Action Plan

Research, Discovery, Creation and Innovation 2022-2027

Vice-Rectorate of research, discovery, creation, and innovation

Université de Montréal et du monde.

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TABLE OF CONTENTS

ACTION PLAN
RESEARCH, DISCOVERY, CREATION AND INNOVATION
2022-2027

A WORD FROM THE VICE-RECTOR

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In these times of profound changes sweeping across the planet, the need for university research to produce new and impactful knowledge is more important than ever. The UdeM is committed to actively supporting a research of excellence that is collaborative, innovative, diverse, and open to the world. Research is at the heart of the mission of the Université de Montréal (UdeM). Thanks to its exceptional disciplinary diversity – with 13 faculties and schools, 465 units of research and vast network of affiliated health centres – research at the UdeM directly contributes to training, knowledge advancement, and the development of the local, national, and international research communities. Freedom of research is pivotal to promoting excellence from an array of perspectives. The discoveries resulting from research at the UdeM often stem from collaborative and intersectoral approaches that foster creative solutions to complex societal challenges.

The current research plan highlights the main strategic orientations of the Vice-Rectorate to promote research activities, creation, and innovation at the UdeM. It seeks to contribute actively to the advancement and mobilisation of knowledge in order to respond responsibly and pro-actively to the challenges of today and tomorrow.

THE UNIVERSITÉ DE MONTRÉAL: A UNIQUE ECOSYSTEM OF RESEARCH, INNOVATION, AND CREATION

The UdeM is one of the most important research hubs in Canada and the francophone world. Thanks to an exceptional disciplinary diversity, the UdeM provides a unique ecosystem of research, innovation, and creation with collaborations of unparalleled richness. The engagement of all members of our research teams, professors, students, and professionals, as well as of numerous partners, is a major asset for the creation of new knowledge open to the world. The priorities highlighted by the Vice-Rectorate of Research, Discovery, Creation and Innovation (VRRDCI) draw on the energetic strengths of the UdeM.

MISSION

The VRRDCI directly supports the mission of the University in its pursuit of excellence in the production of knowledge and commitment to the common good. Its overall task consists of coordinating, supporting, and enhancing research, innovation, and creation activities, in close collaboration with the other vice-rectorates and units. It promotes the respect of the principles of equity, diversity, and inclusion in research, as well as exemplary approaches regarding responsible conduct of research. It provides a collaborative and diversified research environment that fosters new scientific, cultural, social, and economic advances, which, in turn, stimulate and nurture within our student community a passion for discovery, innovation, and knowledge mobilization.

VISION

Support the UdeM's teams to enable the passion for research, creation, and innovation, which stirs our research community, to understand, imagine, and build a better and sustainable world.

THREE INSTITUTIONAL PILLARS

The VRRDCI's vision of development rests on the three pillars of the UdeM's strategic plan:

- Dare to change: Make sure the academic community responds responsibly and creatively to the needs of a world in constant change
- Live our plurality: foster the empowerment of the members of our community by emphasizing the plurality of backgrounds, experiences, and perspectives
- Merge our energies and strengths: Prioritize collaborative and transversal initiatives which have a positive and measurable impact on major societal challenges

10 AREAS OF EXCELLENCE

At the UdeM, excellence is:

Areas of excellence at the UdeM host a critical mass of talent and research activities of outstanding calibre and impact. These areas form a solid foundation on which we will continue to build trail-blazing initiatives responding in an original, rigorous, and impactful way to major scientific and societal challenges.

Bio-innovation and Digital Health

The UdeM encompasses all the health disciplines, human and animal alike. It combines a wide and integrated range of expertise which covers the fundamental approaches on structural, genomic, metabolomic, and proteomic biology, as well as their implementation in precision health throughout life. The UdeM is recognized for its expertise in the discovery and production of innovative medicines and bioformulations. Its research teams possess cutting-edge expertise in immunotherapy and cellular therapy, pharmacogenomic, and nanomedicine, and ensure their implementation, particularly in oncology, cardiovascular diseases, and mother and child health. The development of digital and artificial intelligence (AI) at the UdeM constitutes a fertile ground for fruitful collaboration which stirs our research teams in fields as varied as the discovery and supply of innovative medicines assisted by artificial intelligence, the automation of diagnostic approaches and imaging, the digital transformation of health care and health services. Its Digital Health Consortium brings together all the actors of the

health and AI networks. Thanks to its Consortium, the UdeM stands starkly out in areas related to the characterization and use of dynamic algorithms in health data, whether they are of molecular, genetic, clinical or populational origin. It also rests on the expertise of its teams in the field of governance, innovation in health and public policies, as well as on the close links established with the citizens and patients-partners to promote a research geared to the transformation and increase of digital technology in health for the common good.

Brain, Mind, Perception

The UdeM is internationally recognized for the quality of its research on cognition, psychology, neuropsychology, and neurosciences, notably in fields such as motor control, vision, pain, and cognition. Its researchers are committed to developing further essential aspects of cognition, particularly those related to sensorial perception, sleep, memory, and communication, in normal and pathological contexts such as trauma, cardiovascular arrest, or neurodegenerative diseases. These approaches are combined with other expertise in motor rehabilitation, both communicational and cognitive, treatments of addictions, mental health, play or art therapy, and musical therapy. They will ultimately enable the development of highly innovative and integrated therapeutic approaches. The UdeM supports the deployment of these fundamental and applied research activities in neurosciences and mental health, throughout life. It strives at increasing our global understanding of the human and animal brain, our mind, our perceptions, our emotions and behaviour, and the necessity of establishing and maintaining social networks.

Creation, Culture, and Imaginaries

Our societies are built on imaginaries, cultures, narratives, values, and strong collective legacies, which are highly diversified. The UdeM has developed an internationally recognized expertise in these major fields of studies including interculturality, intermediality, digital humanities, the study of religions and sociocultural perspectives of the sacred, musicology and ethnomusicology, the study of memory and intangible or built heritage, literatures, civilisations and cultures, notably those of the First Nations. This adept sociocultural knowledge, combined with dialogue with communities, bolsters the development of new and highly creative approaches; it similarly improves our relations to others and the world. Research-creation also occupies a preeminent place at the UdeM, especially in areas such as music, cinema, videogames, landscape architecture, design, communication, and literature. Research-creation teams clearly stand out for their work on narratives and their close involvement with communities, inspired by an overall vision of individual or collective empowerment.

Environment, Biodiversity, and Society

For over a hundred years the UdeM has been actively engaged in biodiversity research, particularly in vegetal or microbial biodiversity, as well as in the fields of animal and environmental health. Our teams work on the issues of preservation, conservation and adaptation, as well on the challenges of water management, ecotoxicology, agroindustry, green chemistry, energy storage and conversion, and territory planning. Besides this considerable expertise in natural sciences and environmental studies, the UdeM also studies the impact of our social activities on the planet, our relation to the landscape, to the territories, and the vulnerabilities. The works resulting from these studies thus provide venues and potential answers in domains related to environments of sustainable livelihood (planning, logistics, mobility, and services), circular economy (eco-conception, responsible production and consumption), governance, management of natural resources, and corporate social responsibility. These various research initiatives have the common goal of implementing technologies and essential knowledge and

expertise to confront climate changes, extreme events, the crisis of biodiversity, and the exhaustion of natural resources. They provide indispensable knowledge and tools that will enable the future generations to respond to their needs in an ecological and sustainable way.

Fundamental Explorations of Reality

Understanding our constantly evolving world would be impossible without basic sciences which allow us to expand our conceptions of existence, universe, and matter. The UdeM is actively engaged in these long-term fundamental research activities, ranging from studies at the atomic, molecular and cellular levels, all the way through quantum sciences, astrophysics, the study of dark matter, and exoplanets, while encompassing mathematics, philosophy and epistemology. Their ongoing development generates major methodological advances, theoretical and applied, that will greatly benefit future generations.

Digital, Human and Artificial Intelligence

The UdeM is internationally recognized for its strengths in artificial intelligence (machine learning, deep learning, natural language processing, computational linguistics, neuro-computing), digital intelligence (mathematical optimization, operational research, bio-informatics), statistics (bio-statistics, social statistics) and sciences of digital information. These recognized areas of expertise combine with established strengths in the areas of imaging, language, movement, and visualization of data. With a globally recognized expertise in fields such as cyber-justice, cyber-criminality and cyber-security, privacy, and socially responsible development of artificial intelligence, the UdeM seeks to promote the development of responsible artificial intelligence, in line with the principles of The Montreal Declaration for a Responsible Development of Artificial Intelligence, launched by the UdeM.

Innovative Materials and Processes

Materials science is at the heart of countless technological advances and can create new opportunities in many areas, including manufacturing, industry and medicine. The UdeM stands out for its ability to link experts in artificial intelligence with leaders in designing and producing new materials. The UdeM has developed a unique expertise in areas such as molecular assembly, low-dimensional materials, physical chemistry of polymers, catalytic conversion, non-equilibrium processes, surface and interface engineering, biological fabrics and membranes, bio-based materials, and quantum materials. The UdeM also targets innovative uses of new materials in a wide range of applications, while examining social acceptability and impact of these new materials and processes on health and environment. These goals reflect an overarching perspective of eco-responsibility and include, among other things, initiatives to develop sustainable materials and processes for energy transition and mobility of tomorrow.

Social Relations, Democracy, and Responsibility

The study of collective systems, social relations and challenges of governance, and democracy is a highly dynamic sector at the UdeM. It provides a complementary expertise which spans the provincial and federal as well as the international levels. The issues range widely and address the nature and definition of our democracies themselves. These include: the analysis and comprehension of models of governance, globalization, international relations, and legal and political systems; the examination of social relations, living together with its attendant implications (equity, diversity, and inclusion; social inequalities and vulnerabilities; family and community links; demographic changes; working environment; planning and transformation of space; process of social innovation; new economic models). All these challenging issues require close analyses and probing to better grasp them. Thanks to

their proven expertise in ethics, and in compliance with the UdeM's promotion of the common good, numerous UdeM's teams integrate ethics through their reflection on responsibility and social justice, legislation and public policies, individual and collective rights, governance and regulation, and equity and fundamental rights.

Acquisition and Transmission of Knowledge

The UdeM developed a rich and multisectoral expertise on both knowledge acquisition and on our relationship to knowledge, with the aim of leading learners of all ages toward success and well-being. This expertise is manifest in fields ranging from theories on education and language study and communication (oral, musical, visual or digital) through to research activities in didactics, the foundations of education, psycho-pedagogy, and neurosciences and learning. The teams exploring these challenging areas develop inventive methodologies that expand our knowledge and enrich programmes at all levels. They also foster pedagogical innovation, the reduction of inequalities, and the improvement of the educational systems, particularly thanks to close collaboration with stakeholders. Some of the principles guiding research projects include experiential knowledge or learning systems, to ultimately empower the stakeholders to appropriate the results for a direct positive impact on society.

One-Health

The recent COVID-19 pandemic has made it clear that there is no divide between environmental health, animal health, and human health: there is only One health, and that is health of ecosystems on a global scale. The "One Health" approach, in which the UdeM has been a leader for several years, emphasizes the importance of interactions between humans, animals and their environments. Bringing together a unique combination of expertise in human, animal, environmental health and at the level of population, territorial and global perspective, the UdeM promotes the One Health approach by allowing greater complementarity between fields. This vision is based on proven strengths of the UdeM and its network in the fields of immunology, microbiota, infectiology, epidemiology, toxicology, chronic diseases (for example, cardiovascular and metabolic diseases), oral health, prevention, healthcare, nutrition, animal and agricultural production, health humanities, environmental sciences (protection and conservation), land use planning and management, as well as all the determinants of health, well-being and living conditions of humans and animals. The UdeM analyzes the interaction between all living beings, on an individual and collective basis, while placing them in their political, economic, social, cultural and territorial context. This vision allows to address, in a systemic way, issues such as globalization, social justice, sustainable urbanization, antibiotic resistance, antimicrobial therapies, zoonoses, food safety, quality and eco-responsibility of healthcare and services, and response of living beings to contaminants and extreme events.

ACTION STRATEGIES

To efficiently support its research community and consolidate its areas of excellence, the VRRDCI has identified three action priorities:

- Support collaboration
- Promote responsibility in research
- Maximize impact

These priorities revolve around 14 strategies complementing one another and all linked to the institutional pillars

	Dare to change	Live our plurality	Merge energies
Support collaboration	• Enhance **knowledge mobilization and interpersonal skills**, and welcome **experiential knowledge** within research activities • Promote **open science**, through support of open access and responsible sharing of research data	• Foster **research approaches open to the world,** promoting dialogue and mutual enrichment of perspectives	• Acknowledge, support, and **value team work**, the result of the contribution of all the research community members (students, professionals, professors) • Help connect research teams to support **intersectoral approaches** that tackle challenges at stake

	Dare to change	Live our plurality	Merge energies
Promote responsibility in research	• Empower the teams to ensure **methodological rigor, reproducibility** of results and **safety** in research	• Provide an exemplary environment in terms of **equity, diversity, and inclusion**, at all stages of research and creation • Encourage research **by, for, and with First Nations,** in keeping with the principles of collaboration, reciprocity, and collective enrichment of perspectives	• Support the development of a **culture of responsible conduct in research**

	Dare to change	Live our plurality	Merge energies
Maximize impact	• Develop the **leadership** of the UdeM's research teams within local, national, and international initiatives	• Acknowledge, promote, and support **plurality of approaches in research**, in terms of process and theoretical perspectives, as well as of methodological approaches • Support **valorisation of research and entrepreneurship**	• Foster **training to research, and by research**, for all students at undergraduate and graduate levels • Favor the **sustainable development** of research activities

MECHANISMS TO SUPPORT THE RESEARCH COMMUNITY

The implementation of these actions will rest on the enhanced support to the research community in order to meet and surpass the current research and creation challenges.

- Deployment of a Digital Strategy

  Digital technology affects the way all research activities are conducted, ranging from the collection and management of data to the mobilization and dissemination of research results. UdeM's Digital Strategy seeks to ensure the implementation of exemplary practices and the appropriation of a digital culture in all aspects of research, creation and innovation. It will help the community to acquire expertise in sound data management and sharing, cyber-security reflexes, and, ultimately, lead to a wider and safer dissemination of research results.

- Modernisation of Services for the Research Community

  The Research, Development, and Valorization Office (BRDV) and the Office for the Responsible Conduct in Research (BCRR) are committed to supporting research teams and platforms as well as providing training modules to research teams from all sectors on responsible conduct of research and best practices in governance of research. The BRDV provides assistance to individual application grants as well as to wider institutional research initiatives. It also aims to expand the service offer regarding knowledge mobilization, the valorization of research and creation, and entrepreneurship. It seeks to better empower and acquaint the community with the multiplicity of valorization opportunities, within an overall vision that encompasses commercialization and technological transfer as well as social innovation and responsible entrepreneurship.

- Reinforcement of Research Infrastructures

  Research projects require cutting-edge infrastructures and technological equipment, as well as the expertise of a highly qualified staff for optimal implementation. The VRRDCI will work in close collaboration with the faculties and the research community to ensure the acquisition, deployment, maintenance, and upscaling of research equipment and platforms. The VRRDCI wishes to facilitate the sharing of and access to the facilities, tools and research platforms in a spirit of interaction and exchange, which constitutes the engine of development and research, innovation and discovery. It also aims to enhance the role of our highly qualified staff to foster methodological rigour, the robustness and reproducibility of results.

- Support to Knowledge Mobilization

  Research requires knowledge sharing and mobilization to reach its maximal impact. On the one hand, the transfer of research results must be facilitated by open science, data sharing, and open access to publications, key principles the UdeM abide by. On the other, knowledge mobilization must transcend learned publications to reach a wider audience. This expanded transfer is intrinsic to the research mission, and the UdeM actively promotes public dissemination of scientific research results by experts. In order to facilitate this mobilization, the UdeM intends to provide the research community with the appropriate training and assistance, which will enable them to fulfill this social mission in a responsible and advised way. The UdeM also recognizes that the potential experiential knowledge generated by our various partners

helps to enrich the academic perspectives. In this light, the UdeM encourages the development of a culture of constructive dialogue and sharing, within the spirit of reciprocity and mutual opening.

- The Innovation Lab

  The aim of the Innovation Lab consists in supporting the different faculties and research communities in order to facilitate the networking of researchers from different disciplines and units, as well as the elaboration of major intersectoral initiatives aimed at responding to major challenges of our society. Given the intrinsic research strengths available at the UdeM, which are outlined in our 10 areas of excellence, four major challenges are here specifically targeted:

  - **Understanding and creating/ creating to understand** – whose main objective is to encourage creativity, in both research-creation and teaching, in the practices of research as well as in knowledge mobilization.
  - **Building a sustainable future** (CLAD) – which aims to support the emergence of new knowledge that will help to respond in a sustainable and resilient way to the current socio-environmental challenges. Through its close links with the Unit of Sustainable Development (UDD) and Paths of Transition, CLAD also intends to integrate this new knowledge to the UdeM's practices.
  - **Rethinking Life** – which aims to develop links between the different stages of existence (childhood, adolescence, and adulthood), in order to better grasp the life continuum, and thus increase well-being at all stages of life, ageing well, and a dignified end of life.
  - **Shaping an Inclusive, Innovative and Responsible Society**, whose objective consists of consolidating our knowledge on the challenging issues of equity, diversity, and inclusion, and of welcoming plurality, in both our own institution and in the community at large. The project also seeks to promote and maintain a sustained dialogue with the First Nations in the spirit of collaboration and reciprocity.

  More concretely, the Innovation Lab provides an initial strategic and operational support to new inter-faculty initiatives which, by building on existing strengths and expertise, seek to respond in an original and creative way to these grand challenges. The Innovation Lab facilitates networking among researchers as well as the development of new communities of practice, while it also actively contributes to the development of research tools. In compliance with the UdeM's mission, the Lab aims to actively stimulate and promote knowledge sharing and the links between research, teaching, community involvement, and practice environments.

  These projects will eventually enable to:

  - Stimulate intersectoral dialogue;
  - Increase the impact of existing areas of excellence in research, further still, create new areas of excellence at the UdeM;
  - Support the development of collaborative and innovative perspectives to respond to the major challenges of our society;
  - Encourage interactions between training, research, community involvement, and practice.