McGill University Strategic Research Plan 2019-2024
Summary Document

Section 1: Overview

McGill is a world-class research-intensive, student-centred university with an enduring sense of public purpose. We are guided by our mission to carry out research and scholarly activities that are judged to be excellent by the highest international standards. Our researchers ask important questions and contribute within and across disciplines to address the most pressing and complex challenges facing humanity and the natural environment in the 21st century.

This Strategic Research Plan (SRP) expresses McGill's core commitments to research, identifies ongoing Research Excellence Themes, and outlines our implementation strategy and objectives over the next five years. The SRP informs the University's strategic distribution of Canada Research Chairs (CRC), applications to Canada Excellence Research Chairs (CERC), and Canada Foundation for Innovation (CFI) investments.

The full document, which can be viewed at http://www.mcgill.ca/research/srp, describes in more detail the scope and reach of McGill's research enterprise. The spirit of the document aligns with the Principal's Priorities, the Strategic Academic Plan 2017-2022, the Final Report of the Provost's Task Force on Indigenous Studies and Indigenous Education 2017, the University's Vision 2020 Climate and Sustainability Action Plan 2017-2020, as well as strategic research priorities from our Faculties and affiliated hospitals. It provides our Faculties, departments, centres, institutes, and individual researchers with the freedom and flexibility necessary to pursue their specific goals in the context of the University's strategic vision. The SRP was developed through a collaborative planning process with the McGill community and was then endorsed by the University Senate and the Board of Governors, the highest governing body of the University.

Section 2: Core Commitments

The following five core commitments illustrate McGill's dedication to the pursuit of research excellence:

FOSTERING CREATIVITY: Universities are grounded in a long history of reflection and inquiry in all aspects of the arts and humanities, science and technology, and health. Wherever research may ultimately lead, all advances begin with creative ideas. McGill has been an active participant in this tradition for almost two centuries, and we strongly believe that universities must continue to be spaces where leading minds are free to pursue discovery and create new knowledge.

PROMOTING INNOVATION: Increasing the emphasis on innovation in all its forms – social, pedagogical, and organizational as well as through the development of new products and processes – allows us to play a leading role in a knowledge-based society. We invent and we increase the impact of research by translating the results into social and commercial applications. This translation can take many forms - communicating research discoveries to decision-makers, transferring knowledge and know-how, protecting ideas and inventions, licensing discoveries, and creating new spin-off companies or non-profit organizations.

PROBLEM SOLVING THROUGH COLLABORATION AND PARTNERSHIP: McGill is dedicated to facilitating mutually-rewarding research partnerships across academic fields, both on our campuses and with external partners. Our researchers and students build bridges with leading research institutions, community-based organizations as well as with government and industry partners. Partnerships and team approaches often require extra organizational effort and special institutional support. These efforts are necessary to deliver benefits and bringing together leaders – regardless of discipline, background, or affiliation – can generate new ideas and approaches.

PROMOTING EQUITY, DIVERSITY, AND INCLUSION: Research excellence and equity go hand in hand. The underrepresentation of voices among our researchers and students is an unacceptable loss of human potential that we are striving to overcome. True and full inquiry into all aspects of the arts and humanities, science and technology, and health happens when the visions, experiences, knowledge, traditions, and epistemologies of multiple peoples are embraced.

SERVING SOCIETY: McGill researchers apply their ingenuity and creativity in service to society. Drawing on the strengths and expertise of different stakeholders, they co-create and apply evidence-based research to address shared challenges; guide and develop policies, practices and products; provide innovative learning environments and professional experiences for students at all levels; improve professional practices; and seek out and support initiatives that result in tangible improvements for individuals and communities.

Section 3: Research Excellence Themes

The seven Research Excellence Themes group McGill researchers into broad areas of strategic importance. The themes are not perfectly orthogonal; in other words, some research areas could fit into multiple themes. The set of themes imperfectly accounts for the full diversity and complexity of research strengths at McGill but their breadth allows for most faculty members to find themselves reflected within them. Together, they will be used as a roadmap for setting institutional-level objectives and supporting both disciplinary and interdisciplinary research. Our nomenclature is designed to help generate and reinforce novel linkages that address issues of local, regional, and global significance. The Research Excellence Themes are, by necessity, broad ways of grouping areas of strength and strategic importance.

DEVELOP KNOWLEDGE OF THE FOUNDATIONS, APPLICATIONS, AND IMPACTS OF TECHNOLOGY IN THE DIGITAL AGE

One of the distinguishing features of humans is our ability to build technologies in the hope of improving our collective condition. Pure science, applied mathematics, algorithms, and software provide foundations that enable new discoveries of components, tools, and applications ranging from large-scale transportation systems to new manufacturing technologies to small-scale digital communication systems. Advances in broadband and communication technologies continue to expand communication between non-humans – the "Internet of things" – while advances in machine learning and artificial intelligence open up new ways for humans to communicate with and rely on machines for an increasingly broad range of tasks. Even before recent technological advances – digital media, big data, and the use of wireless and optical networks – questions, such as "How do we make sense of the previously unimaginable amounts of information now at our fingertips?" and "How can individuals, businesses, and organizations utilize technologies to improve how they function?" have long been at the centre of McGill research. Our work in the fields of mathematics, physics, and engineering enables a wide spectrum of industrial-technological applications. Our work in social sciences and humanities helps us better understand technology's role in societal institutions, such as education and health care, and changes to society, such as those to labour markets, commodity supply chains, and the sharing economy. ***Examples of research areas:*** *Artificial Intelligence, Robotics, New Musical Forms, Additive Manufacturing, Optical Fiber Communication Systems, Commodity Supply Chains*

UNDERSTAND THE POTENTIAL OF THE HUMAN BRAIN AND THE ENTIRE NERVOUS SYSTEM

McGill is one of the world's leading centres for research and education in the neurosciences and related fields. Our researchers cover a tremendous range of study, from the genetic, molecular, and cellular foundations of the nervous system to the networks supporting complex behaviours, including pleasure, emotions, decision-making, and language. This range, which spans Faculties, sites and themes, makes McGill uniquely positioned to advance knowledge in cognitive neuroscience and brain plasticity across the life course, models of neurodegenerative disease, population neuroscience, and neuroinformatics and computational modeling – all aimed at the understanding of the human brain and the prevention and treatment of mental and neurological disorders. Our researchers are driven by questions, such as: "Which factors are associated with mental health, and how are mental and physical health connected?", "How do we ease the burdens of individuals and families whose lives are affected by neurodegenerative disorders?" and "How can we develop new approaches for deciphering, applying and sharing the enormous amounts of data we can now collect on the brain and nervous system?" ***Examples of research areas:*** *Neurodegenerative Disorders, Mental Health, Pain*

DESIGN AND CREATE SUSTAINABLE MATERIALS, TECHNOLOGIES, LANDSCAPES, AND COMMUNITIES

Informed by systems thinking, McGill researchers respond to the challenges of sustaining the life support systems of the planet for now and for future generations with fundamental and applied science that advances renewable materials, energy, agricultural, and transportation systems. Global landscapes provide vital "ecosystem services" – air, water, food, energy, and natural resources but can do so only when they are biologically diverse and maintain their ability to adapt. By

working together across disciplines, McGill researchers are driving the new field of evolutionary cell biology and molecular biodiversity, linking the study of cellular processes to the fitness of organisms faced with rapidly changing environments. Biological diversity and adaptive capacity of landscapes depend on advances in clean technology and renewables along with development of sound environmental policy that involves and impacts multiple stakeholders, jurisdictions, and timescales. ***Examples of research areas:*** *Sustainable Working Landscapes, Northern Research, Precision Agriculture, Green Chemistry*

ADVANCE BIOMEDICAL AND HEALTH SCIENCES FOR HEALTHY POPULATIONS

Building on a long history of outstanding contributions to health research, McGill is a world leader in translating discoveries from basic research in disease mechanisms at the molecular and cellular levels into improved clinical outcomes. We are focused on using basic and applied research to provide solutions for efficient and high-quality health care and rehabilitation for a diverse set of diseases and conditions. These solutions range from advancing stem cell research, regenerative medicine and bioengineering (including tissue engineering and the use of nanomaterials in medicine) to the development of precision therapies, surgical innovations, and medical devices. A fundamental question rests at the heart of our work in these fields: "How can we best prevent and treat disease?" In response, we are developing new approaches to better understand and provide novel solutions, over the life course, to complex health problems, such as many types of cancer, infections and immunological disorders, cardiometabolic and musculoskeletal diseases, as well as rare and neglected diseases. Our multidisciplinary approach considers the intrinsic genetic determinants of human health while addressing how environmental and social factors influence individual and collective well-being. The approach also recognizes that the burden of disease and poor health is most acute in vulnerable populations, and so McGill health researchers work with communities to understand and reduce health inequities in Quebec, Canada, and around the globe. ***Examples of research areas:*** *Genomic Medicine, Social and Environmental Determinants of Health and Well-Being, Cancer, Stem Cells, Infectious and Inflammatory Diseases*

STRENGTHEN PUBLIC POLICY AND ORGANIZATIONS, AND CREATE A DEEPER UNDERSTANDING OF SOCIAL TRANSFORMATION

While economic globalization, regional integration, transnational environmental and security issues, international law, conflict and human migration erode the power of sovereign states from without, multiculturalism and multinationalism, federalism, and decentralization, as well as the recognition of the distinctiveness of Indigenous peoples are transforming states and societies from within. McGill is already at the vanguard of global and comparative scholarship examining these issues, in many ways thanks to its setting in a linguistically and culturally diverse Montreal, Quebec, and Canada. The challenges of this century require new forms of global accountability as well as creative, multidisciplinary approaches to implementing change that builds on the strengths of the public, private, and social sectors. McGill researchers ask questions, such as "How are today's societies organized and how are they changing?", "How can we create more productive, equitable, and inclusive societies?" and "How can we use data to improve lives and livelihoods while protecting individual rights to privacy?" In doing so, they are defining, critically analyzing, and implementing social improvements for individuals and communities, as well as the economic, legal, educational, family, and religious institutions that organize and serve them. ***Examples of research areas:*** *International Relations, Human Rights, Reconciliation with First Nations Communities, Public Policy*

EXPLORE EARTH'S BIOLOGICAL AND PHYSICAL SYSTEMS AND THE UNIVERSE

Like others throughout history, McGill researchers investigate foundational questions, such as "What are the origins of life?", "What is the nature and origin of the Universe?", and "What physical laws govern the cosmos?" McGill is a major player in the rapid and extensive advances in our understanding of the natural world and its systems. This research has revealed the laws of physics, chemistry, and mathematics, the nature of life, the place of the Earth in the Universe, and the evolution of our own species. Our knowledge continues to expand, with major discoveries being made every year in fields, such as molecular biology, astrophysics, cosmology, and subatomic physics. Observing and modelling the Earth, atmosphere, the world's ocean and fresh waters are fields of continuing importance at McGill. Our world-class researchers recognize the importance of translating theoretical work into applications for current local, regional, and global environmental challenges. ***Examples of research areas:*** *Cosmology and Astrophysics, Ecology and Evolutionary Biology, Nanoscience*

EXAMINE FUNDAMENTAL QUESTIONS ABOUT HUMANITY, IDENTITY, AND EXPRESSION

McGill researchers explore bold and challenging questions – such as, "Who are we?", "Where have we come from?", "What is good, right, or fair?" and "How do we express ourselves?" – that form the basis of critical and ethical thinking and self-awareness in an interconnected world. Close attention to histories and cultural differences reflects the need to understand the complex relationships between the temporality of the past and the spatiality of the present. At the same time, it is crucial to understand diverse societies – to understand and speak their languages, to know their histories through historiography and other approaches – in order to learn *from* them as well as to learn *about* them. Humanistic inquiry is the search for, and the creation and interpretation of, meaning. We, as humans, aspire to understand the human condition through careful observation and introspection, through the interpretation of cultural and religious narratives, by revealing societies through their legal traditions, their creative arts and performance, and through the analysis of literature, music, and visual arts. ***Examples of research areas:*** *Youth and Girlhood Studies, Jazz Composition and Performance, Linguistics, Interdisciplinary Studies of Montreal*

Section 4: Objectives

McGill aims to provide researchers with the best planning, policies, and infrastructure possible, facilitate the development and reinforcement of research excellence through our programs, and connect people and organizations. This SRP sets a path for the University to be responsive to new challenges and opportunities as they arise on the research landscape and as the social, cultural, economic, and educational realities of our world evolve. In the coming five years, McGill will:

STRENGTHEN ITS INNOVATION AND PARTNERSHIP AGENDA: Creativity and innovation fuel a knowledge-based and digitally-interconnected society. The innovation ecosystem increasingly involves diverse partners and benefits from breaking down barriers between academia, industry, government, non-profit organizations, and communities. We seek to turn collaborative efforts into shared benefits while addressing issues of partner responsibilities and intellectual property.

STEWARD RESEARCH TRAJECTORIES TOWARD COLLABORATIVE, LARGE-SCALE INITIATIVES AND INTERNATIONAL PARTNERSHIPS: In collaboration with Faculties, research groups, and networks, we will develop long-term plans and map the road ahead for high-potential projects to grow into successful, large-scale initiatives. Research trajectories are "built from the ground up," and McGill will support excellence at all stages – from individual to multi-institutional research, and from the generation of ideas to their application in society. We are especially conscious of the needs of early-career researchers and will provide targeted information sessions as well as contribute to the mentoring of early research careers.

PROMOTE AND DRAW ON DIVERSITY IN ALL ASPECTS OF RESEARCH: McGill is strongly committed to equity, diversity, and inclusion (EDI) and promotes EDI within all training and career opportunities, including within our research mission and activities. We strive to create an environment in which diversity is valued and a range of perspectives is sought, enriching and affecting change across all levels of the institution.

LEAD IN OPEN SCIENCE AND DATA MANAGEMENT: Research activities create a massive volume of data that need to be effectively managed, with a view to improving the discoverability, reproducibility, reuse, and transparency of research. Not all research data are suited to be shared broadly. Ethical, legal, or commercial reasons can justify some restrictions. However, adopting best practices in making data available in the public domain for uptake by others can lead to discoveries never even imagined at the outset of research data collection. By becoming the first academic institution globally to adopt an Open Science policy, the Montreal Neurological Institute at McGill is expanding the impact of its research by sharing it with a global community in order to accelerate the discovery of new treatments.

Action plans will be developed in consultation with McGill administrative and academic units as well as external partners in order to implement specific initiatives under each objective.

Appendix: CRC Allocations and Research Excellence Themes

Canada Research Chairs (CRC) and the Canada Foundation for Innovation (CFI) are invaluable to McGill's success in building and strengthening research capacity in areas of strategic importance that underpin our international reputation as a leading research-intensive university. McGill's SRP plays a key role in guiding CRC deployment as well as research infrastructure investments through CFI across all Faculties and affiliated hospitals.

Since the start of the CRC program in 1999, McGill has used its CRC allocation primarily for external recruitment and currently has an allocation of 171 Chairs (*Table 1*). Approximately 60 per cent of McGill's CRC recruits come from outside Canada, and over 40 per cent of these are repatriated Canadian researchers. McGill's Tier 1 CRC awards enhance our ability to consolidate clusters of researchers around a leading senior researcher, while Tier 2 awards help strengthen research clusters and build for the future. In 2000, McGill established two internal awards, the James McGill Professor and William Dawson Scholar, to complement the CRC program and to recognize and retain outstanding

Table 1: Chair and Award Allocations 2018	
Canada Research Chairs	164
Distinguished James McGill Professors, James McGill Professors, and William Dawson Scholars	159
Endowed Chairs and Professorships	153
McGill Affiliated Hospital-based Chairs	106

scholars already at McGill. In 2017, we introduced a new award, the Distinguished James McGill Professor, which recognizes the sustained scholarship and achievements of McGill's most accomplished tenured academic staff currently at the University. Once a CRC Tier 1 professor is no longer eligible to renew their chair, they become eligible to be nominated for the Distinguished James McGill Professor. Fundraising initiatives have also helped sponsor a number of endowed chairs for distinguished faculty members. Together these chair award holders comprise more than one third of tenured and tenure-track faculty. They play a significant leadership role in building research capacity, attracting and training highly qualified personnel, and developing productive research and translational partnerships.

Table 2: CRCs by Research Excellence Themes 2018-2022	%	Tri-Agency
Advance biomedical and health sciences for healthy populations	50%	CIHR
Understand the potential of the human brain and nervous system		
Design and create sustainable materials, technologies, landscapes, and communities	30%	NSERC
Develop knowledge of the foundations, applications, and impacts of technology in the Digital Age		
Explore Earth's biological and physical systems and the universe		
Strengthen public policy and organizations, and create a deeper understanding of society and social transformation	20%	SSHRC
Examine fundamental questions about humanity, identity, and expression		

The distribution of CRCs among the Tri-Agency sponsors is expected to remain relatively stable between 2018 and 2022, including the reservation of some CRCs for major strategic initiatives, such as Canada Excellence Research Chairs program. It is anticipated that McGill will have vacant CRCs to fill each year over this period. The deployment of CRCs to Faculties by the Provost will continue to reflect the academic recruitment plans of the Faculties in the context of the SRP's Research Excellence Themes (*Table 2*). McGill will continue to use CRC's primarily for external recruitment but there may be some instances of internal calls or deployment of CRCs for retention purposes. McGill is firmly committed to excellence and diversity in the recruitment of CRCs. In this spirit, our search for CRC chairholders will be open, encouraging, and unrestricted.

All recruitments to these chairs follow McGill's recruitment guidelines: Employment Equity Policy, EDI Action Plan, and Strategic Academic Plan 2017-2022. As of 2018, McGill is exceeding equity targets for CRCs for women (37% with a target of 32%) and racialized/visible minorities (20% with a target of 15%); on target for Indigenous peoples (1%); whereas persons with disabilities remain underrepresented (1% with a target of 4%).