EUREKA!

NEWSLETTER OF THE FACULTY OF SCIENCE

Fall 2008

Alighting on knowledge

- Beetles and butterflies
- Pesky pesticides?
- Formula for student success

Carleton UNIVERSITY | Faculty of Science

My sophomore year

Another academic year—my second at Carleton—is now in full swing. There is great energy on campus as new students find their stride, and enthusiastically join more senior students, staff and faculty. There are four new professors, David Mould, Jeff Smith, Apollinaire Tsopmo and Tyler Avis, who are delivering their first lectures at Carleton as well as navigating their way through the university. Learn more about them on page 11.

To ensure that each science student has every opportunity to succeed, the Faculty launched a new science student success centre to complement the services already available on campus. Please read more about it on page 5. Sue Bertram, our first assistant dean for recruitment and retention, is at the helm to support, guide and encourage students in their undergraduate studies, graduate school options and research opportunities.

In fact, new research opportunities are opening up in some of our leading laboratories thanks to recent funding that is enabling faculty to increase their student research teams. In addition to the research projects covered on pages 8-9, in October the Ontario government awarded funding to physicists Kevin Graham and David Asner, chemist Jeffrey Manthorpe and biologist Jeff Dawson for their respective work on neutrino properties, the ATLAS detector, synthetic medicines, and insects flying in the face of conventional aerodynamic theory.

The rest of us have been hard at work, too, teaching, conducting research and working with the community. One of our top tasks has been to work on the strategic plan for the Faculty. Each academic unit and the Faculty as a whole has summarized a vision, mission, values and objectives for the coming years. As our new President Roseann Runte develops the plan for the university over the coming months, the final elements of the Faculty of Science's strategy for the future will be shaped.

While new professors and staff are often visible to the university community, the faces of our administrative staff often go unseen. I offer a fond farewell to Yolana Junco, administrative officer, and David Timms, senior development associate, and welcome aboard Karen Kedrosky, administrative assistant to the dean, and Rima Mattar, administrative assistant. I encourage you to come by the renovated Office of the Dean in the Herzberg Building to meet these behind-the-scene staff and share with us your memories of and vision for the Faculty. While you're on campus, have a look at the impressive chemistry Superlab that opened in September in the Steacie Building. This state-of-the-art undergraduate teaching laboratory is truly a wonderful space for learning.

I hope that you enjoy this issue of *Eureka!* and share my pride in the accomplishments of our faculty, staff, students and alumni.

George Iwama
Dean, Faculty of Science

EUREKA!
NEWSLETTER OF THE FACULTY OF SCIENCE

carleton.ca/science/

Newsletter Mission Statement
EUREKA! is published for the alumni, faculty, staff, friends and partners of the Faculty of Science. The newsletter is intended to communicate the faculty's goals, strategic direction and activities in order to connect alumni to each other and the university. It is published in collaboration with the department of university advancement.

On the cover

Carleton's annual butterfly exhibit attracted thousands of visitors in October.

Photo: Amanda Costen

! Your input is important!

Please send your feedback, letter to the editor or story ideas to newsletter_editor@carleton.ca.

@ Take our online survey
Visit eureka.carleton.ca to share your opinions.

Panacea or poison?

By Tyler Avis

As long as humans have been gathering food, we have been trying to protect it and preserve it from other foragers, insects, micro-organisms and even enzymes within the food itself. Sumerian farmers dusted elemental sulphur on crops to kill pests about 4,500 years ago. Since this first known pesticide, we have tried just about everything in our arsenal to reduce damage to crops, increase yield and prevent post-harvest spoilage. For the modern farmer, a dollar's investment in pesticide yields a $2-3 return on investment.

Sometimes, as in the case of medieval farmers using arsenic, lead and mercury, and North Americans spraying DDT, pesticides have toxic effects far beyond the intended target—wreaking havoc on the environment or human health. Yet if all pesticides were banned today, there would be a far more devastating effect on human life as a result of wide-spread crop failure. Some estimates put loss at 25 to 50 per cent.

So, we can't live with it, we can't live without it. What's a scientist to do?

As pests develop resistance to commercial pesticides, manufacturers are under pressure from growers to create or modify products. Techniques that increase the effectiveness of pesticides so that less product is used are one approach. Understanding chemical degradation to avoid persistence and harmful byproducts is another. My area of research is to find pesticides against which pests are less likely to form resistance: molecules that don't affect a precise target won't result in genetic mutation that protects pests.

Among other explored avenues, three main areas of research offer alternatives to synthetic pesticides: cultivated plants bred or genetically modified for pest resistance, a vaccination-type approach to create acquired pest resistance in plants, and biopesticides—using beneficial organisms or substances derived from natural sources to control pests.

Breeding resistance into plants is a long process, but there are already genetically modified organisms being tested for efficacy and safe use. A few products for acquired resistance are already on the market, and more are on the way. These products induce a short-lived defense reaction in plants, priming them to mount a faster defense when they encounter a disease or pest.

Biopesticides include microbial pesticides such as bacterial, fungal or other microbial antagonists as the active ingredient and biochemical pesticides, such as sex pheromones used to disrupt insect mating, barrier film technology using clay as a physical deterrent, and molecules derived from the fermentation of various micro-organisms. Agriculture and Agri-Food Canada says "they represent an important group of reduced-risk pest control products that combine well with other low-risk tools and practices to enhance integrated pest management systems".

As traditional chemical pesticides are banned or lose effectiveness, and as workers and consumers demand safer products, the agriculture industry will be looking to science to develop novel and effective approaches to pest control. We're already on the job!

Tyler Avis, an assistant professor in the department of chemistry, believes that science will continue to develop efficient and safe pesticides that could someday help organic farming become a viable method on a larger, world-wide scale. Learn more about his research on page 11.

Avis was a featured speaker at the Science Café, an informal event for the general public and Carleton researchers to discuss scientific issues and topics of interest. Presented by the Faculty of Science and the Carleton University Alumni Association, the 2008 session of the Science Café runs until December 3 in Ottawa. Visit science.carleton.ca/cafe for details.

A Carleton University research field course in Cuba and a community service trip to Tanzania, where she worked with children, have given Felicia St-Louis the travel bug.

Summer service

Weeding gardens, building bookshelves, painting. These are ordinary tasks for a student during summer break, but for Felicia St-Louis they became extraordinary. As a volunteer with the Global Youth Network, St-Louis travelled to Tanzania with a team of Carleton students performing community projects in the developing country.

"This was an amazing opportunity to see a different part of the world and learn about human values," says St-Louis, who spent four weeks in Africa with the group, which focuses on the importance of community, faith and social justice through first-hand experience. "I met people who had very little materially and were abundantly happy. I learned to value what I have."

While in the northern Tanzanian city of Arusha, working on projects at a local school, St-Louis was able to put her integrated science education into action when she and fellow student James Hickford were offered the chance to teach biology for a week.

"There was no curriculum, so we asked the students what they wanted to learn," says St-Louis, who is researching the biomechanics of the beaver tail in her last year of undergraduate studies. "They had a lot of curiosity, and were interested in issues affecting Africa: disease transmission, health, human anatomy."

After a few days of travel, the group arrived in Stone Town, Zanzibar, where they worked with an association for non-governmental organizations to make contact with agencies and determine their needs, and plan projects that future Global Youth Network teams can undertake. The Carleton group also got its hands "clean" by helping locals make soap to sell to hotels and tourists in support of the Zanzibar Association of People Living with HIV/AIDS (ZAPHA+), an advocacy organization that provides counselling and care services.

"Children at ZAPHA+ painted symbolic stories of their lives, and a boy with fallen trees in his explained it represented his mother's death," says St-Louis. "What was striking is that it wasn't just one boy's story; all those children had suffered loss."

"We used our last funds to repaint a basketball court there, and play a game with the children," says St-Louis. "Most people think you have to do something on a large scale to make a difference, but really, making a difference is putting a smile on a child's face."

Since her return to Canada, St-Louis says she isn't as stressed out as she used to be because she no longer takes unimportant things so seriously. The experience has also interested her in further work abroad after graduation in June.

Model student

The Standard Model of particle physics describes three of the four known fundamental interactions among the elementary particles that make up matter. But its failure to include the fourth—gravity—means the model falls short. The research of master's student Ahmed Ismail, BSc/06, focuses on identifying which new theories are worth pursuing in the search for physics beyond the Standard Model.

Thanks to a Fulbright scholarship, Ismail is now pursuing PhD-level research in particle physics at Stanford University. "Accepting this Fulbright scholarship gives me the opportunity to build associations with, and learn from, leading particle physicists while studying in the United States, but also to establish relations for future collaborations when I return to Canada," says Ismail, who graduated from Carleton in November.

Operating in over 150 countries worldwide, the Fulbright program has long been regarded as the world's premiere academic exchange. The Canada-U.S. Fulbright Program is the gold standard for academic exchanges and intellectual opportunity. Ismail is a past winner of the C.A.B. Betts Memorial Scholarship in Physics at Carleton.

No secret to success

The keys to student success shouldn't be a secret. That's why the Faculty of Science launched a science student success centre in October, and appointed Sue Bertram as assistant dean (recruitment and retention) to oversee the centre.

"I remember people talking about grad school when I was in third year and not knowing what it was," says Bertram, a first-generation university student. "The faculty mentors that reached out to me when I was an undergrad student made a world of difference. They opened my eyes to science opportunities that I didn't know existed and helped motivate me to reach higher goals. Since that experience, I have been helping undergrad science majors succeed."

Bertram, an assistant professor in biology, brings to the centre her experience as a program coordinator and instructor in a Minority Access to Research Careers program at Arizona State University and her enthusiasm for engaging and supporting students.

Tasked with helping students at all academic levels achieve their goals, the centre will direct students to existing study resources, information on careers being pursued by science alumni, summer job and co-op opportunities, events within the Faculty of Science and opportunities for research scholarships and fellowships.

"We want students to know we care about them and that there is a place they can go for help, advice and opportunities," says Bertram. "The centre can play a mentorship role, helping students utilize the academic resources available and providing the encouragement to pursue research grants, graduate studies and varied career paths."

"We want to increase pride and engagement in our community of scientists."

Fast fact...

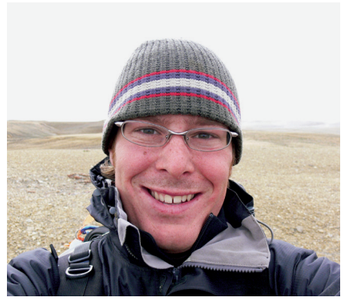
Let us know what your science degree is doing for you or volunteer to be a mentor in the Career Connection program by logging into the Alumni Café at carleton.ca/alumni. Contact the science student success centre at sssc@carleton.ca.

Go north, young man

If you suggest tying markers to your tent strings to make them visible in the dark while in the land of the midnight sun, you can expect some teasing. It's just one of the lessons that Travis Mitchell learned during his research expedition to the Canadian Arctic in July. Another lesson: a tent, even weighed down with gear, is no match for 80-kilometre-an-hour winds. Luckily, the earth sciences student wasn't in the tent when it was blown into the Strathcona Fjord.

Mitchell travelled to the high Arctic as a field assistant for some of the world's leading Arctic researchers: Mary Dawson, a curator emerita at the Carnegie Museum of Natural History; Richard Harington, a researcher emeritus at the Canadian Museum of Nature; geochronologist John Gosse from Dalhousie University; and expedition leader Natalia Rybczynski, BScHon/94, research scientist at the Canadian Museum of Nature and an adjunct professor in Carleton's biology and earth sciences departments.

"It was incredible to be around people with such an amount of knowledge," says Mitchell. "Being with scientists in their element—seeing how they think, work and problem solve—was invaluable. I learned how to think like a scientist from them."



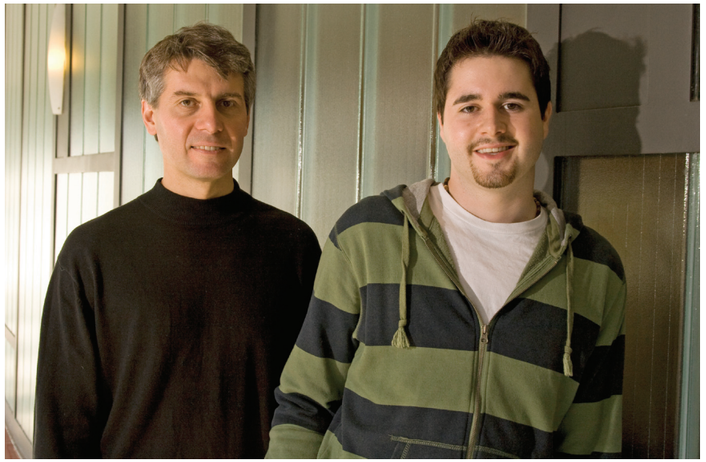
Earth sciences student Travis Mitchell snaps a self portrait during his weeks in the Arctic. His honour's project involves identifying a species of rabbit from teeth and ankle bones. Fortuitously, one of his Arctic companions was Mary Dawson, an expert on rabbit evolution.

The nearly month-long trip was divided into two expeditions. The first was to collect fossils and a cross-section of the peat layer at the Beaver Pond site on Ellesmere Island for analysis. The Beaver Pond site, thought to be approximately three to five million years old, has previously yielded a cornucopia of mammal fossils. Harington found remains of an extinct bear, wolverine, three-toed horse and musk-deer. Rybczynski has studied prehistoric beaver and the evidence of their wood cutting at the site.

The second expedition was to hunt for fossils at a site on Devon Island. On the group's first visit they found the missing skull fragment from a fossil carnivore collected the previous year. "The fossil animal was remarkably complete, but the skull contains a lot of information about how the animal might have lived, so we were there to find the missing piece and prospect for new sites," says Mitchell.

Armed with knowledge from beyond the classroom, an understanding of the Arctic environment, and an appreciation for the work, time and money spent in procuring fossils and samples, Mitchell has returned to Rybczynski's lab at the Museum of Nature, where he sifts through Beaver Pond peat samples looking for bones, rocks and seeds to help piece together the ancient environment, and waits for the next opportunity to travel to "the most beautiful place you can imagine."

What's it really like on an Arctic expedition? Read excerpts from Travis Mitchell's notes online at eureka.carleton.ca.



"Mathematics is addictive, the problem is to find time for everything else," says Professor Yuly Billig (left), who makes time to tutor exceptional students in his algebra class, like Noel Chalmers (right).

Research experience adds up

A soliton—that solitary wave that maintains its shape while travelling at a constant speed—can be found in blood pressure pulses, roll clouds, tidal bores, Jupiter's red spot, and light pulses in fibre optics, making it of interest to physicists and applied mathematicians. Theoretical attempts to understand solitons have been almost exclusively mathematical; most famously, the Korteweg-de Vries (KdV) equation describing waves in shallow water.

A more complex soliton equation, the 2+1 dimensional Bogoyavlensky equation, generalizes the KdV to the point where it leaves the physical realm: it is purely math. Third-year student Noel Chalmers has been working on ways to solve the equation using hierarchies, rather than tackling equations individually.

With an Undergraduate Student Research Award from the Natural Sciences and Engineering Research Council (NSERC), Chalmers spent the summer working on soliton equations under the supervision of Yuly Billig, professor in the department of mathematics and statistics.

"Having just finished second year but doing graduate-level math meant there was a big learning curve for the theory," says Chalmers. "But if it wasn't challenging, I wouldn't be here."

Chalmers is one of five exceptional students in Billig's honours algebra class. The professor, seeing their potential to go further than most, has been teaching the students more advanced math, and encouraged them to apply for NSERC funding.

Billig supervised the summer research of Jonathan Ladouceur into a new mathematical method for digital image processing that reconstructs texture by capturing its statistical properties, and the computer experiments of Daniel MacDonald and Alex Weekes on the highly advanced theory of elliptic curves and its applications in cryptography. Trevor Burn conducted his summer research work in the physics department at the University of Lethbridge.

"All of them made excellent progress through the summer," says Billig. "I assigned individual projects to each student, but their collaboration was encouraged and often it is a team effort. We achieved the goal of this endeavour, which was to give undergraduate students a taste of research in mathematics."

That taste of research was enough to shape Chalmer's future.

"I was uncertain what to do after my undergraduate degree," he says, "but now I know I want to continue in my studies in applied mathematics. This research opportunity has given me the confidence to pursue graduate studies."

Students in the earth sciences enrichment mini-course program try their hand at identifying rock. The samples in the rock kit are collected by professors and students during field work for Beth Halfkenny's outreach program.

The greatest resource on earth

In a country with a resource-intensive economic base, it makes sense for Canadians to understand the basic geological processes that gave us oil sands, coal deposits, diamonds, rich agricultural lands, and lake upon lake upon lake. Yet earth sciences play only a minor role in elementary and secondary school education, leaving many students to stumble upon it in university.

For Beth Halfkenny, curator and geological technician for the department of earth sciences, this just won't do. Halfkenny spearheads the department's active outreach program to increase awareness of the earth sciences and support educators seeking to bring it into the classroom.

"Earth sciences is a way to observe the world around you and open your eyes to what you're already seeing," says Halfkenny. "We try to create opportunities in schools to talk about the field and increase the reach of science."

Administered by enthusiastic undergraduate and graduate students, staff and faculty, the outreach program takes a "what can we do for you?" approach. By providing resources, samples and subject experts, the program enhances existing courses, trains teachers, and creates a community of educators.

"We're a conduit for information —teachers don't need to find things on their own," says Halfkenny. "I want people to know that we're here and we're willing to help."

Among the services provided by the outreach program are courses in the university's enrichment mini-course program for high school students; a half-day campus visit for Grade 12 earth and space sciences classes to attend a lecture, tour the facilities and participate in a laboratory activity; and prepared activities for teachers or visiting experts to use in the classroom on mineral identification, radioisotopic dating, dinosaur footprints, mining, crystal growing and more. All the activities are designed to be hands on, giving students the opportunity to investigate and discover for themselves.

A three-day interactive workshop for high school teachers each spring is proving to be a popular offering. Designed to provide support for the secondary earth sciences curriculum, the workshop introduces teachers to current geological issues, provides hands-on methods, and introduces possible field trip destinations in the Ottawa area.

"The workshop helped to clarify some of the issues I had been struggling to find ways to share with my students," says Sean Clark, a Grade 12 teacher at Sacred Heart High School in Stittsville, Ont. "It gave me a wealth of resources, both tangible and theoretical, that I could bring directly into my classroom."

For teachers new to the earth and space sciences course, the workshop can help them get up to speed. "As this is a course new to my school, I had no teaching resources whatsoever—the workshop provided me with ample supplies to get rolling," says Karen McGaffey of Donald A. Wilson Secondary School in Whitby, Ont. "All the instructors were extremely helpful, and presented their content at a level just high enough above what high school teachers need to cover to give us the confidence to deliver a quality program to our own students."

Not restricted to school groups, the outreach program is also available to the community. In October, to celebrate International Year of Planet Earth and National Science and Technology Week, Halfkenny organized a field day, Explore Geoheritage Day, for the public to learn about Ottawa's geological heritage. She has done sessions with junior naturalist clubs and seniors groups.

"I always say yes to requests, and then figure out how to do it," says Halfkenny. "Outreach is a positive pursuit."

Photo by Dion Manastyrski
Ministry of Forests, Southern Interior Forest Region

Jayne Yack's research has identified how butterflies use ears on their wings to detect predatory bats and birds and how caterpillars use vibrations to defend themselves. Now she's tackling hearing in bark beetles, above.

Listen up!

Armed with a symbiotic blue-stained fungus carried in their mouths, mountain pine beetles bore into tree bark, releasing fungal spores as they go. The fungus stops the spread of toxic resin, the tree's only defense against its attacker. Beetle larvae will spend the winter in the dying tree, abandoning it when they emerge as adults ready to find a new tree, summon mates and begin the cycle again.

These beetles play an important role in the forest: they attack old or weakened trees, speeding the development of a younger forest. However, an outbreak of bark beetles in British Columbia is killing swaths of lodgepole pine forests, wreaking havoc with the province's most commercially harvested tree.

Jayne Yack, BAHons/84, associate professor of biology, hopes that her research into how mountain pine beetles use sound and vibration can be used to better understand how the insects choose trees and for pest control.

"Plants that are stressed produce ultrasound as the cells collapse," says Yack. "Can beetles hear trees that are vulnerable?"

Insect hearing is Yack's specialty. A neuroethologist, she combines the study of animal behaviour and neuroscience. She has identified sensory organs in butterflies and moths, and is moving into larval insects. She suspects beetles also have a tympanic membrane that allows them to detect vibrations through the air and through wood, although the ear hasn't been identified yet.

"Ants use their legs to detect solid vibrations, but I think that beetles detect airborne sound because solid vibrations decay quickly in tree bark," says Yack. "We have examined several regions on the beetles that we are now exploring using histology and neurophysiology to identify air sacs or sensory organs."

Using high-precision equipment, Yack is able to detect minute vibrations outside the realm of human hearing and record nervous system activity of insects in response to sound. She can also record sounds made in different contexts and observe the behaviour of beetles when the sounds are played back. With a grant from the Ontario Ministry of Research and Innovation, Yack is hiring a post-doctoral researcher and doctoral and master's students to launch this new research program on bioacoustics in bark beetles.

"We have been given a great opportunity to take our expertise and apply it to a new insect," says Yack. "The chemical ecology of bark beetles is well known, but the acoustics are not. Insects communicate in multiple ways, so the better we understand those channels and how they work in the environment, the better we can learn to get along with the beetles."

Since insects and their larvae use sound and vibration to communicate with each other, find mates, compete for space and detect predators, a better understanding of bark beetle acoustic communication could result in environmentally friendly pest management. Sound could be used to deter insects from certain crops and trees, attract adults to traps, diagnose infestation in a tree without cutting it down, or send vibrations through a tree to disrupt behaviour.

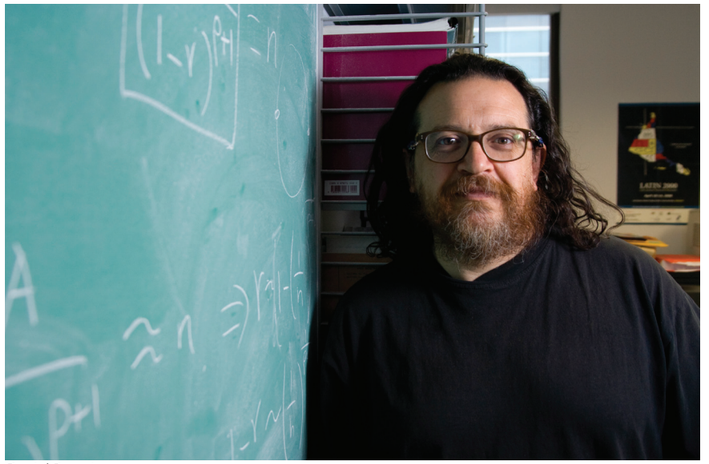
Of course, beetles might not be the problem. Maybe the trees are.

"If we understand what trees beetles target—what they like and how they find it—we might discover that forestry practices themselves are encouraging infestations," says Yack. "We need information like this to keep things in check."

Code word: *ACCELERATOR*

In its early and simplest form, cryptography involved shifting letters of the alphabet by a fixed number of positions. Named Caesar's code, the shift turned plain text into jumbled letters, disguising messages sent from Julius Caesar to his generals. In the digital age, cryptography has turned to simple looking equations like $a = x^n$ that underlie many applications designed to protect everything from government secrets to your online banking.

While a can be calculated from x and n, there is no fast way of computing the discrete logarithm n if a and x are known, making encryption based on this equation difficult to crack. Often in problems like this, the operations—to be performed more quickly—are done in a finite field instead of with real numbers. This interplay between mathematics and computer science is where the research of Daniel Panario takes place.



Daniel Panario

"I am interested in the theory of mathematics, of mathematical proofs, while also tackling the concrete problems in applications, for example in information theory," says Panario, associate professor in the department of mathematics and statistics.

Like most professors, he suffers from a time crunch. There's only so much time in the day to balance between teaching and research. "What is a mathematician?" he asks with a grin. "A person with problems."

Helping him to solve them, a new funding stream introduced by the Natural Sciences and Engineering Research Council (NSERC) will allow Panario to hire a post-doctoral researcher and more students to help decode mathematical secrets in his two areas of research. He works on the average-case analysis of algorithms to understand how they behave and why one performs better than another. He also studies computations in finite fields and their application in cryptography, coding theory and computer science—after all, computers work with the simplest finite field: 0 and 1.

The Discovery Accelerator Supplement was awarded to Panario through a program designed to provide resources to a small group of outstanding researchers who have a well-established research program and show potential to become international leaders in their area of research.

"This funding is about the researcher, rather than the project," says Panario. "There's no certainty in what a research program will deliver, but the supplement shows faith in the attempt. It will help me accomplish more."

Accelerating research

The Natural Sciences and Engineering Research Council (NSERC) introduced the Discovery Accelerator Supplements program to provide substantial and timely additional resources to accelerate progress and maximize the impact of outstanding research programs. Valued at $120,000 over three years, the supplements provide recipients with additional resources to expand their research group, purchase or get access to specialized equipment, or for other initiatives that would accelerate the progress of their research program.

Patrick Morin, associate professor in computer science, will use his award to fund graduate students and post-doctoral fellows on his team conducting ongoing research on geometric algorithms and data structures, with applications to robust multivariate statistics. This research will allow scientists to apply powerful statistical analysis techniques to the huge datasets that are occurring more and more in fields such as medical computing, remote sensing and computer networks.

Paul Van Oorschot, Canada Research Chair in network and software security, is using the award to further his research into web certificate interfaces, such as those pop-up windows that ask users if they want to trust, temporarily or permanently, sites and transactions involving sensitive data. Used for secure communications with e-commerce sites, the certificates may provide insufficient information, cause domain name confusion, or trick users into visiting fraudulent websites. Van Oorschot will explore and compare existing and re-imagined certificate interface design alternatives, determining user attention to visual cues and design improvements for increased security and usability.

Matthias Neufang, associate professor in mathematics and statistics and associate dean of graduate studies and research, is using the supplement to support research in harmonic analysis and Banach algebras, particularly on quantum group theory. The funds are supporting two PhD students and a postdoctoral fellow, collaborative research, and a portion of the 2008 Canadian Symposium on Abstract Harmonic Analysis at Carleton.

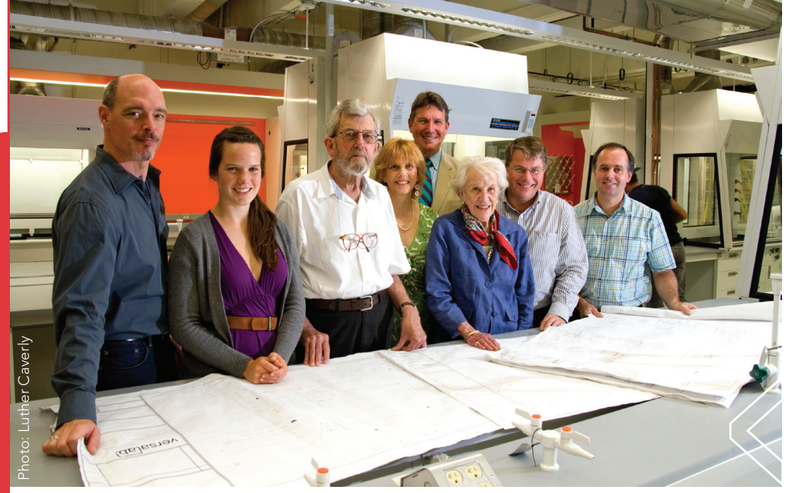


Photo: Luther Caverly

With faculty, the family of E.W.R. Steacie, a distinguished chemist who served as chair of Carleton's board of governors and president of the National Research Council, toured the renovated chemistry lab in the building named in honour of their patriarch. From left: Sean Barry, associate professor, Zoë Bourgard, Dick Steacie, Pamela Bourgard, Gordon Bourgard, Ann Steacie, Adam Steacie and Robert Burk, chair of the department of chemistry.

It's a job for Superlab!

By Mandy Sinclair

Carleton's chemistry Superlab is officially open, only six months after the provincial government announced funding for the Steacie Building renovations.

"Scientists walk into the lab and say 'wow' because of how functional it is. Non-scientists walk in and say 'wow' because of how beautiful it is," says Robert Burk, chair and professor, department of chemistry.

The Superlab allows 124 students to work simultaneously in the 6,500 square foot space, while the exterior hallway is equipped with blackboards for students and teaching assistants to discuss lab assignments.

Students enrolled in a first-year chemistry course or an organic chemistry course will have the opportunity to work in the new state-of-the-art chemistry labs alongside award-winning teachers and leading scientific researchers.

Delayed gratification

After 15 years, what are a few more months? Celebrations erupted among 10,000 scientists from 37 countries when the Large Hadron Collider (LHC) at CERN, the European particle physics lab near Geneva, was switched on for the first time on September 10, 2008. Designed to slam together particles at energies not seen since the Big Bang, the LHC sent beams shooting in both directions—without collision—for the test run.

Unfortunately, on September 19 the biggest and most complex machine on Earth had a glitch that resulted in a helium leak and some damage to the collider. After a three-week warm up from temperatures near absolute zero, repairs are underway. These repairs, coupled with the scheduled winter shut down, mean that the LHC won't be running again until spring.

Group leader Gerald Oakham, Manuella Vincter and David Asner are among the Carleton physicists involved with ATLAS, a general purpose detector designed to explore the physics from the LHC events. They are eagerly waiting for first data; early results are expected sometime during the course of 2009.


Photo: Amanda Costen

All aflutter

Student volunteers with the Carleton University and University of Ottawa chapters of Let's Talk Science hosted 1,100 school children for tours and handed out butterfly educational material and identification sheets during Carleton's annual butterfly exhibit. After last year's hiatus, the October show made a strong return with approximately 6,000 people attending the opening weekend. To spectators' delight, hundreds of tropical butterflies of 30 species emerged from their chrysalises to fly free throughout the two display greenhouses.

Faculty "frosh"

A leader in discovery and innovation, the Facutly of Science is committed to ensuring an outstanding learning experience for its students. Here's what the newest tenure-track teachers and researchers in our dynamic faculty are working on.

Tyler Avis, assistant professor, department of chemistry

Options for pest and pathogen control in produce once it has been harvested are limited. So close to possible consumption, the chemical controls used in the field are often off limits. So what can be done to protect produce from post-harvest micro-organisms that cause decay and can result in a 40-50 per cent loss between harvest and your plate? Avis, a food microbiologist, examines food spoilage and food-borne illness, and is looking for alternate compounds and biopesticides that are safe, cause reduced resistance development in pathogens and are suitable for post-harvest use. Salts and fatty acids show promise, and he's also working on the discovery and development of post-harvest biopesticides.

David Mould, assistant professor, computer science

One side of computer graphics is the production of realistic images; another is the creation of aesthetically appealing images. Algorithmic techniques for creating apparently painted, engraved or pencil-sketched images are a relatively recent but increasingly prominent area of computer graphics. Mould has worked to increase the range of artistic techniques and media that can be imitated in software. Beyond images, algorithmic techniques for creating virtual forests, mountains and skies are of longstanding interest in graphics, with applications in games and films. Mould's research also aims to provide novel methods for creating stylized scenery, architecture and art objects to populate virtual worlds.

Jeff Smith, assistant professor, department of chemistry

Smith is an analytical biochemist with expertise in mass spectrometry (MS). MS has had a profound impact on the field of proteomics—the study of proteins and the way they work within cells. Smith's research focuses on the development of new kinds of technology that couple with MS to identify the way in which proteins "communicate" with each other in a cell and how the lines of communication change after the cell is subjected to some kind of stimulus. His research area holds a great deal of interest to the biomedical research community, pharmaceutical companies and the biotech industry. His teaching interests revolve around topics pertinent to the various areas of employment in analytical biochemistry.

Apollinaire Tsopmo, assistant professor, department of chemistry

A better understanding of the relationship between food, nutrition and health is important to reduce the incidence of chronic disease and improve quality of life. The consumption of vegetables, grains, fruits and legumes is associated with reduced risk of cardiovascular diseases, cancer and atherosclerosis, but what constituents in these foods contribute to the lower incidence of chronic diseases? Health-promoting compounds called phytonutrients or phytochemicals (many of which haven't been identified) may stimulate the body's immune system, detoxify harmful chemicals and reduce blood pressure. Tsopmo is developing methods and bioassays to identify and characterize those phytonutrients that can detoxify harmful chemicals, elucidate their biological processes at the molecular, organism and population levels and thereby provide evidence for their effectiveness.


Photos: James Park

Man to machine

Human interaction is complex enough, but now we've thrown technology in the mix! Understanding the way that people interact with each other and how those interactions depend on the task at hand is essential for the development of collaboration technology—the hardware, software and social processes that support people working together. Kellogg S. Booth, professor of computer science at the University of British Columbia, delivered the 2008 Cognos Innovation Lecture *Collaborating on, with, and about technology* on October 7.

Booth has worked in the fields of human-computer interaction and computer graphics since 1968. The founding director of the Media and Graphics Interdisciplinary Centre at UBC, Booth's research interests include human-computer interaction, visualization, computer graphics, user interface design and analysis of algorithms. The Innovation Lecture annually brings leading researchers in computer science and related programs to Carleton. The Faculty of Science is pleased to co-sponsor the lecture series with Cognos, an IBM company.

Want more news?

The latest Faculty of Science news and events can be found at carleton.ca/science. Or for news that comes to you, subscribe to Explore Science@Carleton, a weekly email newsletter, at carleton.ca/science/e-newsletter/subscribe.

Hot careers!

Ever wonder where a science degree from Carleton has taken your classmates? Where has it taken you? Help inspire current students and inform fellow alumni by sharing your career path. Visit carleton.ca/science/hc to see the hot careers of the month and to submit your own information.

Upcoming events

Graduates from the classes of 1959, 1964, 1969, 1979, 1984, 1989, 1999 and the Carleton College years are invited to **Reunion weekend, June 5-7, 2009**. Visit reunion.carleton.ca for details.

Presented by the Faculty of Science and the Carleton Alumni Association, the **Science Café** is an informal event for alumni, the general public and Carleton researchers to discuss scientific issues and topics of interest. The winter session of the Café runs every other Wednesday until December 3 at the Wild Oat Café in Ottawa. Visit science.carleton.ca/café for the schedule and speakers.

See how fireworks are made, metal that melts itself, reactions that can tell time, spontaneous combustions, and things that glow in the dark and change colour faster than you can blink! Bring the whole family to the one-hour **Chemistry Magic Show** at 11 a.m. or 2 p.m., **February 21, 2009**. Seating is limited so arrive early at Theatre B, Southam Hall. Admission is free but donations to the food bank are encouraged.

Return undeliverable Canadian addresses to:

Department of University Advancement
Carleton University
1125 Colonel By Drive
Ottawa, ON K1S 5B6 Canada

Publication Mail Agreement
No. 40063314
ISSN 0226-5389

Mail To:

PM40063314