



McGill



STRATEGIC
RESEARCH
PLAN 2013-17





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EXECUTIVE SUMMARY

For more than two centuries, McGill University has attracted some of the world's brightest researchers and young minds, all of whom contribute immeasurably to the advancement of knowledge. Today, McGill continues to be dedicated to the transformative power of ideas and excellence in a rapidly changing research environment.

The Strategic Research Plan (SRP) expresses McGill's core commitments to ideas, innovation, sustainability, collaboration and partnership, and social engagement in research. Furthermore, under the banner of primary inquiry and as a result of our dedication to addressing major societal challenges, seven broad Areas of Research Excellence have been identified:

- **Examine fundamental questions about humanity, identity, and expression**
- **Strengthen public policy and organizations, and create a deeper understanding of social transformation**
- **Capitalize on the convergence of life sciences, natural sciences, and engineering**
- **Support health research and improved delivery of care**
- **Unlock the potential of the human brain and the entire nervous system**
- **Advance knowledge of the foundations and applications of technology in the Digital Age**
- **Explore the natural environment, space, and the universe**

The renewed SRP will lay the groundwork for McGill to enhance its research capacity; build and strengthen its strategic alliances and relationships; and emphasize knowledge exchange and translation.

Finally, the SRP remains a "living document." It will be revised and adjusted as new challenges and opportunities arise on the research landscape or as the social, cultural, economic and educational realities of our world change.

INTRODUCTION and OVERVIEW

SECTION

Vision McGill is a world-class research-intensive, student-centred university with an enduring sense of public purpose. Our researchers ask important questions and contribute 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 Areas of Research Excellence, and outlines our implementation strategy, which will be carried out over the next five years. Fundamental to realizing this 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.

Achieving Our Goals McGill has a strong history of achievement, consistently ranking as one of the top universities in the world. We are renowned for attracting some of the brightest researchers and young thinkers, all of whom contribute immeasurably to the advancement of knowledge.

This Strategic Research Plan reaffirms our dedication to the transformative power of ideas and excellence in a rapidly changing research environment, as articulated by five “core commitments.” The document goes on to describe the scope and reach of McGill's research enterprise through seven Areas of Research Excellence. The last section then identifies strategic objectives designed to enhance McGill's ability to provide distinctive contributions to research, teaching and training, and community engagement, both locally and beyond. These objectives build on the University's continued efforts to streamline administrative procedures, increase opportunities for interdisciplinary collaboration, and explore new organizational models for research teams.

Overall, the SRP aims to extend the global impact of our research activities, encourage new and stronger partnerships, deliver quality research experience for trainees, and help McGill tap into the worldwide pool of knowledge while contributing to its advancement.

The Unique Character of McGill Research Founded in 1821, McGill is a vibrant research-intensive university with a history of producing important contributions to art, science, and the humanities. The University both belongs to the world and is firmly rooted in Montreal – a city where different languages, cultures, and perspectives not only co-exist, but come together to create a unique community that is stronger because of its diverse parts.

McGill benefits immensely from its place at the centre of a vibrant hub of intellectual, cultural, and scientific activity. Montreal is home to four major universities and has the highest concentration of postsecondary students in North America. In addition to its academic institutions, major government laboratories, and research-intensive industry are situated in the city. These organizations anchor research clusters in life sciences, aeronautics, gaming, and information and communication technologies.



McGill is engaging in local and regional development in many ways and through multiple channels. Initiatives that reinforce Montreal's status as a world-class centre of innovation, such as the Quartier de l'innovation, demonstrate the strength of partnerships between universities, local government, the public, and industry, where social and cultural creativity, entrepreneurship, technology transfer, and urban planning are key elements.

The intellectual and cultural vitality of Montreal contributes to McGill's ability to attract the very best faculty and students from Canada and around the world. It is telling that McGill consistently recruits undergraduates with the highest entering grades in the country and has the largest percentage of international students among Canada's top research-intensive universities. McGill nurtures this talent by placing a special emphasis on the nexus between research and education, recognizing that top students at all levels are inspired by novel ideas and practices and are the next generation of leaders. It cannot be overstated that graduate students and postdoctoral fellows add to the University's research enterprise and that their support and training is part of the University's research mandate.

Purpose of the Document The SRP is an essential tool that informs the University's strategic distribution of Canada Research Chairs (CRC) and Canada Foundation for Innovation investments. It is also a reference for reporting, fundraising, and promoting our world-class researchers and students. For a summary of McGill's current CRC allocation and projections see Appendix 1.

Consultations for the SRP occurred simultaneously with those for McGill's academic plan, *ASAP 2012: Achieving Strategic Academic Priorities*, which will integrate the Areas of Research Excellence identified in the SRP into its emphasis on interdisciplinary research and teaching at the University. The spirit of the document aligns with strategic plans, including McGill's Master Plan and Vision 2020, the University's sustainability plan, as well as strategic research priorities from our faculties and affiliated hospitals. Finally, implementation strategies included here rely on institutional commitments to increase efficiency and connectivity across a broad spectrum of University endeavours.

The SRP provides McGill 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.

CORE COMMITMENTS

SECTION

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

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. McGill has been an active participant in this tradition for close to two centuries, and we strongly believe that universities must continue to be spaces where leading minds are free to pursue both curiosity-driven and solution-based research to address government, industry, and other imperatives. By asking questions – fundamental and applied – McGill researchers are part of a community that seeks to better understand the universe and take steps, sometimes in the most 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. We invent and implement best practices in teaching and training and increase the impact of research by translating the results into social and commercial applications. This can take the form of advocating for appropriate spaces for the free exchange of ideas, where researchers and their partners incubate and 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.

SUSTAINABILITY Sustainability is a central component of research at McGill. Researchers and students study all aspects of sustainability, taking a comprehensive approach to how they carry out their work. Sustainability is also 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 McGill is dedicated to facilitating, encouraging, supporting, and rewarding productive and equitable research partnerships across academic fields, both on our campuses and with external partners. McGill asks important questions and co-creates knowledge with governmental agencies and its decision makers, local community organizations, citizens association, as well as industry, practitioners and workers. Partnerships and team approaches require extra effort and special institutional and administrative support, because they enrich research endeavours and their outputs, enhance the University's teaching mandate, and often provide important applied learning experiences for students. Bringing together leaders – regardless of discipline, background, or affiliation – can generate new ideas and approaches. At home and abroad, our faculty and students build bridges with colleagues from other leading research institutions, governments, private industry, and community-based organizations. We support the participation of diverse voices and are committed to include and promote indigenous knowledge. This stems from a sincere and historical acknowledgement that aboriginal issues are global issues, and indigenous perspectives are relevant to all fields of study.

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 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.



AREAS of RESEARCH EXCELLENCE

SECTION 3

The seven thematic areas, the Areas of Research Excellence (AREs), describe traditional disciplinary strengths and group McGill faculty expertise into strategic clusters. Key areas identify 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 build 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



AREAS of RESEARCH EXCELLENCE

SECTION 3

CAPITALIZE ON THE CONVERGENCE OF LIFE SCIENCES, NATURAL SCIENCES, AND ENGINEERING

By posing 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 this question 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



AREAS of RESEARCH EXCELLENCE

SECTION

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, Optigenetics, Informatics, Neuroengineering)
- Pain
- Signal Perception – Sound and Acoustics

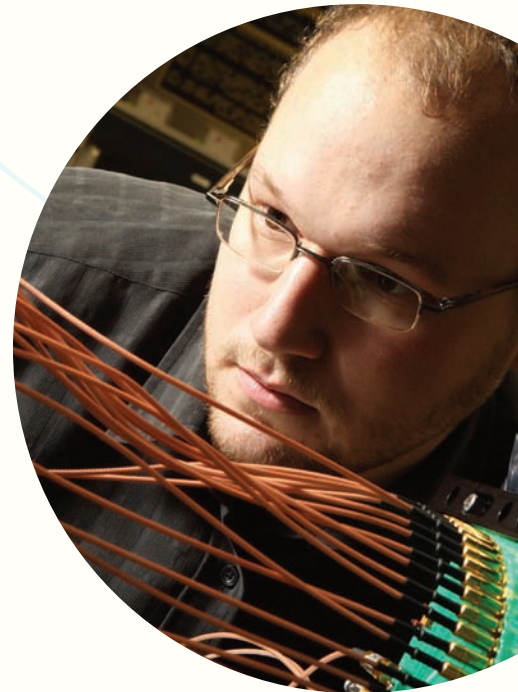


ADVANCE KNOWLEDGE OF THE FOUNDATIONS AND APPLICATIONS OF TECHNOLOGY IN THE DIGITAL AGE

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 systems 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 like 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



AREAS of RESEARCH EXCELLENCE

SECTION

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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



“ENABLING, FACILITATING, CONNECTING”: SRP IMPLEMENTATION STRATEGY

SECTION

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Implicit in this Strategic Research Plan are a number of overarching mechanisms, which can be summarized by the phrase “Enabling, Facilitating, Connecting.” In other words, McGill’s administration hopes 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.

To that end, this Strategic Research Plan has articulated McGill’s core commitments and Areas of Research Excellence for the coming years. The final section of the document outlines our strategic objectives as well as a series of high-level “drivers” that will be developed into specific action plans as this vision is realized.

Three strategic objectives will guide the implementation process:

1. Enhance McGill’s research capacity
2. Build and strengthen strategic alliances and relationships
3. Emphasize knowledge exchange and translation

The drivers associated with each objective do not appear in order of priority or in a chronological sequence of implementation. Instead, this SRP should be considered a “living document.” It will be revised and adjusted as new challenges and opportunities arise on the research landscape or as the social, cultural, economic, and educational realities of our world evolve. In order to maintain our ability to adapt quickly, we have deliberately created an SRP that balances stated purpose with flexibility.

Although this document does not claim to be a definitive statement on values and priorities, it should be read as a touchstone to guide the future growth and success of McGill’s research enterprise. Individual action plans for the research sector will be developed in consultation with other McGill administrative and academic units, as well as with our external partners. Together, we will implement the ambitious goals reflected in this Strategic Research Plan.

STRATEGIC OBJECTIVES

1. ENHANCE MCGILL’S RESEARCH CAPACITY

Driver 1.1 //Research planning and development

- Implement research priorities in collaboration with the faculties and affiliated hospitals
- Contribute to the stability and long-term planning of research centres and other academic structures to advance research



- Seek out and support emerging areas of expertise and leadership
- Encourage interdisciplinary dialogue and provide additional support for team approaches to addressing large, complex research questions
- Provide seed funding to initiate research activities and enable the organization of strategic initiatives
- Establish a special opportunity fund for research activities that have strong potential for unique advancement and cannot be funded through existing sources
- Maintain and enhance infrastructure and operations that support leading-edge research, with an emphasis on shared and core facilities

Driver 1.2 //Comprehensive research administration

- Build an Office of Research and International Relations that supports research excellence at all stages, from the generation of ideas to their application in society
- Provide proximity support within faculties, departments, and labs to principal investigators
- Streamline processes to increase efficiency, transparency, and flexibility of post-award management
- Mentor early to mid-career researchers in how to apply for funding

Driver 1.3 //Nexus between research and education

- Collaborate with professors, departments, faculties, and other units to create adaptable and innovative learning environments
- Encourage and highlight student participation in research centres and large-team initiatives
- Enrich the undergraduate research experience
- Assist with planning related to the recruitment of top graduate students, both locally and internationally

2. BUILD AND STRENGTHEN STRATEGIC ALLIANCES AND RELATIONSHIPS

Driver 2.1 //Develop proactive strategies to attract diversified funding from external sources

- Engage with industry, both multinationals and SMEs, in areas of priority through a business engagement hub
- Increase collaboration with McGill's Office of Development and Alumni Relations

Driver 2.2 //Strengthen local and regional connections

- Develop stronger relationships with key decision-makers in Quebec and Canada, with the goal of better understanding their objectives and shaping their priorities
- Invigorate platforms dedicated to exchanging ideas, promoting entrepreneurship, and developing community engagement



“ENABLING, FACILITATING, CONNECTING”: SRP IMPLEMENTATION STRATEGY

SECTION

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Driver 2.3 //Refresh and implement a comprehensive internationalization strategy

- Enhance McGill’s visibility and presence internationally
- Develop and build upon international partnerships in key areas of McGill research excellence
- Identify priority countries and regions for long-term partnerships
- Renew McGill’s focus on international development and capacity-building

3. EMPHASIZE KNOWLEDGE EXCHANGE AND TRANSLATION

Driver 3.1 //Community engagement

- Work with local and international leaders to identify needs and recognize expertise
- Capitalize on activities undertaken by some of McGill’s academic and non-academic structures to facilitate links between researchers and communities
- Cultivate citizenship, engagement, and professional development activities led by faculty, students, and staff

Driver 3.2 //Knowledge mobilization and communication

- Increase channels for exchanging knowledge
- Support McGill activities related to mobilizing knowledge
- Expand visibility, outreach, and service to the community
- Allocate resources toward collaborative and outreach-focused activities
- Expedite access to information about McGill research for all stakeholders

Driver 3.3 //Commercialization

- Support pre-commercialization and pre-application proof of concept studies, prototyping, and the further development of early-stage technologies with strong potential for commercial or social impact
- Assume an international leadership role in the development and implementation of best practices in risk and value-added assessment as well as intellectual property management



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 academic units, as well as with external partners. Together, we will implement the ambitious goals of this Strategic Research Plan.





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