The University of Toronto:

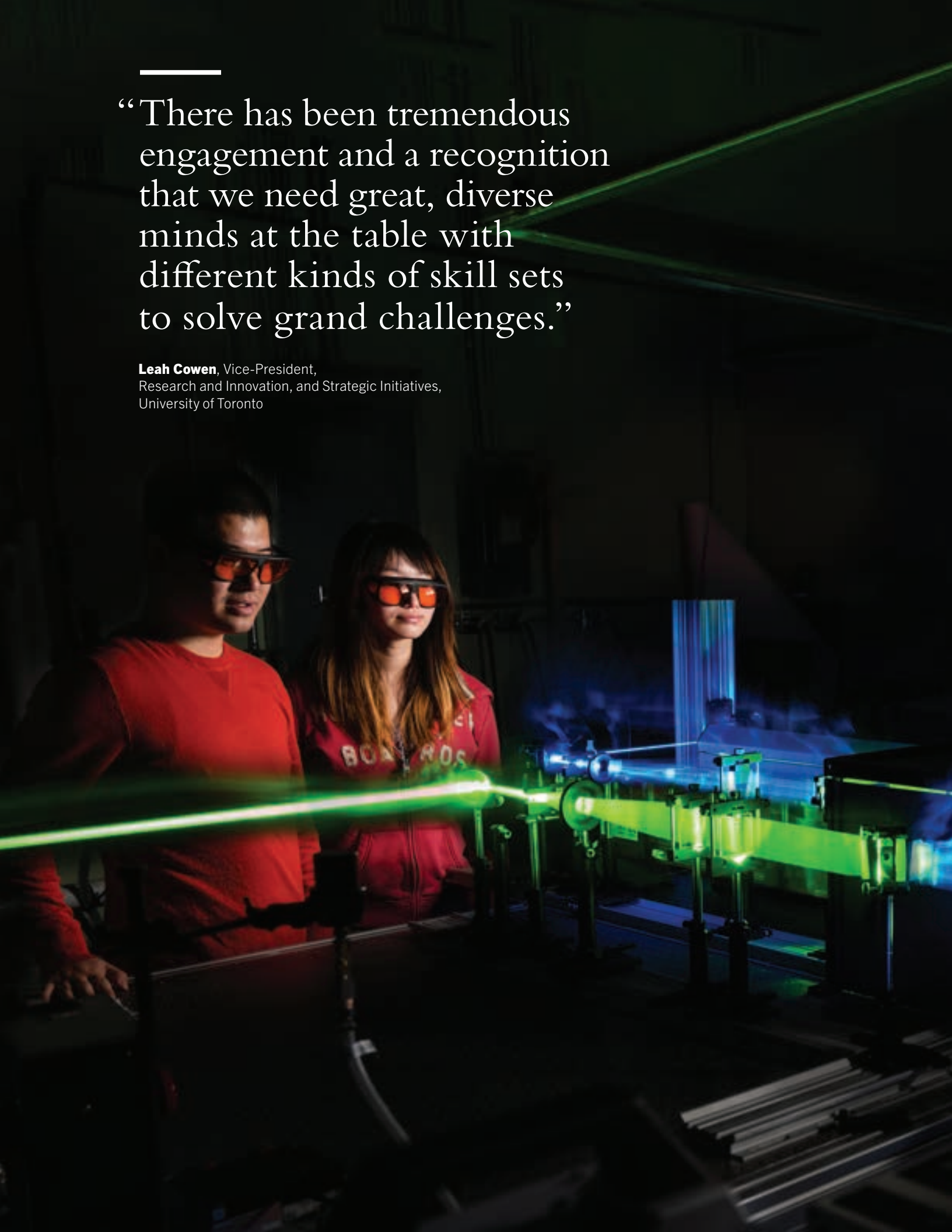
Building competitiveness at the frontiers of science

UNIVERSITY OF TORONTO

DEFY GRAVITY

"There has been tremendous engagement and a recognition that we need great, diverse minds at the table with different kinds of skill sets to solve grand challenges."

Leah Cowen, Vice-President,
Research and Innovation, and Strategic Initiatives,
University of Toronto



How science fuels growth

The economy is changing. From robotics to advanced manufacturing, clean technology to artificial intelligence (AI), advances in science and technology are driving new growth, new jobs and the opportunity to improve the lives of people around the world.

Canada and Canadians are well-positioned to benefit from these science-based advances. Strategic investments in AI, bioinnovation, life sciences and clean technology are already working to revitalize industries, create growth and improve lives. Emerging technologies — from quantum computers to advanced materials — hold the promise of further accelerating productivity and growth.

Recent investments by the United States into energy security, R&D, regional high-tech hubs and a bigger STEM workforce create a magnet for talent and further investment. To be comparable and maintain competitiveness, Canada needs to invest $75 billion here at home over the next decade.

Canada's research universities play a critical role in identifying and translating scientific advances into productivity-enhancing innovation in partnership with industry. The University of Toronto is the country's leading university, with 330 Canada Research Chairs working at the cutting-edge of science and discovery. U of T is an engine of advanced research, second only to the Massachusetts Institute of Technology for the number of research-based startups it has produced and among the top five universities in the world for the number of publications in leading journals.

Drawing on the University's deep excellence, innovation and talent, new strategic research initiatives are building collaborations across disciplines. Through the Institutional Strategic Initiatives portfolio, U of T is supporting interdisciplinary scientific discoveries that promise to match the complexity of the issues we face. With this cross-disciplinary approach, U of T is addressing the scale and scope of the challenges before us and helping transform groundbreaking discovery into societal solutions, products and jobs.

The power of place

Our location is a tremendous advantage. The Greater Toronto Area is recognized among the world's top centres for financial, intellectual and human capital development. The research and talent at U of T and the 14 Toronto-area hospitals that make up the Toronto Academic Health Sciences Network (TAHSN) support one of the most vibrant ecosystems of life and health sciences, biotechnology, AI and tech in the world.

The Greater Toronto Area is North America's third-largest tech centre and the fastest growing market for high-tech jobs. It is also home to 40 per cent of Canada's life sciences firms and 55 per cent of the country's pharmaceutical companies. With approximately 9,000 STEM graduates each year, U of T and its alumni help anchor Canada's tech and biomedical ecosystem.

U of T's proximity to these industries facilitates academic-industry partnerships and allows companies to thrive. U of T attracts more research funding from the private sector than any other university in Canada—driving commercialization outcomes—and is a global powerhouse in translating research into patents, companies and jobs.

"Talented people drive world-changing research, and capital follows talent."

Meric Gertler, President, University of Toronto (*The Hill Times*, September 2022)

Top 50
for 46 subject rankings, more than any other university in the world
(QS Subject Ranking 2022)

#12
for Research
(2023 Times Higher Education World University Rankings)

$1.45 billion
in research funding to U of T and partner hospitals
(from all sources, Web of Science 2022)

#2
among North American universities for number of startups
(AUTM 2020)

#1 GTA
highest tech talent growth region 2016–2021
(CBRE 2022)

At the centre of a dynamic ecosystem

Research: the foundation of competitiveness

Tech clusters power national science, technology and innovation strategies around the world.

In Canada, the Pan-Canadian Artificial Intelligence Strategy invested $125 million in the country's research institutions. Since its launch in 2017, the strategy has helped create a tech ecosystem with thousands of new companies and jobs, harnessing the capabilities of machine learning and training and recruiting a generation of AI researchers drawn from the world's top talent. More recently, extraordinary investments that bolstered Canadians' access to life-saving treatments and vaccines for COVID-19 are leading to a renewal of the country's bioinnovation and biomanufacturing landscape.

In addition, programs that increase Canada's ability to train, recruit and retain top talent such as the Canada First Research Excellence Fund, the New Frontiers in Research Fund, the Canada Biomedical Research Fund and the Biosciences Research Infrastructure Fund recognize the importance of investing in the country's research enterprise.

Through fundamental research and collaboration across disciplines, U of T researchers are transforming the speed of discovery, increasing the private sector's capacity to compete in international markets and strengthening Canada's position in the global knowledge economy.

From AI to life sciences and advanced materials to clean energy, the University of Toronto, through its Institutional Strategic Initiatives, is driving the research that will support the success of new national science-based economic strategies.

Acceleration Consortium

Advanced materials technology has been identified as an industry with the potential to produce trillion-dollar markets by the end of the decade. This technology will pave the way for molecular innovation, leading to new drugs, therapeutics and advanced materials for use in a range of sectors, including energy, mining, transportation, buildings, manufacturing and financial services.

The Acceleration Consortium's Materials Acceleration Platforms (MAPs) are self-driving labs that combine the power of robotics, AI and advanced computing to produce sustainable and efficient materials. MAPs can reduce the time and costs associated with developing new materials from an average of 20 years and $100 million to as little as one year and $1 million.

The rapid development of this promising technology has established the AC as a magnet for leading research talent from the private and public sectors. With 100 academics from over 40 research institutes and over 20 private and public sector organizations including Merck KGaA, Genentech, the National Research Council and Natural Resources Canada, this initiative will catalyze accelerated materials discovery in the Greater Toronto Area and Canada.

acceleration.utoronto.ca

CLIMATE POSITIVE ENERGY

The clean energy sector is projected to grow to $26 trillion and create 65 million new jobs globally by 2030. Climate Positive Energy is examining three critical issues facing Canada as it seeks to tap into this global market and address climate change:

- re-envisioning Canada's energy systems
- advancing clean energy policies and technologies
- ensuring a just and equitable energy transition.

The initiative brings together over 100 faculty and 120 graduate students and postdoctoral fellows across a range of disciplines—from engineering to political science to economics—who are focused on helping the country achieve its net-zero emissions target by 2050. New facilities like the Grid Modernization, Testing and Simulation Centre will provide industry with the ability to test market-ready green technologies and products before they are integrated with the grid, supporting decarbonization in the power system.

Within the initiative, students are receiving training and learning opportunities that will help close the green skills gap in Canada and provide workers for a clean energy sector expected to grow by 50 per cent or 639,000 jobs by 2030.

cpe.utoronto.ca

SCHWARTZ REISMAN INSTITUTE FOR TECHNOLOGY AND SOCIETY

Created in 2019 through a historic $100 million gift from Canadian entrepreneurs Gerald Schwartz and Heather Reisman, the Schwartz Reisman Institute for Technology and Society addresses the ethical and societal implications of technology.

The Institute is focused on AI, which holds the promise of making organizations 40 per cent more efficient by 2035 and unlocking an estimated $14 trillion in new economic value. Leveraging the University's expertise in AI, the Institute's mission is to develop human-centred solutions to meet the challenge of building safe, responsible and inclusive AI and other advanced technologies.

Through this multidisciplinary approach, more than 90 faculty and students are contributing to the development of new forms of regulation and governance to ensure the opportunities that emerge from powerful technologies like AI can be realized and serve the public good.

srinstitute.utoronto.ca

DATA SCIENCES INSTITUTE

Data is one of the foundations of science-based economic sectors and builds on the rich ecosystem of AI and machine learning at U of T. The University launched the Data Sciences Institute as a central hub and incubator for data science research and training, from undergraduate education to lifelong training for professionals. Software developed by DSI researchers is informing partnerships with the University Health Network and Unity Health and improving treatment options for cancer and other illnesses while demonstrating how the field can advance the public good.

datasciences.utoronto.ca

Robotics Institute

Located in the heart of Ontario's innovation super corridor, the Robotics Institute is home to the largest and most diversified robotics program in Canada and is the No. 1 recipient of National Sciences and Engineering Research Council funding in robotics-related fields.

As U of T's hub for multidisciplinary robotics research and innovation, this initiative unites eight robotics research clusters across the University. Areas of focus for the Institute's work include:

- Core robotics fundamentals — hardware design, sensing, machine intelligence and human-robot interaction
- Domain-specific expertise — from health care to mobility to manufacturing
- Global innovation skills — co-creation and collaboration with leading centres of excellence.

Together, these applications are working at the frontiers of robotics innovation — from robotics-enabling technologies like sensors, controls, machine learning and AI to the business, ethical, regulatory and economic impacts associated with these technologies.

robotics.utoronto.ca



Interdisciplinary solutions in health and life sciences

Interdisciplinary initiatives in the health and life sciences build on the medical innovations the University and leading Toronto hospitals have pioneered for more than a century — from the discovery of insulin in 1921 to stem cells in the 1960s to isolating the SARS-CoV-2 virus.

EPIC
Emerging & Pandemic Infections Consortium

EPIC is one of the primary hubs for pandemic preparedness in the country and home to the GTA's only Combined Containment Level 3 facility, the Toronto High Containment Facility (THCF). The THCF has allowed researchers to make significant advances against HIV, tuberculosis and SARS. Since the start of the COVID-19 pandemic, the facility has been the centre of industry partnerships, with companies such as Moderna Inc., Edesa Biotech and Providence Therapeutics developing new treatments and therapeutics and, in turn, helping meet the labour shortages facing Ontario's biomanufacturing sector. Reinvestment in this important element of Canada's health security infrastructure is critical.

epic.utoronto.ca

MEDICINE by DESIGN

Regenerative medicine has the potential to change the future of human health. Using living therapies, including cell and gene therapies, this emerging field helps the body repair and regenerate injured or deceased cells, tissues and organs. Since an initial $114 million investment from the Canada First Research Excellence Fund in 2015, MbD has sparked the creation of more than 40 spinoff companies and 800 new jobs and attracted over $2 billion in investment. With over 140 scientists, engineers and clinicians as well as 300 graduate students and postdoctoral fellows, MbD's impact on the life sciences sector in Ontario and Canada is growing.

mbd.utoronto.ca

AGEWELL

Pan-Canadian network AGE-WELL is accelerating the delivery of technology-based solutions that make a meaningful difference in the lives of Canadians. Its researchers are producing technologies, services, policies and practices that improve quality of life for older adults and caregivers and generate social and economic benefits for Canada. Following a $58.5 million investment from the federal government to establish the initiative as one of Canada's Networks of Centres of Excellence in 2015, this initiative has grown to include over 250 researchers, 110 international collaborations, 47 post-secondary institutions and research centres, and 420 academic, industry, non-profit and government partners.

AGE-WELL has helped entrepreneurs launch close to 60 AgeTech startups offering solutions from commercializing non-invasive neuromodulation therapies to early identification of digital biomarkers for Alzheimer's disease. These startups have raised over $49 million and demonstrated how Canadian companies can turn the challenge of Canada's aging society into a global opportunity to improve lives.

agewell-nce.ca

PRiME PRECISION MEDICINE

PRiME is next-generation precision medicine that leverages U of T's world-class expertise in biologics, omics, molecular chemistry, liquid biopsy, nanomedicine, biology-on-a-chip, and related domains to accelerate new discoveries and novel solutions for unmet needs in human disease. Close to 90 faculty members are affiliated with this initiative.

PRiME's experts were a resource for the health-care system during the pandemic when, through the PRiME COVID-19 Task Force, they developed over 30 projects on novel diagnostics and therapeutic solutions.

Through the integration of physical and life sciences with engineering, PRiME is developing a strong talent pipeline of U of T graduates who have a complex understanding of the biology of disease and the practical skills to collaborate with industry.

prime.utoronto.ca

CRAFT CENTRE FOR RESEARCH AND APPLICATIONS IN FLUIDIC TECHNOLOGIES

CRAFT supports joint R&D ventures between the University of Toronto and the National Research Council in the field of microfluidics, a sector expected to reach around $35 billion by 2028. Over 305 faculty, students and other members are focused on three core research pillars:

- organ-on-a chip technologies that can transform drug discovery and disease modelling
- biofabrication to generate tissue and organ substitutes
- diagnostic tests that can be taken directly to patients for more timely care.

Through a collective investment of $50 million, CRAFT aims to develop leading-edge microfluidic devices, deploy them in clinical practice or industry and position Canada at the forefront of this field. The University's microfluidic researchers have generated several world firsts, including organ-on-a-chip models of blood vessels and heart tissues and a hand-held 3D printer that produces skin sheets that promote healing of large burn wounds.

craftmicrofluidics.ca

Fundamental research — the foundation of economic growth

Policymakers and industry leaders have been clear that Canada needs to take urgent action to advance new science-based industries that can address the country's pressing challenges. U of T's interdisciplinary strategy is harnessing research insights to the commercialization pipeline, supporting economic development and competitiveness and making a meaningful difference in our rapidly changing world.

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