RESEARCH FOR TODAY AND TOMORROW

Innovation in Research, Scholarship and Education
Strategic Research Plan 2013 – 2018
Message from the Vice-President, Research, Innovation and International

The University of Ontario Institute of Technology (UOIT) is forging ahead, solidifying its reputation for research excellence by seeking answers to big questions. The technology-driven scholarship and innovations of our faculty and student researchers are continuing to be recognized for their local and national impact as we solve current problems and work to mitigate future complications. We seek to foster the ideas generated by our outstanding faculty and students, conducting research that leads to transformative cultural, economic and scientific changes worldwide.

At UOIT, we integrate research, innovation and entrepreneurship with education and professional collaboration. This synthesized approach enables well-rounded academics to solve today’s grand challenges and inspire the next generation of researchers to do the same.

UOIT’s strategic research plan Innovation in Research, Scholarship and Education 2013 – 2018 delineates the path by which we will reach our goal to be ranked among the:

- Top 50 science and technology universities in the world
- Times Higher Education top 100 under 50 universities
- Top 35 research-intensive universities in Canada

Improving our competitiveness among Canadian and international research universities requires UOIT to ardently support faculty in their research programs across all disciplines, as well as to increase our research capacity in targeted fields. We are confident with this strategic direction; bolstered by government, industry and philanthropic backing, UOIT will reach its target of becoming an internationally recognized research-intensive institution by 2018.

Our work is just beginning. These pages provide a glimpse at the transformative research taking place at UOIT, while setting the stage for future accomplishments. Discover the impact we are making and learn how you can support our researchers as they constructively contribute to our communities, our nation and our world.

Yours in research and innovation,

Dr. Michael Owen
Vice-President, Research, Innovation and International
QUICK FACTS
UOIT continues to be ranked among Canada’s Top 50 Research Universities according to Re$earch Infosource Inc.

UOIT has 11 Canada Research Chairs in strategic research areas.

UOIT has five sponsored research chairs including industrial research chairs and engineering design chairs.

In our short history, UOIT has created 37 graduate programs—21 at the master’s level, seven at the doctoral level and nine graduate diploma programs.

UOIT proudly promotes undergraduate engagement in research projects. Students are introduced to academic research by working alongside faculty members and graduate students. Through many of these projects, students connect with industry and community partners, gaining a valuable resource for applying to continue their studies or seeking employment.

UOIT is devoted to enabling the mobilization of the intellectual property of its researchers. We are currently managing a diverse portfolio of patent applications and have generated licensing revenue from our technologies.

Relevant research with community and industry applications is a cornerstone of the UOIT mandate that continues to be the foundation for the strategic direction of our research endeavours.
OBJECTIVES
Innovation in Research, Scholarship and Education responds to the science and technology strategies laid out by both the federal and provincial governments that focus on:

- attracting and retaining the best and brightest minds from all over the world to enrich our capabilities
- creating new knowledge, and mobilizing that knowledge and research uptake for social and economic benefit

Through this strategic research plan UOIT will:

- build on and fortify existing research strengths
- foster excellence in targeted fields
- identify and invest in new strategic research priorities
- integrate research, entrepreneurship and innovation with undergraduate and graduate education and community engagement
- invest in infrastructure that enables excellence and promotes regional, national and international collaboration with academic, community and industry partners
- invest in our students’ and researchers’ entrepreneurial capacity to help them link their fundamental and applied knowledge and discoveries to the needs of various partners.
Strategic Research and Training Priorities

- Advanced Manufacturing for 21st Century Innovation
- Education for the 21st Century
- Energy and the Environment
At UOIT, research in materials and manufacturing focuses on developing the technologies needed to meet the challenges of the 21st century. Our research develops sustainable and environmentally friendly approaches and techniques for manufacturing processes, product development and energy systems. Our research will address many current and future engineering ‘grand challenges’ such as how to make solar energy economical, advance health informatics, information and communication technology (ICT) and secure cyberspace, improve pharmaceuticals and support a secure and safe nuclear power industry among others.

UOIT follows an interdisciplinary research approach with a focus on:

- automotive and transportation research
- business and management engineering
- energy systems and nuclear engineering
- human and health factors
- the manufacturing cycle
- pharmaceutical research
- product life-cycle analysis
- sustainable manufacturing and production processes

Creating a sustainable transportation system is of particular interest to our researchers, and this goal requires rigorous inquiry into:

- advanced materials
- batteries and storage
- fuel cell technology
- intelligent systems

The fundamental theme connecting all of our manufacturing research is to understand how to improve processes through effective systems integration and to improve new modes of transportation.
Achieving excellence in education that effectively prepares students for the workplace requires systematic and thorough research into the intersection of teaching and learning, as well as the currently developing field of third-level and professional education. The realities of the evolving workplace inform the content and methods of post-secondary education, as instructors work to create relevant and effective learning experiences in universities and colleges. UOIT researchers are studying the connections between secondary educational preparation and the workplace, tertiary education and educational policy development, in order to propose approaches and methods that will aid teachers to effectively prepare students for contemporary and future careers.

Our faculty investigates ways tertiary-level learning and teaching can be reformed and improved through the use of digital technologies. Research in this area includes the integration of learning and teaching in the digital economy, with a particular focus on:

- design principles in educational and engineering practice
- e- and m-learning strategies and technologies
- learning in the academy
- learning for professional development
- pathways for advanced and life long education
- the professional and clinical education needs of work environments
UOIT’s energy research strives for innovation, within a framework of rigorous conservational and environmental stewardship. Our researchers focus on:

- hydrogen production
- natural gas as a transportation fuel
- nuclear energy
- renewable energy, such as algal biofuel, wind, solar and geothermal

These broad research directions encompass the aims of achieving innovation in engineering, advancing approaches to the education of managers in the safe operation of nuclear power plants, and collaborating with leading partners to advance a safe and efficient energy future for our planet.

Our environmental researchers work to understand the underlying mechanisms of ecosystem function and health, with an emphasis on freshwater resources. Research areas include:

- algal blooms
- ecotoxicology of contaminants found in municipal and industrial wastewater
- energy, nutrient and contaminant dynamics in aquatic ecosystems
- invasive species
- pathogen fate in the environment
- studies of nuclear waste management
UOIT is committed to innovative research that enhances the capacities of local, national and global communities to thrive and grow in ways that are healthy and sustainable. Our goal is to promote and extend social well-being through problem-based research and the application of information and communication technology (ICT) and data analytics, in order to produce tangible and constructive outcomes for individuals and communities.

Sustainable and healthy communities are ones that plan their growth to maintain physical, social, economic and environmental health, while promoting social justice, inclusion and civic participation. Our researchers engage with community and institutional partners to:

- define social problems
- design research initiatives intended to yield insight into those problems
- develop policies, programs and products to facilitate positive change

Our researchers are involved in a wide range of initiatives related to this theme, including:

- community development
- countering violence
- environmental risks
- health informatics and analytics
- health promotion
- human health biology
- improving the quality, safety and experience of health care
- improved water quality
- social determinants of health
- sustainable energy technologies and usage patterns
Information and communication technology (ICT) and informatics are core research fields at UOIT and essential platform technologies that permeate and support all of our research activities. As the applications of ICT and informatics multiply, industry, government, health-care organizations and the public face an increasing number of challenges related to the field. UOIT researchers are tackling how to:

- employ ICTs and informatics to enable the right person to connect to the right content at the right time and at the right location, reliably, securely and with satisfactory quality
- manage the high volume of data that people and organizations generate daily through interactions with one another or between organizations
- preserve the integrity of that data

ICT and informatics research at UOIT is the linchpin required to, among others:

- build energy efficient wireless infrastructures
- create healthy communities
- develop intelligent transportation systems
- enable learning
- ensure energy sustainability
- manage health informatics

UOIT promotes research and development that enables communications between two parties anywhere, anytime. Our research in this area will contribute to:

- advanced manufacturing
- enhanced learning
- high-quality and reliable communications
- improved health care
- secure financial interactions
UOIT provides a stimulating environment for life sciences and biotechnology research. Applying advanced investigational methods in molecular biology, toxicology, synthetic chemistry, physiological studies, epidemiological methods, population studies, qualitative and quantitative research methods, and computational methods, our researchers take on contemporary challenges in a variety of fields, including:

- agricultural crops
- aquatic and terrestrial ecosystems
- micro- and macro-organism forensic models
- symbiotic and pathological micro-organisms

Faculty members engage in developing molecular targets for human and animal health and nutrition, as well as clinical- and population-based studies of determinants of human health, including those that lead to novel interventions such as:

- bio-based products
- biological chemistry
- ecosystem science
- forensic science
- infectious diseases
- microbiology
- molecular biology
- pharmaceutical chemistry
- radiation biology

Our researchers employ numerous and diverse technological tools and instruments. They have a strong vision for the use of biotechnology to initiate work on the forefront of proteomics, genomics and systems biology.
CAPACITY
Collaborations

UOIT fosters collaborations with industry, government and community partners. These organizations approach our researchers with their challenges. We do the research and transfer the results back to government, industry and the community to improve processes, policies, productivity and competitiveness. We build a partnership, make a commitment to provide actionable results, all while teaching our undergraduate and graduate students in an interdisciplinary, industry-focused environment.

International connections

UOIT strives to meet the highest international standards in its recruitment of faculty and students. Our faculty members publish in top tier international journals, present at conferences at home and abroad, and establish research collaborations with colleagues at leading universities and research institutes. International research collaborations work to solidify our global reputation and attract leading scholars and students to our institution.

We promote international connections both at the individual and institutional levels. Our faculty members form strong ties with international colleagues at research universities and institutes, reinforcing disciplinary expertise and facilitating knowledge exchange and mobilization. At the institutional level, UOIT continues to expand its global academic linkages with top-tier universities and research institutions. These connections address core research strategies, expanding international mobility opportunities for faculty and students, and enhancing our research capacity and reputation.
**Infrastructure**

UOIT houses more than 70 specialized research laboratories and facilities, a testament to our commitment of attracting leading scholars and stimulating their success.

### Faculty of Business and Information Technology

- Advanced Networking Technologies and Security Research Lab
- Distributed and Mobile Computing Research Lab
- Finance Laboratory
- GAMER Lab
- Game Science Lab
- Hacker Research Laboratory
- Health Informatics Laboratory
- Immersive D3 Stereoscopic Lab
- Incubator Lab
- Information Forensics and Security Laboratory
- Marketing Laboratory
- Networking Laboratory
- Undergraduate Game Lab
- XOR

### Faculty of Education

- Digital Literacies Research and Development Laboratory (DLRD)
- Educational Informatics Laboratory

### Faculty of Energy Systems and Nuclear Science

- Corrosion and Electrochemistry Laboratory
- Environmental Radiation Laboratory
- High Performance Computing and Visualization Laboratory
- Nuclear Simulation Laboratory
- Scientific Instrumentation Laboratory
- Radiation Protection Laboratory

### Faculty of Engineering and Applied Science

- Active Trailer Steering Systems Simulations Laboratory
- Advanced Materials Engineering Laboratory
- Advanced Metrology Laboratory
- Advanced Multi-Disciplinary Laboratory for Smart Software Systems
- Aero Acoustics and Noise Control Laboratory
- Automotive Centre of Excellence (ACE)
- Clean Energy Research Laboratory
- Communications, Signal Processing and Microwave Laboratory
- Control Power Systems Laboratory
- Electrical Power Laboratory
- Integrated Research and Training Facility
- Machining and Material Modelling Laboratory
- Manufacturing, Design and Materials Laboratory
- Manufacturing Laboratory
- Mechatronic and Robotic Systems
- Model Wind-Tunnel Laboratory
- Power Systems Laboratory
- Robotics and Automation Laboratory
- Robotics and Haptics Laboratory
- Software Systems Laboratory
- Sustainable Energy System Laboratory
- Thermal and Flow Induced Vibrations Laboratory
- Thermo-Fluid and Energy Research Laboratory
- Truck Driving Simulator Laboratory
- Vehicle Battery Testing Laboratory
- Vehicle Dynamics and Crash Simulation Laboratory
- Vibration, Control and Structural Dynamics Laboratory
Faculty of Health Science
• Alternatives in Coagulation in Health and Disease Laboratory
• Applied Exercise Science Laboratory
• Centre for the Study of Disability Prevention and Rehabilitation
• Human Neurophysiology and Rehabilitation Laboratory

Faculty of Science
• Aquatic Toxicology Laboratory
• Big Data Analysis Laboratory
• Computer Science Laboratory
• Crime Scene House at the Centre for Applied Learning in Forensic Science
• Electrochemical Materials Laboratory
• Electrophysiology Laboratory
• Environmental Microbiology Laboratory
• Forensic Entomology Laboratory

Faculty of Social Science and Humanities
• Forensic Psychology Laboratories
• DeCiMaL the Digital Culture and Media Laboratory

Shared High-Performance Computing
• SHARCNET
• Southern Ontario Smart Computing Innovation Platform
Why give?

The support of generous donors, along with industry, government and community partnerships, help us achieve our vision of attracting top students, welcoming highly-skilled researchers and building cutting-edge campus facilities. Our partners provide more than financial support: they become part of the university community by investing in, and benefitting from, the dynamic, ambitious research and education taking place on campus and beyond.

Benefits to giving

UOIT seeks partnerships with industry, government and community agencies, merging expertise and knowledge to contribute to ongoing novel and game-changing research. This allows faculty to work with these partners within their area of research and provides access to academic expertise through collaborative research and development programs, utilizing our state-of-the-art facilities and personnel. Partnerships create strategic alliances between our research chairs and industry, government and community agencies that focus on both fundamental and applied research. There are also opportunities to acquire proprietary technology from UOIT’s intellectual property portfolio through licensing or through supporting start-up companies. Further opportunities for knowledge transfer and knowledge exchange are available through partnerships with the university.

How to give/partner with the university for research

Help us ensure our faculty and students have access to the latest technology and innovation by donating or sponsoring research that will lead to advancements in science and will contribute to solving society’s grand challenges and relevant problems of our partners. This can be done as a philanthropic gift or direct contribution to support specific research programs conducted by our faculty experts. You may also choose to contribute funds toward student bursaries or scholarships to help train the next generation of researchers and professionals.
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