



Strategic Research Plan 2020-2025





DRIVING THE FUTURE WITH RESEARCH EXCELLENCE

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Introduction

Modern and forwarding thinking, Ontario Tech University is a young, small Canadian research-intensive university that advances the discovery and application of knowledge to accelerate economic growth, technological advancement, regional development, healthy communities, and social innovation. We believe it's not only about developing the next tech breakthrough—understanding and integrating the social and ethical implications of technology are our key differentiators.

We excel in nimble, collaborative multidisciplinary research in engineering, natural sciences, computer and computational science, nuclear science, health sciences, business, informational technology, social sciences, and education. Our dynamic research portfolio is comprised of more than 300 members with active research programs and 11 prestigious Canada Research Chairs.

In our short history, we've maintained a fundamental commitment to research excellence in answers to basic scientific questions, applied and technological innovation, and societal challenges. The orientation of this research is toward advancing pure scientific knowledge, developing technological breakthroughs, improving the quality of life and work for all Canadians, and strengthening the quality of public services in Ontario, especially in the sectors of health, education and criminal justice. We work with industry in the commercialization of our research, collaborating with not-for-profits and community organizations, and contributing to the Canadian economy as well as to regional economic and social development in Durham Region and Northumberland County.

Remarkably, in less than two decades, we've created a vibrant, engaged research community of faculty and graduate students, built world-class research facilities and libraries, established extensive networks of research partners, provided unmatched research opportunities for our undergraduate students, and invested in a supportive, knowledgeable research services staff. This commitment to innovation and research excellence has already yielded important and impactful outcomes in a wide range of fields.

As we enter our third decade, we're poised to become a national leader among Canada's smaller research-intensive universities. Our **Driving the Future with Research Excellence: Strategic Research Plan 2020-2025** will guide our university to attain a national leadership role in Canada's research community. This plan outlines our **Current Research Strengths**, identifying six intersecting fields where the university has already become a leader as well as our Strategic Research Priorities for 2020-2025. These priorities will extend our research strengths while determining additional leadership areas and opportunities. We'll gauge attainment of these goals using five metrics for judging our progression outlined in the Measuring Our Success section of this plan.

Our university has an amazing story to tell. This Strategic Research Plan complements our Integrated Academic-Research Plan. Combined, these documents serve as the cornerstone to telling the incredible Ontario Tech University story.

Professor Les Jacobs, PhD, FRSC
Vice-President, Research and Innovation
Ontario Tech University

Vision and mission

The new 2020-2025 Strategic Research Plan advances Ontario Tech University's core founding mission, which aims to:

Provide

superior undergraduate and graduate programs that are technology-enriched and responsive to the needs of students and the evolving workplace.

Conduct

research that creates knowledge, solves problems, results in economic and social innovation and engages students.

Facilitate

life-long learning that is flexible, inclusive and emphasizes college-university transfers.

Develop

academic and research collaborations with industry and community that stimulate and enhance the region and university at home and abroad.

Cultivate

a dynamic learning environment for students by promoting social engagement, fostering critical thinking and integrating experiences inside and outside the classroom.



Institutional priorities

This plan aligns with our academic-research strategic priorities:

Tech with a conscience

We aim to improve the lives of humans and the planet through the ethical application of technology and innovation. It's a key component in our teaching and learning practices, administrative processes and innovative research projects.

Learning re-imagined

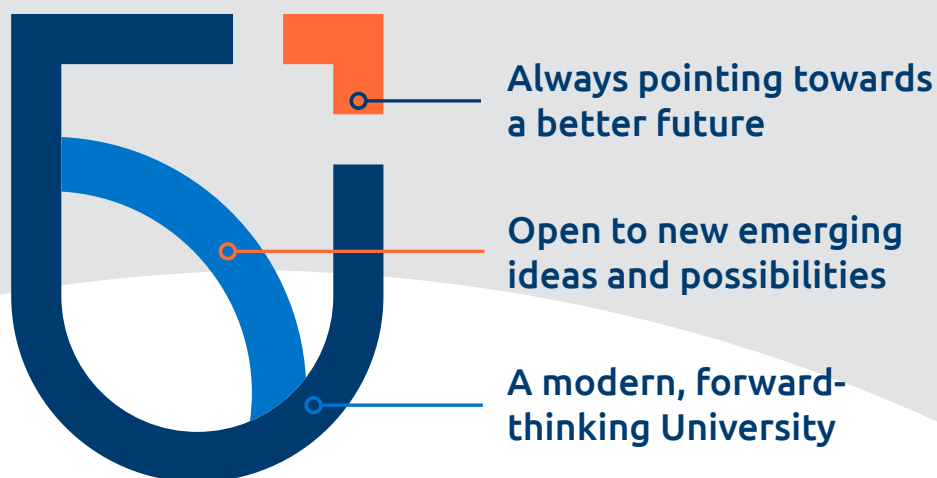
We adapt to the ever-changing educational landscape by experimenting with the most effective ways to deliver flexible and dynamic learning, giving more choices to more people.

Creating a sticky campus

We promote positive social change and encourage an accessible, equitable, diverse and inclusive culture for our campus community.

Partnerships

We help industry, community, government and academic partners be more effective by bringing them together with students and researchers to uncover innovative solutions for our partners' most pressing problems.



Research values

Our research community embodies a set of core values that inform all of our research activity and provide the points on the compass that guide and motivate our researchers to be:

Inventive

Entrepreneurial about real-world applications.

Imaginative

Visionary and think creatively about new research pathways.

Inspirational

Engage the communities where we live, work and play.

Inclusive

Ensure equity, diversity and inclusion underpin all of our research endeavours and our research methods are fair and unbiased.

Integrative

Adopt problem-solving methods that combine multiple perspectives and disciplinary approaches, including community-based research collaborations.



Research code

Academic freedom anchors our research. We follow a code of expectations and professional standards that provides a model for all our research community. The impetus for this code is the fact that the university is embedded within a much broader external ecosystem of research and innovation that is instrumental in ensuring our success. This ecosystem includes other universities in Canada and around the world. Major research and innovation funders including agencies of the Government of Canada and the Government of Ontario provide important investments in research capacity but also set compliance standards and norms. Many of our researchers are also members of professional bodies and associations with their own professional codes of conduct. Our ecosystem also includes industry, community organizations, not-for-profits, local government, and broader public sector organizations that are both collaborators and sponsors of our research as well as agents for knowledge sharing and its commercialization. Ultimately, the principles and commitment that make up our research code reflect not only how we fit into this research and innovation ecosystem but also how our research community distinguishes itself from other research-intensive universities.

Research excellence

We produce world-class original scientific research, achieve technological breakthroughs, and improve our understanding of human behavior to ensure a better future.

Equity, diversity and inclusion (EDI)

We believe that EDI is integral to achieving research excellence at our university.

Tech with a conscience

We improve the lives of humans and the planet through an understanding of the ethical, social, and policy effects and implications of innovations and advances in technology, and their potential to enhance human health and well-being.

Truth and reconciliation

We believe that our research must respect and advance Truth and Reconciliation with indigenous peoples.

Community to national to global impact on resilience, sustainability and the economy

We deliver research that reflects and directly benefits our local Durham Region and Northumberland County, contributes to the Canadian economy, strengthens environmental sustainability, and supports community resilience, while having a global reach that places our research on the world stage.

Equity, diversity and inclusion

We champion equity, diversity and inclusion (EDI), recognizing that EDI strengthens the research enterprise and its quality, social relevance and impact. This perspective acknowledges that historically and currently underrepresented individuals experience systemic barriers and biases that disadvantage them in terms of career opportunities and advancement. We recognize that in order to move beyond superficial responses to EDI and to progress towards more substantive changes to the academic and research culture, we must make EDI values and principles central to our institutional mission and have them permeate every area of practice. This commitment truly embodies our EDI statement:

“Innovation begins with the person behind the good idea. Canadians are vibrant and diverse people, each of whom possesses unique talents, skills, experiences, and perspectives that inspire brilliant ideas. True to the Canadian mosaic, Ontario Tech University fosters an inclusive culture where contributions from all members—including Indigenous Peoples, LGBTQ2+ Persons, Persons with Disabilities, Racialized Persons, and Women—are valued and are given the opportunity to flourish. Ontario Tech is committed to cultivating a diverse and inclusive research community. By refusing to leave talent on the sidelines, Ontario Tech inspires the profound discussions, exceptional creativity, and vanguard thinking that lead to more original, impactful and relevant research results.”
(EDI Commitment Statement, **Being Counted and Considered at Ontario Tech University: Canada Research Chair Equity, Diversity and Inclusion Action Plan**, September 27, 2019)

We will become an EDI leader among Canadian universities by fundamentally changing our research and academic culture to ensure that individuals from underrepresented groups participate and benefit equitably across our institution. EDI capacity building is key to affecting this cultural change. We have met, and are conscientiously working to exceed the current EDI requirements and diversity targets of the Canada Research Chair Secretariat. We were among the first Canadian universities to endorse the Tri-Agency Dimensions Charter on EDI in 2019 and are among the first recipients of a major institutional Natural Sciences and Engineering Research Council of Canada (NSERC) EDI Capacity Building Grant. We also strongly supported the signing of the San Francisco Declaration on Research Assessment (DORA) by the presidents of the Canada Foundation for Innovation (CFI), Canadian Institutes of Health Research (CIHR), NSERC, and Social Sciences and Humanities Research Council of Canada (SSHRC).

We recognize that realizing these pledges will not be easy: over the next five years, inspired by our strategic research plan, we will shepherd and support our research community through the implementation of meaningful, measurable and sustainable progress towards embedding EDI in academia and research.

Current research strengths

We're a national leader in six intersecting fields of multidisciplinary research that are founded on our dual strengths in basic scientific discovery across disciplines and cutting-edge applications of this research in technological breakthroughs, the health and social sciences, engineering, business, and social innovation. In these fields, our researchers stand out in national and international funding and award competitions, secure extensive industry and not-for-profit organization partnerships and sponsorship, and demonstrate research excellence in scholarly outputs such as journal articles and books. Our world-class facilities and libraries in these multidisciplinary fields enable our research community to undertake their research programs and that ensure those scholarly outputs are discoverable around the world. We also provide valuable opportunities for the training of graduate and undergraduate students and other highly qualified personnel such as postdoctoral fellows in these research areas of strength.

Digital technologies, machine learning and artificial intelligence

Situated in Canada's technology hub, we've developed wide-ranging, award-winning research programs spanning multiple disciplines from the natural sciences, computer science, business, education, engineering, health sciences, social sciences and information technology. These research programs exemplify how both pure research in computer science and applied advanced data analysis utilizing artificial intelligence and machine learning delivers a transformative effect on almost every field of scientific discovery and applications. Five of the university's Canada Research Chairs work in this area. This research strength intersects with our strengths in:

- Advanced Manufacturing and Materials
- Applied Bioscience and Environmental Sustainability
- Automotive Engineering
- Energy
- Transportation and Electrification Systems

This research also reflects our core strength in Information and Communication Technologies (ICT), which facilitates information access and sharing that drives the advancement in a wide range of economic sectors, including:

- 5G broadband communication
- Autonomous transportation
- Cybersecurity
- Education
- Gaming
- Health care
- Intelligent energy systems
- Marketing
- Neuroscience
- Smart cities

These innovative multidisciplinary research contributions create valuable opportunities to train our students who gain employment in diverse sectors of the economy in the GTA and other tech hubs.

Our graduate students and postdoctoral fellows are key contributors to this research strength as well as the many undergraduate students who have research opportunities embedded in their programs. Graduate program areas include:

- Business Analytics and Artificial Intelligence (proposed)
- Computational Finance (proposed)
- Computer Science
- Education and Digital Technologies
- Electrical and Computer Engineering
- Forensic Psychology
- Health Sciences (Health Informatics)
- Information Technology Security
- Modelling and Computational Science

We now offer a dual PhD program in computer science with the University of Technology Sydney (UTS) in Australia.

We've built an extensive network of laboratories at the Software and Informatics Research Centre (SIRC) to conduct this research, including:

- Advanced Networking and Security Research Laboratory
- Applied User Experience Research Lab for Interactive Media
- Business Analytics Lab
- Finance and Marketing Lab
- Gaming and Virtual Reality Lab
- Hacker Research Laboratory
- Health Informatics Laboratory
- Laboratory for Games and Media Entertainment Research
- MaxSIM Health
- SAP Next-Gen Labs – Design Thinking

Other important research facilities include the Cybersecurity Institute, Communications, Signal Processing and Microwave Lab, Digital Culture and Media Lab, Digital Life Institute, STEAM-3D Maker Lab, Education Informatics Lab, Clinical Affective Neuroscience Laboratory, and Visualization for Information Analysis Lab. The university also houses the Joint Research Centre in AI for Health and Wellness with UTS.

Areas of research strength:

- Augmented and Virtual Reality
- Big Data Analytics
- Business Analytics and AI
- Business Transformation
- Computational Science
- Computer Vision
- Consumer Behaviour
- Cybersecurity
- Data Visualization and Analytics
- Digital Health
- Digital Immersive Learning Environments
- Digital Learning
- Drones
- e-Commerce
- Ethics and Equity in Technology Use
- Financial Analytics
- Human Machine Interaction
- Human-ability Enhancing Technology
- Information and Communication Technologies
- Internet of Things
- Linguistic Information Visualization
- Marketing
- Modelling and Games
- Neuroscience of Mental Health and Substance Abuse
- Next Generation Networks
- Operations Modelling
- Privacy and Trust
- Real-time Stream Processing
- Risk in the Global Digital Economy
- Robotics
- Signal Processing
- Software Development and AI
- STEAM Education
- Technology and Pedagogy
- User Interface Design

Energy, applied bioscience and environmental sustainability

We've quickly become a national leader in energy and environmental sustainability research. Our scientists focus on new basic scientific discoveries and solving fundamental problems in the natural sciences and computer science that will help unlock the potential of clean energy technologies. Our engineers are developing innovative materials and enabling technology that is key to our future electrical grid, microgrids, and energy systems. Our researchers are among the best in the world in nuclear energy and nuclear science including small modular reactors, radiation science, radiation health and safety, simulation research, and nuclear materials management. We're also international research leaders in developing alternative energy sources. Our researchers have made major scholarly contributions to forms of clean energy such as biofuels, hydrogen and fuel cells, geothermal, and solar. We have outstanding capacity in data management and visualization about energy usage. Working with municipalities, we're building complex networks of high-power charging stations for electric vehicles. Our portfolio of patents related to clean energy continues to grow.

Our strong team of researchers advance scientific discovery and develop innovative biotechnology in applied bioscience using advanced investigational methods in molecular biology, toxicology, chemical biology, synthetic chemistry, physiological studies, epidemiological methods, and computational modelling. Additionally, we have four Canada Research Chairs and two NSERC Industrial Chairs who focus their research on energy, nuclear science, environmental science, and environmental sustainability

Our strength in applied bioscience focuses on the capacity for the biosphere and human civilization to coexist, new and emerging biotechnologies and applications to environmental sustainability. Our scientists study the impacts of disease and human activities, like climate change and resource extraction, on aquatic animals, microorganisms, and livestock. Our social scientists engage critically with environmental governance norms and alternative practices, study how sustainable policies involving access to environmental resources, including clean water and energy, benefit society and the economy, and advance key issues in education around developing resilience, at-risk populations, and technological change.

Our graduate students and postdoctoral fellows are key contributors to this research strength. Graduate program areas include:

- Applied Bioscience
- Automotive Engineering
- Electrical and Computer Engineering
- Education
- Materials Science
- Mechanical Engineering
- Nuclear Engineering
- Nuclear Technology

This research is carried out in our world-class facilities, including:

- ACE
- Aquatic Research Facility
- Biomolecular Characterization Facility
- Borehole Thermal Energy Storage System
- Centre for Small Modular Reactors
- Climatic Wind Tunnel
- Clean Energy Research Lab
- Electrochemical Energy Materials Lab
- Energy Research Centre

Areas of research strength:

- Biological and Medicinal Chemistry
- Biomaterials
- Biotechnology
- Clean Technology
- Computer Modelling
- Energy and Sustainability Education
- Energy Production, Conservation and Storage
- Energy Systems
- Environmental Impacts
- Environmental Monitoring
- Environmental Remediation
- Fluid-Structure Interaction
- Fuel Cells
- Health Physics and Environmental Safety
- Human Energy
- Hydrogen Production and Storage
- Indigenous Governance
- International Environmental Governance
- Nuclear Decommissioning and Site Restoration
- Nuclear Energy
- Nuclear Materials Management
- Radiation Science
- Renewable Energy
- Resource Extraction and Free, Prior and Informed Consent
- Small Modular Reactors
- Smart Grid
- Sustainable Development Strategies
- Transportation and Mobility



Community wellness, human performance and health promotion

We have a very strong network of researchers focused on innovative community wellness and human performance promotion research. This also includes work with vulnerable populations that analyzes best practices in community development and urban resilience, and community-engaged research supporting justice-seeking groups, including those with intellectual disabilities, incarcerated youth, Indigenous communities and other vulnerable populations.

In collaboration with a cluster of research chairs and a dynamic cohort of graduate and undergraduate students, this network is impactful globally in the fields of:

- biomedical and clinical health research
- health informatics
- health systems and services
- health technology
- kinesiology
- psychology
- public and population health

This research application promotes the health and well-being of those living, working and playing in our local communities as well as guiding decision-makers to develop sustainable and healthy global communities that are inclusive and support the physical, social, economic and environmental health needs of global citizenship. Four of our Canada Research Chairs conduct research in this area of strength.

This network includes faculty, students and postdoctoral fellows from graduate programs in:

- Applied Bioscience
- Criminology and Social Justice
- Education
- Forensic Psychology
- Health Sciences
- Nursing

Our hub of labs supporting this research foci include the:

- Applied Skill Acquisition in Sport Lab
- Biomolecular Characterization
- Centre for Applied Nutrition and Cardiovascular Health Research
- Centre for Disability Prevention and Rehabilitation
- Centre on Hate, Bias and Extremism
- Clinical Affective Neuroscience Lab
- Health and Human Performance Lab
- Health Informatics Lab
- Human Neurophysiology and Rehabilitation Lab
- MaxSim Health Lab
- Motor Behaviour and Physical Activity Lab
- Neuroimaging and Electroencephalography Lab
- Occupational Neuromechanics and Ergonomics Lab
- Social Research Centre
- Sport Officiating Studies

Areas of research strength:

- Adapted Physical Activity
- Chronic Disease Prevention and Management
- Clinical Information Systems
- Collaboration with Indigenous Communities
- Community-Based Health Care
- Community Development
- COVID-19-related Research
- Dementia
- Digital Health Monitoring
- Disability, Injury Prevention and Rehabilitation
- Digital Technology and Learning
- Discovery of Novel Therapeutics to Treat Disease
- Educational Accessibility
- Emerging Infectious Diseases and Global Health
- Environmental and Occupational Health
- Epidemiology
- Ergonomics and Biomechanics
- Exercise Physiology
- Health-Care Simulation
- Health Equity
- Health Informatics
- Health Policy, Systems and Services
- Health Promotion
- Healthy Aging
- High-Performance Sports
- Implementation Science and Knowledge Translation
- Indigenous Child Health
- Intellectual and Developmental Disabilities
- Laboratory Medicine
- Mental Health and Addiction
- Mindfulness
- Neuroscience and Motor Control
- Nutrition
- Pandemic Planning
- Pediatric Health
- Poverty Reduction
- Psychiatric Vulnerabilities
- Public Health
- Skill Acquisition and Motor Learning
- Sleep Science
- Social Determinants of Health
- Therapeutic Drug Design
- Violent Crime Reduction



Automotive engineering, transportation and electrification systems

Positioned in the automotive manufacturing heartland of southern Ontario, we've built world-class research facilities including most notably ACE, home to the Climatic Wind Tunnel. This facility has helped positioned our researchers to be both leaders in automotive research and pioneers in new mobility systems including the next generation of cars, buses, trains, drones and even e-bikes. ACE is one of the universities core research facilities accessible to our entire research community. Our automotive engineering research and close industry collaborations are especially innovative due to recent contributions to vehicle dynamics and control, advanced powertrains, and aeroacoustics. As the research hub for the Autonomous Vehicle Innovation Network (AVIN) focused on human interactions with electric and self-driving vehicles, our industry partners include the leading Silicon Valley automotive original equipment manufacturers (OEM). Our talent pipeline in automotive tech combined with our globally leading full-scale Autonomous and Electric Vehicle testing infrastructure has made Durham Region one of the world's strongest innovation environments for companies disrupting the automotive marketplace.

We have five research chairs engaged in projects within this research strength, along with graduate students and postdoctoral fellows.

Graduate programs include:

- Automotive Engineering
- Computer Science
- Electrical and Computer Engineering
- Information Technology Security
- Materials Science
- Mechanical Engineering

World-class facilities supporting our research in mobility and electrification systems include:

- ACE
- Clean Energy Research Lab
- Energy Systems and Nuclear Science Research Centre
- Software and Informatics Research Centre

Areas of research strength:

- Assistive Technologies for Learning Different
- Autonomous Vehicles
- Automotive Dynamics and Control
- Automotive LIDAR and Radar
- Automotive Structure and Chassis Design
- Battery Charge and Storage
- Climatic and Environmental Testing
- Cybersecurity
- Data Ingestion, Analysis and Visualization
- Electrification of Transportation Systems
- Intelligent Mobile Systems
- Mobility and Software Testing
- Precipitation Characterization
- Transit Modelling and Optimization
- Vehicle Thermal Aerodynamics and Thermal Management
- Vulnerable Road Users
- V2X Communication
- Wireless Communication Technologies

Advanced manufacturing and materials

Working collaborative with our extensive network of industry partners, our researchers are recognized leaders in manufacturing engineering as well as the synthesis and characterization of materials. Applications of this award-winning research have led to the development of sustainable and environmentally friendly approaches and techniques for manufacturing processes, product development and energy systems. This multidisciplinary research involving both scientists and engineers is transforming manufacturing processes in a range of sectors of the economy in Canada and abroad.

Our graduate students are important contributors to this research strength.

Programs for graduate study include:

- Applied Bioscience
- Automotive Engineering
- Computer Science
- Electrical and Computer Engineering
- Materials Science
- Mechanical Engineering
- Modelling and Computational Science

Key research facilities that support our intelligent manufacturing and materials research include:

- ACE
- Advanced Digital Manufacturing
- Advanced Digital Metrology
- Electrochemical Energy Materials Lab
- Materials Characterization Centre
- Mechatronic and Robotic Systems Laboratory

Areas of research strength:

- 3D Printing
- Advanced Robotics
- Assistive Mobility Devices
- Climatic and Environmental Testing
- Corrosion-resistant Coating
- Data Storage and Visualization
- Electronic Materials
- Fuel Cells and Electrochemistry
- Mechatronics and Automation
- Nanotechnology
- Next-generation Genomics
- Noise and Vibration Control
- Software Testing and Simulations
- Surface Science
- Sustainable Processes

Crime, justice and forensics sciences

We've established a distinctive national research reputation in the field intersecting forensic psychology, criminology, and forensic science. Anchored by three top-ranked PhD programs, our professors and their graduate students make impactful research contributions that strengthen the justice system in Canada. Our undergraduate and graduate programs are training highly qualified personnel for industry, government, universities and colleges, and the broader public sector.

Our top ranked graduate programs that support this research strength include:

- Applied Bioscience (Forensic Bioscience stream)
- Criminology and Social Justice
- Education and Digital Technologies
- Forensic Psychology
- Information Technology Security
- Materials Science
- Police Leadership, Corrections and Public Safety (proposed)

Our unique research facilities that support this cluster of researchers include:

- Applied Law Enforcement Research and Training Laboratory
- Crime Scene House, the first in Canada
- Centre on Hate, Bias and Extremism
- Clinical Affective Neuroscience Laboratory for Discovery and Innovation
- Development, Context and Communication Lab
- Entomology Lab
- Forensic Materials Laboratory

Areas of research strength:

- Anti-Social Personality Disorders
- Bias in the Justice System
- Body Decomposition
- Bullying
- Child Testimony
- Critical Criminology
- Cybercrime
- Detection of Deception
- Emotional Robotics
- Geographical Profiling
- Hate Crime
- Human Trafficking
- Investigation Techniques
- Law and Community Engagement
- Law and Social Change
- Online Privacy
- Policing
- Prosecution and Trial Procedures
- Psychopathy
- Racial Profiling
- Sexual Violence
- Technology and Crime Prevention
- Technology and Pedagogy
- Vulnerable Populations
- Wrongful Conviction



Strategic research priorities for 2020-2025

We have a strong commitment to providing the research infrastructure and services that are necessary for all members of our research community to achieve excellence in their research programs. Key components of this commitment include:

- Having high-tech facilities.
- Strengthening the internal information technology supports for research.
- Integrating our researchers into regional and national high-performance computing and data networks.
- Enabling access to student research assistants.
- Offering research leave and research chair opportunities.
- Providing research services that guide and support researchers with the submission of funding applications, compliance with research ethics and financial accountability.

We're also committed to increasing investment in on-campus Core Research Facilities (CRF), which are facilities and that house equipment accessible to all of our researchers. We recognize the value and importance of providing strong funding support for our graduate students across the university. Sustaining and extending our research infrastructure and services, including fulfilling our EDI commitment statement, is our highest strategic research priority with the goal to become a national leader among Canada's smaller research-intensive universities.

We've developed six specific strategic research priority areas that will help us to become research leaders by 2025. These priority areas, which build on and extend our current research strengths, reflect major anticipated research funding opportunities—provincially, nationally and internationally—that will be available to our research community over the next five years, and the research and commercialization needs of our diverse set of partners—industry, community organizations, the not-for-profit sector and governments.

Data science, artificial intelligence and new technologies

New and original pure research in computational science and computer research drives technological innovation around the globe. This pure research remains a fundamental priority. Novel integrated technological advances that build on this research drive economic prosperity, security, and social fairness. The use of advanced data analytic techniques including machine learning are revolutionizing diverse sectors of the economy ranging from cybersecurity and gaming to public education and health applications to software testing and industry that are creating demands for innovative applications of data science. Enabling technologies such as micro-and nano-electronics, nanotechnology, photonics and immersive technologies such as digital simulations and virtual reality present new opportunities for impactful **Tech with a Conscience** research.

We will prioritize research that:

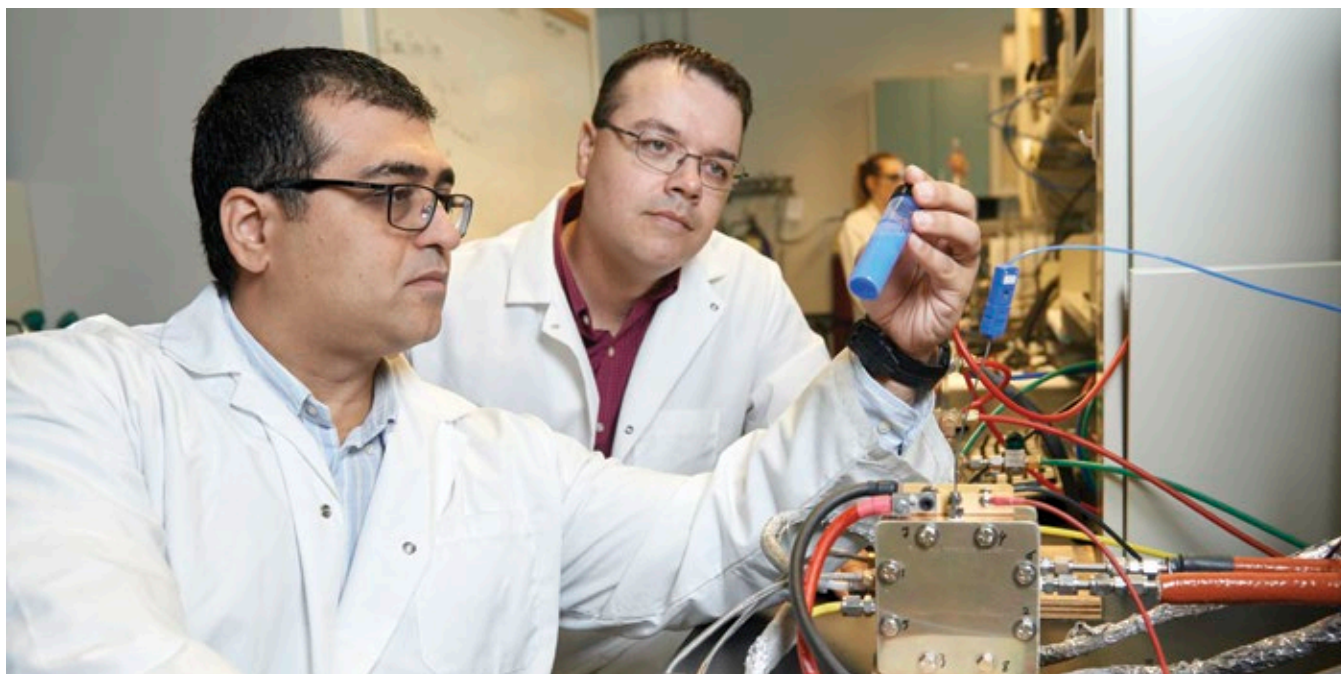
- Focuses on the use of advanced data science techniques, including machine learning and visualization, particularly in applications that can advance our utilization of 'Big Data' analytics, to achieve positive outcomes for society.
- Further develops our world-class strength in cybersecurity and gaming including supporting our new Cybersecurity Institute is a key priority.
- Studies innovative technology-enhanced pedagogy and learning experiences that disrupt traditional educational expectations regarding achievement, accessibility, and skills-development from early childhood education and elementary schooling to high school and post-secondary education and finally, to lifelong learning. Simulation and other immersive technologies are important strengths among our researchers.
- Develops inquiry capacity on hybrid applications of quantum and high-performance computing for use by business and industry. Although theoretical research on quantum computing is decades old, possible business and industry applications are only now emerging as real-world quantum computers with the technical capabilities to utilize artificial intelligence are coming online.

Canada's energy and environmental future

The vision for a zero-carbon economy is one of the most ambitious and disruptive national goals Canada has ever embraced, in large part because it requires new thinking that reaches beyond research silos and integrates advances in the natural sciences and engineering, computer and computational science, business and the digital economy, and the health and social sciences. This vision also requires respectful consultation with Indigenous Peoples. Our immense strength in energy, applied bioscience, environmental sustainability, community wellness, information and communication technology, and business information technology, uniquely positions us to help shape the research agenda on Canada's Energy and Environmental Future and the role of disruptive technology in the realization of that vision.

We will prioritize research that:

- Focuses on developing our research and policy capacity through new initiatives such as the Brilliant Energy Institute and the Centre for Small Modular Reactors as well as existing strengths at Clean Energy Research Lab. We will also invest in developing the Biomolecular Characterization Facility as a Core Research Facility with equipment and resources accessible to researchers across the university.
- Explores major new biotechnology and sustainability-focused research partnerships such as the EARTH District with other universities, community organizations, and First Nations and Indigenous organizations in the region.
- Seizes new funding opportunities that will support our researchers to address the complex challenges that are involved in the transition to a net-zero carbon economy, across disciplines from bioscience and physics to engineering and data science to education and social sciences



Healthy populations, community well-being and social justice

We're committed to investing in our research capacity in the health and human sciences, including supporting our growing number of national and international collaborations in these fields. We place a special priority on COVID-19-related research, which we know will extend beyond the outbreak and exemplifies our nimble capacity to be responsive to the needs of Canadian society. Recognizing our research directly influences the health and well-being of Canadians, we'll continue to prioritize both pure and applied scientific discovery focused on human health and well-being, and biomedical research. Reflecting our institutional commitment to EDI, this positioning offers the university an opportunity for research synergies that will strengthen further our contributions to global public health, health promotion and improving human performance. These synergies will integrate our faculty members and students, including health scientists, psychologists, social scientists, and data scientists.

We will:

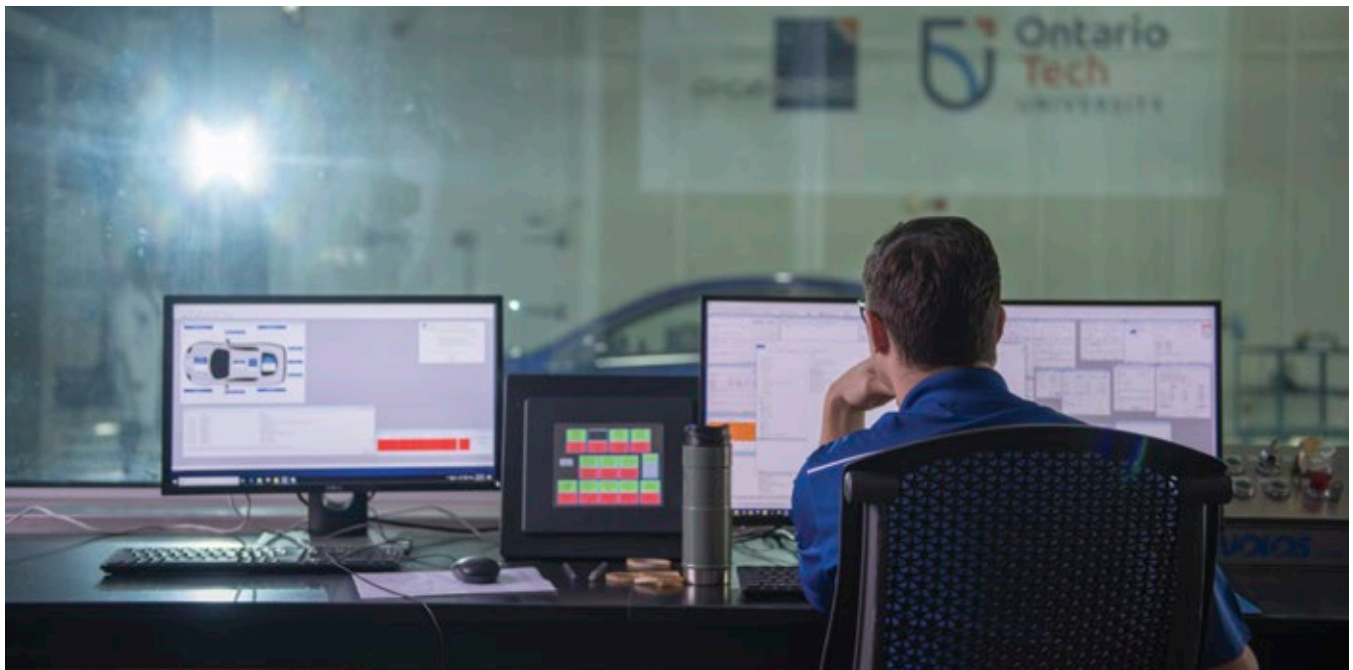
- Conduct biopsychosocial research in the areas of human movement including sleep, sedentary time, physical activity, brain-body interactions, ergonomics and sport. This is essential for maintaining and improving health and performance of all Canadians, across the lifespan and across the spectrum of skill and ability. We will bolster this research through high-tech laboratories, strong partnerships, and trainee support, and we will apply this across health care, community and high-performance sport settings. We will also prioritize evidence-based research focused on improving human performance and reducing maladaptive behaviours in order to promote best practices in training and procedures in applied settings within law, business, government, and education.
- Prioritize public health and clinical research to support the health and wellness of populations, communities and individuals influence on the understanding and application of the determinants of health, health education, health policy, health interventions and health services. This research has applications from the local to global level. The use of technology in addressing health care access and delivery is important at the public, patient and provider level.
- Intensify ongoing research on the twin imperatives of population health and community well-being with an explicit focus on the pursuit of social justice. We'll provide useful data on, and conduct helpful analyses of, social determinants including poverty, access to education and legal services, environmental degradation, social isolation, and other factors. We'll further expand our collaboration with the non-profit sector and social justice advocacy groups, and share research results with relevant public sector actors to help inform evidence-based decision making and policy implementation.
- Build a network of comprehensive research partnerships and affiliation agreements with surrounding hospitals, other health-care service providers, health promotion, recreation and leisure providers, local industries and employers, as well as national/provincial/local health and sport organizations. This will help to facilitate rapid knowledge translation and mobilization, enable the sharing of academic staff, and the submission of joint funding applications to support collaborative research on pressing public health issues such as emerging infectious diseases and pandemic planning.

Autonomous vehicles and systems

Robotics, mechatronics and autonomous systems play an ever-increasing role in the world of tomorrow: from autonomous vehicles, to home assistant robots, to unmanned aerial vehicles. Our research strengths put us at the forefront of this interdisciplinary research area while at the same time contributing to Canada's capacity for advanced and intelligence manufacturing. Building on our unique research capacities at ACE, including the new moving ground plane, our current strengths in **Automotive Engineering, Transportation and Electrification Systems**, and **Digital Technologies, Machine Learning, and Artificial Intelligence** have positioned us as a research hub in future-looking autonomous/electric vehicles and systems, while expanding the historic role that the region has had in the automotive sector. This includes embedded software, real-time systems and safety-critical software systems.

We will:

- Remain nimble and adaptive to new opportunities with automotive Original Equipment Manufacturers (OEM) as well as in other emerging sectors such as aerospace and defence.
- Develop further our strengths in fields such as robotics, sensors, thermal aerodynamics, embedded software, safety-critical software systems, and electrification, which are at the cutting edge of where research on autonomous vehicles and systems is heading.
- Continue to be a research and talent anchor for the development of a manufacturing hub and supply chain in the region for autonomous vehicles and systems.



Intelligent manufacturing and materials innovation

In the current climate of global economic uncertainty, restoring and extending Canada's manufacturing capacity is key to securing the country's economic future. Considering our geographic location and research potential, we prioritize supporting the next generation of manufacturing as a Canadian supercluster in innovation, science and economic development. Our research has always positioned itself as an important contributor to the advanced manufacturing space. Disruptive and emerging technologies create new opportunities to expand these contributions. The integration of intelligent and autonomous technologies that utilize artificial intelligence and machine learning for advanced manufacturing is a research priority, allowing us to build on current research strengths to establish ourselves as a leader in manufacturing and materials innovation. This is a response to the forecasted demands from the industries to move towards the objectives of Industry 4.0, the latest revolution in industrial manufacturing.

We will:

- Expand and grow the Materials Characterization Centre, an existing Core Research Facility where industry and academic research teams from across the university collaborate and develop innovative materials with real world applications.
- Increase our capacities in manufacturing process modelling, precision manufacturing, intelligent inspection, control and diagnostics, embedded software, and their corresponding cyber-physical components aligned with the requirement of Industry 4.0.
- Build on our strengths in polymers and nanotechnology to extend the applications of this innovative research to new sectors of industry including bioengineering, filtration, sensing, energy harvesting and noise mitigation.
- Develop new capacity in the hybrid application of quantum and high-performance computing in intelligent product design, manufacturing, data collection, and cybersecurity.

Social innovation, disruptive technologies and the new economy

Disruptive technologies have played an important part in the creation of the new economy, characterized by precarious employment, vulnerable populations, growing income inequality, mental health crises, dysfunctions in the criminal justice system and social exclusion. Our research strengths in business and the social sciences have enabled the university to become a hub of social innovation and critical inquiry into this new economy. Volatility and uncertainty in global health security, local communities and economic markets create a pressing need to address the social and EDI impact and dimensions of these changes.

We will:

- Continue to support the expansion of our recently established research centres engaged in this work (Digital Life Institute and Centre on Hate, Bias and Extremism) to pursue research across demographic groups seeking social and environmental justice, equity and systemic change.
- Remain supportive of diverse funding opportunities for critical research into the nature and impact of social and technological change on the criminal justice system, education, consumer behaviour and marketing, business, social and political structures, and diverse communities, including Indigenous Communities.
- Capitalize on and develop new business, not-for-profit sector and industry partners to better understand and address how social innovation can help us to deal with changing economic and labour markets and growing instabilities within social and economic power structures.

Measuring our success

The **Strategic Research Plan 2020-2025** is instrumental for Ontario Tech University to become a national leader among Canada's smaller research-intensive universities. Driven by the pursuit of research excellence, our research community set out on this path in 2002 and we aim to realize this goal by 2025. Our success will be measured by five objectives:

Intensify research capacity through partnerships

We will have advanced this objective if we have:

- Significantly increased the number of multidisciplinary research partnerships we have with industry, public sector, not-for-profits and community organizations.
- Extensively broadened the opportunities for our researchers to share and commercialize their research in collaboration with our industry partners.

Strengthen research excellence reputation nationally and internationally

We will have advanced this objective if we have:

- Improved our overall ranking to be among the top 35 research universities in Canada and among the top 25 universities in terms of research-intensity.
- Increased the major awards and honours received by our researchers in recognition of their excellent research contributions and scholarship.

Optimize the matching of research strengths to opportunities

We will have advanced this objective if we have:

- Establish new core research facilities, research institutes, centres and chairs that consolidate and showcase our research strengths in the education, engineering, health sciences, information technology, social sciences and the natural sciences.
- Expanded significantly the size and research strength of our graduate student and postdoctoral fellow community while at the same time preserving our status as a national leader in providing research opportunities for our undergraduate students.



Sharpen the positive impact of our research, regionally and nationally, on economic and social development as well as environmental sustainability

We will have advanced this objective if we have:

- Made demonstrable and highly visible contributions to Durham Region and Northumberland County by providing new economic opportunities and improving the quality of life of people living in the region.
- Increased the opportunities our undergraduate and graduate students have to be directly involved in conducting research with local and national industry and community partners.


Integrate equity, diversity and inclusion (edi) into all of our research activities and practices

We will have advanced this objective if we have:

- Shepherded and supported our research community through the implementation of meaningful, measurable and sustainable progress towards embedding EDI in academia and research.
- Taken a national leadership role as one of Canada's smaller research-intensive universities in the integration of EDI into our research enterprise.

Reporting on our progress

Annually, the Vice-President, Research and Innovation will provide a report card to Academic Council and the Board of Governors on the progress we have made in meeting these five objectives as well as our successes in the current research strengths and the strategic research priorities. This report card will integrate fully traditional research assessment metrics with newer ways to assess research excellence so that this reporting exercise is a reflection of our strong commitment to equity, diversity and inclusion. It will also identify areas of concern that require improvement.



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