issues, but typically refers students to one of the Department Academic Counsellors when needed.
- Counsellors in the Faculty of Science Dean's office handle general counselling issues for students, and the BMSc Administrative Assistant and BMSc Program Coordinator manage issues in the BMSc program

Undergraduate Executive Committee

- This Committee consists of five or six faculty members from the Undergraduate Studies Committee, the Undergraduate Studies Committee Chair, and is supported by our Undergraduate Program Administrator.
- The Committee oversees all aspects of undergraduate education, academic counselling, curriculum and day-to-day operations of the undergraduate program, and meets once per month with the Department Chair to review program status and specific issues.
- Major policy decisions are taken to the Undergraduate Studies Committee for broader discussion before going to the whole Department for input and decision-making.

Survey of Graduating Students related to Career Path

We conduct informal surveys of our 4th year students about their next steps following graduation; data for our graduating classes from 2016 to 2020 are given in **Figure 6**. Data from the 2020-2021 academic year were not collected due to the pandemic, and therefore are not included here. The largest proportion of our students, close to 50%, attend medical or dental school following graduation from our 4th year programs. A good proportion, approximately 30%, go on to graduate school following their BMSc degree. Several of these latter students will enter medical or dental school upon completion of their MSc or PhD degrees. A small number of students will pursue training in other professional programs ranging from the allied health professions to law and education. Up to about 10% of students enter career opportunities mainly unrelated to their BMSc training.

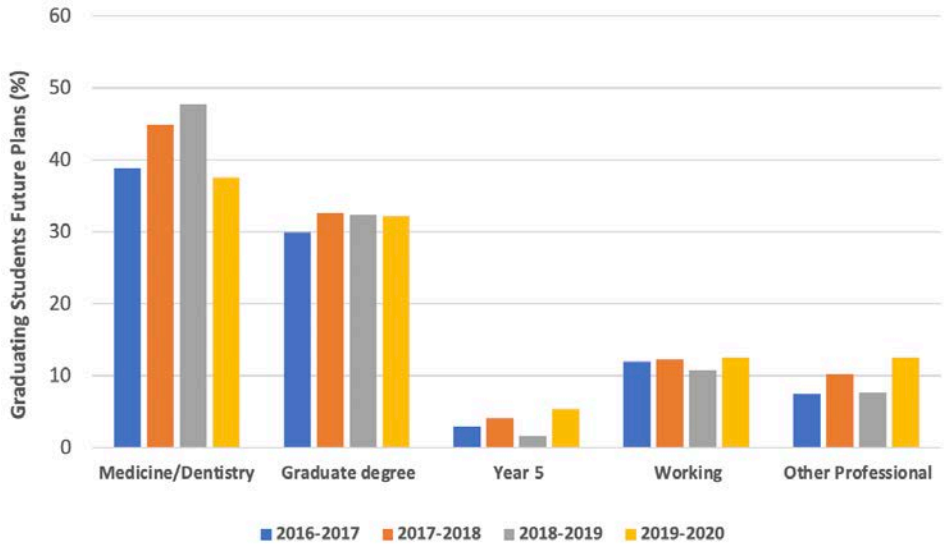

Figure 6: Graduating undergraduate student survey responses to future career plans after completing their degree. * Other Professional includes Pharmacy, Education, Nursing, Law, Physiotherapy, Occupational Therapy, Optometry, Dental Assistant, Clinical Trials

Award-winning Teachers

We are fortunate to have many award-winning educators in our Department. Some highlights include:

- Angela Armitt Award for Excellence in Teaching by Part-Time Faculty
    - Bell [2019]
- Award of Excellence in Undergraduate Teaching from the University Students Council
    - McLean [2017]
- Fellowship in Teaching Innovation Award
    - Campbell [2016]
- Marilyn Robinson Award for Excellence in Teaching
    - McLean [2017], Campbell [2018], Crowley [2019]
- Schulich Educator Awards for Undergraduate Education:
    - Lomber [2016], Beye [2017], Di Guglielmo [2018], Borradaile [2019]
- Schulich UME Scholar of Merit Award
    - Crowley [2019]
- Vice-Provost (Academic Programs) Award for Excellence in Collaborative Teaching
    - Beye, Stavraky & Woods [2019]
- Vice-Provost (Academic Programs) Award for Excellence in On-Line Teaching & Learning
    - McLean [2019], Beye, Stavraky, Woods, **Vanderboor, Thai, Akintola* [2021]
- Western Award for Innovations in Technology-Enhanced Teaching
    - Woods [2019]

    **Vanderboor and Thai are/were staff members of the department and Akintola was an Undergraduate student intern*

Faculty Professional Development in Teaching

Our Institution, Faculty and Department offer various opportunities to learn about and practice evidence-based methods that improve teaching, and aspects of professional development in education. Although these training sessions are not mandatory, many faculty members in the Department are active participants in both attending sessions (**Figure 7**) and delivering sessions to train others.

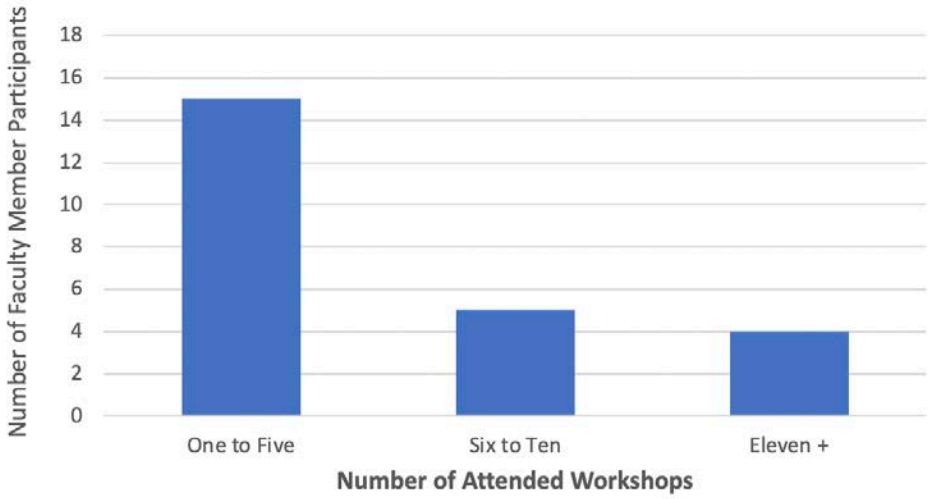

Figure 7: Faculty members participation in teaching workshops

Evolution of Our Undergraduate Program

Our programs are under constant review and evolution. Since the merger of the Pharmacology & Toxicology and Physiology Departments in 2002, we introduced a joint undergraduate degree module in Physiology and Pharmacology to complement the existing programs in Pharmacology & Toxicology and in Physiology. We have subsequently introduced a joint course code discipline of Physiology and Pharmacology in 2017, to allow us to offer courses that cover both topics, instead of having students complete their module with a component of courses from each discipline separately.

Third-Year Laboratory Courses

Until 2016, we had offered two laboratory courses, Physiology 3130Y and Pharmacology 3580Z. Students who were therefore interested in both disciplines, had to make space in their course selections to fit in both labs into their timetables. In addition to the increased time demand students were faced with, both courses had their strengths, but there were also weaknesses in keeping these courses separate. We used these issues as an opportunity to combine the best of both laboratory courses, and to provide the students with exposure to both disciplines. Although individually our laboratory courses were popular, the combined laboratory course has experienced increased demand and we have been asked to increase capacity by offering more sections, in particular in light of the BMSc expansion. For the 2022/2023 academic year, we will expand our current offering from two sections with a capacity of 120 students per section, to three sections, increasing capacity by 50%. This will increase the demand on teaching performed by our faculty members.

We recognize that offering this type of lab course involves a huge commitment from our Department, with more than 30 faculty members, 24 graduate student teaching assistants and two full-time Department technicians involved. However, we believe this is a worthwhile investment in student education, and the reward for this commitment is to create excitement about physiology and pharmacology that translates into top students choosing our 4th year and graduate studies programs.

4th Year Courses

The Department of Physiology and Pharmacology continues to offer a strong, diverse array of courses to students specializing in Physiology, Pharmacology, and Interdisciplinary Medical Sciences. We strive to offer the best student learning experience possible and routinely evaluate our undergraduate courses to enhance the quality and diversity of our programs. With the increased demand for fourth year courses that offer pharmacology, and with more of our Honour's thesis project students selecting both disciplines for their module, we have increased our capacity in courses that include pharmacology. We have modified two existing courses to include more pharmacology content:

1. **Physiology and Pharmacology 4100B –** *Digestion and Related Metabolism*
2. **Physiology and Pharmacology 4530B –** *Biological Basis of Skeletal Health and Disease*

We have also been fortunate to have willing faculty members develop two new courses in Physiology and Pharmacology. Offered for the first time in 2021-2022, we have been able to expand our offerings.

Physiology & Pharmacology 4440B – ***Animal and Cell Modelling of Development and Disease***

"This course examines the use of established and emerging cell and animal models to study developmental and disease processes. From transgenic mice, to CRISPR-Cas9, to rapid screening of drugs for pharmaceutical testing, the understanding of how model systems can be utilized to evaluate normal development and physiology as well as pathologies."

Physiology & Pharmacology 4800A – *Selected Topics: Endocrinology with a specific focus on the Pituitary Gland*

"A course dealing with the role of the pituitary as a key endocrine organ in mammals. Includes discussion of associated pathologies, pharmacological manipulation and key endocrine pathways regulated by the pituitary." As a 'selected topic' course, the subject can be changed every year, allowing greater flexibility in assigning faculty to teach this course.

Second-Year Course Development

Although we have two very popular second year courses offered separately as an introduction to physiology [Physiology 2130] and introduction to pharmacological principles [Pharmacology 2060B], we were encouraged in our last undergraduate program review to combine these two courses. We have been able to successfully merge our Departments' disciplines over the last 12 years and have now focused on extending this to the second-year level with our new PhysPharm2000 course.

The second year of course offerings are pivotal, since at our institution, students don't enter our modules until their 3rd year of studies. Therefore, exposure to elective courses in second year is an important time to shape a student's decisions on which modules they will pursue as their major. With a team of dedicated educators to develop the course to combine the best of content from both physiology and pharmacology in an integrated manner, we have recently received approval for this new course. We will offer it in the 2022/2023 academic year for the first time.

Physiology & Pharmacology 2000 – *Introduction to the Integration of Physiology and Pharmacology*

"Students will study the physiological processes and pharmacological treatments of nerve, muscle, central nervous system, renal, cardiovascular, respiratory, endocrine, reproductive and gastrointestinal control systems as they function in living humans, under both healthy and diseased conditions."

Concluding Remarks - Undergraduate Student Education

Our Department strives to offer the best educational experience to our students, regardless of their discipline, Faculty, or location across Canada. Over the past six years, we have offered new courses in physiology and pharmacology to cover gaps in the curriculum. We have modified our student laboratories to keep pace with current topics and technologies and provided students with the opportunity to learn about both physiological and pharmacological principles in research, in an integrated way. We also continue to recruit a large number of students interested in pursuing a fourth-year research project with our faculty members, many of which continue on to graduate studies.

For our undergraduate program, we see ourselves uniquely positioned to contribute to Western's Strategic Plan in the identified theme of "**Greater Impact**". To achieve this through strategic growth, we will need to recruit more faculty members to help facilitate the constantly increasing demand for our educational offerings. Western has also highlighted the importance of promoting teaching and learning by launching curriculum renewal projects, of which the BMSc program is currently undergoing large revisions. Our students will no longer have to wait until 3rd year to experience what the medical sciences are, with new required courses being offered starting in 1st year. We will be active contributors to these revisions, and our Department will contribute to the teaching in these new courses. Lastly, we strive to enrich the student experience through expanding our ability train students in experiential learning. We recognize the importance of students learning in our labs, whether in third or fourth year of studies, and we will continue to devote resources to these aims to provide students with the opportunities to experience science both inside and outside the classroom.

With award-winning educators, state-of-the-art student laboratories, courses focused on current topics and research, and seven different educational modules, we offer an outstanding student experience in a research-intensive Department.

Priorities For Strategic Planning

- Further integration of our Physiology and Pharmacology offerings
- Evaluation of our 4th year courses to reduce redundancies
- Identification and filling of gaps in our curriculum (for example, 4th courses on muscle, kidney)
- Expansion of 4th capstone projects beyond the current research thesis
- Updating of online courses (Physiology 1020, Physiology 2130 & Pharmacology 2060) to reflect current technology and to update content

GRADUATE PROGRAM

Program Overview

Our research-intensive Department has a strong commitment to graduate student education, offering MSc, PhD and MD/PhD degrees. Prior to 2012, we offered separate degrees in Physiology and in Pharmacology, but these programs were consolidated at that time to offer degrees in the combined disciplines of Physiology and Pharmacology. For the period of this self study, we offered MSc, PhD and MD/PhD degrees in Physiology and Pharmacology only. Research and teaching associated with these degree programs emphasize the multidisciplinary and integrative nature of these disciplines.

Scope of Our Program

Studies are conducted at the molecular, cellular, organ, organism and clinical levels and *in silico* modeling. MSc and PhD students develop skills as physiology and pharmacology researchers in diverse fields, including clinical and basic pharmacology; bone and joint biology; cell, stem cell and cancer biology; heart, lung and blood vessel biology; reproduction, development and metabolism; and neuroscience, neurodegeneration and cognition. The goals of our graduate programs are to expand and disseminate scientific knowledge and to train professional physiologists and pharmacologists with the potential to make significant contributions to the advancement of science in these disciplines. MSc graduates may become researchers, teachers or be employed in science and health care sectors, sometimes after additional training. Graduation from a PhD program is essential for a career as an independent researcher and for many other career opportunities in academia, government, public policy, and the pharmaceutical and biotechnology sectors. The guidelines governing our graduate studies programs are detailed in our "Graduate Student Handbook".

Graduate Student Enrollment Data

Enrollment of students in the Department of Physiology and Pharmacology graduate programs is shown in **Table 9**. These numbers have declined consistently over the past 5 years, reflecting a combination of factors. Current limitations on research funding from tri-council agencies such as CIHR and the increased competitiveness for obtaining research grants has significantly restricted the number of graduate students that our faculty are able to recruit to their labs. Also, during this time, charitable foundations that were historically an important source of research funding for our Department, such as the Heart and Stroke Foundation of Canada and Diabetes Canada, have reduced funding of operating grants. Another factor is that we are in direct competition for students with the Graduate Program in Neuroscience. Most of our faculty supervisors who perform research in the areas of neuroscience, neurodegeneration and cognition preferentially enrol students through Neuroscience. This is because the funding structure provided through Schulich Graduate Studies (specifically the Western Graduate Research Scholarship, WGRS), allows supervisors to pay a significantly lower portion of the graduate student stipend from their grants if the student is enrolled in Neuroscience. Competition with the Neuroscience program has existed for decades, but the effects on enrollment in Physiology and Pharmacology have become more evident in the current research funding environment. In addition to the Neuroscience program, many new course-based one-year MSc programs have been launched over the last years, competing for students that want to obtain a graduate degree without spending two years in the lab. Finally, we have experienced a net loss of 10 faculty members, most of whom were active graduate student supervisors, over the period covered by this self study, as discussed further in the section on **Faculty Supervisors and Research Areas.**

Regardless of the decline in enrolment, we are still one of the largest graduate programs in Schulich. Enrollment in our program reflects its continuing popularity with students and robust applicant pool. We anticipate that the number of students entering our programs will remain stable over the coming years based on the recent

recruitment of new faculty members to our Department. In particular, the recruitment of junior faculty members who are actively building their research programs and have already attracted numerous, high-quality trainees to their research projects will allow us to maintain or increase enrollment. These faculty members are successful in obtaining competitive research grant funding and, as a result, are able to provide stipend support for graduate students, along with excellent training experiences on projects at the forefront of their fields using state-of-the-art approaches and facilities.

Analysis of Graduate Student Enrollment

Currently, 50% of Physiology and Pharmacology graduate students are in the PhD program, with about 80% of these transferring from the MSc program and the remainder recruited as direct entry PhD students. Historically, most of our MSc students do not transfer to PhD, with professional programs such as Medicine and Dentistry having a stronger draw. However, over the past 5 years there has been enhanced initiative in our Department to increase PhD student enrolment, with recruitment of high-quality students as a high-priority. Remarkably, the ratio of MSc to PhD students in our program has shifted from 1.6:1 to 1:1, with a larger than usual number of transfers from MSc to PhD during 2020. Many of our MSc and PhD students come from our 4th year Schulich undergraduate programs and these are typically excellent students. In addtion, we have recently emphasised recruitment of students from outside of our own undergraduate programs. Online recruitment events during 2020 and 2021 resulted in increased applications and student enrolment from other institutions.

Table 9: Enrollment in Physiology and Pharmacology Graduate Programs*

Physiology and Pharmacology Program			
Academic Year	**M.Sc.**	**Ph.D.**	**Total**
2016-2017	54	33	87
2017-2018	45	32	77
2018-2019	39	30	69
2019-2020	44	25	69
2020-2021	33	33	66

* the census date for counting graduate students is November 1st each year

EDID Considerations for Graduate Student Enrollment

Although SGPS does not at present collect complete diversity information on applicants, the Department EDID Committee, led by Drs. Dagnino and Inoue, conducted a survey in January of 2022 to determine diversity at all levels within our Department. Unfortunately, the response rate from graduate students was too low to provide meaningful information at this time. Further attempts will be made to gather this information at the Department level, and we look forward to having enriched information in this regard from SGPS during the application process. To further promote a diverse community within our graduate program and Department, we established a new graduate award, the Physiology and Pharmacology Graduate Opportunity Scholarship in 2021. Our goals with this scholarship are: 1) to recruit and retain a diverse representation of outstanding students who will contribute to research excellence in Physiology and Pharmacology; and 2) to attract Canada's most promising and diverse graduate students who are Black, Indigenous (First Nations, Inuit, and Métis), 2SLGBTQIA+ or who have a disability. The first Graduate Opportunity Scholarship was awarded in September 2021, and the student began their MSc program in January 2022.

Objectives of Our Graduate Program

Our graduate training programs are designed so students obtain a thorough knowledge of phyisology and pharmacology through a combination of course work, seminars, and practical experience in the design, implementation, and critical assessment of a research project. Although individual projects will reflect the research interests of students and graduate supervisors, program policies have been developed to ensure uniformity in the standards of excellence in graduate training in our Department as a whole.

Features of our Graduate Programs designed to facilitate the training process and to promote success are:

- Primary emphasis on research training by an apprenticeship model, supplemented by formal courses.
- Collective responsibility of faculty members in establishing and maintaining high standards based on regular meetings of advisory committees and research seminars.
- Participation by graduate students in the academic life of our Department, including teaching (through Graduate Teaching Assistant [GTA] positons), service on Department committees, and participation at Department seminar series and Research Days.
- Interactions among graduate students at through the Physiology and Pharmacology Graduate Student Council and organized social events.

The objectives of our Graduate Programs are accomplished by helping our MSc and PhD students acquire the following:

- Excellent critical thinking skills.
- Ability to integrate data and information from many sources.
- Ability to articulate and test hypotheses rigorously and to develop corresponding working models.
- Excellent oral and written communication skills.
- Ability to identify problems, and to develop and implement innovative solutions.
- Ability to work independently, and in teams with basic and clinical scientists.
- Ability to co-ordinate or co-supervise the work of others.
- Skills in a range of analytical techniques using sophisticated instrumentation, and the ability to work with equipment and instruments at tasks requiring precision.

Academic standards required of students at completion of their degree

MSc Students

- Completion of a detailed series of experiments that address specific hypotheses, objectives or aims.
- Comprehensive understanding of hypotheses, background, experimental designs, data interpretation, and conclusions related to the research project.
- Reporting of the data in the format outlined in the Thesis Requirements of the School of Graduate and Postdoctoral Studies.
- Expectation that the data is of the amount, quality, and degree of novelty required for the publication of at least one peer-reviewed manuscript.

PhD Students

- Development of the ability to independently formulate a structured research plan, and to apply proper experimental design to conduct experiments to test specific hypotheses.
- Completion of a detailed series of experiments that address specific hypotheses, objectives or aims.
- Completion of a CIHR-format operating grant outlining background/rationale, hypotheses/objective/ aims, experimental plan, anticipated outcomes and overall significance of the proposed research.
- Ability to demonstrate a depth and breadth of knowledge in the chosen research area by successful completion of oral comprehensive examinations.
- Ability to independently analyze and apply statistical analysis to derive and interpret experimental data

- Excellent presentation skills, assessed in part through the presentation of research findings to the Department in a 45-minute seminar.
- Excellent writing skills, including reporting of the data in the format outlined in the Thesis Requirements of the School of Graduate and Postdoctoral Studies.
- Requirement that data is of the amount, quality, and degree of novelty sufficient for publication of at least three peer-reviewed manuscripts.

Faculty Supervisors and Research Areas

Our Department currently has 55 faculty members that are actively involved in graduate student supervision or seeking students in the graduate programs, across 6 defined research areas (**Table 10**). These defined research areas were streamlined over the past 5 years and are now thought to best reflect the broad expertise of our faculty members. Several faculty memebers also supervise students in graduate programs offered by other academic Departments [Anatomy & Cell Biology, Biochemistry, Medical Biophysics, Pathology, Psychology] or by interdisciplinary graduate programs [Neuroscience, Developmental Biology, Musculoskeletal Health Research]. Faculty members indicated in bold in **Table 10** are new recruits (either as new appointments or cross-appointments) to our complement of graduate student supervisors over the past 5 years. Notably, these recruits represent all 6 of our defined research areas, thereby both refreshing and maintaining our broad expertise. Many of these new members were recruited during 2020 and 2021, and we expect that their contribution to our graduate rogram will be reflected as increased enrolment over the coming years.

Table 10: Research areas of faculty supervisors of graduate students within Physiology and Pharmacology

		Research Areas				
Accredited Faculty Members	Clinical and Basic Pharmacology	Bone and Joint	Cell, Stem Cell and Cancer	Heart, Blood Vessels and Lungs	Reproduction, Development and Metabolism	Neuroscience
Appleton, Tom (2017)		X				
Asfaha, Samuel (2020)			X			
Bai, Donglin			X	X		
Beier, Frank		X			X	
Betts, Dean H			X		X	
Borradaile, Nica M				X	X	
Brown, Arthur					X	X
Bussey, Tim						X
Chandy, Mark (2021)			X	X	X	
Chidiac, Peter	X			X		
Corneil, Brian D						X
Cregan, Sean P			X			X
Dagnino, Lina			X			
Di Guglielmo, John			X			
Drysdale, Thomas A					X	
Feng, Qingping				X	X	
Fraser, Douglas D				X		
Garcia-Bournissen, F(2021)	X					
Gill, Sean E				X		
Grol, Matthew W (2020)		X			X	
Gros, Robert				X		
Hardy, Daniel					X	
Hess, David A			X	X	X	
Hill, David J					X	
Hutson, Janine (2021)					X	
Inoue, Wataru						X
Kim, Richard B	X					
Koschinsky, Marlys				X		
Laird, Dale W			X			
Lu, Van (2021)			X		X	
Lu, Wei-Yang			X			X
Martinez-Trujillo, J						X
McGuire, John (2021)				X		

Owen, Adrian						X
Pasternak, Stephen						X
Pin, Christopher			X			
Prado, Marco						X
Prado, Vania						X
Pruszynski, Andrew						X
Ramachandran, R	X			X		
Regnault, Timothy					X	
Rieder, Michael	X					
Rylett, R. Jane						X
Saksida, Lisa (2016)						X
Schwarz, Ute	X					
Seguin, Cheryle		X	X		X	
Stathopulos, Peter	X			X		
Tirona, Rommel	X					
Urquhart, Bradley	X					
Veldhuizen, Rudolf				X		
Wang, Rennian			X		X	
Watson, Andrew					X	
Wilson, Aze (2021)	X					
Welsh, Donald				X		
Yamashita, Cory				X		

Graduate Student Stipends

Funds to defray tuition and living expenses for students in our program are derived from multiple sources, including competitive external scholarships, institutional funds and supervisors' research grants. In terms of institutional funds, graduate students with academic standing over 80% average receive a Western Graduate Research Scholarship [WGRS] that covers about two-thirds of the cost of their tuition [i.e. tuition waiver]. Additional institutional funds are committed to Graduate Teaching Assistantships [GTA] for which students teach in undergraduate laboratories or give tutorials in lecture courses. GTA positions are guaranteed for PhD students in or program. In addition, our Department considers that the opportunity to learn and practice teaching skills as a teaching assistant is an important part of graduate student training. As a result of the heavy GTA requirements for our numerous and large undergraduate courses, we are typically able to provide GTA positions for all graduate students in our program who wish to hold one. Another major component of our students' stipends is also derived from research grants obtained by faculty members. Of note, about 30% of our students compete successfully for scholarships from external funding agencies. Information about funding distribution is illustrated in **Figure 8**.

We have implemented a standardized stipend model for funding of graduate students. Students are compensated based on academic grades, competitive studentship obtained [if any] and whether they hold a GTA position. Particular attention has also been given to standardizing stipends for students who have completed their residency programs ["Year-X students"]. Overall, it is thought that this funding model reduces uncertainty for students about the amount of their stipend, leads to greater equity in stipends amongst students, and avoids supervisor negotiations over individual stipends for students. Other Departments within Schulich have adopted similar models, and the stipend amounts across the Departments are comparable, with the notable exception of the Neuroscience Program.

Graduate student funding data for the academic year 2020 – 2021 is shown in **Figure 8**. In this period, total funding to 66 students was about $1.6 million, with 20% coming from external scholarships awarded to the students, 40% coming from university funding including TA positions, and the remaining 40% coming from supervisors' research grants.

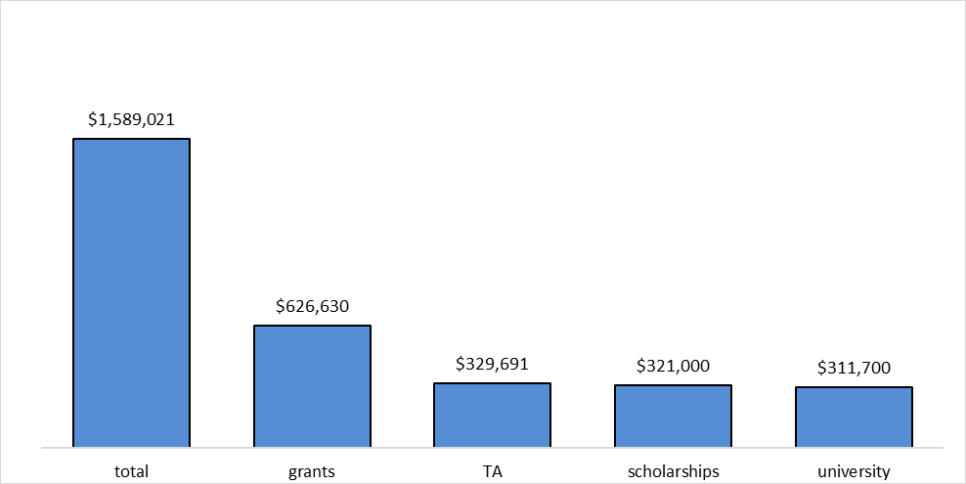

Figure 8: Graduate student funding by source between Sept 2020 and Aug 2021

Graduate Student Quality

Graduate students in the Physiology and Pharmacology graduate programs excel in both research and teaching, based on the many awards that they receive, including but not limited to Canada Graduate Scholarships (CIHR and NSERC), Ontario Graduate Scholarships, charitable foundation scholarships, conference presentation awards, and Department Mogenson Trust Awards. Notably, **30% of our current MSc students and 62% of our current PhD students hold external scholarship funding**. Further evidence of the high quality and success of our students can be found in the number of publications from our Department that include graduate student authors. Despite declining enrolment from 2016-2021, numbers of publications with graduate student authors have steadily increased (**Figure 9**). Together with the trend observed toward proportionately increased PhD enrolment (**Table 9**), these data suggest that over the past 5 years our program has recruited and retained high-quality and productive graduate trainees.

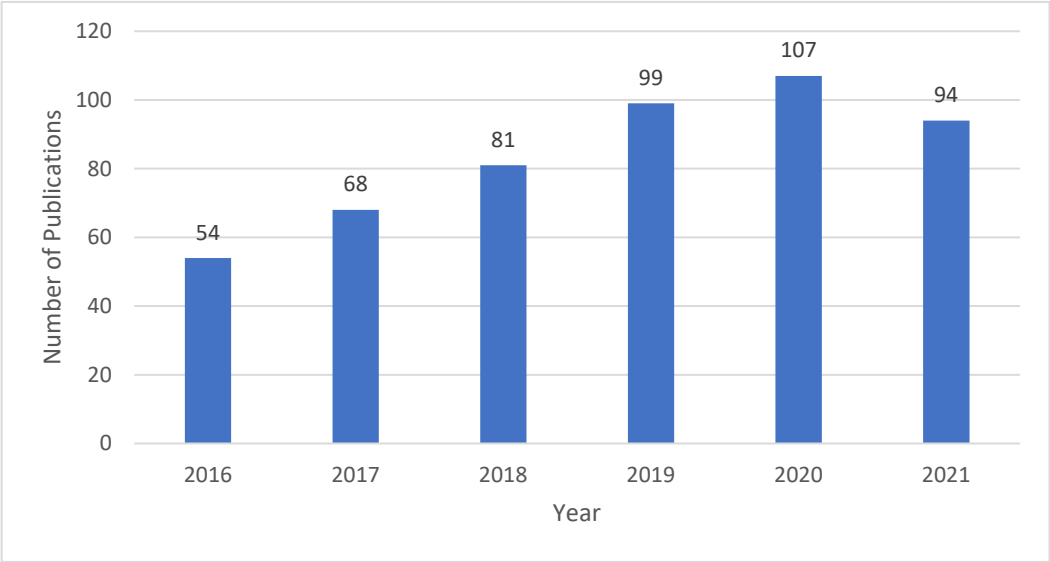

Figure 9. Publications with graduate student authors between Jan 2016 and Dec 2021

Our Graduates

As shown in **Table 11**, analysis of 128 of our graduate students completing their degree programs between 2016 and 2021 indicates, as expected, that a high proportion (32.8%) enter professional schools, including medicine, dentistry and other health professions. However, a similar proportion continue their graduate education (30.5%), which appears to be consistent with the recent increase in the proportion of PhD students in our program. The next most common outcome for our students is to obtain positions in pharmaceutical/ biotechnology companies or as research associates/technicians in university labs (22.7%); and this is more so the case for graduates from the MSc program. An unexpected outcome revealed by this analysis is that 36% of our PhD graduates pursue postdoctoral (PDF) training, which is a substantial decrease (of about 45%) from 5 years ago. Like our overall decrease in graduate student enrolment over the last 5 years, this reduced pursuit of postdoctoral training may reflect decreased grant funding availability from tricouncil and charitable agencies. However, based on the high proportion of our graduates choosing to enrol in PhD programs, and the increase in transfers to PhD within our own program, it appears that our students are recognizing the value of achieving a PhD for career paths beyond academia. This is a goal we have strived to achieve over the past five years through enhanced guidance on professional development within our program and promotion of career development opportunities available through SGPS.

Table 11: First employment and further training of graduate students following program completion

	N	PDF	PhD	Meds	Dent	Other Health Prof	Law / Bus	Teach	Pharma /Biotech	Other Private Sector	Gov	Acad	Res Assoc/ Tech	?
Phd	42	15		8	0	2	1	2	6	4	1	0	3	3
MSc	86		39	19	4	9	1	0	10	6	1	2	10	16
Total	**128**	**15**	**39**	**27**	**4**	**11**	**2**	**2**	**16**	**10**	**2**	**2**	**13**	**19**
% Total	**100**	**11.7**	**30.5**	**21.1**	**3.1**	**8.6**	**1.6**	**1.6**	**12.5**	**7.8**	**1.6**	**1.6**	**10.2**	**14.8**

Graduate Student Times to Completion

Mean times for students obtaining MSc and PhD degrees in the Physiology and Pharmacology Graduate Programs are very close to the University residency periods for these degrees [24 months for MSc students and 60 months for PhD students that transferred from the MSc program] (**Table 12**). We do recognize that we have a broad range of completion times, with a small number of MSc students not defending their theses until about 3.5 years in the program and some PhD students registered up to 7.5 years. A goal of our Graduate Studies Committee is to reduce this range of degree duration, to ensure greater consistency in the timing of degree completion. Toward this end, reminder communications from the Graduate Studies Representative on each student's thesis advisory committee will be important to ensure that the progress of each student is consistently monitored at 6 month intervals, as per our program requirements.

Table 12: Completion times for students who graduated between Jan 2016 and Dec 2021

Completion times of students who graduated between Jan 2016 and Dec. 2021	Number of students	Mean time to completion (months)	SD (months)	Range of completion times	% completing in 28 months	% completing in 64 months
All Students:	127	37.2	18.2	14 - 90	55.1%	91.3%
Total MSc:	85	**25.6**	5.4	14 - 42	82.4%	
Total PhD:	42	**60.5**	11.2	35 - 90		73.8%

Involvement in Interdiscplinary Graduate Programs

Graduate Program in Neuroscience

The Graduate Program in Neuroscience is one of the premier interdisciplinary graduate programs offered at Western. From its inception in 1991, former and current members of the Department of Physiology and Pharmacology have played key roles in the design and governance of this Program. Drs. Goodale, Leung and Vilis were on the original steering committee for the Program, and past Program Directors (Vilis, Rylett and Leung) all held their primary academic appointments in our Department. The current director (Graduate Program Chair) of the program is Dr. Brain Corneil, who holds his primary academic appointment in our Department. As of the most recent Ministry census, **9 MSc students and 28 PhD students enrolled in the Neuroscience Graduate Program are supervised or co-supervised by faculty members that hold appointments in the Department of Physiology and Pharmacology** (a number that is more than 50 % of the number of graduate students in our Department). These students are not counted toward graduate education in our Department, despite receiving their research training by an apprenticeship model under Physiology and Pharmacology faculty members. As mentioned earlier, the funding structure provided through Schulich Graduate Studies allows supervisors to pay a significantly lower portion of the graduate student stipend form their grants if the student is enrolled in Neuroscience.

Collaborative Specialization in Developmental Biology

The purpose of the Collaborative Specialization in Developmental Biology is to create a community of graduate students that have an interest in Developmental Biology and to provide specific courses to support and teach that community. The aim of the program is to train Developmental Biologists who will go on to make significant contributions to the field. As a collaborative specialization, the responsibility of accepting the students into graduate school and ensuring that degree requirements are met rests with the student's home academic Department. However, the collaborative program has forged agreements with each graduate program to ensure that the students receive the additional developmental biology training and that these additional requirements are offset by reductions in the requirements in the home academic Department.

Six academic Departments from both the Schulich School of Medicine & Dentistry and the Faculty of Science participate. This collaborative program is currently entering its 14th year and the Department of Physiology and Pharmacology is the largest participant. In September 2008, the graduate program was awarded an Interdisciplinary Development Initiative award from Western that provided additional resources to the program for three years. Since that time, enrollment contigent funding from the School of Graduate and Postdoctoral Studies and from the Schulich School of Medicine and Dentistry provides the base funding for the program. The first three directors of these program (Drs. Drysdale, Beier and Betts, covering the period from 2008 to 2020) hold appointments in our Department.

Collaborative Specialization in Musculoskeletal Health Research

The goal of the Collaborative Specialization in Musculoskeletal Health Research (CMHR) is to develop scientists with the research and leadership skills necessary to build transdisciplinary research teams focusing on integrated therapeutic, surgical and rehabilitative approaches for the management of bone and joint diseases. There are 16 different graduate programs from four Faculties participating in this initiative, including Physiology and Pharmcacology. The Department of Physiology and Pharmacology is well represented with eight faculty members as program members and Dr. Cheryle Séguin as the current co-Director. The CMHR is supported in part by Western's Bone and Joint Institute, which provides funds that support Transdisciplinary Training Awards, and curriculum offered by the Ivey School of Business. CMHR trainees have the unique opportunity to participate in cutting-edge transdisciplinary research and knowledge translation, while gaining the leadership skills and experience that are essential for scientific progress.

Evolution of Our Graduate Program

Internal program review process - formation of Graduate Program in Physiology and Pharmacology

In 2002, with creation of the Department of Physiology and Pharmacology, the Graduate Studies Committees from the two parent Departments joined to form a single Committee to oversee the progression of students in both the Physiology and the Pharmacology & Toxicology graduate programs. This served us well and provided the foundation for ensuring the development of consistent academic requirements and performance expectations for students in both programs. Following the OCGS periodic reviews of both Programs in 2007-08, the Graduate Studies Committee carried out an internal review of both programs leading to substantial reorganization of the programs, with refinementt and implementation of new degree requirements. The final step in this process was to consolidate our separate degrees in Physiology and in Pharmcology & Toxicology to form the **Graduate Program in Physiology and Pharmacology**. This new program received university Senate approval in 2011 and the first intake of graduate students began in 2012. The current description and requirements for the MSc and PhD in Physiology and Pharmacology is found in detail in our "Graduate Student Handbook". This is one of the few graduate studies programs in Physiology and Pharmacology in Canada.

The implementation of substantial change to our graduate student training programs were stimulated by:

- A commitment to offer our students outstanding research training.
- Acknowledgement by both faculty members and graduate students that there are gaps in the training offered to our students.
- Increasing recognition that our students need more formal training to increase both breadth and depth of their understanding in the subdisciplines of physiology and pharmacology, and in professionalism, communication skills, critical thinking and research ethics.
- A desire to improve our training procedures with well-formulated policies, guidelines and documents adopted by supervisors and students.

Master of Science (MSc) in Physiology and Pharmacology "Accelerated MSc" Option

Description and rationale

Between 2015 and 2020, we implemented and offered a new option within our existing MSc program (Senate approval, February 2015) called the Accelerated MSc Program. The Accelerated MSc was a thesis degree, based on development of an original, advanced research project, together with course work and non-course competency requirements. Completion of the Accelerated MSc was expected in 3-4 academic terms from the initial registration of students in the graduate program. Accelerated MSc students received a stipend according to our policies regarding financial support for MSc students. The Accelerated MSc option enabled a student to complete the requirements for an MSc (and potentially a PhD if students transferred to the doctoral program) in less calendar time than is normally required through sequential enrollment in Bachelor's and MSc programs.

Several factors were considered in developing the Accelerated MSc Program in Physiology and Pharmacology. It provided the opportunity to introduce advanced research competencies to undergraduate students at a stage when they may only just begin to consider post undergraduate training options. As such, we hoped this would be a vehicle to retain high-achieving undergraduate students at Western for a graduate degree; students who excel as undergraduates will likely do well in graduate school. Further, with increased challenges in research funding, the Accelerated MSc could facilitate the timely, and possibly early completion of the MSc degree, or transition to a PhD degree. As mentioned earlier, a large fraction of our graduate student population is in pursuit of professional degrees (i.e. Medicine, Dentistry, etc), and students with an MSc degree often have additional advantages when applying to those professional programs. However, with increasing opportunities for students to enroll in shortened MSc programs elsewhere, students are faced with choosing the graduate program they may be most interested in pursuing *versus* enrolling in a program that will potentially allow them to progress

to their next career step more efficiently. Through the development of the Accelerated MSc option, the Department of Physiology and Pharmacology hoped to provide interested students with the opportunity to achieve both goals.

Outcomes of the Accelerated MSc program:

Following the external review of the Graduate Program in Physiology and Pharmacology in 2017, it was recommended that the Department not continue to direct faculty resources towards continuing the Accelerated MSc program. Total enrolment in the program between 2016 and 2020 was 11 students, of which 3 completed the program within the accelerated timeline, with the remaining 8 requiring additional terms. No students in the Accelerated MSc program transferred to the PhD program. The biggest hurdle for the Accelerated MSc program was the lack of interest from faculty in supervising students through this mechanism, despite initial interest in offering this option. There is occasional interest in the program from students (approximately 1 student inquiry per year since 2020). The Accelerated MSc option has not been officially terminated, but as of 2020 has not been advertised by the Department or School.

Involvement in the Master of Science (MSc) in Interdisclipinary Medical Sciences (IMS)

Although we no longer actively support the Accelerated MSc option, we recognize that there are students with an interest in Physiology and Pharmacology who may not want to dedicate 2 years to its exclusive study at the graduate level. To provide some graduate experience in Phsyiology and Pharmacology to this demographic, we participate in the MSc in Interdisciplinary Medical Sciences (IMS). This is a one-year course-based program which provides students with the skills necessary to integrate, collaborate, and disseminate knowledge and practices related to the fields of research at the Schulich School of Medicine & Dentistry. Mentorship and training are provided by faculty across all Departments including Physiology and Pharmacology. Students who complete an MSc IMS are eligible for direct entry to PhD in Physiology and Pharmacology. The Director of the MSc IMS program is Dr. Nicole Campbell who is appointed in Physiology and Pharmacology. Currently, seven faculty members with appointments in Physiology and Pharmacology participate in the MSc IMS program in various capacities (as course coordinators, instructors, and lab rotation supervisors). We are also currently considering the possibility of a specialized Physiology and Pharmacolgy stream within the MSc IMS program which would cater to students with a more dedicated interest to our dsicplines, and potentially enhance recruitment to our PhD program.

Development of the Master of Science in Drug Safety and Pharmacovigilance (MDSP)

Description and rationale

Drug safety and pharmacovigilance as an education program requires a multidisciplinary curriculum focused on topics in pharmacology, toxicology, epidemiology, public health, public policy and law related to detection, assessment, diagnosis, management, treatment, prevention and understanding of adverse drug reactions. The MDSP is a degree requiring the completion of a one-year course-based program. The program also includes a major research project that runs during the entire year under the supervision of a faculty member. Part of the major research project will be placement at a facility at Western University and the London Health Science Centre (LHSC) for a full-term practicum. The proposed program will be led, hosted, and administered by the Department of Physiology and Pharmacology.

The proposed MDSP program is designed to provide focused and up-to-date graduate level training in the fields of drug safety and pharmacovigilance. Specifically, graduates from the program will:

1) Have a general understanding of the chemical, pharmacological, toxicological and clinical bases and the pathophysiology of adverse drug reactions.

2) Acquire knowledge of statistical and epidemiological methodologies used to evaluate the incidence and understand the significance of the drug safety problem as a public health issue.

3) Demonstrate a special set of skills to better recognize and assess pharmacovigilance signals in the context of specific cases and therapeutic courses.

4) Be able to better utilize research results and scientific evidence to make appropriate decisions in their professional practice.

5) Critically analyze clinical history and data related to drug safety and synthesize knowledge to promote patient safety and optimize healthcare.

6) Develop leadership skills to drive building effective public health policies that endorse patient safety.

Rationale for development of this new course-based program lies in its uniqueness as the only program of its kind in Canada, and its short time commitment. These features make it an attractive option for both graduate students preparing to apply for professional medical programs, for medical professionals starting their medical practice career, and potentially for individuals working in the pharmaceutical industry.

Outcome of external review

The proposed MDSP underwent external review by Dr. Susan Adbel-Rahman (University of Missouri) and Dr. Yaron Finkelstein (University od Toronto) in late February of 2021. While the reviewers were overall enthusiastic about the unique nature of the program and its significant potential to draw students based on a recognized unmet need in graduate education both in Canada and internationally, they also recognized that this will be a resource-intensive program. As it relates to program structure, they recommended the University consider the addition and resourcing of a full-time faculty professor, an enumerated core leadership team, to support the designing and delivery of the new graduate core MDSP courses as outlined, and a dedicated administrator to ensure successful delivery of the program. Further development of the MDSP will depend on acquiring these resources, which is in process.

Graduate Program in Department of Physiology and Pharmacology – Comparison between 2016 and 2021

Table 13 compares key apsects of our graduate student training programs, highlighting areas that have been updated, and new initiatives that have been implemented or undertaken over the past 5 years.

Table 13: Key features of graduate programs from 2016 and 2021

	2016	2021
Programs actively ernrolling students	• MSc, Acclerated MSc, PhD, MD/PhD in Physiology and Pharmacology	MSc, PhD, MD/PhD in Physiology and Pharmacology
Courses offered	• Communication and Critical Thinking • Translational research: From bench to bedside • Pharmacokinetics and drug disposition • Molecular techniques • Grant proposal (PhD)	• Communication and Critical Thinking • Translational research: From bench to bedside • Pharmacokinetics and drug disposition • Molecular techniques • Grant proposal (PhD)

Defined Research Areas	• Cardiovascular sciences • Drug metabolism • Cancer • Endocrinology and Development • Gap junctions • Neurosciences • Skeletal biology • Cell signalling	• Clinical and Basic Pharmacology • Bone and Joint • Cell, Stem Cell and Cancer • Heart, Blood Vessels and Lungs • Reproduction, Development and Metabolism • Neuroscience
Requirements	• PhD seminar • PhD comprehensive exam • Basic Knowledge in Physiology and Pharmacology online modules	• PhD seminar • PhD comprehensive exam • Basic Knowledge in Physiology and Pharmacology milestone assignment (3 hours of online lecture material with corresponding writing assignment)
Collaborative and interdisciplinary programs	• Developmental Biology • Neuroscience • Musculoskeletal Research	• Developmental Biology • Neuroscience • Musculoskeletal Research • MSc IMS
Professional development, Program development, and EDID Considerations	• Letter of agreement/GSR meeting • Student Orientation (September) • Weekly Departmental Seminars • Graduate Research Day	• Letter of agreement/GSR meeting • Student Orientation (September) • Weekly Departmental Seminars • Graduate Research Day • Implementation of professional development workshop within Communication and Critical Thinking • Implementation of Graduate Student Portal within OWL (used as a primary means of communication and repository of current program information for graduate students) • Development of MDSP • Implementation of Graduate Opportunity Scholarship

Concluding Remarks – Graduate Student Education

The graduate programs in Physiology and Pharmacology have grown substantially over the years, but enrollment has declined over the past 5 years. This most likely reflects a combination of decreased availability of tricouncil and charitable foundation funding for research grants, competition with the Neuroscience program (and potentially other programs), and faculty departures. Despite this trend, which we will continue to monitor, the quality and retention of students in our progam remains remarkably high. To address decreased enrolment, we hope to continue to recruit new faculty supervisors to our program through cross-appointments and new appointments. To ensure that we have robust pool of top-quality applicants for faculty supervisors to recruit to their labs, we will further increase efforts to attract students from beyond Western through expanded online recruitment events and promotion. These events will advertise the strength of our program based on its large contingent of faculty members leading vigorous and varied research programs with access to high quality facilities and collaborative groups. We also hope to recruit direct entry PhD students through our participation in the MSc in IMS, to recruit health and industry professionals to the future MSc in Drug Safety and

Pharmacovigilance, and to recruit outstanding, diverse trainees through our newly implemented Graduate Opportunity Scholarship.

Most importantly, the Department of Physiology and Pharmacology has not remained static over the period of this self study and has sought ways to improve its current graduate programs, and to participate in and develop new graduate programs. This growth builds upon our long-standing strengths in providing current and prospective students with a variety of top-quality graduate student training experiences. We have and continue to implement changes to meet the needs of our current and prospective students. These changes span from updating coursework to include current professional development training, to participation in and development of new programs (MSc IMS and MDSP), and to recruit faculty supervisors (11 new and/or cross-appointments) that refresh our research themes and bring new technical approaches. Of note, many of our recent cross-appointees are clinicians in various units at Schulich, increasing the potential for translational and clinical training for our students.

Priorities For Strategic Planning

• Increased efforts toward local, regional, national, and international graduate student recruitment through online events organized by the Physiology and Pharmacology Graduate Studies Committee and Schulich Graduate Studies Office **[Recruitment]**
• Leveraging of participation in course-based MSc IMS offered at the Faculty level. These students are eligible for direct enrolment in the Physiology and Pharmacology PhD program upon completion of the program. **[Recruitment]**
• Ongoing development of MDSP. Like MSc IMS, these students are eligible for direct enrolment in the Physiology and Pharmacology PhD program upon completion of the program. **[Recruitment]**
• Further promotion and work toward securing ongoing funding of the Physiology and Pharmacology Opportunity Scholarship to further attract graduate students from marginalized groups including those who self-identify as Black, non-Canadian citizen of colour, 2SLGBTQIA+, Indigenous, and well as those with a disability. **[EDID]**
• Ongoing development and implementation of access to online and in-class resources, including courses, workshops, and self-assessment tools, to engage and train graduate students at all levels for professional activities inside and outside academia. **[Professional Development Education]**

RESEARCH

Overview

The Department of Physiology and Pharmacology is a research-intensive Department emphasizing integrative biology and translational medicine, and carrying out studies at the molecular, cellular, systems, whole animal and clinical levels. A major objective of our Department is to host a diverse range of state-of-the-art research programs that attract peer-reviewed funding and engage in collaborations within and outside our Department. The rich diversity of world-class research conducted by faculty members in our Department provides outstanding training opportunities for both undergraduate and graduate students and postdoctoral fellows interested in the biomedical sciences.

Scope of Our Research

Research Groups and Research Centres are critical components of the Schulich research enterprise. Members of our Department have played roles in the development of many of the most successful integrated research programs affiliated with Schulich and remain leaders in these initiatives. Many of these initiatives are collaborative ventures with partners such as the Lawson Health Research Institute, Children's Health Research Institute and Robarts Research Institute.

Department of Physiology and Pharmacology laboratories are situated such that principal investigators, staff and trainees have opportunities to interact with groups pursuing similar research interests. This philosophy facilitates interactions, knowledge/expertise exchange and equipment sharing such that productivity is optimized and collaborations are promoted. For example, we have faculty members located in research programs within the Dental Science Building (gap junction group; skeletal biology group); Robarts Research Institute (molecular medicine research group; imaging research; neuroscience); Victoria Research Laboratories/Children Health Research Institute/Lawson Health Research Institute (developmental biology), London Health Sciences Centre – Legacy Pavilion (clinical pharmacology and personalized medicine; CSTAR), and the Medical Science Building (cancer biology, cardiovascular sciences, receptor pharmacology). Department of Physiology and Pharmacology faculty pursue cutting-edge research in six main categories/themes:

Heart, Blood Vessels and Lungs – Includes research on topics such as the cellular and molecular basis of hypertension, dyslipidemia, cardiac arrhythmia, and heart failure, as well as cardiac repair after myocardial infarction. Additional topics of interest include vessel contractility, smooth muscle/endothelial interactions, and roles of ion channels and G-protein-coupled receptor signaling in regulating cardiovascular function. Research also explores the regulation of inflammation and tissue injury/repair following direct (acid aspiration, mechanical ventilation, pneumonia, etc.) and indirect (sepsis) lung injury with a specific focus on endothelial cell barrier dysfunction, as well as alterations of the pulmonary surfactant system.

Cell, Stem Cell and Cancer – Includes multidisciplinary research into cellular physiology that governs tissue maintenance and repair during chronic diseases, cancer and aging. Functional, collaborative, and translational research focused on harnessing the capacity of stem cells for tissue regeneration during chronic diseases such as arthritis, diabetes, and cardiovascular diseases is the focus of the stem cell and regenerative medicine group. Pre-clinical research understanding pathological changes in cells that lead to tumour formation and metastasis, and the targeting of these processes to develop novel therapies for cancer is an intense area of investigation.

Clinical and Basic Pharmacology – Basic research includes molecular, cellular and *in vivo* approaches in the areas of pharmacokinetics (absorption, disposition, metabolism, and elimination of drugs) and pharmacodynamics (receptor signaling mechanisms, dose-response relationships). Clinical and pre-clinical

areas of interest include adverse drug effects, drug-drug interactions, pharmacogenetics/pharmacogenomics, and therapeutics targeting diseases ranging from cardiovascular, skeletomuscular, pulmonary and neurological systems to cancer, diabetes, maternal-fetal health and kidney disease.

Bone and Joint – Research areas include the physiology, pharmacology and development of bone, cartilage, connective, and muscle tissues, and the pathogenesis and treatment of diseases such as arthritis and osteoporosis, as well as muscle- and spine-related disorders. Experimental approaches range from cellular and *in vivo* models, such as pre-clinical animal models of musculoskeletal pathologies, to clinical discovery research and clinical trials in humans. Members of this group collaborate extensively as members of Western's Bone and Joint Institute.

Neuroscience, Neurodegeneration and Cognition – Includes research in a broad area aiming to understand the most complex organ in the body in health and disease. This involves research on the genetic and molecular basis for how individual brain cells work, communicate, operate neural circuits and drive behaviour. Systems and cognitive neuroscience seek to understand the neural underpinnings of our sensory, motor, and behavioural abilities, and what happens when such abilities are compromised by injuries or neurodegenerative conditions including Alzheimer's disease and Parkinson's disease. Members of this group collaborate extensively as members of Western's Brain and Mind Institute and/or the Western Institute for Neuroscience.

Reproduction, Development and Metabolism – Includes research with an emphasis on the physiological and pharmacological mechanisms regulating gonadal function, reproduction, embryo development, placentation, maternal-fetal health, organogenesis and metabolism. This includes, but is not limited to, studies at the genetic, epigenetic, molecular, cellular, organismal and environmental levels that may predispose individuals to infertility, preterm birth, cardiovascular disease, metabolic disease, placental disease, diabetes and cancer.

Postdoctoral Fellows

Members of the Department of Physiology and Pharmacology are committed to training the Physiologists and the Pharmacologists of the future. This training not only involves the education of graduate students (see graduate studies section), but also advanced training of postdoctoral fellows, providing a stepping stone for career advancement in Physiology and/or Pharmacology fields. As evidence of contributions to this advanced training, Department members have supervised 107 postdoctoral fellows in the past five years (**Figure 10**).

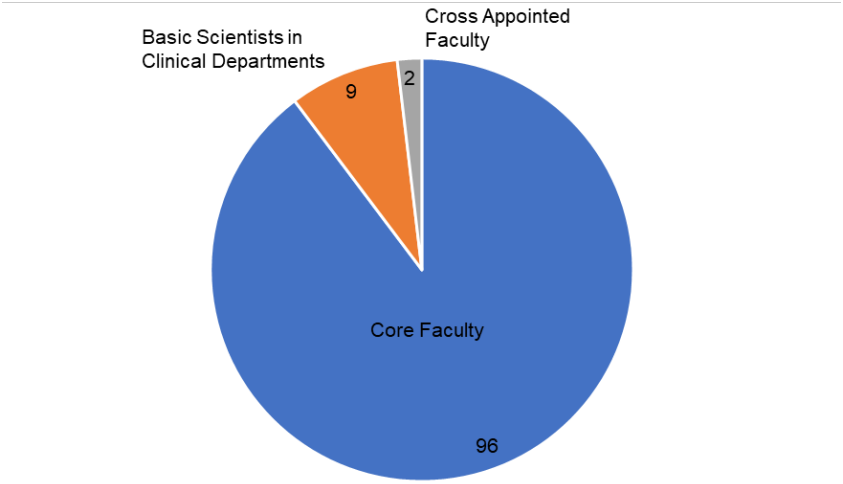

Figure 10. Total number of post-doctoral fellows and/or associates supervised by Physiology and Pharmacology faculty between 2016-2021.

We note that a strong track-record of postdoctoral supervision has been maintained since 2016 despite an unprecedentedly challenging funding climate. Nevertheless, since the start of the pandemic, there is a trend to a lower number of postdoctoral supervision, likely due do travel- and laboratory occupancy-related restrictions (**Figure 11**). In the most recent year (2021), we had 16 postdoctoral fellows training with Department faculty.

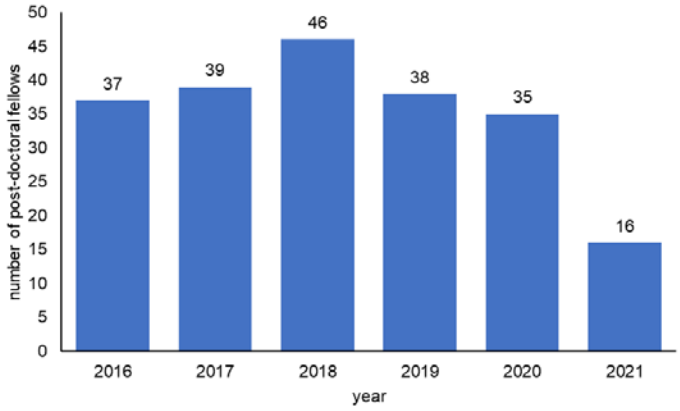

Figure 11. Number of postdoctoral fellows and/or associates supervised by Physiology and Pharmacology faculty on a yearly basis from 2016-2021.

As evidence of trainee excellence, many of the postdoctoral fellows in our Department are recipients of competitive fellowships from diverse national and international agencies (**Figure 12**). Sources include the national Tri-council agencies [CIHR (including a prestigious Banting fellowship to Dr. Jonathan Michaels, Pruszynski lab), NSERC], as well as other national and provincial agencies (MITACS, Arthritis Society). Further support for trainees has come from international agencies such as from the Brazil, Egypt, China, German and Japan governments. Our postdoctoral trainees have also had success securing competitive internal financial support (BrainsCAN, Rotman, Whaley fellowships).

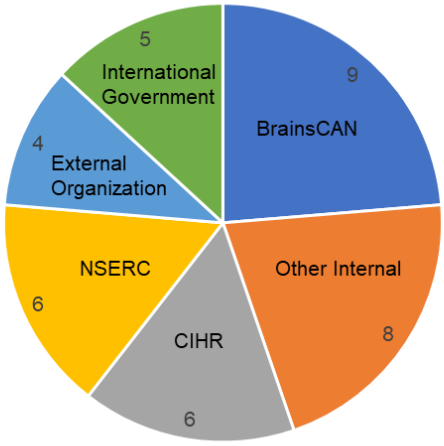

Figure 12. Number and distribution of stipend, travel or research awards received by Physiology and Pharmacology postdoctoral fellows and/or associates between 2016-2021.

Postdoctoral fellows make substantial contributions to the research effort of our Department, as evidenced by authorship on a large proportion of research publications (see **Figure 16** below). Moreover, they contribute in

less visible ways to the training of undergraduate and graduate students in their respective research settings. This includes assistance in the design and execution of studies with advanced instrumentation, preparation of figures and the writing of manuscripts and reports. Ultimately, our postdoctoral fellows contribute essential aspects to establishing a research-intensive setting in our research programs. In addition, some of our postdoctoral fellows contribute to classroom teaching, gaining valuable experience.

As principal investigators and supervisors, we are dedicated to promoting career development and suitable placements for our postdoctoral fellows, consistent with their career goals. Our trainees have demonstrated great success in achieving their professional goals, as evidenced by the distribution of position types acquired after completion of training with our faculty (**Figure 13**). Positions secured have included Professors (e.g. York University, University of Pittsburgh, Memorial University, University of Delaware, Nanjing University, University of Dublin), other stations in academia (e.g. Scientist - Czech Academia of Sciences, Technical Staff – Riken Research Institute, Scientist – Chiba University, Research Staff - McGill), industry (e.g. GlaxoSmithKline, Editorial Consultant, Veristat, Info-Tech), health professional or government (e.g. Pharmacist, Physicians, CIHR Officer, Clinical Practice, Health Canada CRO) and further training.

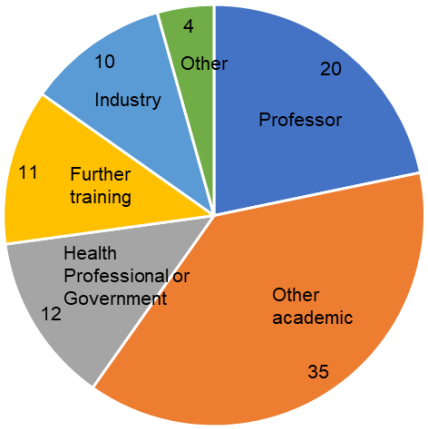

Figure 13. **Distribution of positions acquired by Physiology and Pharmacology postdoctoral fellows and/or associates after completion of training between 2016-2021.**

The School of Graduate and Postdoctoral Studies (SGPS) at Western provides institutional support for postdoctoral fellows. Postdoctoral services include listings of internal placement opportunities, external fellowship program opportunities (CIHR/Banting, MITACS, Ontario Women's Health Scholars), details for ~65 external agency funding opportunities, instructions concerning the placement process at Western, a list of official policies and procedures and contact information for the Postdoctoral Association at Western (PAW). PAW acts as a collective voice for postdoctoral fellows and associates at Western, serving as a liaison between trainees and the University. PAW coordinates social events and professional development opportunities for these trainees. Professional development programs through Western include *Curriculum Vitae* strengthening, creation of individual development plans, programs to promote/improve Teaching (via the Center for Teaching and Learning), Career Education opportunities, information on planning for a career in Science and job/employment postings via Western Connect. Importantly, PAW has information for new and existing postdoctoral scholars on COVID-19 policies and procedures, mental heath and wellness at Western, income tax, supports for family and specific information for international scholars.

In addition to these resources available to all postdoctoral trainees in our Department through SGPS and PAW, our Department promotes the formation of an individual mentorship committee for the trainee, composed of

the postdoctoral supervisor and one or more other faculty members. This committee not only provides guidance on the research project of the postdoctoral scholar, but also facilitates teaching opportunities, presentation opportunities, participation on Department committees, contributions to grant applications (potentially as co-applicants) and general career advice. Collectively, the support in place at Western (SGPS and PAW) and the mentorship program within our Department results in a nurturing environment that greatly enhances postdoctoral trainee success.

Measures of Success in Research

Research Funding

Faculty members of the Department of Physiology and Pharmacology have maintained an exemplary track-record of securing peer-reviewed funding for their research programs between 2016-2021, despite the extremely challenging funding climate. The total value of external funds supporting our Departmental research programs between 2016-2021 was ~$46 million CDN (**Figure 14**). These funding data have been compiled from 41 faculty members who held primary academic appointments in the Department of Physiology and Pharmacology during that time, including 15 based at the Robarts Research Institute, all of whom had protected time for research (typically 60%). We note that 9 of these individuals have either retired or left Western during the 2016-2021 time period; thus, the funding values of these departed faculty members include only part of the time period assessed (until their departure). Note that we have not included any cross-appointed faculty in these numbers. Additionally, collaborative grants were not included in the funding summary when the principal investigator was not a primary appointee in our Department. Most significantly, the Canada First Research Excellence Fund awarded in 2016 to BrainsCAN, which is co-directed by Department member Lisa Saksida and valued at $66 million CDN, was not included in this funding breakdown.

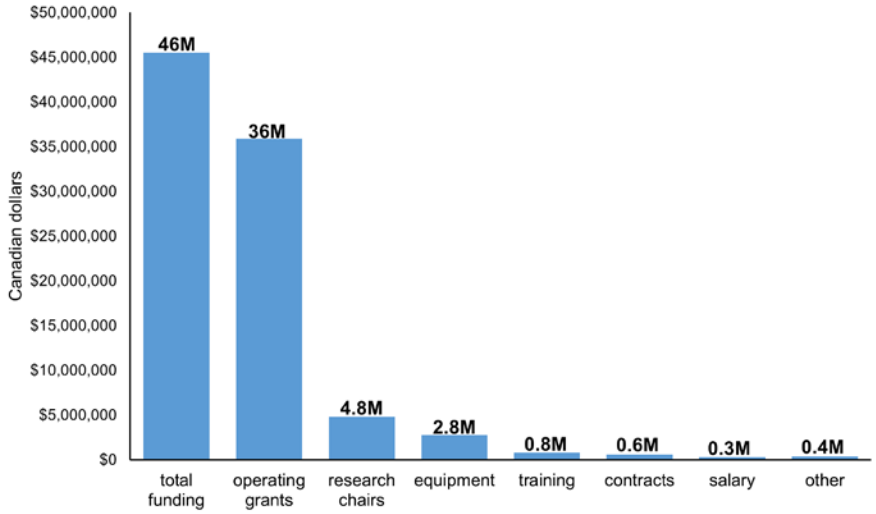

Figure 14. **Total monetary value of external research funds received by Physiology and Pharmacology faculty between 2016-2021.** The funding is separated by grant type. The values are sums of funds received for each year between 2016-2021 and do not include funds to be received beyond 2021 (as part of new grants) or funds received prior to 2016 (as part of pre-existing grants). The values exclude cross-appointed faculty funding. “other” includes team, conference organization and dissemination grants.

The majority of the research revenue received by Department members between the 2016-2021 period was in the form of individual and collaborative peer-reviewed operating grants (78% of the total funding). Of note, 4.8 million CDN external funding was received through research chairs programs (10% of the total funding). Primary

appointees in our Department held five Tier I Canada Research Chairs (Karmazyn, Beier, Saksida, Lomber, Prado) and four Tier II Canada Research Chairs (Cregan, Pruszynski, Kramer, Grol) between 2016-2021. The next largest bracket of external funding directly supported the equipment and infrastructure needs of our Department members, accounting for 2.8 million CDN and 6% of the total external funding. Our previous Self Study showed that individual or collaborative peer-reviewed operating grants accounted for ~74%, group/team grants accounted for ~15% and Research Chairs/salary awards accounted for ~10% of the total funding between 2010-2015 (calculated in a similar manner as the present Self-Study).

In the past Department Self Study (2010-2015), external reviewers noted that faculty had "considerable differences of opinion about the nature and value of various internal funding programs." Over the 2016-2021 period, Department of Physiology and Pharmacology faculty members secured 5.6 million CDN in internal funding, with the majority in the form of operating grants (93% of the total funding) (**Figure 15**). This internal funding includes startup, Tri-council accelerator, Tri-council bridge, Tri-council seed, catalyst, cross-institutional collaborative, collaborative seed, internal chairship, award/honours-associated grants, equipment and training program grants.

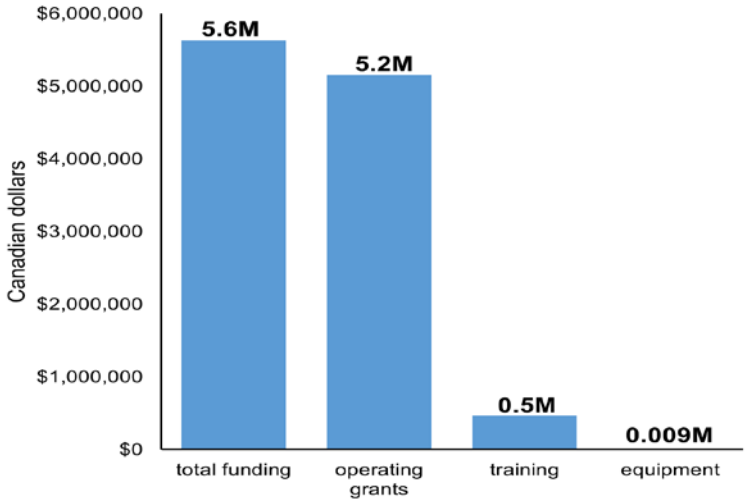

Figure 15. Total monetary value of internal research funds received by Physiology and Pharmacology faculty between 2016-2021. The funding is separated by grant type. The values do not include cross-appointed Faculty.

Peer-Reviewed Publications

Our Department of Physiology and Pharmacology website maintains a list of articles published by our faculty members on a monthly basis (https://www.schulich.uwo.ca/physpharm/research/publications.html). These monthly lists are derived from the PubMed database and annotated to indicate the names of all faculty members appointed to our Department (underlined) as well as trainees within our Department (bolded). Based on these lists and annotations, we evaluated our Departmental publication record between 2016-2021. For this time period, 1551 publications appear in the PubMed database containing names of faculty members appointed to our Department (**Figure 16**). Approximately 50% of these publications (768) contain a Physiology and Pharmacology graduate student and/or postdoctoral trainee as an author, suggesting that the faculty contributions to these papers are largely associated with trainee research within our Department. Further, 303 of these publications (~20%) list a graduate student or postdoctoral trainee as first-author. Please note that these numbers are an underestimate since many of our department members supervise graduate students in other programs, most notably the Neuroscience program (see Graduate Studiess section), that are not captured here. The total number of publications by faculty and the number containing at least one trainee as author have increased by ~17 and 10%, respectively, compared to the previous Self-Study analysis (2010-2015), despite a

lower number of Department members, the more challenging funding climate in recent years and the limitations imposed by the pandemic.

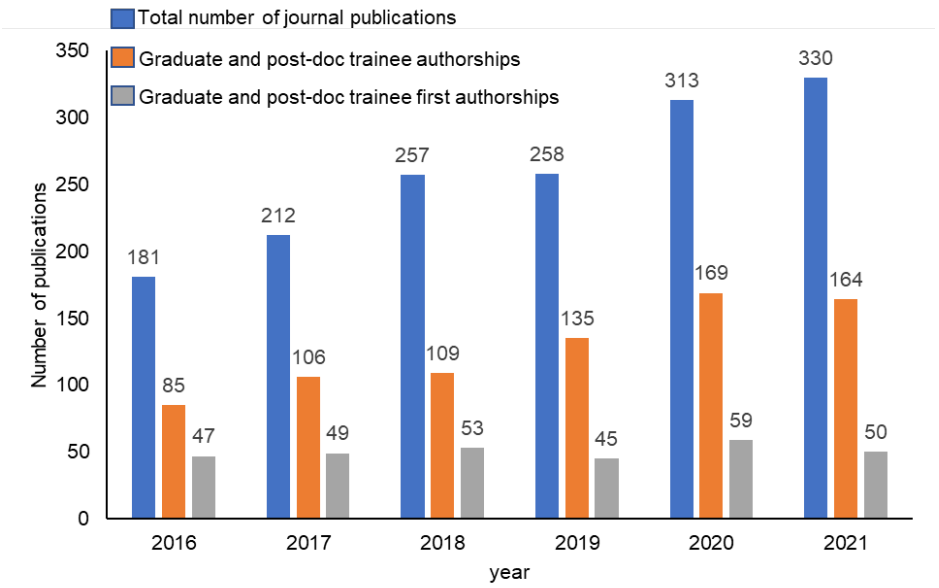

Figure 16. Number of peer-reviewed journal publications by Physiology and Pharmacology faculty between 2016-2021. Among the total publications for each year (blue bars), the number of Physiology and Pharmacology graduate student and/or post-doctoral fellowship authorships (orange bars) and Physiology and Pharmacology graduate student and/or post-doctoral fellowship first authorships (grey bars) are shown.

While it is challenging to assess the impact our 2016-2021 Department-affiliated publications have had or will have in the respective fields, our Department member h-index distributions provide some information on the typical citation impact of publications with respect to career stage. The h-index values (Google Scholar) for our Department members range from ~10 to 115 (**Figure 17A**) and, as expected, appear dependent on career stage (**Figure 17B**), with senior investigators showing the highest h-index values. Nevertheless, we note a clear overlap between h-index values of our early and mid-career researchers with many of our senior investigators, suggesting the impact of our future works from these groups will maintain and/or surpass the high standards of our senior researchers.

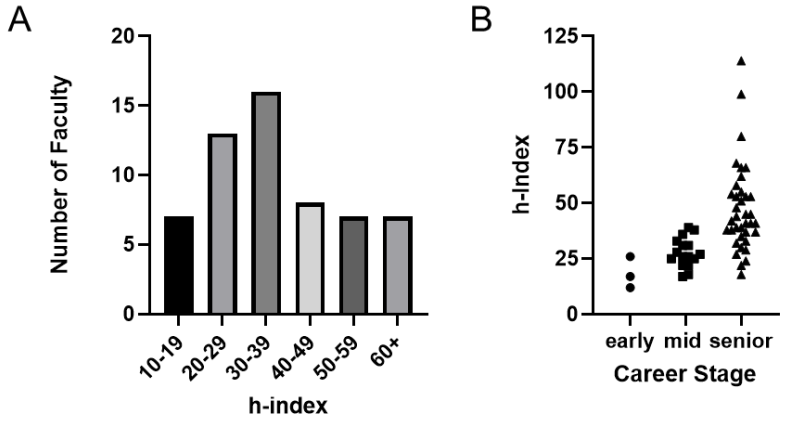

Figure 17. H-index distributions for Physiology and Pharmacology faculty members (including Teaching and Cross-appointed faculty). **(A)** Histogram indicating the number of faculty with h-index values in the 10s, 20s, 30s, 40s, 50s and >60. **(B)** Distribution of h-index values among early (circle), mid (square) and senior (triangle)-career stages.

Award-Winning Faculty Members

Between 2016-2021, many of the current primary appointees in the Department received societal, provincial, national or international-level honours or awards recognizing their research excellence (**Table 14**). For example, our faculty currently hold five CIHR Canada Research Chairs, received prestigious early career investigator awards (Gairdner Foundation, Ontario Mental Health Foundation, Premier's Research Excellence), have been recognized as Fellows (Canadian Academy of Health Sciences, Royal Society of Canada), received highest governmental recognitions (Order of Ontario, Order of the British Empire) and have been identified as elite national leaders (Canada's Top 100 Women Award), to name a few.

Table 14. **External awards and/or honours received by Physiology and Pharmacology faculty between 2016-2021, demonstrating research excellence.**

Year	Faculty Member	Award or Honour	Organization	Core Faculty	Cross Appointed
2016	Wataru Inoue	New Investigator Fellowship	Ontario Mental Health Foundation	X	
2016	Lisa Saksida	Fellow Emerita	Newnham College, Cambridge, UK	X	
2016	Mel Goodale	Ivey Fellow	Canadian Institute for Advanced Research	X	
2016	Dale Laird	Fellow	Canadian Academy of Health Sciences		X
2017	Lisa Saksida	Canada Research Chair	Canadian Institutes of Health Research	X	
2017	Sean Gill	Breath New Life Award	Ontario Thoracic Society	X	
2017	Kevin Shoemaker	Fellow	Canadian Academy of Health Sciences		X
2018	David Hill	Jorgen Pedersen Medal	European Association for the Study of Diabetes		X
2018	Andrew Pruszynski	Early Research Award	Premier's Research Excellence Award	X	
2018	Peter Chidiac	Senior Investigator Award	Canadian Society of Pharmacology and Therapeutics	X	
2018	Peter Stathopulos	Junior Investigator Award	Canadian Society of Pharmacology and Therapeutics	X	
2019	Marco Prado	Canada Research Chair	Canadian Institutes of Health Research	X	
2019	Adrian Owen	Officer/Most Excellent Order of the British Empire	Government of United Kingdom	X	
2019	Rob Gros	Outstanding Volunteer	Hypertension Canada	X	
2019	Frank Beier	Fellow	International Combined Orthopaedic Research Societies	X	
2019	Frank Beier	Basic Science Award	Osteoarthritis Research Society International	X	
2019	Jayne Garland	Fellow	Canadian Academy of Health Sciences		X
2019	Cheryle Seguin	Stars Career Development	Canadian Institutes of Health Research/Arthritis Society	X	
2019	Cheryle Seguin	Founder's Medal	Canadian Orthopedic Research Society	X	
2019	Qingping Feng	Senior Investigator Award	Canadian Society of Pharmacology and Therapeutics	X	
2019	Donald Welsh	Guest Professorship	Beijing/Peking University	X	
2019	Marlys Koschinsky	Midwest Lipid Association Service Award	National Lipid Association	X	
2019	Marlys Koschinsky	Order of Ontario	Government of Ontario	X	
2020	Mel Goodale	Sir Frederic Bartlett Lecture Prize	Experimental Psychology Society, UK	X	
2020	Andrew Pruszynski	Canada Research Chair	Canadian Institutes of Health Research	X	
2020	Rithwik Ramachandran	Junior Investigator Award	Canadian Society of Pharmacology and Therapeutics	X	
2020	Marlys Koschinsky	Fellow	Canadian Academy of Health Sciences	X	
2020	Lisa Saksida	Canada's Top 100 Women Award	Women's Executive Network	X	
2020	Lisa Saksida	Fellow	Royal Society of Canada	X	
2020	Lisa Saksida	Fellow	Canadian Academy of Health Sciences	X	
2020	Michael Rieder	Fellow	Canadian Academy of Health Sciences		X
2021	Frank Beier	Canada Research Chair	Canadian Institutes of Health Research	X	
2021	Timothy Bussey	Fellow	Canadian Academy of Health Sciences	X	
2021	Matthew Grol	Canada Research Chair	Canadian Institutes of Health Research	X	
2021	Van Lu	Early Career Investigator Award	Gairdner Foundation	X	

Consistent with this strong track-record of external recognition associated with our research excellence, Faculty from the Deparment of Physiology and Pharmacology are perenially recognized within the Schulich School of Medicine and Dentistry and/or Western University for research excellence among their peers (**Table 15**). These recognitions include Faculty Scholar Awards, WORLDiscoveries Innovator Awards, Internal Research Chairs, Dean's Awards of Excellence (junior and established) and Distinguished University Professorships, for example.

Table 15. Internal awards and/or honours received by Physiology and Pharmacology faculty between 2016-2021, demonstrating research excellence.

Year	Faculty Member	Award or Honour	Organization	Core Faculty	Cross Appointed
2016	Stefan Everling	Faculty Scholar Award	Western University	X	
2016	Stefan Everling	Dean's Award of Excellence (Research)	Schulich School of Medicine and Dentistry	X	
2016	Timothy Bussey	Western Research Chair	Western University	X	
2017	David Hess	Sheldon H. Weinstein Endowed Chair	Schulich School of Medicine and Dentistry	X	
2017	Qingping Feng	Richard and Jean Ivey Chair	Schulich School of Medicine and Dentistry	X	
2017	Lina Dagnino	Scientist of the Year	Children's Health Research Institute	X	
2017	Lina Dagnino	Faculty Scholar Award	Western University	X	
2017	Brian Corneil	Faculty Scholar Award	Western University	X	
2017	Marco Prado	Dean's Award of Excellence (Research)	Schulich School of Medicine and Dentistry	X	
2018	Dale Laird	Distinguished University Professor	Western University		X
2018	Qingping Feng	Faculty Scholar Award	Western University	X	
2018	Andrew Pruszynski	Dean's Award of Excellence (Junior Research)	Schulich School of Medicine and Dentistry	X	
2019	Peter Stathopulos	First Disclosure Vanguard Award	WORLDiscoveries	X	
2019	Jane Rylett	Alumni of Distinction	Western University	X	
2019	Marlys Koschinsky	Dean's Award of Excellence (Research)	Schulich School of Medicine and Dentistry	X	
2020	Julio Martinez-Trujillo	Provincial Endowed Chair in Autism	Schulich School of Medicine and Dentistry	X	
2020	Donald Welsh	Cecil and Linda Rorabeck Chair	Schulich School of Medicine and Dentistry	X	
2020	Qingping Feng	Innovator of the Year Vanguard Award	WORLDiscoveries	X	
2020	Cheryle Seguin	Faculty Scholar Award	Western University	X	
2020	Brad Urquhart	Young Alumni Award	Western University	X	
2020	John Ciriello	Alumni of Distinction	Western University	X	
2021	Timothy Bussey	Western Research Chair	Western University	X	
2021	Lakshman Gunaratnam	Dr. Robert Zhong Chair	Schulich School of Medicine and Dentistry		X
2021	Brad Urquhart	Faculty Scholar Award	Western University	X	

Leadership and Stature in Research

Faculty in the Department of Physiology and Pharmacology are regularly entrusted with leadership roles in research-related organizations at the national and international levels, consistent with the high international recognition and standing within their fields. A survey of our faculty members revealed highlighted leadership roles on funding panels, research-related societies, journal editorial boards, external conference organization and external research organizations (**Figure 18**), over the 2016-2021 period. For example, our faculty have organized Gordon Research Conferences and joint CIHR-NIH symposia, have presided over professional societies such as the Canadian Society for Pharmacology and Therapeutics, have chaired NSERC, US Department of Defense and CIHR funding panels, have been directors of the Ontario Institute for Regenerative Medicine and CIHR Institute for Aging, and are Deputy Editors of impactful journals such as *Journal of Neurochemistry* and *Osteoarthritis and Cartilage* (**Table 16**).

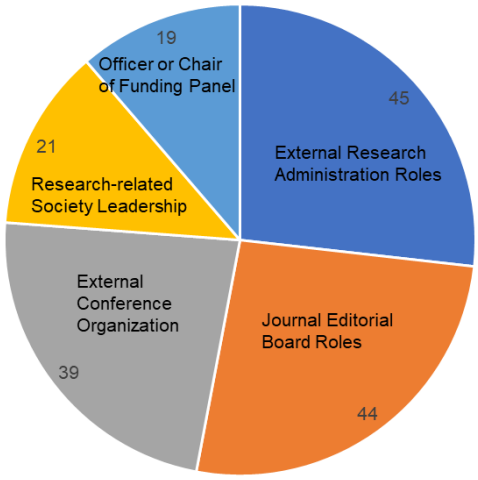

Figure 18. Number of highlighted external research-related leadership roles by Physiology and Pharmacology faculty between 2016-2021. See accompanying **Table 16** for selected examples of these highlighted roles.

Table 16. Sample of highlighted external research-related leadership roles by Physiology and Pharmacology faculty between 2016-2021.

Year	Name	Conference/Event Organization	Role
2017	Frank Beier	Gordon Research Conference on Cartilage Biology and Pathology	Chair
2018	Rommel Tirona	International Society for the Study of Xenobiotics Meeting	Member, Organizing Committee
2019	Marco Prado	International Symposium on Cholinergic Mechanisms, Rehovot Israel	Organizer
2020	Chris Pin	Joint CIHR-INMD and NIDDK Diabetes Symposium	Member, Organizing Committee
2021	Vania Prado	International Society for Neurochemistry Meeting	Chair, Program Committee
		Research-related Society Leadership	
2015-2018	Andrew Pruszynski	Association for Canadian Early Career Researchers	Co-founder, Member National Committee
2016	Adrian Owen	CIFAR Brain Mind and Consciousness Program	Co-director
2017	Adrian Owen	Gairdner Foundation	Member, Awards Review Panel
	Qingping Feng	Canadian Nitric Oxide Society	Vice-President, Science Excellence Committee
2021	Brad Urquhart	Canadian Society for Pharmacology and Therapeutics	President
		External Funding Leadership	
2016	Chris Pin	NSERC – Genes, Molecules and Cells Reviewing Panel	Chair
2016-2017	Frank Beier	US Army – Post-Traumatic Osteoarthritis Panel	Chair
2017	Peter Chidiac	CIHR – Pharmacology and Toxicology Reviewing Panel	Chair
2019-2021	Rob Gros	HSFC – Scientific Committee II Reviewing Panel	Chair
2021	Lisa Saksida	Brain Canada – Future Leaders in Brain Research Panel	Chair
		External Research Administration	
2016-2019	Cheryle Seguin	Ontario Institute for Regenerative Medicine	Director of Research
2016-	Sean Gill	Ontario Thoracic Society	Member, Research Advisory Committee
2019-	Jane Rylett	CIHR Institute of Aging	Scientific Director
2019-	David Hill	Ontario Hospitals Association	Co-Chair, Research Innovation
2021	Lisa Saksida	Canadian Academy of Health Sciences	Member, Fellowship Review Committee
		Scientific Publications	
2016-2020	Brian Corneil	*Journal of Neurophysiology*	Associate Editor
2017-	Dean Betts	*Biology of Reproduction*	Member, Reviewing Editorial Board
2016-2022	Frank Beier	*Osteoarthritis and Cartilage*	Deputy Editor
2019	Marco Prado	*Journal of Neurochemistry*	Deputy Chief Editor
	Marlys Koschinsky	*Atherosclerosis*	Associate Editor
2021	Matt Grol	*Frontiers in Immunology*	Associate Guest Editor

Consistent with the recognition in research nationally and abroad, our primary appointed faculty members delivered over 550 invited external lectures and presentations between 2016-2021 (**Figure 19**). These presentations include several Keynote, Plenary and Award recipient-related lectures on most continents (North America, South America, Europe, Asia and Australia) (**Table 17**).

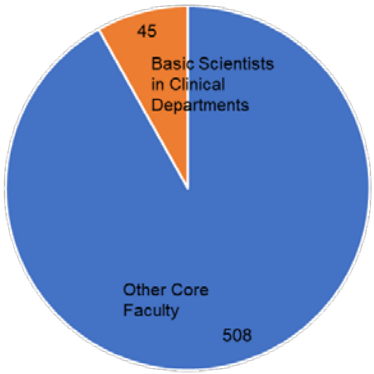

Figure 19. Number of invited external lectures and presentations by Physiology and Pharmacology faculty between 2016-2021. See accompanying **Table 17** for a sample of highlighted lectures and presentations.

Table 17. Sample of highlighted external lectures and presentations by Physiology and Pharmacology faculty between 2016-2021.

Year	Name	Nature of presentation	Organization/Event	Location
2016	Frank Beier	Keynote Talk	Translation in Regnerative Medicine Symposium	University of Regensburg, Germany
2016	Rob Gros	Invited Talk	Experimental Biology Symposium	San Diego, CA
2016	Mel Goodale	Gibson Lecture	Cornell University	Ithaca, NY
2016	Stefan Everling	Invited Lecture	Institute of Neuroscience	Shanghai, China
2016	Stefan Everling	Invited Talk	Cortex Conference	Lyon, France
2016	Stefan Everling	Invited Lecture	Institut de Neurosciences de la Timone	Marseille, France
2016	Brad Urquhart	Invited Talk	American Society of Nephrology Meeting	Chicago, IL
2016	Donald Welsh	Invited Talk	Royal Society Theo Murphy Meeting	Buckinghamshire, United Kingdom
2016	Adrian Owen	Invited Talk	Durham University	Durham, United Kingdom
2016	Qingping Feng	Invited Talk	Perinatal Biology Symposium	Snowmass, CO
2016	Marco Prado	Invited Lecture	National Institutes of Health	Rockville, MD
2017	Christopher Pin	Invited Lecture	University of Palermo	Palermo, Italy
2017	Christopher Pin	Invited Workshop Presentation	Mayo Clinic	Rochester, MN
2017	Adrian Owen	Gairdner Lecture	Gairdner Foundaton	Thunder Bay
2017	Frank Beier	Keynote Talk	Korean Society for Osteoarthritis and Cartilage Repair	Seoul, South Korea
2017	Frank Beier	Invited Talk	Annual European Congress of Rheumatology	Madrid, Spain
2017	Brian Corneil	Inaugural Lecture	Mel Goodale Speaker Series	Monash University, Australia
2017	Stefan Everling	Invited Talk	Primate Neurobiology Meeting	Gottingen, Germany
2017	Qingping Feng	Invited Talk	American Physiological Society Meeting	Chicago, IL
2017	Marco Prado	Invited Talk	Alzheimer's and Parkinson's Diseases Conference	Vienna, Austria
2018	Peter Chidiac	Invited Talk	International Foz do Iguacu	Brazil
2018	Stefan Everling	Invited Lectures	University of Pittsburgh and Carnegie Melon University	Pittsburgh, PA
2018	Stefan Everling	Invited Lecture	Riken	Tokyo, Japan
2018	Stefan Everling	Invited Talk	Meeting of the Japan Society for Marmoset Research	Kyoto, Japan
2018	Andrew Watson	Invited Talk	International Embryo Technology Society Meeting	Bangkok, Thailand
2018	Mel Goodale	Plenary Talk	Univesity of Oxford Larry Weiskrantz Symposium	Oxford, United Kingdom
2018	Vania Prado	Keynote Talk	International Capirica Conference on Splicing	Portugal
2018	Jane Rylett	Invited Talk	Symposium on Cholinergic Mechanisms	Israel
2018	Andrew Pruszynski	Keynote/Early Career Award Talk	Neural Control of Movement Meeting	Santa Fe, NM
2018	Lisa Saksida	Invited Talk	Korean Society for Brain and Neural Science	Yonsei University, South Korea
2019	Ruud Veldhuizen	Invited Talk	Surfactant Symposium	Varadero, Cuba
2019	Andrew Pruszynski	Keynote/Stevenson Award Talk	Canadian Physiological Society	Toronto
2019	Dean Betts	Penary Talk	Veterinary Regenerative Medicine Association Conference	Niagara on the Lake
2019	Frank Beier	Invited Talk	Gordon Research Conference	Galvenston, TX
2019	Nica Borradaile	Invited Lecture	Purdue University	West Lafayette, IN
2019	Stefan Everling	Invited Talk	Primate Neurobiology Meeting	Gottingen, Germany
2019	Stefan Everling	Invited Talk	IRTG-CRC Symposium	Marburg, Germany
2019	Cheryle Seguin	Top Canadian Research Session Talk	International Combined Meeting of Orthopedic Research So	Montreal
2019	Marco Prado	Invited Talk	International Symposium on Cholinergic Mechanisms	Weizmann Institute, Israel
2020	Dan Hardy	Invited Lecture	University of Queensland	Australia
2020	Andrew Pruszynski	Houk Lecture	Northwestern University	Chicago, IL
2020	Peter Stathopulos	Invited Talk	EMBO Symposium on Calcium Signaling, Bangalore	India
2020	Stefan Everling	Invited Lecture	Vanderbilt University	Nashville, TE
2020	Christopher Pin	Invited Lecture	National Institute of Health and Medical Research	Toulouse, France
2020	Marco Prado	Invited Lecture	Virginia Commonwealth University	Richmond, VA
2021	Tim Bussey	Invited lecture	Simon Fraser University	Burnaby
2021	Mel Goodale	Keynote Talk	Science Research Day, Universite de Montreal	Montreal
2021	Mel Goodale	Keynote Talk	British Neuropsychological Society Spring Meeting	United Kingdom
2021	Stefan Everling	Invited Talk	Meeting of the Japan Society for Marmoset Research	Maiko Villa, Japan
2021	Marco Prado	Invited Talk	Congress of the Brazilian Society for Cell Biology	Brazil

While our tabulated lists shown here (**Tables 16 and 17**) provide only selected examples, complete lists can be found in the *Curriculum Vitae* of our faculty members (available upon request).

Finally, it should be noted that many of our Department faculty members were engaged in fruitful international collaborations with colleagues from several continents over the 2016-2021 period. Arbitrarily chosen examples include collaborative publications with the Chinese Academy of Sciences (Everling), Massachusetts Institute of Technology (Martinez-Trujillo), University of Texas (Stathopulos), Aix-Marseille Université and Institut Paoli-Calmettes (Pin), University of South Australia (Regnault), University College (Owen), Universidad Federal de

Minas Gerais (Prado), Portland State University (Bai), Radboud University Nijmegen (Corneil), Showa University (Beier), Yonsei University College (Saksida), Monash University (Goodale) and Weill Cornell Medicine (Séguin) among many others.

Department Seminars and Research Day

The Department of Physiology and Pharmacology Seminar Series invites and features speakers from Western, other research institutions in the London area and distinguished national and international speakers (see list of speakers between 2016-2021). Seminars take place weekly, and importantly, the Seminar Series also provides the opportunity for PhD students to present their data to our Department. Thus, the Seminar Series is a valuable arena for senior trainees to gain feedback on their work and critical experience presenting research seminars. Over the last years, we have made a conscious effort to increase diversity of our speakers, including many early-stage researchers and the topics covered in our seminars (such as EDID-related seminars and talks focused on education research and pedagogy).

The highlight of our academic year is the Department of Physiology and Pharmacology Research Day. Research Day is an annual event, which takes place on the first Tuesday in November. During the morning of Research Day, graduate students and postdoctoral fellows, irrespective of career stage, present their research during a poster presentation session to faculty and staff within and outside our Department. In the afternoon of Research Day, we feature short talks from one outstanding senior trainee and/or a faculty member within our Department followed by a keynote lecture presented by an internationally-recognized Physiologist or Pharmacologist. The keynote lecture is part of our "The James A.F. Stevenson" and "The Charles W. Gowdey" Lecture Series, which are named in honour of former heads of the Department of Physiology and the Department of Pharmacology. During the 2016-2021 period, many world-renowned scientists have presented to our Department including Charles Bourque, John Schuetz, John Scott, Anne-Glaude Gingras (Gairdner Laureate), Amira Klip and Brian Kobilka (Nobel Laureate) (see links a list of James A.F. Stevenson and Charles W. Gowdey speakers and associated biographies). The annual Department banquet is held in the evening following the presentation by the keynote speaker, during which we also present poster presentation awards and annual graduate student awards for excellence in research and teaching.

Concluding Remarks - Research

In summary, between the Self-Study period of 2016-2021, the Department of Physiology and Pharmacology had strong track-record of post-doctoral training with desirable outcomes for most trainees (e.g. only 4% of trainees reported moving on to non-science related fields). Our faculty secured a high level of external funding to support their research (~$46M), despite the very challenging funding climate. Consistent with the vigorous research environment maintained by our faculty, many of our Department members were recipients of external and internal research-related awards (e.g. Canada Research Chairs and numerous Junior/Senior Investigator Awards and Fellow honours). A very strong publication record between 2016-2021 (>1550 PubMed publications) showcased the important science discoveries borne out of our research programs and facilitated many prestigious research-related leadership roles (e.g. CIHR Science Director – Aging, numerous funding panel chairs, presidents and conference organization chairs of professional research societies) and invited presentations (> 550 invited external talks) for our faculty. Finally, we have had renowned scientists visit our Department and present their seminal physiology and/or pharmacology-related research to our members during our weekly seminar and annual Gowdey/Stevenson Lecture Series (e.g. Nobel and Gairdner Laureates).

Priorities for Strategic Planning

Strategic Plans for the University of Western Ontario and Schulich School of Medicine and Dentistry were updated in 2021 (see https://strategicplan.uwo.ca/ and https://www.schulich.uwo.ca/strategicplan2021/, respectively). There are three main themes to Western's Strategic Plan, including "Greater Impact", "People, Community and Culture" and "Our Place in the World". Among these themes, Western's prominent research-related goals are to increase the faculty and staff complement, expand trainee enrolment, secure new partnerships and resources and build infrastructure. Additionally, Western aims to expand support for research, scholarship and creative activity, attract visiting researchers, invest in common resources, strengthen core facilities, expand Western Research Chairs programs, renew postdoctoral trainee and interdisciplinary research programs, achieve greater plasticity in collaborations, revitalize research synergy with regional health partners, intensify engagement with industry and ensure recognition of Western's work locally, nationally and globally. Consistent with Western's strategy, Schulich's Strategic Plan prioritizes educational excellence, research impact, social accountability, people and partnerships. Among these priorities, research-related objectives include embedding a culture of research in education programs, recruiting/retaining/enabling research-intensive faculty, promoting bench-to-bedside translational research, identifying and promoting emerging and existing areas of research strength, re-investing in core facilities, accelerating design and execution of clinical trials, facilitating collaboration and team-based research, creating investigator-centric operational processes and supporting effective communication and dissemination of research.

Moving forward, the Department of Physiology and Pharmacology aims to leverage the research-related initiatives at the institutional and faculty level to enhance the vigor, scope and impact of the research and research-based training within our Department, in-line with the Western and Schulich strategic plans. As a Department we aim to:

- fill missing faculty expertise concomitant with EDID considerations to enhance the scope, innovation and impact of our research programs.
- support translational research initiatives and the development of strategic links with clinical investigation units.
- increase research activities that integrate Physiology and Pharmacology as well as interactions between different organ systems
- take advantage of strategic funding opportunities at the institutional, provincial and federal levels (e.g. COVID-related funding opportunities).
- search for industry partners to support physiology and pharmacology-related research (e.g. MITACS).
- develop new research initiatives between Physiology and Pharmacology research groups and those in other Western Departments to apply for group research funding.
- encourage Department members to participate in the planning and submission of major grants (e.g. infrastructure, Teams, etc.) related to their research expertise and directed toward enhancing our research infrastructure and increasing collaborations.
- communicate our Department's research achievements to others and demonstrate that our actions achieve societal benefit.

EQUITY, DIVERSITY, INCLUSION AND DECOLONIZATION (EDID)

Background

The Department recognizes a lack of diversity amongst its faculty members and beyond. In addition, we became increasingly aware that the Department, as a whole, is ignorant of barriers that affect recruitment, retention, and satisfaction of members at every level. In order to start addressing these issues, we held an EDID workshop in January 2021, with guest speaker Dr. Nicole Kaniki. One of the activities resulting from this workshop was the creation of an EDI Committee. This committee, now termed EDID Committee of the Department of Physiology and Pharmacology, was first established in April 2021 and fully constituted in June 2022. The mandate of the EDID committee is to systematically and comprehensively review and advise on departmental policies, to ensure they are consistent with appropriate and effective EDID practices. Membership in this committee aims at reflecting the diversity in the department, while simultaneously ensuring comprehensive representation from all levels, as illustrated in **Table 18**.

Table 18: Composition of the EDID Committee

Co-Chairs	**Drs. Lina Dagnino*, Wataru Inoue***
Teaching-intensive Faculty	Dr. Fabiana Crowley
Tenure-track Faculty	Dr. Mathew Grol
Tenured and Cross-Appointed Faculty	Drs. Christopher Pin*, Rennian Wang*, Lisa Saksida*
Postdoctoral Scholar	Dr. Jonathan Michaels*
Graduate Students	Nicole Sidor, Jennifer Carlton
Administrative Staff	Hailey Hunter
Research Staff	Dr. Samar Sayedyahossein

** These committee members also hold appointments in Western University-associated research institutes (Lawson Health Research Institute, Children's Health Research Institute, Robarts Research Institute or Brain and Mind Institute).*

Mandate

- To identify barriers to EDID in the Department of Physiology and Pharmacology
- To develop strategies to address EDID disparities and to maintain good EDID practices within the Department of Physiology and Pharmacology
- To advise and promote awareness on EDID best practices and strategies to the department Chair and departmental working committees (Graduate Studies. Promotion and Tenure, Appointments, Undergraduate, Research)
- To report annually or on an appropriate periodic basis to the Chair and the Department
- To liaise with other EDID groups at Western University, its associated institutes, and beyond

Principal activities and contributions (May 2021-April 2022)

- May 2021 – Opportunity Scholarships. Up to two annual graduate scholarships aimed at increasing representation from racialized and/or marginalized student groups, through recruitment to the Graduate Program in Physiology and Pharmacology.

- September 2021 - Department Seminar Series: "Putting inequity in STEM under the microscope: the roles of inclusion, diversity, equity and accessibility in science and innovation". Invited speakers: Mahadeo Sukai, Ph.D. (Director of Research and Chief Inclusion & Accessibility Office, Canadian National Institute for the Blind) and Ainsley Latour, M.L.T. (Genetic Diagnostics, Kingston Health Sciences Centre).
- January-April 2022 – Initial survey of departmental faculty, staff and trainees regarding demographics, equity, diversity, inclusion and accessibility in the workplace. Analysis of survey data have been completed, and recommendations from the committee have been generated (see summary below; full report available on request).
- March-April 2022 – Development of the EDID committee departmental website, in collaboration with departmental administrative staff.

Next Steps (May 2022 and forward)

- May-August 2022 – Complete analyses of survey data
- Fall 2022 – Due to low response rates to our survey in certain groups, we are planning to use additional means to obtain feedback on barriers, concerns, lived experiences etc. For example, we plan to use focus groups.
- Continuing – development of strategies to address some of the concerns identified in our survey
- Continuing – liaison with other departmental committees and groups at Schulich and Western

Summary of Report on EDID Departmental Survey

This report provides insight into the demographics, and the equity, diversity, inclusion and accessibility experiences of the members of the Department of Physiology and Pharmacology at Western University. An anonymous survey was conducted in Jan 2022, to obtain demographic information, and to investigate the experiences and perceptions of faculty members, staff and trainees of the Department vis-à-vis Departmental recruitment practices, experiences of discrimination and/or harassment, inclusion in the workplace, and knowledge of institutional policies, processes and resources. We would like to thank all the members who took the time to complete this survey.

A methodological strength of this survey was that it encompassed broad areas relevant to all Department members. Response rates from graduate and postdoctoral trainees, staff and faculty ranged from 10% to 55%. Typical response rates for a majority of surveys are reported to range from 5%-30%. A potential limitation in the information obtained by the survey exists among those groups with the lowest response rates, for which the information obtained may not be fully representative.

Demographically, the Department is diverse, with 43% and 44% of respondents self-identifying, respectively, as men and women, 25% as visible minorities, but none as members of Indigenous people of Canada.

Hiring practices at all levels were considered to be equitable and designed to allow for diversity in recruitments by a majority of respondents.

Thirty percent of faculty, 66% of staff members, and 60% of graduate students reported experiencing uncomfortable situations associated with discrimination and/or harassment, as did nearly half of women respondents and all of those who self-identified as non-binary. Significantly, sizeable gaps in training and education concerning best practices for equity, diversity, inclusion, accessibility and decolonization exist in the Department. Further, a lack of awareness of resources available on campus is particularly noticeable among those groups which described experiencing uncomfortable situations in the workplace.

The work environment in the Department is considered equitable and inclusive by a large majority of respondents, who also feel their contributions are valued, and that opportunities for career development are

available. The majority of respondents in all Department roles (60%-80%) considered that their working environment is supportive and protective of discrimination and bias.

In response to the results from this survey, several recommendations to address those gaps identified through this survey focus on three areas. First, equity, diversity, inclusion, accessibility and decolonization awareness need to be maintained and expanded through Departmental initiatives and collaborations with other relevant committees at Western University. Second, readily available information and resources for all Department members must be developed to help address uncomfortable situations in the workplace. Third, focus groups need to be organized to further investigate and address specific issues/concerns raised by subsets of Department members. In this manner, the Department can effectively continue working towards improving best practices for a more equitable, inclusive and accessible work community, in which all groups are valued and treated with respect.

SWOT ANALYSIS

Overall SWOT Analysis

This analysis was prepared by the "SWOT Team" comprised of Tom Stavraky, Andrew Pruszynski, Lina Dagnino, Sean Gill, and Daniel Hardy.

Strengths

- Size (50 core members, 23 cross-appointees) of the Department is an asset for research, teaching and collaboration. Faculty also has several national and international collaborations, including 5 CRCs.
- Strong, internationally recognized research groups (clinical and basic pharmacology; bone and joint; cell, stem cell and cancer; heart, blood vessels and lungs; reproduction, development and metabolism; neuroscience, neurodegeneration and cognition).
- Faculty and their graduate students publish well, receive many salary awards, and are competitive in national granting competitions, especially given the current decline in grant funding.
- New faculty members are fostered with a formal mentoring program to aid in P&T and for success in teaching and external grant competitions.
- Department membership has access to well-equipped core facilities (e.g. Transgenic and Gene Targeting Facility, Genomics, Proteomics, Imaging).
- Track record of excellence and innovation in both online and classroom teaching with many award-winning teachers, students, technical, and administrative personnel.
- Department teaches 50% of all courses offered through SSMD. Our courses are highly rated, in demand, and utilized across Faculties and Departments.
- Excellent hands-on third year undergraduate laboratories and fourth year thesis research program to enrich experimental skills and critical thinking.
- Strong commitment to graduate education and successful research programs to promote development of competencies highly sought after by academic and non-academic employers.

Weaknesses

- Difficult external research funding environment negatively impacting excellence in Department research and graduate student enrolment.
- Retirements, without matching replacements, have led to a 20 % reduction in faculty numbers and weakened our educational offerings and research expertise, for both the undergraduate and graduate programs.
- Current composition of faculty (*i.e.* 32% female, 14% visible minority) does not reflect the diversity of Western's undergraduate and graduate population.
- Animal costs are not subsidized fairly or sufficiently; costs are not competitive with other institutions, hindering efforts to carry out excellent research and ability to conduct pre-clinical research.
- Poor capability to attract high-tier, external graduate students.
- Changes in ethics approval requirements impedes some types of experiments offered for 3rd year lab teaching.

Opportunities

- Creation of two new combined Phys/Pharm courses (PhysPharm 4400B and 4800A), modification to existing courses to blend both disciplines (PhysPharm 4100B and 4530B) and joint courses with other Departments/Faculties to increase undergraduate teaching offerings**.**
- Development of a new course-based, one-year MSc in Interdisciplinary Medical Sciences to be offered at the Faculty level *leading* to the opportunity for direct enrolment into the Physiology and Pharmacology PhD program upon completion.
- Establishment of new graduate award, the Physiology and Pharmacology Opportunity Scholarship to further attract graduate students from marginalized groups.
- Expertise to train graduate students for professional activities outside academia, in partnership with private and public sectors (*e.g.* Mitacs).
- Overhaul of animal research housing (*e.g.* new Animal Vivarium) provides hope for long-term pre-clinical research.

Threats

- Increasing competitive and uncertain research funding impacts Departmental research excellence and threatens to close some laboratories. This ultimately impacts graduate student enrolment, overall teaching and research output.
- Progressive increase in course enrollment in our 3rd year flagship courses and laboratory course without appropriate resources to address this yet.
- Loss of expertise is key research areas of Physiology and Pharmacology due to retirements, relocations, and death leading to less undergraduate and graduate course offerings (including enrolment in 4th year thesis course). This also leads to higher teaching and service workload at the expense of research.
- Changes in the administration of specific elements of graduate education to SSMD could comprise our autonomy in decision-making regarding education outcomes, and in our ability to recruit MSc students
- Global “perceived lack of relevance” for graduate training and/or careers in academia impact student interest and enrolment in our graduate research programs.
- Specialized graduate and undergraduate programs (*i.e.* Neuroscience) compete with our program for both students and faculty.
- Downloading of administrative studies from University and SSMD (*e.g.* IT support) increases demand on Department administrative educational support.

Undergraduate SWOT

Strengths

- Combined PhysPharm 3rd year lab is a popular experiential learning course that has been running since 2017/2018.
- Opportunities to continue to improve lab offerings through the Science Student Council requests to develop more innovation in the labs. Over the past 6 years, we have been successful in obtaining over $160,000 in funds to supplement advances in lab design.
- Received capital funding in 2022 to expand tissue culture capacity for student labs, to be able to continue to provide expanded opportunities for the types of student lab experiences.
- Most in demand thesis program, with many more applicants applied than placements available.
- Most fourth-year courses are very popular, and enrollments are high.
- Increased number of courses that are Integrated for both disciplines in Physiology & Pharmacology.

Introduced in 2021/2022 was PhysPharm 4400B - Animal and Cell Modeling of Development and Disease, and 4800A – Selected Topics in Physiology & Pharmacology: Endocrinology with focus on the Pituitary Gland.

- Award-winning teaching faculty to support overall undergraduate teaching mission.
- Great interest in our Department course offerings as evidenced by enrollment in our third year courses. This is exemplified in our third year course in pharmacology, with a doubling of student enrollment since 2017, from 214 in 2017/2018 to 393 in the 2020/2021 academic year.
- Due to our strong integrative teaching faculty, we have had great success in rapidly adapting to online lectures and other innovations.

Weaknesses

- The University has increased enrollment of the BMSc program by 50% in 2020/2021, with this cohort entering our 3rd year classes in 2022/2023. The incoming number of students into our Department modules cannot be facilitated due to lack of adequate classroom space.
- Lack of SSMD IT support for online course module support and to transfer courses online; hard to create new or change current courses.
- Teaching demands from professional programs, such as Medicine, to our faculty members are not communicated early enough to meet deadlines for teaching workload letters.
- Demands from professional programs to our faculty members are poorly articulated and often seen as service contributions vs education contributions.
- Lack of infrastructure to teach how we would want to, *ie*. active learning classrooms, limited auditorium size. There is a lack of classrooms of sufficient space in total. Furthermore, although there is a demand for hybrid courses, there is a lack of available technology to host this appropriately.

Opportunities

- BMSUE curriculum redesign will provide opportunities to interact with students earlier in their programs.
- Creation of a new combined introduction to physiology and pharmacology course in the fall/winter term of 2022/2023 will expose students to both disciplines in their second year of study, replacing the two separate courses previously offered.
- Create new joint courses by collaboration with other Departments/Faculties *ie.* exercise physiology with Kinesiology, and/or courses with Neuroscience combined with Psychology.
- Chance to create/think about offering more combined Phys/Pharm courses like 4th year Gastro/Metabolism course, offered as both a Phys or Pharm 4th year course.
- Potentially develop an internal teaching faculty award to highlight excellent work by our colleagues who may not qualify for a University wide teaching award, but still doing exemplary work.
- Opportunities for teaching scholarship, Sparking SOTL at Schulich group meeting regularly and new Teaching Scholar positions starting to be appointed.
- Department has hired an additional faculty member (Dr. Van Lu) with expertise in gastrointestinal physiology to help fill the void of teaching in this area.
- The Department has a new committee in EDID, which will help to assist with reviewing our curriculum to decolonize. We have recognized that there are limitations of the limited term teaching positions to accomplish this review to implement necessary changes.

Threats

- New BMSUE curriculum redesign will involve large changes which will require more faculty involvement, which is labour intensive; however, faculty numbers have declined by 20 % since 2016.
- Declining faculty contingent also means fewer positions for 4th year thesis students.
- Because we cannot take all 4980E students who request a thesis, we may miss the opportunity to retain promising students who may have pursued graduate studies. The incoming average of successful applicants to the program is the highest levels of all thesis programs in our Faculty.
- Progressive increase in course enrollment in both Pharm 3620 and 3rd year labs but a major lack of resources to address this increased need.
- Online Phys 2130 is over 20 years old and would require funds and time to update, which is necessary as it will continue to serve as a prerequisite for a number of programs on campus (particularly when we stop offering the campus version of 2130 in 2022-2023).
- New ethics approval for our third-year lab offering could impede the types of experiments performed.
- Changing expectations of students, demanding more flexibility for course delivery in light of the necessary modifications that occurred with the early stages of the pandemic. These modifications are productive but require much more faculty time to deliver.
- The Department has lost some excellent, innovative 4th year/graduate neuroscience courses in areas where we have existing high-level expertise. For example, with the retirement of Tutis Villis, we currently have removed Phys 4710A from the course offerings, however it is a high enrolment course and students from IMS and neuroscience program rely on courses like this to fulfil their degree requirements.

Graduate Program SWOT

Strengths

- One of a few graduate programs in Canada to offer a joint degree in Physiology and Pharmacology.
- Research-based training, with a very strong commitment to conducting internationally competitive research.
- Academically strong, award- and scholarship-winning graduate students.
- Clearly defined learning outcomes for MSc and PhD programs.
- Education through courses offered, research-based interactions, and teaching assistantship opportunities to promote development of competencies highly sought after by academic and non-academic employers: (1) communication and relationship building, (2) leadership (3) thriving, (4) teaching and learning, (5) intercultural and social fluency, (6) career engagement.
- Supervisors with strong commitment to graduate education and successful research programs, encompassing Departmental and University-wide collaborative graduate programs.
- Teaching assistant (TA) positions are currently available, which provide valuable teaching experience. The availability of TA positions is guaranteed to Ph.D. students.
- Large and diverse student and supervisor populations, with research interests that encompass all major/strategic areas at Western.
- Ongoing evaluation by the Equity, Diversity, Inclusion and Decolonization (EDID) Committee ensures an optimal environment for all trainees, faculty and staff complement in Physiology and Pharmacology.
- Strong support for graduate student stipends, prizes, internal and external awards.
- Weekly seminar program which includes local, provincial, national and international visiting speakers.
- Appropriate average times to completion for MSc (2 years) and PhD (4-5 years) graduate programs.
- Competent and hard-working office staff provide excellent administrative support for graduate students.

Weaknesses

- Competition with alternative SSMD graduate programs *(e.g.* Neuroscience Program).
- Size and diverse locations across university and city create difficulties for graduate students (*i.e.* TA'ing, course-work) and for communication and interactions. However, the recent implementation of webcasting for weekly seminar program has greatly facilitated off-campus faculty and student participation.
- Relatively few students are recruited from other institutions.
- Limited number of Departmental course offerings for graduate students. Some courses have minimum enrolment requirements to run and, consequently, are not regularly offered.
- Further impending retirements of faculty members may decrease number of graduate student positions available, although some gains have been made through cross-appointments.
- Insufficient resources for marketing and increased visibility are needed to recruit top-tier students from multiple institutions.
- Higher than national average animal care costs limit some types of experimentation available for graduate projects.
- With the COVID-19 pandemic restrictions, there are reduced opportunities for graduate students to interact face-to-face outside their research groups. Similarly, there have been less opportunities to attend national and international scientific meetings. This has limited opportunities for broadening students' knowledge, developing effective communication and networking skills.
- Covid-19-related pandemic measures have had a negative impact on the intensity/quality of supervision for some graduate students.
- Increasing difficulty to successfully secure competitive funding (scholarships and awards), requiring the development and implementation of systematic mentorship approaches specifically focused on this aspect of graduate success.

Opportunities

- Increased opportunities for local, regional, national, and international graduate student recruitment through online events organized by the Physiology and Pharmacology Graduate Studies Committee and Schulich Graduate Studies.
- New course-based, one-year MSc in Interdisciplinary Medical Sciences offered at the Faculty level will engage students that would otherwise enroll in a fifth year of undergraduate studies in short rotations in research labs of interested Physiology and Pharmacology faculty. These students are eligible for direct enrolment in the Physiology and Pharmacology PhD program upon completion of the one-year MSc.
- Re-evaluation of current, limited course offerings and course content will help determine whether needs of students are being met.
- Breadth of research expertise facilitates potential multidisciplinary training, including increased partnerships to train medical residents and fellows, and postdoctoral fellows coming from disciplines such as chemical and biochemical engineering.
- Off-campus study exchange and internship programs to enhance experiential learning are increasingly available through SGPS and external scholarship opportunities (*e.g.* Mitacs Globalink, Michael Smith Foreign Study Supplement).
- Ongoing development and implementation by SGPS of new online and in-class resources, including courses, workshops, and self-assessment tools, to engage and train graduate students at all levels for professional activities inside and outside academia.
- Establishment of new graduate award, the Physiology and Pharmacology Opportunity Scholarship to further attract graduate students from marginalized groups including those who self-identify as Black, non-Canadian citizen of colour, 2SLGBTQIA+, Indigenous, and well as those with a disability.

Threats

- Generally low success rates in securing federal research funding have impacted resources to maintain or increase graduate student enrolment, especially PhD students.
- National grant funding limitations will impact ongoing ability of current faculty members to recruit new graduate students. There is potential that individual faculty members alone may no longer be able to support any graduate students.
- Numbers of graduate student awards from national and provincial sources are becoming increasingly limited, further exacerbating our loss of infrastructure to recruit graduate students.
- There is limited understanding from the students' point of view as to how obtaining a graduate degree will translate into a career (particularly outside of academia). This impacts how students value the prospect of enrolment in a graduate program.
- Limitations on the Department's ability to recruit or replace faculty losses will negatively impact the ability to recruit new students. The range of expertise and experimental techniques available to graduate students may also be negatively affected by faculty losses.

Research SWOT

Strengths

- The size and diversity in research of our Department is an asset; we have 50 core members (including 6 teaching faculty) and 30 cross appointees or adjunct members with a large breadth of expertise. We also have 4 CRCs. Faculty members are well-connected through local, national, and international research collaborations.
- Many of our Phys/Pharm faculty members are also cross appointed to University Associated Research Institutes, which can provide additional resources and opportunities.
- Departmental seminars are streamed city-wide to all Western-affiliated campuses, hospitals and research institutes by videoconferencing, which provides a mechanism to integrate off-campus members and establish collaborations.
- Our Department publishes prolifically and enjoys excellent success rates in granting competitions, which are higher than the national average. This is a significant strength given the current grant funding climate.
- A strong cohort of faculty members are developing intensive, well-funded research programs, incorporating pre-clinical and clinical research.
- Most of our faculty members are leaders in their respective fields and have been invited to give Keynote Lectures at International Conferences, sit on prestigious Editorial Boards of journals, and serve as grant panel members, scientific officers and/or Chairs of granting committees.
- Faculty have established collaborative research groups that are internationally recognized (clinical and basic pharmacology; bone and joint; cell, stem cell and cancer; heart, blood vessels and lungs; reproduction, development and metabolism; neuroscience, neurodegeneration and cognition).
- Department promotes the exchange of new technologies offered at Western and abroad through regular workshops (e.g. Lunch and Learn).
- Department members have access to and support well-equipped research core facilities (e.g. Transgenic and Gene Targeting Facility, Genomics, Proteomics, and Imaging).
- New faculty members are well-supported to establish their research program. Protected time from teaching in the first year and a formal mentoring program help new faculty in applying to external funding agencies.

Weaknesses

- Members of our Department lack sufficient institutional support (e.g. strategic bridge or seed funding) and/or guidance to take full advantage of targeted research funding opportunities at the provincial and federal levels.
- There is a need for stronger spousal support for retention and recruitment. We have lost one junior faculty member (with a CRC) due to a lack of position for his spouse, and others have had or continue to face challenges due to absence of spousal opportunities and apparent institutional indifference.
- Collaboration opportunities are not fully realized or explored with clinicians. Overall support for enabling collaborations with clinicians is weak (e.g. guidance or administrative assistance in completing ethics protocols).
- Opportunities are not fully realized or explored in the areas of technology transfer and patents. Overall understanding of logistics, benefits and disadvantages of patent processes at Western is weak (e.g. guidelines, process, timing).
- Animal care service is not optimal. While the service structure is undergoing a major review and revision, high animal care costs (*per diem* and procedural costs above *per diem*) due to an insufficient institutional subsidization program is a long-standing issue and weakens the competitiveness of our research programs. Additionally, faculty and staff use a significant amount of time addressing Sick Animal Reports (SARs).
- Logistics of moving animals between different containment facilities is difficult, costly and unclear even where containment levels are similar, hampering collaborations.
- Access to expertise, resources and technical support in some core areas is lacking (e.g. microscopy, bioinformatics, proteomics, metabolomics). With recent departures of faculty members, our core expertise in Cells, Stem Cells and Cancer and Cardiovascular research areas have been diminished.

Opportunities

- Strategic funding opportunities at the institutional, provincial, and federal levels (e.g. COVID-related and cannabis-related research funding). We note that an institutional-wide license would make securing cannabis-related research funding more widely accessible.
- Availability of research funds and other forms of government support for translational health research. Pharmacology and Toxicology research, in particular, is well-poised to take advantage of such opportunities.
- Opportunity to obtain support from pharmaceutical industry for pharmacology and toxicology-related research and training (e.g. partnering with MITACS).
- On campus, animal housing is undergoing a major overhaul with Western's new construction of an Animal Vivarium and update of some existing animal facilities.
- Opportunity exists to fill missing faculty and technical expertise concomitant with EDID considerations and initiatives.

Threats

- Expertise in key research areas of Physiology and Pharmacology (e.g. basic pharmacology, cancer, cardiovascular, epigenetics, and neuroscience) has been significantly weakened due to retirements, relocations, and death. This results in higher teaching and service workload at the expense of research. The double threat of rapidly increasing undergraduate enrollment and declining faculty member numbers will likely leave less time for research.
- A challenging tri-council operating grant funding environment jeopardizes research programs, with the real possibility that some faculty members will have to close their laboratories. The effects of these challenges are not limited to research and impacts the number of graduate students that can be accepted. More

robust bridge funding mechanisms are essential to prevent loss of established research programs.

- Lower quality and more expensive animal research at Western restrict research programs. There is great disparity in animal research support across city-wide research institutions.
- There are limited funding opportunities for supporting new and existing postdoctoral researchers.
- There has been a considerable amount of lost research time, reduced laboratory time, and reduced supervisor-trainee contact time in research during the pandemic restrictions, which will have repercussions on productivity and research goal timelines.