



UNIVERSITY OF  
**TORONTO**

# Excellence, Innovation, Leadership

The University of Toronto  
Strategic Research Plan  
2012 – 2017



**Published: October 21, 2011**

## U of T Research & Innovation: Quick Facts

### Research Activity (2009-10):

4,500 research faculty

\$924M research funding (all sources)

\$779M Canada Foundation for Innovation funding since inception

\$510M Ontario Ministry of Research and Innovation funding since inception

### Tri-Council Funding (2009-10):

\$167M in Canadian Institutes of Health Research funding

\$72M in Natural Sciences and Engineering Research Council funding

\$26M in Social Sciences and Humanities Research Council funding

**TOTAL: \$265M**

**14.9% share, first in Canada**

### Research Funds Awarded by Sector (2009-10):

36% federal granting councils

14% other federal

14% Government of Ontario

2% other government

6% corporations

3% international

18% not-for-profit

7% inter-institutional collaboration

### Graduate Students (2009-10):

12,845 full-time graduate students enrolled

1,777 part-time graduate students enrolled

64% published as sole or first author in a refereed journal<sup>1</sup>

65% co-authored in refereed journals with program faculty<sup>1</sup>

79% presented papers/posters at national scholarly meetings<sup>1</sup>

### Innovation (2006-2011):

196 commercialization projects initiated

156 licensing agreements executed

672 patent applications filed

116 patents issued

953 invention disclosures received (2006-2009)<sup>2</sup>

29 new spin-off companies (2006-2009)<sup>2</sup>

### Research Impact (2009-10):

**1<sup>st</sup> in publications and citations** in all fields in Canada.<sup>3</sup>

**2<sup>nd</sup> in publications and 3<sup>rd</sup> in citations** for all fields among all Association of American Universities (AAU).<sup>3</sup>

**3<sup>rd</sup> in world** for current article performance.<sup>4</sup>

**4<sup>th</sup> in rankings** of scientific papers for world universities.<sup>4</sup>

### Rankings:

**9<sup>th</sup> in the world** – 2011 HEEACT Performance Ranking of Scientific Papers for World Universities

**19<sup>th</sup> in the world** – 2011 Times Higher Education Supplement World Universities Survey

**23<sup>rd</sup> in the world** – 2011 QS World University Rankings

**26<sup>th</sup> in the world** – 2011 Shanghai Jiao Tong University Rankings

### Major International Honours:

2008 Kyoto Prize to Prof. Anthony Pawson

2008 Gruber Cosmology Prize to Prof. Richard Bond

2009 Holberg Prize to Prof. Ian Hacking

2010 Holberg Prize to Prof. Natalie Zemon Davis

2010 Bower Award and Prize for Achievement in Science to Prof. Richard Peltier

10 Nobel Prize winners have emerged from U of T since its founding.

### Provincial and National Honours:

2010 NSERC Herzberg Gold Medal to Prof. Geoffrey Hinton

9/10 of all Ontario Premier's Summit Awards (2007-10) have come from U of T

1/3 of all Premier's Discovery Award winners (2007-10) have come from U of T

309 U of T professors were inducted as Royal Society of Canada Fellows from 1980-2010, representing 20% of Fellows at all Canadian universities.

<sup>1</sup> 2010 CGPSS survey results for doctoral students.

<sup>2</sup> Published AUTM Survey FY 2008 and 2007. AUTM STATT data for FY2009. BioDiscovery Toronto 2010 Summary Report on 'AUTM Compatible' Indicators FY2009.

<sup>3</sup> University Science Indicators 2009 Standard and Deluxe Editions, Thomson Reuters.

<sup>4</sup> Higher Education Evaluation and Accreditation Council of Taiwan (HEEACT) 2010.

## 1. TWO CENTURIES OF RESEARCH IMPACT

For nearly two centuries, University of Toronto faculty, students, and staff have been extending the boundaries of knowledge and providing answers to some of the world's most important questions: How can we better promote health and cure disease? How do we help our diverse communities understand one another? How can we use emerging technologies to communicate, build things, and engage our fellow citizens in new and meaningful ways? How did we get here, and what is the nature of the physical universe? How does human activity affect the environment? What does it mean to be human, and can we build societies that advance dignity and justice for all?

Ten Nobel laureates have emerged from U of T, and our researchers are internationally recognized leaders for the ground-breaking contributions they make to their disciplines. Former leaders Banting and Best gave us life-saving medical advances while Frye and McLuhan showed the world why we must understand the past and value our cultures if we are to have a view to the future. U of T's current scholar-leaders continue to push the boundaries of fundamental knowledge, and they are pioneering student engagement in the generation of that knowledge. Our students, postdoctoral fellows, residents, and other trainees are among the best in the country, and they come here to be taught by the best. Given the depth, breadth, and diversity of our institution, opportunities abound for excellence in research, learning, scholarship, collaboration, and teaching, making U of T one of the world's foremost research-intensive universities.

Research at U of T has global impact. Our faculty author or co-author more articles than their colleagues at most other universities in North America. The achievements of our humanities scholars in the study of Languages, Literature, Visual and Performing Arts, Media and Communications, Philosophy, Classics, Religion, Culture, and History only underscores how central their work is to the framing of human consciousness and the evolution of ideas.<sup>5</sup> U of T consistently places alongside the top five U.S. universities whose scientific and technical discoveries are most often cited by other researchers, and we are among North America's leaders in new invention disclosures and the creation of new spin-off companies. The Toronto Academic Health Science Network (TAHSN), composed of the University of Toronto and its nine fully affiliated hospitals and their research institutes, is a leader in Canadian health care research, innovation, and delivery, and is one of the largest, most productive academic health science centers in the world. This creative scholarly activity across academic disciplines and professions contributes much to our society: it compels us to examine our belief systems, models, governance structures, and modes of production; it enables us to understand that what we do has meaning that is rooted in culture, beliefs, and value-systems; it advances our knowledge of the natural world; and it contributes directly to the economic and social good of Toronto, Ontario, and Canada.

In 2027, the University of Toronto will celebrate two hundred years of achievement in research and education. The University's institutional vision *Towards 2030* re-affirms that excellent disciplinary research will retain a central role within the University. Yet it also re-affirms the need to leverage those strengths to nurture successive generations of Canadian scholars, leaders, innovators, and citizens. This Strategic Research Plan will set the stage for how we do that over the next five years. While U of T remains an educational institution at heart, it is also our obligation as public stewards of knowledge to ensure that the scholarship we generate and maintain is made available to the broader community. At the local level, we are collaborating with community agencies, organizations, and municipal governments to work on the issues they face, and we are identifying experiential learning opportunities for our students to

---

<sup>5</sup> U of T ranked 10<sup>th</sup> overall in the Arts and Humanities in the 2011 Times Higher Education Supplement World University Survey.

become engaged in the communities within which they learn and live. At the provincial and national levels, we are seeking out opportunities for our scholarship to inform public policy debates that affect Ontarians and Canadians in every region of the country. Internationally, we are partnering with institutions that can help us extend our reach and identify who can benefit from the application and translation of the knowledge we produce in the global context.

## **2. MEETING TODAY’S GLOBAL CHALLENGES: U OF T’S STRATEGY FOR EXCELLENCE, LEADERSHIP, INNOVATION**

### **2.1 Disciplinary Excellence and Strategic Leadership**

As at any university, much of the scholarship at U of T is undertaken by individual academics working in their disciplinary areas of interest or within department or Faculty-based groups. U of T will always be committed to supporting disciplinary excellence wherever it is to be found on our three campuses, but building a successful research strategy for the future depends on understanding what is happening, and what we think will happen, within the wider research landscape. With the technology and resources available to us today, scholarship is increasingly more collaborative, interactive, and dynamic. The complexity of today’s research problems also demands that we move beyond the confines of our own disciplines and seek out complementary expertise from scholars in other fields.

The funding environment today is similarly much more competitive and complex than it was even ten years ago, and the resources to support research and innovation derive from a multitude of sources and programs, including those of various levels of government, private-sector partners, not-for-profit agencies, and other organizations in Canada and around the world. This is partly the result of exciting developments in the intellectual landscape and of the magnitude of the questions we seek to address. But it is also the result of increasing political and financial investment in the idea of research as an economic driver. As one of the world’s great research universities that is still dependent on significant public investment, it remains a challenge to create a sustainable resource base from all our funding sources.

### **2.2 Cross-Disciplinarity and Partnerships**

The intent of this Strategic Research Plan is not to plan research per se, but to ensure that we enable researchers to do outstanding work individually and in teams, in the best possible environment. But we must get beyond general statements about the importance of enabling researchers to work across disciplinary boundaries and show that, indeed, important discoveries are being made right now at the intersection of disciplines. This trend points to a great strength of the University of Toronto in a time when the big questions before us—global epidemics, environmental issues, terrorism, the consequences of discoveries in molecular biology, the effects and the opportunities of new information technologies, the difficulties of forging social cohesion among multicultural populations, the effects on human lives, societies and governments of the transnational movement of labour and capital—cross boundaries of disciplinary expertise. At U of T we can take on such questions in ways that truly do lead the field because the strength we have in each relevant discipline is enhanced and made more consequential by strengths in other areas of the institution.

However, faced with the world’s most complex issues, no university—no matter what its aspirations to comprehensiveness—has all the necessary expertise. Faced with the high costs of appointing and enabling new faculty, as well as the escalating costs of increasingly sophisticated equipment and

buildings, no government can build such strength in all of the institutions across its system. These constraints require scholars in many fields to work in large, collaborative, interdisciplinary, and often nationally or internationally networked teams. In establishing our research collaborations, we need to remain mindful of the need for such networking if we are going to have global impact, even while drawing on the outstanding strengths of our University and hospital research programs. Embedding research and scholarship strategically in a framework that is at once multidisciplinary, national, and global in its orientation can help meet the demands of the funding environment and can contribute significantly to sustainable research programs.

This Strategic Research Plan identifies seven thematic areas that engage the research community and our partners in some of the challenges that face humanity in the 21st century. The key to the success of this strategy is to support the excellence of basic research within disciplines so that it can inform and in turn support thematic and problem-based interdisciplinary research, as well as remain responsive to new areas of priority as they arise. Conversely, by fortifying strategic clusters in key thematic areas, we can add value to our traditional strengths in disciplinary research and help create the novel approaches and breakthroughs that are needed to address issues of local, national, and global importance. These clusters of scholarship have emerged out of high-level work already going on in many different disciplines and divisions at U of T. Although the themes represent areas of scholarship where U of T and its partners already have considerable strength, they will benefit from support over the next five years if they are to have a lasting impact. The seven themes also represent broad areas of overlapping significance and interaction, and, as such, scholarship in each will have consequences for all the others. The themes align with the objectives of *Towards 2030*, but they are also areas that are important to our government and community stakeholders. They can provide us with opportunities to inform public priorities and policy, and they dovetail with global efforts such as the United Nations Millennium Development Goals and the various “Grand Challenges” programs—all projects in which the international research community is currently concentrating resources and talent.

The themes and sub-themes presented here are not meant to be exhaustive of all the excellent work going on at the University—nor are they meant to be prescriptive. Rather, they are meant to offer students, professors, divisions, and our partners strategic entryways into interdisciplinary and multidisciplinary networks and collaborations that depend upon outstanding disciplinary work, and they offer opportunities to contribute to the big challenges if they so choose. At the same time, the themes give some leeway for responding to new challenges as they arise. They integrate with the work of existing University centres and institutes, which are poised to optimize the impact of current research by creating division-crossing hubs that concentrate on large, globally significant issues. And they embody another established strength of the University that informs its twin teaching and research missions: to foster the discovery and application of new knowledge relevant to advancing education and practice. Research in several areas throughout U of T is yielding insights about how to reconcile diverse theoretical perspectives and how to promote synergy between theory and practice. This important work permeates all of the themes we have identified and contributes to ongoing improvement in the way students are taught in every division of the University.

In a period with constraints on public expenditures and reduced core funding for basic research, universities are understandably eager to present evidence of linkages between the professional activities of their scholars and the larger goals of society beyond the university. New approaches to solving problems would not be possible without strong foundations in basic research, even if the main linkages between innovation and such research are indirect. Indeed, discoveries that are unanticipated are often the most valuable, and purely curiosity-driven research will often have unexpected implications for society far beyond their immediate impact. We must also consider that the most immediate effect of basic and curiosity-driven research on social and technical innovation may be through the training that

PhD and other students receive, and that they then take with them to innovative organizations within government, private industry, and civil society. For many if not most professors, the opportunities for long-term immersion in important intellectual problems without immediate demands to utility are a key motivation to devoting a lifetime to research. This perspective is not always visible in discussions of the value of basic research. Basic research may not pay off immediately—indeed, it may not pay off for many years—but when it does the rewards are often broadly shared, enjoyed by those who bore its costs but also by those who did not. While the risks may be large, so are the rewards for our economy and our society. U of T is, and will remain, an institution where the curiosity-driven pursuit of fundamental and disciplinary knowledge serves as the foundation of our research strategy. The thematic areas we outline below are strategically complementary to our traditional disciplinary strengths.

It is the role of the University to work with its own governance structure, divisions, affiliated partners, students, faculty, and staff, as well as with other universities, governments, non-governmental organizations, private sector partners, and individuals to provide all members of our scholarly community with the tools they need to be successful and competitive. Mechanisms already exist within the University to bring together networks of investigators, but these will be further nurtured, planned, and developed over the next few years to engage the widest University audience. In parallel, new challenges and thematic areas will be identified and addressed in an ongoing way. U of T will establish the mechanisms through which its expertise and analysis can be brought to the public forum so that worldwide funding agencies, opinion makers, and legislators can be guided and informed by its work, thereby contributing to future funding and development. Our vision for the future is challenging but clear: to create the most supportive environment possible so that our researchers, scholars, and learners can do what they do best—advance understanding and apply new knowledge.

### 3. STRATEGIC RESEARCH THEMES

#### 3.1 EXPLORE: Our Place in the Universe

Researchers and students from every academic corner of U of T are exploring profound, fundamentally human questions ranging from the origins of life, species, consciousness, and disease, to the beginnings of our planet and the universe in which it resides. Our experimental and theoretical physicists are actively engaged in large international efforts to move beyond the current particle physics paradigm. Our biologists and philosophers are challenging how we think about life, its interconnectedness, and the conditions under which it thrives. Our astronomers and planetary scientists are unraveling the mysteries of our planet's formation and offering glimpses of its future. Mathematicians are providing the language and the tools with which to explore and articulate the fundamental principles of the universe. Our paleontologists, linguists, geneticists, anthropologists, historians, and archaeologists are plumbing the depths of humanity's past, bringing to light fascinating new knowledge about how our species and the diversity of human cultures came to be. U of T's earth and space scientists are helping us understand phenomena as diverse as extreme terrestrial environments, the effects of microgravity on human bone tissue, weather patterns and climate on Earth and on other planets, and the chemical make-up of stars and galaxies. Our researchers are also exploring the subsurface solid Earth for a better understanding of natural geological processes, how they interact with other complex terrestrial systems, and how to locate, access, and better manage Earth's natural resources. U of T investigators in Education, the Social Sciences, and the Arts and Humanities are collaborating with those in the Biological, Physical, and Applied Sciences to investigate questions that are fundamentally driven by our very human need to understand the meaning of our own existence—and that may also give us the insights we need to help solve some of our greatest challenges here at home. If history is any guide, whatever we discover will very likely radically affect how we think about ourselves and our place on this planet and in the cosmos.



NASA photo

## *Examples of Sub-Themes:*

### ***EXPLORATION OF THE COSMOS***

Observations of space are critical to advancing many key scientific issues that have long interested physicists and cosmologists: the early expanding universe, the formation of stars and galaxies, the discovery of extra-solar planets, and prospects for life elsewhere in the universe. The latest instruments for space-based observations have opened up new electromagnetic windows not available to ground-based astronomy. Here on Earth, several very powerful and extremely large telescopes are currently under development and are expected to come online soon. A new era of space exploration also requires a new generation of space-related technology, and our global desire to explore outer space is driving a revolution in the development of new tools, systems, materials, and machines. From spacecraft to satellites, rovers to biological monitoring systems, and from human life-support systems to strategies to enable long-term human space travel, we need new knowledge and new technologies to push beyond our current limitations. New space-based technologies like the next generation of micro and nanosatellites also provide critical tools for monitoring the surface, oceans and atmosphere of the Earth and platforms for global communications. The advent of high-performance computing has provided an essential tool to analyze the wealth of new data that is being collected by telescopes, and has given us the ability to perform detailed computer simulations of the evolution of our solar system and galaxy. As our knowledge of the solar system, our galaxy, and the rest of the universe grows, the more we understand how the Earth formed and how life here arose. At U of T, our astronomers, astrophysicists, mathematicians, and planetary scientists are world-renowned for their innovative approaches to shedding light on some of the most fundamental questions about the nature of our universe.

### ***PLANET EARTH***

Canada's vast landmass is undergoing unprecedented changes as the climate warms. Detecting and quantifying these changes presents major challenges to remote sensing and imaging from space, but U of T's Earth, Climate, and Atmospheric Sciences investigators are engaging these challenges by developing measurement concepts, biosphere information retrieval techniques, monitoring tools, and models for quantifying change and its effects on terrestrial carbon and water cycles. The three key issues in Atmospheric Science—climate change, air pollution, and the depletion and recovery of the ozone layer—are driven by changes in the chemical composition of the atmosphere. All are global issues, and all require global solutions that can only come from space-based measurements. Remote sensing data is also contributing to a detailed understanding of our boreal forests, from the functional ecology and eco-physiology of trees to community-level patterns of growth, mortality, recruitment, reproduction, and ecosystem processes. All of these issues have clear relevance for public policy, the health of humans and ecosystems, and the economic well-being for Canadians. Although cutting-edge science lies in deciphering how the processes involved in climate change, air pollution, ozone depletion, and forest ecology are physically coupled, the social and political challenges of implementing policy and deciding how resources will be allocated to manage our changing landmass and climate will require the attention of our scholars in Philosophy, Anthropology, Political Science, Geography, Management, Education, and many other disciplines. The big challenge over the coming decades is to move from qualitative and system-level descriptions to quantitative, global, and integrated descriptions, and then integrating the results with our systems of education, governance, law, policy-making, and economics.

### ***ORIGINS AND DIVERSITY OF HUMANITY, SOCIETY, AND CULTURES***

Investigators from fields as diverse as Medicine, the Biological Sciences, Anthropology, Archaeology, Paleontology, Linguistics, Languages and Literatures, History, Psychology, and Cognitive Science are exploring profound, fundamentally human questions ranging from the origins of life, species, consciousness and disease, to the origins of language, art, science, civilization, and culture. This research focuses on our human cultural response to understanding our own origins. For most people, questions of origins hold personal significance and are best explored in multifaceted ways. U of T scholars in these and other disciplines are nurturing collaborations with U of T writers, historians, dramatists, artists, and dancers as they explore precisely how specialists and members of the general public alike can better appreciate our evolving place within the cosmos. With a shared curiosity about how and why things came to be as they are, our investigators are focusing on the origins of human diversity and fostering exploration across time and place, from the first appearance of anatomically modern humans, art, writing, language, and society to the diversity of today's human cultures. They are also studying humans and their primate cousins in all their biological and social dimensions, examining the myriad factors that have affected the evolution of humans and other animals, and that generate, maintain or change contemporary genetic, physiological, and behavioural variation. U of T researchers who deal with institutions and models of social behaviour cross-culturally are establishing higher-level theories about the similarities and differences between human communities and cultures, as they model within their own work the value of collaboration and transdisciplinary research. Questions of origins resonate across all disciplines and among the general public because they directly confront the mysteries associated with our existence, our past, and, perhaps mostly importantly, the possibilities for our collective future.

### 3.2 SUSTAIN: Humanity and the Environment

Human activity is a major cause of environmental change and the rate of that change has accelerated dramatically over the last century. Understanding the dynamics of both natural and anthropogenic environmental change requires knowledge spanning many disciplines. Recent environmental degradation such as surface and subsurface water pollution, air and soil pollution, climate change, depletion of resources, extinction of species, and problems of waste disposal are all partly a result of our limited understanding of environmental systems and processes. Canada's Arctic is one region that will be acutely affected by global warming and climate change in the years ahead, as is already evidenced by loss of year-round Arctic sea ice and changes to local climate—changes that are having profound repercussions on the lives of the people living there. Students and scholars from across the disciplines at U of T's three campuses are highly engaged in efforts to determine if we will be able to control carbon emissions in time to prevent the worst case scenarios for climate change. Given that much of our technological civilization depends upon what comes from either the surface or subsurface of the Earth, our researchers are also keenly interested in developing cleaner and less environmentally damaging ways to produce the mineral and energy resources we need, and in understanding the significance of biodiversity and the underlying biology of organisms and ecosystems to the long-term sustainability of our environment. U of T researchers are trying to understand how the technical, social, and political challenges to implementing potentially costly environmental solutions can be overcome, and how institutions can foster the adoption of critical thinking, rigorous science, and new technology to a given problem. U of T humanists in fields such as Literature and Classics familiarize contemporary audiences with historical ways of thinking about humanity's relationship to nature, and that some of our contemporary ecological problems have their roots in the practices of other times and places. And other U of T thinkers are leading the way in increasing environmental awareness, and in contemplating how we may be able to transition to a more sustainable economy while maintaining growth—or, more radically, if we should be re-thinking the very idea of growth.



*iStockphoto*

## *Examples of Sub-Themes:*

### **SUSTAINABLE ENERGY**

Within the last century, the world—and the developed world in particular—has come to depend almost exclusively on non-renewable fossil fuels and their offspring, petrochemicals, to fuel industry and economic growth. This dependence has had a tremendous impact on the global economy and has been a catalyst for conflict over the last 50 years. Our cities have expanded through the decades built on the assumption that oil is a relatively cheap and available resource, but that assumption is now starting to be tested. As oil supplies decline—and as the demand for energy keeps going up, especially in emerging economies such as India and China—the debate in many jurisdictions centres on expanding the roles of coal, nuclear, and sources of renewable power, such as hydro, solar, or wind. But improving and implementing these technologies presents other problems, both social and technical, ranging from infrastructure/grid development, storage, mobility, and delivery to consumer and market behavior, higher energy costs, power quality issues, and political influence on public policy. Whatever solutions are adopted to reduce dependence on oil, many countries have recognized that we must eventually abandon our reliance on fossil fuels. U of T researchers are collaborating with institutional partners in the private and public sectors to develop world-leading technological solutions—such as new battery technology and fuel cells, solar energy and solar fuels, SmartGrid technology, renewable energy systems, and alternative biofuels—as well as forward-thinking ideas to resolve the institutional, behavioural, and regulatory issues that must be part of any solution to our sustainable energy challenge. As part of this effort, we are using our own campus as a living laboratory to test out new technologies, designs, and strategies for behaviour change to reduce both our demands on the planet's resources and our contributions to polluting emissions.

### **GLOBAL CLIMATE CHANGE**

Climate change and its causes is a controversial topic that tends to polarize debate. However, from the perspective of science, there is no doubt that our climate is changing, and will likely continue to do so long into the future. Still, there are many differences of opinion on what needs to be done, how quickly, and who will pay. As the causes of climate change and its impacts on the environment, human health, and society have come to be much better understood, thanks in part to research done at U of T in collaboration with partner institutions throughout Canada and across the globe, what is clear is that what we do today can have enormous long term effects on climate. Canada is a vast country with a diverse climate, which makes the impacts of climate change all the more important for us, although the impacts will be felt the world over. Researchers at U of T are looking not only at the geophysical science behind climate change and possible technical solutions to some of the problems associated with it, but they are also engaging their broad expertise in an examination of climate change in the contexts of urban planning, building design, economics, poverty and social justice, ethics, education, traditional and historical ecological knowledge, global governance, and environmental policy and law. Climate change is something that affects us all in many different ways, and only the concerted efforts of a wide range of disciplinary perspectives from the physical and applied sciences, the social sciences, and the arts and humanities will reveal a way forward.

### **FOOD, AIR, AND WATER**

Safe and nutritious food is essential to human survival and flourishing. Through a combination of domestic agriculture and international trade, industrialized nations have ample food to feed their populations. Developing countries, on the other hand, face a variety of challenges when it comes to the challenges of staving off hunger. These include land rights and ownership, diversion of land to non-productive use, increasing emphasis on export-oriented agriculture, inefficient agricultural practices, war, famine, drought, flooding, over-fishing, poor crop yields, and not least of all, poverty. Almost 50% of the developing world's population—2.5 billion people—also lack adequate sanitation facilities, and over 900 million people still use unsafe drinking water sources. Air pollution, both indoors and outdoors, is a major environmental health problem affecting everyone in developed and developing countries alike. The World Health Organization estimates that 2.4 million people die each year from causes directly attributable to air pollution. Particulates in the air are not only a health concern at ground level but can also affect cloud formation and climate, contributing to changes in atmospheric processes already underway. Today, the global food, water, and air quality crises are more pressing than ever. Tackling these issues will require substantial policy mobilization within the international community, but it will also require creative thinking and leadership to find and implement new ways to contribute to solutions. Scholars at U of T are looking at food, air, and water issues through the multiple lenses of science, technology, culture, history, art, politics, regulatory frameworks, and health, and are finding that sustainable long-term solutions will only come with a careful examination of the assumptions behind how we manage these resources that are so vital to life, and that play such a central role in every human society.

### 3.3 PROMOTE: Healthy People, Healthy Communities, Healthy World

Improving health and well-being has long been a human imperative, and there is still much we can do to alleviate suffering and improve quality of life for all people. Over the last two centuries, advances in public health, and in fighting infectious diseases, have saved countless lives and have improved and extended the lives of many more. Despite these victories, global trends have created new and increasingly costly health problems that will require all of our ingenuity to solve. Although it is clear that people can remain active and healthy through the lifespan, U of T investigators are asking how best they can do so in practice, and how aging with dignity can become a goal that all of us achieve. As U of T researchers and trainees seek to develop personalized and regenerative medical therapies that will offer hope in the treatment of cancer and the replacement of failing organs, they are also trying to find the best ways to help those at immediate risk from hunger and malnutrition, HIV/AIDS, malaria, and tuberculosis. U of T educators, nurses, social workers, humanists, and public health researchers are asking how education, knowledge of human development, and an understanding of the broader social, cultural, and environmental determinants of health can help us devise better ways of preventing disease in the first place. Our faculty are addressing the importance of physical inactivity, a leading cause of many of the chronic diseases of aging and civilization, and how physical activity and sport can be an important part of disease prevention. U of T mind and brain scientists are relating the importance of mental health to the notion of health in general, and psychologists are examining cognitive functioning, including memory, attention, decision making, and perception. Rehabilitation scientists, computer scientists, and biomedical engineers are making advances in assisted living technologies, neurorobotics, and brain-computer interfaces that are enabling users and improving quality of life. Researchers drawn from across the divisions of U of T and our affiliated hospital and community partners are world-leaders in the pursuit of answers to these questions, many of which are as much cultural, social, political, and institutional as they are scientific, biomedical, or technological. And in their deeply committed work on aboriginal, women's, and inner city health, our researchers and scholars are helping to improve health care access, equity, and delivery right here in the GTA, across Canada, and internationally.



*iStockphoto*

## *Examples of Sub-Themes:*

### ***HUMAN DEVELOPMENT AND HEALTH THROUGH THE LIFESPAN***

Understanding the linkages between early human development and later-life health, learning, and social flourishing may be crucial to preventing illness and ensuring that we not only age well but remain active, healthy, and productive members of our communities. From birth to death, the factors that affect health include economic status, diet, access to opportunities for recreation and physical activity, opportunities for social interaction and community involvement, education and ongoing learning opportunities, the availability of health-care and community services, and infrastructure such as transportation and appropriate housing, among many others. In 2005, there were 4.2 million seniors aged 65 and older in Canada, and Statistics Canada projects there will be 9.8 million seniors by 2036. Older Canadians are living longer and with fewer disabilities than the generations before them, but the majority of seniors today also live with at least one chronic disease that must be managed. Conditions such as cancer, cardiovascular disease, and dementia impose particularly significant personal, social, and economic burdens. Currently, our health care system focuses primarily on cure rather than health promotion and disease prevention. To curb the social and economic costs associated with chronic disease, the focus may need to shift to the latter, and in so doing consider the social, economic, and environmental contexts of disease and illness. U of T scholars, educators, and investigative teams are collaborating to ensure that development and health through the lifespan is at the forefront of the research, education, technology development, and social policy agendas, so that people can maintain optimal health and quality of life whatever age they happen to be.

### ***MOLECULAR MEDICINE AND THE BIOLOGY OF DISEASE***

The completion of the Human Genome Project in 2003 signaled a new era of medicine based on a detailed understanding of human biology and on the underlying genetic, molecular, and cellular mechanisms of disease. But as scientists have learned, genetics are only one part of the picture. Molecular medicine and the biology of disease embrace a vast array of phenomena with wide applications, from genomics, proteomics, bioinformatics, and molecular therapeutics to applied stem cell and regenerative medicine. Personalized medicine is a promising medical approach that involves using an understanding of a patient's genotype and epigenetics to tailor their medical care. U of T researchers are looking for specific biomarkers to aid in the early and more robust detection and prevention of common conditions such as cancer, cardiovascular disease, obesity, diabetes, and asthma. U of T is integrating engineering and scientific approaches, such as stem cell therapy, regenerative biomolecules, tissue engineering, and the use of biomaterials, among many possibilities, to open new paths to the treatment of disease and injury. How expensive new treatments will be, and whether our current health care system will be able to ensure non-discrimination and equitable access while delivering them cost-effectively, are still open questions that will have consequences for all of us individually and as a society. U of T and its affiliated hospitals have an outstanding record of achievement in both basic biomedical, pharmaceutical, and clinical research, and U of T humanists and social scientists are on the forefront of examining the emerging ethical, legal, social, and public policy issues raised by these new approaches.

### ***GLOBAL HEALTH, PUBLIC HEALTH***

When most people hear the phrase "global health," they often think of health problems that affect developing countries. While this may capture a lot of work in the field, global health more accurately refers to public health problems that transcend national borders—problems such as infectious and insect-borne diseases that can spread from one country to another, as well as health problems that are of such magnitude that they have worldwide social, political, and economic impact. Such problems are best addressed cooperatively and solutions are most effective when those who are affected are engaged in the research process. Public health in the local context is also of major concern both internationally and domestically. Since the late half of the twentieth century, the incidence rates of type II diabetes, cancer, and heart disease have soared, in both developed and developing nations. Chronic disease creates a heavy economic burden on all nations of the world by increasing the demand on health care and social systems and reducing productivity. As international travel increases and greater numbers of people migrate from one region of the globe to another, emerging health trends abroad could become part of life anywhere, including here in Canada. And we have much to learn from our urban immigrant and northern communities, as they grapple with health issues that are specific to their lived experiences. U of T researchers across the Health and Social Sciences are working overseas and right here at home, leading an urgent international charge to understand the complex links between illness and lifestyle, poverty, social development, opportunity, and geography.

### 3.4 ENGAGE: Mind, Language, Culture, Values

Language, culture, values—these are not merely aspects of how human beings express themselves or relate to each other. In a fundamental sense, they define us as human beings. In the face of great social, cultural, and technological change, do we risk losing some of that humanity? The importance of constantly engaging our humanity—and our fellow human beings—through our cognitive faculties, languages, literatures, cultures, art, and values cannot be overstated if we are going to negotiate the challenges we face as a species. U of T students, researchers, scholars, and performers who examine the cultural, historical, philosophical, linguistic, literary, and artistic dimensions of human experience are helping us understand the diversity and complexity of our changing world. As distances shrink and global competition mounts, knowledge of these aspects of our experience bridges cultures and engenders new relationships. By examining the ideological practices and processes that have shaped and continue to structure the lives of women and men historically and cross-culturally, it becomes possible to transform and change inequitable practices. By embracing and understanding difference, our students and faculty are helping to fight racism, work for peace, and promote environmental sustainability. Investigators that engage with issues of representation, performance, and recording are giving us better purchase on our shared experiences as human beings, and on our history. Scholars interested in the many modes of human language, communication, literature, constructing narrative, and the image as ideology place our era of digital media, social networking, and the rapid transmission of ideas in its proper cultural and historical contexts. U of T also has a rich community of researchers building cognitive systems—including those in computational neuroscience and machine learning, computational modeling of human learning, language, vision, audition, and knowledge representation—and they are applying the results of their investigations to the design of intelligent artificial agents that will have an enormous impact on our society. Our educational scholars, psychologists and other brain/mind researchers investigating cognition—the very defining boundaries of the human—are also finding themselves able to address important questions of fairness, suffering, human dignity, equity, and social justice. U of T scholars are deeply engaged in understanding all of these characteristics that make us human, and in so doing, are helping to make the world seem both a little bit smaller and perhaps far richer than we might have imagined.



*iStockphoto*

## *Examples of Sub-Themes:*

### ***LANGUAGE AND REPRESENTATION IN THE ERA OF ICT, DIGITAL MEDIA AND SOCIAL NETWORKING***

Fundamental to our identity as human beings is our ability to communicate, particularly through our ability to find, construct, and convey meaning through language and other symbolic means. Technologies such as the printing press, telegraphy, and the telephone radically changed how we communicate with each other, and radio, television, and film have given us new methods for imparting information and constructing narrative, and in so doing have re-made our culture and our world. How will new digital and social media and their associated information/communication technologies (ICT)—the creative convergence of digital arts, science, technology, and business for human expression, communication, social interaction, and education—continue to change how and what we communicate? The exploration of these modes of making meaning and constructing narrative, along with their social, political, epistemological, technological, and ethical implications, is an essential activity in understanding our society in the 21<sup>st</sup> century. Digital media and ICT are applied in a vast variety of contexts: in the spheres of political discourse and radical cultural critiques; digital art and literature projects; eHealth innovations in diagnostics and treatment; computational biology; information policy research; and computer-human interaction and social networking. And U of T scholars working in Languages, Literature, Cinema Studies, and the Visual Arts are not only engaging these new techniques but questioning the kinds of personal, linguistic, and ideological commitments we make through our choices of representation, with far reaching implications for our notions of individuality, personal freedom, and how we interact with our fellow citizens.

### ***VALUES IN PERSONAL AND PUBLIC LIFE***

Values are an integral part of every culture. Being part of a culture or religion that shares a core set of values creates expectations and predictability without which members might lose much of their personal and cultural identities and sense of worth. For many people, their values tell them what is good, beneficial, important, useful, beautiful, desirable, or constructive. Our values guide us in deciding what to do, help solve common human problems, and over time become the roots of revered cultural traditions. The importance of basic research in the Humanities in understanding the role and validity of values in personal and public life cannot be overstated. Literary scholars, whose work is of supreme relevance to the way human beings interpret meaning, are also concerned with the deep significance of the psychology, behavior, and values of the individual. U of T research on classical antiquity is centrally engaged with profoundly influential and enduring statements of values in personal and public life. The exploration of such matters as the role, validity, and transmission of values, who should be responsible for attending to issues of public concern, or what is a fair resolution to a dispute, is fundamental to the development and institutionalization of any solution to a socio-technical problem. More broadly, addressing questions about the validity of different cultural perspectives is essential to comprehending how different cultures interact, and to building understanding, creating opportunities for communication, and promoting peace. Personal and public values arise as critical questions across such diverse fields as philosophy, languages and communication, bioethics, cognitive psychology, public policy, democratic theory and practice, global justice and human rights, constitutionalism and the rule of law, history of thought, morality in literature, and the study of religion. Scholars at U of T who study values in personal and public life are making critical contributions to their fields, helping to generate a deeper understanding of human behavior and society.

### ***MIND, BRAIN, AND THE HUMAN***

Different cultural and religious traditions throughout history have had divergent views on human nature, but most have maintained that humans are unique and distinct from non-humans. Today humanists must contend with an essential question: is the object of their scholarship—humanity—still a valid category? Some of the pressures that challenge the distinctions that make us human beings arise from science, medicine, and technology, and the very attempt to understand our distinctiveness, while at the same time acknowledging our animal biology. When our neurocognitive capacities are interwoven with those of computers and artificial intelligence, what does this tell us about the distinctiveness of the human mind and its cultural products? Studies in many disciplines, including the History and Philosophy of Science and Technology, Linguistics, Music, and Neuropsychology are questioning the nature and status of human rationality and creativity. Cognitive Science at U of T brings together researchers in Computer Science, Philosophy, Psychology, and Linguistics, and they are looking to the Neurosciences to extend the reach and impact of their work. U of T's psychologists, sociologists, and anthropologists are studying the social aspects of what it means to be human and are making fascinating discoveries about how humans interact with each other. The exploration of the assumptions that underlie our human identities in Literature, Philosophy, Psychology, and Anthropology has suggested that we are not who we have imagined ourselves to be, and that perhaps our problems are partially a consequence of that misunderstanding. U of T scholars in Biology, the Applied Sciences and Engineering, Artificial Intelligence and Computer Science, Mathematics, Medicine, Law, Psychology and Neuroscience, Political Science, Sociology, and Philosophy, among other disciplines, are examining and debating the nature of these most human characteristics. In so doing, they are revealing important implications for our social, political, and economic institutions, and they are helping us understand just what makes the human mind unique.

### 3.5 ADVANCE: Institutions, Peace, and Prosperity

Effective governance is a prerequisite for human prosperity and well-being. The study of governance in its various forms and in different jurisdictions, types of organizations, and other times in history, is central to several contemporary issues: reform of public institutions and public law; the creation and establishment of procedures and rules that lead to greater efficiency, transparency, and accountability; and the challenge of making governance more inclusive and participatory through the strengthening of democracy and civil society. While the concept of governance includes the formal institutions of government, it also encompasses other formal and informal processes of community and organizational decision making and administration. Governing for peace and prosperity presents colossal policy challenges: according to the United Nations, more than one third of our world's citizens currently live in poverty and over 20 countries are currently engaged in civil wars, with many more suffering from nearly constant low-level political violence. A crucial task facing the international community is to develop institutional structures, guidelines, and principles for how such conflicts should be resolved, or prevented from arising in the first place. Although the links between political institutions, peace, and prosperity may be relatively clear, their relationships are complex, and U of T scholars who study these relationships are finding that the institutions that foster peace and prosperity in one culture, geographical location, or historical period may be detrimental in another. Moreover, we have little understanding of how to promote the development of effective institutions, laws, governance and regulatory frameworks in jurisdictions that don't have them. Researchers in the Social Sciences, Law, Management, and the Humanities at U of T are learning about the ways that political and social institutions, peace, and prosperity influence one another, and how they are entwined with issues as diverse as climate change, resource depletion, population pressure, migration, health care reform, international security, and international development. Similarly, our scholars are showing that ideas about leadership, decision making, or public deliberation all matter and shape our capacity to govern, and they are realizing that the more we know, the better we are able to create the conditions that will promote higher standards of living, life-long learning, and better governance for all the world's citizens.



*United Nations photo*

## *Examples of Sub-Themes:*

### ***THE KNOWLEDGE ECONOMY, DEVELOPMENT, AND SOCIAL INNOVATION***

The sectors that were hardest hit by the 2008 economic crisis include natural resources, manufacturing, and finance. The world economy has been driven by these sectors for over a century, but in the late 1990s, globalization, advanced ICTs, new media, and computer networking became powerful economic driving forces. These forces made it easier for business to shift its focus from the production of goods to the provision of services, knowledge products, and, increasingly, social innovation—a paradigm shift that quickly became described as the “Knowledge Economy.” Since then, questions around the meaning and value of different forms and roles of knowledge and human capital have become central to economic theory and are having significant implications for public policy, finance, and social and human resources development. In an era when countries are scrambling to increase access to postsecondary education, U of T investigators are also raising critical questions about the ever-increasing globalization and proliferation of information and knowledge: How is the widespread growth of information and communication affecting the boundaries between public and private life? What are the relationships between mass media, civil society, and private enterprise? Does the convergence of media affect freedom and democracy? Will the knowledge economy create wealth and opportunities for developing economies? U of T scholars are learning that full global economic recovery will depend not only on understanding what triggered the 2008 financial crisis but also on recognizing opportunities for change, so that we may build a more sustainable, humane, and just knowledge economy.

### ***PEACE AND CONFLICT***

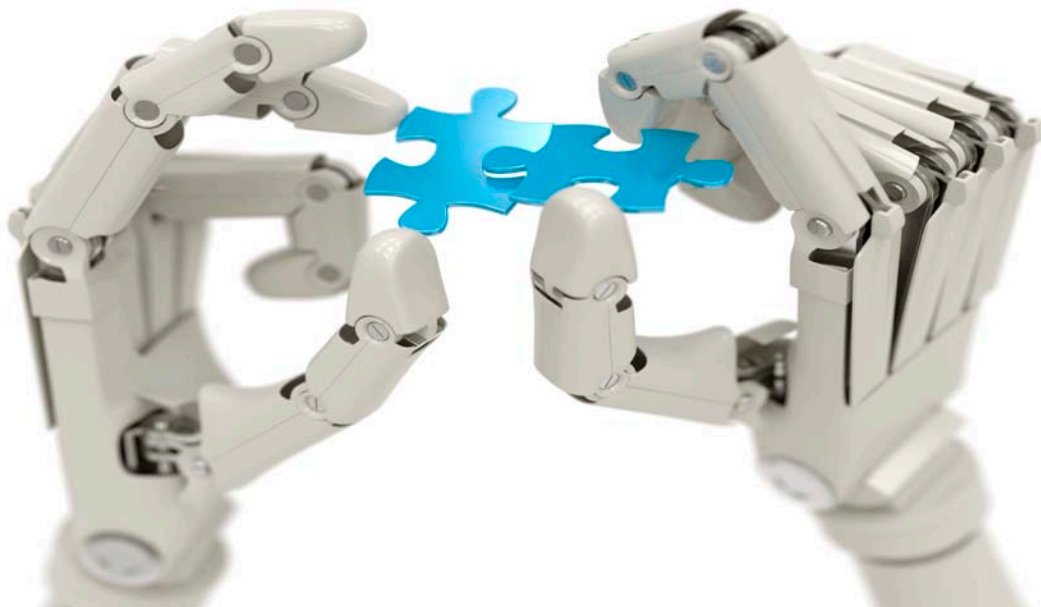
Despite our attempts to understand and prevent them, the problems of conflict, violence, and war persist. The personal, social, and economic burdens of war over the last century have been immeasurable, and tens of millions have died worldwide in armed conflicts since the Second World War ended in 1945. The beginning of the 21st century has seen the development of new kinds of conflict, in which adversaries are less clearly defined and sources of hostility are based on major discrepancies between the social, cultural, and political systems of the combatants. Scholars at U of T are working within and beyond the traditional purview of international affairs in an effort to identify the deep causes of strife—from poverty, resource scarcity, and weapons proliferation, to competing claims for justice and failures of foreign-policy decision making. Other scholars who study human behaviour from the disciplinary perspectives of Political Science, History, Classics, Philosophy, the Study of Religion, Economics, Law, Anthropology, Psychology, Biology and Ecology, and Neuroscience, have also taken up the task of understanding war and peace. But preventing war requires more than understanding the causes of conflict; it requires understanding the types of institutional arrangements that can lead to the peaceful resolution of conflict. United Nations and other institutionalized peacekeeping efforts, long vehicles of Canada’s commitment to the principles of peace and freedom, have been examples of such arrangements, albeit not always successful ones. U of T researchers are studying the roots of peace and conflict in our own culture through studies of such phenomena as imperialism in ancient Greece and Rome and the contemporary manifestations of that historical legacy in the modern West and other parts of the world. And they are leading innovation by proposing peace education, new and better ways of organizing institutions, and marshalling institutional expertise to stop conflict before it starts.

### ***LAW, ETHICS, AND THE PUBLIC/PRIVATE INTERFACE***

What is right and what is just? What is in the best interest of the public good? What are our obligations as individual citizens and as organizations in a world where our actions can have global consequences? These difficult questions have been at the heart of democratic life since ancient Athens, and trying to provide answers is of strategic importance to modern Canada’s growth and well-being. At U of T, humanists and social scientists have realized that the best and most sustainable solutions for Canada and the world will come from uniting scientific and technological insights with the results of basic research in Bioethics, Geography, History, Law, Literature, Political Science, Philosophy, Sociology, and many other disciplines. The study of successful public institutions has led to the insight that they serve their societies most effectively and humanely when they have the creative capacity to break away from the administrative application of policies and traditions and instead publicly imagine and realize new social arrangements. Effective institutions take risks, invent programs, challenge constituents to live up to ethical commitments, and find ways to ensure that they remain dynamic and responsive to the public they serve. But to do this, and to tie scientific and technical innovation to social innovation, public institutions must adopt laws, regulatory frameworks, and intellectual property rights that deftly negotiate the public/private interface. Legal and management scholars, philosophers, psychologists, and sociologists at U of T are asking how societies can fairly and equitably utilize and allocate knowledge in an age where the rights and obligations conferred by citizenship are not equitably distributed and when the separation between private and public spheres of responsibility has begun to blur.

### 3.6 **ENABLE:** Technologies for the 21st Century

New technologies, advanced materials, processes, and engineering techniques have enabled society to realize new ways of doing things that have thoroughly transformed the world. And there is no end in sight to this ongoing technological revolution. U of T researchers are actively engaged in developing new materials and processes for sustainable manufacturing. They are trying to establish new paradigms in computing, and in so doing, create more powerful ways to process information and manipulate data. Nanoscience—the science of doing things at incredibly small scales—is redefining possibilities from drug development to moviemaking. They are exploring fundamental properties like superconductivity that might one day lead to advances in sensor, imaging, and myriads of other technologies. The field of quantum optics and cold atoms could yield results for quantum information processing and simulation. The human use of technology and how we interact with it has become an important field of study. What’s next on the horizon, and how will we manage the rapid changes ahead? Wherever we end up, new knowledge and new technologies, with their tremendous capacity to permanently alter our social and physical landscapes, are intimately intertwined with questions of values, ethics, and social policy, which, in turn, cannot be disentangled from the fundamental science behind the technologies. Intellectual property, including the negotiations over who gets to reap the financial and other benefits from it, is also central to the ways societies utilize and allocate new innovations in science and technology. Our conceptions of new and emerging technologies and the roles they play in our society must include all of these considerations. The implications are important not only for the way we address the ethical, legal, and social issues, but also for how we do science and engineering, and how we design the institutions that oversee them. U of T researchers are world leaders in the development and application of emerging 21st century technologies and applying these innovative approaches to solving some of our most pressing issues. But they are also profoundly questioning whether we conceive, design, or plan technologies with full recognition and consideration of human capacities and limitations, or expect humans to adapt to the technologies. Human interactions with complex technologies is an area of growing concern, and one with which our scholars in the humanities, social sciences, and the basic and applied sciences are deeply engaged.



*iStockphoto*

## *Examples of Sub-Themes:*

### ***NANOSCIENCE AND NANOTECHNOLOGIES***

Nanoscience is the study of manipulating matter on an atomic and molecular scale, and nanotechnology is the engineering of functional systems at that scale. The possibilities and promise of nanoscale science and technology are remarkable. Investigative teams at U of T are exploring these possibilities: improved manufacturing methods, water purification systems, novel and more efficient energy systems, physical enhancement, nano- and regenerative medicine, personalized diagnostics and pharmaceuticals, and better food production methods. The tiny scale of nanotechnologies may allow for the automation of tasks which were previously inaccessible, and which in turn may reduce labor, land, or maintenance requirements. Nanotechnology may also hold the key to making space flight more practical: advancements in lightweight nanomaterials could significantly reduce fuel requirements, which would lower the cost of reaching orbit. But, as with any technology, there are potential risks and implications to be thought through, including environmental, health, and safety issues; transitional effects such as the displacement of traditional industries as the products of nanotechnology become dominant; military applications such as biological warfare and implants for soldiers; and breaches of privacy rights from covert surveillance through nanosensors. With these advances and many more already on our doorstep, U of T scholars are also busy examining and advising on the possible unexpected ethical, social, and cultural consequences of technologies that operate unseen to the naked eye.

### ***SIMULATION AND IMAGING***

The arts and humanities have long been concerned with how human beings can create new worlds by imagining and imaging them: worlds come alive in performance and through various modes of representation. Leading research at U of T in the performance and figurative arts intersects with our very human impulses to record, document and imitate, themes that makes the University of Toronto an exciting laboratory of ideas and practices. The processes of representation cross cultures and embrace not only how images relate to the world, but also how, as both individuals and societies, we generate and make use of images, simulations, and other representations. Simulation, imaging, and visual modeling techniques are now used routinely in disciplines as varied as neuroscience, structural chemistry, geophysics, and electrical engineering. Digital imaging and simulation technologies are also relied upon to analyze and communicate technical data—for example, to create maps of Earth from orbit and geophysical maps of the Earth's interior, maps of the large-scale structure of the universe, and three-dimensional models of molecules. And these technologies have migrated back to the arts, and especially to film-making and design, via the latest digital ICTs. Researchers at U of T from disciplines within every division are collaborating to create new kinds of representation, and to study the many applications of simulation and imaging technologies, including computational photography, semantic image retrieval, non-realistic image rendering, image-based modeling, image-based navigation, robotic-vision, biometric image analysis, intelligent vision-based interfaces, and automated medical image analysis. Given that digital imaging technologies have become so prevalent, U of T scholars are also asking how they are changing the way we document our personal lives, how we communicate with each other, what we think of privacy, and how we see ourselves.

### ***INFORMATION AND COMPUTATION***

The massive processing power generated by computer manufacturers has not yet been able to quench our thirst for speed and computing capacity. In 1947, computer engineers were predicting that just six electronic digital computers would satisfy the computing needs of the entire United States indefinitely. However, such predictions did not foresee the proliferation of personal computers, the emergence of the Internet, or the large quantities of complex data that would be generated by scientific research, which have only fueled our need for ever more powerful computers. By harnessing the quantum mechanical properties of atoms and photons, U of T physicists, mathematicians, and computer engineers are studying how quantum computers could far surpass the speed and efficiency of even the most powerful supercomputers of today. Studies of quantum cryptography, using quantum principles together with techniques from mathematics, computer science and engineering, look at how existing codes can be broken. These studies may produce practical quantum key distribution (QKD) systems, a crucial element in quantum cryptography which will eventually lead to the creation of completely secure encoding systems. Perhaps most tantalizingly of all, new computer systems and designs may one day have the ability to search large databases in a fraction of the time that it would take a conventional computer, leading to breakthroughs in environmental science, bioinformatics, the neurosciences, and any area that depends heavily upon understanding patterns and frequencies within large data sets. With so many possibilities yet to be explored, U of T researchers are at the forefront of a revolution that promises to solve our need for speed and power, change the way we do science, conduct business, communicate with each other, secure our information, and entertain ourselves.

### 3.7 BUILD: Community and Liveable Societies

What makes a society “liveable?” Liveability might be defined as the sum of the factors that add up to a community’s quality of life—including the built and natural environments, the rule of law and accountable governance, access to safe and secure food and water supplies, overall economic prosperity, health and access to affordable health care, housing, social stability and equity, educational opportunities, and possibilities for artistic, cultural, linguistic, entertainment, and recreational participation and enjoyment. But there may also be other, more abstract, determinants of liveability. Are citizens able and empowered to participate in the processes that will ultimately govern the societies in which they live? Do they feel comfortable and safe in their own neighbourhoods, and do they feel that local and national authorities genuinely protect their interests? Do people feel proud of the societies they live in, and are they sufficiently engaged to care about how their societies look, how they are organized, how they function, and how they treat the most vulnerable? As more people seek refuge from the pressures of conflict, poverty, and lack of economic opportunity and as work becomes more mobile, the question of who gains membership into which societies becomes increasingly relevant. Our scholars in such disciplines as History and Classics have shown us that many of the things we take to be the hallmarks of just and liveable societies have roots in civilizations of the past. Researchers in Architecture, Urban Planning, Geography, Political Science, Cinema Studies, Philosophy, Buddhist Studies, and many other areas are collaborating on projects designed to explore the interactions of politics, art, design, and culture in historical and contemporary urban environments. And scholars in Engineering, Computer Science, Information, Economics, Management, and Law are studying how to build and manage complex technological and operational urban systems that are also humane and facilitate civic engagement, rather than hinder it. Liveability is about more than one’s local personal, social, and physical environments: as U of T scholars are revealing in their studies of urbanization, human rights, internationalization, and multiculturalism, no society is truly liveable unless it can concern itself with global issues of security, the global environment, social inequalities, health, and justice.



*Photo by Xavier Snelgrove*

## *Examples of Sub-Themes:*

### ***LIVEABLE CITIES***

The world is experiencing the greatest migration in human history. Over 50% of the people living on this planet live in cities, and more are following every day. This rural-to-urban migration will swell the population of the world's cities from 3.3 billion today to 4.8 billion in 2030, or an estimated 60% of projected world population. With so many living in urban settings, it is urgent that we gain a better understanding of how cities work, and their impact on human health and prosperity. Canada is already over 80% urban; cities of every size are defining and re-defining Canadian life, from St. John's, Newfoundland to Victoria, B.C. In trying to understand cities and the impact of increasing urbanization, U of T investigators come together in multidisciplinary centres and networks to look at poverty and prosperity, at the effects of urban sprawl, at transportation, pollution, new theories in urban design and architecture, youth, the elderly, the middle-class, crime, social services, sport and fitness, language, arts and culture, education, health care, taxation, and industry in the urban context. But they are also asking some fundamental questions about urban living itself: just how sustainable is it? Are cities too resource-intensive? Can they be made more resilient in the face of natural disasters and other stressors on the fabric of society? Even with the best urban planning, public policy, and a prosperous economy come costs not only to the local environment but to the planet as a whole. Ideas of what make a city liveable preoccupy the discourse on urban issues in Toronto, and the work of U of T students and researchers in this area has a direct bearing on the dynamic and cosmopolitan environment in which they find themselves.

### ***HUMAN RIGHTS, JUSTICE, AND HUMANITARIANISM***

Any search for justice is based upon identifying values that are viewed as so critical to the well-being of humanity and the character of being human that they have come to be institutionalized as "human rights." Many of the basic ideas that animate the modern human rights and humanitarian movements developed in the aftermath of the Second World War, culminating in the adoption of the Universal Declaration of Human Rights (UDHR) by the United Nations General Assembly in 1948. Despite the establishment of the UDHR, however, there is still no universal agreement as to what should be regarded as a human right, and the notion of human rights itself has been the subject of ongoing intense philosophical debate and criticism for millennia, as our scholars of ancient Greece, Rome, Islam, China, and other traditions can attest. Human rights and humanitarianism scholars at U of T are moving beyond these debates by engaging normative questions surrounding the allocation, distribution and protection of sovereign authority; the role that culture, minority and indigenous rights, and the right to self-determination play in the promotion of a just international legal order; the relationships between international economic, social, equality, and labour rights, and the right to development; and international legal commitments to the liberalization of trade, services and development. The globalization of human rights and humanitarian law is creating huge expectations that globalization in general can be harnessed for the greater good. At U of T, scholars are asking if international human rights law can reinvent itself as a law of social inclusion and, in the process, redraw the boundaries of political community and the nature of political association.

### ***IMMIGRATION, INTERNATIONALIZATION, MULTICULTURALISM, AND IDENTITY***

Marshall McLuhan's vision of the global village may have been fully realized, but how does a global society function while preserving human dignity, justice, and identity? Faced with the challenges posed by declining birth rates, security, and the need to integrate large migrant populations, the themes of identity, multiculturalism, multilingualism, immigration, integration, and asylum dominate the national and multilateral agendas of many regions. Can Canada live up to its reputation as a welcoming home for people around the world seeking a better life? The values of respecting diversity and equality, both of central importance to a multicultural state with a constitution like the Canadian Charter of Rights and Freedoms, sometimes clash. Under such conditions, how do we simultaneously respect cultural and linguistic differences and protect the rights of vulnerable groups? U of T scholars in the Humanities, Law, Languages, Public Policy and Governance, Education, and Psychology are asking how issues of immigrant inequality in the labour force, the migration of highly skilled labor, the social construction of ethnicity, and the integration of the second generation of immigrant parents inform the identity of immigrants and their contributions to Canadian society. They are also studying the notions of asylum, human trafficking, and security and are asking whether immigration policies in Western democracies meet principles of justice and good government. In the process, U of T scholars are encouraging dialogue among policymakers, non-governmental organizations, and the members of migrant communities themselves.

## 4. STRATEGIC OBJECTIVES AND ENABLING ACTIONS

As Canada's top-ranked research-intensive university, U of T is well-positioned to employ its strengths to extend the boundaries of human understanding, knowledge, education, and expression, and to seek answers to the world's most pressing and challenging questions. Our aim is to be counted among the top ten public research-intensive universities in the world. To do so, we must continue to attract the best students and trainees from around the world and build a sustainable culture of inquiry that will develop the next generation of researchers. Beginning with our undergraduates and continuing with our graduate students and postdoctoral fellows, we want our learners to be asking difficult questions and thinking about how research can answer them. We must attract and retain world-leading investigators and thinkers who will benefit from and contribute to our culture of excellence in scholarship, and who will inspire colleagues and students alike. We must also be prepared to make the recruitment and funding of the very best students, nationally and internationally, a top priority. We recognize that excellent graduate students contribute greatly to the creation of a stimulating intellectual environment where new ideas—including ideas that potentially only younger scholars might generate—are encountered regularly. We must have policies, procedures, and oversight in place to facilitate research with the highest standards of ethics, integrity, and accountability. And we must recognize the strategic advantage of our tri-campus structure and that all three campuses have distinguished themselves as innovative research leaders in their own right.

It is also important to recognize, however, that U of T cannot achieve all of its goals alone, and that our success very much depends on solid and supportive partnerships among our academic divisions, our hospital-based research institutes, MaRS Innovation,<sup>6</sup> our affiliated hospitals, and numerous governmental, non-governmental, and other organizations and institutions. With our partners, U of T has built a robust research and knowledge transfer enterprise—one that puts us in an exceptional position to be leaders in the creation of strong national research networks that, with ongoing public support, will strengthen Canada's position in the global knowledge economy.

Any Strategic Research Plan must address the realities of supporting excellence within the existing funding environment, as well as provide guideposts for the research plans of the divisions and centres that themselves take their cues from the individual scholarly activities of our professoriate and excellent graduate students. This strategic plan reflects priorities within and across the divisions of our three campuses and with our nine fully affiliated teaching hospitals. Our planning process has well-defined academic and related infrastructure objectives informed by the priorities of the Canada Foundation for Innovation (CFI), the Ontario Ministry of Research and Innovation (MRI), the Canada Research Chairs (CRC) program, and the Canada Excellence Research Chairs (CERC) program, as well as other government research and infrastructure programs. These programs are essential to attract and retain outstanding researchers, to strengthen existing areas of excellence and to develop new ones, and to strengthen synergies between teaching and research. They also provide an exceptional opportunity to increase Canada's talent pool and research infrastructure and thus boost our nation's productivity and international competitiveness. Moreover, we must take advantage of new strategies of support by bringing emerging and established research leaders of demonstrated distinction across disciplinary, career stage, geographic, and sectoral boundaries. Opportunities exist through institutional and private sector partnerships, nationally and internationally, as well as through programs such as the new suite of

---

<sup>6</sup> MaRS Innovation is a commercialization partnership among the University of Toronto, the Toronto Academic Health Sciences Network hospitals (TAHSN), Ryerson University, York University, the Ontario Institute for Cancer Research, the Ontario College of Art and Design, and the Thunder Bay Regional Research Institute.

U of T Connaught Funds. Opportunities also exist to align research with divisional and University advancement strategies. Distinguished Chairs and Professorships can help create excitement and drive gifts, and advancement expertise can assist interaction with granting bodies other than the traditional Tri-Council sources of support.

## **4.1 Strategic Research Objectives**

The following Strategic Research Objectives are not intended to limit intellectual freedom and creativity; rather, they have been articulated to provide guideposts for the divisions as they pursue their own agendas in research. They represent the collective aspirations of the research and scholarly outputs of the institution. Divisions will develop their own, more detailed objectives and benchmarks that extend over the life of the plan.

### **1. STRIVE FOR GLOBAL LEADERSHIP**

The University of Toronto is on a path to entrench our institution among the top ten research-intensive universities around the world. We will benchmark our success in terms of the outcomes of our educational and research programs, our research impact, publications, awards, international recognition, or other areas deemed appropriate according to academic unit, discipline, and activity. We will also benchmark successes in creative knowledge application and innovation. Faculty and students will be recruited from the best in Canada and around the world. Partnerships will focus on international peer institutions in academia, the government, and the private and social sectors that lead to excellent research outcomes and added value.

### **2. ADDRESS QUESTIONS OF LOCAL, PROVINCIAL, NATIONAL, AND INTERNATIONAL IMPORTANCE**

Since its foundation almost 200 years ago, the University of Toronto has continued to grow as an institution that offers solutions to the challenges that face local, provincial, national, and global communities. This Strategic Research Plan sets out seven broad scholarship themes that address urgent questions facing people around the world, including right here in Toronto. We will consistently strive to apply our research to these challenges. Given the tremendous expertise of our faculty in virtually every discipline that affects humanity and the planet, the University of Toronto can play a powerful role in addressing the problems we face by advancing solutions that are sustainable, equitable, and that promote diversity and social justice.

### **3. PROVIDE WORLD-CLASS TRAINING THROUGH THE INTEGRATION OF RESEARCH AND TEACHING**

Research and teaching at the University of Toronto are inextricably linked, and the University is dedicated to promoting and nurturing this dual mission. Research activity should, as appropriate, actively engage undergraduate, graduate and postdoctoral students. Research intensity and diversity at the University of Toronto should enhance the entire educational mission and position the institution as the “go to” place for future students, researchers, and innovators. Ongoing graduate intensification on all three campuses signals our intention to strengthen our research performance and relate it to teaching.

### **4. MAXIMIZE THE APPLICATION OF RESEARCH AND THE INNOVATION OF CREATIVE CONCEPTS**

Institutions of higher learning have an obligation to help translate their discoveries and insights to the benefit of the public good, where this is appropriate. A goal of the University of Toronto is to maximize its positive impact on society and the Canadian economy by establishing priorities and mechanisms to facilitate translational research and its commercialization. The research themes outlined in this Strategic Research Plan have been identified with this objective in mind. Evidence

for establishing return on investment will require the development and evaluation of new methods of measuring impact using quantitative and qualitative metrics.

**5. FACILITATE INTRA- AND INTER-DIVISIONAL COLLABORATION WITHIN U OF T AND ACROSS INSTITUTIONS, CANADA-WIDE, AND INTERNATIONALLY**

Collaborations with colleagues of the highest order at other institutions, both within Canada and internationally, can enable outstanding work right here at U of T. We will actively seek out excellent collaborators wherever we find them. Given that advances in research often occur where disciplines meet or overlap (e.g., biomedical engineering or digital media), we must promote division-crossing, multidisciplinary and interdisciplinary collaboration. This, too, will not be restricted to intra-institutional partnerships but will include Canada-wide and international initiatives.

**6. CREATE A CULTURE OF SCHOLARSHIP WHERE INTERACTION, COLLABORATION, AND COMMUNITY ARE VALUED AND FACILITATED**

The research enterprise and output at the University of Toronto must be greater than the sum of its constituent parts. Often our best work gets done when we come together with colleagues in socially, culturally, and intellectually vibrant environments. The University must create the tools, policies, and procedures that allow this to happen freely and easily. Organizational structures and processes should serve the University in multiple dimensions to create these environments, and to create a more unified, supportive, and inclusive community of scholars. Finally, our institution will strive to exemplify the values and culture we espouse in our research endeavours, acting as a living laboratory for sustainability initiatives and examining methods to reduce our research-related resource consumption and emissions, without narrowing the scope of our scholarly endeavours.

## **4.2 Enabling Actions**

The following Enabling Actions recognize that concrete steps will have to be taken to move U of T closer to our strategic research objectives. The details of how these actions are to be implemented will be established over time in consultation with the divisions and our external stakeholders.

**1. ATTRACT, FUND, AND RETAIN THE WORLD'S BEST TALENT**

The University of Toronto will recruit and retain the world's top faculty, staff, students, and other trainees. Special attention will be paid to how we can best implement this action by considering strategies to increase our current recruiting success rates and funding mechanisms. These include aligning recruitment with research priorities, developing strategies for attracting and retaining the best, and developing orientation and mentorship programs for new recruits, and, indeed, for those across the career-span. A balanced diversity of our faculty will be achieved by proactively seeking best-qualified candidates from underrepresented groups for endowed chairs, tenure track positions, and Canada Research Chairs.

**2. DEVELOP RESEARCH LEADERSHIP SKILLS**

The University of Toronto will develop leadership training opportunities for individuals who aspire to assume responsibility for leading and managing research teams. Enhanced knowledge and training in leadership, management, and academic administration will enable a new generation of leaders to assume responsibility for developing a robust framework for research endeavours at the University of Toronto.

### **3. ENCOURAGE BOLD AND INNOVATIVE INQUIRY**

We recognize that research success often depends on a combination of long-term planning, flexibility and intellectual agility that enables researchers to respond rapidly and creatively to new initiatives and emerging areas in their fields. The University of Toronto will encourage bold scholarly exploration in established and emerging fields through strong advocacy and by promoting new and existing funding opportunities.

### **4. ADVOCATE AND COMMUNICATE STRENGTHS AND SUCCESSES**

Communication, to both internal and external stakeholders, is essential to the success of a strategic research plan. The University of Toronto will communicate what we are planning to do and how we hope to achieve our goals and objectives, and will regularly report the outcomes of our research and scholarship. We will also continuously refine communications practices for gathering and disseminating information related to research productivity. An important component of this communication strategy is public engagement. The University will proactively communicate its activities to the public and governments. A key message will be a call for the full costs of research to be provided by funding agencies that are based on clear metrics that define impact and return on investment. We must also tell the stories of our people and their many successes.

### **5. CONTRIBUTE TO ECONOMIC, CULTURAL, AND SOCIAL DEVELOPMENT**

The University of Toronto will endeavor to translate the results of our scholarship to the benefit of Canadian and global society. Mechanisms will be developed to achieve this goal. A culture of social accountability will be encouraged. Knowledge and innovation from research and scholarship need to be applied effectively. Communication and cooperation should exist between the divisions and the Innovations and Partnerships Office within the Office of the VP Research. Faculty involvement in innovation should be recognized divisionally and centrally in tenure and promotion. And we are committed to exemplifying this process in our own activities as an institution, by acting as a test bed for sustainability research and exposing new innovations to scrutiny and study by our students.

### **6. DEVELOP NEW INTEGRATED GOVERNANCE MODEL FOR RESEARCH ACROSS THE UNIVERSITY AND WITH KEY PARTNERS**

To enable interdisciplinary and integrated research themes, the University of Toronto will develop new models of governance that will enhance partnerships and engagement of faculty and their leaders across divisions and with key external partners. Increased flexibility in terms of the aggregation of investigators on and off campus with clear oversight and rules of engagement will be necessary.

### **7. ACQUIRE AND MAINTAIN STATE-OF-THE-ART INFRASTRUCTURE**

Successful research and scholarship, as well as recruiting faculty and trainees, are greatly facilitated by state-of-the-art facilities and infrastructure. Divisional strategic plans need to consider this key parameter, which often determines whether research groups are competitive for funding opportunities. Research space should be a major consideration in requests for funding and the subject of both central and divisional advancement programs. The University of Toronto research leadership will work with senior divisional leaders to implement systems that will permit monitoring of the state of our research facilities and equipment and to identify needs in advance of funding opportunities. At the same time, we are committed to pioneering the development of efficient research operations, which use environmental and other resources carefully and reduce consequent waste and toxic emissions. We will explore new ways to accomplish these goals within our larger research plans. Funds to permit improvements for high priority projects will be sought divisionally and centrally. Particular attention will be directed at achieving institutional success in provincial and

national infrastructure programs, as well as advancing strategies to decrease our reliance on such programs. We also recognize our obligation to contain the costs of research, and in particular avoidable utilities and resource costs, and reduce, wherever possible, the resource consumption and waste emissions, as well as the associated costs generated by our research activities.

#### **8. MAINTAIN A COMPETITIVE AND SUSTAINABLE RESEARCH FUNDING BASE**

The University of Toronto will make every effort not only to increase the level of Tri-Council funding but also to encourage applications to those programs that are undersubscribed by the University. We must promote a culture of research partnerships with the private and public sector that help leverage funding to maximize the impact for all. Supports will be developed by the University research leadership to facilitate timely communications about funding opportunities, provide grant writing workshops, and promote interdisciplinary and partnership applications. The leadership must continue to be strategic with our advocacy at government levels, and we must be responsive to new funding opportunities and work with our colleagues in the Division of University Advancement and in the divisional advancement offices.

#### **9. DEVELOP PERFORMANCE INDICATORS AND BENCHMARKS**

A strategic research plan needs to consider how to measure and record the results of research at U of T. Each division should set targets regarding research funding levels and impact. Divisions and the University will annually compare our results to the Strategic Research Plan's broad objectives, to the more detailed divisional plans, and to the accomplishments of peer institutions. Research fields continuously evolve. We need robust mechanisms to determine whether the consequences of our research activities and programs are meeting our goals and objectives, and these mechanisms must allow for changes in direction and the cessation of unproductive or wasteful activities. National and international performance measures should be considered when developing our own, but we must also consider new ways to evaluate areas of innovation and excellence that reflect the impact of the collective value of the University of Toronto and its partners. And we must also recognize the need to encourage and assess scholarship and activity that is unique and distinct, and that certain kinds of scholarship and activity are not easily amenable to measurement through traditional academic performance indicators. U of T has an opportunity to lead by developing meaningful standards and metrics in these areas.





UNIVERSITY OF  
**TORONTO**

**Office of the Vice President, Research**

Simcoe Hall

27 King's College Circle

Toronto, Ontario

Canada M5S 1A1

Tel: 416-978-4984

[vp.research@utoronto.ca](mailto:vp.research@utoronto.ca)

[www.research.utoronto.ca](http://www.research.utoronto.ca)