



McGill

Summary of Strategic Research
Plan 2013-17

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Office of the Vice-Principal
(Research and International Relations)



McGill University Strategic Research Plan 2013 – 2017

Summary Document

Section 1: Introduction and Overview

McGill is a world-class research-intensive, student-centred university with an enduring sense of public purpose. Throughout our history, we have attracted some of the brightest researchers and young minds, all of whom ask and study important questions and contribute across disciplines to address the most pressing and complex challenges facing humanity and the natural environment in the 21st century.

The Strategic Research Plan (SRP) is an essential tool that informs the University's strategic distribution of Canada Research Chairs (CRC) and Canada Foundation for Innovation (CFI) investments. For a summary of McGill's current CRC allocation and projections see Appendix 1. Overall, this SRP aims to extend the impact of our research activities, encourage new and stronger partnerships, deliver quality research experiences for trainees, and help McGill continue to tap into the worldwide pool of knowledge while contributing to its advancement. Like the full plan, this summary expresses McGill's core commitments to research and identifies seven Areas of Research Excellence.

The full document, which can be viewed at www.mcgill.ca/research, outlines a more detailed implementation strategy for the next five years. Fundamental to realizing McGill's vision is the expansion of a climate that nurtures and facilitates research excellence, allowing faculty and student researchers to explore the full richness of their intellectual pursuits and co-create solutions with partners that will have an impact on a global scale. These overarching mechanisms can be summarized by the phrase "Enabling, Facilitating, Connecting." In other words, with the SRP as our roadmap, McGill has and will continue to "enable" researchers by providing them with the best planning, policies, and infrastructure possible; "facilitate" the development and reinforcement of research excellence through our programs; and "connect" people and organizations by proactively engaging in pairing, matchmaking, and relationship building.

The SRP was developed through an iterative and collaborative planning process under the leadership of the Vice-Principal (Research and International Relations) in close consultation with the Provost, Faculties, the Research Advisory Council, Faculty Councils, and student groups. The Vice-Principal also met with individual faculty members and chaired a Strategic Research Plan Advisory Committee, comprised of researchers from across the University who provided critical guidance. The SRP was then endorsed by Senate and the Board of Governors.

Section 2: Core Commitments

We recognize that all forms of research output affect society, directly or indirectly by underpinning the advancement of knowledge, and can be expressed as social, economic, environmental, or cultural benefits. There is no single metric that effectively measures the success of research and its impact on society and the environment. We believe that fundamental research extends the boundaries of knowledge so it can inform and, in turn, support thematic and problem-based interdisciplinary and disciplinary research, while remaining responsive to new challenges as they emerge. The following five core commitments illustrate McGill's dedication to the pursuit of research excellence:

Ideas – Universities are grounded in a long history of reflection and inquiry in all aspects of art, science, and the humanities. Wherever research may ultimately lead, all advancements begin with ideas. By asking questions – both fundamental and applied – McGill researchers are part of a community that seeks to better understand the universe and take steps, sometimes in unexpected and exciting ways, into the future.

Innovation – Increasing the emphasis on innovation in all its forms – social, pedagogical, and organizational, as well as through the development of new technologies – allows us to play a leading role in a knowledge-based society. This can take the form of advocating for appropriate spaces for the free exchange of ideas, where researchers and their partners jointly develop ideas and

products; communicating research discoveries to decision-makers; transferring knowledge and know-how; protecting ideas and inventions; licensing discoveries; or creating new spin-off companies or non-profit organizations. The Quartier de l'innovation is a key example of this commitment.

Sustainability – Sustainability is a central component of much of the research at McGill, where faculty and student researchers study all aspects of the subject. Sustainability is a comprehensive approach to how they carry out their work, and it is an essential element of what the University does to ensure the long-term viability of its research enterprise through maintaining and renewing its infrastructure and core facilities. McGill faculty, staff, students, and administrators are citizens who consider the environmental, social, and economic contexts and consequences of their work.

Collaboration and partnership – Bringing together leaders of diverse disciplines, backgrounds, and affiliations can generate new ideas and approaches. At home and abroad, our faculty and students build bridges with colleagues from other research institutions, governments, private industry, and community-based organizations. We support the participation of different voices and are committed to include and promote indigenous perspectives and knowledge.

Social engagement – McGill researchers use their learning, ingenuity, and creativity to participate in dialogue and work toward common purposes with community partners. Drawing on the strengths and expertise of different stakeholders, they 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: Areas of Research Excellence

The seven thematic areas, the Areas of Research Excellence (AREs), describe traditional disciplinary strengths and group McGill faculty expertise into strategic clusters. Key areas are examples of McGill research strengths at a higher resolution. Together they will be used as a roadmap for setting institutional-level objectives and supporting both disciplinary and interdisciplinary research. Our goal in doing so is to help generate and reinforce novel linkages that address issues of local, regional, and global importance.

Examine fundamental questions about humanity, identity, and expression

McGill researchers deepen understanding of what it means to be a person living in the 21st century. They explore bold and challenging questions – such as “Who are we?”, “Where have we come from?”, and “How do we express ourselves?” – that form the basis of critical thinking and self-awareness in an interconnected world. Close attention to history and cultural difference 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 speak their languages, to know their histories – in order to learn *from* them as well as to learn *about* them. We, as humans, aspire to understand the human condition through observation and introspection, through cultural and religious narratives, through the creative arts, and through the analysis of artistic creations. Humanistic inquiry is the search for, and the creation and interpretation of, meaning. It allows research into human lives to begin with the question of who we humans are. *Key areas: Analysis of Literature, Music, and Visual Arts* ▪ *Digital Humanities* ▪ *Creative and Artistic Expression and Performance* ▪ *History and Historiography* ▪ *Culture and Identity* ▪ *Gender and Sexuality* ▪ *Ethics, Religions, and Legal Traditions* ▪ *Linguistics and Languages* ▪ *Human Psychology and Development*

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, and human migration erode the power of sovereign states from without, trends such as 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 scholarship examining these challenges, as it ought to be given its unique setting in Montreal, Quebec, and Canada. The challenges of this century require new forms of global accountability as well as creative approaches to implementing change that builds on the strengths of the public, private, and social sectors. McGill researchers thus

ask both “How are today’s societies organized and how are they changing?” and “How can we create more productive, equitable, and sustainable societies?” In doing so, they are defining, critically analyzing, and implementing social improvements for individuals and communities, as well as the institutions that organize and serve them. *Key areas: Federalism, Governance, and Democratic Citizenship ▪ Education, Health, Environment, and Social Welfare Policy ▪ Religion in the Public Sphere ▪ Diversity and Inequality ▪ Social Statistics and Demography ▪ Urban Systems ▪ Montreal, Quebec, and Canadian Studies ▪ International Development, International Relations, and Human Rights ▪ Law and Legal Pluralism ▪ Intellectual Property, Open Access, and Privacy Protection ▪ Risk and Stability ▪ Management, Organizations and Operations*

Capitalize on the convergence of life sciences, natural sciences, and engineering

By proposing questions like “How can we tackle complex life science problems by using specialized methods and tools from engineering?”, McGill is poised to make critical advances in sectors ranging from health care and energy to climate change and water resources management. Current areas of interdisciplinary research include groundbreaking work with molecular synthesis, nano-biomaterials, biomedical devices and prostheses, cell and tissue engineering for regenerative therapy, biosensors, drug delivery systems, monitoring and diagnostic devices, and imaging tools. The convergence of life sciences, physical sciences, and engineering also provides new opportunities to understand the impact of the environment on human health, sustainable agricultural and food systems, bioresource engineering, the generation of products for a bio-based economy, and innovative ways of reducing harmful chemical by-products. *Key areas: Advanced Materials ▪ Nanoscience and Bio-nanotechnology ▪ Advanced and Alternative Energy ▪ Green Chemistry and Green Chemicals ▪ Chemical Biology ▪ Cellular and Molecular Mechanisms ▪ Systems Theories and Environment ▪ Agriculture, Food, and Nutrition ▪ Development of Instrumentation, Software, and Other Tools ▪ Quantitative Biology, Bioinformatics, and Systems Biology*

Support health research and improved delivery of care

Research and innovation as they relate to the understanding of health and disease as well as to the delivery of health care and social services in the 21st century will increasingly focus on the personalized needs of individuals across all stages of life. Building on a long history of outstanding contributions to health research, McGill is a world leader in translating discoveries from basic research into clinical outcomes and better health care applications and management. We are focused on using basic research to provide short- and long-term solutions that create efficient and high-quality patient care in relation to a wide range of diseases and conditions. 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 cancer, infections, mental health and neurological disorders, chronic diseases that afflict the aging population, and rare and neglected diseases that affect vulnerable populations. Our multidisciplinary approach considers the intrinsic genetic determinants of human health while addressing how environmental and social factors influence individual and collective well-being. *Key areas: Aging and Chronic Conditions and Diseases ▪ Cancer ▪ Genomics, Proteomics, and Epigenetics ▪ Global Health ▪ Health Management ▪ Health Services, Outcomes, and Translational Research ▪ Infection, Immunity, and Inflammation ▪ Personalized Medicine ▪ Preventative, Primary, and Community Care*

Unlock 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, beginning with the genetic, molecular, and cellular foundations of the nervous system and building up to the networks supporting complex behaviours, including pleasure, emotions, decision-making, and language. Along the way, they are driven by questions like “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 influenced by degenerative diseases?” and “How can we develop new approaches for deciphering and sharing the enormous amounts of data we can now collect on the brain and nervous system?” As a result, McGill is uniquely positioned to produce important advancements in areas such as cognitive neuroscience, imaging, pain, aging, and the prevention and treatment of mental disorders and neurological diseases. *Key areas: Aging ▪ Brain Development ▪ Cognition and Learning ▪ Mental and Behavioural Health ▪ Systems Neuroscience ▪ Neurological Diseases ▪ Neuro Technology (Imaging, Optogenetics, Informatics, Neuroengineering) ▪ Pain ▪ Signal Perception – Sound and Acoustics*

Advance knowledge of the foundations and applications of technology in the Digital Age

One of the distinguishing features of humans is our ability to build upon technologies in the hope of improving our collective condition. Pure science provides a foundation which enables new discoveries and applications ranging from large-scale transportation networks to small-scale digital communication systems. Over the past 10 years alone, profound changes have occurred in the way we communicate using technology and in our expectations of what technology will deliver in terms of speed and content. With the Internet's capacity continuing to grow at 50 to 60 per cent annually, the global telecommunications network is now the largest and most complex machine humanity has ever constructed. Even before recent phenomena such as 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 and helps us better understand technology's role in society, in areas such as education and health care. *Key areas: Pure and Applied Mathematics ▪ Algorithms, Software Engineering, and Software Systems ▪ Computational Science (Data Mining, Large-scale Data Processing) ▪ Nanotechnology, including Quantum Computing ▪ Development of Components, Devices, and Other Tools ▪ Broadband and Information and Communication Technologies ▪ Intelligent Machines and Artificial Intelligence ▪ Robotics ▪ Aerospace ▪ Music Technologies ▪ Transportation Systems ▪ Science, Technology, and Society ▪ Innovation Systems and Technology Management*

Explore the natural environment, space, and the universe

Like others throughout history, McGill researchers investigate foundational questions such as: "What are the origins of life?", "How do we ensure the continued viability of our planet?" and "What are we made of, how do we control it, and how can humanity benefit from it?" McGill is a major player in the rapid and extensive advance of our understanding of the natural world and its systems. This intellectual adventure has revealed the laws of physics and chemistry, 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, cosmology and nuclear physics. Observing the Earth, atmosphere, and oceans, as well as exploring the capacity and sustainable exploitation of natural resources, are fields with long and productive traditions at McGill. Furthermore, our world-class researchers emphasize the importance of translating theoretical work into concrete results, which can often be applied to current local, regional, and global challenges. Research in these fields is already influencing how we approach issues related to the safety and security of food, water, and infrastructure, as well as how we design communities and build environments. *Key areas: Astrophysics, Cosmology, and Subatomic Physics ▪ Space Technology ▪ Weather, Climate, and Air Quality ▪ Atmospheric / Hydrospheric Geochemistry ▪ Earth Systems Observation ▪ Quantification and Predictive Modelling ▪ Evolution ▪ Ecology and Biodiversity ▪ Water Management and Safety ▪ Food Security ▪ Mineral Exploration, Mining, Minerals Processing, and Materials Manufacturing*

Conclusion

McGill's renewed Strategic Research Plan supports and furthers research excellence. It reinforces the aspirations of individual researchers as well as teams by providing broad direction, especially within areas that bridge traditional disciplinary boundaries. Continual reflection, appraisal, and strategic reinvestment will help us nurture a dynamic research environment that explores new ideas, contributes to the advancement of education, and mobilizes knowledge with our partners for the benefit of society. Individual action plans for the research sector will be developed in consultation with other McGill administrative and academic units, as well as with external partners. Together, we will implement the ambitious goals reflected in this Strategic Research Plan.

Appendix 1: CRC Allocation and CFI Investments

Canada Research Chairs (CRC) and the Canada Foundation for Innovation (CFI) continue to make invaluable contributions 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 shaping University and Faculty academic hiring strategy, including CRC deployment. Since 2000, McGill has implemented an ambitious academic renewal strategy, hiring almost 100 new faculty members each year and growing the overall faculty total by 25 per cent.

Since the start of the CRC program in 1999, McGill has used its CRC allocation primarily for external recruitment. Nearly 75 per cent of McGill's CRC recruits come from universities and institutes outside Canada, and over 40 per cent of these are repatriated Canadian researchers. McGill's Tier 1 awards enhance our ability to consolidate clusters of researchers around a leading senior researcher, while Tier 2 awards help strengthen research clusters. McGill created two internal awards, the James McGill Professor and William Dawson Scholar, to complement CRC programming as well as recognize and retain outstanding scholars already at McGill. Recent fundraising initiatives have also helped sponsor a number of endowed chairs for distinguished faculty members. Together these award holders comprise nearly 30 per cent of tenured and tenure-track faculty. They play a significant leadership role in building research capacity, training highly qualified personnel, and developing productive research and translational partnerships through their own activities and on behalf of research centres and institutes. Table 1 provides McGill's CRC allocation and internal award allocations for 2012.

Table 1: Chair and Award Allocations 2012	
Canada Research Chairs	157
Endowed Chairs	143
James McGill Professors and William Dawson Scholars	155
Hospital-based Chairs and Funded Professorships	18

Table 2: Distribution of CRCs by Area of Research Excellence (ARE) 2013-17

ARE	Percentage	Tri-Council Sponsor
Health research and improved care delivery	50%	CIHR
Neurosciences		
Convergence of life sciences, natural sciences, and engineering	35%	NSERC
Exploring the natural environment, space and the universe		
Technology applications in the Digital Age		
Humanity, identity, and expression	15%	SSHRC
Public policy, organizations, and social transformation		

The distribution of CRCs among the disciplines is expected to remain relatively stable between 2012 and 2017, including the reservation of some CRCs for major strategic initiatives, such as Canada Excellence Research Chairs program. It is anticipated that McGill will have about 16 vacant CRCs to fill each year over the 2013-2017 period.

For the period covered by the new SRP, 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 seven Areas of Research Excellence (Table 2). Some CRCs are reserved to support applications for major competitions as determined by the Provost in consultation with the Vice-Principal (Research and International Relations).

McGill will continue to use CRCs primarily for external recruitment while, in exceptional cases, internal allocations will be made for retention purposes. McGill is firmly committed to the recruitment of diverse and excellent academics. In this spirit, our search for CRC chairholders will be open, encouraging, and unrestricted.