(e)AFFECT

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(e)AFFECT is published twice a year by the Office of the Vice-Principal (Research). The mission of our office is to stimulate, enhance and facilitate ethical research and scholarship at Queen’s by providing leadership, support and services to advance Queen’s position as a research-intensive university, while raising awareness of the excellence of Queen’s research and providing accountability to our stakeholders.

Our goal is: Helping people achieve excellence in research and scholarship.

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Dear Colleagues and Friends,

I am pleased to present to you the 5th issue of (e)AFFECT – an important issue as it marks a transition from the inaugural (e)AFFECT focus on the four themes of the Strategic Research Plan. However, in keeping with previous issues, we continue to look to the future, and in particular, the younger cohort of scholars who are leading us into it.

Queen’s has been home to some of the most respected scholars in Canadian society. Many of our distinguished faculty continue to make significant contributions throughout their careers and continue to be recognized with awards and prizes. Despite the fiscal challenges faced by all universities that impact on our ability to support faculty renewal and appointments, we have been privileged at Queen’s to attract a stellar group of young people to our ranks – most recently through the reinstated Queen’s National Scholar program, for example. This new generation of scholars has developed in a different world context, a different social and cultural context, and with new technologies that are allowing them to pursue their disciplines in unique ways. They have grown in a world where digital scholarship, data, and new collaborative models are beginning to dominate.

In this issue, our feature story introduces three of the youngest members of the Queen’s Cancer Research Institute – Drs. Andrew Craig, Penny Bradbury and Chris Booth – who approach the study of cancer and cancer care in three different, yet interconnected, ways that together help advance this research area. Our other stories are wide and varied, discussing ideas on the odd use of ostrich imagery in the Renaissance (Professor Una D’Elia, p. 17) to international criminal law concerning war crimes (Professor Darryl Robinson, p. 14). Even undergraduates are making a lasting impact at Queen’s – Troy Sherman has launched the exclusively-online peer-reviewed journal, Politicus, which provides undergraduate students with a vehicle to publish their own research. The common thread in almost every story in this issue is that it is told by a younger generation. Our future looks bright indeed.

I hope that you enjoy reading this issue and, as always, I welcome your comments and encourage you to explore, discover, and engage in the research enterprise at Queen’s.

Dr. Steven N. Liss
Vice-Principal (Research)
Across faculties and departments, Queen’s researchers are capturing headlines in Canada and around the world. Here are a few highlights from the past few months:

**A New President and CEO for PARTEQ Innovations**

In March 2014, Dr. Jim Banting (Artsci’93, PhD’97 Pharmacology) became the new president and CEO of PARTEQ Innovations. He brings to PARTEQ 15 years of experience in the life sciences sector and extensive expertise in business development. Banting began his career as a co-founder of the Queen's spin-off company, Vaxis Therapeutics Corp., and, most recently, he was head of business development for Sigma-Tau Pharmaceuticals Inc., a US company focused on meeting the needs of people with rare diseases. Previously, Banting spent six years in the business development group of the US biotechnology company, Human Genome Sciences, where he led the due diligence and negotiation of a number of in- and out-licensing, manufacturing, platform, and co-development related collaborations.

**Mark Chen named to Gray Chair in Particle Astrophysics**

Professor Mark Chen (Physics, Engineering Physics and Astronomy) has been named the Gordon and Patricia Gray Chair in Particle Astrophysics, previously held by Professor Art McDonald. Chen is currently the director of the SNO+ project, which builds on the first SNO project conducted at the Sudbury Neutrino Observatory (1999-2006) and will study the fundamental properties of neutrinos, including whether their matter-antimatter nature could contribute to why matter is dominant in the Universe, and hence why we exist. Chen proposed, led the development, and secured over $16 million in funding for converting SNO into the SNO+ experiment. The chair helps to further establish Chen as a leader in particle astrophysics and will facilitate research in the area.
What Matters Now: A Public Outreach Event

Research Matters is a public campaign which explores how Ontario university research affects everyday life and improves the way people live, work, and play. On May 21, 2014, they hosted What Matters Now: Kingston, which saw Ontario university researchers “pitch” their research ideas to a public audience who ultimately decided what mattered most to them. Queen’s own Professor Warren Mabee (Geography, School of Policy Studies) discussed his work on policy and technologies for renewable energy and explored the question “is ‘waste’ a relative term?” The event took place at Kingston’s Memorial Hall (City Hall) and was open to the public.

DID YOU KNOW…?

In 1981, Queen’s researcher Dr. Adolfo de Bold discovered atrial natriuretic factor (ANF), a naturally occurring hormone in the heart that regulates fluid volume in the body. Over the next two years, Dr. de Bold and Queen’s protein biochemist, Dr. T. Geoffrey Flynn, succeeded in purifying and elucidating the protein sequence of the hormone. The discovery and characterization of ANF would earn them the prestigious Gairdner International Award in 1986 for outstanding biomedical research. The novel discovery of ANF was issued several patents and is credited with opening up a new field of research which has resulted in multiple therapeutic and diagnostic applications in heart failure.

New Antifreeze Protein: Maxi

Professor Peter Davies (Biomedical and Molecular Sciences) and his research team have described a unique protein called Maxi in winter flounder, which prevents the fish from freezing. The notion of an antifreeze protein is not new – they have been described in fish, insects, plants, and microorganisms – but this particular antifreeze protein is significantly larger than the others, hence the name. Maxi also has a unique way of interacting with water. Unlike “normal” proteins that force water out of their core during their regular folding process, Maxi instead keeps icy water on the inside to help strengthen its structure.

This discovery could have tremendous implications in protein engineering for redesigning or selecting proteins to work at low temperatures. The group’s findings were published in Science (February 2014).

“DID YOU KNOW…?” is a recurring feature in (e)AFFECT. If you know of a Queen’s research discovery you would like to see in an issue of the magazine, contact research@queensu.ca.
Saving the raw material of research

By Tim Lougheed

For more than five decades, Nancy Ossenberg has been taking stock of skulls. Now a professor emeritus in the School of Medicine, she devoted her entire career to gathering and analyzing skull measurements from North America and beyond. Since 1960, she has amassed records for more than 8000 skulls, noting dozens of distinctive physical features for each and applying those data to describe the ebb and flow of various populations around the world.

In the mid-1990s, she had the foresight to have some 15 boxes of print records transcribed into electronic form. However, only recently did she work with the Research Data Centre of Queen’s University Library (QUL) to convert these 27 data files — stored in the venerable Borland Paradox database format on a vintage personal computer — into a single, well-documented database that is now available in a publicly accessible archive.*

“That information was right on the cusp of being lost,” says Jeff Moon, QUL Data Librarian. “Getting it cleaned up required Dr. Ossenberg to answer questions about things that we would never have been able to decipher. We would have been lost without that.”

This is just one example of how the Research Data Management Service is preserving the original materials from a project so that others can continue to study them. Moon can point to 11 of these completed archives, along with 15 more that are underway, spanning disciplines from nursing and biomedical sciences to law, economics, and sociology.
“Queen’s Library, in partnership with others at Queen’s and beyond, is well positioned and experienced to support researchers with this kind of research data management,” he explains. “Collaboration has been a key part of our success, and we work with a number of champions here on campus, including University Research Services, IT Services, the university librarian, the chief information officer and the vice-principal of research.”

Moon, who has spearheaded this initiative at Queen’s for several years, regularly approaches researchers who have acquired treasure troves of data that could be of wider scholarly interest. Another outstanding example involves the Globalization of Personal Data Project, conducted by the university’s Surveillance Studies Centre. Data from this major international, multi-disciplinary, and collaborative research initiative have been documented, archived, and made available to the world for further study.* *

“Ideally, researchers would think about the life cycle of their research from the outset of a project, and work to collect, document, and ultimately deposit their data for current and future researchers,” says Moon, who suggests that new funding requirements could mean there are many more of these projects to come.

The country’s three federal granting councils, NSERC, SSHRC, CIHR, as well as the CFI (collectively the TC3+), in collaboration with Genome Canada, have completed extensive consultations on a digital scholarship study (Capitalizing on Big Data: Toward a Policy Framework for Advanced Digital Scholarship in Canada) in anticipation of a policy requiring researchers to develop plans for the long-term management of their data.

“I think the floodgates could open on this,” concludes Moon, who eagerly awaits more information from the granting councils on their vision for data management plan requirements.

This transition is also likely to be accelerated by the fact that younger researchers invariably start their work with electronic sources. Sharon Murphy, who heads QUL’s Academic Services Division, says university libraries across Canada and abroad are regularly sharing their visions and best practices for making sure this on-line environment includes the richest possible source material.

She adds that QUL works closely with the Ontario Council of University Libraries, including the Dataverse Project and the Canadian Association of Research Libraries, the latter of which is spearheading the development of a national research data management network.

“The growth of digital scholarship presents us with new opportunities,” observes Murphy. “We have had a vibrant Social Science Data Centre for 27 years and we’re ideally situated to take part in this growth with our partners on campus and elsewhere.”

Building Digital Infrastructure

More than nuts and bolts

The archiving efforts of the Queen’s University Library are just one aspect of the ongoing evolution of Canada’s digital infrastructure, a term that might seem to refer only to mechanical matters such as computers and communications networks. But the Leadership Council for Digital Infrastructure has much broader priorities. This group of volunteers, made up of individuals and organizations with key interests in the subject, regards the expertise and data that drive this system as no less important than its hardware.

The council held its second annual summit in Ottawa this January, where participants identified such fundamental challenges as turning research data into a publicly-valued asset. The group concluded that government policy should reflect an understanding and appreciation of this asset, so that digital infrastructure can become even more relevant and effective.

Steven Liss, Queen’s Vice-Principal (Research), co-chairs the Digital Infrastructure Leadership Council with Jay Black, Simon Fraser University’s Chief Information Officer. In an article they wrote for the influential publication RE$EARCH Money, they pointed to an urgent need to enhance our ability to continue building our digital infrastructure.

“While Canada has made major strides over the past decade to build upon some of the key pieces of this ecosystem, efforts have been fragmented and the growth uneven,” they argued. “Currently, important data sets of value to Canadians at large are being lost forever because older data are not being digitized, or digital artifacts disappear through lack of long-term archival facilities.”

* http://library.queensu.ca/webdoc/ssdc/cntd
** http://guides.library.queensu.ca/rdm
Young talent at the Queen's Cancer Research Institute

BY ALEC ROSS
Most cancer patients in Kingston and the surrounding area receive treatment at the Cancer Centre of Southeastern Ontario, a shiny new facility attached to Kingston General Hospital that houses facilities for radiotherapy and chemotherapy, dietary counselling and other cancer support services. What these patients may not know is that, steps away, is the Queen's Cancer Research Institute, a four-storey building full of physicians and scientists who, on the front lines and behind the scenes, are figuring out how cancer works and improving the quality of cancer care in Canada and around the world.

Queen's established the QCRI in 2001 as a place where academics, practicing physicians, scientists, graduate students and postdoctoral fellows from across the cancer research spectrum could work in close proximity to, and learn from, each other. The idea was that research creativity and productivity could flourish if those doing it could easily communicate with each other instead of being isolated in silos on different parts of campus. Today, the institute is a hive of activity comprised of three closely linked divisions. The Cancer Biology and Genetics division houses researchers who investigate the biological origins of cancer. Staff in Cancer Clinical Trials manage and participate in national and international trials of cancer drugs and treatments such as radiation and surgery. The Cancer Care and Epidemiology division is concerned with learning more about what causes cancer and identifying strategies to improve the quality of cancer care.

To learn more about the research that occurs at QCRI, (e)AFFECT spoke with three mid-career researchers who are each making important contributions to cancer knowledge in Canada and around the world.

Dr. Andrew Craig
Cancer Biology and Genetics

When cancer is confined to a single site, it's often possible to remove the tumor through surgery, and sometimes this is enough to ensure a good outcome for the patient. However, if cancer cells break free from the tumor site and spread to other parts of the body – a process known as metastasis – more aggressive and systemic treatments are required and the survival rates of patients are greatly reduced.

To prevent metastasis, you first need to know how it works. Enter Andrew Craig, an associate professor in the Queen's Department of Biomedical and Molecular Sciences, whose QCRI research team studies human-derived cancer cells. In the lab, they remove certain cancer-cell genes thought to be involved in metastasis to see whether this affects the cell’s ability to breach a protein-rich barrier that encircles the tumor. They have found that if key pathways in cancer cells are altered, the ability to break through the barrier is impaired. The next step is to see what happens to the same altered cells in an animal model of cancer metastasis.

So far, Craig's lab has identified several proteins that play a role in cancer metastasis, particularly in breast, lung and skin cancer (melanoma) – cancer types that are prone to spread to other parts of the body. The long-term plan is to use this knowledge to develop a new type of cancer therapy that specifically targets aberrant proteins or enzymes that enable cancer cells to metastasize. In some patients,
this type of therapy could complement existing therapies that target rapidly growing cancer cells.

Craig is also investigating the role that normal white blood cells (the basis of our immune system) may play in metastasis. There is evidence that cancer cells can co-opt white blood cells to aid the metastasis process, in effect upending their normal disease-fighting function. Craig and his collaborators are working towards a type of therapy that will “awaken” the white blood cells so that instead of remaining passive or ineffective against cancer cells, they actively attack them.

“To me it’s a very exciting time for cancer research,” says Craig, who earned the 2011 Young Investigator Award from the Canadian Cancer Society. “In addition to developing better targeted therapies against the tumor, we can also find therapies that reenergize our immune system to finish the job and prevent metastasis.”

Dr. Penny Bradbury
NCIC Clinical Trials Group

Every day, somewhere, cancer researchers like Craig make a discovery deemed by their peers to be worthy of further study. This is when clinical trials come into play. Clinical trials are carefully controlled tests that provide understanding about new treatments for cancer and other diseases. Phase 1 trials take place in the early development stage of a treatment and involve a small number of patients who try it so researchers can learn more about side effects and dosage. A Phase 2 trial provides preliminary evidence of efficacy and benefit in a larger population of patients, while a Phase 3 trial may involve hundreds or thousands of patients in a single country, or many countries. It’s the gold-standard test that compares the new treatment with the current standard treatment to determine whether the new one is an improvement.

“People often assume that a new drug must be better, but that’s not always true,” says Dr. Penny Bradbury, a practicing medical oncologist and assistant professor in the Queen’s Department of Oncology. “It’s critical to do clinical trials to understand what the best treatment strategies for patients really are.”

Within the QCRI’s Cancer Clinical Trials Division, Bradbury is the senior investigator at the NCIC Clinical Trials Group (NCIC CTG) for clinical trials involving lung disease. As such, she works closely with other lung-cancer experts at approximately 60 NCIC CTG-affiliated hospitals across Canada and internationally to identify promising treatments – these days, typically targeted lung cancer drugs. Once a treatment is chosen for a trial, Bradbury leads a team at NCIC CTG to guide the trial from concept development to activation and analysis.

Clinical trials are complex and labour-intensive research projects. Bradbury ensures that the trial protocols are being followed to the letter, monitors safety aspects related to the trial, and ensures the data flowing in from all the different hospitals are consistent and error-free before they are analyzed and interpreted. It’s incredibly detail-oriented and time-consuming – a Phase 1 trial may take 18 months or longer to complete, but a large international Phase 3 trial may take many years.

“We always want that positive study, because it may change practice and will help patients and patient outcomes,” says Bradbury, who also holds a Cancer Care Ontario Research Chair in Experimental Therapeutics. “But a successful clinical trial is equally one that’s been well conducted and answers the research question. It may be negative, but you can learn from it – you take what you can from it and then change tack.”
Dr. Chris Booth
Cancer Care and Epidemiology

It’s natural to assume that a cancer drug or treatment that survives clinical trials and enters routine practice will perform as it did during the trials. But that’s not always the case – and there are good reasons why.

To be part of a clinical trial, patients must have the disease or condition that the trial treatment is designed to address, but otherwise they are usually reasonably fit, young, active, and free of other diseases that might complicate the interpretation of trial results. As well, trial patients are treated by specialists at state-of-the-art cancer hospitals. In other words, the strict eligibility criteria that apply to clinical trial subjects don’t necessarily apply to everyday patients, who more often than not are elderly, have multiple illnesses and are treated in hospitals big and small.

“Results of clinical trials reflect what happens when a new drug is given to ‘Olympic’ patients, by ‘Olympic’ doctors and nurses in ‘Olympic centres,’” says Dr. Chris Booth, a medical oncologist and associate professor at Queen’s. “But what happens when you take potentially toxic medications that have been given to these ‘Olympians’ in tightly-controlled situations and treat thousands of patients who are older, sicker, with other co-morbidities, and who are treated by real doctors in the real world?”

To answer this question, Booth analyzes data in the Ontario Cancer Registry and provincial treatment records, a massive repository of population-based data about every cancer patient in Ontario. It contains decades’ worth of anonymous information about cancer type, the patient’s age, treatment, long-term survival, geographic location and a host of other factors that together paint a vivid picture of cancer care and outcomes in Ontario. For cancer health services researchers like Booth, the registry is a gold mine of information that can offer vital clues about changes in cancer incidence, how it is being treated, whether there are gaps in care that need to be addressed as well as patient outcomes achieved in the “real world.” Another Queen’s professor of oncology, Dr. Bill Mackillop, pioneered the use of the Ontario Cancer Registry for health services and outcomes research in the early 1990s, and successfully lobbied for Ontario’s chemotherapy and radiation treatment records to be made available for research.

One way Booth’s work has made a difference involves an investigation on the use of adjuvant chemotherapy in patients who have had surgery for lung cancer. An international clinical trial led by the NCIC Clinical Trials Group and published in 2004 showed that adjuvant therapy improved the survival rates of lung cancer patients by as much as 15 percent. It was a landmark finding that, almost immediately, changed treatment recommendations worldwide. Subsequent research by Booth and colleagues showed that “real world” patients treated in Ontario derived a survival benefit very close to that seen in the clinical trial. But while use of adjuvant therapy for lung cancer increased after 2004, the increase was not as much as expected. The study also revealed that some cancer hospitals in the province used adjuvant therapy more often than others – thus opening the door for further improvement in care and better outcomes for patients with lung cancer in Ontario.

“Society invests a huge amount of time and money towards finding new treatments for cancer,” says Booth, “but if we invest some of those resources to ensure that doctors do some of the things that we already know work, the population health benefits would be enormous.”
Follow the trail Professor Bill Nelson’s research is blazing and you’ll end up in a room in the basement of the Biosciences Complex. There, after donning a lab coat and elasticized booties that slip on over your street shoes, he guides you into a screened-off area filled with boxes created out of hard pink insulation, resting on industrial shelving, each connected by hoses to a noisy cooling system sitting in the corner. Those boxes, each kept at a separate temperature, house Japanese tea tortrix moths at the different stages of their life cycle – egg, larva, pupa, and adult.

“What I do, if you want to put a name on it,” Nelson says, “is physiologically-structured population biology – in my case by bringing together mathematical and experimental biology.” Simply, explains Nelson, a member of the Queen’s Department of Biology, most traditional ecology focuses on total populations. It looks at predator and prey relationships, the rise and fall of entire populations, but never generally pays much attention to the individual members of the population under study. Nelson, by contrast, focuses on the individuals, in particular where they are in their life cycle, and how this generates much bigger population changes. Using data gleaned by studying the life stages of individual members of a species in the lab, he creates mathematical models that can be used to provide insights into the behaviour of larger animal populations in the natural environment. His goal is to understand the “underlying fundamental principles behind population dynamics.”

Nelson’s initial insights into the importance of the individual in these dynamics came from his work on the zooplankton known as Daphnia (a.k.a. the water flea). This incredibly common plant-eating microorganism, Nelson calls them “the cows of the lakes,” is found in abundance in freshwater everywhere.

Considered at the population level, and following standard ecological models, the expectation would be that numbers of Daphnia in any population should oscillate...
wildly as their food supply increases and decreases. “In those systems,” says Nelson, “you expect crazy cycles. But you never see them.” Instead, Nelson found what altered was the length of time juveniles took to become adults. The less food, the longer each member took to reach maturity, which prevented the expected wild cycles.

Nelson continues to work with *Daphnia*, and has also expanded his research to examine the importance of the life cycle in bean weevils — drawing him away from his initial work as a freshwater biologist to concentrating on terrestrial insects. His goal, always, has been to “push his research,” and take it in new directions.

Five years ago, he got his chance. For more than 50 years, Japanese scientists have been conducting population counts on a moth known as the tea tortrix at one tea plantation in Japan, counting its numbers every five days. “Fifty years of data,” says Nelson. “I had never come across a system like this before.”

The tea tortrix is known as an “outbreak species” — the moth’s population is liable to erupt suddenly, four times in some years, five in others. This is a particularly undesirable behaviour in what is, after all, a pest species, and over the years, tea planters had tried a wide range of methods to control these outbreaks. “Everything,” Nelson says, “from DDT, to mate disruption pheromones, bacteria, viruses – none of these control strategies had any effect on population dynamics.”

“Fifty years of data,” says Nelson. “I had never come across a system like this before.”

Scientists have long known that changing temperatures have an effect on the individual development of insects. Could the effect of temperature explain the tea tortrix’s outbreaks? The challenge for Nelson and the scientists he has teamed with — Ottar N. Bjørnstad at Penn State University and Japanese scientist Takehiko Yamanaka — was to replicate natural variations in temperature in the laboratory, hence those pink boxes. Each is maintained at a different temperature to allow Nelson and his students to observe the effects of both constant and changing temperatures on small moth populations.

Nelson’s research suggests that the effects of temperature on individual development lay behind the outbreaks. The population of moths would be stable until “you hit 12 degrees,” says Nelson. “Then boom,” the moth’s population erupts. From the data they had collected in the lab, generally studying how fast larvae matured, Nelson was able to create a mathematical model that predicted the outbreaks. When this model was compared to the 50 years of data, the correspondence between them was immediate and obvious.

Understanding the role of temperature in a pest species can help us to control it. It may also point to future problems caused by climate change — in a warmer world, outbreak species such as the tea tortrix moth may be an even greater problem. For Nelson, however, there are fundamental questions still to be answered. Why does the moth have these outbreaks? What is the evolutionary explanation?

“I plan to spend the next five years trying to find out.”
Chemist Anne Petitjean rhymes off her childhood influences with ease – the work of Louis Pasteur, a desire to be an artist, and a need to answer life’s mysteries from the “bottom up.” She found convergence of these interests in supramolecular chemistry, a field she describes as “molecular sociology … how [molecules] behave together, the way they interact, the way they feel each other, recognize each other, sense each other.” The field applies to everything from materials science to medicine and environmental studies.

Like Pasteur, Petitjean’s approach to research is “to feel what society needs and be aware of where your chemistry takes you.” One of her favourite targets is DNA, which has the most predictable structure of the large, biologically important molecules. Most DNA molecules at rest in our cells have a double helix shape – with pairs of nucleic acids arranged in a twisting ladder. The arrangement is compact and keeps our genetic material safe, buried inside the helix.

But cells are dynamic and when DNA’s information is read, the molecule’s architecture transforms into folds, loops, and other secondary structures. It is these temporary structures Petitjean finds most interesting for they are “responsible for life.” Her favourite secondary structures are the guanine quadruplexes. Guanine is one of four nucleic acids in DNA, and it forms quartets – squares that lie flat, stacked like pancakes, turning a section of the DNA ladder into a wide staircase. With 23 known structural variations and a number of specific functions, Petitjean is revelling in quadruplex mysteries.
Telomeres, the ends of chromosomes, are comprised of these quadruplexes, but they occur along the DNA strands as well. Petitjean thinks they play a major role in pacing DNA processing by creating a “bulge” that stalls proteins reading a strand. The proteins cannot progress past a quadruplex bulge, so reading of the DNA stops, and gene expression is prevented.

Quadruplex folding differs between healthy and cancerous cells, so targeting quadruplexes is one anti-cancer strategy. In normal chromosomes, telomeres are chopped down a little after each replication. When the telomere becomes too short, the cell ceases to divide. In cancer cells, the telomeres elongate again after replication and division never stops. Petitjean’s lab has created a small molecule that interacts with telomere quadruplexes, preventing elongation, and slowing down cancer. However, the lab has accidentally discovered that exposing DNA to this manufactured molecule and X-ray radiation does more than slow down cancer cells, it kills them. Petitjean is not sure why the combo is effective, but it might have to do with their invented molecule interacting with quadruplex folding along DNA strands, preventing repair, and thus enhancing radiation’s efficacy.

Accidental discoveries like this seem to be commonplace in Petitjean’s lab, though it is not just luck but open-mindedness that contributes to the revelations. Petitjean says, “In science, you start with a hypothesis, it takes you maybe to where you thought you were going, but most often it takes you somewhere else.”

Another unplanned line of inquiry pursued by Petitjean started with a molecule made while “playing” in the lab. The molecule has a tiny pore, and Petitjean was quick to take note that the pore is the size of a calcium ion. In solution, they tested to see if calcium interacts with the molecule. They were not disappointed. Not only does the molecule bind to calcium, but it also likes to “align itself in a regular cylinder.” What they’ve made is a channel for calcium. Now they’re working on whether this molecule can self-assemble as a channel in a cell’s membrane. Such calcium ion channels function in the body to control the influx of calcium into cells, particularly in muscle and nerve tissues. It is Petitjean’s hope that this artificial calcium channel might someday have applications in medicine. With discoveries like these, Petitjean’s childhood hero, Pasteur, would be pleased at how well she embodies his famous words, “chance favours the prepared mind.”
The Complicated Realities of Justice

BY ALEC ROSS

Darryl Robinson
In July 1995, Dražen Erdemović, a soldier in the Bosnian Serb Army, was dispatched with his military unit to a village in Bosnia-Herzegovina near the Serbian border. There the soldiers were ordered to execute approximately 1,200 Bosnian men and boys who had surrendered to the army near Srebrenica. Erdemović resisted the order, but his commander told him to participate in the massacre or be shot himself. Erdemović chose the former. He later estimated he’d killed about 70 men and boys who, like the other victims, were buried in mass graves.

In a few months the three-year Bosnian War was over and Erdemović was a free man, albeit one tortured by a guilty conscience. Eventually he described the massacre and his role in it to an American reporter. Soon after his videotaped confession he was arrested and charged with crimes against humanity by the International Criminal Tribunal for the former Yugoslavia, which sentenced him to ten years in prison. His term was subsequently reduced and Erdemović was granted early release in August 1999.

Erdemović’s tale illustrates some of the legal and moral issues inherent in crimes against humanity, genocide and war crimes. Must a soldier be held responsible for atrocities he committed under duress? If the answer is yes, how much leniency, if any, should be granted during sentencing to acknowledge the duress? How does a mass murder committed during war differ from one committed during peacetime?

These and other difficult questions also consume Darryl Robinson, a professor at Queen’s Faculty of Law. He specializes in international criminal law (ICL), which is applied by international criminal tribunals that deal with war crimes. Robinson came to the field by happenstance about 15 years ago, when he was a newly-minted lawyer doing volunteer work for human rights organizations. He was soon recruited as a legal officer in Canada’s Department of Foreign Affairs, helping to develop international criminal law and institutions. He helped draft the Statute of the International Criminal Court, which is now established in The Hague, the Netherlands. The court is investigating and prosecuting mass atrocities in eight different countries. For three years Robinson worked as a legal adviser in the prosecutor’s office.

Robinson came to Queen’s in 2008. Since then his research has focused on identifying and refining universal criminal law principles, or doctrines, that transcend national legal systems and facilitate the fair and just prosecution of war crimes. The ultimate goal of his scholarship is to help create a body of international criminal law that enables war-crimes tribunals to function in a way that is neither unduly harsh nor too lenient, while accounting for the extraordinary circumstances – the shockingly-high body counts, the breathtaking extent of state-sanctioned brutality – typically associated with war crimes.

The tribunals lose credibility if they act as mere “conviction machines” – bodies that render a guilty verdict for most defendants almost by default – or are so obsessed with narrow interpretations of criminal law and procedure that they give war criminals lax sentences or let them walk free because of a legal technicality. Neither instance results in the appearance or reality of justice.

Robinson’s theoretical work draws on international criminal law as it is currently practiced, national criminal law systems, and moral philosophy. Each of these sources has strengths and weaknesses in terms of informing ICL, an area of law still in its infancy. Robinson suggests that principles derived from national systems can provide a source of inspiration about commonly shared intuitions of justice. However, the extreme and abnormal contexts of mass atrocity can raise new questions. Thus, not only can national criminal law theory illuminate ICL, but the special problems of ICL can illuminate criminal law, exposing parameters and limits in what appeared to be elementary principles.

“If we are exercising law on behalf of humanity,” says Robinson, “then we have to exercise that law with humanity.”
Risky business: Understanding the Economy

BY LOWELL COCHRANE

Morten Nielsen smiles patiently as I ask him if his work will help avert the next financial crisis. “It might… but that is a little like asking a theoretical physicist if his work will make stronger bridges. My work in econometrics is theoretical and involves developing mathematical and statistical tools to analyze economic data in various ways.”

Dr. Nielsen, a professor of economics at Queen’s, holds both the David Chadwick Smith Chair in Economics and the Canada Research Chair in Time Series Econometrics. His research creates tools to uncover the intelligibilities in economic data. “And yes,” he adds, “hopefully those tools can be used by others to avoid the next financial crisis.”

Nielsen wants to make it clear that his work does not involve recommending which actions governments should take, or what policies they should follow. Rather, his research takes its starting point from revealed shortfalls of current theory and develops tools that empirical economists need to make better predictions about the economy, and that policy makers want to model the effects of new policies.

For instance, even though many economists commented how obvious the warning signs were after the fact, almost no one predicted the economic crisis of 2008, let alone its timing. Assessing and predicting volatility and risk in markets is one of the greatest challenges in modern economics, a fact laid bare by the last crisis. It seemed that certain basic assumptions about the economy didn’t seem quite up to the task.

Nielsen tackles one of these assumptions in his research into the effect of past data on future events in a market. In econometrics, this idea is called “long memory.”

“What that means,” Nielsen explains, “is that the past data of a particular variable in the economy is highly correlated to its future behaviour.” In analysis of, say, stock market returns, the assumption is typically the opposite. And for good reason. To suggest that there is memory in returns data is a little like saying that if you flip a coin, whether you flipped heads or tails on the previous turn has some influence on what you’ll flip next. Which is just not how the world works. Even though, as you keep flipping, the ratio of heads to tails approaches 50/50, there is certainly no memory in coin flipping – each coin-flip is independent of the one that came before. More or less, the same is assumed for stock market returns over time – that is, one day’s returns offer no correlation to tomorrow’s. As Nielsen explains, “the assumption is logical in the sense that if future returns were in any way predictable from past events, people would do it and make bazillions. Since no one is doing so, that seems to indicate there is no memory in stock market returns.”

However, for the past 30 years or so, empirical researchers have been finding more and more evidence of long memory in many other economic and financial data. The implication is that the data of economies are not like the data of coin flips – at least not universally. Rather, there is memory in the data that can be used to predict the future. However, the great challenge remains to tease out the variables in the data that are correlated over time. And that requires very sophisticated tools which Nielsen and his colleagues are still developing.

One recent success by Nielsen and his colleagues was to collect data from the pricing of futures and use those data to predict future volatility in the underlying markets. Futures traders try to predict the future volatility of the assets in the underlying market (e.g. stocks) in order to price futures contracts 30 days or so into the future. So by looking at the data from the entire futures market, Nielsen was able to tease out a level of implied volatility in the underlying market and thereby better predict the volatility, or risk, of the assets in the underlying market.

These are exactly the tools needed by economists working in industry and government, whose job it is to be able to see the signs of risk in the market before crises happen. And this progress will only be made by researchers such as Nielsen who are attending carefully to the data to gain mathematical insights that will in time reveal more and more the hidden patterns of our economy.
The Ostrich: An Unexpected Allegory

BY MELINDA KNOX

The ostrich, the world’s largest and heaviest bird, is quite a curious looking creature with its long and skinny neck, small head, prominent eyes and legs that seem to go on for miles. For centuries, the strange form and habits of this flightless bird known as the *Struthio camelus* or “sparrow camel” both baffled and amazed ancient, medieval, and Renaissance scientists who encountered it. They viewed the peculiar creature as a hybrid – half bird, half beast.

For the past few years, associate professor of art history Dr. Una D’Elia has been on an ostrich hunt throughout most of Italy and other parts of Europe. Exploring museums, palaces, places of worship and archives, she has uncovered dozens of images of the exotic bird. This may seem like a curious quest, but D’Elia was initially drawn to the bird because of its strange but deliberate use in one of the last paintings attributed to the revered high-Renaissance artist, Raphael. On the wall of the Sala di Costantino in the Vatican Palace, Raphael painted the well-known figure of Lady Justice (page 19). But there is something strange here – in one hand, she holds the traditional attribute of the scales, but her other hand, rather than wielding the customary sword, is curled around the neck of an alert, realistic and aggressively ugly ostrich. Why? How would Renaissance visitors to the Vatican have understood this weird interloper?

Such questions sparked D’Elia’s interest in the strange allegorical imagery of the 16th century and are the subject of her forthcoming book, *Raphael’s Ostrich* (Penn State 2015), which follows depictions of the ostrich through many permutations and shifts in its meaning.

In an age before Darwin, this enormous bird with its “useless” feathers was a living enigma. D’Elia explains, “Ostriches are central to Egyptian beliefs about the passage to the underworld. They were also hunted in the Roman Coliseum and served up at lavish banquets. In the Middle Ages and Renaissance, they were objects of curiosity in menageries and of study for scientists. Their strange form and habits were read as moral lessons written in the book of nature, in that these beasts were both reviled as images of heresy,
stupidity, and gluttony and praised as exemplars of stoic endurance, among other qualities.” When the ostrich was depicted in art before Raphael, it was often miniaturised and used as a flat symbol with an obvious meaning. For example, ostriches were frequently depicted with a nail in their beak as a symbol of toughness because of their fabled ability to digest iron.

Raphael’s image of the ostrich was drastically different. In the large, naturalistically-painted bird Raphael veiled the meaning and evoked a hidden knowledge — a sort of modern hieroglyph. Raphael’s invention forces us to ask a profound question — how the natural world is imbued with meaning — that D’Elia reveals came to a crisis with the rise of the foundations of both modern art history and natural history.

After his death in 1520, Raphael was enshrined as a god of art, and his work was worshipped and copied over and over. His strange conception of the ostrich became a kind of a classic, which could be imitated, emulated and satirized. However, not only did his followers copy the allegory of the ostrich as justice, they played with it in all sorts of ways, gave new life to the bird, and created their own allegories. D’Elia believes that the ostrich ultimately represents a new tradition invented by Raphael — one that gives free rein to the imagination.

Her unique research on the ostrich has allowed D’Elia to reveal a whole other side of Raphael and a Renaissance far weirder than the classic view. And when you take a closer look, after Raphael ostriches are everywhere — men and women played memory games that involved ostriches, danced in ostrich costumes, collected prints of ostriches, made scientific studies of ostriches, wrote poems about ostriches, invented fantastic ostrich tableware, and painted and sculpted the flightless bird in churches, palaces, villas, pilgrimage destinations, and parade floats. By examining the “vivid oddities, such as the ostrich, we reveal fundamental issues about art, the natural world, the role of fantasy, and the ways in which images convey meaning in the Renaissance.” And this is a story that cannot be told without the ostriches.

Quick facts about ostriches:

• The ostrich is the world’s largest and heaviest bird, growing up to 10 ft. tall and weighing up to 350 lbs.
• The ostrich is the only bird with two toes on each foot — one reason it was likened to a camel.
• While they cannot fly, the ostrich can run at speeds of up to 70 km/hr.
• Ostriches have the largest eyes of any land animal and the smallest brains in ratio to their body size.
• The ostrich was originally native to the Middle East and Africa, which is why ostriches are invoked in the Bible. The Middle Eastern ostrich was hunted to extinction in the feather boom of the 19th century.
• Contrary to popular belief, the ostrich does not bury its head in the sand when threatened, but it does eat iron, and so our view of the ostrich is even less accurate than the Renaissance one.

D’Elia carried out much of her research for Raphael’s Ostrich while a Fellow of the Villa I Tatti, the Harvard Center for Italian Renaissance Studies in Florence, Italy. This prestigious fellowship, granted annually to only 15 Renaissance scholars around the world, allowed her access to rich resources such as the Biblioteca Berenson and notoriously difficult-to-access spaces such as the Bibbiena Apartments in the Vatican. She is pictured here in the WD Jordan Library Special Collections and Music Library at Queen’s, which contains a number of rare, early printed ornithological and architectural treatises with splendid woodcut illustrations.
Raphael’s oil mural Lady Justice in the Sala di Costantino, Vatican Palace, 1519-20. Replacing the traditional sword in Justice’s hand with a naturalistically-painted ostrich, Raphael paints an enigma. The ostrich had meant many things in the Middle Ages and Antiquity, but not justice. Instead, Raphael’s invention is based upon a Renaissance understanding of ancient Egyptian hieroglyphs. In ancient Egypt, the soul’s passage to the underworld was determined by weighing the heart against an ostrich feather, and so the hieroglyph for justice is an ostrich tail feather. Raphael brought this arcane hieroglyph to life and playfully hid the tail, forcing the viewer to search for the meaning. Justice is labeled, but what is the bizarre exotic bird doing in the halls of power of the Vatican?

Cesare Baglione and others, grotesques, detail with an ostrich, fresco, Sala degli Acrobati, Castello di Torrechiara, 1583. The nail-eating ostrich is at home among the hybrid monsters and delicate fantasies of grotesques, a classically inspired form of decoration that was also spearheaded by Raphael earlier in the century. The flightless, huge, heavy bird is made impossibly light, supported only by a piece of cloth delicately draped between two likewise floating supports—a real creature transformed into an airy daydream.

Baldassare Peruzzi, Michelangelo Sanese and Tribolo, Lady Justice, Tomb of Pope Hadrian VI, marble, Santa Maria dell’Anima, Rome, 1523-33. This richly decorated tomb with its marble ostrich, made by one of Raphael’s followers, commemorates an austere Dutch pope, who detested pagan classical statuary and humanist learning. It is ironic that even in honoring this severely pious moralist, the fantastic ancient Egyptian ostrich rears its head next to a splendidly classical Lady Justice.
Each year, Queen’s celebrates major research contributions of faculty members in the humanities, social sciences, natural sciences, health sciences, and engineering. We asked each of the 2013 winners about their accomplishments, inspiration and the words they live by.

**Dr. R. Kerry Rowe** is the Canada Research Chair in Geotechnical and Geoenviromental Engineering in the Department of Civil Engineering, a Fellow of the Royal Society (London) and the Royal Society of Canada, and a former President of the Engineering Institute of Canada and International Geosynthetics Society. He has been recognized with over 75 prominent research and teaching awards including the Killam Prize for Engineering.

**What is your inspiration?** My primary inspiration is working with bright young minds to solve unsolved problems that have significant societal impact.

**What is your greatest research challenge?** For the past 30 years my biggest challenge has been assessing the long-term performance of liners for landfills and the clean-up of contaminated soils. The current challenge relates to liner applications arising from mining. A few examples include brine ponds which act as collectors of solar energy and heat liners to >90 C, as well as liners for tailings dams that require a service life of millennia.

**Favourite Quote:** "The reason a lot of people do not recognize opportunity is because it usually goes around wearing overalls looking like hard work.”
– Thomas Edison

**Dr. Richard Birtwhistle** is a professor in the Departments of Family Medicine and Public Health Sciences, the director of the Centre for Studies in Primary Care, and the chair of the Canadian Primary Care Sentinel Surveillance Network (CPCSSN). He was named Family Medicine Researcher of the Year by the College of Family Physicians of Canada in 2010.

**Do you see yourself as a doctor or researcher first?** I have always considered myself a doctor first because I came to be interested in research after I was in practice for a number of years. Providing care to people takes precedence and is never far from my thoughts even when I am doing or presenting research. I think that practicing medicine helps us to understand what the important research questions are and makes your research more relevant.

**What is a challenge of your research?** One of the challenges for the CPCSSN will be to improve the structure of where coded data are put in the electronic medical records. If agreed upon categories are developed, coded and stored, it will be much easier to extract the information.

**Favourite Quote:** "One of the essential qualities of the clinician is interest in humanity, for the secret of the care of the patient is in caring for the patient.”
– Francis W. Peabody
**Dr. Troy Day** is a professor in the Departments of Mathematics & Statistics and Biology, the editor of *The American Naturalist*, and a Fellow of the American Association for the Advancement of Science. In 2012, he received the Canadian Applied and Industrial Mathematics Society Research Prize.

*Why the combination of math and biology?* I always liked the structure and discipline of mathematics, but viewed it mostly as solving puzzles for the sake of the puzzle itself. So I switched around a lot in my undergrad, from pre-med to math to microbiology and then to education. It wasn’t until my final undergraduate year that I learned about evolutionary biology as a unifying principle in biology and one that had the flavour of mathematics as well.

*What is a challenge for your research?* One interesting challenge will be to integrate the vast amounts of genomic and bioinformatics data that are now being produced into an evolutionary perspective.

*Favourite Quote:* “Like most mathematicians, he takes the hopeful biologist to the edge of a pond, points out that a good swim will help his work, and then pushes him in and leaves him to drown.”

– Charles Elton

**Dr. John Burge** is a professor of theory and composition in the School of Music and is a board member of the Society of Composers, Authors and Music Publishers of Canada (SOCAN). Amongst many awards for his compositions, he received the 2009 Juno Award for the Best Classical Composition for his string orchestra work, *Flanders Fields Reflections*.

*Why music?* In high school, I was blessed to have a wonderful piano teacher named Dorothy Hare who taught me concepts about music and music-making that I draw upon to this very day. For whatever reason, my mind seems to be hard-wired to always be thinking about composing and solving composition problems and I could not imagine doing anything else.

*Advice for Young Composers:* For any young composer starting out today, you must embrace technology while developing an understanding of a wide variety of musical styles and genres ... your own musical voice will be richer from such a wide knowledge base.

*Words to live by:* Being always focused on the end result of trying to create something of lasting significance, a creative artist doesn’t count the hours spent striving for perfection.

**Dr. W. George Lovell,** a historical geographer of Latin America, has been a member of the Queen’s Department of Geography for 35 years. A former editor of the scholarly journal *Mesoamérica*, he has eleven book titles to his credit. In 2012-2013 he was a Killam Research Fellow.

*Why academia?* Back in 1930s Glasgow, my mother was the top pupil (dux) of her elementary school, but family circumstances meant that she had to leave high school early to find work and earn a wage. She always wanted one of her children to do what she was curtailed from doing, and get a good education. I was the lucky one.

*Greatest accomplishment:* Receiving the Carl O. Sauer Distinguished Scholarship Award. Sauer was the greatest geographer of the 20th century. One of Sauer’s doctoral charges, Henry F. Bruman, supervised my doctoral supervisor, John F. Bergmann. That means, intellectually speaking, I am Carl Sauer’s great grandson — I am immensely proud of that.

*Words to live by:* “The lesson lies in learning, and by teaching I’ll be taught,” is a Keith Reid lyric to a song of the rock band, Procol Harum. A good professor cannot separate teaching from research, because the classroom is best place to test and present research.
Living in a Debtfare State

BY ALEC ROSS

Susanne Soederberg
Household debt in North America has reached record levels owing to an unprecedented accumulation of consumer debt. In the United States, student loans total more than $1 trillion – more than all auto loans and credit card loans combined. Since the 1990s, a particularly pernicious form of debt has emerged. “Payday loans” are short-term loans taken out by people who need a few dollars to tide them over until their next paycheck arrives. Issued by private lenders, payday loans often come with annual interest rates that average 400 per cent.

Today, growing numbers of the working poor routinely use consumer credit to cover daily expenses, and many fall behind on their payments. Because harsh penalties are attached to late payments, the debt load quickly adds up and plunges the already cash-strapped borrower into deeper financial trouble. This scenario is being repeated hundreds of thousands, perhaps millions, of times. “All this debt, and by extension, the underlying credit-fuelled growth that dominates the global economy, is clearly destructive of people’s lives and a threat to the global economy, yet why is it that little is being done to fix this new normal?” asks Susanne Soederberg.

Soederberg is a professor and Canada Research Chair in Global Political Economy of Development in the Departments of Global Development Studies and Political Studies. For the past 15 years, first at the University of Alberta and now at Queen’s, Soederberg has been exploring the institutional and regulatory landscape of global finance and how it affects democracy, economy, public policy and the lives of everyday people.

“Although economists, the media and scholars represent finance as a technical, natural and apolitical phenomenon best left to the experts to manage and explain, its core component – privately-created money (credit) – is highly political,” says Soederberg. “People need to know the politics of how the system works and why it breaks down. Financial analysis is too important to be left to economists and their reliance on mathematical models.”

In her fourth and most recent book, Debtfare States and the Poverty Industry, Soederberg explores the legal mechanisms through which more and more people in the United States and Mexico have become reliant on expensive forms of credit (“debtfare”) to augment or replace living wages. There is no simple explanation for the phenomenon, but part of the answer involves what is known as “financial inclusion” – a concept purveyed by powerful financial institutions like the World Bank, which argue that the best way to reduce or eliminate poverty is to provide widespread access to formal credit through vehicles such as micro-loans. This, says advocates, enables people to start small businesses that provide a livelihood for them and their families. In reality, says Soederberg, “financial inclusion just gives everybody an equal opportunity to get into debt.”

Soederberg is now turning her attention to the problem of affordable housing for the world’s poor through an incipient research project of slum rehabilitation in Mexico City, Manila and Mumbai. As is the case elsewhere, national governments in Mexico, the Philippines and India claim that neither they nor public donors have sufficient funds to pay for the sheer volume of housing needed to provide a basic right to shelter for their most vulnerable populations.

As a result, institutions such as the UN-Habitat are proposing that low-cost mortgages be made available to the slum dwellers so that they can afford their own homes. In turn, these mortgages can be bundled en masse as residential mortgage-backed securities (RMBS) and sold in the global marketplace to investors such as public pension funds.

The proponents of RMBS typically portray them as a win-win solution that provides needy people with homes and investors with dividends. What troubles Soederberg is that RMBS are the exact same class of subprime investments that went sour in 2007-08 and triggered the global financial crisis.

“Will RMBS and other forms of private financing really resolve the issues they’re supposed to without the guarantee of living wages for the poor?” says Soederberg. “Who really benefits from these arrangements, and why?”
If we are living in a global village, how do we tell its history? It’s not a question we’re used to asking. We understand local histories, certainly, national histories, even the histories of larger regions, say, Europe or Latin America. But the entire world? Wouldn’t global history have to be, somehow, the history of everything?

Spend some time talking to Queen’s history professor Amitava Chowdhury, however, and it starts to make sense. What global history means to him is not so much a subject as an approach to history – an understanding that historical processes are not constrained by borders, and have repercussions that spill out of the traditional categories that historians slot them into.

When the intense historian begins to tell you about his background, his interest in global history starts to make sense. (Chowdhury himself prefers to call it world history – for him, the “globe” is a metaphor, but a “world” is personal and historical.) Born in India, he moved to Mauritius to teach at the university there and work as a field archeologist. Two notable archaeological sites he excavated there were later designated UNESCO World Heritage Sites. The first was Aapravasi Ghat, which served as the immigration depot that the ancestors of today’s Indian population entered the country through. “Half a million came into Mauritius between 1834 and roughly 1917,” says Chowdhury. The other was Le Morne Brabant, a rocky outcrop located on the southwestern tip of Mauritius, where Chowdhury discovered conclusive evidence supporting the local legends that escaped slaves (the so-called maroons) had sheltered high on this almost unclimbable formation, with the summit 556 metres above sea level. While excavating another maroon site on the island, he and his team uncovered evidence that suggested that the dodo, Mauritius’s famed flightless bird, had survived about thirty years longer than previously believed – into the early 18th century.

This is the only instance, to date, where bones of the dodo have been found in a context pointing to human hunting practices.

After three years in Mauritius, Chowdhury says, “I found myself getting interested in questions you could not answer in the field.” Specifically, he began to wonder about the historical formation of Indian labour communities, the experiences of Indian labourers elsewhere in the British Empire and their development of an Indian identity. “When these
people actually left India, they had no idea of themselves as Indians. Caste, occupation, religion, yes, but nobody would have said, ‘I am Indian.’ How did they become Indian?” asks Chowdhury. “By crossing the ocean.”

Awarded a PhD by Washington State University, he joined the Department of History at Queen’s in 2008.

When it comes to global history, says Chowdhury, “People say it’s too vast, too big. How can you know so many languages? Do you really have to know the entire world? But it’s not like that. It doesn’t have to include all corners of the world. You can do local, archivally-based history that can also be global history if it captures a global process or reveals a global story that would have otherwise remained in the dark.” Indeed, Chowdhury’s own work on Indian diasporas is an example – a series of local studies that are, at the same time, global in reach in the way they capture a transnational moment in 19th century history.

Global history is also about how historians have long done history. In some ways, for Chowdhury, global history, beyond all the networks, connections, comparisons and transnational ties, is a critique of the discipline of history. “All societies in the past had a way of engaging with their past and writing history.” In the late-18th century, for the first time, says Chowdhury, history “becomes professionalized, and archivally-based.” But, emerging at the same time as the idea of the nation-state was taking hold in Europe, it also became “a handmaiden of the nation.” “From the 19th century, history has become a discipline that is mostly framed on a national scale.” The historian became, as Chowdhury puts it, “the accomplice” of the nation-state. “Historical work gradually became something tied to a landscape.”

“The bad thing about this is that a vast number of intellectual and historical processes are transnational. You can’t understand them if you limit yourself to a single nation-state,” says Chowdhury. “Take the English industrial revolution. Can you think of it without cotton from the United States or India?” These indispensable goods went into the creation of an event we once thought of as purely local.

In the past decade or so, since he first became interested in global history, Chowdhury has seen its concerns and approaches move from the margins of historical research to the mainstream. “Traditional historians are now writing books on, say, the French revolution – in a global perspective.”

“We are always reconstructing the past,” says Chowdhury. “But we are always really trying to understand ourselves by doing it.” And in that sense, since we live in a global world as we have never done before, our questions are increasingly framed in a global perspective. “We may not all be global historians now, but we can no longer ignore it.”
Imagine a machine capable of transmitting a signal directly to someone’s brain, allowing them to see, hear, or feel. Conversely, consider manipulating a machine with nothing more than a thought. This may sound like the stuff of science fiction, but in fact, for over forty years, researchers around the world have been working on devising communication pathways between the brain and external devices. One such researcher is Saba Farbodkia, a 3rd year PhD candidate at the Centre for Neuroscience Studies (CNS), who hopes to dedicate her career to helping create such brain-machine interfaces.

As computational power continues to grow alongside our understanding of the human brain, the production of such cognitively controlled devices becomes increasingly attainable. According to Saba, “Such an advancement is not simply about convenience. Especially for those severely disabled, the development of brain-machine interfaces could be life changing. This could be one of the most important technological breakthroughs in decades.”

Saba first entered neuroscience at the master’s level after completing a bachelor’s degree in biology. Completing both degrees at the Baha’i Institute for Higher Education (BIHE) in Iran, she began her academic career at Queen’s University starting her PhD. Having been fascinated with the applied aspect of science her entire life, the prospect of building a cognitively controlled brain-machine interface had been an extreme motivator for her transition to neuroscience. “Brains have electrical activity. Much like a machine, they can actually record that activity and transmit it. To connect the two however, we need an interface able to translate the code used by the brain to that used by a machine,” Saba explains. “Deciphering the code used by the brain is the first step. This is a giant feat. One I am actively working towards.”

At CNS, Saba is a member of Professor Martin Paré’s research team – a team focused on mapping the physiology of cognitive processes. Saba specifically works towards determining the physiology of visual working memory in the parietal lobe, an area of the brain important for the integration of sensory information. In “essentially a simple version of a video game,” Saba monitors brain activity in response to assigned behavioural tasks, such as determining whether the various colours of a “light show” have changed between a first and subsequent presentation – a measure of working memory.

Determining how working memory is represented in the parietal lobe is an important first step in understanding how to influence and modify it. Once elucidated, Saba plans to apply her acquired signal isolation and recording experi-
ence to investigate other areas of the brain. She hopes her research, both current and future, will serve as key stepping stones in one day making cognitively controlled brain-machine interfaces a reality.

In addition to her stimulating research, Saba is also an active member of the Queen's community. Since beginning her studies, Saba has been heavily involved in activities across campus, including sitting on several internal educational review committees. Her most current appointment is as student ambassador for “Research Matters,” a campaign run by the Council of Ontario Universities.

The campaign is a collaborative project between Ontario’s 21 publically-assisted universities, which aims to connect the public directly with Ontario’s researchers and their work, and demonstrate the large-scale impact of research.

As an ambassador, Saba’s main role has been engaging the student body as well as the larger Kingston community in campaign events and special initiatives. For example, in February 2014, Research Matters hosted a 21-day virtual scavenger hunt in which participants received a daily email clue about a particular research group at an Ontario-based university. The clues varied in discipline and difficulty, yet were designed to encourage people to spend a few minutes scouring the websites of various university research groups for answers and learn a thing or two along the way.

Saba believes that the campaign is making great strides towards breaking down barriers and building bridges between Ontario researchers and the public. “Every day university researchers are producing new, useful and fascinating knowledge that affects industry, government and community life in a multitude of ways. Research enables not only leaders in industry or government but also average citizens to make smart, informed decisions regarding a range of issues important to all Ontarians and those around the world.”

On May 3, Research Matters came to Kingston with their “Curiosity Shop” – a travelling pop-up venue that allows people across the province to ask questions to be answered by some of the tens of thousands of researchers at Ontario universities.

The booth was exhibited at the Rogers K-Rock Centre at Science Rendezvous – a free national one-day public festival of events that takes place annually, and showcases the passion and importance of science and research, primarily for a younger audience.

The Kingston event met with resounding success, with over 3500 visitors. Queen’s staff and graduate students, who managed the booth, channeled hundreds of questions in the form of shared photos and written post-its, such as “Why is my baby sister’s hair curly?” and “Where do fruit flies come from?”
Troy Sherman is not your average student. While balancing a full course load and completing an undergraduate thesis in international relations theory, he serves as managing editor of an academic research journal – a journal he successfully founded and launched within a one-year time span. Aptly named Politicus, the journal caters specifically to undergraduate students and explores wide-ranging, often controversial issues in politics and international affairs.

The idea for Politicus materialized following initial talks with Sherman’s current thesis supervisor, Professor Charles Pentland of the Department of Political Studies. Realizing the paucity of opportunity for academic publication as undergraduates, it dawned on him: “Queen’s students are brilliant. They are able to write fantastic papers.” Sherman recalls thinking, “Why not provide them with an outlet in which they can be subject to a peer-review process and be published in an academic journal?”

The concept behind Politicus was inspired by the highly-prestigious international relations journal published at the London School of Economics, Millennium, which highlights the work of young scholars.

Regular consultations with the Vice-Principal (Research), as well as the Departments of Political Studies and Global Development Studies, fine-tuned Politicus and helped secure appropriate funding. Additional financial support and resources were also provided by the Arts and Science Undergraduate Society (ASUS). All four were instrumental in shaping Politicus in its early stages.

Launching officially in September, Sherman and a freshly-assembled team of 15 worked tirelessly toward publication. Seven students served as part of the management board, helping Sherman oversee day-to-day operations; the other eight served on the student editorial board, an important part of the double-blind review process. Over 20 faculty members sat on the board of referees – 12 of whom are professors at the neighbouring Royal Military College of Canada (RMC).

Queens and RMC undergraduate students from all academic disciplines were eligible to submit papers. As Sherman explains, “There is a great breadth of issues that can be tackled. Politicus is not exclusive to politics students. We have seen and engaged with students from gender studies, sociology, history, and global development studies. As long as the subject matter is related to political and international affairs, we are open to it.”

The first issue was published in March, and is available in its entirety on the journal’s website: politicusjournal.com. Prior to the publication of the inaugural issue, Politicus was already well-received not only by faculty and students, but also by outside experts. Leading up to the publication date, Sherman and his team assembled a series of public lectures to spark discussion and help market the first issue. The speaker series has been widely successful, often filling...
The future for Politicus at Queen's University is promising. Beginning next year, Politicus will be published biannually. Having expanded to RMC in its first year, Sherman envisions additional collaboration with other universities in the future. He hopes Politicus will continue to attract all-star speakers to be featured in panel discussions from high-ranking political officials to the leaders of change-making NGOs.

As for his role, Sherman is a big believer in yearly turnover. He already has a pipeline established. “Politicus is all about bringing fresh perspectives to long-standing issues,” he notes. Upon graduation, Sherman will return to Queen's for a full-time position in student government, his other passion. Next year, he hopes to submit his own paper to be featured in Politicus.

Politicus hosted five popular public lectures in their first year. Above is a photo from their discussion entitled “Dirty Laundry,” which featured (from left to right) Professor Jonathan Rose, the CBC’s Adrian Harewood, Professor Elizabeth Goodyear-Grant, and Queen’s student Taylor Mann.
Heart to Heart

with

Dr. Stephen Archer

BY KAREN RICHARDSON
In his day-to-day life, Dr. Stephen Archer wears two hats – two extremely large and important ones. On the administrative side, Dr. Archer is the Head of Medicine at Queen’s and affiliate hospitals. With 13 divisions, Medicine is the largest department in the Faculty of Health Sciences. He expertly balances this with his role as an internationally-respected clinician scientist and cardiologist who has made discoveries in oxygen sensing, mitochondrial dynamics, and new therapies for pulmonary hypertension and lung cancer.

Recently, Karen Richardson sat down with Dr. Archer to discuss his research successes and how he is working to promote medical innovation and ensure that Kingston elevates its international profile in medicine, research and education.

**What inspires you?**

I am inspired by the important lessons that I have learned from my parents, my mentor (Dr. E. Kenneth Weir) and my trainees. As well, the patients serve as a daily reminder that we have both the privilege, and the responsibility, of providing advanced care for a population of over 600,000 people. Although Kingston is not large, we “punch above our weight” as a university, a hospital network and a Department of Medicine … and we can do even better! Complacency is not in my nature and I am closely engaged with the hospitals, foundations and the Faculty of Health Sciences to ensure patients get the care they need without needing to leave for Ottawa or Toronto.

**What are some priorities for you as Head of Medicine?**

To elevate the standards of care in the city and region. And we are doing this through the development of new tools and resources. For example, we’ve initiated the process of obtaining a regional electronic health record to enhance patient care and research.

I also promote clinical programs of distinction – the types of high-tech, clinical care that must be provided by a competent university-hospital system. For example, we’ve just launched an academic dermatology program, created a successful program to place heart valves without opening the chest (TAVR) and secured support to start a living-related donor renal transplantation program.

Opportunities for professional development are also important to me, and one way they have been achieved is through new electronic media. We created an iPad program here for the house staff, which our trainees now use to interact with health records and to assist in patient education. Our medical students have also used new media to create the Queen’s Medical Student Survival Guide, which explains everything you need to know as a medical student.

Since my arrival I have focused on growing the department and increasing its research intensity. We bring in about $10 million in research funding a year, and my goal is to roughly double that, as well as to increase the number of endowed chairs and lectureships in the department. We’re also recruiting clinician scientists – physicians who have protected time to do research.

**What is your research claim to fame?**

As a cardiologist I study the mechanisms of oxygen sensing in the lung blood vessels. Among other things, my team has identified the role of mitochondria as oxygen sensors in lung circulation, and the biochemical pathways that make these blood vessels either constrict or relax. Building on this, we have found that these oxygen-sensing mechanisms fail in many diseases, such as cancer and pulmonary hypertension.

My current research focus is on the role of mitochondrial dynamics in human diseases. Mitochondria are traditionally thought of as the cell’s powerhouse making the energy-containing molecule adenosine triphosphate or “ATP.” However, they are also dynamic organelles that are continuously dividing (fission) and joining together (fusion). My lab studies the how and why of these dynamic processes. When fission and fusion are abnormal, many cellular processes cease to function normally. In diseases such as pulmonary hypertension, for example, impaired fusion and increased fission contribute to disease progression. We have identified the enzymes that cause this fission/fusion imbalance and showed that in both pulmonary hypertension and lung cancer we can achieve therapeutic benefit by blocking fission or enhancing fusion. This research has brought funding...
Dr. Stephen Archer, Canada Research Chair in Mitochondrial Dynamics and Translational Research, has received numerous research awards, and recently delivered the inaugural Queen’s University Heart & Stroke Foundation Lecture.

The discoveries related to oxygen sensing were made with my mentor, Dr. Weir, at the University of Minnesota and Dr. Thébaud, then at the University of Alberta. The research on pulmonary hypertension was conducted with Dr. Michelakis and Dr. Bonnet, formerly at the University of Alberta, and the mitochondrial dynamics research was with Drs. Rehman, Ryan, and Marsboom, formerly at the University of Chicago and the University of Ottawa. We were assisted in each case by talented trainees, most of whom now lead their own research programs. We translated some of our basic science discoveries into therapies for pulmonary hypertension and cancer. The discovery that sildenafil (Viagra®) was useful for treating pulmonary hypertension has contributed to the approval of this drug as a standard therapy. Other discoveries, such as the use of dichloroacetate to treat cancer, have been tested in patients and show promise.

What is your proudest achievement?

I am probably proudest of the Coeur D’Or Award from the American Heart Association. I received this award for my leadership in creating a Network of Care for Heart Attack (STEMI) Patients in Chicago in 2011-2012. This initiative was part of a national strategy called “Mission: Lifeline” and its goal was to ensure that patients received timely angioplasty upon activation of the 911 emergency system. The final product established PCI-capable hospitals (specialized cardiac care), equipped ambulances with 12-lead EKGs, and most importantly, improved the care of those suffering from myocardial infarction in America’s third-largest city.

I would be remiss if I didn’t mention the Queen’s Gold Medal in Medicine, which I received during my time in medical school. I’ve always been proud of that, because when I first came to Queen’s from the Maritimes, recruited by Padre Laverty himself, I struggled as a first-year student. Ralph Clench, a unique calculus professor, helped me get through first year. No one was more surprised than I was that I had success in medicine at Queen’s.

What do you do when you’re not practicing medicine?

I really enjoy spending time with my family whenever I can. My wife, Kathie, is an epidemiologist with Public Health Ontario, and our common interest in health leads to some great conversations. We have three children, one of whom is a student here at Queen’s. My other interests include playing classical guitar, photography, reading and travel. I’m also an avid old-timers hockey player.

What is the future of the Department of Medicine?

When I hear concerns that our size or proximity to larger centres are limitations, I think of Shakespeare’s quote: “The fault … is not in our stars, but in ourselves.” The only serious limitations on the growth of excellence in the department are those we impose from lack of ambition or vision. We need only to follow our curiosity and passion, and we will play a leading role on national and international stages.