University of Victoria Science

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Funding creates new program in forests and climate change


Photo | Brian Parsons

Forests are an essential link in the global carbon cycle. They act as large carbon sinks and are major consumers of greenhouse gases. However, rising temperatures threaten the health of current forests. Future forests will have to adapt to different conditions and be managed to maximize their uptake and storage of atmospheric carbon.

The newly established NSERC CREATE Program in Forests and Climate Change at UVic's Centre for Forest Biology (CFB) will train graduate students and post-doctoral fellows in research that focuses on the interaction of forests and trees with climate.

"It's a vital area to understand with some important questions to be investigated," says Peter Constabel, CFB Director. The program, unique in Canada, will put the CFB on the map. It is expected to attract students to UVic and galvanize the focus of the centre's research.

"It'll catalyze a new level of graduate training; one that is more intensive with workshops and new graduate courses," says Constabel. "Students will be able to take a course over at the proteomics centre and get a leg up on the latest techniques in genomics and bioinformatics."

Neil von Wittgenstein (BSc Biology 2010), one of the inaugural students to undertake the program this autumn, says, "It excites me because it's practical, relevant and current. Career-wise it'll be very useful because climate change is going to be a primary focus of scientific research for years to come."

One of the features of this program is to carry out research collaboratively. Students will be supervised by more than one professor within in the centre, or work with outside collaborators at the Ministry of Forests and Range, the Pacific Forestry Centre (NRCan), and scientists at UBC, Laval University, and abroad.

von Wittgenstein particularly likes this aspect and feels it will draw students. "Co-supervised projects allow you to tell much more of the story, whatever your research, because you have a broader scope."

Constabel also adds that the inter-lab collaborations will give students an edge. "Students have the option of internships in government research facilities. They'll gain some insight into the job of a scientist in expert labs off campus which will better prepare them for career choices."

Major research themes of the new program will include how scientists can use the nutrition, physiology and genetics of trees to maximize the removal of atmospheric carbon; how trees allocate carbon to internal 'pools' of carbon-rich chemicals; and the importance of microbe-plant-environment interactions on greenhouse gas emissions from forest soils.

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NEW DEAN AT THE HELM

Photo | UVic Photo Services

Dr. Robert Lipson

"Before arriving at UVic, I had a sense of the quality of research and of the teaching profile within the Faculty of Science. Since arriving, all my initial impressions have been confirmed," says Dr. Robert Lipson, who became Dean July 1.

"The next five years will be an exciting period where many of our younger faculty members will experience personal growth in their research impact as they begin to hit their stride. I consider one of the roles of my office is to ensure the Faculty of Science allows this burgeoning research excellence to flourish. At the same time we have a responsibility to our undergraduate students. I am convinced that existing programs, which are already very effective, will only improve if we can integrate more of our research activities into the classroom. Students will also be well served by a sustained commitment to the university Co-op Program. I look forward to working with the departments and the school within the Faculty to ensure that we are a university any student in Canada would automatically consider if they want a top science education."

Prior to joining UVic, Dr. Lipson was a professor in the University of Western Ontario's Department of Chemistry with a cross appointment in the Department of Physics and Astronomy, and served as Chair of the Department of Chemistry from 2000 to 2005.

Lipson is a Fellow of the Chemical Institute of Canada (2009) and the former Director of the Western Institute for Nanomaterials Science (2005–10). He is the recipient of numerous academic prizes, including the Florence Bucke Prize for Research Excellence (2000), a Distinguished Research Professorship from the UWO Faculty of Science (2008), and the E.G. Pleva Award (2008)—Western's highest accolade for teaching. He is the Senior Editor for the Canadian Journal of Chemistry.

Lipson has served on numerous boards, including the Technical Advisory Board of the Ontario Centres of Excellence in Photonics and is currently Director of Conferences for the Canadian Society of Chemistry (CSC) and a member of its Accreditation Committee. He has also served as a member (2004–06) and chair (2007) of the NSERC Grant Selection Committee for Physical and Analytical Chemistry, as a member of the NSERC E.W.R. Steacie Award Committee (2008-10), and on several committees for the Optical Society of America.

Chemists pursue cure for the flu

In the past few years, Canadians' awareness of influenza as a serious global health issue has risen dramatically as the media covered the Asian avian outbreak and an H1N1 outbreak at home, which many experienced firsthand.

Over the course of a normal flu season, one in 10 adults and one in three children will catch the flu. Health Canada says between 4,000 and 8,000 Canadians—mostly seniors—will die from pneumonia related to flu and many others may die from other serious complications of flu. Influenza is a highly contagious respiratory disease that strikes as many as eight million Canadians in flu season, between October and April.

Researchers within UVic's chemistry department are working on a possible cure. While researching a method to disrupt the protein-protein interactions of the Human Immunodeficiency Virus (HIV), medicinal chemist Jeremy Wulff discovered a synthetic molecule which he believes can be effective in fighting the flu.

"It turns out that the molecule we made looks structurally like certain classes of molecules which are used to treat influenza–they're inhibitors of neuraminidase," explains Wulff.

Photo | Kate Hollefreund

Jeremy Wulff (right) is working to lay the foundations for advances in the design of new drugs to fight influenza, cancer and HIV.

When infected with the flu, the virus invades a human's cells and reproduces. Through a protein, the newly formed virus attaches itself to the surface of the host cell. In order to spread, a neuraminidase enzyme has to cleave it from the host cell, allowing the virus to move on and infect the next cell, and the next and the next.

"If you can block that enzyme from doing its job, you can stop the virus," says Wulff. Flu vaccines in use today, such as Tamiflu™, act as an enzyme inhibitor. However, commercially available flu drugs use plant-derived molecules as the inhibitor. These are, by nature, not perfectly shaped. The enzyme finds the weak spot, mutates and effectively sidesteps the inhibitor.

"With our synthetic inhibitor, we aim to design it as a better match—to ultimately make it less susceptible to drug resistance. We're working to structurally modify it," says Wulff. Backed with funding from CIHR, Wulff and his research team over the next year will work toward building a potent inhibitor for use in animal studies and cell-based challenge tests.

UVic leads consortium to build powerful electron accelerator

The University of Victoria is playing a leading role in a major expansion at TRIUMF, Canada's national laboratory for particle and nuclear physics.

In June, the province announced a $30.7 million investment in TRIUMF to support ARIEL (Advanced Rare IsotopE Laboratory), a $62.9 million facility that will allow TRIUMF to broaden its research in particle and nuclear physics, and materials science. It will also develop the technology to advance Canada's supply of medical isotopes.

ARIEL will house an electron linear accelerator (e-linac) that will produce intense beams of particles to create a variety of isotopes for pure and applied research. The e-linac will be one of the most powerful accelerators of its type in the world and the first of its kind in Canada. Current TRIUMF facilities produce one type of isotope at a time; the new accelerator will be, in essence, a "production line" for a variety of isotopes which will help triple the scientific output of the laboratory.

The e-linac is being designed and built by TRIUMF through a 13-university consortium led by UVic physicist Dean Karlen, who is jointly appointed to TRIUMF. At the heart of the e-linac is a new and highly efficient way of accelerating particle beams—known as superconducting radio frequency technology.

Reading the Rocks

Taking learning to the field

In the education of a geologist, fieldwork is a long-held educational tradition. During intensive two-week courses, School of Earth and Ocean Science undergrads apply their classroom and laboratory instruction to solve geologic problems in the field. Since the school's inception in 1991, fieldwork—data collection, constructing measured sections, interpreting geologic features, and creating geologic maps—has been integral to the curriculum.

Field schools offer students the comprehensive training prized by the minerals industry. Field experience has become more and more important to industry—not only in hiring, but also as demographic trends thrust geoscientists and geological engineers into senior roles at earlier stages of their careers.

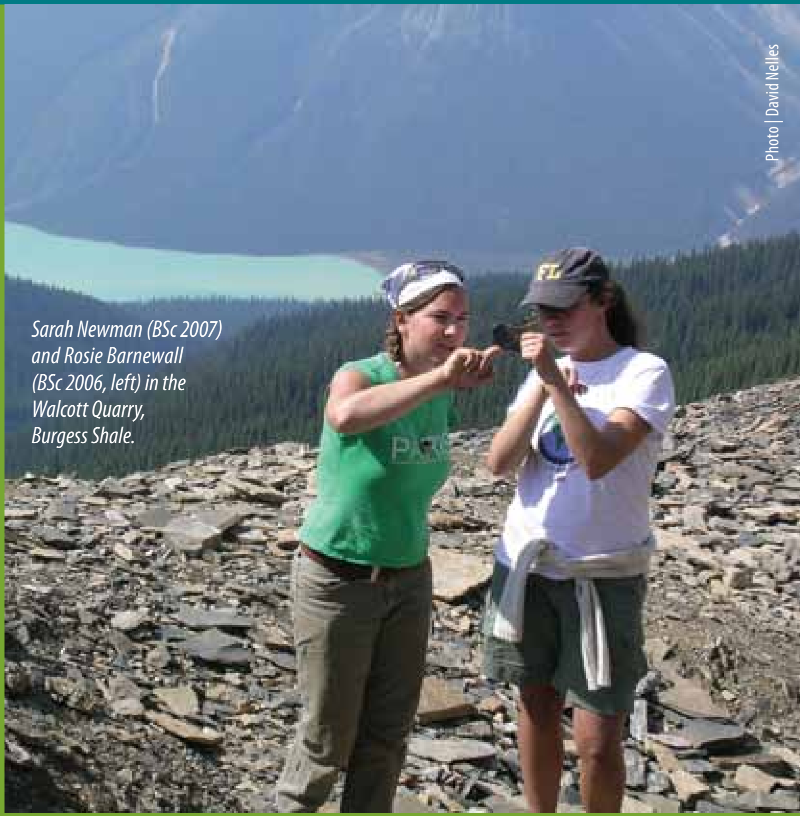
"It's essential for their success as future geologists," says Dr. Stephen Johnston, who leads the fourth-year field school each August. This course takes students through a trans-section of the Western Cordilleran mountain system, starting from the coast out to the Alberta Badlands. "It is an opportunity for them to put it all together. They learn it bit by bit in the classroom. Out there, they see how it all comes together."

Keelan Brown says the experience is both intense and relevant to his other geological studies. "Geology is quite multifaceted," notes Brown, a fourth-year student who elected to take both the 300 and 400 level course this summer. "The field schools let me see the synergy between each area of geology. The tools and skills I learned bridge the gap between theory and application. The experience makes me a more rounded geological student."

Johnston also notes another important aspect of field schools: it lets students know that not all is known about how the earth works. He cites the Burgess Shale—one of the world's most significant fossils finds located high in the Rockies in Yoho National Park—as an example. The fossil bed provides students with a window into what the world looked like 520 million years ago. "There are many unanswered research questions," says Johnston.

Dr. Laurence Coogan's third-year course takes students each April to Salt Spring Island and Strathcona Park. At these sites, the proximity to diverse geologic terrain, well developed geologic structures, and abundant rock exposure provides the right environment for a total learning experience.

"It's all hands-on. The whole course is about learning by doing," says Coogan. The reward for him is when a student says, 'This finally makes sense. I get it.' "That's a great feeling. It happens much more in a course like this when I'm talking with students and the examples are right there at their feet.



Sarah Newman (BSc 2007) and Rosie Barnewall (BSc 2006, left) in the Walcott Quarry, Burgess Shale.

Photo | David Nelles

At the end of each course, students produce maps and written reports. Interpreting their observations and completing assignments in the field camp are essential learning steps in the field-school environment.

"It's the best course I've ever taken. It was the most practical, most fun, most hands-on," says third-year student Liana Stammers. "It put to use all we've learned in the classroom and solidified it."

Components of the e-linac are being built at UVic's physics and astronomy department. "Our contribution will be to develop three beam-diagnostic systems for the accelerator. The diagnostics will tell us where the beam is and how broad it is at different points along the length of the accelerator, which is critically important," says Karlen.

"It's a fabulous opportunity for our graduate students," says Karlen. "It's opening up a potential new career path. There are few opportunities in the world to learn how to build and operate an accelerator, and advance accelerator physics. While accelerators are prevalent around the world, there is a shortage of people with this specialized expertise."

The first commissioning of the new accelerator is expected at the end of 2013. If you happen to be in Vancouver, check out the free public tours at the TRIUMF lab. For further details visit **www.triumf.ca**

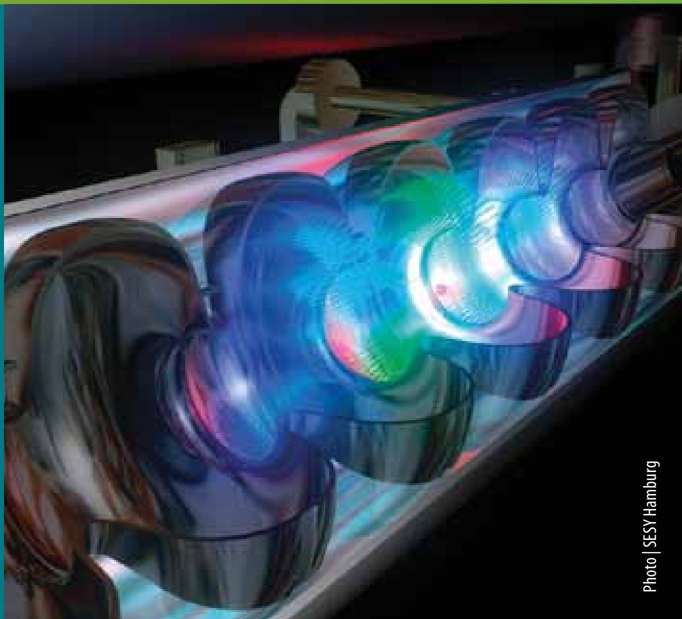


Illustration of e-linac, which will accelerate electrons through a series of superconducting cavities to energies equivalent to 5,000 light bulbs concentrated in one square centimeter.

Photo | SESY Hamburg

Wesley Corbin,
Mathematics & Statistics

For fourth-year statistics major Wesley Corbin, summer work as an assistant researcher has solidified his resolve for graduate studies.

"I've been considering a masters in actuarial studies, so I thought I should get a taste of what research and actuarial-type math are like," explains Corbin. "I had taken a course from Dr. Mary Lesperance, liked her teaching style and was intrigued by her work in survival analysis, which is related to actuarial science."

Survival analysis, a branch of statistics, involves the modelling of time-to-death in biological organisms and time-to-failure in mechanical systems. Through an NSERC undergraduate Student Research Award program, Corbin approached Lesperance, who in turn signed him on for the summer.

"He did a great job. He's laid the groundwork for modelling end-of-life trajectories for patients admitted to hospice which I can extend further," explains Lesperance. She is impressed because Corbin had to teach himself survival analysis as he had not yet taken a course in it. "He demonstrated that if one is interested enough in a subject, one can produce top-quality work."

The path to UVic was not direct for Corbin. By his own admission, he was not serious about his scholastics throughout high school and didn't consider university at first. While completing a business diploma at Camosun College, he decided he would pursue university studies in economics. Knowing he needed to better his math grades for admission, he took college math courses, excelled, and discovered a love of the subject.

In 2008, Corbin received the inaugural Richard & Elizabeth Flury Scholarship, which is designated for a third-year transfer student. "I'm so grateful. It freed me from needing to work. I get better grades and learn so much more when I can focus on my studies," says Corbin, who had worked three days per week in a family business all through his college program.

Photo | UVic Photo Services

Wesley Corbin (far right) and UVic President David Turpin (right), with Richard (BSc '70) and Liz Flury (left) at a June ceremony that named a lecture hall in their honour, in recognition of their $1.5 million gift to support the capital costs the Bob Wright Centre, Ocean, Earth & Atmospheric Sciences. The Flury's first gift to the Faculty of Science established a $100,000 endowed scholarship fund. See page 10 of UVic's alumni magazine, Torch (Autumn 2010), for a profile of the Flurys.

Photo | Shea Wyatt

Francis Nano is working to apply his temperature-sensitive technology to make a vaccine against tuberculosis and other deadly diseases. While still in the beginning phases of development, the cold-loving bacteria may be the key to a ground-breaking new vaccine.

Chilled genes are hot hope for new vaccine

By Andy Coghlan, reprinted from NewScientist

Genes borrowed from Arctic bacteria could generate safer vaccines against diseases like tuberculosis. The genes enable researchers to make temperature-sensitive bacteria that prime the immune system before dying back.

So say Dr. Francis Nano and colleagues at UVic's department of microbiology. They replaced genes in *Francisella tularensi* bacteria with versions from different species of bacteria found in the Arctic. The Arctic genes evolved in freezing temperatures and stop functioning at the higher temperatures inside animals.

The team chose genes indispensable for survival, such as those that repair DNA, so that their engineered bacteria would die when the genes stopped working. They successfully vaccinated mice against normally fatal doses of *F. tularensis* by first injecting their tails with the temperature-sensitive version.

The bacteria managed to survive within the lower temperatures of the skin, allowing it to prime the immune system, but was not present in internal organs, so posed no threat of disease. "TB is our big target now," says Nano.

Making a mark

In April, molecular parasitologist Dr. Terry Pearson received the university's 2010 Craigdarroch Gold Medal for Career Achievement in Research. He also has been named the recipient of the UVic Legacy Award for Research, which will be presented at a November awards gala. Dr. Pearson is an international leader in the use of immunological approaches to disease, with more than 130 publications, three patents and two inventions to his credit.

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