November 2025

Fueling Ontario's Future: Advancing the Life Sciences Ecosystem

Fostering Talent, Innovation and Collaborative Partnerships

ONTARIO'S UNIVERSITIES
Partnering for a better future

CONTENTS

Introduction

Ontario's life sciences sector is a cornerstone of the province's prosperity – driving innovation in health care, biomanufacturing, agriculture, biomedical research and rehabilitation sciences. It is creating solutions that improve lives and fuel economic growth. As this dynamic sector expands, the need for a highly skilled workforce and cutting-edge research has never been greater.

Ontario's universities are central to this success. From world-class research labs to classrooms and industry partnerships, universities are preparing the next generation of highly-skilled talent, advancing transformative discoveries and translating ideas into real-world solutions. Through work-integrated learning, reskilling opportunities, and specialized programs, universities are equipping students with in-demand skills – helping address workforce shortages while ensuring Ontario remains competitive on the global stage.

At the same time, universities are leading research that tackles some of the province's most complex challenges by developing new therapies, advancing cancer care, enhancing agricultural productivity, and creating sustainable biotechnologies. Through strong partnerships, they are accelerating the path from discovery to deployment – helping ensure these breakthroughs reach people faster, while building companies, attracting investment, and generating long term benefits for people and the economy.

As catalysts of growth and innovation, Ontario's universities are helping ensure the province's life sciences sector remains globally competitive, resilient and well-positioned for the future.

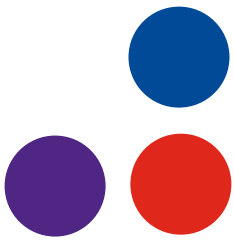
This booklet highlights stories of how universities are shaping the next chapter of Ontario's life sciences success – driving innovation, building strong ecosystems, and supporting a healthier, more prosperous Ontario.

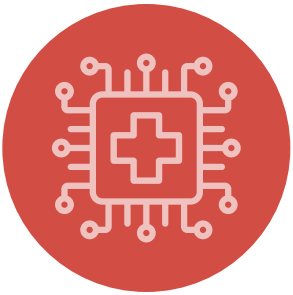
Advancing Ontario's Life Sciences Sector: Building Talent Through Work-Integrated Learning

To meet the growing demands within the life sciences industry, Ontario's universities are helping drive growth in the sector by equipping students with the skills employers need. Through work-integrated and experiential learning, students gain hands-on experience in cutting-edge research settings while developing the practical, job-ready skills to succeed in a competitive economy. These initiatives prepare students for impactful careers and foster innovation, contributing to advancements that improve health outcomes and address pressing societal needs.

From creating AI-powered simulators that transform surgical training to linking biology with entrepreneurship, universities are transforming the power of hands-on learning. Work-integrated education equips students with practical skills, addresses critical issues in life sciences, and fosters innovation and improved outcomes.

By developing a workforce with interdisciplinary skills and addressing critical skills gaps, Ontario's universities are ensuring the province remains a leader in life sciences – supporting high-tech scientific jobs, strengthening competitiveness and driving innovation that benefits people and communities across Ontario.





AI-Powered Simulator Helps Train Pediatric Surgeons

To prepare the next-generation of pediatric surgeons, **Carleton University** engineering undergraduates are developing an AI-powered, cyber-physical simulator that helps train medical students in laparoscopic surgery.

The simulator uses machine learning to assess performance against expert surgeon movements, teaching key skills like tool handling, hand positioning, and force. Fourth-year students apply engineering theory in real clinical contexts, collaborating directly with practicing pediatric surgeons. By combining work-integrated learning with advanced technology, the simulator accelerates skill development, reduces training costs, and lessens the need for senior surgeon supervision.

Aimed at enhancing surgical training globally, this hands-on, interdisciplinary training tool has the potential to revolutionize medical education, making it accessible even in resource-limited settings. While still in the prototype phase, the simulator shows incredible promise as an effective and accessible teaching tool to help cultivate job-ready surgical talent and foster innovative health care solutions that meet emerging challenges in medicine.

Student-Led Forensic Science Innovation

To help students prepare for careers in forensic sciences and gain real-world experience in the field, **Laurentian University**'s Master of Forensic Science program provides hands-on opportunities to share their work on a national stage. Working closely with faculty supervisors, students build both research expertise and professional skills through applied, practical learning.

One of this year's award-winning student presentations focused on improving DNA recovery methods from oral fluid collection devices used in toxicology testing, bridging forensic science and molecular diagnostics. Another examined mental health–related health care patterns among sexual assault survivors, bringing forensic research into the realm of public health.

Beyond conference participation, students develop their skills in specialized facilities such as a state-of-the-art forensic teaching laboratory and a fully equipped crime scene apartment simulation facility. These environments allow them to practice and refine techniques in DNA analysis, forensic chemistry, forensic toxicology, and laboratory operations and quality assurance, preparing them to meet the demands of an evolving field.

Learning to Bring Health Care Innovations to Market

By connecting science and entrepreneurship, **McMaster University** students are turning biomedical ideas into real-world solutions through the Entrepreneurship in Biomedical Innovation: Bench to Market course. The program combines biology, clinical insight, and business principles, giving students the chance to create projects that are both scientifically sound and market-ready.

The first-year Integrated Biomedical Engineering and Health Sciences (iBioMed) students work in teams to develop prototypes and models to tackle health challenges, such as devices for tracking multiple sclerosis, predictive tools for neurodegenerative diseases, and new therapies for Creutzfeldt-Jakob Disease. Students pitch their solutions to faculty and industry experts and have the opportunity to showcase top projects at the annual iBioMed Showcase, giving them real-world practice in communicating value, assessing risk, and refining their ideas.

Through hands-on labs, research, and collaboration, and by embedding this kind of work-integrated learning from year one, the course is cultivating a new generation of life sciences talent – students who understand not just the science, but how to translate discoveries into products and services that benefit patients and communities.

Student Entrepreneurs Tackle Health Challenges Through Hackathon

Trailblazing student teams at **Ontario Tech University** are turning bold ideas into health innovation through the university's Brilliant Catalyst "Catalyst Challenge" hackathon – a work-integrated learning initiative that gives students an authentic path from concept to commercialization. In 12 days, participants addressed sustainability and health challenges, working under mentorship to refine ideas, validate solutions and pitch to expert judges.

This experiential model immerses students in entrepreneurship and interdisciplinary collaboration. Rather than passively observing, they engage in ideation, prototype development, business modeling, and public pitching – skills increasingly in demand across biotechnology, health tech, and life sciences industries. Through support from the Brilliant Catalyst incubator, teams can further develop promising solutions post-challenge.

Through the integration of research, education and partnerships, The Catalyst Challenge demonstrates how universities can connect academia, industry, and community to create sustainable, real-world health care solutions.

iBest Powers Innovation and Talent in Life Sciences

Breakthroughs in regenerative medicine, drug delivery, imaging, and health-care AI are helping patients live longer, healthier lives – and the Institute for Biomedical Engineering, Science and Technology (iBEST), a partnership between **Toronto Metropolitan University** and Unity Health Toronto, St. Michael's Hospital, is driving these advances.

The institute's work spans a broad spectrum, from publishing research and filing patents to creating new companies and health products. By nurturing the development of spin-off companies and patient-centred solutions, iBEST is improving early detection, treatment, and care, while also shaping the next generation of talent in life sciences and biomedical engineering.

In addition to advancing research and accelerating the translation of research into real-world solutions, iBEST is giving students, clinicians and researchers hands-on experience in interdisciplinary projects. This approach helps cultivate the next generation of innovators and leaders in both the health and technology sectors, ensuring continued progress in improving health care solutions.

New Long-Term Care Home Builds Talent

A new 224-bed long-term care home at **Trent University** will do more than expand housing for seniors in Peterborough – it will create a hub for research, innovation and student learning that helps drive Ontario's life sciences workforce. The project will provide urgently needed care while positioning students at the centre of efforts to improve health outcomes for older adults.

The LTC home will provide more than 90 student placements each year across programs including Nursing, Social Work, Kinesiology, Business Administration, and Sustainable Agriculture. These placements give students experience working with older adults, helping them develop practical skills and direct experience supporting seniors, and prepare graduates to meet growing demand for health and life sciences talent across Ontario.

Faculty from the Trent Centre for Aging and Society and other experts in aging will work with residents and staff to explore and test new approaches to elder care, ensuring research informs practical improvements in quality of life. Located at Trent University (a designated Age-Friendly University), the new LTC project will also encourage residents to participate in campus life, fostering intergenerational connections that benefit both students and the broader community.

Building Ontario's Life Sciences Future:

The Vital Role of Universities in Innovation, Talent and Industry Growth

From life-saving health care breakthroughs to agricultural innovations that sustain local communities, universities are partnering to strengthen Ontario's life sciences ecosystem.

The impact of the skilled talent, research and innovation fueled by Ontario's universities has an effect spanning across industries, generating growth and innovation, and advancing Ontario's life sciences future.

Here are a few examples of Ontario's universities' contributions to this thriving sector:

Building Life Sciences Infrastructure

From 2017-2022, Ontario's universities built 60 major **infrastructure projects** fostering life sciences research, innovation and talent development across eight campuses. This includes collaborative projects with industry partners who seek access to specialized knowledge, research hubs and institutional facilities to develop and test innovations.

Generating Homegrown IP

More than **720 start-up companies** were created in life sciences fields across 10 Ontario universities from 2017-2022. Universities also generated nearly **$141 million in licensing revenue** and provided equity and grant financing for start-ups equal to **$2 billion** over that same period.

Developing Health Care Talent

In 2022, Ontario's universities graduated more than **14,000 students** from health care programs. These students will go on to practice in regions throughout Ontario, ensuring that people in communities across the province have access to the health care they need and deserve.

Driving Partnerships with Industry

Nine Ontario universities reported that more than 2,300 students participated in research internships with industries related to life sciences between 2017-2022. These internships offered students an invaluable opportunity to gain hands-on experience in the field, preparing them to enter into lucrative careers in high-demand fields that are fueling Ontario's economic prosperity

Meeting STEM Demand

Since 2010, STEM enrolment at Ontario universities has grown by **76 per cent** and in health fields by **44 per cent**.

Attracting Global Life Sciences Investment

Since 2018, Ontario has seen **more than $6 billion** in investments from the life sciences sector. Ontario's supply of highly skilled talent and advanced research and innovation ecosystem are critical to attracting interest from leading companies such as AstraZeneca, Moderna and Roche.

In 2025, AstraZeneca invested **$820 million** in Ontario to expand clinical research and establish a new state-of-the-art facility in the GTA, creating more than 700 high-skilled jobs and strengthening the province's position as a global leader in life sciences

> *"This investment is a reflection of our growing clinical pipeline, our strong belief in Canada's potential as a global hub for life sciences innovation, and the value of public-private collaboration with the Ontario government. We believe the diverse talent pool together with the network of world-class universities, hospitals, and research centres will help us bring new medicines to Canadians and patients worldwide."*
> — **Pascal Soriot, Chief Executive Officer, AstraZeneca, 2025**

Fueling a Growing Life Sciences Workforce

More than **500,000 Ontarians** were employed in the life sciences sector in 2017 across nearly **90,000 companies** according to Life Sciences Ontario – meaning one in 13 Ontarians worked in a job connected to the industry. The number of Ontarians working in the sector has increased in subsequent years as Ontario has continued to attract new investments. As leaders in the creation of life sciences talent, Ontario's universities will continue to play an essential role in fueling this industry.

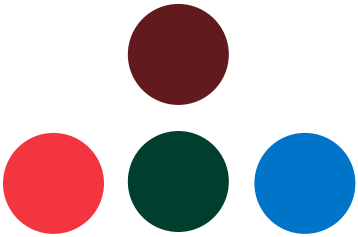
Life Sciences Innovation: Turning Research into Real-World Solutions

Life sciences research and innovation, driven by Ontario's universities, are delivering stronger health care, tackling global health challenges and creating solutions that support the province's prosperity and competitiveness.

From designing non-invasive wearable technology that monitors health in real time, to developing new supports for dementia care, these innovations not only improve health outcomes but also create jobs, attract investment, and position Ontario as a global leader in life sciences research.

Whether advancing cancer cure research, exploring the role of gut health in human and environmental well-being, or fostering sustainable solutions for the future, these partnerships are tackling the province's most pressing challenges head-on.

Together, these efforts showcase the power of university research to advance innovation in the life sciences sector and drive results that improve lives and build a healthier, more resilient Ontario.



Connecting Data, People and Purpose

Early detection saves lives – and new research at **Algoma University** is giving Ontario clinicians powerful tools to diagnose cancer sooner and with greater accuracy. By developing advanced computational methods that analyze circulating cell-free DNA, Algoma researchers are helping identify disease signals before traditional imaging, creating opportunities for earlier intervention and improved patient outcomes.

In collaboration with Princess Margaret Cancer Centre and industry partners, the researcher and lab team have shown how combining methylation, fragmentation, and single-cell data through graph-based deep learning enhances detection and interpretation of cancer signals.

These innovations are being translated into open, user-friendly software and web tools, ensuring hospitals and labs across Ontario can adopt multimodal liquid biopsy approaches without costly reinvention – strengthening both care delivery and the province's life sciences ecosystem.

Targeting Cell Communication to Stop Cancer's Spread

A breakthrough in controlling cancer cell growth that could pave the way for new therapies, has been identified by **Brock University** researchers. They have discovered a mechanism in the Notch receptor pathway that can be manipulated to suppress uncontrolled cell proliferation, offering promising avenues to slow or stop the spread of cancer.

Using optogenetics, the team engineered a light activated version of the Notch receptor. When triggered with blue light, the receptor is released from the cell membrane and moves to the nucleus, activating downstream genes. Notch signaling is particularly active in cancers such as human T-cell lymphoblastic leukemia, where blocking the pathway can stop cells from multiplying.

This precision approach revealed key drivers of cell growth, including the MYC proto-oncogene, highlighting potential targets for future therapies. The next step is to study Notch self-assembly in breast cancer and explore how it interacts with other cell signaling pathways.

Understanding Gut Health for Human and Environmental Benefit

Breakthroughs in gut microbiome research by one **University of Guelph** molecular microbiologist are reshaping how scientists understand and treat disease, with new possibilities for improving health and wellness. This research is uncovering how microbial communities in the human gut influence conditions like colorectal cancer, diabetes, and inflammatory bowel disease – paving the way for new diagnostics and microbial-based therapies.

At the centre of this research is “Robogut,” an artificial gut model that allows microbes to grow under realistic conditions. This innovative tool helps researchers test how diet, chemicals, and microbial changes affect gut health, translating lab findings into real-world applications. Beyond human health, the lab’s collaborations extend to projects like the Canadian Bee Gut initiative, which applies microbiome science to strengthen pollinator health and agricultural sustainability.

Harnessing microbes holds promise for health and environmental restoration. Beneficial strains can be used as probiotics, while others show potential in bioremediation – breaking down harmful substances like plastics and toxic chemicals, offering sustainable solutions to reduce environmental damage.

Innovating to Cut Fertilizer Waste and Boost Farm Profits

To help farmers apply fertilizer more effectively, a **Lakehead University** researcher is developing a low-cost, high-tech device that provides real-time data on nitrogen loss – solving a long-standing challenge of balancing crop yields with environmental sustainability.

The research team has developed a prototype device, based on patented technology, that accurately detects gases such as nitrous oxide (N_2O), carbon dioxide (CO_2), ammonia (NH_3), and other nitrogen oxides released from fertilized fields. A specialized laser now in development will enhance its sensitivity and accuracy, giving farmers a clear, real-time picture of nitrogen loss to guide smarter fertilizer use.

By using affordable components from the telecommunications industry, the device is far more cost-effective than existing systems, making advanced monitoring accessible to farmers in Ontario and worldwide. The innovation offers multiple advantages: helping farmers boost yields and profits while using less fertilizer, reducing pollution, and potentially setting a new industry standard for nitrogen management. It also aims to provide scientists, agronomists, and policymakers with valuable data to inform fertilizer choices across different climates, optimizing plant growth and minimizing nitrogen loss.

Enhancing Dementia Care

Innovative approaches to dementia care are being developed at **Nipissing University** to better support individuals with rare and young-onset dementias. The researchers are leading a national project to evaluate and expand the Rare Dementia Support (RDS) model, tailoring services to meet the unique needs of affected individuals and their families.

This research examines which support mechanisms most effectively improve well-being and quality of life. By studying how interventions impact both individuals and their families, the project aims to optimize the RDS model's reach and efficacy across diverse communities.

With up to 15 per cent of individuals who live with dementia and have a rare, inherited, or young-onset form of the condition, this work will help create a more inclusive and effective network of support that meets the unique needs of these communities across the province and beyond with a commitment to making a lasting impact on dementia care and support.

Advancing Wet Lab Research Capacity

Ontario's life sciences capacity is being strengthened through the **University of Ottawa**'s new wet lab at the Advanced Medical Research Centre, which will expand research infrastructure and foster collaboration between scientists, clinicians, and industry partners to accelerate the development of made-in-Ottawa health innovations.

Focused on enabling the discovery of life-saving therapies, the space will bring together researchers, core facilities, and biomanufacturing expertise under one roof. It aims to offer the specialized environment required for pre-clinical research – enabling teams to test, refine, and scale new diagnostics and therapeutics. Wet labs play a critical role in advancing pre-clinical research, yet access to such specialized spaces has been limited across the region – the new facility will help directly address this gap, fostering collaboration and supporting the development of Ontario-made medical breakthroughs.

By improving access to shared facilities and expertise, the space will help accelerate innovation, expand training opportunities, and drive economic growth while attracting investment and improving patient care through cutting-edge research.

Design Meets Medicine: Safer Fetal Procedures

Breakthrough tools are reshaping how surgeons learn – and one **OCAD University** professor is partnering with Mount Sinai Hospital to design lifelike models that allow surgeons to practice high-risk fetal surgeries in a safe, controlled environment – ultimately improving patient safety and outcomes.

Drawing on expertise in art, sculpture and design, these simulators are grounded in the intersection of art, engineering, and health sciences – bringing together design thinking and clinical needs. The model is waterproof, can hold liquid and gas, and features a uterine wall strong enough to withstand puncturing and resealing, providing a realistic training model for surgeons.

This advanced simulation model allows surgeons to perform fetal surgery aimed at repairing spina bifida in utero, reducing the risk of complications for both mother and baby during real surgeries. This breakthrough approach is bridging creativity and clinical practice, accelerating research in medical technologies, and supporting a safer, more sophisticated future for health care delivery.

Transforming Agricultural Waste into Clean Technologies

By turning canola meal, a common waste product from oil production, into valuable materials like bioplastics, carbon-capture electrodes, and sustainable packaging, **Queen's University** researchers are transforming how agricultural byproducts are used. This breakthrough strengthens Ontario's clean technology leadership, reduces waste, and creates new opportunities for farmers and manufacturers to grow the province's bioeconomy.

The researchers extract natural polymers such as cellulose and proteins from renewable sources like canola meal and microalgae, engineering them into nanomaterials that can replace traditional plastics. These innovations add value to existing agricultural products, reduce waste and help lower plastic pollution.

To guide the adoption of these technologies, the project, which unites multiple universities, industry leaders, and farmers, also focuses on developing a policy roadmap for the emerging canola bioeconomy that will help assess economic impact, support farmer participation, and advance a more sustainable and circular agricultural system that benefits communities across Ontario.

Revolutionizing Skin Wound Care Through Bioprinting Solutions

A groundbreaking bioprinting technology developed by VRIT, a start-up co-founded at the **University of Toronto**, is transforming wound care by offering a faster, less painful alternative to traditional skin grafts. The handheld INSITE bioprinter allows surgeons to print personalized bioinks directly onto wounds – promoting rapid healing, reducing complications and minimizing scarring.

By combining regenerative medicine with clinical practice, VRIT is advancing a patient-centered approach that tailors treatment to each individual's biology. These personalized bioinks not only speed up recovery but also lower infection risks and reduce the need for invasive surgeries – representing a major step forward in tissue engineering and redefining how complex injuries are treated.

This innovation holds particular promise for patients with extensive burns, chronic wounds, or those unable to undergo skin graft procedures. With a focus on making advanced wound care more accessible, efficient, and effective, VRIT's work is reshaping clinical practice and setting new standards in regenerative medicine.

Rebuilding Bones with 3D Printing

A groundbreaking solution to repair damaged bones is underway at the **University of Waterloo**, where researchers are designing 3D-printed bone grafts that could transform how patients heal after injury or surgery. This innovation aims to make bone repair safer, more precise, and less invasive, offering new hope for faster recovery with fewer complications.

By developing a nanocomposite material that mimics the natural properties of bone tissue – strong, biocompatible, and 3D-printable – researchers are enabling surgeons to create grafts that precisely match a patient's bone structure. The material's strength and biocompatibility come from hydroxyapatite particles, which both reinforce the structure and create a surface ideal for bonding with bone cells.

This approach improves integration, reduces the risk of rejection or infection, and allows for engineered features that hold the graft in place, eliminating the need for metal screws and plates used in traditional bone repair. As the body heals, these properties enable new bone tissue to grow and gradually replace the graft, leading to stronger, more natural recovery outcomes.

Strengthening Ontario's Defences in Biomanufacturing and Pandemic Preparedness

Ontario's life sciences readiness is being strengthened through the INSPIRE (Integrated Network for the Surveillance of Pathogens) research project led by the **University of Windsor**, which aims to strengthen biomanufacturing capacity, supply chains and pathogen surveillance to prepare for future pandemics.

INSPIRE brings together 43 experts across seven universities and public/private agencies, from microbiology and bioengineering to supply chain logistics and public policy. Its work emphasizes cross-border coordination and resilience – especially in regions critical to supply chain movement and infectious disease pathways – and integrates modern surveillance technologies to detect threats early.

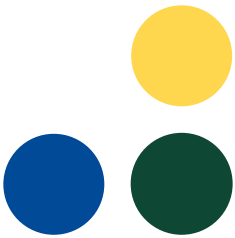
Beyond its scientific goals, INSPIRE is training graduate students, offering rotational placements and deploying mobile labs to bring capacity to remote or underserved regions. This translates into a deeper pool of skilled talent, an accelerated pipeline of research to health technologies, and greater resilience in delivering medical solutions to communities when they're needed most.

Driving Innovation in Infectious Diseases

Amid growing global health risks and an increasing demand for biomedical innovation, **Western University** is launching the Pathogen Research Centre in 2027 – a new facility that will help Ontario lead in detecting, understanding and fighting infectious diseases. The centre will combine real-world transmission testing and vaccine and therapeutic manufacturing for clinical trials to accelerate breakthroughs in public health and bio-innovation.

Equipped with containment labs, including a microbial transmission unit that can simulate environments like hospital rooms or airplane cabins, and a GMP (Good Manufacturing Practice) facility capable of producing biotherapeutics and vaccines to clinical standards for human clinical trials, the Centre will fill critical gaps in Ontario's life sciences ecosystem. It will enable scientists and industry partners to test how pathogens spread in realistic conditions and develop therapeutics locally, reducing reliance on international manufacturing. The facility will also provide graduate students, postdoctoral researchers, and faculty with access to unique tools and projects, strengthening the province's talent pipeline in immunology, virology and bioengineering.

This infrastructure will accelerate the translation of scientific discovery into life-saving solutions. By advancing the development of homegrown solutions that can protect communities and strengthen the province's life sciences sector, the Pathogen Research Centre will not only improve health outcomes but also strengthen Ontario's bio-innovation economy.



Decoding Brain Function Through Bioengineered Models

By developing bioengineered, three-dimensional neural networks, researchers at **Wilfrid Laurier University** are creating models that mimic the brain's structure and behavior. These miniaturized "brains" allow researchers to study learning, memory, and cognition in ways that were once impossible.

Created from biomaterials such as silk and neural cells, these three-dimensional networks contain millions of cells that communicate like a human brain. They physically adapt to stimuli, allowing scientists to track how learning and memory unfold at the cellular level. By pairing these bioengineered brains with robots, the research explores biological intelligence as a foundation for developing artificial intelligence that more closely mirrors human thought.

The technology is also transforming how we study neurological disorders. Instead of waiting decades for disease markers to appear in patients, scientists can observe changes within months in a petri dish. This accelerates the search for treatments for conditions such as Parkinson's, traumatic brain injury, and Alzheimer's, enabling researchers to test hundreds of potential therapies at once.

Wearable Biosensor Unlocks Real-Time Insights from Sweat

A new wearable device designed by researchers at **York University** is turning sweat into a powerful window into health. Designed to be non-invasive and comfortable, the technology continuously monitors health in real time, detecting early signs of disease long before symptoms appear.

By integrating microfluidics, advanced sensors and artificial intelligence, the device analyzes biomarkers in sweat to track subtle physiological changes linked to chronic conditions. Instead of relying on blood draws or lab tests, the wearable device promises a more accessible and patient-friendly way to track changes in metabolic and disease states, alerting users and health providers to subtle warning signs before symptoms emerge.

The project aims to bring this next-generation biosensing technology to market within two years. With potential applications ranging from chronic disease prevention to personalized health monitoring, this valuable tool represents a major step forward in accessible, continuous care.

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