



WIN ANNUAL REPORT

2023 - 2024



UNIVERSITY OF
WATERLOO



WATERLOO INSTITUTE FOR
nanotechnology



OUR PEOPLE **116** faculty members

SCHOLARLY TALKS

6 WIN Seminars **1** Innovation Seminar

9 2D-MATURE Seminars **3** WIN Joint Seminars

1 WIN Thematic Seminar **3** Workshops

4 Distinguished Lectures **4** Pitches and Demos

13 DEPARTMENTS

- Applied Mathematics
- Biology
- Chemical Engineering
- Chemistry
- Civil and Environmental Engineering
- Economics
- Electrical & Computer Engineering
- Mechanical & Mechatronics Engineering
- Physics and Astronomy
- School of Environment, Enterprise, & Development
- School of Optometry & Vision Science
- School of Pharmacy
- Systems Design Engineering

INTERNATIONAL

43 international partners in **16** countries

RESEARCH

10,117 papers published, and

252,979 citations since 2008

*Scopus/SciVal evaluation as of April 2023

NANOFELLOWSHIP

44 nanofellowships awarded in 2023-2024

Waterloo Institute for Nanotechnology

16 rounds of nanofellowship competitions **598** nanofellowships awarded (since 2008)



UNIVERSITY OF
WATERLOO



WATERLOO INSTITUTE FOR
nanotechnology



MESSAGE FROM THE **EXECUTIVE DIRECTOR**



SUSHANTA MITRA

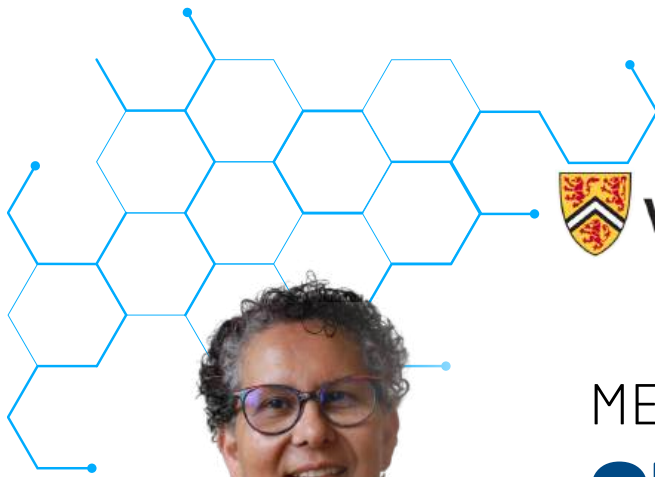
EXECUTIVE DIRECTOR

This has been a monumental year for the Waterloo Institute for Nanotechnology (WIN). Our incredible progress is the result of the collective efforts of our members, researchers, graduate students, and post-doctoral fellows, all of whom contribute to the vibrant and impactful nanoscience and nanotechnology community on our campus. Their pioneering research continues to garner international recognition through high-impact journal publications, patents, grants, and invited talks.

This year, we have aligned our activities with the Global Futures initiative launched by the President's office. As Canada's largest nanotechnology institute, and having been aligned with the United Nations' Sustainable Development Goals since 2019, WIN has seamlessly integrated its activities and scholarship with Societal Futures, Health Futures, Sustainable Futures, Technological Futures, and Economic Futures.

Our bottom-up approach has involved engaging with Departments and Faculties across the campus, and we have extended our reach to communities outside Waterloo through various international and domestic outreach activities. These efforts reflect our commitment to not only advancing nanotechnology but also making a positive impact on society.

It is an honor to lead this esteemed institute, one of the jewels of Waterloo, and I look forward to witnessing its continued growth and success in the coming years.



UNIVERSITY OF
WATERLOO



DR. CHARMINE DEAN

VICE PRESIDENT

RESEARCH AND INTERNATIONAL

MESSAGE FROM THE **CHAIR OF THE BOARD OF DIRECTORS**

The Waterloo Institute for Nanotechnology (WIN) has demonstrated remarkable progress in advancing its mission to be at the forefront of nanotechnology research and innovation. This year marks a significant milestone as WIN has seamlessly integrated its activities with the University's Global Futures initiative, exemplifying our commitment to addressing complex global challenges through interdisciplinary collaboration and innovation.

Our alignment with Global Futures spans across multiple dimensions – from Technological Futures, where our researchers are pioneering quantum materials and devices, to Health Futures, where we're democratizing healthcare through innovative diagnostics and therapeutics. The successful partnerships with the Faculty of Health and the Centre for Bioengineering and Biotechnology (CBB) have led to groundbreaking initiatives in health technologies, while our collaboration with the Faculty of Arts has opened new avenues in exploring the socioeconomic implications of alternative energies and the hydrogen economy.

WIN's international presence continues to strengthen, with new strategic partnerships established across the Czech Republic, Korea, and India. The success of these collaborations is evident in initiatives such as the WIN-CEITEC Joint Research Fund Program and our enhanced engagement in the Indo-Pacific region. These partnerships not only foster research excellence but also create valuable opportunities for our students and early-career researchers.

I am particularly pleased with WIN's commitment to nurturing the next generation of researchers. The recruitment of outstanding Early Career Researchers from diverse backgrounds and the continued success of our Nanofellowship program demonstrate our dedication to building an inclusive and dynamic research community. The expansion of our seed funding programs, supporting projects from quantum materials to healthcare technologies, showcases our strategic approach to fostering innovation across disciplines.

The Institute's role in advancing Sustainable Futures is exemplified through initiatives like the Network for Sustainable Nanotechnology (N4SNano) and various outreach activities that connect our research with real-world applications. Our researchers are actively working on solutions for critical challenges in energy storage, environmental monitoring, and sustainable materials, aligning perfectly with our commitment to the UN's Sustainable Development Goals.

As we look ahead, WIN is well-positioned to continue its trajectory of excellence in nanotechnology research and innovation. The Board remains committed to supporting WIN's mission and ensuring that our governance structure facilitates the Institute's growth and impact. I extend my gratitude to our Executive Director, Sushanta Mitra, the WIN team, and our entire research community for their dedication to advancing nanotechnology research and its applications for societal benefit.

STAFF AND GOVERNANCE

WIN MANAGEMENT AND ADMINISTRATION

Sushanta Mitra	Executive Director
Lisa Pokrajac	Assistant Director, Research Programs
Dennis Wong	Business Development Manager
Kendra Goertz	Operations and Marketing Coordinator
Kyle Murphy	Space Coordinator

BOARD OF DIRECTORS

CHAIR

Charmaine Dean	Vice-President, Research and International, University of Waterloo
-----------------------	--

MEMBERS

Warren Chan	Director, Institute of Biomaterials & Biomedical Engineering, University of Toronto
Lora Field	Team Lead, CleanTech & Advanced Manufacturing Branch, Ontario Innovation Office
Chris Houser	Dean, Faculty of Science, University of Waterloo
John Honek	Professor, Chemistry, University of Waterloo
Na Young Kim	Professor, Electrical & Computer Engineering, University of Waterloo
Sushanta Mitra	Executive Director, Waterloo Institute for Nanotechnology, University of Waterloo
Carolyn Ren	Professor, Mechanical & Mechatronics Engineering, University of Waterloo
David Sinton	Professor, Mechanical & Industrial Engineering, University of Toronto
Shirley Tang	Professor, Chemistry, University of Waterloo
Mary Wells	Dean, Faculty of Engineering, University of Waterloo
Yimin Wu	Professor, Mechanical & Mechatronics Engineering, University of Waterloo
Aiping Yu	Professor, Chemical Engineering, University of Waterloo
Boxin Zhao	Professor, Chemical Engineering, University of Waterloo

WIN INTERNATIONAL SCIENTIFIC ADVISORY BOARD

CHAIR

Linda Nazar	University Professor & Canada Research Chair in Solid State Energy Materials, University of Waterloo
--------------------	--

MEMBERS

Adrien Côté	Executive Director, Velocity, University of Waterloo
Monica Alonso Cotta	Professor, Universidade Estadual de Campinas, Brazil
Kazuhiro Hono	President, National Institute for Materials Science, Japan
Sushanta Mitra	Executive Director, Waterloo Institute for Nanotechnology, University of Waterloo
Ajay Sood	Principal Scientific Advisor, Government of India, Professor, Indian Institute of Science, India
Albert van den Berg	Scientific Co-Director of MESA+, University of Twente, Netherlands
Chen Wang	Ex-Director General of National Center for Nanoscience and Technology, China
Sir Mark Welland	Deputy Vice-Chancellor, Master of St Catharine's College, Director of the Maxwell Centre, University of Cambridge, England

EXECUTIVE COUNCIL

CHAIR

Sushanta Mitra Executive Director, Waterloo Institute for Nanotechnology, University of Waterloo

MEMBERS

Kyle Daun Professor, Mechanical and Mechatronics Engineering, University of Waterloo
Emmanuel Ho Professor, School of Pharmacy, University of Waterloo
John Honek Professor, Chemistry, University of Waterloo
Carolyn Ren Professor, Mechanical and Mechatronics Engineering, University of Waterloo
Vassili Karanassios Professor, Chemistry, University of Waterloo
Na Young Kim Professor, Electrical and Computer Engineering, University of Waterloo
Dayan Ban Professor, Electrical and Computer Engineering, University of Waterloo
Yimin Wu Professor, Mechanical and Mechatronics Engineering, University of Waterloo
Boxin Zhao Professor, Chemical Engineering, University of Waterloo

SPACE COMMITTEE

CHAIR

Zbig Wasilewski Professor, Electrical and Computer Engineering, Faculty of Engineering

MEMBERS

Amy Bender Space Planning & Classroom Management Specialist, Provost
Chris Kleven QNC Facility Technician, Provost
Juewen Liu Professor, Department of Chemistry, Faculty of Science
Sushanta Mitra Executive Director, WIN
Kyle Murphy Space Coordinator, WIN

HEALTH AND SAFETY COMMITTEE

CHAIR

Laura Deakin Continuing Lecturer; Associate Dean of Science, Student Relations; Associate Director of Nanotechnology Engineering Program

MEMBERS

Dhananjai Borwankar Senior Safety Officer, Safety Office
Kendra Goertz Operations & Marketing Coordinator, WIN
Chris Kleven QNC Facility Technician, Provost
Yuning Li Professor, Chemical Engineering
Kyle Murphy Space Coordinator, WIN

SPECIAL PROJECTS AND RESEARCH COMMITTEE (SPARC)

CHAIR

Bernard Duncker Associate Vice-President Research and International, University of Waterloo

MEMBERS

David Clausi Associate Dean of Research and External Partnerships, Faculty of Engineering
Shirley Tang Associate Dean of Research, Faculty of Science
Zbig Wasilewski Professor, Electrical and Computer Engineering, Faculty of Engineering
Lisa Pokrajac Assistant Director, Research Programs, WIN

WIN THEMATIC AREAS

Since 2017, WIN focuses on four thematic areas – Smart & Functional Materials, Connected Devices, Next Generation Energy Systems and Therapeutics & Theranostics. Each of these thematic groups are overseen by leads and co-leads who work together with the WIN staff over two-year terms. Theme leads and co-leads offer guidance and advice on the best ways to support and promote each research theme, particularly in terms of funding opportunities and external academic, industry or international partnerships.

SMART AND FUNCTIONAL MATERIALS WORKING COMMITTEE

Professor Kyle Daun

Mechanical and Mechatronics Engineering

Research interests: combustion and heat transfer phenomena, heat conduction from aerosols, laser-based nanoparticle metrology, optical tomography and design optimization of combustion devices

Professor John Honek

Chemistry

Research interests: Bionanomaterials, protein structure and function, Soft Matter mechanistic enzymology, recombinant DNA and biophysical methods, medicinal chemistry and molecular modeling

Professor Boxin Zhao

Chemical Engineering

Research interests: fundamental and practical aspects of adhesion, wetting, and friction of soft bionanomaterials

3 GOOD HEALTH AND WELL-BEING



6 CLEAN WATER AND SANITATION



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



CONNECTED DEVICES

Professor Vassili Karanassios

Chemistry

Research interests: micro- and nano-analytical chemistry and instrumentation

Professor Na Young Kim

Electrical and Computer Engineering

Research interests: large-scale solid-state quantum computer, quantum simulator for quantum information processing and communications

6 CLEAN WATER AND SANITATION



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



11 SUSTAINABLE CITIES AND COMMUNITIES



SOCIETAL IMPACT OF RESEARCH

To achieve societal impact and sustainable future, WIN's thematic areas are mapped with the United Nations Sustainable Development Goals (SDGs).



NEXT GENERATION ENERGY SYSTEMS

Professor Dayan Ban

Electrical and Computer Engineering

Research interests: near-infra red light conversion, design and fabrication of high-performance quantum devices and ultra-sensitive surface plasmon sensors

Professor Yimin Wu

Mechanical and Mechatronics Engineering

Research interests: energy materials; electronic materials; photonic materials, responsive materials; in situ multimodal characterizations; interfacial science and engineering

7 AFFORDABLE AND CLEAN ENERGY



11 SUSTAINABLE CITIES AND COMMUNITIES



13 CLIMATE ACTION



THERAPEUTICS AND THERANOSTICS

Professor Emmanuel Ho

School of Pharmacy

Research interests: biomaterials for drug delivery systems such as nanoparticles, medical devices, biodegradable films, hydrogels, etc.

Professor Carolyn Ren

Mechanical and Mechatronics Engineering

Research interests: micro/nano-fluidics, lab-on-a-chip, protein separation, live-colony detection

3 GOOD HEALTH AND WELL-BEING



SCHOLARLY OUTPUT

PUBLICATIONS, CITATIONS AND IMPACT

WIN members consistently show high productivity each year, publishing in reputable scientific journals and accumulating a substantial number of citations.

BIBLIOMETRIC ANALYSES

Through the tools available through SciVal and Scopus (Elsevier), WIN can identify key strengths based on global comparative indices such as field-weighted citation impact (FWCI*) and collaborations.

Total Publications, Citations and Collaborations

2018 to 2023, based on SciVal (Scopus) data

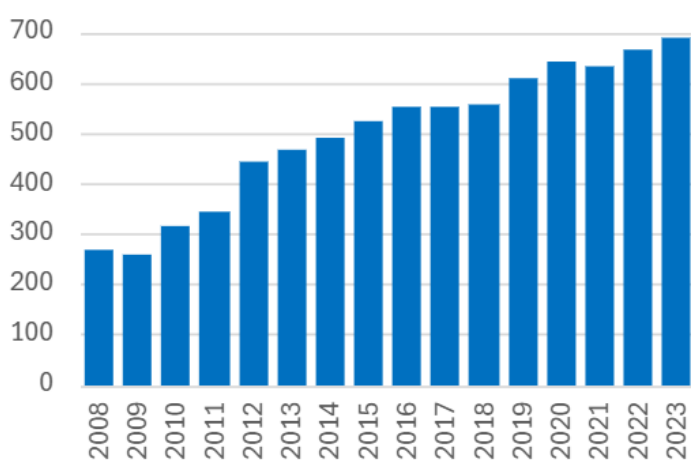
GROUP (2018 - 2023)	TOTAL	TOTAL CITATIONS	FWCI*	OUTOUT IN TOP 10% CITATION PERCENTILE	COLLABORATIONS: NATIONAL	COLLABORATIONS: INTERNATIONAL	COLLABORATIONS: INDUSTRY
WIN Members (total)	4,328	131,044	1.65	19.5%	10.2%	55.6%	4.6%
Smart and Functional Materials	2,375	61,699	1.48	16.2%	8.7%	54.7%	4.2%
Next Generation Energy Systems	1,579	69,055	2.0	24.8%	8.3%	61.1%	2.8%
Connected Devices	1,548	31,748	1.34	14.1	10.5%	50.3%	6.1%
Therapeutics and Theranostics	1,472	36,735	1.41	16.0%	9.9%	56.9%	3.5%

*FWCI: Field-weighted citation impact compares the number of citations received by a researcher with the average number of citations received by all other similar publications indexed in the Scopus database (ie: a score of 1.65 means the publications have been cited 65% more times than average)

Our numbers in 2023

# PUBLICATIONS	# CITATIONS	FWCI	% PUBLICATIONS TOP 10%
688	5312	1.53	17.7%

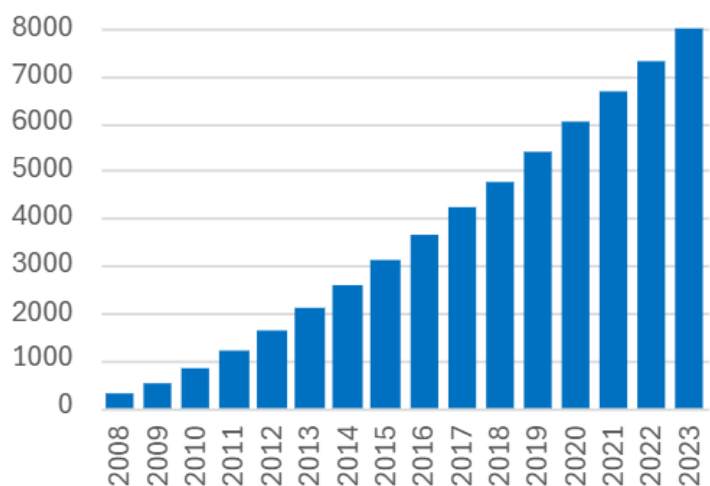
Total Publications Year-wise by WIN Members



WIN Publications in High Impact Factor Journals in 2023

Nature Reviews Materials	79.8
Chemical Reviews	51.5
Nature	50.5
Nature Energy	49.8
Science	44.8
Chemical Society Reviews	40.4
Joule	38.6
Nature Nanotechnology	38.1
Nature Materials	37.2

Cumulative Publications by WIN Members



WIN Publications in High Impact Factor Journals in 2023

Chemical Engineering Journal	15 (IF 13.4)
ACS Applied Materials & Interfaces	13 (IF 8.5)
Analytical Chemistry	13 (IF: 6.8)
ACS Sustainable Chemistry & Engineering	9 (IF 7.1)
Langmuir	9 (IF 3.7)
Small	8 (IF 13.0)
Scientific Reports	8 (IF 3.8)
Advanced Materials	7 (IF 27.4)
Nature Communications	7 (IF 14.7)

WIN EMBARKING INTO GLOBAL FUTURES INITIATIVE



University of Waterloo has embarked on an ambitious plan for Global Futures, and interdisciplinary research will be one of the drivers that will enable this opportunity. The Waterloo Institute for Nanotechnology (WIN) at the University of Waterloo is at the forefront of cutting-edge interdisciplinary research. With our long-standing collaborations with the Faculties of Engineering, Science and Mathematics, we are enabling Technological Futures. We are creating new materials and devices to meet the world's most pressing challenges while ensuring that such disruptive technologies have minimal environmental impact. This is enabled through our partnership with the Faculty of Environment. Our commitment to the UN SDGs enables us to pursue Sustainable Futures. Our researchers are creating sensors, building new medical devices that could democratize health care, developing innovative therapeutics that could cure life-threatening diseases, and bringing technology closer to patients through ongoing partnerships with the Faculty of Health, which is fostering Health Futures. Finally, an exponential technology like nanotechnology will create a better and equitable society for everyone where we can benefit from the economy of scales and, at the same time, provide value-addition through societal impact, thereby fostering Societal Futures and Economic Futures in collaboration with the Faculty of Arts for our local community, across Canada and beyond.

SOCIETAL FUTURES



How do we share and translate knowledge to positively advance society's future and ensure that communities and everyone within them thrive?

Czech Republic: Technical University of Liberec (TUL)

In May 2023, WIN welcomed Professor Jan Valtera from the Technical University of Liberec (TUL) in the Czech Republic as a WIN Visiting Scholar, hosted by WIN Member Michael Tam from the Department of Chemical Engineering. Valtera is also the Vice-Dean for International and Public Relations. The WIN Visiting Scholar Program provides \$1,500 CAD for travel and living expenses for one month while at UWaterloo and WIN, to be matched equally by the hosting WIN Member's department.

Later in June 2023, Professor Valtera gave a seminar on "Advanced Technologies for the Production of Polymeric Nanofibres and Specific Nanofibrous Structures". During his month at the University of Waterloo, he engaged with academics, students, and university officials, including representatives from Waterloo International, the

Office of Research, and the Student Success Office. Valtera's discussions focused on enhancing Canada-EU programs related to funding, scholarships, and mobility opportunities for both faculty and students.

A Memorandum of Understanding (MOU) was signed in January 2024 between the Technical University of Liberec (TUL) in the Czech Republic and the University of Waterloo (UWaterloo) through the Department of Chemical Engineering and the Waterloo Institute for Nanotechnology (WIN).



India: Sister Nivedita University (SNU)



On September 22, 2023, WIN Executive Director, Sushanta Mitra, visited Sister Nivedita University (SNU) to finalize the Memorandum of Understanding (MoU) to commence collaboration between our two institutions.

As SNU builds its teaching and research capacity in materials science and nanotechnology, WIN and Waterloo will be able to share knowledge and expertise to

develop the SNU Engineering curriculum, as well as set up their nanotechnology laboratories and facilities.

The first WIN-SNU joint activities will involve research collaboration and materials characterization at WIN, hosting SNU faculty through the WIN Visiting Scholars Program, and students through the Mitacs Globalink Program over the next 12 months.

WIN Member Spotlight: Lyndon Jones

Dr. Lyndon Jones began his career as a UK-trained optometrist, earning his degree at the University of Cardiff in Wales and finishing his professional training in London. In 1991, he purchased a private optometry practice in London with his wife. During this time, he also pursued a part-time PhD in chemical engineering, driven by a curiosity about the interactions between tear fluid and contact lens materials. For five years, he split his time between clinical practice and research, analyzing his patients' lenses to identify opportunities for improvement.

In 1998, both he and his wife joined the University of Waterloo. Jones started the biomaterials research group at the Centre for Contact Lens Research (CCLR) and has since become Director in 2011. Now known as the Centre for Ocular Research & Education (CORE), the center has expanded its focus to include dry eye, myopia, ocular drug delivery, and clinical trials. These areas reflect the core of their research objectives, which are to enhance contact lens materials for improved comfort, investigate dry eye treatments, and enhance ocular drug delivery systems to release medication effectively over extended periods.

Currently, much of Jones's time is dedicated to teaching at the university, as well as securing funding through industry partnerships and grants that support his team's activities. Jones teaches his course online, giving students the flexibility to access lectures on their schedules while allowing him to focus on his responsibilities as Director of CORE—including extensive travel for conferences, continued education meetings, and industry partnerships.

Jones largely credits his success to interdisciplinary collaboration, a principle reinforced by his cross-appointments in chemistry, physics, biology, and chemical engineering. During his time at the University of Waterloo, he has forged connections across fields, including materials science, biology, and engineering—which he integrates into optometry research. His dedication to bridging disciplines has been recognized with prestigious interdisciplinary awards from both NSERC and the American Academy of Optometry. Jones highlights how WIN's platform keeps him informed about ongoing initiatives, which is crucial for the discovery of innovative projects and unexpected collaborative opportunities.



“Never say never,” he says, encouraging an open-minded approach to interdisciplinary research. Additionally, he emphasizes that building strong, lasting relationships with collaborators is the key to long-term success.

One notable collaboration is a GelMA-based drug delivery system developed with Dr. Evelyn Yim, WIN Member. This system responds to MMP-9 enzymes, with potential applications not only in contact lenses but also in wound dressings for diabetic foot ulcers and bedsores. Another milestone came from a partnership with Dr. Frank Gu, former WIN member (now faculty member at the University of Toronto), with whom he shares multiple patents and publications. Their research has produced a nanoparticle-based drug delivery system which enables slow drug release into the eye. These achievements underscore the impactful contributions of his work, advancing both vision care and broader biomedical applications.

With rates of myopia projected to reach 50% by 2050, Jones is dedicated to slowing the progression of the condition, as well as developing comfortable, effective vision correction products for patients. By integrating diverse expertise and fostering groundbreaking partnerships, his research is actively shaping a brighter future for global eye health and reducing inequalities by empowering people with proper eye vision.



HEALTH FUTURES

How will we ensure everyone achieves optimal health and well-being? How can we redesign our health systems through technological advances, virtual care and health data applications?



WIN-CBB-Faculty of Health Mixer

On 5 May 2023, WIN co-hosted the Mixer on Health Technologies with the Faculty of Health and the Centre for Bioengineering and Biotechnology (CBB). This mixer was a networking opportunity connecting health/medical researchers with those in nanotechnology to explore new collaborations within relevant research themes. This workshop was designed to bring to light the need for universal access to good healthcare systems, which is lacking for a large portion of the population. The program aimed to discuss advancements in nanotechnology and microengineering needed for novel medical, diagnostic and treatment systems. Knowledge mobilization is also a very important aspect of health and wellness research, ensuring end-users are aware of new technological developments that are optimized for ease of use and wide adoption by society, which will ultimately help democratize healthcare. As equitable access to health care is often a challenge in limited resource communities, collaboration across jurisdictions is critical to ensure health equity between “haves” and “have nots”.



The event was opened by Bernard Duncker (Associate Vice President of Research and International), Lili Liu (Dean of Health), Clark Dickerson (Executive Director, Centre for Bioengineering and Biotechnology) and Sushanta Mitra (Executive Director, WIN). This was followed by short technical talks from members of WIN, CBB, the Faculty of Health, and on-line presentations from researchers from Saxion University in the Netherlands, concluding with a networking lunch and a student poster presentation.

WIN-CBB-Faculty of Health-IIT KGP Seed Funding Program

On December 4, the Interdisciplinary Seed Grant Program on Health Technologies and Knowledge Mobilization was announced, co-sponsored by WIN, the Centre for Bioengineering & Biotechnology (CBB), the Faculty of Health, and the Indian Institute of Technology Kharagpur (IIT-KGP) Common Research and Technology Hub on Healthcare (CRTDH).



This call was designed to support outstanding projects in:

- Advanced Healthcare Platforms such as point of care diagnostic technologies, wearable or implantable devices for therapeutics and measurements, tissue repair and regeneration, promoting repair and recovery of neural, musculoskeletal and cardiovascular tissue;
- Delivery Systems for Therapeutics for pharmaceuticals and medications, nutrient delivery, food safety and security, etc;
- Biomedical Imaging for cells, tissues, systems, pre-/post clinical assessment and monitoring
- and other applications.

The following joint projects received \$20,000 CAD each for a one-year duration:

- Designing Real-Time Emissions Monitoring Sensors to Mitigate Household Pollution and Enhance Indoor Air Quality in India, with Eihab Abdel Rahman (SDE), Anindya Sen (Econ), Plinio Morita (Public Health) and Sandip Chakraborty (CS & Eng)
- Validating Bone Mineral Density Using a Single Exposure Dual-Energy X-ray System in Upper-extremity Fractures: A New Quantitative Method for Point-of-Care Diagnostics, with Karim Karim (ECE) and Nikolas Knowles (Kin)
- Multiplexed Raman Imaging of Live Breast Cancer Models, with Jung-Ho Yu (Chem), Kostadinka Bizheva (Phys) and Shirley Tang (Chem)

WIN Member Spotlight: Jung-Ho Yu

Dr. Jung-Ho Yu began his scientific journey with an interest in pharmaceutical chemistry, eventually transitioning to synthesizing quantum dots as a nanoparticle and nanocrystal chemist.



After earning his PhD, he joined Stanford University's School of Medicine as a staff scientist, focusing on developing preclinical imaging methods that incorporated nanotechnology. Under the mentorship of the radiology department chair, Yu explored multiplexing techniques to encode biomolecules using spectroscopy. His journey led him to Waterloo, where he now researches solutions to the complex systems of cancer and viral infections.

Yu's current work focuses on developing bioanalytical platforms capable of monitoring numerous molecular changes in biological systems non-invasively. While traditional sensors typically target one or two biomarkers, understanding complex systems requires

simultaneous monitoring of many molecules. At the core of his research is the use of nanoparticles in Raman barcoding, which amplifies signals and enables deep, non-invasive molecular monitoring in live systems such as preclinical models and human tissues—achieving brightness levels comparable to fluorescence. Additionally, Yu is working on biodegradable nanoparticles that degrade within the body, addressing common clinical concerns with ongoing efforts to improve their clearance speeds.

Yu has also engaged with teaching, recently leading a second-year course in analytical chemistry. While the topics covered did not perfectly align with his research, the experience allowed him to emphasize practical applications and refine his approach based on student interactions. Despite the challenges of balancing teaching and research, Yu finds the integration of mentoring, teaching, and advancing his scientific work to be a rewarding and essential part of his career.

Joining the Waterloo Institute for Nanotechnology (WIN) has provided Yu with opportunities to collaborate with fellow WIN members such as Prof. Shirley Tang and Prof. Juewen Liu. These collaborations have allowed him to test his sensing technologies in 3D tissue models and explore interdisciplinary ideas. WIN's collaborative environment and proximity to experts have proven invaluable for fostering innovation and advancing his research.

Yu's vision for his nanotechnology-based platforms focuses on contributing to human healthcare solutions and supporting UN SDG #3. His work aims to improve tumor monitoring, deepen understanding of disease heterogeneity, and advance personalized treatments. These tools have the potential to enhance preclinical models, providing more accurate predictions of patient responses to therapies.



Reflecting on his career, which spans pharmaceutical chemistry to biomedical imaging, Yu emphasizes the transformative power of collaboration and adaptability in advancing research. By embracing interdisciplinary opportunities and innovative approaches, he continues to shape the future of health and biochemistry with solutions that address some of the most pressing challenges in modern science.

**“WIN’s collaborative environment and proximity to experts
make it an ideal space for innovation.”**

– Jung-Ho Yu

SUSTAINABLE FUTURES



How will we enact the social, economic and geopolitical changes required to ensure a prosperous future for humanity and the planet?

Sustainable Future Perspectives Series: Circular Economies: Electronic and Electrochemical Devices

On November 2, WIN and the Department of Chemical Engineering co-hosted the third Sustainable Future Perspectives discussion, titled “Circular Economies: Electronic and Electrochemical Devices.” The event concluded the series on recycling electronic components and battery materials, exploring how University of Waterloo research advances recycling, battery innovation, and solutions to mining delays.

Moderated by Professors Mario Ioannidis and Sushanta Mitra, the panel featured Professors Komal Habib, Stephen Young, Mike Fowler, and Ting Tsui, along with Dr. Asmae Mokrini of the National Research Council (NRC). Discussions addressed critical issues, including Canada's 2035 zero-emissions vehicle mandate, the demand for critical minerals, and sustainable sourcing challenges.

The panel emphasized responsible consumption, waste reduction, and extended producer responsibility, highlighting the necessity of a circular economy. They advocated for prioritizing efficient technologies over recycling and called for interdisciplinary collaboration to enhance sustainability education, redesign electronics, and hold producers accountable for emissions.



International Network for Sustainable Nanotechnology



The International Network for Sustainable Nanotechnology (N4SNano) is a consortium of leading organizations in the field of nanotechnology representing institutes, universities, non-profit and governmental agencies. Founding members of the Network are from the Waterloo Institute for Nanotechnology (WIN) in Canada, MESA+ Institute for Nanotechnology from the Netherlands, the University of Sydney Nano Institute (Sydney Nano), and the University of California Los Angeles (UCLA). The Japan Science and Technology Agency (JST) has been a supporting member since its inception.

N4SNano Global Summit 2023

The 2023 N4SNano Global Summit, held from November 27 to 29 at The University of Sydney, focused on UN SDG #7: Affordable and Clean Energy. The three-day event featured thematic sessions, plenary and keynote talks, as well as engaging discussions on advancing energy sustainability and clean energy solutions.



DAY 1

The Summit opened with a Welcome to Country Ceremony and remarks emphasizing sustainability and collaboration. The morning sessions addressed energy applications in Australia, with a plenary by Professor Rachel Caruso discussing innovations in materials for energy technologies. Talks highlighted advancements in electric aviation, clean economy strategies, and energy technologies tailored to regional needs. Later sessions focused on energy harvesting, featuring a keynote by Professor Satish Patil on renewable energy technologies supporting net-zero goals. Discussions included advancements in photovoltaics, solar cells, and catalytic innovations for CO₂ conversion. The day concluded with a Sydney Nano facility tour and a networking dinner at St. Paul's College.

Day two went deeper into energy harvesting and storage technologies. Professor Yun Liu's plenary explored nanostructural design for photovoltaics, followed by discussions on energy management, resilience modeling, and catalytic processes for sustainability. Afternoon talks addressed innovations in redox flow batteries, methane capture, and CO₂ reduction, alongside a keynote by Professor Sally Brooker.

The evening featured "Live from the Lab," a public event blending science and art, where researchers and musicians collaborated on musical pieces inspired by energy research.

DAY 2



DAY 3



The final day focused on actionable strategies for clean energy policy. A panel discussion, moderated by Associate Professor Alice Motion, brought together experts to explore public policy challenges and opportunities in the clean energy sector. Breakout sessions on UN SDG #7 and Australia's energy landscape followed, leading to the Summit's conclusion with a feedback session, prize ceremony, and closing remarks.

WIN Summer School on Sustainable Nanotechnology

In June 2023, WIN launched its first Summer School in Nanotechnology, welcoming exceptional undergraduate students from across Canada to explore cutting-edge research at Waterloo. Over three days, participants from McGill University and Memorial University engaged in technical talks across WIN's four research themes—Smart & Functional Materials, Connected Devices, Next Generation Energy Systems, and Therapeutics & Theranostics—as well as seminars on the environmental and economic impacts of nanotechnology. The program included lab tours of facilities like the Giga-2-Nano fabrication site, RoboHub, and QNC research spaces.

Students expressed enthusiasm for the opportunity to deepen their understanding of nanotechnology. Students described the program as intellectually stimulating and an excellent introduction to Waterloo's nanotechnology ecosystem. WIN is excited to host the next Summer School and looks forward to welcoming more top students in the upcoming years!



TECHNOLOGICAL FUTURES

How will we lead the next technological transformation to ensure a safe and human-centered digital future?



WIN-Waterloo.AI-University of Bordeaux Joint Seed Funding in Artificial Intelligence and Machine Learning for Sensors and New Materials Discovery

With support from the WIN, Waterloo.AI and the University of Bordeaux, this seed funding program will foster interdisciplinary research between international partners for “high risk-high reward” blue-sky discoveries typically not supported by traditional granting agencies. The intent of the program is to kickstart research that could provide some initial data points and insights as a first step in targeting various established joint funding programs, such as NSERC Alliance International, NFRF-International, and ANR (French national research agency), or Horizon Europe.

The expectation is that the proposal objectives will align with the UN Sustainable Development Goals (SDGs) and have the potential for societal benefit. Each award from this funding competition was valued at \$50,000 CAD for one year. The following proposals submitted by the following WIN members were selected for funding:

- Mahla Poudineh (ECE) and Mohammad Kohandel (Appl Math): Developing and Exosome-Lactate Sensor for Brain Tumors
- Kevin Musselman (MME) and Conrard Giresse Tetsassi Feugmo (Chem): Advancing Food and Beverage Quality Control
- Eihab Abdel Rahman (SDE) and Anindya Sen (Econ): Equitable Monitoring and Remediation of Air Pollution

WIN-IQC Workshop in Quantum Materials & Devices

Quantum and nanotechnologies are intricately linked, with quantum phenomena governing the desirable properties of nanomaterials and devices. WIN has already been working with IQC for the Quantum Nano Collision (QNC) Series to foster research collaboration since Fall 2021. On October 16, WIN and IQC hosted a joint workshop in quantum materials and devices to showcase the research conducted at WIN at the intersection of these two fields.

IQC Institute for Quantum Computing

UNIVERSITY OF WATERLOO | WATERLOO INSTITUTE FOR nanotechnology

Waterloo Institute for Nanotechnology
Institute for Quantum Computing

QUANTUM-NANOMATERIALS & DEVICES WORKSHOP

WIN DISTINGUISHED LECTURE
JIWOONG PARK
UNIVERSITY OF CHICAGO

The program featured the Distinguished Lecture by Professor Jiwoong Park of the University of Chicago, titled “Magical 2D Materials”, and included a series of short technical talks from WIN and IQC members including:

- Jonathan Baugh (Chem) on InSb Surface Quantum Wells for Proximity Superconductivity
- Adrian Lupascu (Phys) on Superconducting Quantum Devices – A Platform for Quantum Computing and Quantum Sensing
- Chris Wilson (ECE) represented by Dmytro Dubyna speaking on Robustness Test of Topological States in Su-Schrieffer–Heeger Model
- Holger Kleinke (Chem) on Thermoelectric Quantum Materials: Bismuth Chalcogenides
- Kevin Musselman (MME) represented by Fan Ye on Synthesis of Nanomaterials by Femtosecond Laser Ablation of Powders in Liquids
- Michael Pope (ChE) on Understanding the Cathodic, Electrochemical Exfoliation Mechanism of Transition Metal Dichalcogenides

The workshop included a networking lunch and poster session showcasing graduate student research in this field.

This workshop highlighted the common and overlapping themes of quantum and nanotechnology, promoting increased collaboration between our two institutes.

Czech Republic: Central European Institute of Technology at Brno University of Technology (CEITEC-BUT)

At the start of the Winter 2024 term, WIN hosted a delegation from the Central European Institute of Technology at Brno University of Technology (CEITEC BUT). WIN welcomed Professors Jozef Kaiser and Pavel Porizka from CEITEC BUT and Eva Libs Bartoňová and Karolína Konicarová from the Consulate General of the Czech Republic in Toronto as part of the delegation.



This visit included lectures from Jozef Kaiser and Pavel Porizka as part of the WIN Seminar Series. At the end of these lectures, the WIN-CEITEC BUT Joint Seed Funding Program was announced, a program to help foster international collaboration between our two institutes.

In July 2023, UWaterloo and CEITEC BUT signed a Memorandum of Understanding (MOU) supporting the cooperation in nanotechnology research, mobility and other areas of shared interests.

WIN-CEITEC Joint Research Fund Program



The WIN - Central European Institute of Technology (CEITEC), Brno University of Technology (BUT) Joint Seed Funding Program was announced in January 2024, a program to help foster international collaboration between our two institutes.

This unique funding program will span over three years. From 2024 to 2026, there will be one call per year with funding of \$60,000 CAD/1,000,000 CZK available for two projects, for a total envelope of 3,000,000 CZK from CEITEC BUT and \$180,000 CAD from WIN for the entire program. To be eligible, each team must have at least one full-time faculty member at CEITEC BUT and one full-time Core member of WIN; associate members of WIN were able to apply as co-applicants.

In March 2024, eight proposals were submitted for the call, with two outstanding projects selected for support:

1. AI Enhanced Microrobotics Systems for Drug Delivery, by Hamed Shahsavan (ChE) and Martin Pumera (CEITEC BUT)
2. Bio-inspired Injectable Bone Glue: Synthesis, Modification, and ex-Vivo Bone-to-Bone Adhesion Testing, by Boxin Zhao (ChE) and Lenka Michlovská (CEITEC BUT)

Each project was awarded 500,000 CZK for CEITEC BUT applicants, and \$30,000 CAD for WIN members for one year. Successful teams are eligible to apply for future seed funding calls.

Recent Trends in Encapsulation

On March 25, WIN hosted a half-day workshop on “Recent Trends in Encapsulation” in collaboration with the Technical University of Eindhoven (TU/e) Netherlands, and the University of Strathclyde UK. This workshop was designed to spark collaboration between researchers in the field of encapsulation, particularly in the areas of consumable products, ranging from pharmaceutical drugs to consumer electronics.

This well-attended workshop opened with welcoming remarks from Associate Vice-President, Research & International, Bernard Duncker and WIN Executive Director, Sushanta Mitra. The workshop consisted of two technical sessions, with talks from invited guests, Jan van Hest from the Institute for Complex Molecular Systems at TU/e, along with Clare Hoskins, Monica Oliveira and Paolo Capobianchi from the University of Strathclyde. WIN researchers from the Faculties of Engineering and Science rounded the sessions with talks on their research and potential applications for this area of nanotechnology.

The full list of speakers for the workshop included:

- Jan van Hest (Institute for Complex Molecular Systems, TU/e, Netherlands)
- Clare Hoskins (Pure and Applied Chem, University of Strathclyde, UK)
- Sirshendu Misra (MME)
- Utsab Banerjee (MME)
- Monica Oliveira (Mech and Aero Eng, University of Strathclyde, UK)
- Veronika Magdanz (SDE)
- Paolo Capobianchi (Mech and Aero Eng, University of Strathclyde, UK)
- Hany Aziz (ECE)
- Juewen Liu (Chem)



Korea: Korea Carbon and Nano Industry Association (KCANIA)



On January 25, WIN Executive Director, Sushanta Mitra and Business Development Manager, Dennis Wong, travelled to Korea to strengthen its strategic partnerships in Asia. During this trip, WIN had the pleasure of meeting with the Korea Carbon and Nano Industry Association (KCANIA) to learn about the latest nanotech ecosystem in Korea. WIN engaged with KCANIA's partners, SKK GSB Sungkyunkwan University and Hallym University to discuss new innovations in nanotechnology.

Korea: Korea Advanced Nano Fab Center (KANC)



During this trip, WIN also met with Korea Advanced Nano Fab Center (KANC), the national core R&D and support infrastructure in nanotechnology. WIN explored opportunities for research collaboration in key areas such as quantum technology, human resource exchange, and use of equipment and facilities. An MoU was created to extend the WIN KANC partnership, with

the Gyeonggi Provincial Government and SKK as the co-signing partners. A signing ceremony of this MoU by the four parties was held in April 2023 at Korea, with Sushanta Mitra giving his greeting speech virtually.

Korea: Korea Institute of Materials Science (KIMS)

For the first time since the pandemic, WIN reconnected with the Korea Institute of Materials Science (KIMS) and met with experts from the National Nanotechnology Policy Center (NNPC)—a think tank that provides strategic guidance and policy recommendations for nanotechnology development in



Korea. WIN invited KIMS and NNPC to join the Nanotechnology for Sustainable Network (N4SNano), highlighting their shared mission in Korea and synergy on global nanotechnology topics.

Recognizing mutual interests in AI and materials discovery, WIN also invited KIMS to speak at the Fall 2024 joint symposium with Waterloo.AI, "AI for Materials Discovery."

Korea: Yonsei University

WIN visited Yonsei University on the newly established International Campus. This visit was a great opportunity to foster international collaborations in various fields, especially in quantum and nanotechnology. During the meeting, an MoU was drafted and it was signed in April 2024, which also included the Institute for Quantum Computing at UWaterloo.

WIN Member Spotlight: Subha Kalyanamoorthy

Dr. Subha Kalyanamoorthy's career started with bioinformatics, during the rise of the Human Genome Project. Motivated by her love of biology and her computational skills, she pursued a five-year integrated Master's degree in the field. The emerging nature of bioinformatics and its potential to uncover unknowns aligned strongly with her passion for discovery and impactful contributions.

Her academic pursuits continued at La Trobe University in Australia, where she earned a PhD specializing in structural bioinformatics and cancer drug discovery. She then joined the Commonwealth Scientific and Industrial Research Organisation (CSIRO), one of Australia's largest research institutes, as a postdoctoral fellow, where she explored evolutionary bioinformatics. After moving to Canada, Kalyanamoorthy furthered her research at the University of Alberta, focusing on the cardiotoxicity effects of drugs. Her dedication and accomplishments earned her an NSERC fellowship, ultimately leading to her current role as an Assistant Professor at the University of Waterloo.

Joining the Waterloo Institute for Nanotechnology (WIN) has further enhanced her ability to collaborate and innovate. WIN provides her team with access to resources, mentorship opportunities, and grant proposal reviews, which she leverages to strengthen her research capabilities and secure funding.



In terms of Kalyanamoorthy's research, it spans three key areas: environmental sustainability, health, and software development. In the realm of environmental sustainability, her team is focused on developing novel biocatalysts for plastic degradation and reducing carbon dioxide emissions from industries. A significant milestone in this area was the creation of a novel enzyme with a melting point of 107°C, making it the most active carbonic anhydrase known. This enzyme's enhanced stability and efficiency in CO₂ capture have great potential for industrial applications.

Her health research centers on protein aggregation in neurodegenerative diseases and developing advanced therapeutics, including PROTAC molecules, pan-coronavirus antivirals, and cancer immunotherapies. Among these efforts, her team has developed peptides and small-molecule inhibitors for multiple sclerosis, which reduce protein aggregation, exhibit low toxicity, and have shown promising results in mouse models.

Leveraging artificial intelligence, Kalyanamoorthy's team applies machine learning to design biocatalysts more efficiently and uses generative AI to identify molecular scaffolds for synthesis and testing.

This cutting-edge work, published in Nature Machine Intelligence, highlights the innovative applications of AI in her research.

Kalyanamoorthy aims to address global challenges through her work. By reducing CO₂ emissions and improving diagnostics and therapeutics, her research contributes to combating climate change and addressing long-standing health issues.

With her commitment to interdisciplinary collaboration and innovative problem-solving, Subha Kalyanamoorthy is shaping advancements that address critical challenges in health and sustainability, driving impactful solutions for the future.

"I chose Waterloo for its exceptional students and the groundbreaking research conducted here."

- Subha Kalyanamoorthy



WIN-HILASE Virtual Workshop



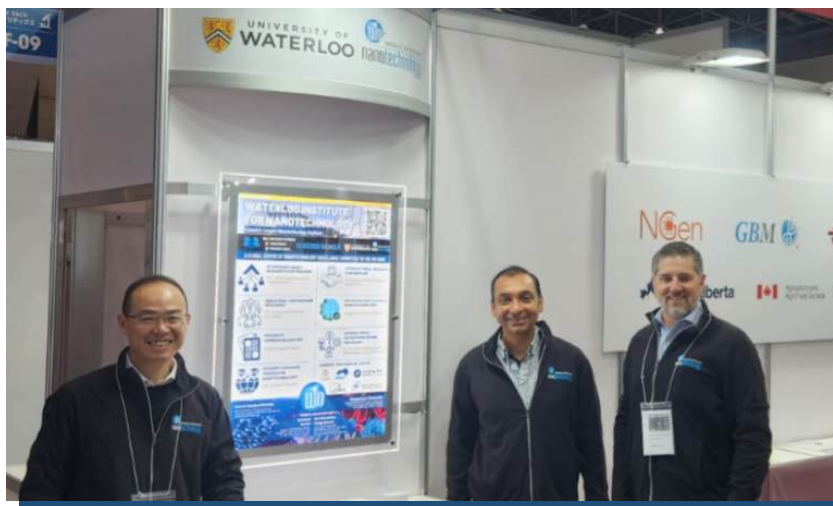
A virtual workshop was jointly organized by WIN and HiLASE in September 2023 to explore potential collaboration in laser technology, building on the MoU signed earlier in the year between WIN and CEITEC BUT. Sushanta Mitra's visit to HiLASE proved highly impactful, offering valuable insights into HiLASE's sophisticated, state-of-the-art laser infrastructure. During the visit, several areas of mutual interest were identified, particularly in using femto- and nano-laser systems to investigate

quantum effects in nanostructures, with applications in biosensing.

Additional opportunities were recognized to extend these applications, including detecting neutron leaks in nuclear reactors using BN- and Gd-doped graphene oxide, as well as other advanced 2D materials like silicene, borophene, and MXene. Researchers from both institutes discussed challenges and complementary research scopes, culminating in a detailed summary of collaborative opportunities shared with WIN members by the end of the year. Efforts are already underway to pursue European or Horizon funding calls to support and sustain this promising partnership.

NanoTech Japan 2024

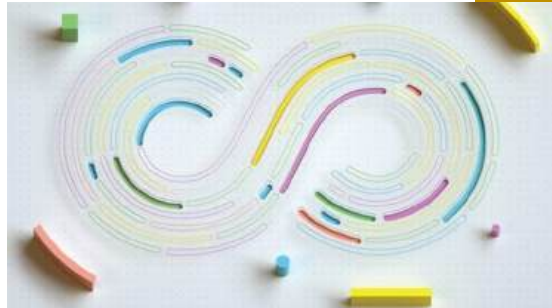
From January 31 to February 2, WIN participated in Deep Tech Canada's NanoTech Japan 2024 mission which was held at Big Sight, Tokyo. With support from the Embassy of Canada in Japan, WIN was represented by Sushanta Mitra, Dennis Wong, WIN member Leonardo Simon (ChE), together with a startup associated with his lab member, TANGHO, to exhibit their commercialized cellulose technology. During the exhibition, WIN Executive Director, Sushanta Mitra



presented at the 16th Nanotech Association Conference hosted by Nanotechnology Business Creation Initiative (NBCI), connecting the some of the world's key nanotechnology organizations from Germany, the Netherlands, Taiwan, Malaysia, Thailand, Singapore, and Japan. This network opens potential for future collaboration, especially in the Asia Pacific region.

ECONOMIC FUTURES

How do we create equitable and resilient local and global economies to lead us into the future?



WIN-Arts Seed Funding Program on Challenges of Alternative Energy and the Hydrogen Economy

Following the WIN-Arts Mashup held in April 2023, WIN and the Faculty of Arts announced the Joint Seed Grant Program: Addressing the Challenges of Moving to Alternative Energies and the Hydrogen Economy. Proposals must address challenges of alternative energy technologies from different disciplinary lenses, including political, social, policy and economy of scale considerations. The competition supported joint projects in compiling initial data points and insights to enable researchers to target various funding programs, including “New Frontiers in Research Fund (NFRF) International Joint Initiative for Research in Climate Change Adaptation and Mitigation.” An envelope of \$45,000 CAD was available for this call, which will support the following joint projects for \$15,000 CAD each for one year:

- Low GHG Emissions Methods to Produce Hydrogen from Methane and Calculate Optimal Taxes, with Eihab Abdel-Rahman (SDE) and Anindya Sen (Econ)
- Impacts of a transition to hydrogen-based aviation transport systems on economy and gender equality with XiaoYu Wu (MME) and Ana Ferrer (Econ)
- Preliminary Investigations on Technical, Policy and Economic Barriers for Airport Hydrogen Storage with John Wen (MME) and Anindya Sen (Econ)

WIN - ARTS Joint Seed Grant Program

Addressing the Challenges of Moving to Alternative Energies and the Hydrogen Economy

WIN WATERLOO INSTITUTE FOR nanotechnology | UNIVERSITY OF WATERLOO | FACULTY OF ARTS

7 AFFORDABLE AND CLEAN ENERGY | 13 CLIMATE ACTION

H₂ € \$

Japan: Tokyo Landing Pad

On January 30, WIN was grateful to meet with their strategic partner, Tokyo Landing Pad. With their support, WIN was able to visit local Small to Medium Enterprises (SME), including Kawada Technology, Showa Precision Tools, and Ebina Denka Kogyo. The plant tour by Ebina Denka Kogyo was particularly insightful, as it illustrated “pain points” that local companies were facing and how technological innovation could be driven on an SME scale. During this visit, WIN met with Yasuyuki Inoue, Chairman and Hiro Inoue, CEO of Aichi Sangyo Ltd to discuss commercialization opportunities, together with a plant tour and business operations that provided valuable insights.

Pitches and Demos

Throughout the past year, WIN hosted four Pitches and Demos events at the Quantum-Nano Centre (QNC), showcasing innovative technologies and fostering collaboration between academia, industry, and government.

The first two Pitches and Demos were held in Fall 2023. The first focused on clean technology and featured seven speakers, including representatives from StormFisher, KEYENCE Corporation, and the Quantum-Nano Fabrication and Characterization Facility (QNFCF). Notable contributions came from WIN-Velocity scholars and PhD students in Chemical and Mechanical Engineering. The second event emphasized health technology, with eight speakers, six from industry. Highlights included presentations from Ventus Respiratory Technologies, Cobionix Corporation, and the Ontario Ministry of Economic Development, alongside innovative student-led projects.

In Winter 2024, WIN continued the series with two more iterations. One explored diverse topics such as coatings, fabrication, and nanotechnology, featuring speakers from Nfinite Nanotech, INTLVAC, and Angstrom Engineering. Another event focused on the "Convergence of AI and Smart Materials Manufacturing," with six presentations,

including Capstone Design projects by Nanotechnology Engineering students. Highlights included talks by LumeNeuro Co-Founder Professor Melanie Campbell and leaders from Advanced Bio Material Technologies and Uma.



The Pitches and Demos series showcases WIN’s commitment to supporting business innovation, drawing participants from diverse sectors to share insights and foster partnerships. With more exciting sessions planned, we look forward to seeing more inspiring Pitches and Demos in the coming months!

WIN-Velocity Scholarship in Entrepreneurship

This year, the WIN-Velocity Scholarship was awarded to Agosh Saini, a first year MASc student in MME, working with Kevin Musselman on the development of metal oxide gas sensors for biomedical, environmental and wearable technology applications. This is the second WIN-Velocity scholarship awarded since the program’s inception in January 2022.

This scholarship supports first-year UW Science or Engineering Masters students studying nanotechnology while also pursuing “Deep tech” startup activities to commercialize this technology. It is valued at the equivalent of the Graduate Student Research Stipend (GRS) for two years supported by WIN, and mentorship and startup guidance support from Velocity.

NEW TO THE WIN MEMBERSHIP IN 2023 - 2024



Anindya Sen

Professor

Department of Economics

Faculty of Arts

Research interests: Pricing and firm strategy in imperfectly competitive markets such as retail gasoline, Deregulation of retail alcohol and marijuana, Smoking and cigarette taxes, Poverty and the minimum wage, Government policy in electricity markets, Border effects and trade flows



Lyndon Jones

Professor

School of Optometry & Vision Science

Faculty of Science

Research interests: Interaction of novel and existing contact lens materials with the ocular environment, Dry eye and the development of novel materials for ocular drug delivery



Jung-Ho Yu

Assistant Professor

Department of Chemistry

Faculty of Science

Research interests: Chemical Spectroscopy, Molecular Imaging, Nanotechnology, Bioanalytical Chemistry



Subha Kalyanamoorthy

Assistant Professor

Department of Chemistry

Faculty of Science

Research interests: Developing and employing computational methods to address biological, health and environmental challenges



Shunde Yin

Professor

Department of Civil & Environmental Engineering

Faculty of Engineering

Research interests: Coupled thermal, hydraulic, mechanical and chemical phenomena

UNDERGRADUATE

NANOTECHNOLOGY

ENGINEERING

The Nanotechnology Engineering (NE) program, Canada's first accredited Nanotechnology Engineering program, is designed to provide a practical education in key areas of nanotechnology; including the fundamental chemistry, physics, engineering of nanostructures and nanosystems, and quantum physics. Students in this Bachelor of Applied Sciences undergraduate program receive a comprehensive education in the rapidly developing nanotechnology field, allowing them to work across conventional disciplines in many industry sectors.

Though the program shares its home with WIN, the relationship between these students and our institute goes beyond a location. Many of WIN's international and industry partnerships resulted in co-op placements for NE students.

COLLABORATIVE

NANOTECHNOLOGY

GRADUATE PROGRAM

The Collaborative Program in Nanotechnology at the University of Waterloo (UW) is a unique program not offered elsewhere in Canada. From basic research to direct application, this program encourages the collaboration of faculty, students and industry towards technological innovation, social benefit and economic growth. The goal of this distinctive program is to provide a rich and interdisciplinary educational journey, with the opportunity to pursue a nanotechnology related MASc, MSc or PhD in any one of the following six departments:

- Chemistry
- Physics
- Chemical Engineering
- Electrical and Computer Engineering
- Mechanical and Mechatronics Engineering
- Systems Design Engineering

The Mike & Ophelia Lazaridis Quantum-Nano Center's (QNC) cutting-edge labs and facilities is home to UW and WIN's nanotechnology research, and many courses offered in this program are taught by WIN members. Alongside research and instruction, WIN also strives to create a supportive environment for students by managing a welcoming main office for students to seek assistance, organizing key and office allocations and supporting their academic success through the Nanofellowship program. Outside of the lab, WIN encourages communication and collaboration between students by hosting many interactive and networking events and supports their extracurricular activities through the Waterloo Institute for Nanotechnology Graduate Student Society (WINGSS).



NANOFELLOWSHIPS

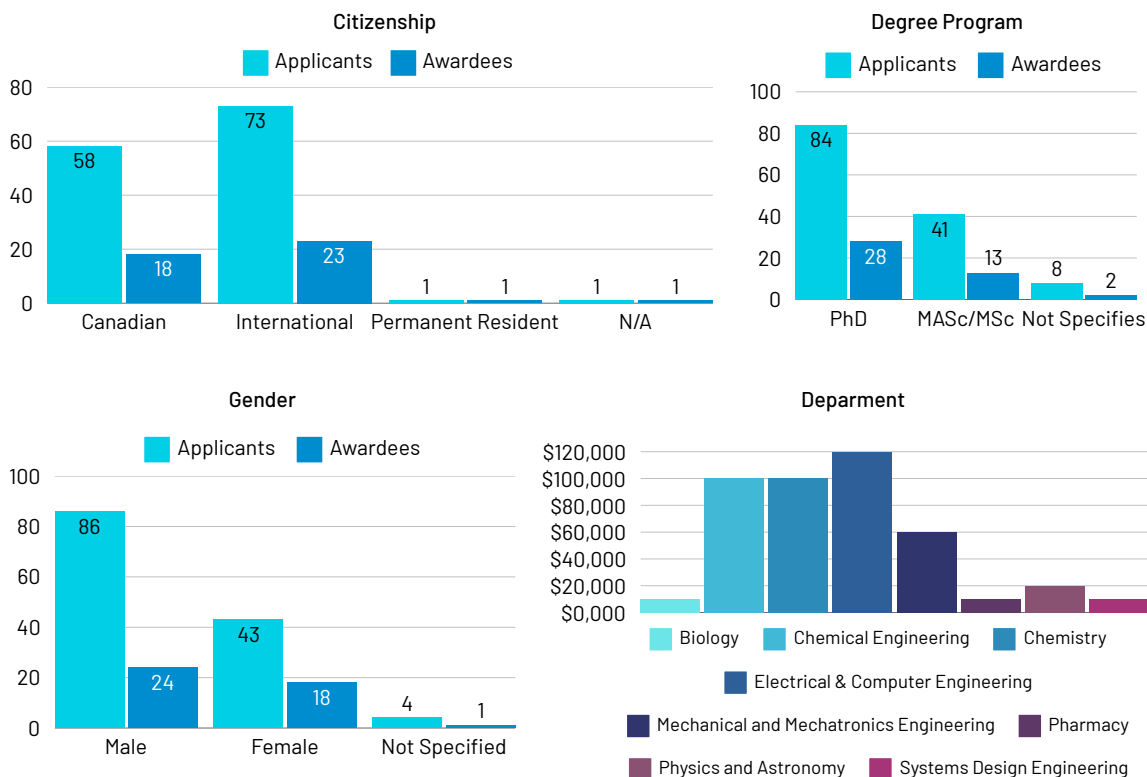
Since 2008, WIN's Nanofellowship program attracts and supports graduate students from Canada and around the world to pursue nanotechnology research at the University of Waterloo. Valued at \$10,000 each, each scholarship is made possible through a generous donation from an anonymous donor. Through an annual competition, the Nanofellowship is awarded to top graduate students for their outstanding research and contribution to the future of nanotechnology.

WIN is proud to present 43 Nanofellowship Awardees who were honored at the 2023 Annual Research Leaders Gala and Holiday Reception. Congratulations to all the Nanofellowship winners this year!

2023 Recipients

Hesam Abouali	Diogo de Oliveira Livera	Michelle Dieu Thao Huynh	Bruna Siebeneichler
Akash Chowdhury	Mei Han	Yousra Rahham	Hanjia Zheng
Atefeh Ghorbani Koltapeh	Paul Park	Jinxuan Zhang	Irina Bukhteeva
Mirfath Sultana Mesbahuddin	Hao Yu	Subhamoy Biswas	Pranav Gavirneni
Ethan Watt	Mahsa Barjini Khabbaz	Mohammadali Emadi	Yasaman Maddah
Sharafat Ali	Cameron Lucas Dean	Fatemeh Keyvani	Michael Spinazze
Fabio Cuzzucoli	Seyed Ali Hosseini Farahabadi	Ahmed Shahin	Zulong Chen
Naman Kumar Gupta	Ethan Kristopher Piercey	Yichen Zhao	Peyman GhavamiNejad
Sarah Odinotski	Jixi Zhang	Rachel Blanchard	Jonathan Mayry
Emily Yip	Bersu Bastug Azer	Carina Filice	Cailum Stienstra
Mohsen Azadinia	Poojitha Durgamahanti	Samed Kocer	

Statistics of 2023 Nanofellowship Competition



WIN RISING STAR AWARD 2023



Samira Siahrostami

Professor, Simon Fraser University

This year marked the fifth Rising Star Award Competition in Nanoscience & Nanotechnology. The program is designed to introduce full-time early career researchers, or "Rising Stars" to WIN/UWaterloo faculty which will lead to new partnerships and promote WIN as a world-class institute in Nanotechnology.

In 2023, WIN received applications from ten outstanding researchers from around the world, including Canada, Singapore, the United States and the United Kingdom. This year's WIN Rising Star was awarded to Professor Samira Siahrostami from Simon Fraser University in Burnaby, BC, Canada, as chosen by a committee of three previous Rising Star awardees and the WIN Executive Director, and in consultation with the Associate Vice-President Research & International.

The WIN Rising Star Award provides a \$5,000 cash honorarium to be used to bring the Rising Star to UWaterloo and WIN to meet researchers and students, give guest lectures and seminars, and commence potential collaboration. In May 2024, Professor Siahrostami joined us in-person at UWaterloo for WIN Day.

OUTREACH & COMMUNITY ENGAGEMENT

WIN-Velocity Scholarship in Entrepreneurship



In March 2024, WIN hosted an International Women's Day event in the QNC 3rd floor lounge, dedicated to celebrating and supporting women in STEM. International Women's Day provides inspiration and empowerment, allowing women to share stories, celebrate successes, and connect. This event highlights women's achievements in STEM and beyond, serving as examples for others.

Professors Moira Glerum (Bio), Carolyn Ren (MME), Veronika Magdanz (SDE), Na Young Kim (ECE), and Shirley Tang (Chem/ADR Science) shared their stories and advice, emphasizing the importance of diverse journeys to success.

No two paths to success will be the same, so sharing these stories is important to help foster inspiration and encouragement. Their

impactful words and experiences made the event truly enlightening and inspiring for all who attended. WIN looks forward to continuing this celebration annually.

Waterloo-Wellington Science & Engineering Fair and Canada-Wide Science Fair

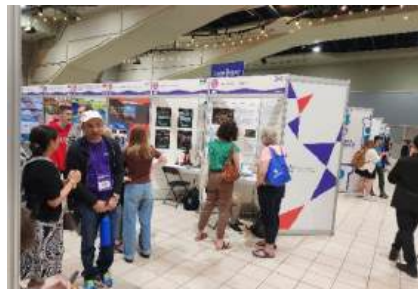
Each year, WIN sponsors the Waterloo-Wellington Science & Engineering Fair (WWSEF) and the Canada-Wide Science Fair (CWSF) to support the organizations and provide prizes for outstanding projects. The CWSF is the country's largest annual youth science, technology, engineering and mathematics (STEM) event, bringing together top young scientists and their projects. This year the event was held in person at the Edmonton Convention Centre in Edmonton Alberta from May 17-19, 2023. This was the second year in a row that WIN has been invited to participate as an exhibitor in the Youth STEM Expo and act as a judge for the nanotechnology-specific awards sponsored by WIN.

The award is for an outstanding project related to one of the four theme research areas of WIN. Students competed for an award in the following categories:

(a) Senior Award and opportunity to visit WIN to present the project at WIN's Research Day Celebration; (b) Intermediate Award; and (c) Junior Award.

The students awarded for best projects in nanotechnology-related themes at the 2023 CWSF are:

- Junior Prize Winner (\$500): Ryman Hammoud from South Fraser BC for "Smart Naloxone Kit"
- Intermediate Prize Winner (\$750): Sophia Zhang from Eastern Newfoundland for "Triboelectric Nanogenerator for Wind Harvesting"
- Senior Prize Winner (\$1,000): Hooman Reza Nezhad for "From Dust to Habitation – Molten Salt Electrolysis from the In-situ Reduction of Marian Regolith"



The Senior Winner Hooman Reza Nezhad gave a poster presentation of his project at the WIN Research Leaders Gala that was held in November 2023.

WIN Day 2023

In June 2023, WIN hosted the first ever WIN Day, where we welcomed the community to join us in celebrating accomplishments and building connections among fellow researchers.

The day commenced with a networking breakfast and featured opening remarks from Bernard Duncker, Associate Vice President Research and International, and Sushanta Mitra, WIN Executive Director.

The highlight of the day was a keynote talk from Letian Dou, Charles Davidson Associate Professor of Chemical Engineering at Purdue University and past recipient of the WIN Rising Star award. He shared insights on the latest trends in nanotechnology and his experiences as a young researcher.

Following the keynote speaker, the community had the opportunity to hear from two WIN members, Elisabeth Prince, a new core member, and German Sciaini, a longtime core member. Additionally, Nathan Nelson-Fitzpatrick, the Director of the QNCF, presented the current and upcoming plans for the QNCF and Metrology Suite.

Subsequently, the WIN administrative team provided updates on WIN's activities over the past year and what lies ahead. The day concluded with a networking lunch in the QNC atrium, featuring poster presentations from fourth-year Nanotechnology Engineering capstone and past seed-funded projects from 2018 to 2022. We are excited to make WIN Day an annual event!



2023 WIN Research Celebration and Holiday Reception

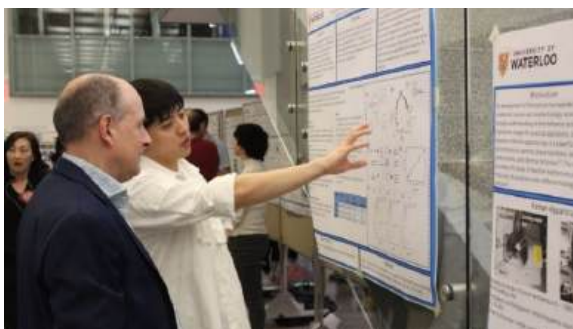
On November 23, WIN hosted the 2023 Research Celebration and Holiday Reception to recognize the achievements of our researchers, graduate students, staff members in the QNC, as well as the 2023 WIN Rising Star award recipient. The WIN Rising Star Award was awarded to Samira Siahrostami, Associate Professor of Chemistry Simon Fraser University.

In addition, nine researchers were recognized with the WIN Research Leader Award which acknowledges the significant research achievements of WIN members within the past year. Congratulations to all the awardees:

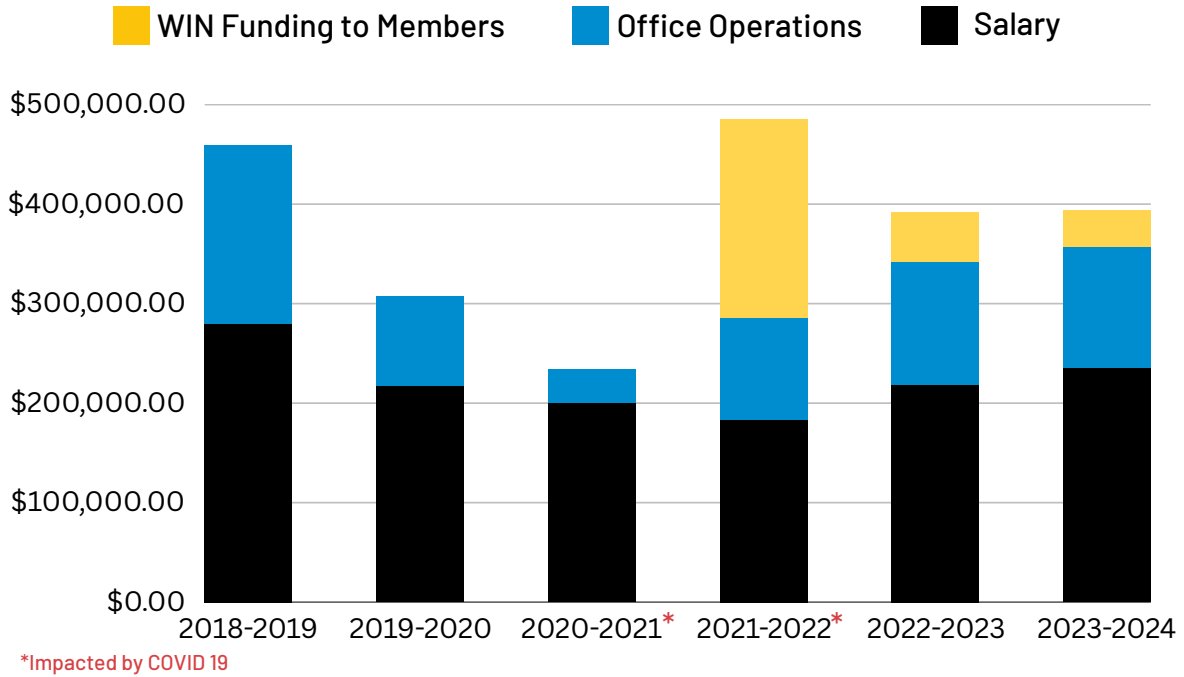


- Johnathan Baugh, Chemistry
- Emmanuel Ho, Pharmacy
- Na Young Kim, Electrical and Computer Engineering
- Xianguo Li, Mechanical and Mechatronics Engineering
- Juewen Liu, Chemistry
- Luis Ricardez-Sandoval, Chemical Engineering
- John Wen, Mechanical and Mechatronics Engineering
- XiaoYu Wu, Mechanical and Mechatronics Engineering
- Yimin Wu, Mechanical and Mechatronics Engineering

WIN also recognized staff member Kyle Murphy, Space & Access Operations Coordinator for his outstanding contributions to WIN and the QNC by going above and beyond the call of duty to help support and advance nanotechnology research.



BUDGET



LIFE AT THE QNC



ACKNOWLEDGEMENT OF TRADITIONAL TERRITORY

The University of Waterloo acknowledges that much of our work takes place on the traditional territory of the Neutral, Anishinaabeg and Haudenosaunee peoples. Our main campus is situated on the Haldimand Tract, the land granted to the Six Nations that includes six miles on each side of the Grand River. Our active work toward reconciliation takes place across our campuses through research, learning, teaching, and community building, and is co-ordinated within our Office of Indigenous Relations.

UNIVERSITY OF
WATERLOO



nano.uwaterloo.ca

WATERLOO INSTITUTE FOR NANOTECHNOLOGY
200 UNIVERSITY AVE. W., WATERLOO, ON, CANADA N2L 3G1