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OutFront

RESEARCH THAT MATTERS

Dr. Yung-Hau Li has been working with the dental plaque-causing bacterium, Streptococcus mutans.

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DALHOUSIE UNIVERSITY RESEARCH PROJECTS: KEY FUNDING RESOURCES

While Dalhousie University receives research dollars from more than 500 funding agencies and private sector companies, it is also the recipient of over $50 million from the public sector. Below are some of the key government groups that have provided support:

AIF – ATLANTIC INNOVATION FUND, managed by the Atlantic Canada Opportunities Agency, is designed to strengthen Atlantic Canada's economy by accelerating the development of a knowledge-based industry. www.acoa.ca/e/financial/aif/

NSERC – NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL OF CANADA makes strategic investments in Canada's capability in science and technology. www.nserc-crsng.gc.ca

SSHRC – SOCIAL SCIENCES AND HUMANITIES RESEARCH COUNCIL OF CANADA promotes and supports university-based research and training in the social sciences and humanities. www.sshrc-crsh.gc.ca

CIHR – CANADIAN INSTITUTE OF HEALTH RESEARCH funds more than 8,500 researchers in universities, teaching hospitals and research institutes across Canada. www.cihr-irsc.gc.ca

CFI – CANADA FOUNDATION FOR INNOVATION provides 40 per cent of infrastructure costs for quality research projects; research institutions must then secure the remaining funds from other government sources and the private sector. www.innovation.ca

NSRIT – NOVA SCOTIA RESEARCH AND INNOVATION TRUST FUND helps the province's researchers pursue projects with social and economic benefits in virtually any sector. The fund helps Nova Scotia's research institutions to secure grants from the Canada Foundation for Innovation. www.gov.ns.ca/econ/

CRC – CANADA RESEARCH CHAIRS PROGRAM invests $300 million a year to attract and retain some of the world's most accomplished and promising minds, in the effort to make Canada one of the world's top five countries for research and development. www.chairs.gc.ca

NSHRF – NOVA SCOTIA HEALTH RESEARCH FOUNDATION works with the health research community and other stakeholders to invest the province's health research resources in a manner that will best serve to improve the health of Nova Scotians. www.nshrf.ca

BEING ACCOUNTABLE

As this issue of ***OutFront*** is being prepared, my office has just finished drafting a detailed report on Dalhousie's progress in the area of Information and Communications Technology (ICT) and responding to two days of questioning during a site visit by a panel of ICT experts appointed by the Canada Foundation for Innovation (CFI). This was in response to a new initiative by CFI to measure outcomes resulting from its investment.

CFI is conducting an in-depth evaluation of key outcomes generated by its funding over the past 10 years. It's an important undertaking because it stresses accountability: by CFI in wisely investing taxpayers' dollars, and by the research institutions in implementing their projects strategically.

I am pleased to say Dalhousie has made significant inroads in the ICT theme. Without question much of this success can be attributed to CFI's support of approximately $6 million, which provided a much-needed infusion of funds to help researchers access new space and state-of-the-art equipment. You can read more about the ICT transformation on page 15.

For Dalhousie, this doesn't really tell the whole CFI story which is much larger than ICT. To date, the university has received more than $73 million in CFI funding ($100 Million with matching funds) for 153 projects and infrastructure upgrades that traverse various themes. Perhaps one of the best outcomes was that it enabled more student funding, albeit indirectly, by allowing researchers to use other grant monies to support graduate students and research projects. This is important because students are the backbone of the institution; without them we wouldn't exist.

In this issue, you will read about several students who are involved in some very interesting and relevant research, research that may one day change the way we currently do things and inspire others to follow similar academic paths.

Carl Breckenridge, PhD
Vice-President, Research
Dalhousie University

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DEALING WITH THE MOODY BLUES

Abriel Photo

Dr. Sherry Stewart has no trouble finding participants for her research. She's looking for alcohol drinkers, and since about 80 per cent of university students indulge, she has an excellent pool from which to draw study participants.

Specifically, she seeks students for whom alcohol consumption is emotionally rather than socially driven. These drinkers have a tendency to binge drink or overindulge. Stewart is interested in the emotional triggers and cognitive processes that compel these students to drink. "We have consistently found that there is a higher rate of negative consequences among people who either drink to 'cope' or drink 'for enhancement,'" says Stewart, a Killam research professor of psychiatry and psychology at Dalhousie. "The harms come in different forms such as missing class because they're hung over, arguing with their girlfriend or boyfriend, vomiting, passing out or getting into fist fights."

Stewart's lab-based research has shown that mood plays a significant role in the volumes of drinking in both of these categories. For those who drink to cope, a negative mood means they drink more (perhaps to assist with the coping). For those who drink for enhancement, a positive mood means they consume more alcohol. Stewart calls this "chasing the high" through drinking.

Stewart and her research students are able to create different mood states in the lab by having the participants listen to different, but specifically selected music. Certain musical pieces can evoke a happy, sad or anxious mood. PhD student Valerie Grant has found that the 'coping drinkers' had different results depending on their reasons for drinking.

"If the anxiety or depression was addressed in coping-motivated drinkers, then it's quite likely that the heavy drinking pattern might change."

"There was a big distinction between anxiety-related and depression-related drinkers," explains Grant. "People who drink to cope with depression tend to drink more than other drinkers, whereas those drinking to deal with anxiety have more negative outcomes of drinking, even after accounting for how much they drink. We have also shown in the lab that an anxious mood evokes thoughts about alcohol in those students who drink to deal with anxiety."

This type of research is particularly relevant in Nova Scotia where, with the introduction of a 10-year alcohol strategy, the province is stepping up efforts to encourage a culture of moderation rather than extreme drinking behaviour.

Stewart's work emphasizes preventive strategies and the development of practical tools that can help relieve the root causes of heavy drinking and the resulting consequences. "If the anxiety or depression was addressed in coping-motivated drinkers, then it's quite likely that the heavy drinking pattern might change," says Stewart. "A different approach would be used with enhancement drinkers, such as helping them find other, less risky ways of achieving their need for excitement."

Stewart's recent work in Nova Scotia high schools has shown promise for this type of early intervention approach in increasing abstinence, decreasing binge drinking and decreasing alcohol problems among high-risk adolescents. ■

STOPPING CANCER IN ITS TRACKS

For years, the Canadian Cancer Society has used the slogan of hope "Cancer Can Be Beaten." One begins to believe it when speaking to Dr. David Waisman, Dalhousie's Canada Research Chair in Cancer. He and a team of master's students, PhD candidates and postdoctoral fellows are studying how a tumour grows and spreads, all toward the end effort of stopping cancer in its tracks.

"If the cancer stays localized then you can more easily burn or poison it," explains Waisman. "When a tumour metastasizes and travels to the bones or a major organ, it becomes much more challenging to treat and is more likely to result in fatal consequences."

His team is considering blocking the spread in two ways: starving the tumour by cutting off its blood supply and ridding cancer cells of their ability to travel.

Second year master's student Alexi Surette is focusing his research on the latter. For cancer cells to spread, they must first bore through blood vessel walls. The cells do this very effectively by using an existing protein called p11 as "molecular scissors."

"In order to metastasize, the cancer cells need to leave the primary tumour and chew their way into the bloodstream, which serves as their mode of transportation," says Surette. "If we can find a way to eliminate the p11 production, hence disabling their travel, we may be able to stop the cancer in its tracks."

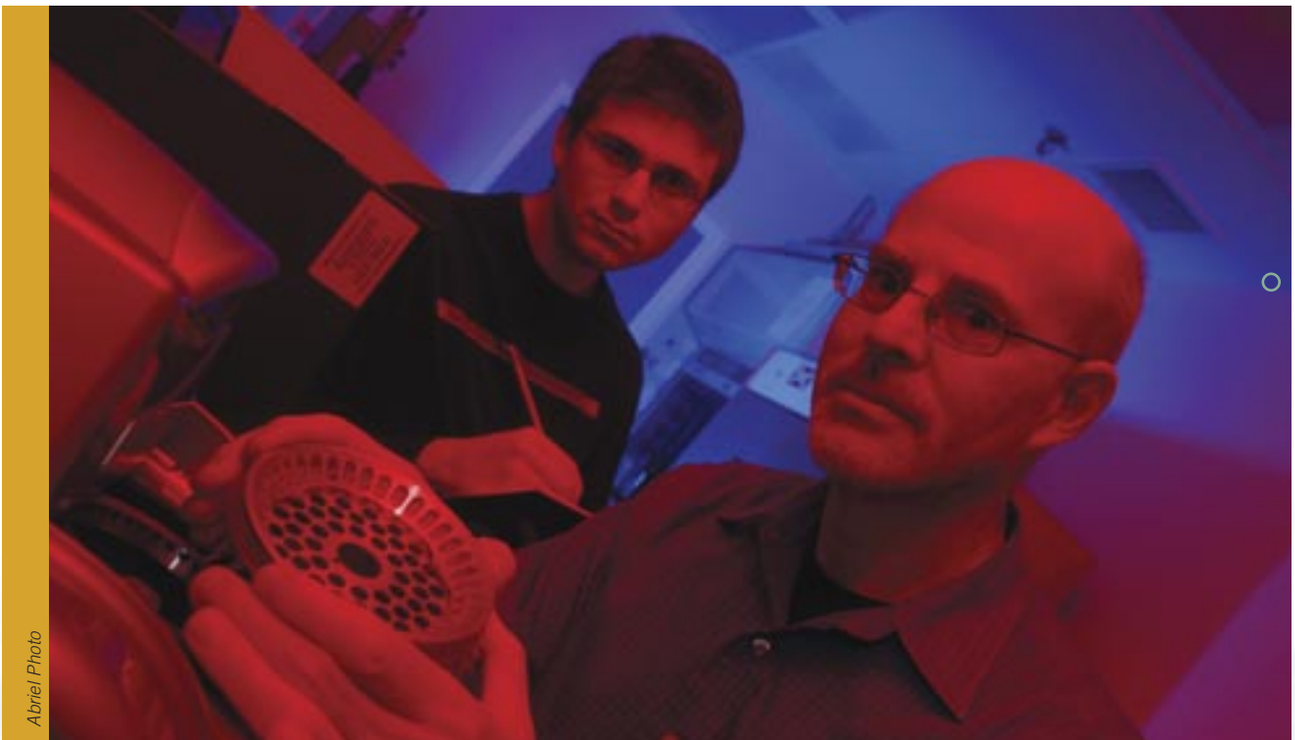
This might sound relatively basic, but p11 plays an important role in healing wounds and, to a lesser extent, in embryonic growth during a woman's pregnancy. So eliminating the p11 may not be a viable option. Plus, cancer cells are very smart.

"When a tumour metastasizes and travels to the bones or a major organ, it becomes much more challenging to treat and is more likely to result in fatal consequences."

"If a protein is useful, cancer will find a way to use it," says Waisman. "Cancer is called 'the wound that doesn't heal' because cancerous cells are extremely adept at undergoing genetic mutations that help make it mobile and adaptable to hostile environments."

In addition to a mode of travel to metastasize, tumours need nutrients from the bloodstream to grow. If the blood supply is cut off, the tumour could essentially starve to death. Waisman is exploring angiogensis, the process that enables the supply of oxygen and nutrients to the tumour. "If we can effectively engineer cell-killing toxins and add it to the angiostatin, it's possible that we could cure the cancer," he says.

The bottom line is that their work is all about preventing cancer cells from growing. "Ninety-five percent of all the cells in an adult body are not growing – that's how it is supposed to be," says Waisman. "With cancer, cells that shouldn't be active are actually growing quite actively. That's precisely what we want to stop." ■



Master's student Alexi Surette, Dr. David Waisman

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Dr. Jasmina Milićević, PhD student Muriel Pequret, Dr. Marie-Joseé Hamel

UNLIKELY TRANSLATION

For an anglophone, learning to speak, read and write in French is considered an attainable goal. Becoming fluent is a much more difficult prospect and it's a challenge that isn't appropriately supported by way of electronic learning and teaching tools.

Take the English phrase "heavy rain." The literal translation would be an inversion, "pluie lourde." While for an anglophone it seems logical that this word combination would be correct, the result would sound strange to a francophone's ear. Instead, the correct expression is "grosse pluie," literally "fat rain." Even though a francophone would likely understand the meaning of "pluie lourde," its usage certainly isn't apropos for someone deemed to have a good grasp of the French language.

This represents a basic example of a mismatched word combination but emphasizes the importance of the research work of Marie-Joseé Hamel and Jasmina Milićević, professors in Dalhousie's French Department. With PhD students Muriel Pequret and Alain Takam, they are developing an e-resource that will help French-learning students acquire a more natural, spontaneous and, most importantly, correct grasp of the French language.

"We're building a computer-assisted learners' dictionary that will enable French-as-a-second-language students to properly combine words to convey meaning," says Hamel. "Through our teachings and with the help of our graduate students, we have collected in excess of 1,000 incorrect word combinations or usages in texts written by our students. This has helped us to better understand and address difficulties they experience in the learning process."

The research team, which also includes former Dalhousie honours student Yves Bourque and graduate students from the University of Montreal's research lab Observatoire de la Linguistique Sens-Texte, is currently developing a small prototype containing 1,000 word entries. Yu Centrik, a Montreal-based company that specializes in the evaluation of on-line interactive systems, has also joined the research project to work on the user-centred aspects of the dictionary's interface.

"The development of the e-learning resource is based on a specific linguistic theory (Meaning-Text theory), which has a well-developed semantic and lexicological component," says Milićević. "One of our research goals is to determine if this linguistic framework can effectively guide an application that is practical and usable for intermediate to advanced learners of French." ■

"Through our teachings and with the help of our graduate students, we have collected in excess of 1,000 misused word combinations or usages..."

GENE INTERRUPTED

Bacteria are sneaky little microorganisms. They can multiply rapidly, thrive under obscure conditions and fiercely protect themselves with a goo-like substance called biofilm. The good ones help digest food and keep harmful bacteria at bay. The bad ones cause serious, sometimes fatal, illnesses.

Listeria monocytogenes, a bacterium being studied by Dr. Lisbeth Truelstrup Hansen, can cause meningitis, gastro-intestinal problems and even spontaneous abortions. And it persistently thrives in environments where food is being processed for human consumption.

Part of what makes L. monocytogenes so problematic is its ability to attach itself to surfaces, potentially leading to contamination of foods touching that surface. Truelstrup Hansen, associate professor with Dalhousie's Food Science Program, and master's student Yuheng Chen are working to figure out which factors enable this bacterium to adhere so effectively.

Abriel Photo

Master's student Yuheng Chen, Dr. Lisbeth Truelstrup Hansen

"While certain types of bacteria are good for you, others are very dangerous and we need to be able to ensure that they are kept out of our food supply."

"The bacterium is present in processing plants and affixes itself to usually slippery stainless steel. From there, it begins to grow and multiply, creating colonies, which in turn ensconce themselves with a protective slime making the contaminant extremely difficult to get rid of," explains Truelstrup Hansen. "If we understand the mechanism that allows it to attach, we can devise better strategies for effective bacteria removal and sanitation."

Chen is getting close to better understanding this problem through a rather time-consuming process of elimination. "We obtained 4,000 L. monocytogenes mutant strains where each one had taken up a mobile DNA piece to essentially interrupt its current state," says Chen. "We then tested to see which ones could still attach to the stainless steel. Out of this 'library of mutants,' there were only 14 that didn't attach, meaning something had been altered in the genome."

The challenge now is to find out exactly what has changed. Under Truelstrup Hansen's guidance, Chen will compare the 14 mutants' genomes to the parent strain and attempt to pinpoint what interfered with the bacteria's ability to attach to the stainless steel surface. This finding could lead to relevant information and practical solutions for the food industry.

"Whether it's in the processing of meat, vegetables or even dairy products, sanitization is one of the key parts of the safe food equation," says Truelstrup Hansen. "While certain types of bacteria are good for you, others are very dangerous and we need to be able to ensure that they are kept out of our food supply. That's exactly what our research is helping to do." ■

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PhD student Shelley Lang and Dr. Sara Iverson

LIVING AMONGST THE SEALS

Every year right after Christmas, Dr. Sara Iverson and her husband pack their duffle bags and journey to Sable Island, where they set up camp in a rather rustic but practical house. They are usually joined by several Dalhousie students and researchers from Fisheries and Oceans Canada, all eager to spend five to seven weeks studying the grey seal in its own habitat.

Iverson studies marine mammals, sea birds and bears, concentrating on their adaptations to environmental constraints and changing ecosystems. On Sable Island, she focuses mainly on the lactation strategies of the mother seals and the ability of their pups to tolerate – and indeed rely on – a very high-fat diet in their first few days of life. What makes this research particularly relevant is that seals have the same digestive enzymes as humans, yet their high-fat food tolerance is very different.

"The grey seal mother feeds her pup 22,000 calories a day in milk, with no chance to replenish her own body tissue losses (required to produce the milk) because seals give birth on land where they are separated from their food source," explains Iverson, a professor in Dalhousie's Biology Department. "The grey seal's milk is 60 per cent fat, much higher than human's milk at only four per cent fat."

Lactation is the most intensive thing a female mammal will do in her lifetime. "The grey seal mother spends 16 days feeding her pup before she abruptly weans it and heads for the sea," says Iverson. "During the lactation period, the mother seals may lose almost half their body weight. If humans lost such mass, we would have a heart attack, but the grey seal switches to an almost entirely fat-based catabolism, sparing her body protein."

In spite of the high-fat diet, seals never experience clogged arteries. This phenomenon has made the American Heart Association very interested in Iverson's work and its potential to help us better understand how the human body stores and uses fat.

Another way to study animals, ecosystems and adaptations to changing environments is to look at diet. Iverson has developed a scientific model – Quantitative Fatty Acid Signature Analysis (QFASA) – that enables her to determine exactly what an animal has eaten in the wild, just by analyzing a minuscule amount of the animal's stored fat and that of its potential prey.

"This is much more humane and informative than killing an animal to study the contents of its stomach," says Iverson, who has been conducting field studies on Sable Island for 18 years. Other scientists involved in similar research have adopted her QFASA model.

For students, the Sable Island trips represent more than just an opportunity to learn alongside a highly regarded scientist. They also mean hard work and a bit of roughing it. There are two houses on the island, but just one has running water and electricity. This is where the daily meal preparations take place. "Sometimes it seems that the biggest challenge for the students is to figure out what and how to cook for a large hungry group with high expectations of great meals," chuckles Iverson. "We all take turns and do the best we can." ■

"During the lactation period, the mother seals may lose almost half their body weight. If humans lost such mass, we would have a heart attack…"

GUIDING THE SYSTEM

Four hundred million. That's roughly the number of prescriptions written in this country each year, resulting in an average of $700 per Canadian spent on drugs per year. This is significantly more than in many other countries, yet Canada lacks an adequate national system for monitoring drug use. Better methods are needed to detect and prevent patient harm that may result from such things as adverse reactions or drug interactions.

Dalhousie's Dr. Ingrid Sketris provides the government with research on this issue. She holds a 10-year Chair in Health Services Research from the Canadian Institutes of Health Research and Canadian Health Services Research Foundation. Sketris is one of just 11 such chairs in Canada and the only one in the Atlantic provinces. In addition to her medication management advisory work, she has a role of educating and mentoring graduate students who come from a variety of academic disciplines.

"The processes by which drugs are regulated, marketed, prescribed and used have broad-reaching ramifications," says Sketris. "There are business implications, legal perspectives and, of course, medical challenges that all play a part, so I tend to have students from many disciplines."

Typically her students go through a 17-week residency, during which they delve into policy-relevant research. One of Sketris' most recent residents is PhD student Stacy Ackroyd Stolarz, who spent her time at Capital Health studying the association between the use of sedatives – specifically benzodiazepines such as Valium – and fall-related injuries for patients over the age of 65.

"It's important to know whether there is overprescribing or underprescribing and if patients are inadvertently or deliberately misusing the prescriptions."

"I wanted to explore whether the use of the commonly-prescribed benzodiazepines had any impact on the number of falls that occurred in the hospital," says Ackroyd Stolarz. "My research showed that there was indeed a slightly greater occurrence of falls when patients were prescribed sedatives. Based on these results, some very practical approaches could be adopted to reduce the risk of this potential side effect, including prescribing slightly smaller doses."

This work was a natural fit for Ackroyd Stolarz, an occupational therapist and a faculty member of the Department of Emergency Medicine at Dalhousie University, but it was Sketris' strong reputation and excellent networks that provided her with the opportunity. "Working with Ingrid opened so many doors for me. She truly is one of the best in her field."

Sketris is committed to raising awareness about the importance of medication management and promoting best practices, especially since there are marked differences even among provinces and health authorities in Canada. "It's important to know whether there is overprescribing or underprescribing and if patients are inadvertently or deliberately misusing the prescriptions," she says. "These are important issues, especially with an aging population, the advent of new drugs and rising drug costs." ■

PhD student Stacy Ackroyd Stolarz, Dr. Ingrid Sketris

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GLAUCOMA – THE SILENT THIEF

The painless eye disease glaucoma is far more common than one might think – and half the people who have it are completely unaware of it. One in 100 Canadians over age 40 are plagued with the condition and the likelihood increases with age. Over the age of 70, people have a one in 20 chance of developing glaucoma. And women are twice as likely to see the disease progress.

Dr. Balwantray Chauhan, an endowed Chair of Vision Research at Dalhousie, says sight damage often happens well before people even realize they have glaucoma. "Once symptoms are present, the disease is usually quite far along," explains Chauhan. "It affects the peripheral vision first and then moves to the central line of sight. This is when patients become symptomatic."

Chauhan is the principal investigator of the recently-released Canadian Glaucoma Study, which tracked 258 people in five university hospitals over 15 years. Along with age and gender issues, the study showed that high eye pressure and the presence of anticardiolipin antibodies can speed up the disease's progression.

Chauhan stresses the importance of having regular eye examinations because any damage to a person's sight due to glaucoma is irreversible. Ophthalmologists look carefully to detect any degeneration within the eye. They also measure the field of view and the eye pressure. Early detection is critical.

Because the condition is incurable, treatment focuses on disease control. "Unfortunately, you can't take a magic pill to cure glaucoma. Once the nerve cells are dead, there is currently no way to restore them," says Chauhan.

Treatment is individualized but typically starts with a drug regime to reduce eye pressure. Fluid circulates regularly in the eye, but it needs to be removed at the same pace as it's being generated. When the pressure needs to be lowered, you can either decrease the inflow or reduce the outflow, something Chauhan says is akin to "a basic plumbing issue."

While he is interested in the disease and its control, his work goes well beyond the clinical science of glaucoma. Chauhan conducts research on the basic mechanisms of glaucoma in the Retina and Optic Nerve Research Laboratory at Dalhousie. He also considers its impact from a health economics perspective. "With so many people having this silent condition, one that worsens with age, it is a certainty that the health care system will become stressed," he says. "It's important to find a more efficient way to diagnose the disease and treat it for better outcomes for the patient. That is our challenge." ■

"It's important to find a more efficient way to diagnose the disease [glaucoma] and treat it for better outcomes for the patient. That is our challenge."

Dr. Balwantray Chauhan

Abriel Photo

Abriel Photo

"Determining fairness is a common theme between the oil companies and the government that lays claim to the offshore."

THE POLITICS OF FAIR PLAY

Dr. Jerome Davis is an American-born, Danish citizen living in Canada and he couldn't be more contented. His provocative views and deep experience in oil and gas regulation have, for years, made him a sought-after expert in Denmark and Norway. Today, as Dalhousie's Canada Research Chair (CRC) in Oil and Gas Regulation, he thinks that Nova Scotia can learn some lessons from Denmark, a country that expanded its oil and gas industry from one producing 100,000 metric tonnes of oil per year to 100,000 metric tonnes of oil per day.

"For years, Denmark was 90 per cent dependant on import for its oil and gas," says Davis. "When, in 1973, Saudi Arabia added Denmark to its embargoed list, the Scandinavian country had to make some drastic domestic changes to ensure supply continued to meet Danish demand."

Davis played an unlikely role in Denmark's transformation. With a father who was CEO of ESSO Standard Eastern and who felt academia was an unworthy occupation, at age 22 Davis was determined to neither follow in his father's footsteps nor teach for a living.

That assertion changed four years later. When the Danish government was trying to get its energy industry to a point where it could support the needs of its citizens, it asked Davis to play a role in validating information put forth by companies with a vested interested in downplaying the potential of wells on Denmark's offshore. He agreed.

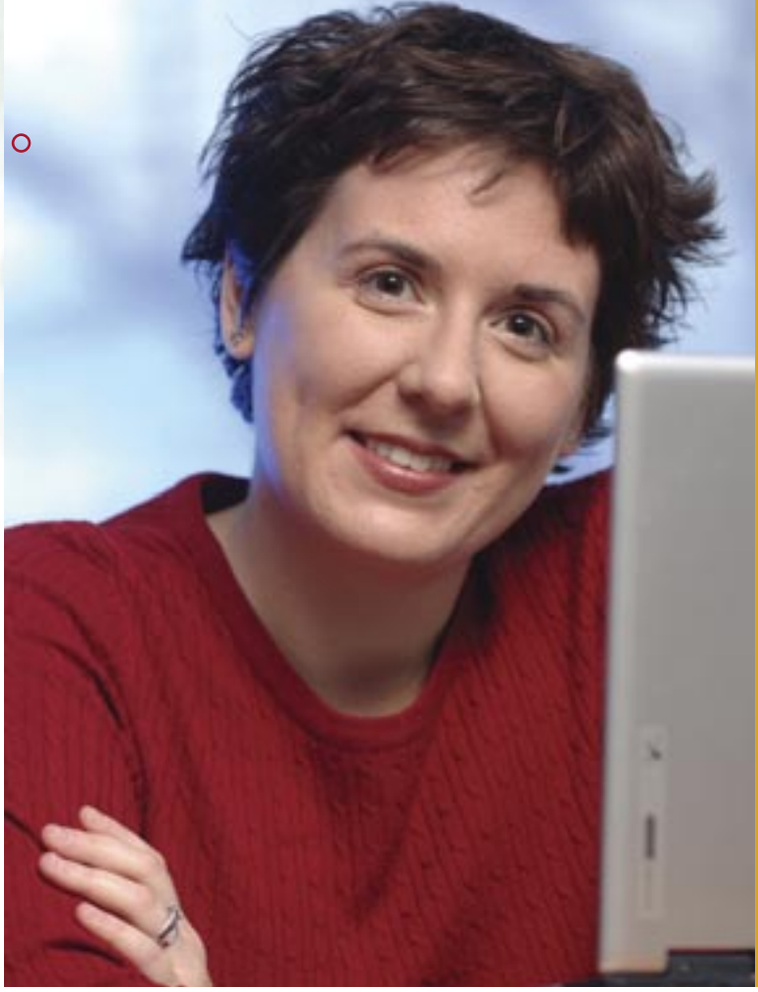
"It was very difficult for the Danish government to know who to trust. It would hire an economist consultant who would eventually be wooed over to industry," says Davis. "It was an incredibly challenging time. The basis of the controversy was disagreement over what was deemed fair. Determining fairness is a common theme between the oil companies and the government that lays claim to the offshore."

In the end, Denmark's oil and gas industry had to be rebuilt from the bottom up and Davis had a role all the way along. In 1979, he began to translate his experience into academic language and authored a number of books including perhaps his most well-known, *Blue Gold: The Political Economy of Natural Gas.*

Now as a CRC and professor in Dalhousie's political science department, he spends a great deal of time reflecting on Nova Scotia's offshore potential and sees some strong alignment with Denmark's situation 40 years ago.

"Again, it's a question of fairness, with there being a number of different interpretations about what is just," says Davis. "However, as in Denmark, trying to change things here is difficult. Not only are both the feds and the province involved in regulating offshore activities, making regulation highly complex, but deciding what, if anything, must be done can be very difficult." ■

PhD student Heather O'Brien



Abriel Photo

ATTENTION PLEASE

It takes an average of half a millisecond for internet users to decide whether to remain at a website or move on to another. That's less than the time it took to read the first 12 words of this story.

Capturing and maintaining a web reader's attention is a huge challenge for organizations. Much effort is now going into developing sites that sustain the length of online visits while aptly promoting an organization's products, services or information.

Dalhousie PhD candidate Heather O'Brien refers to this concept as "user engagement." This goes far beyond the idea of user-friendliness, with an added focus on quality of experience. As part of her thesis, she's developing a process model that will determine the point at which a person becomes engaged, how long interest is maintained and the point of disengagement.

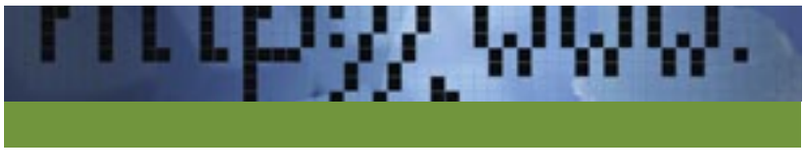
"There are five key attributes that are part of this 'engagement,' ranging from aesthetics to challenge to novelty," O'Brien explains. "The reason that a person is surfing is also relevant. For example, travel and shopping sites tend to be judged on looks whereas health and general information sites are based on information clarity. In some cases, menu names can turn people off and too much text can be a deterrent."

O'Brien's work is particularly relevant to online retailers and one North American company has provided a venue for her work. "A major online book retailer sent my survey to its customer list on my behalf, so I could conduct a study that delves into the relationships between the attributes."

While the results may help shape an online sales strategy for the book company, they will also play a major part in O'Brien's thesis, which she will submit and defend later in this school year. But not before she benefits from the perspectives of her four PhD supervisors, who have varied research interests.

"I am enrolled in an Interdisciplinary PhD, and hence benefit from multidisciplinary feedback," says O'Brien. "My supervisors come from Business, Management, Psychology and Computer Science."

"I will have developed a rigourous methodology that measures engaging experiences for internet shoppers and web searchers."



Her primary supervisor is Dr. Elaine Toms, who was featured in ***OutFront's*** fall/winter 2006 issue. "My love of research and my interests fit well with Elaine's ideas and passions, so it was a natural next step for me to work closely with her."

But O'Brien's research won't end with successful completion of her PhD. "I will have developed a rigourous methodology that measures engaging experiences for internet shoppers and web searchers. But then I want to study physiological reactions such as heart rate, eye movements and skin response in relation to a user's interest."

A number of prestigious awards have helped O'Brien make progress on her research, including: The Izaak Walton Killam Predoctural Scholarship, the Social Science and Humanities Research Council of Canada Doctoral Scholarship, and the Eliza Ritchie Doctoral Scholarship for Women. ■

DEVELOPING NEW DEFENCES

Interrupting bacterial communication. It's an unusual way to describe the work of dental professionals but it is an important part of what they do. Our mouths are filled with bacteria. By brushing and flossing daily, some are flushed away but the rest build up and attach themselves very tightly to the teeth and gums. The bacteria develop cell-to-cell communication strategies to multiply. To increase their likelihood of survival, they create a microbial biofilm, a coating that is impenetrable with a toothbrush but can be removed with dental instruments.

Dr. Yung-Hau Li has been working with the dental plaque-causing bacterium, Streptococcus mutans. He has synthesized an analogous molecule that makes this bacterium more sensitive to the detergent found in toothpaste, inhibiting its ability to form biofilms. Li has also been exploring the idea of inoculating someone's mouth with mutated bacteria to stunt the growth of the Streptococcus, research that has shown much promise.

Graduate students and postdoctoral fellows in Li's lab are working to take this concept further and develop analogues that could have broader medical applications in the fight against biofilm-based infections. This involves the molecular dissection of microbial biofilms and associated infections, work that is especially timely given the increasing prevalence and subsequent burden of these infections in the clinical setting.

"Normally, our immune system keeps us free of infection," says Li. "When it fails us, then we usually turn to antibiotics to get rid of the infection. But if the drugs don't work, our defence against these seemingly resistant bacteria is very limited."

"Normally, our immune system keeps us free of infection. When it fails us, then we usually turn to antibiotics to get rid of the infection. But if the drugs don't work, our defence against these seemingly resistant bacteria is very limited."

It's at this point that "communication interruption" becomes a potential part of the solution. "By introducing molecular analogues, you may be able to interfere with the bacterial communication and its controlled pathogenic activities, meaning that the total number of disease-causing cells becomes so limited that there are not enough to cause a problem."

Li has also been working with antimicrobial peptides, proteins that have natural immunity agents. This research is based on the premise that most bacteria have a positive or negative charge. The peptide assumes the opposite charge and bonds with the bacterium, essentially rendering it neutral and reducing activity. While they have great potential in controlling 'superbugs,' the downside of the antimicrobial peptides is that they become ineffective when they come into contact with liquid – something the body has a lot of.

While Li and his students haven't found any definitive answers to controlling the superbugs that are beginning to plague the medical community, their research has greatly enhanced the understanding of potential solutions. ■

From left: Post-doc Yongxing Gong, technician Xiaolin Tian, Dr. Yung-Hua Li and PhD student Kai Zhang.

Abriel Photo

Abriel Photo

Dr. Michael Lee and PhD student Ian Aldous

THE HEART OF THE MATTER

Collagen is the most common protein in the body and determines the strength and stiffness of all our parts, from bone to muscle to skin. For such an important molecule, surprisingly little is known about it from a fundamental, basic science perspective. This is beginning to change thanks to the work of some very bright and determined biomedical engineering students at Dalhousie.

"Collagen is far more complicated that we imagined," says Dr. Michael Lee, the founder of Dalhousie's School of Biomedical Engineering. "We suffer from many injuries and body malfunctions due to collagen injury. But we don't actually know what happens to the collagen when it gets damaged."

PhD student Ian Aldous is particularly interested in the role collagen plays in the heart. He is considering it from two perspectives: tissue repair and geriatrics. "The four valves of the heart open and close 35 million times every year. The valves never stop, meaning that they have to repair themselves 'on the fly.' Understanding this repair process would have some very important implications for successfully replacing people's worn out or damaged heart valves."

Currently, replacement heart valves are either made from synthetic materials or with chemically-treated tissues called bioprostheses. Bioprosthetic valves typically fail within 15 years, requiring another surgery. "If we can figure out how to replace the valves with live tissues that have the ability to repair themselves, then the need for ongoing replacements would be eliminated," says Aldous.

He's also studying how the composition of heart valves changes with age. Aldous has found that heart valve collagen becomes less stable at the molecular level with advancing age. This is the opposite of what is generally believed to happen in other aging tissues rich in collagen.

"Much of our research is groundbreaking and will have a significant impact on disease and damage prevention and recovery strategies."

Lee points out it's not always easy for his students. "They get most of their collagen-rich tissues from an abattoir in the Annapolis Valley," he says. "Some of the best collagen for heart valves is in a sac around the animal's heart: the pericardium. It essentially looks like a sheet of canvas yet it is absolutely integral to the school's research."

Although Lee seems to enjoy the fact that his students have to make monthly collagen collection trips, there is no question he's truly proud of his students and committed to their research.

This fall, during his thesis defence, Tom Willet will reveal the first evidence of how sprain injuries can lead to actual damage of the collagen molecules. One of Lee's former PhD students, Dr. Mark Glazebrook, is in high demand as a foot and ankle specialist at the QEII. And PhD student Marianne Arigannello is working on that proverbial chicken and egg question, to determine whether damaged collagen causes inflammation or if inflammation leads to damaged collagen.

"Much of our research is groundbreaking and will have a significant impact on disease and damage prevention and recovery strategies," says Lee. "I'm delighted that it's all happening here in Halifax." ■

A SOBERING EXPERIENCE

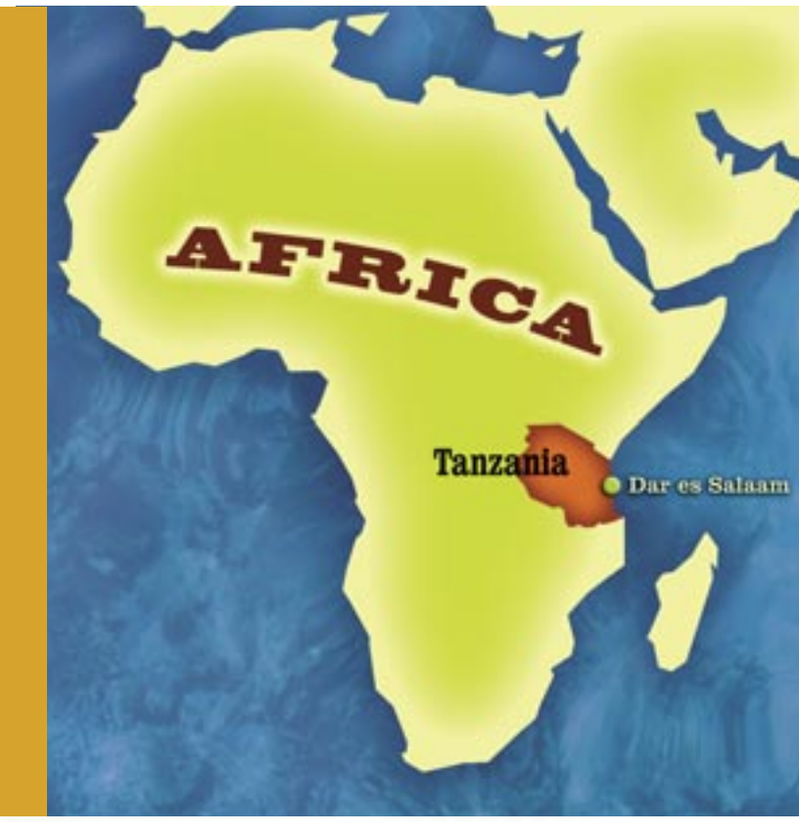
Sometimes the best research is conducted not in a laboratory but by getting immersed in other people's realities and considering them from a number of perspectives.

Last summer, students from several of Dalhousie's health professional programs did just that by spending three weeks on the east coast of Africa in Tanzania, one of the world's poorest countries.

Dalhousie Medical School's International Health Office (IHO) coordinated this study tour for students from a variety of health care programs. Twenty-one students made the trip: eight medical students, eight dentistry students, four nursing students and one pharmacy student.

"Even in our pre-departure preparation sessions, the students were incredibly excited to be working with those from other health professions," says Ashley Pinsent, IHO's manager of student programs. "The trip to Tanzania strengthened those bonds, as the students learned to look at extreme health care situations from the different professions' perspectives."

The inter-professional study tour to Tanzania is part of a larger strategic initiative for Dalhousie's Faculty of Medicine, Faculty of Dentistry and Faculty of Health Professions. These health care faculties have launched several joint research, training and clinical programs to strengthen the ability of diverse professionals to work together in teams.



"I was shocked by the enormous range of conditions the doctor saw in one morning, from elephantiasis and malaria to dog bites and bicycle accidents, syphilis and HIV."

The Dalhousie students spent two weeks in Tanzania's bustling capital, Dar es Salaam. They toured and attended lectures at the Muhimbili University College of Health Sciences. They also observed the work of Kimara Peer Educators, a grassroots advocacy group dedicated to teaching the truth about HIV and AIDS, and Kiwohede, a rescue and rehabilitation agency for young victims of human trafficking and other abuses. They spent another week in the village of Ifakara, observing rural health care.

"I was shocked by the enormous range of conditions the doctor saw in one morning, from elephantiasis and malaria to dog bites and bicycle accidents, syphilis and HIV," says Nicole Richard, a second year medical student. "They made diagnoses without the sophisticated tests we have here, [in Canada] and dealt with conditions that patients had let go far past the point where I thought help was possible. I was amazed by the talent and dedication of the health professionals in Tanzania; lack of education and skill is not the problem, but lack of funds and resources."

Plans are already underway for next year's inter-professional study tour to Tanzania. "It has been such a successful partnership," says Pinsent. "The students come back with a whole new perspective on the Canadian health care system and how they can contribute to international health." ■

Dr. Carolyn Watters

FINAL WORD

(We invite researchers to share their thoughts in Final Word, **OutFront's** *regular guest column. This edition's guest is Dr. Carolyn Watters, Dean of the Faculty of Graduate Studies.)*

Imagine Dalhousie University without its graduate students and postdoctoral fellows. It would indeed be a completely different place. Dalhousie's reputation as a research-intensive university is intrinsically tied to the productivity of its graduate students and post-docs, and the fact that Dalhousie "punches above its weight class" in national research funding can be attributed in part to their excellent work.

The breadth and depth of research opportunities at Dalhousie are remarkable, ranging from oceanography to genetic research to petroleum engineering to social anthropology to sustainable communities. Graduate students and post-docs experience research at the cutting edge with leaders in their discipline. *The Scientist* recognizes the high standing of our young researchers' experience with its designation of Dalhousie as "the best place for research outside the USA." Dalhousie is a leader in the promotion of interdisciplinary programs at the graduate level. It offers interdisciplinary programs at both the Master's and PhD levels and boasts the largest Interdisciplinary PhD program in Canada.

" *The Scientist* recognizes the high standing of our young researchers' experience with its designation of Dalhousie as "the best place for research outside the USA."

Graduate students and post-docs have an impact that goes far beyond research productivity at Dalhousie. The innovations and results from their work directly benefit the economy and society of Nova Scotia, Canada, and indeed, the world. While here, graduate students from nearly 100 countries provide a cultural diversity that enriches the entire academic community.

The competition for the very best graduate students has accelerated in recent years with other provincial governments implementing aggressive graduate recruitment and funding programs. Dalhousie University has recognized the need to be competitive at this level and has introduced the President's Awards to help with our recruitment. Dalhousie researchers have also benefited from the generosity of the Killam Trusts. This endowment typically funds up to 100 graduate students and 16 postdoctoral fellows each year at Dalhousie.

While the Faculty of Graduate Studies is best known for the administration of graduate student programs, our role is much more than that. We invest in programs that develop skills to complement the academic teaching and research excellence expected of our graduates including: career planning, presentation skills, time management, grant writing and public speaking, among many others.

The Faculty of Graduate Studies is very proud of the calibre and research productivity of our young researchers. We will continue to support them and to celebrate their successes in the future. ■

ICT – AN INTEGRAL PART OF DALHOUSIE

In 1997, Dalhousie University's Computer Science Department merged with the Computer Science Department of what was then the Technical University of Nova Scotia (TUNS). The resulting Faculty of Computer Science comprised 18 people who were located in a small suite of offices in Halifax's downtown core. Since then the computer science landscape, and indeed the Information and Communications Technology (ICT) theme, has changed profoundly at Dalhousie.

Today, the Faculty of Computer Science is housed in a modern, four-storey building at the heart of Dalhousie's campus. It will also soon occupy part of a new building being constructed for research activities.

Faculty of Computer Science

While the ICT outcomes at Dalhousie over the last decade are numerous, below are the top five:

- Significantly increased staff complement (by 100%) in Computer Science, housed in a new facility on campus
- Appointment of seven ICT-related Canada Research Chairs
- Improved ability to attract and retain accomplished and promising researchers
- Enhanced interdisciplinary graduate student training/research programs (three new master's programs have been developed and are now being offered to students)
- Increased competitiveness on the national and international research stage

This transformation did not occur by chance. Instead, it was a strategic response to a societal need and an up-and-coming trend. A decade ago, the provincial government concluded it would have to substantially improve the quality of IT training in Nova Scotia if the province was going to be part of the IT boom. The university leadership capitalized on this opportunity, collaborating with the provincial government to create an academic program that would help ensure a pool of educated workers for companies that might choose to establish themselves in Nova Scotia. It was also an opportunity for the university to strengthen its competitive position both on the national and international stage.

Instead of hiring a dean who possessed traditional academic experience and presence, Dalhousie went "outside the box" and recruited someone with an industrial and academic perspective to lead and develop the Faculty of Computer Science. As IBM's head of research, Dr. Jacob Slonim had strong industry connections that he could leverage when establishing programs and facilitating research at Dalhousie. His leadership was followed by Dr. Nick Cercone and now acting dean, Dr. Norman Scrimger.

Complementary initiatives are taking place in other faculties, due in part to the expansion of expertise in Computer Science. The Faculty of Engineering is expanding its capacities in networking, photonics and wireless technology. The Faculty of Management is increasing its capacity in information management, and the Faculties of Science and Medicine are expanding their capabilities in informatics through collaboration with the Faculty of Computer Science. ■

(Adapted from Dalhousie's 2007 ICT report to CFI)

ODDS AND SODS

Influential American magazine *The Scientist* has rated Dalhousie University as the best place to work in academia in its international category (American schools are ranked separately). The United Kingdom's University of Nottingham and the University of Helsinki in Finland join Dal in the top three. The magazine cited Dalhousie's "vigorous research atmosphere," and location in "the idyllic seaside town of Halifax, Nova Scotia" as benefits.

WILLIAM STANISH, an orthopedic surgeon and professor at Dalhousie University, has been awarded the Order of Nova Scotia. He has worked with top athletes since the Montreal Olympics in 1976 and served as chief medical officer for the Canadian Olympic teams in 1984 and 1988.

Doctoral student **ELAINE CRAIG** received a prestigious Trudeau scholarship, awarded to 15 recipients across Canada yearly. It will fund Ms. Craig's research into why different cultures and religions have not, to date, found significant commonality in their interpretations of human rights principles.

Master of Nursing student **DARLENE DAVIS** received the Norah Stephen Oncology Scholar Award. Cancer Care Nova Scotia funds the award to foster an interest in the field of oncology among undergraduate and graduate students in Nova Scotia.

Dalhousie and 10 other universities are taking part in a new research program aimed at boosting the economic development of Aboriginal peoples and communities across Atlantic Canada. The consortium will undertake a wide range of research in partnership with the Atlantic Policy Congress of First Nation Chiefs Secretariat Inc. The four-year program will develop research linked to the needs of aboriginal communities, as well as workshops to strengthen strategic decision making.

Congratulations to **CONSTANCE ADSETT** (Computer Science) and **ERIN JOHNSON** (Chemistry). They received the NSERC André Hamer Postgraduate Prizes, awarded to the most outstanding candidates in NSERC's master's (Constance) and doctoral (Erin) scholarship competitions. Each receives $10,000.

JOY ARMSON (Human Communication Disorders) received the Eve Kassirer Award for Outstanding Professional Achievement from the Association of Speech Language Pathologists and Audiologists. This prestigious award is presented to a CASLPA member who has made a significant contribution in the areas of education, clinical services, administration or public awareness.

Three new Canada Research Chairs (CRC) have been named at Dalhousie. **BRENDA BEAGAN** is a CRC in Women's Health, **KIMBERLEY HALL** is a CRC in Ultrafast Science and **NORBERT ZEH** is a CRC in Algorithms for Memory Hierarchies. Dalhousie now has 50 chairholders.

WILLIAM H. BALDRIDGE (Anatomy & Neurobiology and Ophthalmology & Visual Sciences) has received the Murray L. Barr Junior Scientist Award. The Canadian Association for Anatomy, Neurobiology and Cell Biology (CAANCB) presented it in recognition of his research on the mechanisms of retinal network adaptation and calcium dynamics of retinal ganglion cells.

Congratulations to **PENNY CORKUM** (Psychology) for receiving the 2007 Roger Broughton Young Investigator Award from the Canadian Sleep Society, in recognition of her important early career research contributions in the area of sleep. In particular, her research focused on sleep and ADHD (attention deficit hyperactivity disorder) in children.

Congratulations to **ALAN DALTON**, **GERARD BRAY**, **DAVID MACNUTT** and **SARA RENDELL** (Kinesiology) for receiving the top award in MOTRIN*IB's My Game My Pain national campus challenge for their *Ultimate Borden Ball: Wheelchair Edition.* The students donated their $2,500 prize to the Abilities Foundation of Nova Scotia toward the purchase of a specialized sports wheelchair.

HEATHER LUMMIS (Drug Use Management and Policy resident) has received the Gail McGlynn-Tuttle Memorial Practitioner Award. The Nova Scotia Branch of the Canadian Society of Hospital Pharmacists presents it in recognition of significant contributions to hospital pharmacy practice.

The Canadian Mathematical Society's 2007 Adrien Pouliot Award was given to **RICHARD NOWAKOWSKI** (Mathematics & Statistics). The award is an acknowledgment of Dr. Nowakowski's outstanding contributions to mathematics education locally, regionally and nationally.

Congratulations to **INGRID SKETRIS** (Pharmacy), who received the Canadian Pharmacists Association (CPhA) Centennial Award. This award recognizes 100 leaders and builders of CPhA and the profession of pharmacy in Canada over the past 100 years.

LIFE SCIENCE RESEARCH GETS A BOOST

L-R: Dalhousie President Dr. Tom Traves; Defence Minister Peter MacKay; Nova Scotia Premier Rodney MacDonald; Capital District Health Authority CEO Chris Power; Brain Repair Centre Chair, Dr. Ivar Mendez; and Dalhousie Dean of Medicine, Dr. Harold Cook. Missing from photo: IWK Health Centre Vice-President of Operations and Support Services Brian MacDougall.

The Government of Canada has confirmed $15 million in funding for the Life Sciences Research Institute (LSRI) and plans are underway to begin construction of the $42-million building next winter.

Dalhousie, Capital Health and the IWK Health Centre are the three governing council partners in the Institute. The LSRI's lead tenant will be the renowned Brain Repair Centre, which is dedicated to finding treatments for conditions such as Parkinson's disease, Alzheimer's disease and spinal cord injury. The LSRI will provide space where all brain-repair researchers can work together; they are currently working in separate labs located throughout Dalhousie Medical School, Capital Health and IWK Health Centre facilities. More than half a dozen leading local research groups are competing to determine who will occupy the remaining research space. One floor will be devoted to helping find and develop investment for commercially viable ideas.

In addition to Industry Canada funding, the Province of Nova Scotia and the Canada Foundation for Innovation have pledged support to the LSRI's capital costs; ACOA is supporting associated research. Financial commitments have also been made by a number of very generous private benefactors, including the Dalhousie Medical Research Foundation. ■

Correction: Dr. Paul Bishop's (***OutFront*** Spring/Summer 2007) title is associate professor in Materials Engineering.

OutFront RESEARCH THAT MATTERS

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