



University  
of Windsor



Strategic Research Plan

# MEETING OUR GRAND CHALLENGES

**FUTURE FULL  
OF PROMISE.**

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# EXECUTIVE SUMMARY

**The University of Windsor is a place of promise. We are home to a diverse, vibrant, and growing body of scholars recognized nationally and internationally for the importance and impact of contributions to the humanities; social, physical, environmental, and biological sciences; business; law and human dignity; nursing; engineering; education; and the creative arts. Every day, across our campus, our nation, and globally, University of Windsor faculty, students, and staff are making a difference. We are advancing our collective understanding of the world, maximizing benefit to society, and enhancing the quality of life today and tomorrow.**

Given our historic research strengths and distinctive geographic location, the University of Windsor's vibrant research community is uniquely positioned to lead the way in addressing four Grand Challenges that are of paramount importance to our region, our nation, and our world. In fulfilling our promise, we aim to:

**Safeguard Healthy Great Lakes;**

**Foster Sustainable Industry;**

**Understand and Optimize Borders; and**

**Build Viable, Healthy and Safe Communities.**

Collectively, these four grand challenges define us and inform the external world of our aspirations and goals. There is not another university that can so distinctly be identified with and conduct leading-edge research on this ensemble of challenges today.

The University of Windsor's Strategic Research Plan provides a framework for the pursuit of our Grand Challenges. It is a cogent yet versatile strategy designed not only to facilitate continued excellence in research, scholarship, and creative activity, but also to actively engage our research community and collaborative partners in achieving our promise.



“The University of Windsor has become a vessel for the cross-transfer of knowledge, technology and expertise. It is known as a place to stimulate creativity and collaboration, as well as to nurture the inventive spirit. Research and innovation at the University of Windsor are traversing exciting new terrain and opening new vistas. Great things are happening here and, from where I stand, the view has never been more exhilarating!”

**– DR. K. W. MICHAEL SIU, VICE-PRESIDENT, RESEARCH AND INNOVATION**





## A PLACE OF PROMISE

The University of Windsor is a place of promise that is recognized nationally and internationally for advancing collective understanding of the world around us, maximizing benefits to society, and enhancing the quality of life today and tomorrow.

## OUR MISSION

It is the University of Windsor's research mission to foster transformative research, innovation, and creative activity to meet the University's unique collection of four Grand Challenges. We are committed to recruiting the best and brightest scholars and to supporting their continued development by providing them with access to state-of-the-art infrastructure and facilities, and first-rate research support services. We will strive to provide our graduate and undergraduate students and postdoctoral fellows with exceptional experiential research opportunities that will enable them to become tomorrow's leading scholars, artists, entrepreneurs, community leaders, and decision makers. We will work with the community we serve through collaboration with key stakeholders and ensure that results of the stellar research, scholarship, and creative activity undertaken at the University of Windsor are mobilized through cross-transfer of knowledge, technology, expertise, and artistic creativity for the betterment of society.

## INTRODUCTION

The University of Windsor's Strategic Priority Plan, *Thinking Forward... Taking Action*, aspires to "create a more research-intensive university with graduate programs that build on academic and professional strengths". In support of this priority, the University of Windsor launched its first Strategic Research Plan (SRP 2012-2016) in January 2012. Developed in consultation with key stakeholders from our research community, SRP 2012-2016 envisioned a University that is "recognized nationally and globally for the excellence of its research, innovation, and creative activity" and for its "role as a catalyst for intellectual, social, cultural, and economic advancement". It identified five highly multidisciplinary thematic areas of research strength and one emerging area of strategic priority in which to promote development, set major performance objectives and action oriented sub-goals, and established metrics that would be used to measure performance over the next five years. A Strategic Research Plan Implementation Committee was formed to promote achievement and monitor progress of this vision and the objectives identified in SRP 2012-2016.

In his 2013 annual address, *The Future is Never What it Used to Be*, President Alan Wildeman challenged the campus community to elevate SRP 2012-2016 to the next level and to anchor it on grand challenges that can be addressed and solved. In responding to the President's challenge, the Strategic Research Plan Implementation Committee employed the five thematic areas of research strength and the emerging area of strategic priority originally identified in SRP 2012-2016 as foundations from which to recast the University's research aspirations and goals in the form of four Grand Challenges: Safeguard Healthy Great Lakes; Foster Sustainable Industry; Understand and Optimize Borders; and Build Viable, Healthy and Safe Communities.

These interrelated, multidisciplinary Grand Challenges were selected to reflect our historic research strengths and unique geographic location and are recognizably associated with the University of Windsor to the extent that no other university in Canada can so unmistakably be identified today by the collective of them. Across our campus, one would be hard pressed to find faculty, student, or staff engaged in research, scholarship, or creative activity that is not engaged in one of these challenges. Collectively, our Grand Challenges define us and tell the external world our aspirations and goals.

Going forward, the University of Windsor's *Strategic Research Plan: Meeting our Grand Challenges* will lay a framework for the pursuit of our Grand Challenges and realization of our promise as a place that is recognized nationally and internationally for advancing collective understanding of the world around us, maximizing benefits to society, and enhancing the quality of life today and tomorrow. It is a cogent yet versatile strategy designed not only to facilitate continued excellence in research, scholarship, and creative activity, but also to actively engage our research community and collaborative partners in realizing our promise.





# OUR RESEARCH ENVIRONMENT

## OUR GEOGRAPHY AND COMMUNITY

The University of Windsor is situated on the banks of the Detroit River, in the heart of the Great Lakes region between Lake Erie and Lake Huron. Our campus is located just steps away from the international border between Windsor in Ontario and Michigan in the United States, the largest commercial border crossing in North America, and the most economically significant land-crossing on earth. Windsor is recognized as an industrial powerhouse in Canada. Within a 100-kilometer radius of our doorstep lies one of the highest concentrations of automotive and original equipment manufacturers and tier one suppliers on the continent.

Our campus, our community, and our region celebrate diversity. University of Windsor faculty, staff, and students hail from all walks of life and all corners of the globe; the Windsor-Essex region is heralded as among the most ethnically diverse in Canada. Our regional diversity and close proximity to the United States have established Windsor-Essex as an important centre for the arts, social services, and advanced healthcare systems. Ours is a region that is of enormous environmental, economic, and cultural significance nationally and internationally. The University of Windsor is playing a pivotal role in the protection of our environment and health, efficacy of our economy, and cultural vibrancy of our communities.



## OUR HISTORY OF EXCELLENCE

The University of Windsor has a rich and dynamic history dating back more than 160 years. It has impacted the lives of more than 115,000 alumni globally and has made significant and far-reaching contributions to the success and well-being of Windsor-Essex, Ontario, and Canada. From our founding as Assumption College in 1857, incorporation in 1962, and opening as the University of Windsor in 1963, the University of Windsor continues to combine tradition with a commitment to the future. Today, the University of Windsor is home to more than 500 faculty and nearly 13,000 undergraduate and 3,000 graduate students. We pride ourselves on being a top comprehensive, research-intensive university that promotes excellence in research, scholarship, and creative activity and is committed to providing students with exceptional experiential learning opportunities. We offer over 65 Master's and Doctoral programs and 190 undergraduate degree programs in nine academic faculties. Everyday across our campus, the University of Windsor's faculty are engaging their graduate and undergraduate students in fundamental as well as applied research. Our emphasis on student engagement in research is outfitting our graduates with a significant advantage, setting them apart from their peers, and shaping them as tomorrow's top scientists, technological innovators, community leaders, entrepreneurs, and artists.

Since our inception, the University of Windsor has cultivated excellence in research, scholarship, and creative activity. Our campus is home to some of the world's most celebrated minds. Among our faculty are global leaders in the sciences, social sciences, humanities, and engineering; distinguished authors; and renowned artists who have been recognized for the significance and impact of their scholarly and artistic contributions with prestigious honours such as the Order of Canada and Orders of several Canadian provinces, Governor General Awards, Royal Society of Canada Fellowships and College Memberships, Molson Prizes, CAP Herzberg Medal, Gerhard Herzberg Awards, Humboldt Research Awards, Killam, Pierre Elliot Trudeau, and Fulbright Scholar Awards and Fellowships, NSERC Steacie Prize and Synergy Award, and Queen Elizabeth II Diamond Jubilee Medals as well as countless field-specific accolades and distinctions.

“The dependence of our future world on knowledge and innovation has never been more evident. The University of Windsor is a place where scholarship and research across the arts, sciences and humanities, and the professions, are revealing new insights into our world and enhancing the quality of life. Everywhere you go on the campus, you will find scholars who are internationally renowned in matters of the environment, the automobile, innovative engineering, social justice, creative arts, humanities, law, business, education, nursing, and the social, physical and biological sciences. Students at the University of Windsor are able to benefit from the close relationship that exists between research, creative practice, and teaching. We also are providing greater opportunities for graduate students, recognizing that advanced education and research training will be essential for future innovation.”

**– DR. ALAN WILDEMAN,  
PRESIDENT AND VICE-CHANCELLOR,  
2008-2018**

## RESEARCH INSTITUTES, CENTRES, AND CHAIRS

Our Grand Challenges are further bolstered by numerous research institutes, centres, and groups, and research chairs. The University of Windsor proudly supports four university research institutes and more than 35 faculty research groups and centres, each of which can be linked to one or more of our Grand Challenges. Through our Canada Research Chairs, Industrial Research Chairs, and Ontario Research Chair, we are able to attract and retain the brightest minds in key disciplines that will help us meet our Grand Challenges. Not only do our research chairs deepen our knowledge of the world around us and maximize our benefit to society, but they also serve as role models and mentors to the next generation of scholars, artists, scientists, engineers, and entrepreneurs, contributing directly to their development through student supervision, teaching, and coordination of research endeavours.

## ADVANCEMENTS IN RESEARCH INFRASTRUCTURE

In recent years, the University of Windsor has undergone a major campus transformation. In the last five years alone, we have invested over \$333 million in new buildings, facilities, and state-of-the-art research infrastructure. In 2012, the University of Windsor opened the doors to the Ed Lumley Centre for Engineering Innovation (CEI). This 300,000 square-foot world-class teaching and research facility, designed to promote creativity, collaboration, and innovation, houses more than 80 research and teaching laboratories and an Industrial Courtyard that supports the cross-transfer of knowledge, technology, and expertise between academia and industry in a hands-on collaborative research environment.

In 2013, the University of Windsor unveiled plans to invest \$75 million in the expansion of its campus into Windsor's downtown by revitalizing and repurposing key heritage buildings in the city centre. In 2015, the University opened the School of Social Work and Centre for Executive and Professional Education in the 1920s era former Windsor Star building located in downtown Windsor. This unique facility, honoured with a Built Heritage Award, positions faculty and student researchers within blocks of critical social service agencies, significantly enhancing access and opportunities for field research and placements, and closing the gap between academic programming and the needs of our community. In 2018, the University relocated its School for Creative Arts to the re-imagined century-old Windsor Armouries and a new stand-alone facility located adjacent to the Windsor-Detroit tunnel crossing. Designed to inspire creativity, these new state-of-the-art facilities will not only provide University of Windsor faculty and student researchers with studio, exhibition, performance, and practice spaces, but also with increased access to Windsor's major artistic venues.

The year 2014 saw the University of Windsor open the doors to the Joyce Entrepreneurship Centre, which houses the Office of Research and Innovation Services, the Entrepreneurship, Practice, Innovation Centre (EPICentre) and the Cross-Border Institute (CBI). EPICentre provides over 9,000 square feet of modern, fully equipped collaborative work space for young entrepreneurs across disciplines and supports the business incubation of these young entrepreneurs and new business ideas. The new CBI space features the Traffic Lab, a world-class research facility that maintains sophisticated software, data, and hardware, including sensing resources, which supports cutting-edge research that is improving traffic performance at border crossings.

Throughout our history, the University of Windsor has maintained strong, fruitful collaborative relationships with the automotive industry. More than 20 years ago, it embarked on a first-of-its-kind partnership with Fiat Chrysler Canada when it opened the University of Windsor-Fiat Chrysler Canada Automotive Research and Development Centre (ARDC) with an initial \$30 million investment. Since its inception, this cutting-edge research facility has provided opportunities to more than 500 student engineers to participate in hands-on industrial experience in automotive innovation. At ARDC, student researchers work with some of the field's most prominent experts on new and innovative product design and automotive engineering projects. In 2016, ARDC received an additional \$85 million from the province of Ontario to further enhance research and technological innovation at the centre.

In 2017, the University of Windsor announced a \$30.3 million investment in a new Science Research and Innovation Facility that will open its doors in 2018. This modern 46,000 square-foot facility, featuring state-of-the-art open concept research labs, has been designed to promote an inventive spirit and foster collaborative research partnerships. It will house laboratories dedicated to advanced material science, translational health, and medical physics.

## COLLABORATION AND COMMUNITY ENGAGEMENT

At the University of Windsor, we are committed to maximizing our benefit to our community at the regional, provincial, and national levels. We have a demonstrated track record of success in ensuring that we accurately identify, remain responsive to, and appropriately adapt to the needs of our community. We feel strongly that academic research, scholarship, and creativity should be translated out into the community for societal gain. Across our campus, our researchers are developing and mobilizing ideas and technologies that address real-world challenges and enhance quality of life. We achieve this goal by cultivating and maintaining strong collaborative research partnerships with key community, government, as well as industry stakeholders.



**IN 2017, THE UNIVERSITY OF WINDSOR WAS RANKED BY HUFFINGTON POST AS CANADA'S TOP RISING STAR UNIVERSITY FOR ITS MAJOR INVESTMENT IN NEW BUILDINGS, PROGRAMS, AND RESEARCH.**



TOP: WINDSOR HALL  
BOTTOM: SCHOOL OF CREATIVE ARTS, ED LUMLEY CENTRE FOR ENGINEERING INNOVATION, JOYCE ENTREPRENEURSHIP CENTRE, SCIENCE RESEARCH AND INNOVATION CENTRE

# OUR GRAND CHALLENGES

The four Grand Challenges identified in this Strategic Research Plan reflect the University's research strengths and the importance of its location in Ontario. Not only do our Grand Challenges build on core research strengths, but they also reflect areas in which the University can respond to the needs of our community and has the capacity to have the greatest impact. They are areas in which we have assembled a significant body of researchers who are recognized for the excellence of their contributions to the field, and where the University of Windsor has made significant investment to ensure continued success. Our Grand Challenges are highly collaborative and multidisciplinary in nature and converge naturally in terms of significance and benefit to society. They are areas of research priority that are important to our community, government, and industrial stakeholders.

While our Grand Challenges facilitate in positioning our research, scholarship, and creative activity; making real and lasting contributions; and maximizing benefits to society; they are not meant to be dogmatic, nor do they represent an exhaustive record of all the important research activities underway at the University of Windsor. The University will always have a place for curiosity-driven fundamental and applied research that does not apparently fall within the Grand Challenges, and we will continue to exploit new and developing opportunities in order to respond to changing societal needs and emerging issues or challenges.





# 1

## **SAFEGUARD HEALTHY GREAT LAKES**

**The Laurentian Great Lakes hold nearly 85% of North America’s freshwater. The dynamic ecosystem that relies on them supports more than 3,500 species of plants and**

**animals, over 35 million people, and a multi-billion dollar economy. The continued viability of this critical natural resource is being threatened by increasing agricultural intensification, climate change, invasive species, and population growth. Situated on the Detroit River between Lake Erie and Lake Huron, the University of Windsor’s close proximity to these vast bodies of freshwater has uniquely positioned us to take the lead in safeguarding the health of the Great Lakes through research that provides science-based solutions to the most pressing socio-ecological challenges facing the Great Lakes today.**

In 1981, the University of Windsor established the Great Lakes Institute for Environmental Research (GLIER). Today, GLIER is an internationally recognized research centre focused on providing real-world solutions to acute and serious pressures faced by the Great Lakes. At GLIER, a growing body of core, cross-appointed, and multidisciplinary researchers from diverse University of Windsor departments, including Biology, Civil and Environmental Engineering, Chemistry and Biochemistry, Sociology, Economics, and Earth and Environmental Science, dedicate themselves to advancing and communicating fundamental knowledge of Great Lakes science; understanding and helping to develop policies and regulations to safeguard the Great Lakes; advancing technologies to improve water quality and biota health; mitigating and adapting to the effects of natural and societal impacts on the Great Lakes; and promoting remediation efforts in the Great Lakes region and beyond.

GLIER houses some of the most advanced environmental analytical instrumentation in North America and is globally acknowledged as a centre of excellence in graduate and undergraduate student training and engagement in Great Lakes research. Through access to the world-renowned, interdisciplinary research and state-of-the-art equipment that GLIER offers, the University of Windsor is providing students with a unique opportunity to develop the research methods and processes needed to protect, conserve, and manage the Great Lakes. We are training highly qualified personnel

“If the Laurentian Great Lakes Basin was a nation, it would be among the richest in the world... Despite efforts such as the Great Lakes Water Quality Agreement and Ontario’s Great Lakes Act, we are failing to manage this critical resource... This is no simple task and solutions will not be found overnight. Finding solutions requires targeted assessments for each lake... involving university, government and industry.”

– **DR. DOUG HAFFNER,  
PROFESSOR AND CANADA RESEARCH CHAIR  
EMERITUS IN GREAT LAKES ENVIRONMENTAL  
HEALTH, AND  
DR. HUGH MACISAAC,  
PROFESSOR AND CANADA RESEARCH CHAIR  
IN AQUATIC INVASIVE SPECIES**

“The Great Lakes basin contains more than 3500 species of plants animals and it is this biodiversity that allows natural systems to function properly. We have now moved beyond merely cataloging biodiversity and now aim to restore biodiversity and ecosystems services to provide a better quality of life for the millions of people who live within the basin.”

**- DR. TREVOR PITCHER, DIRECTOR, FRESHWATER RESTORATION ECOLOGY CENTRE**

who will become next-generation scholars, leaders, and policy makers capable of engaging in productive dialogue on the science of ecosystem function, as well as in the conservation, protection, and management of the Great Lakes environmental resources.

The University of Windsor’s research in safeguarding healthy Great Lakes is further bolstered by strong and longstanding collaborative research partnerships that have been developed within academia and with the community, with government and non-government organizations, and with industry stakeholders at the local, regional, provincial, national, and international levels. These collaborative relationships have led to a number of highly successful, large-scale scientific research initiatives, which have contributed directly to the advancement of Great Lakes science and innovation, and the implementation of much-needed solutions to pivotal challenges to the sustained environmental efficacy of our aquatic freshwater resources.

In support of this challenge, the University of Windsor recently launched the Freshwater Restoration Ecology Centre (FREC) in collaboration with the Town of LaSalle, Ontario. Located on the banks of the Detroit River, this world-class research facility features state-of-the-art research infrastructure and focusses on conserving freshwater ecosystems, especially biodiversity, water quality, and mitigating invasive species. At FREC, University of Windsor faculty and student researchers are conducting cutting-edge research and experiments targeted to preserving and restoring biodiversity, cleaning up our waterways, mitigating the impact of invasive species, and restoring natural fish populations in the Great Lakes.

Knowledge developed in support of the Healthy Great Lakes theme is highly translational and is supporting major research projects in other parts of Canada and internationally. For example, University of Windsor researchers are collaborating with a number of institutions and organizations in China to adapt Great Lakes research to address grave issues affecting water quality, loss of biodiversity, and ecosystem services in China’s Plateau Lakes and the Three Gorges Dam Reservoir.





TOP: LAURENTIAN GREAT LAKES AS SEEN FROM SPACE  
BOTTOM: LAKE STURGEON FRESHWATER RESTORATION ECOLOGY; ZEBRA MUSSELS; FISH FRY; ALGAL BLOOM IN LAKE ERIE



“In May 1996, FCA Canada pioneered a partnership, the first of its kind, with the University of Windsor - the Automotive Research and Development Centre (ARDC). Truly collaborative, ARDC benefits both the University of Windsor and FCA Canada.... This long-standing relationship has resulted in over 500 undergrad and graduate level students who are exposed to the work culture at FCA and play an essential role in working on world-class products.”

**- FIAT CHRYSLER AUTOMOBILES (FCA)**







“Ford Motor Company, and especially the Powertrain Engineering Research and Development Centre, values collaboration with the University of Windsor. Through our long-term working relationship, Ford is able to benefit firsthand from the research innovation of UWindsor researchers, as well as attract the students and postdocs graduating from these labs. They, in turn, gain industrial exposure and experience by their close association with Ford.”

– **DR. JIMI TJONG,**  
**TECHNICAL LEADER AND MANAGER,**  
**POWERTRAIN ENGINEERING R&D,**  
**FORD MOTOR COMPANY**

# 2

## **FOSTER SUSTAINABLE INDUSTRY**

The University of Windsor’s historic research excellence and the uniqueness of our geographic location have enabled us to cultivate a dynamic research culture, dedicated to fostering sustainable industry, in which both fundamental and industrial research flourish. The University of Windsor is located within a 100-kilometer radius of one of the highest concentrations of automotive and original equipment manufacturers and tier one suppliers in North America. Given our geographic proximity to top automotive manufacturers and suppliers, the University established itself early on as a leader in conceptual and applied automotive research, and has long been recognized for its significant contributions to innovation in the automotive industry. The University has worked to develop and maintain strong collaborative relationships with our region’s automotive stakeholders. Partnerships with Fiat Chrysler Automobiles, Ford, and General Motors, and a broad range of automotive parts manufacturers have resulted in important innovations in automotive materials, casting, controls, power-trains, acoustic, electric vehicle, and clean combustion engineering, with many of these innovations now incorporated into today’s automobiles and manufacturing processes.

Today, research at the University of Windsor reaches far beyond the automotive sector to foster sustainable industry in a broad range of fields, including environmental, civil, industrial, and electrical engineering. Through collaboration with multi-sector industrial stakeholders, the University's research is helping to build sustainable industries by mobilizing and translating knowledge and technologies to collaborating industry partners. Our multidisciplinary researchers are providing technical, legal, and business advice to industries on a collaborative basis and working with industry partners, both in-house and off-site, on the development of next-generation concepts and products.

For example, the Clean Combustion Engine Laboratory (CCEL) is among the most advanced academic engine research facilities internationally, and features leading-edge precision diagnostic and testing infrastructure. The highly collaborative and ground-breaking research currently pursued by CCEL's world-class faculty, student, and staff from our Faculty of Engineering, in partnership with industry, government, and academic stakeholders, is at the forefront of combustion technology, contributing directly to dramatic improvements in engine combustion processes and emissions reduction.

Similarly, the University of Windsor's Centre for Hybrid Automotive Research and Green Energy (CHARGE) Lab is fostering sustainable industry that leads ultimately to a cleaner environment and benefit Canada both socially and economically. CHARGE advances knowledge, technology, and expertise through cutting-edge research and innovation in electric vehicle science and engineering. In collaboration with a broad range of industrial stakeholders and national and international academic partners, CHARGE is clearing bottlenecks in the commercial viability of electric transportation, including driving range, charge time, and affordability through significant contributions to electric machine design and testing, machine drives and control, electric vehicle simulation, and inductive and conductive charging. CHARGE provides important opportunities for hands-on training in state-of-the-art facilities through academic exchange programs with institutions across Canada and around the world.

Our faculty, students, and staff are recognized nationally and internationally for seminal contributions to scholarship and innovation in sustainable energy, environmental remediation, green materials and manufacturing processes, and clean water, air and soil technologies. Researchers from Civil and Environmental Engineering, specializing in fluid-structure interactions, flow turbulence, thermo-, aero-, and vortex-dynamics, and renewable and sustainable energy infrastructure, are pioneering new applications that escalate

conventional, current, and future energy technologies. They are training next-generation engineers and entrepreneurs who will take the lead in developing the sustainable energy systems of tomorrow. Researchers from our departments of Chemistry and Biochemistry, Biology, and Civil and Environmental Engineering are collaborating to develop new and environmentally friendly clean stoichiometric, catalytic chemical, and biocatalytic processes for waste-water treatment. They are producing novel resin applications for coatings, metal casting, and forest products, ground-breaking techniques for petroleum extraction and refinement and oil sands remediation, and ethanol production. Researchers from our departments of Mechanical, Automotive, and Materials Engineering, Chemistry and Biochemistry, and Physics are engaged in highly interdisciplinary advanced materials research.

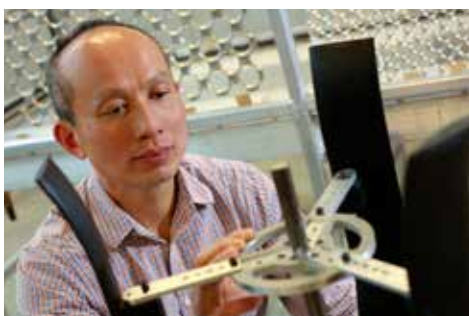
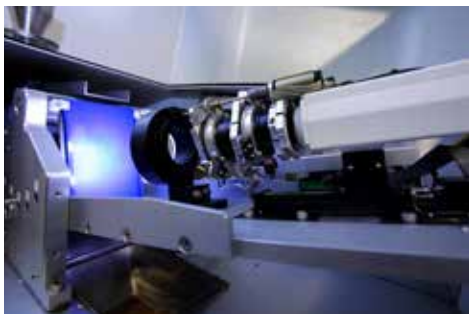
This world-class group of faculty, graduate and undergraduate student, and staff researchers are revolutionizing methods and techniques for the synthesis, preparation, and characterization of new materials and their development and deployment in new technologies and infrastructure. Through collaboration with industry, community, and government partners, our researchers are developing real-world solutions and technologies to foster sustainable industry today and tomorrow for the betterment of society.

The University of Windsor's internationally acclaimed researchers are training the highly qualified personnel who will become tomorrow's social and technological scholars, leaders, and entrepreneurs. At the University, students engage in hands-on training and research in the state-of-the-art facilities at the world-class Ed Lumley Centre for Engineering Innovation. Through Entrepreneurship, Practice, Innovation Centre (EPICentre), the University of Windsor is fostering sustainable industry by providing a forum and a venue for students and graduates to transition from research, to innovation, and to entrepreneurship. EPICentre hosts more than 60 programs annually, and provides collaborative incubation and innovation space, including three incubators, and mentorship that has helped launch many new and innovative businesses.





TOP: WIND ENERGY RESEARCH  
BOTTOM: HIGH POWER  
CONVERTER AND REAL-TIME  
SIMULATION PLATFORM  
USED TO TEST NEW ELECTRIC  
MOTOR CONTROL CONCEPTS  
FOR ELECTRIC VEHICLE  
APPLICATION, SOLID SIZER,  
SMALL-SCALE VERTICAL  
AXIS WIND TURBINE,  
RECONFIGURABLE HARDWARE  
SETUP FOR 3D-BASED  
PEDESTRIAN IDENTIFICATION  
AND TRACKING



“Canada’s prosperity depends on efficient and effective borders at home, and the capability of Canadians to navigate the maze of international borders around the world.”

– DR. BILL ANDERSON,  
ASSISTANT VICE-PRESIDENT, INNOVATION IN CROSS-BORDER STRATEGIES

CANADA  
- - -  
U.S.A.



# 3

## UNDERSTAND AND OPTIMIZE BORDERS

The University of Windsor is situated on the Detroit River, steps away from the

border between Ontario in Canada and Michigan in the United States. The Windsor-Detroit border, the busiest trade crossing between Canada and the United States, provides a unique perspective from which to observe, study, and understand logistical, economic, societal, human, cultural, political, legal, and trade issues associated with borders and border-crossing. Through collaboration with public and private sector stakeholders, the University's research strives to understand and support the development of policies, regulations, and best practices that facilitate border-crossing and the binational coordination of environmental and emergency management in border regions. Our researchers are advancing critical knowledge on the transportation of goods and people, with the associated certifications and regulations, and are actively engaged in developing the science, technology, and engineering that will facilitate safe and secure border-crossings.

The University of Windsor is home to the Cross-Border Institute (CBI), an internationally leading centre of excellence in the study and scholarship of borders and border-crossing. CBI brings together a growing body of multidisciplinary researchers from a large number of departments and disciplines, including Political Science, Physics, Computer Science, Computer and Electrical, and Civil and Environmental Engineering, Business, Economics, and Law who are engaged in ground-breaking research and instructional and outreach activities associated with the most pressing issues and challenges affecting our borders today. Areas of focus include modeling and simulation of border traffic delays and congestion; design and operation of border infrastructure and inspection plazas; sustainable urban transportation and land use modelling and policy; cross-border supply chain and trade analysis; real-time data acquisition systems, GIS, and intelligent transportation systems (ITS); economic impact of border performance and border

“Thanks to the increased liberalization of trade, globalization has been put into hyperdrive... the global economy is shifting from a marketplace in which we buy and sell finished products, to one where we increasingly make products together within global value chains that take advantage of specialized production capabilities, access to labour, proximity to international transportation networks and low-cost shipping.... The speed at which trade happens along these supply networks and value chains is dependent on a number of factors, most notably the use of information and communications technology... Finally, as trade boundaries expand our interdependencies deepen, and policymakers are forced to rethink strategies that are designed to protect and serve national economic interests in favour of more collaborative approaches that harness the economic advantages of highly connected, functional geographies...”

– **MARK FISHER,**  
**PRESIDENT AND CEO,**  
**COUNCIL OF THE GREAT LAKES REGION**

infrastructure investments; human trafficking and other cross-border criminal activities, cross-border municipal and healthcare services and facilitation of cross-border medical research; and border policy for customs, immigration and security.

CBI houses a state-of-the-art Traffic Lab which maintains sophisticated software, data, and hardware, including sensing resources, that aim to examine the traffic patterns and ultimately improve traffic performance between Canada and the United States. Key projects currently underway at CBI's Traffic Lab include analysis of new border infrastructure's impact on the performance of regional and national road networks; assessing vulnerability, criticality, and resilience in Southern Ontario freight networks; collection and analysis of nation-wide micro-level business establishment commercial vehicle movement data; real-time analysis and short-term prediction of commercial border crossing times using artificial intelligence; big data analysis of over 1.5 billion records from GPS transponders in a sample of 60,000 trucks; and development of a Computable General Equilibrium (CGE) model to assess the full economic impacts of border-crossing policies. Many of these analytical resources are combined in a comprehensive analysis of the economic implications of the Gordie Howe International Bridge project for the binational Great Lakes economic region.

Through frequent workshops, conferences and other events, the CBI provides a trusted forum where all levels of government, private sector firms, and the general public can meet, learn about and discuss the challenges associated with the Canada-US border and the maintenance of the huge Canada-US economic relationship. Through collaborations with scholars and stakeholders in India, Poland, and Ireland, the CBI is increasingly applying its expertise to land borders around the world.

In addition to the high-impact research underway at CBI and the Traffic Lab, scholars, artists, scientists, and entrepreneurs from across our campus are engaged in activities associated with borders and border crossing. For example, researchers from Sociology, Anthropology and Criminology are engaged in a number of significant studies relating to Canadian newcomers that are providing insight on the movement of migrant agricultural workers across international borders, the social and economic integration of immigrants, the impact of agency-facilitated settlement, and sexual health issues affecting the African-diasporic population in our region. In partnership with the University of Detroit Mercy Law School, the University of Windsor's

Faculty of Law offers the only three-year Dual Juris Doctor program in North America and its faculty and student researchers are advancing legal scholarship in a number of areas critical to understanding borders in today's complex international environment. Areas of emphasis and expertise include national security, anti-terrorism and human rights, racial profiling, international humanitarian law, international business, customs, transportation law, international development and global governance, international innovation strategy, and international environmental law.

Our commitment to understanding borders also includes training of the highly qualified personnel who will become our next-generation scholars, leaders, innovators, and decision makers. CBI engages a large number of undergraduate and graduate research assistants and postdoctoral fellows. At CBI, these students are offered a unique opportunity to learn directly from recognized leaders in border science, engineering, and policy in a cutting-edge, hands-on research environment.





TOP: AMBASSADOR BRIDGE  
BOTTOM: CANADA BORDER SERVICES AGENCY AMBASSADOR BRIDGE CUSTOMS, US CUSTOMS AND BORDER PROTECTION PORT OF DETROIT, CANADA BORDER SERVICES AGENCY OFFICER, DETROIT-WINDSOR TUNNEL



“The health and social consequences of sexual assault can be serious and long-term for victims. We know that the Enhanced Assess, Acknowledge, Act Sexual Assault Resistance Program works and see it as an important step in empowering young women to resist unwanted sexual activity and enjoy their sexual lives. This is the only program that actually decreases the sexual violence women experience. It shows that providing women with knowledge and tools can increase their ability to defend themselves and reduce the severity of the violence they experience. This is a key component of any comprehensive sexual violence prevention plan.”

**- DR. CHARLENE Y. SENN, PROFESSOR,  
DEPARTMENTS OF PSYCHOLOGY AND WOMEN'S AND GENDER STUDIES**





# 4

## **BUILD VIABLE, HEALTHY, AND SAFE COMMUNITIES**

**Viable, healthy, and safe communities are ones in which the continued development of a complex, multifaceted social fabric comprising a multitude**

**of attributes, such as health, social services, and creative arts, is valued and supported. Across University of Windsor departments and disciplines, thematic research and creative activity converge to fulfill this goal. At the University, our world-class faculty, graduate and undergraduate students, and staff are working together to build viable, healthy, and safe communities here in our city, in our country, and around the world. Nearly every facet of our diverse research community is in some way engaged in research that helps address the challenges facing humanity in a rapidly changing world.**

Our multidisciplinary research approach to the exploration and understanding of the social, economic, and health conditions that will lead to the development of viable, healthy, and safe communities builds on synergy from various sectors and stakeholders. It aims to significantly advance knowledge about the lives of designated groups and people, including First Nations, women, ethnic and sexual minorities, the disabled, recent immigrants, and people of all cultural and socioeconomic strata, and to advance the humanities, arts, social and natural sciences, engineering, and technology. Advanced knowledge is harnessed and leveraged to address issues and build on strengths and resiliencies to enhance and maximize the vibrancy, health and well-being, livability, and safety of communities.

For example, the University of Windsor has emerged as a national leader in the study of sexual assault and violence against women. Researchers from a range of the University's departments and disciplines, including Psychology, Women's and Gender Studies, Sociology, Anthropology and Criminology, Social Work, Political Science, Kinesiology, Business, History, and Education, have come together to form the Violence Against Women Research Group. Faculty, student, and staff researchers affiliated with this group are working with campus and community stakeholders to broaden our understanding of

“To see our laboratory-based research impact clinical practice within my career is something truly remarkable. I am so very grateful for the support of the University of Windsor – to my incredible students, to our amazing research participants, to our student volunteers and research assistants, to my encouraging colleagues and mentors – by working together, this “bench to bedside” realization was possible.”

**– DR. CHERI L. MCGOWAN,  
ASSOCIATE PROFESSOR,  
DEPARTMENT OF KINESIOLOGY**



violence against women and develop real-world strategies to prevent and mitigate its effects. The Enhanced Assess, Acknowledge, Act (EAAA), a program developed by researchers from this group focusing on knowledge translation and mobilization in the reduction of sexual assault against university women, demonstrated a 50% reduction in rape and attempted rape and a simultaneous decline in “women-blaming” over a one-year period. The success of this initiative has generated requests from around the world to adapt and test EAAA in different cultural and institutional contexts. Similarly, the Bystander Initiative developed by researchers from this group is working toward a campus that rejects sexually aggressive behaviour and empowers students by embedding sexual assault prevention in course work. Other significant endeavours led by researchers associated with the Violence Against Women Research Group include studies on how police respond to calls to intervene in domestic violence, and community characteristics and social determinants affecting incidence of intimate partner violence; co-occurrences of animal and interpersonal violence, which have led to discussions with women’s shelters and the development of policies enabling women to leave abusive relationships by allowing them to bring their pets with them; and cross-country comparisons of social determinants, community characteristics, and government programmes related to intimate partner violence in diverse international settings.



Researchers from Kinesiology are leading the way in maximizing wellness by reducing cardiovascular disease-related morbidity and mortality. Working in collaboration with University of Windsor colleagues from our departments of Biological Sciences and Psychology, local community organizations such as the Windsor Essex Community Health Centre and and Hôtel-Dieu Grace Healthcare (HDGH), and national and international academic and healthcare institutions, including the Western, Brock, and McMaster universities and the University of Waterloo in Canada, the University of Michigan, Wayne State University, Henry Ford Hospital in the United States, Greenwich University and the University of Northampton in the United Kingdom, and the University of New England in Australia, our researchers are seeking to better understand contributions of the autonomic nervous system to disease pathophysiology, and are exploring the effectiveness of traditional (cardiac rehabilitation) and alternative (isometric handgrip (IHG) training) applications on cardiovascular health. This pivotal IHG work has made substantial contributions to meta-analyses used as a foundation for formal recommendations put forth by the American College of Cardiology and the American Heart Association in their 2017 Guidelines for Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults.





The University of Windsor's Odette School of Business is home to the World Health Innovation Network (WIN) and host of the Global Network in Strategic Health Sector Supply Chain Innovation Network Centres of Excellence (SCI-NET). The University's researchers are leading the way with the World Health Innovation Network by adding value to healthcare for Canadians and driving economic growth for healthcare innovators. WIN partners with health system stakeholders to source innovation, create evidence for value, and develop models for scalability to imbed innovative technologies, products, and models of care into health systems. Through SCI-NET, our researchers are promoting and supporting the mobilization of knowledge and learning opportunities to advance supply chain innovation in healthcare systems. By promoting innovation in health care sector supply chains, SCI-NET is contributing to safer, more sustainable and affordable healthcare systems in our community, province, and country.

Researchers from Biology, Nursing, and Chemistry and Biochemistry have built on synergy with clinicians and oncologists from the Windsor Regional Hospital to form the Windsor Cancer Research Group (WCRG). Working closely with key community stakeholders, WCRG is engaged in a number of important research initiatives that are advancing cancer screening, identification, and treatment technologies and improving patient care. In our region and beyond, WCRG is serving as a catalyst for important discussions on cancer research and for the exploration of new commercialization opportunities.

University of Windsor researchers from Kinesiology and Psychology are collaborating both internally and externally, with researchers and research institutes at HDGH, Henry Ford Hospital, Wayne State University, the University of Rochester Medical Centre, and the

“Canadians are living longer, thanks to better healthcare stemmed from advances in research and innovation. Windsor-Essex is an ethnically diverse and rapidly aging community sitting at the nexus of the U.S. and Canada, making our region unique in the healthcare questions that we face and opportunities available. With new investment in healthcare regionally, I am excited and honoured to join my talented colleagues and students in building a united community bridging cutting-edge research with world-class healthcare.”

– **DR. LISA PORTER,**  
**PROFESSOR AND SCIENTIFIC DIRECTOR,**  
**WINDSOR CANCER RESEARCH GROUP**



Centre of Excellence for Suicide Prevention at Canandaigua VA Medical Centre, to address major issues in neuropsychology. For instance, the Cognitive Neuropsychology Laboratory is engaged in a collaborative, community-based study that is addressing the impact of aphasia in the workplace and developing practical solutions to mitigate its impact. In partnership with HDGH and situated in state-of-the-art facilities on their campus, the Centre for Neurobehavioural Science research teams are tackling some of the field's most pressing problems, including development of effective mindfulness interventions for ADHD, advancing knowledge of the cognitive effects of diabetes, the socioemotional impact of traumatic brain injury, and the ergonomics of patient transfers by nursing staff. The Sports-Related Concussion Centre (SRCC), formed in partnership with regional hockey associations, is engaged in cutting-edge research in sport-related concussions and the translation and mobilization of its findings. SRCC serves not only as a research centre but also provides clinical services to varsity athletes at the University of Windsor.

Researchers from our School of Creative Arts are emerging as leaders in exciting new fields of expression such as BioArt, which employs live media in the creation of artistic works and provokes thought and important dialogue on issues surrounding living systems, human-environment interactions, and the continued health of our natural world. The In/Terminus research centre draws from the creativity of a multidisciplinary group of faculty and student artists and scholars from the School of Creative Arts, Political Science, History, and Law, as well as from a breadth of community organizations, in the exploration of the boundaries between media, art, music, and the built environment. The Noiseborder Ensemble, featuring a combination of acoustic and



electronic instruments and live processing and mixing of sound and video, creates and performs multimedia works regionally and internationally. The impact of creative endeavours such as those undertaken by these groups has made the University of Windsor a catalyst for dialogue and hub of creativity in the community.

Researchers from Education, History, and Political Science are engaged in a large-scale international research initiative that is comparing Canadian and Chinese educational cultural narratives to provide frameworks for understanding and appreciating similarities and differences to facilitate cross-cultural reciprocal learning. In addition to its identified research outcomes, this substantial endeavour involving 42 researchers and 105 graduate students and postdoctoral fellows at two Canadian, four Chinese, and 40 associated schools in Canada and China is providing exceptional experiential learning with international engagement to an emerging educational workforce and broadening their horizons in an increasingly diverse, multicultural environment.

The University of Windsor has a celebrated tradition and a stalwart reputation in humanities research. The Humanities Research Group (HRG) fosters research across disciplines, including History, Philosophy, Languages, Literature and Culture, and English Language, Literature and Creative Writing, through fellowships, seminars, and speakers that contribute to the intellectual fertilization of ideas. HRG enjoys exceptional support from the campus and wider communities, and is valued for the role it plays in stimulating public discourse on a broad range of topics. Similarly, the Centre for Research in Reasoning, Argumentation and Rhetoric brings together researchers from diverse disciplines in regular seminars and workshops, and through publication of its book series and journal, *Informal Logic*. The University's



Digital History Research Group (DHRG) draws from the expertise of librarians, historians, and scientists in disseminating historical research within scholarly circles and to the community as a whole. DHRG research is providing the public with an avenue to explore Windsor-Essex and Southwestern Ontario's richly diverse history through digital media. Projects undertaken by DHRG provide experiential learning opportunities to K-12, undergraduate, and graduate students to participate in original historical research. In doing so, DHRG is engaging the next generation in the fascinating world of historical inquiry.

Across our campus, graduate and undergraduate students from diverse disciplines are actively engaged in hands-on research that promises to build viable, healthy, and safe communities, not only in our region or our country but around the world. By engaging students directly in research activities and creative initiatives, our stellar body of internationally renowned multidisciplinary researchers are training the highly qualified personnel who will become tomorrow's social community leaders.

“My academic life is built on two ideas that shape everything I do: I want to help build harmonious two-way learning bridges between immigrant cultures and host Canadian culture(s) and I want to focus on intersecting lives as cultures meet and cross bridges locally and globally.”

– **DR. SHIJING XU,**  
**PROFESSOR AND CANADA RESEARCH CHAIR IN**  
**INTERNATIONAL AND INTERCULTURAL RECIPROCAL**  
**LEARNING IN EDUCATION**



# MEETING OUR GRAND CHALLENGES



## OUR STRATEGY

We aim to meet the Grand Challenges by implementing the following actions:

- 1 Promote research and innovation and pursue new opportunities to address the University of Windsor's Grand Challenges.**
- 2 Attract, retain, and support the continued success of world-class scholars.**
- 3 Develop the highly qualified personnel who will become next-generation scientists, engineers, artists, community leaders, and decision makers by providing exceptional experiential learning through hands-on research.**
- 4 Foster and build on collaborative partnerships with key community, government and non-government organization, and industry stakeholders at the regional, provincial, national, and international levels.**
- 5 Facilitate the cross-transfer and fertilization of knowledge, technology, expertise, and artistic creativity for the betterment of society.**
- 6 Obtain, develop, and support state-of-the-art infrastructure.**
- 7 Celebrate and encourage equity, diversity and inclusion to promote awareness and understanding through hiring practices that reflect the University's commitment, and by supporting research, scholarship and creativity that advances this objective for society as a whole.**

## REVIEW AND MONITORING

The review and progress monitoring of the Strategic Research Plan: Meeting the Grand Challenges will be coordinated by a Strategic Research Plan Implementation Committee (SRPIC) comprising new and established faculty across the campus. The SRPIC will meet annually (and more frequently when needed) to review the Strategic Research Plan, ensuring that it remains relevant to the research, scholarship, and creative endeavours undertaken at the University of Windsor. It will also consider and recognize new and emerging areas of research strength, and will retain the ability to adjust the University's research strategy for optimization of the potential for growth and increased impact.

Furthermore, the SRPIC will be tasked with reviewing the outcomes of research, scholarship, and creative activities at the University of Windsor. Accountability of public institutions, including the Strategic Mandate Agreements of Ontario Universities with the Province, is increasingly reliant on metrics in the measurement of success. The Office of the Vice-President, Research and Innovation will engage and work with academic units to develop and employ such metrics, which may be institutional or relevant only to specific units. Data collection and documentation will be the responsibility of individual units.

We will communicate the success of our research, scholarship, and creative activities to the outside world by reporting these endeavours and the metrics to the community. A strong research communication strategy will be developed in collaboration with key stakeholders from our research community that will demonstrate how we are achieving our promise and meeting our Grand Challenges.



# CLOSING REMARKS

**The University of Windsor sees itself not only as an institution of higher learning, but also as a catalyst for social change and economic development. Aligned with our strategy of expanding the campus to downtown, we aim to better work with our external stakeholders and the community at large. Research and innovation generate new knowledge and possibilities. For these to be most impactful, we need to translate the knowledge and their applications out to the community. This will help make the University of Windsor into a place of promise.**







University  
of Windsor

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