ART OF RESEARCH: The Power of a Picture
For a complete description, please visit queensu.ca/research/art-of-research.
Dear Colleagues and Friends,

The passion and dedication of our researchers, scholars, students and trainees, and their desire to affect the lives of people universally and effect positive change in the world, is evident in this 11th issue of (e)AFFECT – a publication that epitomizes the aspirations of the Queen’s community. As the interim Vice-Principal (Research) and as a scientist, it is with great pleasure that I present this issue to you. It is an uplifting acknowledgement of the place our scholars have in making a difference not only locally, but around the globe.

In the pages of this issue, I am delighted to present our five outstanding Prizes for Excellence in Research winners. They reflect the diversity and depth of our scholarly and research strengths throughout the social sciences, health sciences, humanities, natural sciences and engineering. For instance, you will learn about Virginia Walker’s work on how organisms adapt to stress through biochemical mechanisms that enable them to withstand freezing temperatures, and your interest will be piqued by Gauvin Bailey’s exploration of Sans-Souci, a Haitian palace whose unique architecture has much to reveal about the cultural history of its time and place. Furthermore, this issue exhibits the winning and shortlisted images from our second annual Art of Research photo contest that give a unique glimpse into the beauty and variety of creative research projects happening at Queen’s. The accomplishments of these researchers reaffirm the deep commitment and vision required to achieve excellence, to challenge and advance scholarship, and to sustain the social and innovation fabric of our society.

According to Canada’s Fundamental Science Review (scienccreview.ca), submitted to the Government of Canada in April and whose advisory panel included our own Dr. Art McDonald, the overall stewardship of the federal research ecosystem requires attention, despite its considerable strengths. A number of recommendations were made to strengthen the foundations of the research environment in Canada; I encourage each of you to examine the Review, as investment in Canada’s future is contingent upon the opinions, and interests, of our citizens. Among the recommendations is the request for a deliberate and increased federal investment in research that will ensure the success of a diverse group of early career researchers, as well as greater levels of coordination and collaboration between the granting councils. The goal is to improve our international presence in research, foster cutting-edge Canadian innovations, and inform evidence-based policy. The U15 has previously commented on the importance of the Review (u15.ca) and, as a member, Queen’s is committed to the goals and aspirations that are outlined within it.

Research and scholarship is, after all, a contact sport! I encourage you to reach out to your provincial and federal representatives to contact them, and remind them of the value and impact of fundamental research and scholarship on the economy of Canada and on our future success. Together, let’s #supportthereport.

John Fisher, PhD
Interim Vice-Principal (Research)
Flipping the switch
Jacqueline Monaghan (Biology) recently co-authored a study, published in *Science*, which describes a previously unknown molecular mechanism by which plants regulate their immune signaling in response to a pathogenic challenge. RALFs (Rapid ALkalinization Factors), which are a family of small peptides in plants, are produced in response to rapidly changing conditions. Monaghan and her colleagues demonstrated how RALFs can act to “turn off” the immune response once a threat is eliminated – an important process to avoid the possible negative consequences of unnecessary immune activity on plant growth and development.

Supporting Ontario’s researchers
On March 14, the Honourable Reza Moridi, Minister of Research, Innovation and Science, and Ms. Sophie Kiwala, Member of Provincial Parliament for Kingston and the Islands, announced more than $4.5M in new infrastructure and research funding for four Queen’s researchers through the Ontario Research Fund – Research Excellence and Research Infrastructure programs. The funding highlights Queen’s record of sustained research excellence and demonstrates how our researchers are working to address crucial issues – such as renewable energy development – facing the province and the public at large.

Praveen Jain (Electrical and Computer Engineering) discusses how the funding will help researchers at the Queen’s Centre for Energy and Power Electronics Research (ePOWER) continue to find new methods of producing efficient and environmentally-friendly renewable energy.
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:

How the brain makes critical decisions

Jason Gallivan and Randy Flanagan (Centre for Neuroscience Studies) are working on a variety of projects to determine how the brain enables successful interaction with the world around us. In a recent study published in *Cell Reports*, they demonstrated that when humans are presented with two action options, the brain’s motor neurons prepare for both possibilities before deciding which action to take.

“Whether you’re navigating a route to work or browsing produce at the grocery store, our brains are constantly making decisions about movement,” Gallivan says. “Even outside your conscious awareness, your motor system appears to always be operating in the background, coming up with potential actions. Should I reach for the red or green apple? When should I cross the street?” Having alternate movement plans encoded likely improves reaction times should action decisions change.

Caring for Canada’s frail and elderly

The Canadian Frailty Network (CFN), an internationally recognized research network focused on improving health care for an aging population, has received $23.9M in renewal funding from the Government of Canada’s Networks of Centres of Excellence (NCE) program. Hosted by Queen’s, CFN is a national initiative to improve the care of older Canadians living with frailty. Its goals are to increase frailty recognition and assessment, support new research and engage frail older people and their caregivers to improve decision making, and mobilize evidence to transform health and social care to meet the needs of the aging population.

Extending the Rafters

The final report of the Queen’s Truth and Reconciliation Commission Task Force, entitled “Extending the Rafters,” was released in March. Amongst previous initiatives supported by the university, the report recognizes Queen’s faculty who engage in Indigenous community-based, participatory research, and the recent hiring of faculty who specialize in many Indigenous-focused fields. The report also lists several research-related recommendations, including establishing an Office of Indigenous Initiatives, raising awareness of Indigenous research at Queen’s, and ensuring researchers receive training on ethical guidelines for Indigenous research. The full report is available at queensu.ca/provost.
Celebrating Exceptional Research Achievements

Every year, Queen’s awards its Prizes for Excellence in Research, the university’s highest honour for researchers. The prizes are given to scholars – one in each of the humanities and creative arts, social sciences, natural sciences, health sciences, and engineering – who have completed noteworthy research while at Queen's. The achievements of the 2016 winners are profiled below.

Gauvin Bailey: Architecture and empire in the Americas

Haiti’s opulent Baroque Palace of Sans-Souci (ca. 1806-13), a complex occupying nearly eight hectares of land, is one of the most spectacular yet least-studied buildings of its era in the Western Hemisphere. Although it was named a UNESCO World Heritage Site in 1982, Sans-Souci has never been studied as a work of architecture, and Gauvin Bailey (Art History and Art Conservation) is fascinated by the way it intersects with so many cultures and societies, from the ex-slaves who built it to an international cast of characters including Napoleon, Tsar Alexander I of Russia, British spies, and West African warriors. “I am interested in the way architecture reveals a dialogue between cultures,” Bailey explains. “A building like Sans-Souci is a potent mixture of admiration, hatred, tyranny, and enlightenment.”

Bailey, professor and the Alfred and Isabel Bader Chair in Southern Baroque Art, has spent the last 20 years studying the arts of Southern Europe and Latin America. His latest research has taken him to the outer reaches of France’s former Atlantic Empire, and he has just completed two books on the subject. One, to be published in December 2017 as part of his Panofsky Professorship at the Zentralinstitut für Kunstgeschichte in Munich, focuses on Sans-Souci and examines what happened after the French were expelled. The second, to be published in 2018, will be the first comprehensive study of architecture in the French Atlantic Empire, comprising North America, the Antilles, Guiana, Senegal, and the West African coast.
Virginia Walker: Adaptations to stress

If the air is too cold, humans put on a coat or seek shelter. Many organisms don’t have that option, but they have developed biochemical mechanisms that enable them to withstand freezing cold. In fact, all living organisms, large and small, adapt to stress and change in different ways – and throughout her career, Virginia Walker (Biology) has been fascinated by how they do it.

But that overarching goal is not immediately apparent when you scan Walker’s curriculum vitae. Her research is varied and eclectic, ranging from inquiries involving cell and molecular biology, physiology, ecology and evolution. Her research subjects include plants, bacteria, mammals, insects and fish. “I’m interested in how organisms adapt to change, how they become resistant to various stresses,” says Walker, a geneticist. “I’m not particular about what stress it is.”

Walker says she’s undertaken much of her research just to satisfy her curiosity about how things work at a cellular level. More recently, though, she’s been using her scientific expertise to examine societal issues. She’s concerned about the effect of nanoparticles – infinitesimally small bits of silver, titanium and other materials used in commercial products – when they get into water and soil and affect living organisms. Another project involves studying the genomics and microbiomes of fish species in the Canadian Arctic, so that communities there can sustainably harvest them while maintaining genetically diverse and healthy stocks in the face of climate change and help reduce food insecurity.
Janet Hiebert: How bills of rights affect lawmaking

Traditionally, a bill of rights was seen as incompatible with the parliamentary (Westminster) system of governance. However, when Canada enshrined the Canadian Charter of Rights and Freedoms in the Constitution Act of 1982, it opened the door to all sorts of rights-based legal challenges to government legislation. To safeguard against this, the Minister of Justice has a statutory obligation to report to parliament when legislation is inconsistent with the Charter, in the hope that this will discourage the government from proposing rights-offending legislation and/or increase parliamentary pressure on the government to amend its legislation to make it more Charter-friendly.

One might assume that the government would vet proposed legislation to ensure that it is consistent with constitutional rights. After all, legal challenges can be politically damaging and derail the government’s agenda. In fact, the research of Janet Hiebert (Political Studies) has found that this is not necessarily the case. Although proposed legislation is subject to Charter assessments by government lawyers, governments appear quite willing to pursue risky legislation but are not willing to let parliament know. No reports of Charter inconsistency have ever been made, and yet the government frequently loses Charter challenges. Unravelling how this complex topic unfolds in different parliamentary contexts – Hiebert’s specialty – requires exhaustive forensic assessment. To date, she has interviewed more than 100 government lawyers and other public officials in Canada, New Zealand, Australia and the UK, read thousands of pages of legislative debates to assess the impact of rights on the legislative process, and dug behind the scenes to shed light on the interplay of political factors and incentives that affect the relationship between rights and legislation.

Stephen Vanner: Gut feelings

Irritable bowel syndrome (IBS) is a common disorder that affects 10-15 per cent of adults in Canada, but is especially prevalent in women, who comprise roughly 80 per cent of cases. Patients with IBS suffer abdominal pain and altered bowel patterns. The causes of IBS are unknown, but Stephen Vanner (Medicine), an expert in pain signaling from the abdomen, says certain triggers appear to be consistent. “There’s a dynamic between our gut and brain that’s constantly altering the signaling between the two and, ultimately, can disrupt the gut’s function,” says Vanner, the director of the Gastrointestinal Diseases Research Unit (GIDRU) at Queen’s/Kingston General Hospital. His research has found that when you look inside the gut of IBS patients and take biopsies, you find an elevation in signaling molecules that can sensitize nerves, change the contractions of and motility in the gut, and aggravate more enhanced pain signaling from the gut. The fact that the gut has more nerves than the spinal cord helps to explain why IBS-related pain can be so complex to understand. Vanner’s research, soon to expand into a five-year study of 2,000 IBS patients in Canada, looks into what factors – stress, certain foods or diets – can cause these signaling changes. It is a complex puzzle. In addition, every person has a unique set of bacteria (microbiome) living in their gut that interact differently with our unique diets, so it’s likely that the answers will vary for every person.

“The gastrointestinal tract can only do so many things,” says Vanner. “It can go faster, it can go slower, it cannot be sensitized. We only can relate IBS symptoms to this limited repertoire – but what’s driving those symptoms? It’s likely to be a variety of different things.”
James Cordy: Transforming the computing world

Many years ago, when he was a budding computer scientist, James Cordy (School of Computing) was presenting a paper on computer programming education at a conference in Germany. When he was done, an audience member stood and asked, “Why is a young person like you wasting your time on these old ideas?” Cordy was taken aback, but his challenger’s words ultimately changed Cordy’s life. “He forced me to take an attitude to research that’s very different, and it really informed the rest of my career. After that, I told myself that I want to look far ahead. I’m not interested in what we can do now; I’m interested in what may be possible in the future.”

Cordy has delivered on that vow by spending the past 30 years inventing and exploring the ramifications of “source transformation,” a technique that software engineers use to translate one computer language to another. First developed by Cordy and a few colleagues in the 1980s, the process uses artificial intelligence to discover patterns and relationships in computer code to reveal a program’s fundamental structure. This has made it possible to analyze, understand and detect problems – such as the infamous Y2K bug – in existing software consisting of many millions of lines of code. It also helps programmers to use schematic-like graphical representations of the underlying code relationships (called “models”) to build new programs in any coding language. When Cordy first tried to publish his ideas, his papers were rejected because conventional wisdom said that source transformation was impossible. However, within a decade it was in use at IBM, and today it is the basis of standard coding tools that computer engineers around the world use every day.
Building a nuclear reactor is not for the faint of heart. Between the competing and challenging demands of technical design, regulatory approval, and a potentially wary host community, the process can take years, even decades, to complete. In fact, perhaps the best reactor is one already up and running, which is why Queen’s researchers are looking at ways of extending the working lives of these critical, sometimes controversial installations.

The Reactor Materials Testing Laboratory (RMTL) is among a handful of facilities in the world dedicated to studying the physical materials used to make a nuclear site, including the piping carrying cooling liquids, fuel containers and the structures holding it all in place. Most of these items might be considered little different from what would be found in major commercial or industrial structures, with one major distinction: significant amounts of radiation.

Mark Daymond, who holds the NSERC-UNENE Industrial Research Chair in Nuclear Materials and a Canada Research Chair in Mechanics of Materials, likes to point out that radiation – the blanket term for all forms of electromagnetic energy – is everywhere. Background radiation is all around us: cosmic radiation from above, from the rocks under our feet and those used in our buildings. The difference in annual background radiation between living in Toronto or Winnipeg compared to Halifax is equivalent to the radiation received by smoking 2.5 packs of cigarettes a day. Or take an average cross-country flight on a commercial airliner and you will be exposed to similar radiation to what you would receive from a medical X-ray.

Nevertheless, the radiation levels found at the heart of a nuclear reactor are much more intense than any of these examples, and consequently much more difficult to study. It is too dangerous for investigators to enter this hazardous environment and take samples or measurements to learn how well the place is holding up after what might be decades of continuous operation. Yet the possibility that this same radiation could be damaging the physical integrity of the reactor is too serious to overlook.
Daymond’s position was created to tackle this difficult challenge. Supported by the Natural Sciences and Engineering Research Council (NSERC) and the University Network of Excellence in Nuclear Engineering (UNENE), a not-for-profit corporation made up of public and private partners with an interest in nuclear engineering, his research chair enables him to explore how radiation affects some of the common materials that are used to build reactors.

He and his colleagues have spent the last few years establishing the RMTL, which is located in the north end of Kingston near Highway 401. The one-story building is largely indistinguishable from others found in this industrial park, although none will boast the array of technology found inside. The centerpiece is a linear accelerator that dominates a room, about the size of a passenger bus. At one end is a small container of hydrogen that serves as feedstock for protons, which this equipment accelerates into high energy beams. When these sub-atomic particles strike a sample of material, the result simulates the effect of radiation in a nuclear reactor. More importantly, the specific features of that radiation can be tailored to answer specific questions.

“You’re very limited in the kinds of tests you can do in a working reactor,” says Daymond, who explains that these facilities must always work within a narrow set of parameters as they generate electricity from day to day. Placing samples in a reactor is also problematic because they will become radioactive afterward and require elaborate handling to keep people safe, such as the use of cumbersome, lead-shielded “hot cells.”

No such hot cells are required at the RMTL. If the accelerator beam strikes a piece of zirconium alloy, for example, which is commonly used in reactor tubes, the material is affected but exhibits only very low levels of radioactivity. Beyond the safety and convenience of this technique, the accelerator makes it possible to control radiation and the conditions of the sample being irradiated much more precisely than could be done in a reactor.

“You can pick the energy of your particles and the number of particles – you can dial your flux, essentially,” says Daymond. “You can control your environment very easily, including stress, temperature, or corrosive environment.”

The ability to manipulate these variables will allow the RMTL to pose questions about how reactors hold up to long-term operation and, more importantly, obtain answers that could be found in no other way. Since officially launching the lab in 2015, students and staff have been busy calibrating various detectors and examining irradiated samples to ensure that their findings reflect what would happen in a real-world setting.

“Comparing our early predictions and now our experimental results, we can see that we are able to predict how much radioactivity and damage that we’re producing in materials extremely well,” says Daymond. “During the design phase of the facility, we were doing these predictions theoretically. There can be orders of magnitude of variation in experimental conditions, so it is very satisfying that we’re still coming in spot-on.”

Controlled by the standards and regulatory framework of the Canadian Nuclear Safety Commission, the RMTL has received $14M from the Canada Foundation for Innovation and the Ontario government, as well as support from Queens, its Faculty of Applied Science and Engineering, and High Voltage Engineering Europa, the Dutch-based accelerator manufacturer. The site also houses microscopes powerful enough to analyse samples at the nanometre scale, as well as equipment for testing the mechanical properties of irradiated material to determine if it has been weakened or compromised in some way. Such insights will help the owners and operators of reactors make crucial decisions about how long and how well these complex systems can function. At a time when this form of electricity generation has been praised for its lack of climate-altering carbon dioxide emissions, efforts to extend reactor working life are welcome.

“From both a financial and environmental sense, keeping existing reactors going as long as possible makes huge sense,” he concludes.
When Wendy Parulekar was first starting out as a physician and researcher, she remembers feeling uneasy about admitting that there were things she didn’t know.

“It was an uncomfortable space for me when I first started my career,” she recalls. “But honesty and transparency are so important in our interactions with patients, that if we want to find cures, we have to articulate what we don’t know and what we want to improve.”

Indeed, Parulekar says it is those questions inspired by the unknown that are at the heart of the work she does as a Senior Investigator with the Canadian Cancer Trials Group (CCTG), a research group at Queen’s that brings together

 Asking Questions and Improving Outcomes:

Making a Difference through Clinical Trials

BY MEREDITH DAULT
more than 2,000 Canadian and international investigators overseeing as many as 30 to 40 trials at any given time. “Any clinical trial that is conducted represents efforts on the part of a lot of people,” she says. “That’s why we do our best to design what we think are the best clinical trials answering the most important questions.”

For Parulekar, who first arrived at Queen’s in 1999, being a part of the CCTG team has allowed her to be part of an organization that has defined practice standards in many cancers, including breast, brain, colon, lung, and prostate. Her commitment to clinical trials is reflected in her status as a Fellow and Past President of the Society for Clinical Trials. “My role is to be engaged, really, at the forefront of clinical research within Canada and internationally,” Parulekar explains, “whether we’re testing new therapies or new drugs, or evaluating established therapies in innovative ways.”

“Clinical trials should be viewed as part of our commitment to each other, and our commitment to improving the health of our nations.”

She also works as a clinician, meeting with breast cancer patients on a weekly basis at Kingston General Hospital, a practice that allows her to see firsthand where the gaps are in terms of knowledge and care – gaps that can, in turn, inform future clinical trials. “The excellent care that every cancer centre promotes – care that I think is the right of every Canadian to expect – is based on the results of clinical trials,” she says. “The decisions and treatment recommendations we make are based on data – data we have accumulated with the assistance of patients who participated in studies.”

According to Parulekar, many clinical trials are designed to resemble standard medical practice, with a goal of minimizing additional inconvenience to patients. Participating in trials gives patients the ability to assist in the evaluation of new treatment strategies, while allowing them to be part of research that can make a real difference in tackling various cancers for current and future generations.

One such trial, looking at the impact of extending hormone therapy in post-menopausal women with a common type of early breast cancer, was included on the Canadian Cancer Society’s list of the top 10 research impact stories for 2016. The MA.17R trial, which was led by the CCTG in collaboration with the National Clinical Trials Network in the United States, examined what would happen if the length of time women were treated with an aromatase inhibitor was extended from five years to ten. “We know that women who have this kind of breast cancer are at risk of the cancer coming back, even years after the surgery to remove the tumour,” says Parulekar. “That’s an example of an unmet need. We needed to help these patients further.”

The trial enlisted the participation of almost 1,900 women across North America between October 2004 and May 2009. Half of the participants were given a drug, while the other half received a matched placebo. The results, which were available nearly six and a half years later, confirmed a 34 per cent reduction in the risk of the cancer coming back for those who took the hormone for an additional five years. “We did this trial because the data told us that this would be an important question to study,” she says, explaining the trial also allowed researchers to collect information on significant side effects associated with hormone therapy, like hot flushes, vaginal dryness and bone thinning. “The drug is currently available. It’s cheap, and it’s available in many countries. So these are the types of results that can have an immediate impact on patients lives,” she says of the results that will enable post-menopausal women and their doctors to make more informed decisions about breast cancer treatment.

Parulekar looks forward to a day when clinical trials aren’t viewed as a luxury, but as part of a robust and forward-looking medical system. “Most, if not all, of the recommendations I make to patients are based on data that were generated thanks to the generosity and hard work of researchers and patients through clinical trials,” she says. “It’s not just a theoretical discussion. Clinical trials should be viewed as part of our commitment to each other, and our commitment to improving the health of our nations.”

Parulekar is deeply grateful to be a member of the CCTG team. “I would not have had the kind of impact I do now if I were working as an individual physician,” she says. “Ideally, advances in disease outcomes have no geographical boundaries.”
“Sorry,” I ask incredulously, “What do you mean, you can stop light?”

Professor Stephen Hughes (Physics, Engineering Physics and Astronomy) looks at me with a smile and continues: “Well, slow it down to a near standstill. I know, it’s crazy. Our team has even made a t-shirt that says: ‘We’re faster than the speed of slow light.’ And it isn’t a pipe dream. This is a fabricated structure.”

Hughes is attempting to explain to me some of the seemingly impossible things done in nanophotonics and the strange behaviour of photons at the nano-scale. His research is on the cutting edge of new information technologies that work by manipulating light particles (photons) in ways analogous to how integrated circuits manipulate electrons. And just as integrated circuits and electronic computers had world-changing effects in the last century, Hughes, and many others, believe that photonics (and nanophotonics in particular) is poised to bring about a similar technological revolution in this century.
There are many advantages to communicating and computing with photons rather than electrons. For one thing, unlike electrons, photons can be sent over very long distances with virtually no loss of signal. A photonic integrated circuit could also do more while producing less heat and using up less energy. And the behaviour of photons, particularly at the quantum level, will allow for types of computation and control that are not practical or not possible with traditional electronic computers.

Yet, the challenges are very real. At the scale of everyday life, individual photons are particularly difficult to control. Not only do individual photons interact with the physical materials around us, but they also “see” an electromagnetic vacuum through which they travel – a vacuum swarming with virtual particles of all sorts. And that is why physicists like Hughes are delving into the realm of the nano-scale – a domain that is 100 times smaller than the thickness of a human hair, where a tiny material can be fabricated to help control and manipulate light-matter interactions. For example, the science and techniques of Cavity Quantum Electrodynamics (or Cavity QED) involve the use of very small materials (photonic cavities) in which photons can be tamed to behave in a quantum mechanical way where quantum coherence overcomes the unavoidable effects of dissipation.

At the classical level of a few photons (for example, from an attenuated laser), where the photons are distinguishable, usually one can operate in a realm of “so many, every so often,” but by carefully manipulating the photonic environment in which a quantum emitter finds itself, you can start to emit precise numbers of indistinguishable single photons within discrete times, alter their direction, slow them down, and even entangle them over large distances (“spooky action at a distance”). And just as in silicon semiconductor technology, these tiny photonic widgets can be grown and replicated to produce combinations of behaviours to accomplish new and exciting things, including quantum cryptography. Some of this technology is already in use: in specialized detectors, solar collectors and telecommunication devices, and secure communications. Yet there is still much work to be done to turn it into a mainstream technology.

“On one hand,” Hughes explains, “as you go down to this scale, there are a lot of interesting things that will happen even at the classical level. But the quantum stuff has largely been untouched for these types of structures. And I think the regime of ‘quantum nanophotonics’ is perhaps the next big thing.”

While much of his work is developing the theoretical framework and models for new nanophotonic technologies, a significant portion of his efforts are spent in collaborating with researchers and experimental groups around the world, and helping them to interpret their experimental results and design next-generation devices. The science of nanophotonics is still so young that analyzing the real-world behaviours of optical and nano-mechanic materials is a work in progress, often requiring new theoretical tools and models to make sense of the new data. Much of what needs to be worked out is at the quantum level, which presents many big challenges and exciting prospects for new science.

Hughes leans forward to describe the big picture: “That’s what’s coming. It is a new emerging field of quantum optical physics that largely has not been explored.”

Towards this vision, Hughes has begun to put together a multidisciplinary research team of computational scientists, physicists, theorists, experimentalists, chemists, and engineering physicists to develop the theory, modelling tools, and the technologies needed to underpin this emerging field of quantum optical technologies.

I leave our discussion with a heightened sense of what this technological future has in store.
HOPE IN DIVERSITY: Environmental Change in Lakes

BY JUDY WEARING
When Shelley Arnott (Biology) stands beside a lake, it gives her a relaxed “ahhhh” feeling. She sees recreation, tranquility and solitude. However, she also sees environmental problems and unanswered questions.

Arnott and her graduate students are working together to answer how lakes are affected by a slew of environmental stresses, including climate change, eutrophication, invasive species, declining calcium, road salt deposition, and pollution. These are big picture questions, moving target questions, that touch on physics, chemistry and biology. But for Arnott, understanding is crucial because “we need fresh water, we need it to survive. And as Canadians, it is part of who we are, part of our culture, part of our psyche.”

Like the lakes she studies, Arnott’s research methods are diverse, though conducting experiments that tease apart complex interactions are a key strength of her work. She focuses on zooplankton – tiny, free-living animals that are critical to lake ecosystems because they graze on algae and supply food for fish and other animals.

In a typical experiment, large bags, 1m in diameter, are placed in an Ontario lake, and filled with water and zooplankton. The bags keep the communities of organisms inside separate from the rest of the lake, and from each other, while still exposing them to natural conditions. By altering the conditions inside the bags, Arnott and her students can detect how the zooplankton are affected over time.

In one such experiment, the amount of calcium in the water was systematically varied, and a spiky little animal known as the spiny waterflea was added to half of the bags. This invader from Eurasia is now in 180 Ontario lakes. It’s a voracious predator of native zooplankton, which reduces the food supply for juvenile fish and other animals. In this experiment, the negative effect of the spiny waterflea overshadowed a minor impact of low calcium, though further experiments demonstrated how low calcium levels could also impact zooplankton in some Ontario lakes.

Arnott points out that whether it is calcium levels or invasive species, our lakes are changing and we need to decide whether or not to worry. “I could put on one hat, and say of course we have to worry about everything. But practically we can’t, we have limited resources. We have to deal with what’s most serious.” Research can help us decide when and how to act.

Because of the complexity of ecological interactions, doing sound research on the impacts of multiple stressors is difficult, but the challenge excites Arnott. She feels we need to better understand how environmental changes affect the entire ecosystem – all the way from algae to humans.

Achieving this ambitious undertaking requires more than zooplankton experiments; it requires scaling up and engaging many partners. Arnott often collaborates to extend expertise and information, and to inject diverse perspectives. The ecosystem studies she has planned involve plugging information gleaned from numerous scientists’ experiments with algae, zooplankton, and fish into a computational model, along with long-term data from the Ontario Ministry of the Environment and Climate Change. Eventually, the resulting model will represent how environmental changes over time affect a range of organisms in a lake. Her studies will make it possible to predict the future impact of combinations of stressors on algae, zooplankton, and fish.

Arnott's ultimate purpose is to provide information to help society make important decisions. Indeed, the connection between ecology, society, and legislation is a source of hope for this scientist, whose research in Killarney Provincial Park has convinced her that legislation really can work. The Killarney region and its lakes, just south of Sudbury, were hit hard by acid rain. But when Canada introduced strong legislation “to turn down the acid rain tap, emissions in the Sudbury area were reduced by 90 per cent, and these lakes started to recover chemically, and the zooplankton are starting to recover.”

This bounce-back story belies a certain amount of resilience inherent in ecosystems. Arnott’s team has observed this capacity to adapt to changing conditions even in the face of the invasive spiny waterflea. Arnott relayed how some of this invader’s prey are escaping predation by going deep down into the water during the day.

Zooplankton, and the lakes they live in, have a devoted ally.
Research is more than writing papers or staring into a microscope for hours on end. Research is creative, probing the edges of our world and beyond through inquiry and discovery. The second annual Art of Research photo contest gave us a glimpse into the variety of creative research projects happening at Queen’s. From a raven to a water droplet to a set of hands, each photo has its own unique story to tell of the research that inspired its capture.

With nearly forty submissions from faculty, students and staff members, the adjudication committee was challenged to narrow the list down to four winning and six shortlisted images. Those selected showcase the finest moments where research is the artistic and creative endeavour it always has been, and always will be.

1st Prize

Tulugak on the Crucifix
Dr. Norman Vorano
Professor, Art History and Art Conservation
Location: Pond Inlet, Nunavut

Dr. Norman Vorano was conducting historical research with Inuit elders in Nunavut in April and May of 2016. One woman recounted the loss of cultural traditions as a result of the changes that happened during the twentieth century, particularly from residential schools, the missionaries, and the waves of southerners who flooded into the Arctic after the Second World War. After they broke for lunch, Vorano stepped outside. The white sky was indistinguishable from the ground. He walked past a towering crucifix erected behind the Catholic Church, on an imposing hill overlooking the community. A raven flew down from the ethereal sky, perched on the crucifix, and began vocalizing. For Western culture, the raven is a harbinger of death. For Inuit culture, tulugak — raven — is a tricky fellow that symbolizes creation.
An underwater camera mounted in the SNO+ (Sudbury Neutrino Observatory) neutrino detector captures a snapshot image when the 12m diameter acrylic sphere is 85 per cent full. Viewed from below, ropes are seen crisscrossing the top of the sphere extending down (foreground), and each of the shiny cells that are visible is a 2cm diameter super-sensitive light detector. The water-air interface inside and outside the acrylic spherical tank creates visual distortions as light refracts at the optical boundary. Once full, the upgraded detector was turned on in Fall 2006, ten years after the original SNO detector completed its Nobel-prize winning studies.

This moment arrives at the end of the staging for the musical number “Aldonza” from The Man of La Mancha — one of two musicals Dr. Tim Fort directed at the Weston Playhouse in Vermont in the summer of 2016. Many of the show’s creative team are Broadway veterans, including the designer and the performer playing Aldonza — whose character is pictured ignoring the aggressions of the muleteers as they sing to her in this musical version of the Don Quixote story. Dr. Fort’s research interests lie in lighting and staging, and he has been a producing director at the Weston Playhouse for the past 10 years.
Honourable Mention

Amphibian from the Inside
Dr. Rute Clemente Carvalho
Postdoctoral Fellow, Biology
Location: Zeiss stereomicroscope in the laboratory

The evolutionary process called miniaturization can lead to morphological changes in body structures. The internal morphology of tiny specimens can be seen/observed using a special staining technique. This method digests the muscles, making them transparent, and colours the bones and cartilages. In the case of this froglet, it has a body size of around 18mm, and features like osteoderms in the skin and hyperossification on the skeleton can be observed. The knowledge of morphological structures can help researchers understand the evolution of the species’ behaviour, its ecology, and its phylogenetic relationships with related species.
Shortlisted Images

Evelyn Mitchell and her “Burler,” Dr. Laura Murray
Location: Kingston, ON

5000m High Sunset in the Andes, Chris Grooms
Location: Lake Sibinacocha, Cusco, Peru

Polypyrrole, Dr. Danesh Roudini
Location: Kingston University, UK

“Non-wetting” Water, Timothy Hutama
Location: Chernoff Hall, Kingston, ON

Phantasie Ist Alles, Julia Partington
Location: Museum Island, Berlin, Germany

For full descriptions, please visit queensu.ca/research/art-of-research.
Equity has always been a top priority for Dr. Heather Aldersey, Queen’s National Scholar in international community-based rehabilitation and assistant professor in the School of Rehabilitation Therapy. A researcher in community-based rehabilitation (CBR), a discipline focused on supporting people with disabilities and their families and communities in low- and middle-income countries, Aldersey works with families and people with disabilities to identify the problems they face.

“I really try to focus on strengths and solutions,” she says, “by looking at what exists and what works with families, and how to build on that and share that with other families.” Aldersey worked with families in the Democratic Republic of the Congo, Tanzania, and Bangladesh, and through her role as the faculty lead for the Queen’s-based International Centre for the Advancement of Community-Based Rehabilitation (ICACBR). Her participatory approach inverts the traditional top-down methods employed in many research projects.

“A big piece of participatory research is that I’m not setting the research agenda – I’m working with communities to identify problems and set the research agenda together,” Aldersey explains. For example, through the Access to Health and Education for all Children and Youth with Disabilities in Bangladesh (AHEAD) project, Aldersey and colleagues collaborated with wheelchair users in Bangladesh to identify research questions that were important to them. Aldersey and colleagues then trained them in the relevant research methods and analysis techniques, and the research team members who used wheelchairs collected data from other wheelchair users. Now the team, comprised of both academic and community researchers, is working on data analysis and action based on the research findings.

In an exciting new partnership with the University of Gondar in Ethiopia, Aldersey will collaborate with international colleagues on a much larger scale. The MasterCard Foundation (MCF) Scholars Program has invested $24.2M USD for a ten-year period into this partnership, funding multiple research projects and scholarships that will create a new generation of researchers and leaders in Ethiopia. Aldersey, as the designated Queen’s faculty lead in the partnership, is thrilled about the impact this grant will have on the University of Gondar’s vision to become the top research facility for CBR in East Africa.

The grant will fund eight research projects from a variety of disciplines over the next ten years, and any project topic will be considered so long as it benefits community-based rehabilitation and/or inclusive education in Ethiopia. The wide scope of projects that could fall under these themes was an intentional construction from both universities.

“We’ve left it very broad to allow the freedom for researchers here at Queen’s and researchers at the University of Gondar to come together and explore their mutual interests,” Aldersey explains. Projects must have one principal investigator at each university, and this construction relies on individual faculty members to reach out to each other in order to develop their project proposals.

“The research projects will involve a sharing of leadership amongst PIs at each institution,” says Aldersey. “We anticipate that the project leads will work together to explore topics of mutual interest that address pressing issues related to education and inclusion of youth with disabilities in Africa.”

The partnership is still in its early stages, with calls for project proposals to be released over the coming months. Other portions of the MCF grant will fund Queen’s-based training for University of Gondar faculty members in different areas, and provide 450 undergraduate scholarships for talented but disadvantaged youth at the University of Gondar. Queen’s will enroll 16 University of Gondar faculty members into its MSc in Occupational Therapy program, and these faculty members will then return to the University of Gondar and continue to work with Queen’s faculty and MCF project staff to create the first undergraduate Occupational Therapy program in Ethiopia. The grant will also support the University of Gondar’s mission to employ more faculty with doctoral degrees by supporting 44 of its faculty members to undertake PhD research at Queen’s focusing on topics relevant to disability.
The partnership between Queen’s and the University of Gondar will make a substantial impact on the education and scholarship of both schools’ faculty members, but more importantly on the quality of life of those living with disabilities across Ethiopia and other parts of Africa. “Often people with disabilities in situations of poverty are the most disadvantaged when compared with people without disabilities,” Aldersey says. “In terms of human rights and access to services, the time is right now. There is an urgent need to increase access to support and capacity for inclusion for people with disabilities on the continent of Africa.” Her inclusive, participatory work with the ICACBR and the University of Gondar is an important contribution to meeting this need over the next decade.
THINKING SMALL ON A GLOBAL SCALE

BY IAN COUTTS
To help create a greener and cleaner world, Queen’s chemistry professor Gregory Jerkiewicz is reaching out globally.

If we could wean our cars, buses, and trucks off of fossil fuels, it would go a long way in making our cities cleaner and healthier, and in reducing the greenhouse gases pumped into the atmosphere (road transportation accounts for close to 20 per cent of all CO₂ emissions worldwide).

Electric vehicles could help solve this problem, but as Jerkiewicz explains, they face a major stumbling block. Currently, car fuel cell technology relies on platinum-containing plates in an acidic environment to generate electricity. “If we were to get into large-scale production, the cost of platinum would jump three, four, or five times – who knows how much.” Worse, he says, “there is not enough platinum on the planet” to make such a large-scale switch a reality.

Nickel is a possible alternative. In fact, back in the early part of the 21st century, what was then Inco Limited (now Vale Canada Limited) developed a macroscopic nickel foam-resembling sponge that Panasonic used in metal-hydride batteries, and which Toyota employed in their Prius automobile. One drawback with nickel, however, is that it isn’t as good of a catalyst as platinum – if you replace the platinum in a fuel cell with a similar amount of nickel, it won’t produce the same amount of electricity. Space is at a premium in cars and trucks, so making the batteries bigger (and heavier) is not a solution.

Jerkiewicz thought there might be a solution on a different level – the nano level. Carrying out research on these macroscopic foams, he discovered that the fibres were hollow – and within them were nanoscopic fibres. (Nanoscopic here refers to anything under 100 nanometres in size. By contrast, a human hair is 86,000 nanometres in diameter.)

A key to the working of any battery (fuel cells being a type of battery) is the total area of the catalyst available for electrochemical reactions. A cube of nickel or platinum will have conversion occurring on its six surfaces. Open this up, coat substrates with it, do anything that increases the surface area, and you’ll boost the conversion and, hence, the power it produces. If you could open it up at the nano level, you could increase the surface area incredibly. “For instance,” says Jerkiewicz, “in PEM [polymer electrolyte membrane] fuel cells, the surface area is in the order of 30-50 square metres per gram of platinum.”

What Jerkiewicz wants to do is to create nickel-based nanoscopic forms that will maximize the surface area, but also have a connected structure that will allow a current to pass through them. He describes these as resembling “scaffolding or a nanoscopic cube with edges but everything else is empty, a nickel nanoframe.”

Jerkiewicz knew that creating these was beyond what one professor, one department, or even one university could do. “My vision was to put together a team that could design them, synthesize them on a small scale, test the stability of their electro-catalytic activity, and then transfer it to industrial partners who will scale it up” for commercial production. He dubbed the project Ni Electro Can (for Engineered Nickel Catalysts for Electrochemical Clean Energy).

The team he put together draws in seven Canadian universities as well as partners on three continents. His experts on nano materials for use in electrical applications are at the University of Poitiers (France). If he needs to examine materials, he turns to Gianluigi Botton at McMaster’s Canadian Centre for Electron Microscopy – “one of the best facilities in the world.” Byron Gates at Simon Fraser University (SFU) is an expert on designing nano materials, particularly foams. Steven Holdcroft at SFU and Dario Dekel at the Israel Institute of Technology are experts on the membranes used within fuel cells. All in, there are about 30 researchers involved, along with a similar number of graduate students, which is growing as the project is only in the middle of its second year.

“It is difficult to coordinate,” says Jerkiewicz. “If we were in a small European country, we could have a review meeting every month and everyone would be able to get there in a few hours.” Fortunately, email and the Internet help to keep them connected. After an initial meeting in January 2016, they now meet annually for a project review, and hold workshops every few months for the Canadian participants. Ni Electro Can has a full-time project manager to coordinate its far-flung researchers.

In January 2016, the Natural Sciences and Engineering Research Council of Canada awarded the group with a $4M Discovery Frontiers Grant to cover its research over the next four years. It is still very early days, but if, says Jerkiewicz, “it can be scaled up, and if it can be created in a way that immunizes against any environmental impacts,” then the world will be one big step closer to leaving the internal combustion engine behind.
Rediscovering Kingston’s Skeletons: Ronen Goldfarb

By Leigh Cameron

For many people, some of the most recognized moments of Kingston’s history are centred on the political career of Canada’s first Prime Minister and Kingston resident, Sir John A. Macdonald. For Ronen Goldfarb (Artsci’17) and his supervisor Dr. Laura Murray (English), Kingston’s history goes well beyond that.

Taking on an Undergraduate Student Summer Research Fellowship with Dr. Murray in 2016, Goldfarb participated in her oral history-based project SWIHHP – the Swamp Ward and Inner Harbour History Project. The Swamp Ward and Inner Harbour neighbourhoods are largely ignored in the traditional Kingston historical narrative in favour of the more glamorous stories of Sir John A. Macdonald and the Sydenham Ward. However, these neighbourhoods were the location of much of Kingston’s industry in the 19th and 20th centuries. Working with current Swamp Ward residents, as well as Queen’s Archives and the Kingston Frontenac Public Library (KFPL), SWIHHP is bringing some of this history back into the fold.
“There’s a lot of really interesting history in these neighbourhoods that has been explored and is yet to be explored,” says Goldfarb. His USSRF project began with many hours spent in the archives and at KFPL going through city directories, censes, and fire insurance maps to piece together an image of the historic Swamp Ward.

“All of this helps us to get a really holistic vision of what the neighbourhood would have looked like from the mid-to late-19th century up until today.”

After collecting these data, Goldfarb used the SWIHHP website and other social media to post blogs about the information and pictures he had found and to connect with the Swamp Ward community. “The posts got tremendous feedback,” he says, “with lots of people commenting and saying ‘I remember playing outside this house when these people lived there’ – and it actually allowed us to get in touch with those people and find out more about the neighbourhood.”

Energized by his community connections, the Swamp Ward’s McBurney Park, or “Skeleton Park” as it is commonly called, became the focus of the second half of Goldfarb’s USSRF project. Skeleton Park has quite a famous macabre history. Until the 1860s, it served as a burial ground for Catholics, Anglicans, and Presbyterians. After burials there stopped, the cemetery was not properly maintained and fell into disrepair. An 1893 decision to re-inter all bodies in other cemeteries and turn the burial ground into a park showed a promising new future for the area, but was overshadowed by a gruesome discovery.

“As [the exhumations] began, they found several bodies shoved in the same coffin – ‘casket stacking.’ In one case, they found 11 bodies stacked on top of each other up, with the shallowest burials three feet below the surface,” Goldfarb explains. “The exhumations had to be halted because the Americans were threatening to close their Canadian embassy in Kingston because of fear of a cholera outbreak. The situation in the park had become so grotesque that they just decided to level the ground and flatten any tombstones that were still visible.”

Stories emerged throughout the 20th century of children playing baseball using the tombstone crop markers as bases, or of residents finding femurs in their lawns. Goldfarb became interested in finding out more about this morbid history and how it affected current Swamp Ward residents. However, after conducting many interviews during the Skeleton Park Arts Festival, he was surprised to find that residents were much more concerned with the “present day reality” of the park than its spooky history. Stories he heard painted the park as a growing family-friendly attraction for people in the neighbourhood.

“I think the park really represents the changing reality of what it means to live in the Swamp Ward,” Goldfarb says. “It seems like a real point of pride now – they talk about how it’s really become a much more family-oriented neighbourhood where kids can go play in the park.”

Goldfarb’s project, and the larger mission of SWIHHP, is to rediscover the history of the Swamp Ward and Inner Harbour and bring this history back to their communities. With more projects on the way, including an upcoming audio documentary, SWIHHP’s researchers are ensuring that the past of these historic neighbourhoods stays present in Kingston’s larger history.

Each year, the Undergraduate Student Summer Research Fellowship (USSRF) provides an opportunity for students at Queen’s to engage in discovery-based learning and develop their research and presentation skills. The program is targeted to students in the social sciences, humanities and education.
The implications of Bill C-51 and current surveillance trends on citizens are pressing issues in Canada today. Bill C-51 “authorizes Government of Canada institutions to disclose information to Government of Canada institutions that have jurisdiction or responsibilities in respect of activities that undermine the security of Canada” (C-51 First Reading, 2015). These “activities” are defined as events that interfere with the capability of the Canadian Government in relation to intelligence, public safety, espionage, acts of terrorism, and cause harm to a person or property. The act states, “for greater certainty, it does not include lawful advocacy, protest, dissent and artistic expression” (62-63-64 ELIZABETH II, Parliament of Canada).

However, it is unclear how these activities intersect with artists’ and citizens’ use of activism and protest. Along with my supervisors, Drs. David Murakami Wood (Sociology) and Susan Cahill (University of Calgary), my doctoral research focuses on analyzing these issues. More specifically, I create artistic and cultural objects as a way of critically engaging, translating, and analyzing the sociological, political, affective, and theoretical impact surveillance has on Canada. My methods of investigation are unique because they include artistic intervention and production at all stages of my research. I produce exhibitions, art work, interactive web platforms, and installations that include multi-dimensional interaction from my audiences, including my peers, the
research community and study participants. My creative research aims to ask questions and find answers through cultural productions that have been created and framed with political and social ideas in mind. Since we are never disconnected from the media and cultural objects we experience (i.e. artworks, posters, social media, memes, protest banners, films, music, television series, etc.), it is imperative that we look at these productions as texts that are continuously creating and reimagining new information.

My interest in surveillance stems from its ubiquitous nature. Surveillance inescapably permeates our everyday lives, impacts our performance and engagement with a place and time, controls our borders and rights to movement, and is continuously practiced and repurposed consciously or unconsciously. We are all participants in a surveillance culture, whether it be by protecting personal or corporate land from trespassers or following friends on social media. The emerging and evolving surveillance culture has been studied and written about for decades by leading scholars at Queen’s (Surveillance Studies Centre) and others around the world.

Then why do we continue to exhaust a subject that we know is, cynically, impossible to change? We study surveillance because we know there is something more to be said and no matter how many times we slice it and dice it, there’s always a new angle to be explored. For example, how does surveillance impact our most vulnerable and marginalized communities? Surveillance theory has continuously looked at surveillance as something that impacts all citizens on a similar level, though it is very evident that most surveillance practices and trends predominantly target vulnerable and oppressed communities. In Canada, the implementation of Bill C-51 does this.

Bill C-51 is one of the ways that the Canadian government is attempting to follow global movements of constructing a survival state post-9/11. Sociologists Greg Elmer and Andy Opel define a survival state as a construction where citizens and institutions’ priority and collective responsibility is to survive, using technologies and surveillance processes to do so. Paradoxically, as scholars Rachel Dubrofsky and Shoshana Magnet argue, most citizens who would be adversely influenced by these surveillance strategies are marginalized and oppressed minorities who use activism and self-expression as a method of reclaiming their rights and identity. In Canada, this issue is constantly affecting Indigenous people who are fighting and actively contesting contemporary political, economic, and environmental violence. An example of this, outlined in Battell Lowman and Barker’s 2015 book Settler: Identity and Colonialism in 21st Century Canada, is the protesting of pipeline construction throughout Canada.

Bill C-51 is one of the ways the Canadian government is attempting to regulate protests and activism that counter their political agenda. These impacts include expanding definitions of security as well as broadening meanings of activities that are considered a threat and ‘chill the freedom of expression’ (Cheung and Stryker, 2015). There is an urgent need for studies that prove the significant impacts of Bill C-51 on Canadian citizens, artists, and cultural advocates.

My work aims to bring to light contemporary surveillance trends that have yet to be fully explored by academics through visual means. It explores new ways of contending with questions of politics, law, and human rights through artistic intervention. My hope is to continue to create interactive, subtle but powerful images and objects that encourage audience intervention and critique.
As the field of cardiovascular science rapidly develops, novel technologies are emerging as attractive options not only for treating patients, but also for earlier identification and diagnosis of vulnerable patients. Dr. Amer Johri, an associate professor in the Queen’s Department of Medicine, founder and director of the Cardiovascular Imaging Network at Queen’s (CINQ), and a practicing cardiologist, is attracting national and international attention for his research into ultrasound techniques. He also actively advocates the concept of investigating fat and cholesterol build up located in the carotid artery as a “barometer” of identifying coronary atherosclerosis. Recently, Olivia Yau, an MSc candidate in the Department of Biomedical and Molecular Sciences, sat down with Dr. Johri to discuss his research and the work of CINQ.
You began your career as a physician and now you are part of a unique group of clinician scientists here at Queen's University. What role, if any, do your clinical duties play in your research?

A: Patients are the reason why we, the Cardiovascular Imaging Network at Queen's University (CINQ), do research. Heart disease is the second leading cause of death for Canadians, and coronary artery disease risk factors like high blood pressure, increased blood cholesterol levels and increased blood sugar levels are skyrocketing. There is an urgent need to study methods for earlier, more accurate detection of these risks to deal with this “tsunami” that threatens to overwhelm our health care system. Our research is completely patient-focused and is enhanced by clinical work. We address questions like: How can we detect heart disease and stroke risks earlier? How can we increase the efficiency of current approaches to cardiovascular care? The focus of our network is imaging technology, specifically ultrasound – a non-invasive, radiation-free, portable and inexpensive tool.

Q: You were recently elected as the Chair of the American Society of Echocardiography (ASE) Council on Vascular Ultrasound. What caused you to shift the focus of your research from cardiac to vascular ultrasound?

A: Cardiac ultrasound and vascular ultrasound are interconnected. I don’t really see this as a shift, but rather an extension of CINQ’s mission to better understand and treat atherosclerosis – a silent, yet deadly disease that involves hardening and narrowing of the arteries, eventually blocking blood flow and resulting in various cardiovascular events like heart attacks and strokes. My leadership role at ASE allows me to promote the importance of identifying and detecting atherosclerosis from less traditional angles like vascular ultrasound in a global manner, allowing collaboration in this field, and ultimately pursuing changes in clinical practice for patient benefit. Vascular ultrasound is a rapidly evolving technology. We are very excited to explore its development through 3D imaging, contrast imaging, radiofrequency analysis, gray scale median analysis and plaque texture analysis.

Q: You published a paper on 3D ultrasound showing it may be more accurate than 2D ultrasound. Can you explain how this understanding is being applied to research today?

A: We were one of the first groups to show that 3D ultrasound produced better images than 2D methods for visualizing plaque – the cholesterol build-up responsible for heart attack and stroke. 3D ultrasound is therefore the main method we use to assess the effects of novel therapies on heart disease. This work has attracted attention from industry, and subsequently a 3D ultrasound probe specific for plaque assessment was developed. I believe 3D ultrasound is the first step towards the future of cardiovascular risk stratification.

Q: As the founder of the Journal of Point of Care Ultrasound, can you elaborate on what point of care ultrasound is? What inspired you to start a journal dedicated to this technology?

A: Point of care ultrasound (POCUS) is an immediate, convenient form of examination that can be provided by the primary care physician with more portable tools like hand-held ultrasound devices. POCUS can be invaluable to patients in acute care settings, and is often used as an adjunct to physical exams. While it is changing the landscape of bedside physical assessment of patients, there are very few peer-reviewed resources available. We created an iBook to demonstrate the use of cardiovascular POCUS, but there was an acute need for an ongoing vehicle to provide education on general POCUS use. This is why we created the Journal of POCUS – a highly interdisciplinary and collaborative endeavour. Expert users from Kingston General Hospital’s Anesthesiology, Emergency, and Internal Medicine departments, as well as the Intensive Care Unit, are serving on our editorial board.

Q: You are a recent recipient of the Faculty of Health Sciences’ Mihran and Mary Basmajian Award for Excellence in Health Research, awarded to younger faculty members with meritorious contributions to health research. With this recent recognition of your success and momentum, where do you see yourself and your research in 10 years?

A: My plan is to have a sustainable research program in 10 years’ time. I envision that CINQ will have a life of its own and will be recognized worldwide for high-quality, translatable cardiovascular research leading to patient care solutions. This is why we are investing heavily in training the next generation of clinician scientists, and building important partnerships with the Queen’s School of Computing, the Clinical Evaluation Research Unit, researchers from Sun Yat-Sen University in China, and numerous other academic and industrial collaborators worldwide. I can share this vision of CINQ with you now, but the daring part of research is that you really don’t know where it will take you!

Keep up with Dr. Johri and his research by following him at @amerjohri on Twitter. Learn more about the CINQ lab at CINQLab.com, and please take a look at our latest issue and contribute at POCUSJournal.com.