University of Victoria
Science

ScienceMatters

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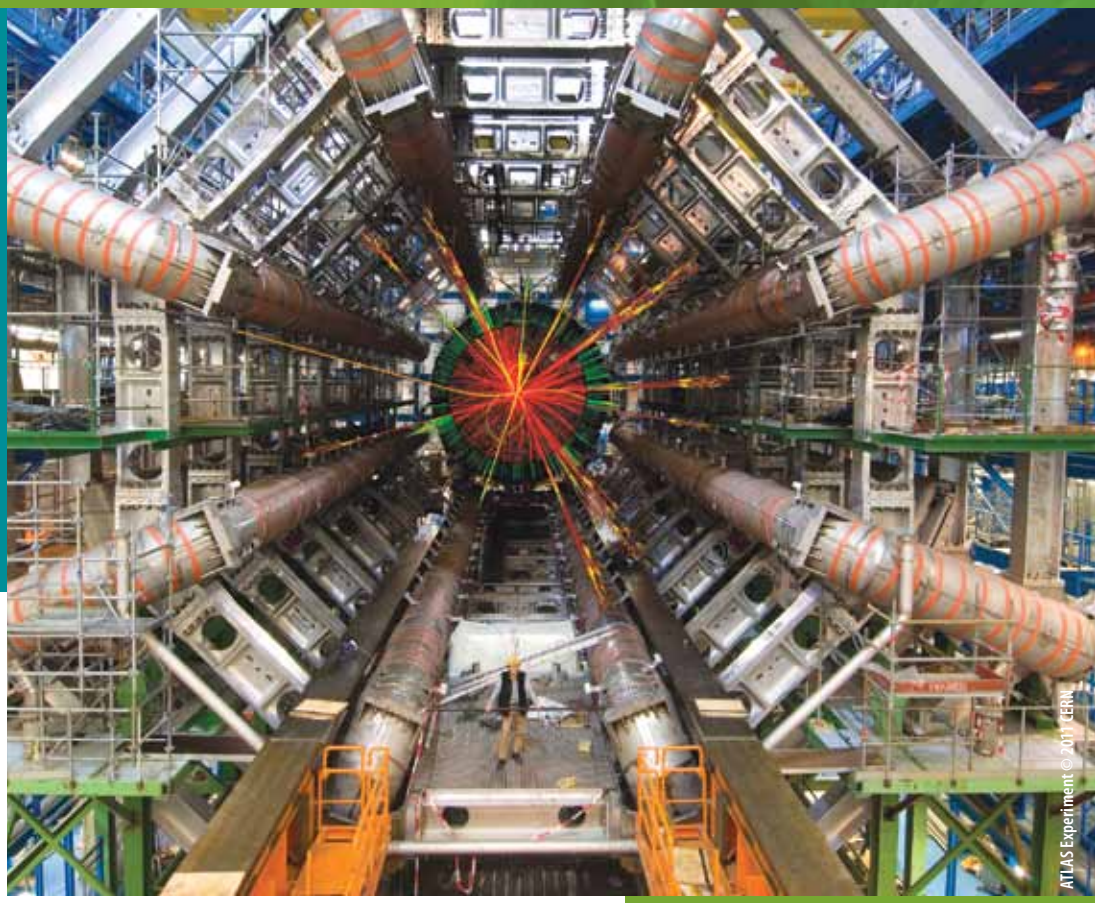
Smashing success

UVic physicists at the frontier of science



Large Hadron Collider with a particle collision event superimposed.

The 27-km subterranean Large Hadron Collider (LHC) that straddles the French-Swiss border is the most powerful particle accelerator in the world and UVic has been at the centre of the action since 1992. The protons accelerated by the LHC collide in the middle of the ATLAS particle detector—a massive microscope that allows physicists to collect data from collision debris.

The ATLAS detector is searching for new discoveries in the extraordinarily high-energy head-on collisions of protons. Through the ATLAS particle physics experiment, physicists are learning about the basic forces that have shaped our universe since the beginning of time.

The UVic-ATLAS team is one of the founders of the international ATLAS collaboration, which includes more than 3000 physicists from 37 countries. UVic researchers designed and built critical components of the 7000-ton ATLAS detector at UVic and in TRIUMF, Canada's national particle and nuclear physics laboratory in Vancouver.

In 2010, LHC scientists created collision experiments at energies of seven trillion electron volts (7 TeV), a record energy for particle collisions produced in the laboratory. Data collected by the ATLAS detector in 2010 has already led to over 20 scientific publications, with many more to be published in 2011.

Recent ATLAS publications include the search for structure inside quarks, the most basic building block of matter known today. "This is frontier science," says physics professor Michel Lefebvre. "The detector has effectively been able to capture features about two billion times smaller than an atom."

ATLAS is also pushing the frontier in the search for an unknown type of exotic matter—called dark matter—which is believed to be the dominant type of matter in the universe. If the constituents of dark matter are new particles, ATLAS should discover them and elucidate the mysterious nature of dark matter.

The 25-member UVic ATLAS team is composed of faculty members, students, research associates, technicians, computer experts, and engineers. The UVic team continues to contribute crucially to the operation of the ATLAS detector and to the analysis of the data collected.

The LHC is scheduled to operate at 7 TeV for 2011, with a potentially higher energy in 2012. "Our team is really looking forward to an enlarged collision-data set and to unique research opportunities," says Lefebvre, who is currently at the LHC. "In particular, ATLAS is just starting to look for the elusive Higgs Boson, believed to be intimately connected with the mystery of the origin of mass. But its discovery, if it exists, may have to wait until the LHC operates at its design energy of 14 TeV in 2014 or in 2015."

The UVic-ATLAS team is preparing the detector for planned upgrades to the LHC so it can achieve energies of 14 TeV. "Future data collection in such conditions requires modifications to the detector. We're now intensely studying and developing these improvements," adds Lefebvre.

New physics research centre

People throughout Canada and across the world have great interest in the most basic questions addressed by science, such as the nature and origin of the universe and the laws that govern its evolution. Physicists at the new Victoria Subatomic Physics and Accelerator (VISPA) Research Centre, established this year by the Faculty of Science, are playing leading roles in the worldwide effort to answer these questions.

VISPA will formally bring together the work of numerous UVic researchers who are pursuing particle physics. These individuals will work together to secure funding for, and ensure UVic's impact on, leading international particle physics experiments, as well as provide a research environment for adjunct faculty from other institutions, and support high-quality graduate and post-doctoral training in accelerator physics. Nine faculty, three emeritus faculty and nine adjunct professors, from TRIUMF in Vancouver and the Institute of Particle Physics in Toronto, comprise the centre.

DEAN'S MESSAGE

Over the last five years UVic has emerged as a research powerhouse in large part because of the activities taking place in the Faculty of Science. As the stories in this issue of Science Matters demonstrate, UVic Science researchers work at the forefront of their fields and are providing fundamental contributions to their disciplines as well as to major national and international efforts designed to understand and address some of the world's most pressing challenges, such as climate change, environmental stewardship, and health.

This year UVic is renewing its Strategic Plan as it charts its course for the next five years. The Faculty of Science is deeply involved in the planning process at the departmental and faculty levels. Our goal is to maintain and grow our research prowess, and to provide academic leadership for emerging university research themes such as health. At the same time, we remain committed to enhancing the quality of undergraduate and graduate science education not only in the classroom but by providing more experiential opportunities such as labs, land- and ocean-based field work, and exchanges with other institutions. We believe that the great strides in research and innovation will take place by fostering interdisciplinary collaboration. I am looking forward to reporting on our success as a Faculty in future issues of Science Matters. It is a truly exciting time for UVic Science. Enjoy this issue.

Rob Lipson

Science student becomes milestone co-op placement

Thirty-five years after launching one of Canada's largest co-operative education programs, UVic is celebrating its 60,000th co-op placement.

Biochemistry student Britney Allen became the 60,000th co-op student to secure a co-op work term when she was hired by Science Venture to work as a science/technology camp instructor this summer. Since 1991, Science Venture has been offering hands-on, mind-engaging science, engineering and technology outreach for Island youth from 5 to 18 years of age.

UVic's Co-op Program was established in 1976 in the Departments of Chemistry and Physics. The program secured 58 placements in its first year; today it includes 13 co-op offices that provide opportunities for students in 47 academic areas.

Brain matters Taking neuroscience education to the next level

The brain—that three pounds of tissue in our heads—is the master control for every dimension of a human's existence. The study of this organ and its systems is a relatively new research field with a history only a little longer than a century. Nevertheless, remarkable discoveries have been made and will continue to unfold over the next hundred years, with researchers in the Department of Biology contributing to the field.

"We're a small, young institution with a historical emphasis in neural research," say department chair Kerry Delaney, himself a cellular neuroscientist. "Neuroscience has been one of the pillars in our department going back to the 1970s with the neural biology work of [professor emeritus] George Mackie."

Neuroscience is one of the five themes identified by the Biology department as priorities for support in its research and teaching endeavors. "We have a strong core faculty with neuroscience research programs and have been able to accomplish much," says Delaney, "but the lack of an integrated graduate program for teaching and collaboration has been an impediment to UVic being on the map as a center of excellence in neuroscience."

That's all about to change. UVic is set to introduce a Neuroscience Graduate Program in 2011, which is the result of collaborations between the departments of Biology, Biochemistry, Psychology, the School of Exercise Science, Physical and Health Education, and the Division of Medical Sciences.

Neuroscience is an expanding strength at UVic, with research spanning many departments, faculties and research collectives. Delaney says the establishment of the Division of Medical Sciences in 2004 further strengthened the neuroscience faculty at UVic. The field of neuroscience is characterized by an interactive, multidisciplinary research approach employing ideas and technologies from a variety of disciplines, all of which are well represented at UVic. The new program will be hosted within the Division of Medical Sciences and combines the strengths of several academic units at UVic.

"This program will add training in a field important to the department and adds another dimension to the graduate offerings at UVic," says Delaney. "It will be a unique, innovative, and much-needed educational program that will integrate students from a variety of neuroscience disciplines. For Biology, it's a continuation of our department's long-standing commitment to neuroscience research and training."

Neuroscience research at UVic covers the spectrum: learning and memory, synaptic function, developmental neuroscience, sensory motor systems, disease and injury. Scientists across disciplines are working to unlock answers to their questions and gain new insight into the workings of the brain.

The new graduate program will increase the competitiveness of UVic in acquiring funding and attracting trainees to do biomedical research centered around health initiatives that have been mandated at the provincial and federal levels. It will enhance graduate student training, enable UVic to recruit the highest-quality research trainees, and galvanize innovative interdisciplinary research. It will add an emphasis to biomedicine which will be valuable to UVic as it strives to meet its strategic goals.

The program is in the final approval stages with the provincial Ministry of Advanced Education. Students will be accepted for admission once it is approved later this year. Interested alumni can contact the Biology department at biology@uvic.ca

Patented technology

developed by student microbiologist

A student microbiologist and his young company are attracting a lot of attention. DuVax, a UVic spin-off company, has patented technology to create bacterial vaccines. Founded last year by PhD microbiology candidate Barry Duplantis (BSc Biochem & Chemistry 2004) with his engineer father, Neil Duplantis, the firm recently earned the Emerging Technology Award from the British Columbia Innovation Council. The younger Duplantis says the award will further the potential to commercialize DuVax's technology and help the company compete in a global business environment.

"We hope to make DuVax a world leader in the production of both human and animal vaccines, reducing the need for antibiotics and the risk of bacterial infection like tuberculosis," says Barry Duplantis. "The continued support of UVic will be critical to my ability to take a concept and build a viable business around it. The company is now past the conceptual stage and this award strengthens our position to approach industry."

The BCIC award recognizes a new venture at the pre-investment stage that has developed an innovative technology in BC. The technology must demonstrate proof of concept and have strong potential for global commercialization.

DuVax's technology has been produced through grants provided by the Bill and Melinda Gates Foundation which have amounted to more than $100,000.

Photo | Shea Wyatt

Duplantis in lab.

Microbiology alumnus joins fight again cancer

With his convocation last November, Eric Tran (PhD Biochemistry and Microbiology) is the first to complete the doctoral program in cancer immunology at the BC Cancer Agency's Deeley Research Centre in Victoria. Tran, from Ucluelet, is realizing his high school dream of using science to help others. He is continuing his work on T-cell cancer therapy with his post doctoral appointment at the U.S. National Institutes of Health.

Leading math success

Actions speak louder than words and the department of mathematic and statistics has taken a leading step in demonstrating its commitment to excellence in teaching and student success.

"Every research institution says in its mission statement that it values teaching. But, the reality is that teaching is often sacrificed to research," says Alfonso Gracia-Saz. "I don't feel that is the case at UVic." He says his position, newly created last July and dedicated to examining math pedagogy with the mandate of improving student success rates, speaks volumes.

"Many Canadian universities have been experiencing downward pressure on pass rates for first-year math classes," says department chair Chris Bose. "At UVic, we decided to try to do something about it." In partnership with the Learning and Teaching Centre, the department recruited Gracia-Saz. "He has a top-notch math background for this position," adds Bose "He's a really strong young researcher with an even stronger teaching record."

"During my recruitment I was impressed with how much people clearly cared," says Gracia-Saz. "One's reaction could be, 'Students will simply have to work harder.' That's not what I encountered here. The department was actively trying to improve the success rate—to do things differently, right from senior instructors to the chair."

Gracia-Saz

Individuals adjusted teaching styles, others modified the course format to improve things but with heavy teaching loads, current faculty were challenged as to how much they could devote to the issue. "My position is designed with a minimal teaching load so I can dedicate time to this," explains Gracia-Saz. "It's unique in Canada, I believe." He'll examine the overall program, determine the impediments to success and seek solutions.

"To get the pass rate up, we can't simply lower expectations. Students need the core competencies," says Gracia-Saz. Mathematics is fundamental to any science or engineering discipline, and the majority of students in first-year math classes are drawn from disciplines other than math.

Part of the problem is that many first-year students arrive at university with a poor math foundation. "Lack of a baseline knowledge of algebra and pre-calculus and poor study skills are two of the main reasons students struggle," says Gracia-Saz. "Students need to understand mathematical concepts, as opposed to memorizing algorithms and plugging numbers in."

As a senior instructor cross appointed with the Teaching and Learning Centre, Gracia-Saz manages the Math & Stats Assistance Centre. Formerly it was managed by term appointments which meant high turn-over and lack of a consistent pedagogical vision.

He has reconfigured it with an emphasis on guiding learning and discovery instead of simply answering questions. He's accomplishing this through more rigor in the hiring of the centre's math tutors and by securing improved physical space for the centre's two on-campus sites. With two large rooms for study, students are encouraged to come and work for a couple of hours. When they get stuck, top-notch TAs are on hand to help. "Before, one of our locations was an office with just a few chairs outside—students would simply seek an answer and then leave."

One of his next steps is to examine the calculus course sequence and to determine if it can be redesigned to make it more effective. Gracia-Saz says options may include rethinking when material is taught in the sequence to better lay a foundation of knowledge on which to build subsequent courses.

He will also consult with all the departments from which math students are drawn to better understand what math competencies those students need for their core program and determine how that correlates to the current teaching.

ALUMNI PROFILE

Robert Young, PhD

Merck Frosst-BC Leadership Chair in Pharmaceutical Genomics and Drug Discovery, Simon Fraser University

Robert Young, BSc (Honours Chemistry 1967) received this year's Distinguished Alumni Award from the Faculty of Science during Alumni Week at an awards ceremony February 9.

Bob Young's career has focused on the design and synthesis of novel drugs for asthma, inflammation, osteoporosis and related diseases. He is most noted for his part in the discovery of Singulair™ , a breakthrough drug for the treatment of asthma and seasonal allergic rhinitis. Now sold in nearly 80 countries with sales of more than $5 billion US per year, Merck Frosst Canada cites Singulair™ as the company's number one research accomplishment.

Young spent most of his career with Merck Frosst, which he joined in 1977. There he worked in various capacities in Canada and the UK, eventually rising to Vice President, Medicinal Chemistry in 1993—a position he held until his retirement in 2006.

After six months of a self-confessed unhappy retirement, Young joined SFU. His current research is focused on the design and use of novel pharmacological probes and proof of concept molecules for the discovery and validation of new drug targets.

Young was in the first cohort of chemistry students starting at UVic when it obtained its degree-granting charter in 1963. Of his time here, Young says: "The quality and rigor of the faculty were impressive, very inspiring. They encouraged us to not only be the best we could in our fields, but to also go out and accomplish something for the greater good. Thanks to UVic for all that motivation."

Young is a member of the Order of Canada, a fellow of the Royal Society of Canada and the Chemical Institute of Canada, and is currently president elect and fellow of the Canadian Society for Pharmaceutical Sciences. Young holds many honours. As part of the discovery team for Singulair™ he was awarded the UK and Canadian Prix Galien. He was named a Hero of Chemistry by the American Chemical Society for his contributions to medicinal chemistry and its impact on the health and welfare of children.

W.R. Gordon Scholarship Fund

Remembering Dr. Bill Gordon

Bill Gordon joined the math department in 1965 and served UVic for more than 36 years until his retirement in 2001. Dr. Gordon was a highly respected and dedicated member of the faculty, and served as both the Assistant and Associate Dean of Arts and Science. With his death in Dec. 2010, colleagues and friends are building an endowed scholarship in his name. To contribute, you can give online at www.give.uvic.ca or call 250-721-8965. For a full profile of his career, go to http://ring.uvic.ca/news/uvic-colleagues-establish-scholarship-honour-bill-gordon

Vifor Pharma

DISTINGUISHED LECTURE SERIES

Magnetic speaker packs in a crowd

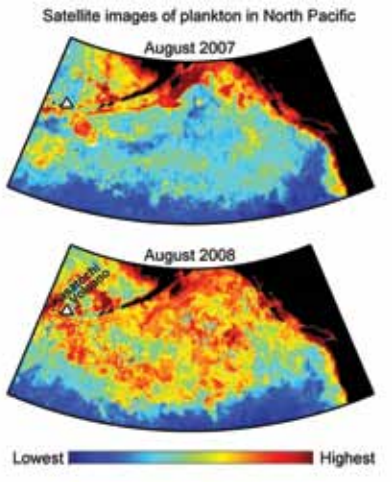
Dr. Brian Greene.

A packed house at UVic on Feb. 1 took in the free public lecture by Dr. Brian Greene on "Why Science Matters." The audience of 1000 joined Professor Greene as he took them on a whirlwind exploration of the quest to unravel some of the biggest mysteries of space and time—and came away with a visceral understanding of why science matters.

Physicist, string theorist and author of *The Elegant Universe*, Greene is one of the world's leading theoretical physicists and a brilliant, entertaining communicator of cutting-edge scientific concepts. The Faculty of Science brought Greene to campus as its 2011 Vifor Pharma Distinguished Speaker. For a complete review of his presentation, go to http://ring.uvic.ca/culture/why-science-matters-brian-greene

Volcanic eruption sparks massive plankton bloom

In August 2008, ash from the explosive eruption of Kasatochi Volcano in the Aleutian Islands not only snarled air travel in the region, it also fuelled the largest plankton bloom ever observed in the North Pacific. Local oceanographers recorded the event when a Fisheries and Oceans Canada research cruise was in the area at the time of the bloom. Ocean color satellites showed that the bloom covered an area one-fifth the size of Canada.



In a recent paper in Geophysical Research Letters, an international team led by UVic chemical oceanographer Roberta Hamme report that ash from the eruption was spread over the North Pacific by a storm and provided the iron that ocean plankton need to grow. "People have speculated that volcanic ash could have this effect, but this is the first time we've seen it happen in nature," explains Hamme.

Some have suggested that climate change could be combated by purposefully fertilizing the ocean with iron to cause plankton to take up carbon dioxide during photosynthesis. However, despite a huge fertilized area at an optimum time of year, the bloom consumed only 0.1% of the amount of carbon dioxide produced each year by burning fossil fuels. "This event shows that you would have to add iron over an impossibly large area of the ocean to have a significant effect on atmospheric carbon dioxide," says Hamme.

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