IDEAS THAT COULD CHANGE THE WORLD

EXCELLENCE, INNOVATION, LEADERSHIP: RESEARCH AT THE UNIVERSITY OF TORONTO
1827.

The frontier town of York, soon to be called Toronto (as it was known by Aboriginal groups who had lived in the region for 11,000 years), has a population of about 2,000.

John Strachan returns from England with a royal charter for the “establishment of a college...to continue for ever, to be called 'King’s College.'”

And out of 150 acres of forest north of the city, a university is born.

TODAY.

King’s College transformed into the University of Toronto. The forest is now U of T’s St. George campus, one of three with U of T Mississauga and U of T Scarborough.

The University has grown with the city.

Toronto, the economic and cultural centre of Canada, now has a population of more than 2.5 million, including descendants of the original Aboriginal peoples, and is part of an urban region of more than 5.5 million.

U of T has become the home of Nobel Prize Laureates and discoveries and scholarship that have changed the world. It is an academic and research powerhouse ranked among the world’s leading institutions. In the 2009 Times Higher Education-QS World University Rankings, U of T was ranked by academic peers globally as a leader in all fields:

• 8th in the world in Engineering and Information Technology
• 11th in the world in Life Sciences and Biomedicine
• 11th in the world in Arts and Humanities
• 14th in the world in Natural Sciences
• 15th in the world in Social Sciences

At the core of these achievements is our outstanding research community, made up of thousands of brilliant scholars and students who create knowledge that helps to move the world forward.

This publication showcases some of our current innovators as they explore 10 key questions that will transform the future of global society. We stand committed to continuing our pursuit of knowledge creation and research impact for the benefit of our next generations.

PROFESSOR R. PAUL YOUNG, PhD, FRSC
Vice President, Research
Are universal human rights possible?

RON DEIBERT

Information and communication rights and freedoms – such as access to information, freedom of speech and privacy – are integral to human rights. Cyberspace is the domain within which such rights are contested. There is an arms race in cyberspace today that threatens human rights online, characterized by Internet censorship, cyberwarfare, espionage and surveillance. Human rights are possible, but citizens must be vigilant against these breaches and protect and preserve cyberspace as an open, global commons.

AYELET SHACHAR

One of the most important questions I have ever responded to is whether or not human rights are portable. Do we take them everywhere we go? I think not. Rights are a product of interpretation, generally not our own, and generally not conducive to Indigenous sensibilities. Universal rights are something to aspire to, but they are not a common feature in the world in which we presently live.

DAVID RAYSIDE

As a set of ideals to strive for? Absolutely! Is there agreement on what rights claims are legitimate? Absolutely not! Working on gender equality and sexual diversity means regularly facing claims that some rights are more important than others. Or alternatively, that western values have no universal application. Tricky territory and social context surely matters. But hiding behind cultural or religious difference is a popular cover for stark prejudice, ignorance and oppression.

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Is War Inevitable?

**THOMAS HURKA**

War’s an evil, but it can prevent greater evils such as the violation of a people’s right to political self-determination or, in extreme cases, genocide. The question I study is: When is war morally justifiable, or when are the evils it can prevent sufficiently important to justify the death and destruction it will cause? Many wars are wrong, but some are worth fighting. How do we tell the two apart?

**JANICE GROSS STEIN**

Evolutionary biology tells us that we are hard wired to fight or flee when we sense danger. Evolutionary psychology tells us that we naturally distinguish between our group and theirs. These two imperatives, working together, create a powerful tendency to violent conflict. Over time, however, at a painfully slow pace and at great cost, we have learned to discipline these tendencies so that today, in some parts of the world, war is inconceivable.

**MICHAEL INZLICHT**

While intergroup conflict is inevitable, war is more than conflict—it is violent, aggressive conflict that takes thought and deliberation. Psychologists have argued that one of the features that separate us from other animals is our ability to control our automatic impulses. So it is possible to prevent those inevitable conflicts from escalating into war. Just because it’s possible, however, doesn’t mean it’s easy. Inhibiting predominant desires is hard work, taking motivation, ability and effort. If we want it enough, if our desire to end war is autonomously chosen and self-determined, then war is not inevitable.

If we can bring ourselves to the realization that threats of indiscriminate slaughter are no more to be tolerated than is the implementation of those threats, we shall have taken a historic step toward the outlawing of war.

**Professor John Polanyi**

Nobel Laureate in Chemistry (1986), nuclear disarmament proponent

**Noblesni**

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**U of T Scarborough Department of Psychology and Toronto Laboratory for Social Neuroscience**
How will the new economy transform our lives?

RICHARD FLORIDA
When we hear the words “new economy” most of us think of Google, RIM and other high tech companies, but I believe the period of transformation we’re entering goes far beyond just technology. The industrial age brought with it massive changes in employment, housing, transportation and culture. The creative age will see paradigm shifts on a similar scale. Toronto, and really all of Canada, is uniquely positioned to be at the forefront of this transition.

EUGENE FIUME
To the extent the “new” economy will be different from the “old”, it is that technology will allow the provisioning of labour, goods and services to become ever more global. The people of many nations will be able to participate and prosper, but competitive forces could push us all into a race to the bottom. Research, creativity and innovation will be essential, but the new economy, like the old, will require human wisdom to transform new ideas into global races to the top.

JUDITH TEICHMAN
Economic globalization has not produced equitable nor sustained prosperity in many parts of the world. In some disadvantaged regions it has contributed to a marked rise in political and criminal violence. The way recent economic events affect us depends entirely on us both as a society and as “citizens” of the world.

Jim Balsillie
U of T alum, Co-CEO of Research In Motion, Ltd., founder, Balsillie School of International Affairs

The New Economy offers global society in the 21st century powerful transformative possibilities. How we communicate with each other will continue to evolve and mobility will become even more important. The digital services of the near and far future will have richer media and more powerful tools – and they will be even more personalized, contextual and inter-related. This communications transformation will apply to every part of a borderless global society – business, consumers and government.
Personalized medicine: What’s possible? What’s right?

WAYNE SUMNER
As medical science continues to push back the frontiers of the possible, it raises ever new questions about the ethical. I believe that philosophers have an important contribution to make to the vital public debates over these questions. My own current research is addressed to one of them: What can – and should – we do to avoid persons in the dying process to end their lives on their own terms?

JOHN DICK
We are making significant advances in our understanding of the genetic makeup of cancer tumours and their response to drugs. However, we are also recognizing that the cells that make up tumours have differing abilities to sustain tumour growth and to respond to therapies. Now we need to go beyond sampling the genetics of bulk tumours and delve a layer deeper to learn more about the genetic regulators of stem cell-like cancer cells to determine patient prognosis and to create therapies to destroy these cells.

MOLLY SHOICHET
Regenerative medicine promises to overcome diseases rather than simply treat symptoms. We’re tackling the most challenging organs – the brain and spinal cord. We’re delivering therapeutic molecules and stem cells to stimulate regeneration after a traumatic injury such as stroke or spinal cord injury. Working with neuroscientists and neurosurgeons, we test innovative solutions to these complex problems. Our goal is to promote healing when it does not happen on its own.

ALEED EDWARDS
The sequencing of the human genome has provided a stark reminder of our commonality with our fellow humans, but also our individuality. To discover new medicines, these commonalities and differences must be considered, both for economic reasons, as well as to ensure that the safest and best medicines are produced. Our goals are to facilitate this process by providing scientists with research tools that have no restriction on use and to promote the concept of open access science to advance human health.

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I’m excited about the potential that the move towards personalized medicine presents. Through innovative approaches to medicine, and the advancement of research, health care providers will increasingly have the opportunity to deliver customized care, based upon factors specific to an individual. This is a landmark outcome of targeted and innovative thinking that will change our approach to health care, and ultimately, benefit patients.

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Can vaccines save us?

Allison McGee
Before smallpox vaccine was used to eradicate smallpox, one person in the world died every second from the disease. Vaccines can save us from many diseases – but only if we can rise to the challenge of new vaccine development against increasingly difficult target diseases, if we can build societies that ensure they are available to the most vulnerable and if we learn to better understand the human psychology that consistently leads us to underestimate their value.

Peter A. Newman
Vaccines have made tremendous contributions to global health. Nevertheless, many diseases, such as HIV/AIDS being one that I focus on, travel along the fault lines of poverty and disenfranchisement. Persistent disparities in health and access to care that stem from structural inequalities and social injustices may leave us with great vaccines but with limited accessibility and acceptability to the vulnerable populations who need them most. There is no vaccine for stigma and discrimination.

Kevin Kain
Despite the remarkable contribution of vaccines to advances in public health, their potential impact on even greater challenges such as HIV, malaria and cancer are threatened by a growing tide of misinformation and anti-scientific thought. So while it is clear that vaccines alone will not save us, the more pressing question is whether we can save vaccines from us. Perplexing, how time after time, we can’t seem to recognize a good thing when we have it.

This is an idea whose time has come with greater urgency than ever before, mostly because AIDS has added such a vast human population at risk. We are making tremendous progress with some vaccines. We have a vaccine to combat Hepatitis B and now to prevent the Human Papillomavirus so as to eliminate the risk of cancer. We have significant possibilities in vaccines for children, we’re also testing a new vaccine for malaria and soon for tuberculosis. With HPV, prevention, treatment and care are, of course, critically important, but the only way to bring an end to the disease conclusively is through a vaccine. Nothing else will suffice.

Stephen Lewis
U of T Nancy Beleza Chair of Love, Senior Fellow, Massey College, Chair of the Board, Stephen Lewis Foundation, former United Nations Special Envoy for HIV/AIDS in Africa.
Is there life elsewhere in the universe?

NORMAN MURRAY

We don’t understand how life started on Earth, so it is difficult to say how common life is. This motivates the intense ongoing exploration of Mars and of Jupiter’s moon Europa. Finding Earth-like planets around solar type stars, as the Kepler telescope is expected to do in the next three years, would allow us to look for signs of life, such as oxygen, in those planets’ atmospheres. Astronomers may be able to answer the question empirically!

BARBARA SHERWOOD LOLL

An important component of astrobiological research actually involves the study of life on Earth. Investigations of the microbial life in extreme environments on this planet have profoundly impacted our search for life elsewhere. The discovery of microorganisms capable of surviving from the geochemical energy discharging at deep sea hydrothermal vents changed our understanding of the diversity of metabolic processes that can sustain life. This discovery and other research findings have wrought transformational change in search strategies for life on other planets and moons.

GABRIELE D’ELEUTERIO

There was a time when the word ‘robot’ was as much a staple in science fiction as the idea of finding life elsewhere in our universe. But the global aerospace community has made important leaps forward in designing technology that will help us answer this question today. Robots are a fact of life in space science and we are sending robotic explorers off to hunt for signs of potential life on other planets. Through this amazing technology, I expect that someday, somewhere we will indeed find those ‘alien’ life forms. Won’t that be thrilling? Or maybe I’m just being hopeful.

It is presumptuous of us to think that the third planet of an average solar system in an average galaxy, when there are several billion galaxies around us, would be the only source of life. While it’s an incredible challenge to search for evidence of life elsewhere in the universe, we must continue that search. It is a fundamental question, and the day we find proof, even at the bacterial level, of life somewhere else in the universe besides Earth, will be a tremendously important event for humankind.

Julie Payette

U of T alumnus, Honorary Doctor of Science, Canadian astronaut

University of Toronto Institute for Aerospace Studies

Department of Geology

Canada Research Chair in Isotope Geochernistry of the Earth and the Environment

Director, Canadian Institute for Theoretical Astrophysics

Canada Research Chair in Astrophysics
Will we be ready when the oil runs out?

HEATHER MACLEAN

Society must transition to energy systems that have much lower negative impacts on the environment and public health before oil runs out. No fuel is without associated risks and negative consequences – I take a lifecycle approach in evaluating the full impact of alternative energy systems. In evaluating replacements for oil, it is critical to examine the associated tradeoffs and find the alternatives with the highest overall net benefits to society. Technological innovation is important but behavioural change is urgently needed.

GREG SCHOLES

A number of parallel alternative energy solutions will eventually be needed. Nature’s primary approach is to use energy from the sun and it is likely we will follow suit. Nature’s solar cells have been improved through 3.5 billion years of evolution. Plants, algae and other photosynthetic organisms have thus developed tricks that lie behind their success that will inspire new paradigms for solar energy conversion that will benefit humankind.

JOHN KIRTON

When the oil runs out Canada will do well and the world could too. Canada is a clean energy superpower. With the world’s second largest territory, it leads in producing the uranium needed for safe, climate-friendly nuclear energy. With the world’s largest fresh water supply, it has enormous hydroelectricity. It has world-leading supplies of natural gas and the technology to get more. And with the world’s longest coastline, it could be a wind energy superpower too. All Canada needs are the policies and infrastructure to get all these abundant, affordable oil alternatives to Canadians and the world.

We’re not going to run out of oil soon in a geological sense, but we are starting to run out of oil we can afford to burn. Our natural instincts are to find new sources of supply so we can sustain our energy-intensive lifestyle – which may, in fact, be unsustainable under any form of energy supply. Instead, we must re-organize our economy to expend less energy.

How? Move from our current mode of economic organization that is energy and particularly oil-intensive – the Global Economy – to a much more local economy.

Jeff Rubin

U of T alumnus, former Chief Economist, CIBC World Markets, author, Why Your World is About to Get a Whole Lot Smaller (2009)
Is lifestyle the greatest cure of all?

Jan Angus

Exercise and diet contribute to healthy aging. Yet lifestyle is not simply a product of whether we exercise and eat well. It also emerges from constraints, opportunities, and resources that are differently distributed in society according to gender, ethnoracism and discrimination against people with disabilities. Before we declare lifestyle the greatest cure of all, research is needed to understand how these inequitable conditions lead to health disparities and chronic illness in an aging population.

Guy Faulkner

Evidence shows that being physically active adds years to life, but more importantly, life to years. Physical inactivity is the most common risk factor for premature death in Canada. My research examines how we can help people be more active more often — through economic levers such as tax credits to subsidize physical activity, social marketing campaigns like ParticipACTION or modifying the built environment to make parents more confident in letting their kids walk to school.

David Jenkins

Humans are successful due to their ability to thrive on very different kinds of diets. The challenge is now to choose the diet which is both good for us and for the rest of the planet. I believe such diets must focus on plant foods. They will be constructed to maximize health and prevent those chronic diseases that are major causes of mortality and suffering and are increasingly making contemporary health care economically unsustainable.

Jayna Hefford

Is it too late to reverse climate change?

**STEPHEN SCHARPER**

Our present ecological moment calls for the emergence of a new ethical framework. Our collective challenge is to grapple honestly and humbly with the sobering indicators of climate change and at the same time remain open to a future lined with such intangible essentials as hope, societal compassion and a re-valuing of the Earth. All of these, in concert with scientific diagnostics and technological shifts, are requisite companions as we strive to confront climate change candidly and effectively.

**KIMBERLY STRONG**

Climate change is happening, as seen in atmospheric and ocean temperatures, retreating glaciers, declining Arctic sea ice, rising sea levels and changing precipitation patterns. Greenhouse gas concentrations have increased over the past 250 years due to human activities. These gases will remain in the atmosphere for many years. Even if we froze greenhouse gases at their 2000 levels, global surface temperatures are predicted to rise at about 0.1°C per decade. Without reductions in greenhouse gas emissions, about twice as much warming is expected, with serious consequences for the planet.

**SPENCER C.H. BARRETT**

Climate change is the most important environmental problem facing the planet today. It is influencing the distribution of plants and animals and is affecting biodiversity and ecosystem function. We are already seeing shifts in the ranges of species and in their behaviour and reproduction. Our work on introduced invasive plants shows that some species have the necessary genetic variation to adapt to changing environmental conditions. However, others inevitably face extinction, an outcome that cannot be reversed. Concrete action on climate change is a political imperative that cannot be delayed.

**Robert Bateman**

U of T alumnus, Honorary Doctor of Laws, artist, naturalist, environmental activist
Why are people still hungry?

Josée Johnston

Like the economic system more generally, the global food system is segmented into multiple tiers. While it produces an astonishing variety of foods for affluent consumers, it has been far less successful promoting equitable food access or sustainability. Food activists, particularly in the Global South, critique this system and demand food sovereignty – the ability to produce foods for one’s own population, on one’s own land and not focusing exclusively on export markets.

Herbert Kronzucker

The challenge of furnishing sufficient food for the burgeoning human population represents one of the most daunting issues of our time. Current rates of population growth outpace agricultural gains more than threefold. While warfare and distribution inequities play important roles in producing hunger around the world, the issue is, at its core, one of fundamental biology: the capacity for primary productivity in the world’s agricultural fields. Solutions require unprecedented research investment and human intellectual dedication.

Valerie Tarasuk

Canadians support food banks and other food assistance programs to help those in need. Although such efforts are a testament to the compassionate nature of Canadians, our research suggests that the net result of this community action is a limited, fragmented ‘system’ of food relief, with little capacity to respond to poverty-related problems of hunger. To address the unmet needs that underlie these demands for food assistance, a more adequate and inclusive system of income assistance is required.

Craig Kielburger

World hunger is very closely connected with the abuse and exploitation of children around the world. As families struggle with extreme poverty, it’s too often kids who bear the brunt of its effects. They miss out on meals, face illness that could be prevented through proper nutrition and are often denied a quality education that would empower them to break the cycle of poverty. By fighting apathy and encouraging people to take action against the injustice they see, we can put an end to world hunger.

Craig Kielburger, U of T alumnus, child rights advocate, founder, Free The Children
Toronto Star.

and ethics columnist for the Bible. A popular media

anthropologist, of Cunningham, a social-cultural co-author with his wife, Hilary

and Time: A Political Theology of Redeeming the

violence and nonviolence. He

ecology, ecological values and ethics, religious ethics and the areas of environmental

Professor Emeritus in the Department of Philosophy.

of Social Work. She has 25

years of experience working in community and policy

studies at the Centre for Research Chair in Tissue

for making atmospheric measurements from the ground, balloons and space to study ozone depletion, air quality and climate. She runs the U of T Atmospheric Chemistry and is a founding member of the Canadian Network for the Detection of Atmospheric Change. Strong has served on national and international committees and panels and has published more than 65 refereed papers.

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GREG SCHOLE

Greg Scholes is a professor of chemistry. His current research focuses on interactions between molecules that are initiated by light, for example, photosynthesis in algae. His many honours include election to the Royal Society of Canada’s Academy of Science in 2009 and the Royal Society of Canada Rutherford Memorial Medal in Chemistry. In 2017, Scholes was elected to the Royal Society of Canada. Life Sciences and the Royal Society of Canada and widely recognized as one of the world’s leading moral philosophers. In his most recent book, The Helpful and the Obnoxious, he focuses on the limits of free expression. The book was awarded the C.B. Macpherson Prize for Political Theory by the Canadian Political Science Association.

Judith Teichman is a professor in the Department of Philosophy. His recent work in ethical theory, bioethics and political philosophy earned him the 2009 Molson Prize in Humanities and social sciences. Sumner is a fellow of the Royal Society of Canada and widely recognized as one of the world’s leading moral philosophers. In his most recent book, The Helpful and the Obnoxious, he focuses on the limits of free expression. The book was awarded the C.B. Macpherson Prize for Political Theory by the Canadian Political Science Association.

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