

# 2015–2020 RESEARCH DEVELOPMENT PLAN

INSTITUTIONAL STRATEGY



UNIVERSITÉ  
**LAVAL**

**OFFICE OF THE VICE RECTOR OF RESEARCH AND INNOVATION**

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# Background

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The research environment has undergone tremendous transformations in recent decades, pressured by scientific challenges and inherently complex societal and economic issues that call for solutions unconstrained by national boundaries. This requires the pooling of expertise from various sectors and the sharing of available resources. More than ever, the future of our societies hinges on creativity and the ability of all concerned actors to innovate.

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The 2015–2020 Research Development Plan (the “Plan”) is the product of an environment that reinforces the need for new approaches based on collaboration, public-private ventures, and an international outlook. The ability to quickly and effectively capitalize on opportunities to strengthen areas with strong potential and to develop new areas and partnerships by making full use of institutional resources is becoming a major priority.

This Plan follows upon its predecessor, which saw research funding increase upwards of \$20 million, and PhD student enrolment grow 10%. During the period covered by the previous plan, the number of partnership chairs increased by 35%.

The 2015–2020 plan builds upon major infrastructure, including facilities developed within the past five years, such as the Laboratoire de physiologie intégrative en sciences animales, Laboratoire de sustainable development des infrastructures publiques, la Plateforme de génomique intégrative humaine et microbienne, and Laboratoire audio-numérique de recherche et de création.

The Plan continues the high visibility achievements of late, including Alliance health Québec and Institut nordique du Québec. And like its predecessor, it leverages Université Laval's position as a leader in the francophone world and in sustainable development. The university's location in a vibrant, outward-looking city further adds to its appeal.

The 2015–2020 Research Development Plan ties in closely with Université Laval's Horizon 2017 action plan, in terms of research and innovation. It has been specifically developed to help attain four of Horizon 2017's nine objectives:

- > Step up the internationalization of training and research, as well as our international cooperation initiatives;
- > Ensure effective development of research and innovation;
- > Attract and recruit more professors and foster faculty loyalty to contribute to institutional development;
- > Nurture the commitment and contributions of members of the university community and enhance the university's reputation

The actions identified to attain these objectives are an integral part of the present plan, inasmuch as they involve research, and are identified as such throughout the document.

In addition to these contextual elements, the Plan is built on the expertise and influence of UL professors who are recognized as international leaders in numerous fields, and on their ability to develop new niches where unexpected scientific advances can occur. It is also based on an academic community whose members have excelled at collaborating with partners both here at home and the world over.

The Plan is further based on the remarkable innovation capacity of UL educators, the creativity of the graduate and post-doctoral students who help map out our future, and the skills of the research professionals who help keep projects running day in, day out. Lastly, the Plan draws inspiration from the concerns of regular citizens, whose increasingly important contributions enrich and influence the priorities and practices of our academic faculty.

The Plan grew out of an ambitious consultation conducted in 2014 within the university community and its affiliated centres. UL's scientific community will also be called upon in the course of implementation to update Plan priorities.

The Plan is meant for all UL members as well as the university's various private and public partners. The document also constitutes an important reference tool for the institutional programs run by Fonds de recherche québécois and the federal research councils. Professors requesting financial aid under these programs must demonstrate that their research efforts reflect the institutional priorities set forth in the Development Plan.

The Plan also draws on faculty development plans. UL faculties, which are attuned to both global scientific trends and local needs, are the anchor point for the university's current and emerging research capabilities. With the help of professors working in collaborative networks at the international level, they can bring a unique dimension to the university's institutional priorities, while at the same time ensuring an exceptional convergence of effort. By linking faculty and institutional means for action, the university can boost its leverage tenfold.

The mission of the Office of the Vice Rector of Research and Innovation is to develop an institutional vision for research by identifying key priorities. The office takes the lead in research development by introducing strategies to spur and optimize funding opportunities. And it brings together and implements the conditions that enable faculties to achieve their goals from an institutional perspective.

The 2015–2020 Research Development Plan differs primarily in its systematic effort to delimit a vast range of activities in connection with two major priorities and seven societal challenges. The Plan's strategic approach is also distinctive, focusing on dialogue between research teams and close collaboration with public and private partners at the local, national, and international levels.

The Plan also highlights Université Laval's ability to help answer high-priority questions confronting various research institutions and research users from the economic, social, and political arenas with respect to such challenges as sustainable development, health and wellness, good governance, Northern development, and the cultural vitality of our society. The skills and expertise of UL faculty members, professionals, students, and post-doctoral fellows in the area of research and innovation will help UL expand its influential role in the scientific, social, cultural, economic, and technological development of our globally oriented society.

# About Université Laval

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Université Laval, a leading research institution, is ranked among the top ten research universities in Canada by Research Infosource Inc. With 3 Canada Excellence Research Chairs and 84 Canada Research Chairs, UL ranks sixth in terms of funding obtained from the main federal granting agencies, and its research teams are known worldwide for their performance. The university is home to numerous world-class scientific experts, many of whom are widely cited authorities in their fields. It also has some 50 major research platforms that ensure it remains competitive.

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Université Laval is an important actor in the community, as shown by the many contractual agreements of different types it has. Faculty members regularly establish long-lasting partnerships with community organizations, social enterprises, and private businesses throughout the Québec City area, especially in technology-related fields. The institution is also an important economic contributor to the city and region. Over the term of the current five-year plan, its research investments will exceed \$1.5 billion, helping to attract top specialists and the most promising students.

Université Laval is an international institution. The number of international students has risen steadily, and they now comprise 12.5% of the overall student body and 25% of graduate student ranks. UL professors collaborate with peers from all over the world, and 46% of articles published are joint publications with institutions outside Canada. The numerous formal agreements signed with non-Canadian universities and the many articles produced by faculty with co-authors from the U.S., Europe, and Asia, attest to our international worldview. Multi-national units and consortiums with France, Brazil, Switzerland, and England are another aspect of the growing trend to international research collaborations led by UL.

Université Laval is an institution that embraces innovation, as evidenced by its many invention disclosures, commercial licences, and agreements for the use of research results. The university is actively engaged in the innovation chain, in keeping with governmental policies designed to stimulate the transfer and use of knowledge. UL also recognizes the benefits that derive in all areas from social and cultural innovation.

Well before granting agencies encouraged them to do so, UL research professors were in the habit of working together. Université Laval established centres and institutes that cut across faculty boundaries, encouraging the creation of high-level networks of deep, diversified expertise and instilling a penchant for dialogue and knowledge transfer with various spheres, and offering students and post- doctoral fellows a particularly stimulating learning environment. More recently, Université Laval has pioneered a unique capacity-building collaborative model by establishing partnership research chairs that further strengthen already productive relationships with private and public partners alike. Université Laval's 70 partnership chairs have spawned the development of high-potential niches that have been particularly effective in training a highly qualified workforce.

Through its efforts to build research capacity, Université Laval has acquired tangible means to deal with the changing research landscape. By establishing partnership agreements with other leading universities and organizations, UL is gaining in stature at the international level. For many years the university has played a unifying role, convening diverse resources to address regional issues.

# Université Laval teaching and professional resources, chairs, centres and partners (2013)



**16**

faculties



**1,350**

full-time professors



**\$307 M**

million in research revenue



**150**

research-oriented master's and PhD programs, with nearly 4,300 graduate level students



**400**

post-doctoral fellows



**700**

research professionals



**800**

Université Laval strategic private/public partner-investors



**84**

Canada Research Chairs



**68**

partnership research chairs



**3**

Canada Excellence Research Chairs



**39**

recognized research centres



**9**

institutes



**4**

affiliated research centres

# Our vision

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In order to fully play its role within Québec and Canadian society and the international scientific community, Université Laval will work to consolidate and enhance its stature as a major research and innovation institution that embraces the future and is open to the world. Université Laval will continue to serve as a cornerstone of its community, both through its humanist approach and its ability to educate tomorrow's leaders, and undertakes to expand the frontiers of knowledge by ensuring its transfer and creating innovative, sustainable solutions.

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OUR VISION IS BASED ON THE FOLLOWING VALUES:

## Curiosity

Question, break new ground

## Creativity

Innovate, create, ideate

## Openness toward others

Collaborate, break down barriers between disciplines, actors, and communities

## Integrity

Pursue excellence, be transparent and intellectually rigorous

## Commitment

Join together to tackle major societal challenges from a sustainable development perspective

## Leadership

Explore new ways to conduct research, innovate, and develop partnerships

# Strategy

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To make this vision a reality, Université Laval has adopted a strategy based on the belief that tomorrow's solutions to the complex questions of today will emerge from a solid research and innovation base and the interplay between key disciplines.

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This strategy is expressed in two main priorities:

- 1) Mobilize the Université Laval scientific community around seven major scientific and societal challenges that transcend institutional structures and correspond to our current research strengths and paths to future development;
- 2) Support research capacity building and dissemination.

## **Priority 1: Mobilize around societal challenges**

Université Laval wants to play a role in solving societal issues by building on its research and innovation strengths in each of its disciplines, developing high-potential emerging fields, adapting to rapid changes in research, encouraging cross-disciplinary collaboration among its professors, and supporting membership in these communities of interest.

The research strengths and emerging fields identified in the Plan are the result of an analysis of several thousand projects currently under way at the university. This analysis formed the basis of a capstone effort articulating research activities for seven focus areas, each corresponding to a major scientific or social challenge. In the case of the first and sixth challenge, UL professors, their research teams, and university partners are already hard at work within a structured and evolving framework. For the other five, the Office of the Vice Rector of Research and Innovation will organize forums for the purpose of refining the strategic priorities and convening partners to address shared issues. The Plan is therefore a dynamic, unifying tool.

### **UL research team discoveries are helping to:**

- 1.1. Create a society where health and well-being are sustainable;
- 1.2. Explain how humans develop in their environment;
- 1.3. Understand societies, their cultures and their arts;
- 1.4. Model intelligent communities, invent their technologies and their logistics;
- 1.5. Manage and develop natural resources in a responsible manner;
- 1.6. Consolidate and develop Northern sustainability;
- 1.7. Engage actively in ethics, sound governance, and social organization.

**Priority 2:**

**Build research capacity and support the dissemination of Université Laval research through four areas of action:**

- 2.1 Support and promote excellence in research and innovation
- 2.2 Stimulate and promote regional, national, and international partnerships and collaborations
- 2.3 Encourage research through and for training, and promote the achievements of students and post-doctoral fellows
- 2.4 Encourage and promote innovation



## Priority 1

# Mobilize around societal challenges

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Université Laval is building its research focus areas around seven major societal challenges, and has identified strategic priorities within each focus area that reflect our strengths.

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Addressing these critical scientific and societal issues requires pooling expertise, both to explore and solve fundamental scientific problems and to develop dynamic solutions that draw on developments in emerging, and often multidisciplinary, research fields. Faced with such massive challenges, the university must enlist all available resources and research approaches.

Close to 56% of UL professors are currently working in areas that contribute to more than one of the seven challenges identified. This high degree of interdisciplinarity shows that researchers can collaborate across disciplines to build a better future through research and innovation.

To define the seven major societal and scientific challenges, the university looked to the current research context and reviewed several thousand ongoing research projects. This process was supplemented with assessments to ascertain UL's research and innovation strengths. Specific objectives were then set in each of the seven research focus areas.

Only a comprehensive approach can achieve sustainable health. Such an approach not only requires contributions from every field of health research, but also from virtually every other field of research, including the human and social sciences, arts and literature, the natural sciences, and engineering.





# Create a society where health and well-being are sustainable

Université Laval is home to leading researchers in population health and optimal healthcare practices.”

Given the now widespread consensus on the correlation between environmental factors and human health and well-being, it is crucial to further our understanding of these correlations and develop health promotion and prevention strategies. Université Laval is home to leading researchers in the fields of population health, optimal healthcare practices, and food security, a matter of global geopolitical importance. Other areas attracting growing interest are the effect of psychological, sociological, and spiritual factors on health and wellness, and the ethical dimensions of medical treatment. Université Laval has responded by fostering participative patient- and citizen-centered approaches to health and wellness as well as complementary and alternative approaches, all with a view to meeting the needs of all healthcare system users.

While some diseases have declined or are increasingly under control, new ones have emerged, creating new challenges for researchers and clinicians. Université Laval is a leader in the study of chronic illnesses in society. UL researchers have been recognized by the international scientific community for their publications on the causes, effects, and prevention of cardiometabolic diseases, to give just one example. This pathbreaking work bodes well for research projects planned for the next five years.

## Université Laval is home to leading researchers in population health and optimal healthcare practices.

Université Laval is committed to making decisive breakthroughs in the understanding and treatment of disease. Using state-of-the-art technology, it has advanced the understanding and diagnosis of neurodegenerative mental illness, and is leading the way in neuroscience and neurophotonics. Top research teams are also exploring the treatment of disease from a pharmacogenomic perspective and in terms of patient adherence to treatment.

The university is recognized for excellence in the study of infectious and immune diseases, respiratory diseases, and oncology. It is home to leading authorities doing fundamental and clinical research in pneumology, endocrinology, nephrology, and reproductive and mother and infant health. Regenerative medicine is another fast-growing field and a source of hope in the treatment of severe burns and other conditions.

Another area where knowledge is advancing is the link between oral health and general physical condition. UL dentistry professors have made substantial contributions to understanding this relationship.



Rehabilitation is yet another field where well-regarded work is being done by multidisciplinary research teams, demonstrating the remarkable potential when research professors collaborate to find solutions that are both valuable to individuals and highly effective from a societal perspective as well.

Université Laval is also a recognized leader throughout the francophone world in research on integrating spirituality into healthcare.

We live in a complex society where the organization of institutions is a key factor in promoting health and wellness, and where the university has a role to play in optimizing healthcare system management. UL professors are cognizant of the economic, logistical, legal, ethical, and management issues in healthcare, as well as of questions of fairness and access to care. Close to 800 UL professors and their research teams in ten different faculties are helping build a society where health and well-being are sustainable. The university works in partnership with close to 100 strategic investors and is a key member of Alliance santé Québec.

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AsQ (Alliance santé Québec) defines sustainable health as a state of complete physical, mental, and social well-being that is achieved and maintained throughout life through healthy, rewarding, and fulfilling living for all and through access to appropriate, high-quality resources used responsibly and effectively.

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## STRATEGIC GOALS

Understand the connections between environment and human health

Make decisive progress in the treatment of physical and mental disease

Leverage the positive impact of nutrition research and improve food security

Contribute to the smooth and efficient functioning of the healthcare system

Develop innovative strategies for disease prevention and health promotion

Harness the power of science and technology to improve health at every phase of life

Develop healthcare approaches centered on individuals and their well-being

## Alliance santé Québec (AsQ) is a concrete expression of Université Laval's vision and institutional strategy for sustainable health.

A UL initiative, AsQ grew out of the desire of key actors in the Québec City area to pool their expertise, resources, creativity, and innovation capacity to tackle the major healthcare and social services challenges we are facing in Québec and internationally.

AsQ's mission is to maximize positive spinoffs from research and innovation on individual and population health and wellness, the healthcare and social service ecosystem, and economic development.

By turning its attention to sustainable health, AsQ is laying the groundwork for bold and original collaborations between healthcare researchers and innovators and those who apply their research. Collaborations are multidisciplinary and based on a holistic vision of health that involves ongoing dialogue with the public. AsQ approaches health and social service issues from a social health perspective, as well as from the standpoint of ethics and responsible and effective use of resources—a perfect fit with Université Laval's focus on interdisciplinarity and sustainable development.

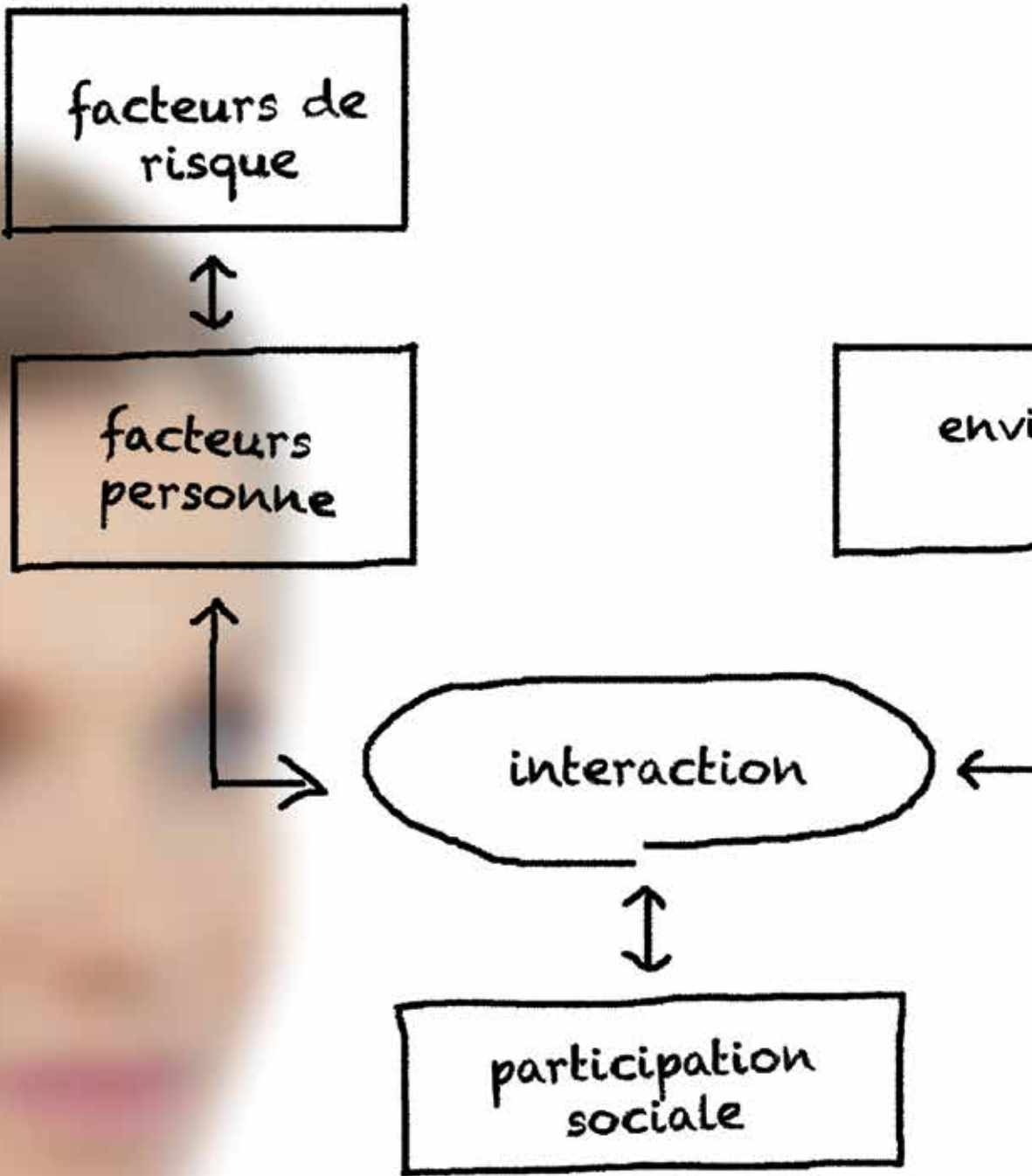
AsQ plans include a longitudinal cohort study of the health of individuals within their ecosystems examining multiple factors associated with health, including personal habits and living conditions. This major study will bridge the gap between fundamental, clinical, population and healthcare system-focused research. It will draw on the ability of individuals to take preventive action with respect to their health in order to significantly reduce the risks and cost associated with chronic diseases. Its findings will serve to accelerate changes in healthcare practices and services to boost healthcare system performance and improve the care pathway.

AsQ founding members, including Université Laval and ten UL faculties, are leveraging both regional assets and international collaborations to cement the Québec City area's reputation as a welcoming and fertile environment for research and innovation in health and social services.

The main sustainable health objectives are the following:

- > Accelerate the transfer of research findings
- > Raise Université Laval's profile  
(in conjunction with *Horizon 2017*)
- > Diversify funding sources
- > Multiply international collaborations  
(in conjunction with *Horizon 2017*)
- > Strengthen interdisciplinary ties









# Explain how humans develop in their environment

How humans develop in their environment is a particularly complex research area, one where a multidisciplinary perspective is required to develop a more accurate and nuanced understanding. This research focus studies the experience of individuals in fast-changing societies where the institutions that have traditionally anchored life—family, work, education—are no longer stable. As social and environmental change accelerates, research into new and changing phenomena is needed to develop solutions tailored to the present and future. Research professors are working in this direction with studies of human development from childhood through adulthood, in both formal and informal educational settings, that consider how the family environment, social and occupational conditions, and demographic and climate change impact key societal institutions. Work in a similar vein is being done on educational innovations.

## EXPLAIN HOW HUMANS DEVELOP IN THEIR ENVIRONMENT

Université Laval boasts teams of top-notch professors that are also doing important research on relationships between individuals or groups of individuals and society as a whole. Their interests range from rights and freedoms, social responsibility, labour relations, and equity between social classes, generations, regions and communities, to topical concerns like access to life-long education and social and professional integration. Others investigate sensitive social issues like violence against women, bullying and abuse, social maladjustment and exclusion, and delinquency and criminality. Université Laval professors have also made noteworthy contributions in the study of men and masculinity.

Certain UL faculty members are conducting important research into the economic dimensions of individuals in their environment. Others are studying the challenge of demographic change and its massive social and economic impacts in a number of spheres. Work is being done to examine the challenge of creating public space for citizens in various cultural, economic, and environmental contexts and on various scales—from buildings to cities to larger geographic entities—a process that can transform both urban and rural landscapes, with repercussions on services and citizen participation.

The work of 410 UL professors from six different faculties demonstrates that the study of how humans develop in their environment is thriving. Université Laval is and should remain a driver of new understanding in this vital field.



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## STRATEGIC GOALS

Better understand the individual  
and support eco-friendly human  
development

Shed light on the multiple individual,  
social, and occupational facets  
of human life paths

Comprehend the economic dimension  
of human development

Meet the challenge of community-building  
in a context of demographic  
and climate change

Optimize educational approaches  
to create the schools of tomorrow

The Center for Interdisciplinary Research in Rehabilitation and Social Integration (CIRRIIS) is a concrete example of Université Laval's strategy and vision for studying how humans develop in their environment.

With a mission to support social inclusion, and research spanning such varied disciplines as anthropology, engineering, sociology, kinesiology, geomatics, psychology, architecture, and physiotherapy, CIRRIIS is effectively tackling the challenge of human integration in their environment.

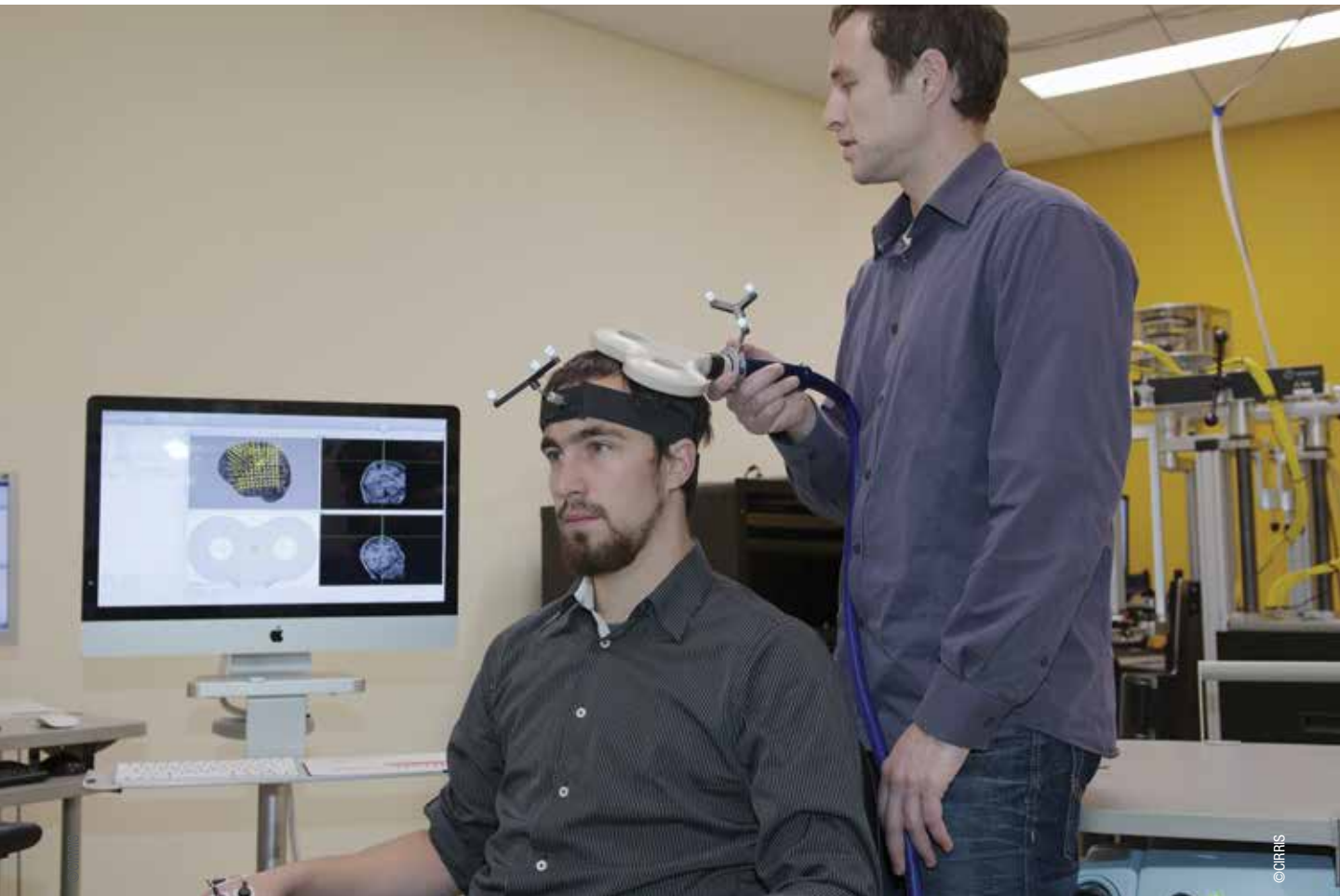
The Center's nearly 50 internationally recognized research professors and clinical researchers, working in 15 state-of-the-art laboratories, are contributing to the development and dissemination of knowledge in habilitation and rehabilitation with research on the determinants of social participation, both personal (impairments and disabilities) and environmental (obstacles and facilitators). CIRRIIS work is organized around a hierarchy of knowledge approach that covers everything from understanding mechanisms and specific needs in habilitation and rehabilitation to developing and testing assessment and intervention tools and applied technologies. This innovation cycle would not be complete without field assessments of practices, programs, and policies for integrating children, adolescents, and adults into their communities.

Multidisciplinarity is par for the course at CIRRIIS, a natural response to the complexity of the issues it studies. Rehabilitation engineering, for example, is an approach used to develop practical solutions to complex issues by bringing together researchers from various disciplines to work on finding technological support solutions for today and tomorrow. Drawing on robotics and neurophysiology, work in this pioneering field seeks to design a next generation of prosthetics, robotic limbs, and functional exoskeletons. This transdisciplinary approach situated at the frontier of scientific knowledge and new technology is driving the creation of partnerships with the private sector.

CIRRIIS researchers understand that new knowledge can bridge the gap between the research and clinical environments, but acknowledge that effective solutions to habilitation and rehabilitation issues must not only be based on sound data and best practices but also applicable in a real-world clinical and community settings. For this reason CIRRIIS has built strong ties with a range of clinical and community partners to promote the dissemination of its members' knowledge and expertise.

In this research focus area, the development of the people in their environment, the main objectives are:

- > Boost graduate student enrollment
- > Consolidate teaching faculty critical mass
- > Raise Université Laval's profile







# Understand societies, their cultures, and their arts

Since it was founded in 1852, Université Laval—the oldest French-language university in North America—has earned a reputation for excellence through its contribution to culture and the arts and the innovative research produced by its professors, both individually and collectively, at leading research institutes and centers. As language is central to culture, and Québec is the only French-speaking society in North America, Université Laval has a responsibility to focus on the study of both the facts and symbolic productions of the language that has helped shape and define Québec's identity and way of being.

## UNDERSTAND SOCIETIES, THEIR CULTURES, AND THEIR ARTS

Many UL professors are renowned for their expertise in creation and research-creation. They enjoy access to state-of-the-art platforms to consolidate, develop, and disseminate knowledge in their respective fields. Other faculty members, through their membership in large national and international networks, have built a reputation based on new approaches to heritage studies and archival science and their contributions to society. UL professors are also active in using new theoretical tools to explore ancient and modern philosophy and the world's major religions.

Faculty members are renowned for their work on living labs, which bring together various actors sharing different strategic perspectives on a given subject, and on mobility as an art form.

Some are also members of well-known research centers on the history of Québec society and literature.

Every society owes it to itself to support research in the arts and culture, the foundation of all civilizations and touchstones guiding contemporary societies as they face new challenges to the health and vitality of democracy.

220 UL professors and their teams, drawn from eight faculties, are working in this field and will continue to play a critical role analyzing and interpreting societies and their arts and cultures.





Many UL professors are renowned for their expertise in creation and research-creation.

## STRATEGIC GOALS

Develop research at the interface of culture and digital technology

Analyze the facts and symbolic productions of language

Expand the study of Québec and other francophone cultures, in historical and contemporary contexts

Stimulate creative endeavours in the university setting and continue to develop research-creation

Study the various dimensions of history and heritage from new methodological perspectives

Consolidate the integration of artistic disciplines within knowledge ecosystems

Continue to develop new forms of socially relevant expression

The Observatoire interdisciplinaire de création et de recherche en musique (OICRM) is an eloquent example of Université Laval's vision and strategy for understanding societies, their cultures, and their arts.

Since 2010 OICRM, with members from Université Laval and Université de Montréal, has been recognized as a strategic cluster by Fonds de recherche du Québec–Société et culture (FRQSC). The Observatory has an interdisciplinary research approach with contributions from researchers, artist-researchers, and artists. Members have expertise in such varied fields as teaching (music education and instrumental teaching), creation (performance, music technology, composition), and musicology (music history and theory; Canadian, Québec and Aboriginal music studies).

Researchers and artists have identified four priority areas: learning, including research into music education; doing, which targets projects that combine research and creation; understanding, comprising the study, description, and analysis of musical practice for the purpose of developing theoretical models; and interfacing, a space for members to explore music- and sound-based projects that cross artistic and disciplinary boundaries. OICRM programming is based on a clear definition of research/creation in which creation is both the subject and generator of research, and part of a self-aware, self-reflexive artistic process. Thanks to support from the Canada Foundation for Innovation (CFI), UL members of OICRM enjoy access to cutting-edge facilities including LaRFADI, a laboratory for ear training and instrumental teaching; MUS-Alpha, a library specializing in the impact of music education on cross-spectrum learning; and LARC, a digital audio research and creation laboratory. LARC's impressive sound quality and state-of-the-art analog and digital equipment has attracted the interest of many partners and contributes to Université Laval's national and international reputation.

In the study of societies, arts, and culture, the main research objectives are the following:

- > Increase intensity of research-creation
- > Set up living labs
- > Develop partnerships (in conjunction with *Horizon 2017*)
- > Maintain leadership in the francophone sphere
- > Build critical mass







# Model intelligent communities, invent their technologies and logistics

The society of the future poses a major challenge that inspires professors from every field to join forces and share their visions and discoveries. Intelligent communities demand multidimensional approaches to research and innovation projects that address multiple issues in technology, art, architecture, education, governance, citizens' rights, safety for seniors, food production, transport of people and goods, logistics, societal organization, and communications.

Intelligent communities represent a new kind of development designed to meet the economic, social, and environmental needs of institutions, businesses, and citizens. Investing wisely in skills and infrastructure foster sustainable development coupled with high quality of life, and promotes participatory governance. Development along these lines is an emerging global trend widely considered to be the way of the future.

Developing intelligent communities means harnessing the power of fast-changing technologies. Top-flight UL researchers are working on innovative materials such as biomaterials, nanoparticles, low carbon footprint materials, cellulose-based composites, and materials and processes for the aeronautical and ground transportation industries. Outstanding work is being done in areas like electroactive and photoactive polymers. The university is also an international leader in optics and photonics, home to a Canada Excellence Chair and a critical mass of highly productive research professors. Optics-photonics has applications in communications (virtual communities and electronic media), healthcare (medical imaging

## Université Laval has top-notch professors ready to meet the social challenges of the digital world.

and neurophotonics), and astronomy (research into exoplanets), as well as the environment and agriculture.

UL professors are also doing outstanding work to develop innovative instrumentation and robotics technology used in industrial applications (non-destructive testing, hydraulic equipment) and theoretical research (astrophysics). Other research teams are hard at work developing next-generation IT through their work in organic computing.

The university is also home to specialists in areas important to intelligent communities, including processing, managing, and analyzing big data; developing mathematical, analytical, and computing tools; and modelling and simulation. All these fields are critical to understanding complex systems and realities such as climate or demographic change, and essential in artificial intelligence, artificial vision, and augmented reality. Université Laval brings together leaders in these technical fields with their peers working in urban studies.



The university is also well positioned to meet the social challenges of the digital shift in spheres such as the arts, health care and education. Leading-edge research teams are striving to promote better integration of information and communication technologies (ICT) in schools, while others study the legal implications and application challenges of digital trust.

With 525 professors working with teams in ten faculties, Université Laval will maintain its status as a leading player in building the society of tomorrow.

## STRATEGIC GOALS

Explore social, cultural, economic, and digital challenges

Understand social issues in communication

Produce a new generation of innovative materials

Accelerate the technological revolution, notably in the field of intelligent systems

Make significant breakthroughs in data processing, management, and analysis

Make major advances in modeling and simulation

Develop the intelligent machines and systems of tomorrow

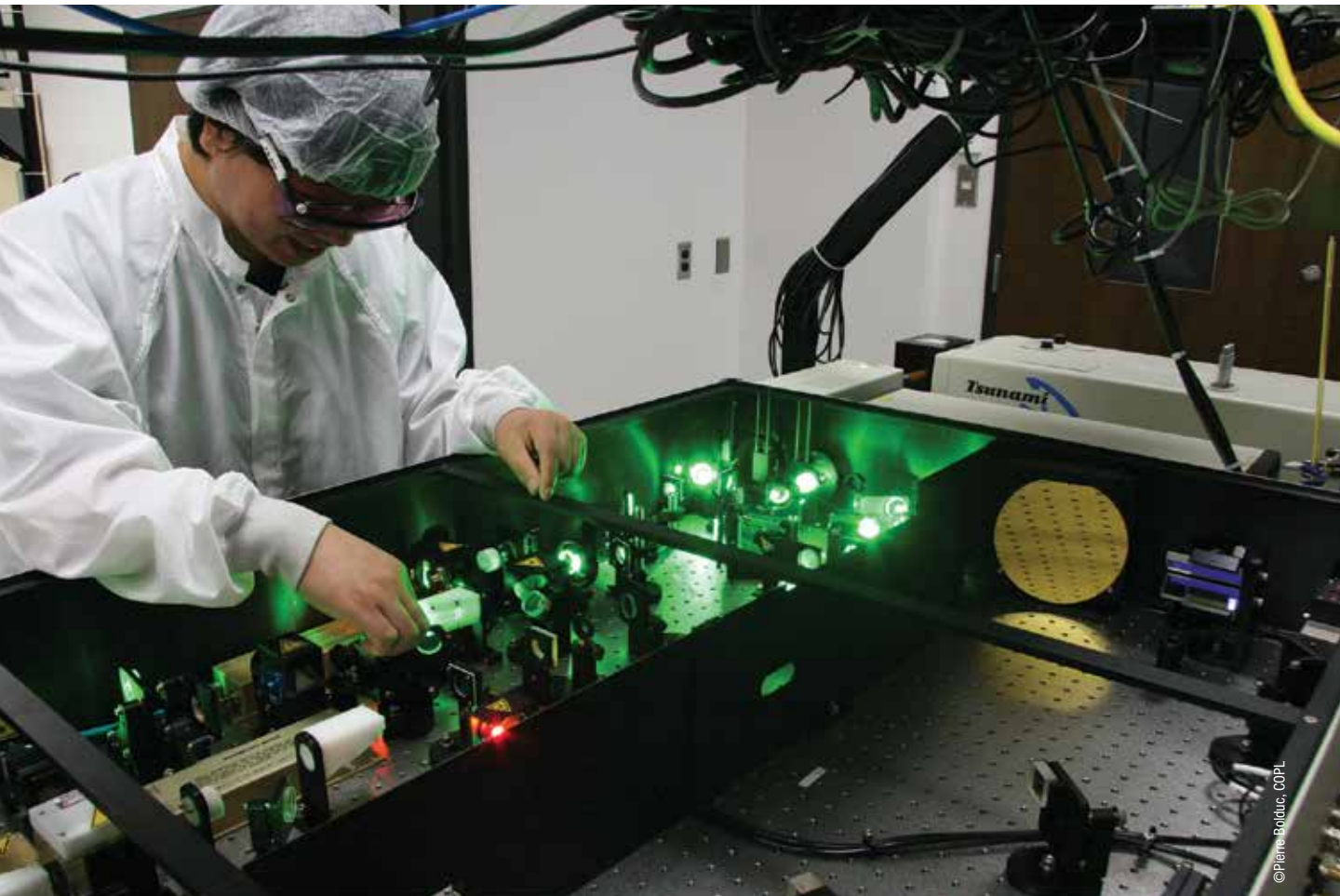
The Center for Optics, Photonics and Lasers (COPL) shows what's possible when Université Laval's vision and strategy are applied to the technological and logistical challenges of intelligent communities.

COPL is a recognized Canadian leader in optics and photonics research and a key reason behind the Québec City area's high concentration of enterprises in this important field. COPL research showcases UL professors' impressive ability to work together with experts from all different fields and backgrounds to advance our understanding of light-related phenomena and develop a growing number of applications. For example, COPL researchers are working with biologists and microbiologists to understand the basic mechanisms that determine the spatio-angular self-organization of biological molecules, advancing our understanding of phenomena that can improve liquid crystal alignment control techniques. One application being developed with health researchers on the basis of their discoveries is non-destructive testing for studying inaccessible organs like the brain or gut microbiota; another is miniature lenses. These new insights into the organization of biological structures are also being applied to develop new types of optical fibers that will enhance telecommunications. COPL is a model of how combined skillsets and industry partnerships can be used to develop new technologies and materials that will shape the communities of tomorrow.



The objectives in the intelligent communities research focus area are as follows:

- > Accelerate knowledge transfer to users
- > Consolidate teaching faculty critical mass
- > Diversify funding sources
- > Increase international partnerships  
(in conjunction with *Horizon 2017*)







# Manage and develop natural resources in a responsible manner

The Industrial Revolution sparked massive economic growth, but also put tremendous pressure on the earth's natural resources, many of which are non-renewable. To counter this trend, more research-based approaches are needed to inform sustainable natural resource use and management.

## MANAGE AND DEVELOP NATURAL RESOURCES IN A RESPONSIBLE MANNER

Université Laval professors are leading the way in their respective fields, with fresh ideas on how to responsibly manage and develop natural resources. Successful research teams are studying a range of ecosystems to better understand their genomics and biodiversity, and gauge the impacts of ocean biogeochemistry on living organisms, and of global changes on managed or natural environments, including peatlands.

The legal aspects of natural resource exploitation are another area where respected UL professors are doing important work.

UL faculty researchers are making significant contributions in many areas: land use planning, agroforestry and crop protection, aquatic resource and water conservation, eco-efficient agriculture, mine site remediation, peatland rehabilitation, forest management, wood products, and green building. Work on the characterization and commercialization of new bioactive compounds has also met with international acclaim.

The high-level expertise of UL professors is leading to advancements in integrated and comprehensive resource management, with work on production and manufacturing processes, energy consumption, logistics, and new environmentally responsible business models. Other noteworthy research is examining green processes and biofuels, energy efficiency, and eco-friendly and alternative energy production.

Researchers at Université Laval are collaborating to find new ways to reduce natural and human-made hazards, enhancing ecosystem conservation and rehabilitation efforts.

In total, 420 professors and their teams from six faculties are doing important work to ensure Université Laval remains at the forefront of responsible natural resource management.



The high-level expertise of UL professors is leading to advancements in integrated and comprehensive resource management through the development of environmentally responsible processes, products, and modes of production.

## STRATEGIC GOALS

Enhance our understanding of the living world and the changes that affect it

Develop sustainable natural resource management approaches

Develop environmentally responsible processes, products, and methods to better produce and consume energy

Reduce natural and human-made hazards and enhance ecosystem conservation and rehabilitation

Propose sustainable resource development strategies

The Alliance Université de Bordeaux–Université Laval (ABL) is a compelling example of the UL vision and strategy applied to responsible natural resource use and management.

For over 30 years now ABL has been a model of international collaboration between universities, with a focus on research into natural resource use and sustainable development.

As part of this strategic partnership, various networks have been created, including Institution de nutrition Aquitaine Québec (nutrition), Réseau scientifique Aquitaine Québec Forêt-bois (forestry and wood science), and Réseau scientifique Aquitaine-Québec sur l'eau (water science). In 2014 a new network was born, Réseau scientifique Aquitaine Québec en optique et photonique (optics-photonics), with a third partner, INRS. Other initiatives are under development in various fields including health.

Scientific networks foster the sharing of expertise and provide a framework for collaboration on training, research, and knowledge transfer between faculty members and research teams at the two institutions.

In 2014 ABL received an honourable mention in the “International Achievement” category at the 29th edition of the Prix d'excellence de l'administration publique du Québec (Québec public administration achievement awards).

In the natural resources focus area, the main objectives are the following:

- > Consolidate interdisciplinarity
- > Develop partnerships  
(in conjunction with *Horizon 2017*)
- > Boost international leadership  
(in conjunction with *Horizon 2017*)









# Consolidate and develop northern sustainability

The complex challenges of northern sustainability can only be tackled when professors from wide-ranging disciplines work together with community partners. These challenges encompass everything from remote sensing, autonomous marine monitoring, and the development of materials and technologies adapted for northern infrastructure to questions of public policy, culture, health, and indigenous rights, all of which are informed by the central issue of climate change and its impact on the northern economy, community life, and flora and fauna.

## CONSOLIDATE AND DEVELOP NORTHERN SUSTAINABILITY

The North has acquired renewed strategic importance in recent decades, in no small part due to the vast economic potential of its subsurface resources. Responsible development of these resources, especially in marine environments, poses significant technical challenges due to the environmental risks involved. Climate change, already much more evident in the North, will have sweeping repercussions. As northern residents' lives change rapidly, much work will be required to manage growth, particularly in critical areas like the economy, education, housing, and health.

### **In June, 2012, Université Laval committed to the following objectives:**

- > Leverage its research strengths and those of its partners to meet northern development challenges
- > Develop and enrich knowledge by conducting research projects in a manner respectful of northern community needs, cultures, and ways of life
- > Transfer knowledge and technology to better equip current and future generations to address the challenges of the North
- > Foster multidisciplinary research to better deal with the complexity of sustainable northern development



For over half a century UL professors have been doing outstanding oceanography research on such topics as phytoplankton, marine and continental ecosystems, and northern human geography. UL faculty are also doing important work to develop effective strategies to adapt to climate change and environmental risks, including studies on northern and Arctic flora, thawing permafrost, and assessing the risks and impacts of contaminants released into the northern ecosystem.

The flagship of Université Laval's northern research endeavours is the Amundsen icebreaker, a veritable floating laboratory. The ship, the only one of its kind in Canada, helps UL professors and researchers remain at the forefront of Arctic Ocean research.

Université Laval research teams are prominent in fields as diverse as glaciology, the study of carbon flow, soil characterization, safe environmental rehabilitation, environmental law, and the sociology of indigenous peoples.

With 140 professors and teams drawn from nine faculties, Université Laval will continue to lead the way nationally and internationally in research fields related to northern sustainability.

## STRATEGIC GOALS

Refine our understanding of northern ecosystems and human geography

Develop effective strategies for adapting to climate change and reducing environmental risks

Comprehend the technological and economic aspects of northern development

Clarify the human and social challenges related to northern development

Facilitate access to the North

Based at Université Laval, Institut nordique de Québec (INQ) is an outstanding example of the university's vision and strategy at work to promote sustainable northern development.

For over 50 years Université Laval has been developing unique, wide-ranging expertise in northern science, as reflected in research into economic, social, and environmental issues facing the North. Today the university is a world leader in northern research. At a time when the sustainable development of the North is imminent, yet many unique challenges persist, scientific engagement with the North is of vital importance. Université Laval is building on its longstanding leadership in this area and has partnered with two other renowned Québec research institutions, McGill University and INRS, to create Institut nordique du Québec (INQ).

By bringing key partners like Québec universities and northern communities to the table, INQ will combine the strengths of traditional knowledge, scientific knowledge, and technological know-how to provide northern residents and decision makers with the expertise needed to ensure the North is developed in an ethical, harmonious manner. Bringing together top experts, this partnership reaches beyond the walls of academia while at the same time reasserting Québec's international role as a driving force in scientific research. Both today's northern residents and future generations stand to benefit greatly from INQ work to develop and disseminate new knowledge.

Bringing Québec centers of excellence together under the ArcticNet umbrella has had a spectacular impact on northern research in Québec. One important benefit is the shared use of the *Amundsen*, a Canadian research icebreaker that has breathed new life into Canadian Arctic research and propelled Québec to the forefront of polar science. On the strength of ArcticNet, Université Laval secured the Canada Excellence Research Chair in Remote Sensing of Canada's New Arctic Frontier, and welcomed the Takuvik joint UL/CNRS laboratory program (a partnership with the French Centre National de la Recherche Scientifique), established at Université Laval in 2010. In 2011 Québec ArcticNet researchers were awarded an NSERC Discovery Frontiers ADAPT grant (Arctic Development and Adaptation to Permafrost in Transition).

To achieve its goal of fostering sustainable Northern development, Université Laval's main objectives are the following:

- > Raise Université Laval's profile  
(in conjunction with *Horizon 2017*)
- > Promote new research areas
- > Develop top-level partnerships  
(in conjunction with *Horizon 2017*)







# Engage actively in ethics, sound governance, and social organization

Sustainable health, sustainable northern development, intelligent communities, sustainable resource management, culture and creation, development of humans in their environment: in each of these spheres UL professors are leveraging their expertise in the name of social progress and working to achieve greater collective wellbeing. And each of these areas of endeavour shares the need for good governance—which is inseparable from ethics—and for forms of social organization respectful of both individuals and communities. One of the great challenges facing us, both today and in the future, is how to live together in societies shaped by immigration where the plurality of values challenges social cohesion.

## ENGAGE ACTIVELY IN ETHICS, SOUND GOVERNANCE, AND SOCIAL ORGANIZATION

Ethics, a normative branch of philosophy that addresses real-world problems, is in a period of flux. Université Laval professors are doing valuable ethics research to elucidate contemporary ethical issues in areas ranging from political philosophy and economics to agrifood, and health.

Renowned UL professors are working to define the foundations of good governance by studying the functioning of private, public, and community organizations, corporate governance and, more broadly, issues related to entrepreneurship and takeover entrepreneurship. New light is being shed on emerging issues in finance and accounting, such as environmental accounting, and human resources management in its broadest sense.

With international trade growing at every level, international relations are a paramount concern. Université Laval is home to leading professors in the field, particularly in the fields of political economy and sustainable development.

Many UL research groups, centers, and chairs take an interest in sustainable development issues: no less than 48% of UL research chairs are concerned with an aspect of sustainable development.

Researchers are examining the importance of citizen participation in democratic life by studying parliamentary institutions and how they respond to public opinion. In doing so, they develop management and participatory governance models and are also looking at the emerging role citizen science has come to play.

The research of 175 professors and their teams from eight different faculties demonstrates the strength of Université Laval's commitment to the study of ethics, good governance, human resources management, and social organization.



Nadia Mohammed Azizi completed a final internship for her MA in International Studies with SOCODEVI in Guatemala (2009)



UL researchers are examining the importance of citizen participation in democratic life by studying parliamentary institutions and how they respond to public opinion.

## STRATEGIC AREAS

Elucidate contemporary ethical issues

Analyze in greater depth the foundations of governance, including risk management and entrepreneurship

Promote citizen participation in democratic life

Envision ways of living together harmoniously in societies shaped by immigration

Integrate an international dimension into the study of social organization

## The Institute for Advanced International Studies (HEI) exemplifies Université Laval's vision and strategy applied to the study of ethics, good governance, and social organization.

Université Laval has always been at the forefront in international studies. In 1970, faculty members from various disciplines founded the Centre québécois des relations internationales (CQRI) and launched *Études internationales*, a scholarly journal. In 1987 Université Laval introduced the first French-language interdisciplinary master's degree program in Canada. And in 1994 new ground was broken when teaching and research programs were grouped together within the Institute for Advanced International Studies.

Since its foundation as a graduate teaching and research institute, HEI has grown steadily. Its mission is to contribute to the advancement of knowledge on international affairs through an interdisciplinary approach and to help train experts who can understand, debate, and effect change on the major issues facing the world.

Interdisciplinarity is woven into the very DNA of the students and scholars who call HEI home. The interdisciplinary approach adds value to HEI's work, and is the only way to achieve a nuanced understanding of international phenomena. Researchers study thinking about borders in an ongoing quest to reach beyond them in the name of social progress. This interdisciplinary approach is not only valuable in itself, it also pushes the boundaries of the disciplinary logic that has long structured academic life. This is why HEI is constantly interrogating and promoting its interdisciplinary approach and seeking out new and optimal practices in its field.

HEI master's and PhD students follow a rigorous program of study that includes a strong foundation in law, economics, management and political science, supplemented by work in areas such as geography, history and sociology. Research groups bring together researchers happy to put their expertise to work to develop an understanding of major international issues. Most of HEI's over 60 members are UL professors. There are nine research groups affiliated with HEI, including three Canada Research Chairs established in partnership with university faculties. Their areas of expertise include international security, terrorism, trade, environmental issues, sustainable development, the Americas, Europe, Asia, Africa, and North Africa. HEI also publishes *Études internationales*, an academic journal, and organizes some fifty scientific events annually.

HEI researchers are making meaningful contributions to knowledge on global security, environmental, economic, humanitarian, and cross-disciplinary issues. *Études internationales* is a French-language voice for international affairs research heard all around the world. And the summer schools organized by the HEI are open to the public, offering interested people a crash course in many of the most pressing issues of the day.

In the areas of ethics, good governance, and social organization, the main objectives are as follows:

- > Raise Université Laval's profile  
(in conjunction with *Horizon 2017*)
- > Diversify funding
- > Increase knowledge transfer to potential users  
of research findings



## Priority 2

# Build research capacity and support research dissemination

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Université Laval has chosen four focus areas based on institutional excellence, productive partnerships, top-notch programs, and leading-edge innovation.

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A range of communication tools is used to share the success stories, achievements, and exceptional commitment of UL professors, professionals, and students, acknowledging the quality of UL research, knowledge transfer, and partnerships, and raising the university's profile at home and around the world.

### **SUPPORT AND PROMOTE EXCELLENCE IN RESEARCH AND INNOVATION**

Université Laval boasts top level faculty and research professionals, and students who are truly world-class. The university's research excellence rests squarely on the shoulders of its people.

As one of Canada's top-ranked research universities, Université Laval is a focal point for development. Beyond the normative approach of major grant agencies, the institution works proactively to help develop a renewed culture of research integrity for the 21st century in keeping with its values and its focus on good governance and sustainable development.

Université Laval's deep roots in the community, along with the humanist values and ethics that inform its mission, have earned the enduring trust of area residents. This trust is what inspires so many local people to volunteer for the research projects that contribute to the university's reputation. And Université Laval plans to uphold this trust by effectively supporting professors in their reflections on the issues surrounding the use of human subjects in research.

*Knowledge is not an ivory tower. How can we change the conditions to make it a shared heritage?"*

*Fernand Dumont*

Université Laval recognizes and will continue to support the centers of excellence that underpin research performance:

- > Research centers: UL faculty and interfaculty research centers are recognized by the University Council for research excellence and the wealth of support they provide students and postdoctoral fellows, from scientific activities to access to leading experts.
- > Canada Excellence Research Chairs and Canada Research Chairs: Held by world-leading professors, these prestigious appointments bring high-profile research to Université Laval and help the institution attract the best and brightest professors, students, and postdocs.
- > Institutes: With a focus on societal priorities, institutes bring together leading specialists committed to meeting specific knowledge transfer and training needs in an environment optimized for dialogue and the synthesis of knowledge.
- > Health research centers: By bringing together top UL faculty with specialists from affiliated institutions in research areas like cancer, infectious diseases, neuroscience, and frontline care and services, health research centers enrich expertise within the healthcare system and health sciences with contributions from the natural sciences, engineering, humanities, and social sciences.
- > Research Partnership Chairs: Designed to boost capacity in research areas that address societal, cultural, economic, and technological concerns shared with public- or private-sector partners, these chairs facilitate graduate student training in the areas where their skills are needed most.
- > Networks of Centres of Excellence: These networks mobilize multi-disciplinary research capacity from across Canada in concert with industry and government to develop the next generation of highly qualified personnel and facilitate knowledge transfer.
- > International mixed units, affiliated laboratories, consortia, and research groups: These research group models facilitate international collaboration with academic and private-sector partners and spawn outstanding new research in many fields, including those targeted by Canada Excellence Research Chairs.

UL professors and their research teams are also encouraged to do their part in addressing major societal challenges by adding to the university's collective knowledge base and contributing to knowledge dissemination.

The university has already identified emerging research areas such as big data management, digital creation, and food security; more will be added in the future. Working directly with UL faculties and academic staff, the university will adopt a flexible, nimble strategy to swiftly grasp opportunities using all available resources including recruitment, new interfaculty research centers, partnerships, and supplemental funding.

Université Laval believes it is crucial to show strong support for new professors during their first years on faculty, when they must develop research interests, build a publication record, and secure funding from various grant agencies.

Major research platforms and infrastructure are indispensable to strengthen and further develop research in all fields. This means they must be properly funded, well-governed, sustainable, and used to maximum effect.

The Office of the Vice-Rector, Research and Innovation, as well as individual faculties, will strengthen their joint strategy to support access to core and strategic funding through internal competitions, matching funds, grant application assistance, and external support as needed. Professors will also be supported and encouraged to take part in peer-review processes of provincial, national, and international funding bodies. Such activities provide valuable insight on the latest developments in research areas and a forum for professors to contribute their experience and expertise.

The Université Laval research commission is responsible for assessing the university's research centers, and, at the request of university administration, any matter related to research coordination and development. The commission will continue in its advisory role and help promote a constantly updated vision of research development.

The Vice-Rector, Research and Innovation will continue working to recognize research excellence and the outstanding contributions of UL professors to scientific and social progress locally, nationally, and internationally.

To support and promote excellence in research and innovation, Université Laval will make the necessary efforts to achieve the following objectives:

- > Develop tools to support ethical decision-making and responsible research conduct
- > Support new researchers through improved application assistance tools (in conjunction with *Horizon 2017*), ongoing mentoring (in conjunction with *Horizon 2017*), and the creation of a UL fund to help raise seed money for startups (in conjunction with *Horizon 2017*)
- > Support centers of excellence and emerging research areas through recurring funding and one-time grants
- > Promote the creation of Canada Research Chairs and Canada Excellence Research Chairs (in conjunction with *Horizon 2017*)
- > Support access to core and strategic funding by providing quality advisory services and access to strategic advisors during application processes
- > Promote interdisciplinarity and support professors' involvement in communities of interest by organizing community-building forums around scientific and societal challenges
- > Develop research facilities and support facility governance
- > Promote the optimization and pooling of expertise and research and innovation infrastructure (in conjunction with *Horizon 2017*)
- > Improve tools for assessing research and innovation strengths (in conjunction with *Horizon 2017*)
- > Raise the profile of faculty members and share success stories (in conjunction with *Horizon 2017*)

## **STIMULATE AND PROMOTE REGIONAL, NATIONAL, AND INTERNATIONAL PARTNERSHIPS AND COLLABORATIONS**

Today partnerships of various kinds are an essential component of research. Université Laval has 500 current formal partnership agreements, and is constantly developing new ones. Plans call for maintaining these joint ventures while developing further agreements of the same type with institutions in Québec, Canada, and beyond. University administration, in collaboration with UL faculties, also plans to increase the number of Research Partnership Chairs (with public- and private-sector partners), and help create new consortia and inter-institutional research groups.

To further enhance research and innovation performance in the Québec City area, Université Laval and its partners founded Alliance santé Québec (AsQ), an alliance that brings together all regional actors in the health and social services community to help create environments conducive to research and innovation. Over the next five years, the university would like to build on this experience and extend this to other priority sectors. Harnessing the power of stakeholder collaboration in a given field is a promising path forward.

To stimulate and promote regional, national and international collaborations, Université Laval will make every effort to achieve the following objectives:

- > Foster international research collaborations (in conjunction with Horizon 2017)
- > Promote the creation of new Research Partnership Chairs (in conjunction with *Horizon 2017*)
- > Foster the creation of new consortia and inter-institutional research groups
- > Create, jointly with Fondation de l'Université Laval, a startup fund for new research and innovation initiatives that tackle emerging social issues (in conjunction with *Horizon 2017*)
- > Showcase faculty participation in major international research networks (in conjunction with *Horizon 2017*)



## **ENCOURAGE RESEARCH THROUGH AND FOR TRAINING, AND PROMOTE THE ACHIEVEMENTS OF STUDENTS AND POST-DOCTORAL FELLOWS**

Université Laval is a popular choice for graduate students, as demonstrated by the over 4,000 students enrolled in graduate research programs. Students enjoy an exceptional level of supervision and access to top-notch expertise thanks to the presence of professors, research groups, renowned research centers, and exciting scientific activities and events. By supporting faculty and research groups, the university also ensures students have access to stimulating internships in a range of settings. In a similar vein, the university also encourages professors and research groups to align their teaching and training with the requirements of the public and private sectors. The numbers show that this approach is working: employment rates for graduates of many programs is extremely high.

Université Laval will continue to support student funding through internal and external grants, and will also encourage faculty to promote international internship opportunities with their students so they can start developing their own networks.

Université Laval is convinced that concerted efforts to boost PhD enrollment will substantially impact research capacity on several levels, and thus encourages professors to supervise an optimal number of doctoral students, while ensuring their employability.

To encourage research through and for training, and promote the achievements of students, the university will make the necessary efforts to achieve the following objectives:

- > Encourage the adaptation of programs and training to public- and private-sector needs
- > Facilitate student funding through grants
- > Encourage student participation in research and innovation projects (in conjunction with *Horizon 2017*)
- > Promote access to private sector, public sector, and international internships
- > Showcase success stories and raise graduate students' profile

## ENCOURAGE AND PROMOTE INNOVATION

Innovation is a powerful force driving our society forward. Governments, organizations, and private companies all seek to boost efficiency, while public policy must evolve in response to rapid societal change. Decision makers in every sphere are increasingly looking for scientific evidence and expert opinion to guide them.

Université Laval believes we must prioritize effective use of technological, social, and cultural innovations; today we need more and higher-impact innovations and faster knowledge transfer. By acknowledging this priority the university has shown it is in step with the international trend toward closer ties between knowledge and innovation.

Successfully navigating the innovation chain doesn't just take new knowledge, but courage and determination too. In short, without an entrepreneurial spirit there can be no innovation. Université Laval understands the importance of entrepreneurship in an innovation society such as our own, as evidenced by the establishment of the Chair in Entrepreneurship and Innovation. Professors and students with an entrepreneurial bent have access to resources such as Entrepreneuriat Laval, an entrepreneur's association, and SOVAR, a UL-affiliated technology development and commercialization company. SOVAR identifies and helps develop innovative technologies and expertise derived from research with a view to facilitating the transfer of knowledge for use in utilitarian and commercial applications. SOVAR supports spin-off companies until they become independent, helping them secure financing from various public agencies.

To encourage and promote innovation the university will make the necessary efforts to achieve the following objectives:

- > Act as a catalyst for knowledge mobilization, transfer, and development
- > Work with regional organizations to promote scientific innovation, technology transfer, and the creation of value in our environment (in conjunction with *Horizon 2017*)
- > Enhance social innovation from knowledge transfer activities (in conjunction with *Horizon 2017*)

# Conclusion

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A central premise of knowledge societies is that “brains” are the key to the future. Governments of knowledge societies are already enlisting top scientists to advise them on important social, economic, cultural, political, technological, and scientific issues.

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As we have seen, the strategy set out in the 2015–2020 Research Development Plan is based on a number of factors: Université Laval’s research strengths, the creativity of faculty members and their ability to attract and train the best and brightest students, faculty willingness to collaborate and identify promising ways forward, and the research professionals who provide stability and make an essential, significant contribution to projects.

This five-year plan describes the winning conditions necessary for UL professors and research teams to make significant contributions to tackling the major challenges facing our society and our world. By drawing on their creativity, leadership, integrity, research excellence, and ability to build productive partnerships in the Québec City area, nationally, and internationally, and to mobilize around major social issues and innovate, Université Laval will be well-positioned to fulfil its role in society for the next five years and beyond.

Université Laval wishes to thank its partners, funding agencies, and research project participants who all contribute in many different ways to research development and knowledge transfer.

# Summary Table

## ORIENTATION 1: SOCIETAL CHALLENGES

STRATEGIC GOALS	
<b>SOCIETAL CHALLENGES</b>	<b>Create a society where health and well-being are sustainable</b> <ul style="list-style-type: none"> <li>– Make decisive progress in the treatment of physical and mental disease</li> <li>– Leverage the positive impact of nutrition research and improve food security</li> <li>– Contribute to the smooth and efficient functioning of the healthcare system</li> <li>– Develop innovative strategies for disease prevention and health promotion</li> <li>– Harness the power of science and technology to improve health at every phase of life</li> <li>– Develop healthcare approaches centered on individuals and their well-being</li> </ul>
	<b>Explain how humans develop in their environment</b> <ul style="list-style-type: none"> <li>– Better understand the individual and support eco-friendly human development</li> <li>– Shed light on the multiple individual, social, and occupational facets of human life paths</li> <li>– Comprehend the economic dimension of human development</li> <li>– Meet the challenge of community-building in a context of demographic and climate change</li> <li>– Optimize educational approaches to create the schools of tomorrow</li> </ul>
	<b>Understand societies, their cultures, and their arts</b> <ul style="list-style-type: none"> <li>– Develop research at the interface of culture and digital technology</li> <li>– Analyze the facts and symbolic productions of language</li> <li>– Expand the study of Québec and other francophone cultures, in historical and contemporary contexts</li> <li>– Stimulate creative endeavours in the university setting and continue to develop research-creation</li> <li>– Study the various dimensions of history and heritage from new methodological perspectives</li> <li>– Consolidate the integration of artistic disciplines within knowledge ecosystems</li> <li>– Continue to develop new forms of socially relevant expression</li> </ul>
	<b>Model intelligent communities, invent their technologies and logistics</b> <ul style="list-style-type: none"> <li>– Explore social, cultural, economic, and digital challenges</li> <li>– Understand social issues in communication</li> <li>– Produce a new generation of innovative materials</li> <li>– Accelerate the technological revolution, notably in the field of intelligent systems</li> <li>– Make significant breakthroughs in data processing, management, and analysis</li> <li>– Make major advances in modeling and simulation</li> <li>– Develop the intelligent machines and systems of tomorrow</li> </ul>
	<b>Manage and develop natural resources in a responsible manner</b> <ul style="list-style-type: none"> <li>– Enhance our understanding of the living world and the changes that affect it</li> <li>– Develop sustainable natural resource management approaches</li> <li>– Develop environmentally responsible processes, products, and methods to better produce and consume energy</li> <li>– Reduce natural and human-made hazards and enhance ecosystem conservation and rehabilitation</li> </ul>
	<b>Consolidate and develop northern sustainability</b> <ul style="list-style-type: none"> <li>– Refine our understanding of northern ecosystems and human geography</li> <li>– Develop effective strategies for adapting to climate change and reducing environmental risks</li> <li>– Comprehend the technological and economic aspects of northern development</li> <li>– Clarify the human and social challenges related to northern development</li> <li>– Facilitate access to the North</li> </ul>
	<b>Engage actively in ethics, sound governance, and social organization</b> <ul style="list-style-type: none"> <li>– Elucidate contemporary ethical issues</li> <li>– Analyze in greater depth the foundations of governance, including risk management and entrepreneurship</li> <li>– Promote citizen participation in democratic life</li> <li>– Envision ways of living together harmoniously in societies shaped by immigration</li> <li>– Integrate an international perspective in the study of social organization</li> </ul>

## **KEY STRATEGIC PERFORMANCE INDICATORS**

- > New faculty appointments
- > Number and types of research chairs
- > Number of research projects led or coordinated by UL faculty
- > Number of local, national and international partnership projects led or coordinated by UL faculty
- > Number of graduate students supervised
- > Student graduation rate
- > Student employment rate
- > Number of postdoctoral fellows
- > Number of research professionals
- > Total funding obtained from Université Laval
- > Strategic funding secured (Canadian Foundation for Innovation, strategic groups)
- > Number of published articles in the first percentile every year
- > Number of co-authored publications (lead author or contributor; locally, nationally, internationally)
- > Number of book publications and book chapters
- > Number of invitations to lecture
- > Commercialization: invention disclosures, number of patents, consultancy contracts, royalties
- > Social value: number of links with agencies and duration of relationship







Géomatique

Sciences infirmières

Matériaux et technologie innovants

Foresterie

Optique photonique

Projet Santé

# NOS CERVEAUX SONT HYPERACTIFS

Études nordiques et de l'Arctique

Nanotechnologies

Culture et création

Philosophie

Médecine

Droit

Aménagement

Ressources naturelles

Lettres

Sciences de la santé

Environnement et développement durable

Médecine dentaire

Communautés intelligentes

Pharmacie

Architecture

Sciences et génie

Sciences de l'agriculture et de l'alimentation

Théologie et sciences religieuses

Arts visuels

Sciences de l'éducation

Musique

Sciences de l'administration

Génomique et protéomique

Sciences sociales

Géographie

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