Software engineers score a double header in e-health

Patient records are going digital and new research in the Software Engineering Program will investigate potential privacy and security issues of e-health services in Canada.

Dr. Jens Weber and his team are gearing up two projects with funding from the Office of the Privacy Commissioner of Canada. "This funding is competitive, so to have both our proposals receive support is quite a coup," says Weber.

One project will focus on existing and emerging health informatics systems that are designed to be used by the patient. The interdisciplinary team of software engineers, computer scientists, lawyers and researchers from UVic's School of Health Information Science will conduct a comprehensive scan of consumer health tools available internationally online, such as personal health records and patient websites that collect personal health information.

"The development of these consumer health products has been driven mainly by software companies," explains Weber. Google Health and Microsoft HealthVault are two of the largest players in consumer health informatics. This technology allows individuals to access and manage copies of their lab results, X-rays and other medical information online and share it with various healthcare providers.

"There is a grey zone," says Weber. "These products are not clearly regulated by the federal privacy laws that govern e-health products used by healthcare organizations." Weber's team will assess the privacy risks associated with consumer health informatics products, examine how software tools can mitigate the risk and evaluate certifications for such products. Could the research findings influence future Canadian policy? "That's the idea," says Weber.

The second project will focus on First Nations' data in electronic health record systems. Aboriginal claims of sovereignty and self-determination regarding information management have been difficult to reconcile with mainstream privacy laws. The objectives of this research are to explain the First Nations' concept of communal privacy; assess existing efforts to reconcile communal privacy and existing federal privacy laws; and suggest methods and software tools to help this reconciliation.

"We will contact First Nations groups to get first-hand input on their concerns. We'll try to establish what it means to retain ownership and possession of communal health data in a networked software infrastructure," explains Weber. "Electronic health record systems as they currently exist don't instill trust in Aboriginal communities. They don't trust they have ownership and possession of their data. But, it's possible to create the technology to ensure they do and earn their trust."

The past few months have been filled with new developments and accomplishments within our faculty. A number of faculty members have achieved recognition (see back page) and a few significant developments are summarized here.

In the spring newsletter, we highlighted the Engineering Entrepreneurship@UVic pilot project, which tested an innovative partnership between Wesley Clover, a world-class investment company, and UVic. The pilot gave engineering students the opportunity to pursue a graduate degree while securing a stake in an upstart company. In May, The Governments of Canada and British Columbia, the Alacrity Foundation (formed by Wesley Clover and the BC Innovation Council), UVic and the MITACS Accelerate Program announced their financial support for the program.

In June, six researchers from the Institute for Integrated Energy Systems (IESVic), along with Vice President Research Howard Brunt, travelled to China to participate in the first annual Canada-China Clean Energy Workshop. Held at Peking University and attended by researchers from the top 10 universities in China, it succeeded in developing connections and opportunities for collaborative research and graduate-level education. With 15 UVic faculty members and more than 35 graduate students working with industry partners in Canada and abroad, IESVic has helped UVic become a world leader in energy systems research.

I'm very proud to note that in June, the Canadian Engineering Accreditation Board extended the accreditation of Computer Engineering, Electrical Engineering and Mechanical Engineering for six years, the maximum term. Software Engineering was accredited for three years, with another three years pending a satisfactory progress report in June 2012. This is a vote of confidence in our academic programs and a credit to the many people who worked very hard to put together an exceptionally strong case.

In September, Western Economic Diversification Canada announced its support for a Green Vehicle Research and Testing Centre within the faculty. The centre, the first of its kind in western Canada, will undertake applied research and development for green vehicle powertrain technologies and near-market prototypes. The new centre will enhance domestic and international industrial partnerships, create industrial patents, and transfer technology and ideas to local, national and international partners.

I was delighted to connect with those of you who attended the Alumni Reception in Calgary on Sept. 29th and look forward to meeting more of you in Vancouver on Oct. 26th at a second Alumni Reception.

Please read on for more news about the Faculty of Engineering. I encourage you, as alumni, to stay connected with the Faculty and UVic, by participating in an alumni event or contributing to a faculty initiative.

Tom Tiedje
Ph.D., FRSC, P.Eng.

Photo | Kate Hollefreund

Dr. Alex Thomo

Billions of bytes
Data exploration, integration and analysis

In today's wired world, there are billions of bytes of information stored on computer systems. The challenge is to extract, integrate and intelligently process the knowledge contained within the data.

Alex Thomo is one researcher addressing this challenge. The computer scientist's expertise lies in databases, data mining and smart analytics.

"We have so much data today—it far exceeds our human capability to understand it. We really need automation to extract useful information and present it in an aggregated form to the user," says Thomo.

The advanced information-technology tools he develops help people analyze and better comprehend what's in the massive volumes of data. One aspect of his research covers finding correlations between data that are not obviously connected. The analytics software his team develops can process millions of Web pages, blogs and social network sites and find patterns that are not obvious to people.

A well-known example of large-scale correlation analysis is a "beer and diapers" association found in the sales of a large, chain retailer. Why the correlation? Those that have babies, don't have the leisure to go to bars. This type of smart analytics drives business innovation.

Thomo works also to improve the performance of complex data queries, such as DNA analysis. Finding the similarities between strings of DNA may seem like a simple problem. But, it's challenging because the DNA sequences are very large—in the millions of characters. For example, to find what's similar between human and mouse chromosomes the sequences need to be scanned multiple times.

"This is a time-consuming process. To speed it up, we have developed full-text indexes that facilitate a multitude of sequence-processing tasks," says Thomo.

Another part of Thomo's research is data integration; how to connect islands of data contained, for example, within a database and multiple spreadsheets. He tackles the question of how to integrate those islands of information to form a database from which users can extract knowledge and find the connections.

"I find the common interfaces, what is common among the facts," says Thomo.

Newest Canada Research Chair
does big things in a small way

Dr. Reuven Gordon is the Faculty of Engineering's newest Canada Research Chair (CRC). As the CRC in Nanoplasmonics, Gordon will conduct research that will help in the creation of sensors for the early detection of cancers, new tools to study viral infection and more efficient and cost-effective solar devices.

Under a microscope, human cells can be seen with our eyes. Viruses or cancer markers, however, are invisible because they are much smaller than the wavelength of light. To see them, the light must be reduced to the nanometre scale. (A nanometer is equal to one billionth of a meter.) Gordon, an electrical and computer engineer, is using "nanoplasmonics," with nanofabricated metals, to "squeeze" the light.

Gordon is also researching the use of nanoplasmonics for more efficient solar energy conversion. While solar energy is the most bountiful of green-energy sources, it is also the most expensive, so it is hardly used. Again, nanostructured metals show promise in this area because they allow for more efficient light absorption from the sun with lower material costs.

"By shrinking light to the nanometer scale— the size of viruses, for example—it is possible to increase the interaction of light with materials," Gordon explains. "This has obvious benefits when trying to detect a single molecule that identifies if someone has cancer, or when trying to capture and study a virus with light. Even large-scale devices, like solar cells, can benefit from nanoplasmonics because they enhance light-matter interaction dramatically." Gordon's five-year appointment is one of the 10 CRCs within the Faculty of Engineering.
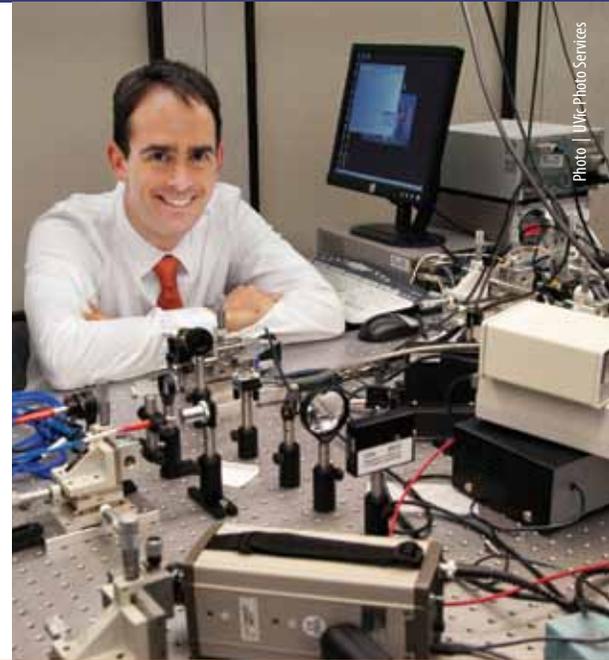

Photo | UVic Photo Services

Dr. Reuven Gordon

FACULTY NEWS

Dr. Stephanie Willerth joined the Department of Mechanical Engineering in August and is cross appointed with the Division of Medical Sciences. Her research interests focus on using quantitative, engineering-based approaches to significant biological problems in the field of tissue engineering. Her laboratory will focus on designing 3D biomaterial scaffolds to control stem cell behavior.

"Dr. Willerth's work on the development of induced pluripotent stem cells provides an exciting alternative to the use of embryonic stem cells and complements the work of other researchers in the department," says Dr. Colin Bradley, Acting Chair. "Collectively, this group of researchers is taking the department in new and exciting research directions." Willerth's lab is located in the Medical Sciences Building and, therefore, will greatly assist in building linkages between medical sciences and engineering.

Willerth conducted her post doctoral research in the California Institute for Quantitative Biosciences at the University of California-Berkeley. She collaborated with the VIRxSYS Corporation, from 2008 to 2010, where she studied HIV evolution in clinical patients using next generation DNA sequencing technology. Her doctoral research involved developing biomaterial scaffolds for neural tissue engineering applications in the Department of Biomedical Engineering at Washington University, Saint Louis. She obtained her undergraduate degrees in Biology and Chemical Engineering from the Massachusetts Institute of Technology in 2003.

Dr. Ben Nadler joined the Department of Mechanical Engineering in September. Nadler's research interests are theoretical and computational mechanics. Of main interest are soft materials and structures, thin films and the theory of evolving materials with applications in biomechanics and impact mechanics.

"His work is fundamental to many branches of engineering and will enable the department to both strengthen its existing program and branch out into new teaching and research areas," says Dr. Colin Bradley, Acting Chair. Nadler's research focuses on developing new theories in computational mechanics and applying them to current research problems in areas such as biomechanics. The advances in numerical solution methods have enabled him to develop new, and more precise, theories that can be applied to many research areas.

Nadler received his Ph.D. in Mechanical Engineering from University of California at Berkeley in 2006, and received MS and BS degrees from Technion-Israel Institute of Technology in 2002 and 1999, respectively. In 2006, Nadler was appointed Assistant Professor in the Department of Mechanical Engineering at the University of Alberta.

Congratulations to the following professors who became registered in 2010 with the Association of Professional Engineers and Geoscientists of British Columbia, as Professional Engineers: **Drs. Thomas Darcie**, **Michael McGuire**, and **Mihai Sima** (Electrical and Computer Engineering) and **Dr. Nikolai Dechev** (Mechanical Engineering). The registration of our instructors with APEGBC is needed to maintain the accreditation of our programs.

Photo | Rebecca Dunn-Krahn

Dr. Ulrike Stege (left) and student volunteers Steven Lonergan and Serena Lee-Cultura take SPARCS workshops into schools through after-school clubs.

Sparking a love of **computer science**

A group of computer science professors, graduate students and undergrads aim to ignite a spark for computer science by teaching kids about the field in fun and novel ways. They've done it so well, they're the 2010 winners of the BC Educational Technology User's Group (ETUG) Innovation Award.

Initiated by Dr. Ulrike Stege in 2007, the SPARCS (Solving Problems with Algorithms Robots and ComputerS) program uses technologies in innovative ways to get students, grades 3-8, learning computer science through fun after-school clubs. Aside from learning about algorithms and concepts, students get to learn how to design video games, operate Wii-motes on a computer rather than a Wii console, create storyboards, solve difficult puzzles, and work on unique projects that combine creativity and science.

"The group formed when enrollment in computer science went down at UVic," says Stege. "Being a woman in computer science, it opened my eyes and I wanted to change people's perception."

"SPARCS won the award because they meet the key values and priorities of ETUG: excellence in the application of technology for teaching and learning," says Tracy Roberts, chair of the ETUG steering and awards committees. "They use innovative technology for teaching and learning; not just technology for its own sake."

The group shares their love of computer science with children by using creative lessons and innovative techniques. Stege explains that there is a way to do computer science on paper and by playing games, which makes it possible to "learn technology with no technology." Stege notes that this makes computer science fun and accessible, and easier to integrate into the classroom.

"Students learn to design and play at the same time. This program allows them to learn about computer science even if it's not offered at school," says Stege, who also hopes that SPARCS will steer interested students in the direction of computer science for post-secondary studies.

With files from BCcampus

Making a mark
Faculty milestones & achievements

Canadian Academy of Engineering

Jens Bornemann, Professor and Chair, Electrical & Computer Engineering, **Ned Djilali**, Professor, Mechanical Engineering, and **David Scott**, Professor Emeritus, Mechanical Engineering, have been elected as Fellows of the Canadian Academy of Engineering. The official induction took place in June during the annual general meeting of the Academy in Toronto.

Members of the Academy are nominated and elected by their peers to honorary Fellowships, in view of their distinguished achievements and career-long service to the engineering profession.

Wighton Fellow

Dr. Ashoka Bhat was named the 2010 Wighton Fellow. He is the 25th Wighton Fellow to be named and the second electrical & computer engineering professor from UVic; Dr. Adam Zielinski was the first in 1990. The Wighton Fellowship is a national award to recognize excellence in the development and teaching of laboratory-based courses in Canadian undergraduate engineering programs.

Craigdarroch Medal

Computer science professor **Margaret-Anne (Peggy) Storey** has won the UVic Craigdarroch Silver Medal for Excellence in Research. As a world expert in collaborative and visual software tools, Dr. Storey focuses on the interplay between technology, human behaviour and social structures to design software that helps people organize, analyze and better comprehend information. Her research has been applied in many areas, including software engineering, biomedicine and education.
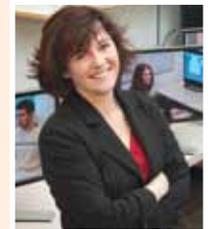
Harry Hickman Alumni Award for Excellence in Teaching

Computer science senior instructor **Mary Sanseverino** (BSc 1986, MSc 1991) has won the Harry Hickman Alumni Award for Excellence in Teaching. Sanseverino is recognized for her "innovative and scholarly approach to teaching and her engaging classes, which are strongly focused on learning, enlivened and deepened by technology and brilliantly clear in design." She has been a UVic instructor for 20 years and will receive the award at UVic's Legacy gala event in November.

Science Foundation Faculty Advisor Award

Drs. **Curran Crawford** and **Zuomin Dong**, mechanical engineering, are the recipients of the EcoCAR, American National Science Foundation's Outstanding Long Term Faculty Advisor Award and $10,000 for their work on the EcoCAR project— UVic's fuel-efficient, low-emission car of the future. The NSF's citation says they "demonstrated a unique ability to mentor students, provide opportunities in developing advanced technologies, and to learn real-world hands-on engineering skills valuable in the workspace." UVic's EcoCAR team placed fourth overall, and won eight awards, in the year-two EcoCAR Challenge finals held in May. For more information about the three-year international EcoCAR competition, check out the UVic EcoCAR Team on Facebook.