APPLIED RESEARCH

BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY

Natural Health and Food Products Research Group assistant conducts tests in the Phytoanalytics Lab.

BCIT™

INNOVATION
FOR A COMPLEX WORLD

For more than 50 years, the British Columbia Institute of Technology (BCIT) has been training the experts, innovators, and professionals who shape our economy—across BC and around the world. With nearly 50,000 students on five campuses, BCIT is one of the largest post-secondary institutes in BC.

BCIT applied research creates solutions to industry challenges and is critical to the growth and success of BC business. Applied research takes place throughout BCIT—from student-led projects to collaborative research programs involving faculty, students, and external partners. It is integral to the Institute's education model—enhancing the student experience through hands-on learning opportunities that solve real-world problems.

By using a collaborative and technology-based approach to problem-solving, BCIT researchers and students also help businesses and industry increase their competitive strength and productivity while providing accelerated solutions that benefit society today.

MAKE+ researchers conduct biomechanical analysis in the Motion Capture Lab at the BCIT Centre for Applied Research and Innovation.

CENTRE FOR APPLIED RESEARCH AND INNOVATION

The Centre for Applied Research and Innovation (CARI) has been a hub of interdisciplinary research projects for business and industry for nearly 30 years. CARI is the home of three dedicated BCIT research groups and state-of-the-art labs as well as the Applied Research Liaison Office that provides support and guidance to BCIT faculty, researchers, students, and industry partners.

MAKE+ researchers and product development experts work in The Soft Shop wearables lab with textile fabrication technologies that allow integration of sensors and textiles.

MAKE+ Product Development Experts

MAKE+ is an interdisciplinary research group focused on product development, applied research, and education. The team optimizes the functionality, user experience, value, and commercial success of emerging health, consumer, and industrial products. This team is capable of taking complex projects and ideas from requirement discovery and concept development through to verification and product validation.

The MAKE+ subgroup, Product and Process Applied Research Team (PART), is the only academic product development group in Canada registered to the ISO13485 Quality Management System for medical device manufacturers.

By integrating classic tools with leading-edge technology, the NRG team is fully-equipped for research-oriented investigations that support the agricultural and natural health product sectors.

Natural Health and Food Products Research Group (NRG)

The BCIT Natural Health and Food Products Research Group (NRG) concentrates on issues related to natural health and food product quality, process improvement, and human health. With an emphasis on quality assurance, the NRG team has developed a reputation amongst industry stakeholders for providing innovative solutions to real-world applied research challenges.

NRG's goal is to ensure that all Canadians can achieve the potential health and economic benefits offered by natural health products, medicinal plants, and food products.

NRG research and development is closely aligned with the priorities and policies created by industry and government regulators, both provincially and nationally. The team collaborates extensively with universities, healthcare facilities, and other research institutes around the world.

Smart Microgrid Applied Research Team (SMART)

The Smart Microgrid Applied Research Team (SMART) converges expertise in the information technology, communications engineering, and energy management fields to develop prototypes and solutions for complex applied research problems. SMART has a reputation for unique experience in three strategic research themes: smart microgrid and energy management systems, electric vehicle infrastructure, and critical infrastructure cybersecurity. SMART helps stimulate BC's economy through collaborative projects with other academic institutions, industry, and government.

SMART members helped BCIT create Canada's first campus-based Smart Microgrid.

CANADA RESEARCH CHAIRS AT BCIT

The Government of Canada selects and funds Canada Research Chairs to attract and retain the best and most promising researchers from around the world. BCIT currently holds three Canada Research Chairs. Each of these experts conducts research that improves our depth of knowledge and quality of life while enhancing the Institute's capacity to train the next generation of leaders.

Dr. Jaimie Borisoff

Canada Research Chair in Rehabilitation Engineering Design

Dr. Borisoff researches how better technology can improve mobility and quality of life for people with disabilities. One focus of his work is on expanding the ability for all people to interact more fully with others, the environment, and the world. This includes dynamic wheeled mobility, the ability to quickly change wheelchair function to better suit different daily activities. Rehabilitation Engineering Design looks at how people use devices in real life and, from these observations, designs better versions of the devices. Dr. Borisoff is also Research Director of REDLab at BCIT, an Adjunct Professor in both the Department of Occupational Science & Occupational Therapy and Biomedical Engineering Program at the University of British Columbia, and a Principal Investigator at ICORD.

Dr. Paula Brown

Canada Research Chair in Phytoanalytics

Dr. Brown is the Canada Research Chair in Phytoanalytics, investigating a wide range of chemicals produced by plants, how they are synthesized, regulated, and allocated within plant tissue, their extractability and activity, and their role in plant and human health. Dr. Brown is also the Director of the BCIT Natural Health and Food Product Research Group, which has supported the natural health product and food product industries for nearly 20 years through applied research, training and education, and volunteer board appointments. Supported by grant funding and industry contracts, the NRG team focuses on projects related to health policy, regulatory affairs, product formulation, botanical authentication, analytical method development and validation, chemometrics, and therapeutic monitoring for preclinical and clinical studies.

Dr. Fitsum Tariku

Canada Research Chair in Whole-Building Performance

Dr. Tariku's building science research program ranges from materials and building envelope systems through to whole-building performance analysis. Currently, he is focused on material property measurements and characterizations, hygrothermal modeling and measurements of building envelope systems, and integrated analysis of whole-building performance. The objective of his research is to develop tools that support the design of buildings that are energy efficient, durable, economical, environmentally friendly, and provide superior indoor air quality to occupants. As the Director of the Building Science Centre of Excellence, Dr. Tariku mentors students and works to build comprehensive building optimization and decision-making tools that integrate whole-building simulation, risk assessment, and cost-benefit analysis.

APPLIED RESEARCH IN ACTION

Innovation helps premature babies thrive

Skin-to-skin contact helps maintain body temperature and promotes mother-baby bonding in premature babies. It has also been shown to calm them, protect against infection, and improve brain development. Yet, some babies are too fragile or ill to be out of incubators, making it difficult for their mothers to hold them.

BCIT MAKE+ researchers collaborated with engineers and researchers from the University of British Columbia to build the Baby Calmer—a robotic platform that rises and falls like a mother's chest and replicates a heartbeat to simulate skin-to-skin contact inside the incubator.

"The team created an aesthetically beautiful prototype," said Dr. Liisa Holsti, Canada Research Chair in Neonatal Health and Development at UBC. "The device required multiple changes in specifications along the way, and the team handled them with ease."

The Baby Calmer is in clinical testing in the Neonatal Intensive Care department of BC Women's Hospital.

Researchers tested the Baby Calmer in the Neonatal ICU department of BC Women's Hospital.

Advances in assistive mobility

Researchers from MAKE+ worked with entrepreneur Jean-Pierre Berger from the initial research phase through to prototyping on the BiKube—a revolutionary walker device that lets users be hands-free to perform tasks at home.

"MAKE+ works with clients to provide product development leadership services," said MAKE+ Director Nancy Paris. "In some cases, this entails product design, fabrication, and evaluation but it may also include applied research necessary to determine what the problem is that the client is trying to solve to begin with."

Drawing on his background in mechanics and robotics, project lead Gordon Thiessen and the team helped turn Berger's ambitious vision into a commercially-viable device.

"It was exciting to see the development from start to finish," said Thiessen, "and to experience the challenges that went along with developing a new product."

BiKube is about to embark on the production phase, and details about the product are available online.

MAKE+ experts helped take BiKube from entrepreneurial idea to commercially-viable product.

Dr. Hassan Faranghi, Director, Smart Microgrid Applied Research Team, examines the rooftop solar panels at the Burnaby Campus.

A top innovation to watch

The BCIT SMART Microgrid Applied Research Team's Energy Oasis Project—Canada's first campus-based smart power microgrid—was named one of the "Top 50 BC Innovations to Watch" by Business in Vancouver.

Researchers in SMART are working to identify cost-effective technologies and solutions for Canada's evolving smart electricity grid by using the microgrid on the Burnaby Campus to explore how energy can be produced, stored, and distributed efficiently and sustainably. The BCIT program provides opportunities for electrical utility companies, technology providers, and researchers to work together to advance the state of smart grid technology.

"Being selected as one of the Top 50 BC Innovations to Watch reaffirms BCIT's position as one of the most innovative academic institutions in Canada," said Dr. Hassan Farhangi, Director of the SMART Team. "This collaborative work is supported and funded by Canada's leading-edge utility companies and global high-tech players in the energy industry who recognized BCIT's ability to embark on such a world-class initiative."

Further enhancements are planned to the microgrid on the Burnaby Campus and electric vehicle charging infrastructure at the Aerospace Technology Campus.

SMART research associate looks for cybersecurity breaches in Smart Grids in the Substation Automation and Critical Infrastructure Security lab.

Securing the grid

Recent shifts in the energy landscape in Canada, including the advancement of technologies and connectivity of electrical networks, have opened utilities to the possibility of cyber attacks—compromising the integrity, reliability, and security of these networks. Cybersecurity is a critical issue for grid operators today—as the grid becomes more digital, it also becomes more vulnerable to cyber attacks.

The BCIT SMART group hopes to address the gaps in Canada's critical public utilities infrastructure through research, knowledge-sharing, and training.

The sophisticated technology in the Phytoanalytics Lab allows the NRG team to further advance cannabis research.

High-tech cannabis research supports quality control

As the Canada Research Chair for Phytoanalytics, Dr. Paula Brown knows a thing or two about cannabis. Within the Natural Health and Food Products Research Group (NRG), Dr. Brown and her team are essentially drafting an open-access instruction manual that will guide research around this very misunderstood plant.

Using sophisticated nuclear magnetic resonance technology, Dr. Brown and the NRG team are able to get a full map of the plant and identify the nuanced compounds of various cannabis samples, including their individual healing properties. Unfortunately, as a result of a previously unregulated dispensary market, there are also plants being sold that are tainted with pesticides and toxins as a result of individual producers' growing processes. These toxins are understandably worrisome for any user—especially medicinal users.

In the wake of recreational cannabis legalization, Dr. Brown hopes that testing of cannabis products becomes more consistent and comprehensive to ensure safety, efficacy, and quality of products across the country.

"With our research, we are able to go beyond smell or taste and create a fulsome plant profile," said Dr. Brown. "Using novel approaches and validating methods will lead to better therapeutic results for the end user."

By breaking down cannabis to the base level and validating testing methods to evaluate the plant, Dr. Brown and the NRG team are developing the industry-standard tools that governments, producers, and scientists will need to fully understand this complex plant.

STUDENTS
IN APPLIED RESEARCH

BCIT creates practical learning opportunities for students, engaging them in real-world research projects through practicum placements, capstone projects, student challenges, and lab assistant positions. Students use their knowledge and skills to collaborate with BCIT researchers, faculty, and industry partners.

Research activities are a key component of student learning at BCIT, enabling our students to remain at the forefront of technological change to meet the needs of industry partners and maximize the Institute's impact on economic development and environmental sustainability.

The research groups in the Centre for Applied Research and Innovation bring a wide range of experience to capstone projects by mentoring students and providing access to state-of-the-art labs.

Saboor Meherzad won the $5,000 first prize in the BCIT Student Innovation Challenge with his Divine Natural Bars.

Student-developed Divine Natural Bars hit the market thanks to BCIT

A BCIT Technology Management student earned the $5,000 prize for Entrepreneurship in the 2018 Student Innovation Challenge. Saboor Meherzad entered the competition with Divine Natural Bars, nutritional snacks made from mulberries, nuts, and seeds.

Inspired by an episode of Dragon's Den, Saboor began making and testing the product in his parents' kitchen. When he discussed his ideas with his marketing instructor at BCIT, she encouraged Saboor to focus his assignments around his product for the remainder of the course. He conducted market research, talked to consumers, and sought out retailers to better understand what he needed to do to bring his product to market. Eventually he brought the snacks to craft fairs and farmers markets, selling more than 300 units.

Upon entering the BCIT Student Innovation Challenge, Saboor successfully demonstrated the product's market potential, financial viability, and development plan.

Divine Natural Bars have already hit the shelves at The Stand on the BCIT Burnaby Campus. Since winning the Innovation Challenge, Saboor is ready to take his product to a wider market with a goal to have the bars available across Canada by the end of 2019.

Engineering students mine for success

When electrical engineering students Navtej Heir and Andrew Ydenberg flew to the Red Chris mine in northwestern BC for their capstone project, they were eager to help the multi-million dollar mining operation improve the efficiency of its operations.

Mining processes must run continuously, and shutdowns of any type are costly. Shutting down the processing line to adjust control parameters or experiment with optimization is prohibitively costly. In addition, improper configuration of the control system can potentially damage equipment or worse, cause injuries to plant personnel.

Heir and Ydenberg were tasked with building, designing, and validating a model that would allow the process control system parameters to be optimized and tested in simulation prior to bringing the control system changes online.

"Red Chris flew us up to the mine to verify and validate our model and get an appreciation of the process and control systems in place," said Heir, a fourth year student in Electrical Engineering. "We enjoyed visiting the mine because it showed us the complex problem we were trying to solve, along with ideas for innovative solutions."

"Nav and Andrew were very motivated to learn about the production process" said Thomas Gross from Red Chris mine. "We were very happy with the results. We encourage industry to tap into this hidden gem of knowledge with BCIT capstone students."

Electrical engineering students Andrew Ydenberg and Navtej Heir flew to the Red Chris mine in northwestern BC for their capstone project.

International students gain experience with MAKE+

For more than a decade, students from around the world have come to BCIT to learn from MAKE+ researchers, helping to fulfill the Institute's vision of increasing its global impact. In 2018, researchers welcomed four students from France to the team.

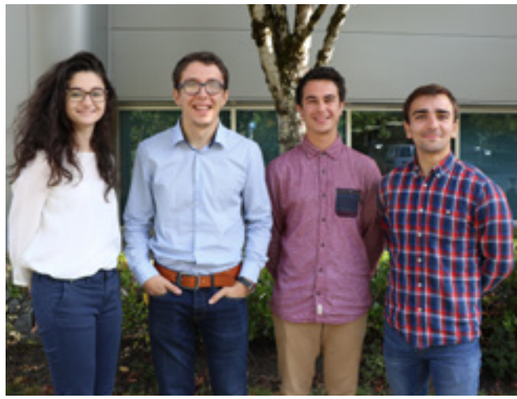
For Alice Grango, a five-month internship was an opportunity to further explore the healthcare career field. Taking the advice of her English professor, she left Paris for BCIT.

"I came to BCIT to discover if the healthcare field and the work of a research and development engineer is the right fit for me," she said.

MAKE+ provides students opportunities to learn and apply their knowledge. Remi Olivier, who hails from Nantes, enjoyed working with MAKE+ and learning the mechanical systems of the Baby Calmer (page five). Brittany-native Taaroa Cantois is completing his Master's degree in mechanical engineering by undertaking a project with BCIT researcher Judy Findlay to develop improved technology for people living with an ostomy.

For Etienne Bonte, working with MAKE+ provided a chance to take on a complex project and see it through.

"My goal is to complete a project from start to finish—from the consultation process through to completion," he said.



Alice Grango, Remi Olivier, Taaroa Cantois, and Etienne Bonte came to BCIT from France to gain experience with the experts on the MAKE+ product development team in Burnaby, BC.

APPLIED RESEARCH ACROSS BCIT

Building Science Centre of Excellence

The Building Science Centre of Excellence (BSCE) was created within the BCIT School of Construction and the Environment in 2005. The Centre's vision is to establish BCIT as a key provider of building science knowledge and master's degree graduates through advanced educational programs, leading-edge applied research, technology development, and knowledge transfer. The mandate of the BSCE is to support the construction industry with outcomes that transcend regional interests, as demonstrated by its participation in major international efforts.

A graduate student works on the Building Envelope Test Facility at the Burnaby Campus.

Centre for Architectural Ecology

The BCIT Centre for Architectural Ecology—Collaborations in Green Roofs and Living Walls evaluates the function and performance of green roofs and living walls in the rainforest climate of Coastal BC through collaborations with industry, government, and academic partners. Facilities include the BCIT Green Roof Research Facility in Vancouver, the White Rock Operations Centre, and the Elevated Research Platform and Sound Transmission Facility at the BCIT Burnaby Campus.

Dr. Maureen Connelly and her students research living walls at the Centre for Architectural Ecology on the Burnaby Campus.

Diversity Circles

Guided by an Indigenous Framework, the Diversity Circles model utilizes mentoring, networking, and community-based expertise for engaging student and community diversity. A series of panels, workshops, conversations, and tools help educators engage with increasing diversity positively, sensitively, and strategically, to empower all participants in the diversity conversation. A digital knowledge map connects knowledge holders, seekers, and digital resources, links local, provincial, and national networks, and features a unique digital user experience informed by an Indigenous aesthetic.

Diversity Circles was launched in 2015, benefiting from a major grant from the Social Sciences and Humanities Research Council of Canada Community and College and Community Social Innovation Fund

A Diversity Circles event on the Burnaby Campus.

Emission Reduction and Research Test Hub (ERRTH)

The Emission Reduction and Research Test Hub (ERRTH) is an applied research facility located at the BCIT Motive Power Centre for Excellence in Delta, BC. Together with industry partners and all levels of government, ERRTH is creating a cleaner environment by effectively measuring vehicle emissions, testing proposed solutions, and improving air quality. ERRTH supports new product development from proof-of-concept through design, testing, and commercialization, and offers objective data to governments on engine emissions.

The sustainability-focused Emission Reduction and Research Test Hub tests and measures exhaust gas for all modes of transportation and fuel types.

Augmented reality to improve surgical counts

BCIT Nursing instructor Manu Gill is researching the use of augmented reality (AR) to ensure that all surgical instruments are accounted for in the operating room. The project is a collaboration with Chris Nguan, MD, FRCEC, Urology at the University of British Columbia School of Medicine.

A computer-assisted system has the potential to eliminate the risk of tools being left behind during surgery and provide benefits at multiple levels. For patients, it will enhance safety and reduce the need for prolonged or subsequent operations to retrieve retained items. In addition, the system will reduce the workload of the operating room staff and enable them to work more efficiently.

"A computer-assisted system, in conjunction with nurses, can perform surgical counts with higher specificity and sensitivity than a purely manual approach," said Gill.

A prototype will be developed using a camera-based sensor and on-board computer to image and classify surgical items in real-time. A dataset of surgical images will be recorded and used to train a machine-learning algorithm. This algorithm will be the core of the system and will be used to intelligently detect and classify a surgical item in an image.

Computer-assisted surgical counts that use augmented reality will help avoid errors in the operating room.

The Spartan Controls Centre for Energy Education and Research allows students to work on some of the most advanced energy management systems available.

Spartan Controls Centre for Energy Education and Research

Forty-eight percent of all energy produced in Canada is consumed by industry and any improvements in industrial processes have significant impacts on overall consumption patterns.

The research and teaching that happens at the BCIT Spartan Controls Centre for Energy Education and Research is helping shift Canada's industrial plants toward cleaner and more efficient technologies and processes.

The Centre brings industry, students, academics, and researchers together to work in a cross-disciplinary learning and research environment focused on energy production, distribution, sustainability, and management.

Dr. Michal Aibin's research into cloud computing traffic patterns will help increase data transfer capability.

Understanding traffic patterns in cloud computing

Nobody likes a traffic jam, even on the Internet. While we rely on Internet connectivity constantly, most of us don't stop and think about traffic management in the cloud very often.

"Usually when people find their Internet speed getting slower, they think they need to upgrade their service," explains Dr. Michal Aibin, researcher and faculty member with the School of Computing and Academic Studies. "This challenge is different: currently deployed optical networks won't be able to support the global traffic needs of the near future, unless we can develop new algorithms to help increase data transfer capability."

The algorithms used in Dr. Aibin's research can be adapted to existing cloud services, such as Amazon Web Services, Microsoft Azure, or Google Cloud.

APPLIED RESEARCH BY THE NUMBERS

BCIT Applied Research is home to state-of-the-art facilities and specialized experts producing outstanding results for small- to medium-sized businesses and industry clients.

Our resources

25 research labs with specialized equipment

80,000 sq. ft. of laboratory space

40+ full-time, dedicated researchers

$4 million in research grants annually

100+ faculty experts

$34 million Centre for Applied Research and Innovation

Annual results

50+ collaborative projects

$1.5 million of industry services contracts annually

1,000+ applied research projects with faculty and students

How we can help

BCIT researchers have developed hundreds of practical solutions to industry challenges for a range of stakeholders—from independent entrepreneurs with a unique prototype idea to established companies developing new products and services.

BCIT Applied Research falls into five key themes:

- Sustainability and the Built Environment
- Health, Natural Health, and Biotechnology
- Social Enterprise, Human Capital, and Entrepreneurship
- Energy, Resources, Manufacturing, and Transportation
- Information/Communications Technology, and Security

If you have a potential research project or idea and would like to explore working with BCIT, please contact us through the Applied Research Liaison Office.

BCIT Applied Research Liaison Office
Centre for Applied Research and Innovation (CARI)
4355 Mathissi Place
Burnaby, BC, Canada
V5G 4S8

research@bcit.ca

bcit.ca/appliedresearch

BCIT™ BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY