

VOL. 36, NO. 2, FALL/WINTER 2019

CONTOURS

SHAPE THE WORLD



UNIVERSITY OF ALBERTA
FACULTY OF SCIENCE

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The University of Alberta Faculty of Science is a research and teaching powerhouse dedicated to shaping the future by pushing the boundaries of knowledge in the classroom, laboratory, and field. Through exceptional teaching, learning, and research experiences, we competitively position our students, staff, and faculty for current and future success.

Science Contours is a semi-annual publication dedicated to highlighting the collective achievements of the Faculty of Science community. It is distributed to alumni and friends of the faculty.

- Dean of Science**
Matina Kalcounis-Rueppell

Editor-in-Chief
Jennifer Pascoe

Managing Editor
Katie Willis

Associate Editor
Andrew Lyle

Design
Lime Design Inc.
- Contributing Writers**
Chris Fetterly
Andrew Lyle
Julie Naylor
Jennifer Pascoe
Katie Willis

Photography
John Ulan
Dawn Graves

Proofreader
Sasha Roeder Mah

Send your comments to:

The Editor, *Science Contours*
Faculty of Science
6-194 CCIS, University of Alberta
Edmonton, AB, Canada T6G 2E1
science.contours@ualberta.ca



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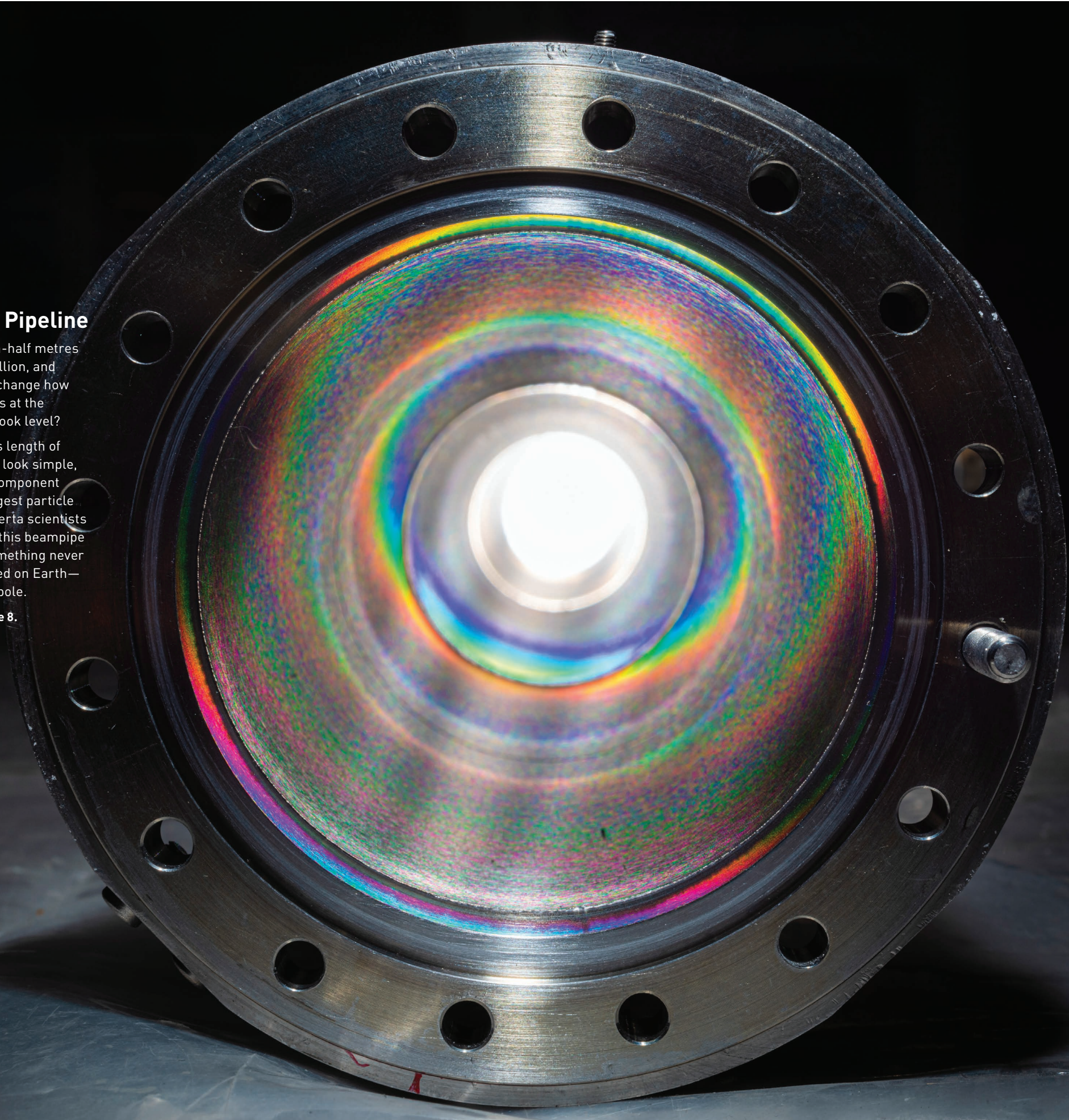
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Innovation Pipeline

What's two-and-a-half metres long, worth \$1 million, and could potentially change how we explain physics at the high-school textbook level?

The answer is this length of pipe, which might look simple, but is actually a component of the world's largest particle accelerator. UAlberta scientists are cutting apart this beampipe in the hunt for something never before documented on Earth—a magnetic monopole.

Learn more on page 8.



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Taking a look at Alumni Weekend 2019



CHRISTOPH FREI (MATHEMATICAL AND STATISTICAL SCIENCES) IS USING MATHEMATICAL MODELS TO STUDY THE POTENTIAL OF DIGITAL CURRENCY TO CHANGE OUR WORLD. FREI IS AN EXPERT IN MATHEMATICAL FINANCE AND ECONOMICS, FOCUSING ON ALGORITHMIC TRAINING, CREDIT RISK MANAGEMENT, AND DIGITAL CURRENCIES—INCLUDING CRYPTOCURRENCIES SUCH AS BITCOIN.

CHEQUES AND BALANCES

MEET MATINA



Dear Faculty of Science supporters,

It is an honour to greet you in my first issue of our alumni and friends magazine as the new dean of the Faculty of Science at the University of Alberta.

In just four short months in my role, I have come to appreciate the critical engagement, leadership, and impact of our alumni, donors, government, industry partners, and countless other community supporters in steering science and our local, national, and global society forward.

It has been my pleasure, and a highlight of my first few months, to meet many of you, whether in person, on the phone, via email, or at our inspiring and energizing Alumni Weekend events (catch a glimpse on page 31). I sincerely look forward to reconnecting with and meeting many more of you in the coming months and years. Consider joining us at any of our upcoming alumni events, because meeting with you and hearing your perspectives are top priorities for me.

Though the year ahead promises challenges, the Faculty of Science is in

a strong position to carry forward our core mission of excellence in research, innovation, discovery, and teaching. Supporting and defending this mission of excellence in research and the student experience is paramount for my vision for success for the Faculty of Science. To support our excellence, we need to work together in a balanced, inclusive, and welcoming way.

At its core, science is about individual creativity in our classrooms, laboratories, and field sites. When we can make connections between individuals and across disciplines and boundaries, our potential for problem solving increases. Opportunities for connections abound. I have been gratified, even in the short time since I began as dean, by work on multidisciplinary programs within our science departments, between our faculty and the faculties of Engineering, Medicine & Dentistry, and Arts, among others, and between universities in Canada and across the world.

We also have enormous opportunities ahead for communicating our science and the impact it has locally and globally. We are all aware of the world-leading programs and expertise in the Faculty of Science at the University of Alberta, and I would like to see increased recognition for our programs and expertise. This recognition will be important for our future to ensure that the best and brightest scientists and future scientists choose our Faculty of Science as a place to study, work, and lead. This will require meaningful engagement from all of us. How can you help? As our alumni, friends, and supporters, you are our champions.

In the pages ahead, you will be inspired and energized by the stories of our students, faculty, and alumni, who are transforming the world around us with innovative solutions to some of society's—and the world's—most pressing problems. Enjoy these stories and tell these stories. You are uniquely positioned within your incredible spheres of leadership and influence to increase awareness of the Faculty of Science and the important and innovative research and training happening here on campus and beyond.

Sincerely,
Matina

MATINA KALCOUNIS-RUEPPELL began her **five-year term** as dean in the Faculty of Science on **July 1, 2019**.

1 **MATINA** is the **first** female dean in the Faculty of Science.

Prior to joining us, Matina was a faculty member at the University of North Carolina at Greensboro for **16 years**.

MATINA is an expert on the biology of acoustic communication in bats and mice, **two biodiverse groups** of mammals that communicate using ultrasound.

25 **Matina** has spent more than **25 years** doing field research.

IN NORTH CAROLINA, Matina and her research team examined approximately **100,000 bat calls** and **1 million mouse call files**.

THERE ARE 9 SPECIES of bats in Alberta and they all are nocturnal and major consumers of insects. Matina has recorded **at least 3** of these species flying over CCIS this fall.

GRADUATE STUDENT THERON FINLEY

travelled to **5 countries** on **3 continents** on his journey to understand geothermal energy around the world. He took **25 flights**, many train rides, and countless steps.

Read more on page 20.



SCIENTISTS are working to drill through

700 metres

of ice to access the subglacial lakes below the Devon Ice Cap.

Read more on page 13.

A RESEARCH PARTNERSHIP between UAlberta and Edmonton game studio **Improbable** is creating better, more realistic video games.

Read more on page 27.



20 **SUSAN JENSEN**, **1st female chair** of the Department of Biological Sciences, reflects on more than **20 years** of support as a donor to the Faculty of Science.

Read more on page 24.

23

The Faculty of Science offers **23 massive open online courses (MOOCs)**, with topics ranging from Bugs 101 to Problem Solving, Python Programming, and Video Games.

Learn more at uab.ca/moocs

BYTE-SIZE SCIENCE

50

50% OF LEARNERS enrolled in our MOOCs are between the ages of **25 and 34**, and more than half work full time.

These lifelong learners come from around the world—from **Brazil to Russia to India to Spain**.

\$500,000

pledged to the overhaul of undergraduate chemistry lab space by Gilead Sciences Inc.

3,000

Gilead's gift will support nearly 3,000 undergraduate students each year through the renovated laboratory spaces.

Read more on page 8.

116

116 Faculty of Science alumni are currently employed at Gilead.

33

33 students have completed an internship with Gilead through the Science Internship Program.

80

The Faculty of Science offered **80 sessions** of 40 different camps this summer, from artificial intelligence to space

40

MEANINGFUL EMPLOYMENT was provided for **40 undergraduate students** who led and instructed Science Summer Camps.

Nearly 1,800 campers in grades 1 through 10 joined us on campus for Science Summer Camps in 2019.

1,800

WHAT LIES BENEATH

INNOVATIVE PROJECT SET TO CEMENT CANADA'S LEADERSHIP IN ARCTIC RESEARCH

ASHLEY DUBNICK (LEFT) AND ALISON CRISCITIELLO, ALONG WITH ANJA RUTISHAUSER, ARE CHARTING A NEW COURSE FOR COLLABORATIONS IN CANADIAN SCIENCE.

HYPER SALINE LAKES BENEATH ONE OF THE MOST STUDIED ICE CAPS IN THE CANADIAN ARCTIC? MAYBE EVEN AN ENTIRE BRINY NETWORK WEAVING A WATERY WEB UNDER THE ICE? IT SOUNDS MORE LIKE SCIENCE FICTION THAN SCIENCE FACT. BUT ARMED WITH AMBITION, INNOVATIVE IDEAS, CUTTING-EDGE TOOLS, AND PRICELESS SUPPORT FROM ONE OF CANADA'S FOREMOST FOUNDATIONS—PLUS A COSY PARKA OR TWO—THESE SCIENTISTS ARE SET TO HELP US BELIEVE THE ONCE UNBELIEVABLE, CHANGING THE FACE OF THE CANADIAN SCIENCE COMMUNITY ALONG THE WAY.

By **JENNIFER PASCOE** / Photography by **JOHN ULAN**

The Devon Ice Cap. Situated in one of the most extreme environments and remote locations on the planet, this cooler than cool environment is a literal hotbed of scientific discovery. Like all Canadian Arctic ice caps, Devon was assumed to be cold-based and frozen to the bed. Despite being well studied by scientists for decades, it took a Swiss PhD student studying in Canada to surprise everyone with a remarkable finding.

"At first, we thought this geophysical evidence for subglacial lakes beneath the cold-based interior of the Devon Ice Cap was impossible because the temperatures at the glacier bed are estimated below -10C," says Anja Rutishauser ('19 PhD). "Only after looking at the surrounding geology did we realize that the water is likely saline, so its freezing point is depressed, sourced from salty rocks that underlie parts of the ice cap. That's when we started to recognize that we had discovered a worldwide unique subglacial water system."

This is not only the first subglacial lake discovered in the Canadian Arctic, it is also considered the first isolated hypersaline subglacial waterbody of its kind discovered on Earth.

This waterbody presents a unique scientific opportunity because it is a potential extreme microbial habitat, representing the combination of cold, salty, and dark conditions under pressure. These conditions

make this subglacial waterbody one of Earth's most extreme environments and one of Earth's closest known analogues to extraterrestrial habitats hypothesized to exist on Mars, Jupiter's moon Europa, and Saturn's moon Enceladus.

That otherworldly component captured the attention of countless people around the world when the finding was first announced in the spring of 2018. And it's the opportunities presented by the project that have the potential to chart a new course for collaborations in Canadian science.

HIGH RISK, HIGH REWARD

The heavily interdisciplinary (glaciology, biogeochemistry, geophysics, hydrology, microbiology, and fluid dynamics, to name a few), highly collaborative project has united scientists from seven universities so far, including the University of Alberta, McGill, Waterloo, Simon Fraser University, and the University of British Columbia, plus the University of Texas Institute for Geophysics (UTIG) and Montana State University. The project is spearheaded and led by Ashley Dubnick ('18 PhD), a postdoctoral fellow at the University of Alberta; Alison Criscitiello, technical director of the Canadian Ice Core Lab housed at the University of Alberta; and Rutishauser, now completing a postdoctoral fellowship at UTIG. Not only is this one of the largest, most interdisciplinary projects to date



Rutishauser (left) and Criscitiello at the Devon Ice Cap

IMAGE SUPPLIED

led out of the Faculty of Science, it is also being led by three early-career researchers who are all passionate about deepening our understanding of the Arctic.

“The Canadian Arctic is incredibly remote,” says Dubnick, who in her graduate studies focused on the chemistry and microbiology of glacial ice and the meltwater that drains from ice sheets. “It’s a huge landmass—3.5 million square kilometres covered by a ton of coastline and 150,000 square kilometres of glaciers and ice caps. There’s so much diversity in terms of the terrain.

“It’s a harsh environment, but every nook and cranny is unexplored and new, so the scientific opportunities are endless. It’s an inspiring yet hugely understudied area, mostly because it’s so remote and hard to access, and there’s not a great funding structure within Canada to do research up there. We want to explore what adaptations have been created in this extreme environment to extend the definition of biodiversity on Earth,” says Dubnick.

BIG SCIENCE, BIG SUPPORT

How support came to be to move the project forward from Rutishauser’s initial discovery is more poetry than science fiction.

Dubnick, a biogeochemist who completed her PhD studies with Professor Martin Sharp (earth and atmospheric sciences), was supported by The W. Garfield Weston Foundation during her graduate studies. Following her PhD, Dubnick completed a postdoctoral fellowship with Professor Emeritus John England (earth and atmospheric sciences), recently named to the Order of Canada and himself supported by the foundation as the 2016 recipient of the Weston Family Prize for Lifetime Achievement in Northern Research.

The magnitude and potential impact of the Devon Ice Cap project and the mystery behind it motivated

significant support from the foundation, which has solely supported the first two years of exploration since.

“The discovery of these lakes is such big news, and it’s so scientifically important, not to mention incredibly unique,” says Criscitiello, a celebrated ice core researcher. “There was an energy around it, and we wanted to leverage the inertia of the discovery to turn this into something much bigger, cementing Canada’s place in Arctic research.

“This project would not be happening without the philanthropic support of The W. Garfield Weston Foundation. There is no structure in Canada at the moment for funding huge science like this. It is high risk but high reward. Because it’s such a massive investment, and it’s coming from a foundation, it feels more personal.”

Criscitiello details the uphill battle of getting beneath all that ice. Travelling to the Devon Ice Cap requires precision planning in logistics—a costly flight to Resolute, Nunavut followed by a bumpy flight on a small fixed-wing plane equipped with skis. The trip is further complicated by the need for optimal (yet uncontrollable) weather conditions that are typically sub -20C—some instrumentation doesn’t work in extreme cold or cloud cover. And ultimately there is the question of the physical limitations of getting through 700 metres of ice to the water below. It means innovative approaches to drill through the ice, plus a new way of thinking about how to keep the water beneath pristine.

So why jump through all the hoops?

REDEFINING BIODIVERSITY

“This is a moment to change Canada’s role in cryosphere research,” says Criscitiello. “This salty, dark, cold, isolated environment means that there’s a place on Earth that will allow us to ask questions about the extremes of life and biodiversity on our planet, and by extension, what may be possible on other planets where similar conditions are hypothesized to exist.

“Studying a hypersaline waterbody beneath 700 metres of ice requires state-of-the-art geophysical, drilling and sampling equipment that doesn’t cur-

DESPITE THE FACT THAT WE ARE A POLAR NATION AND CHANGES IN THE ARCTIC ARE WIDELY ACCEPTED AS A HARBINGER FOR CHANGES WE MAY ONE DAY EXPERIENCE ON THE REST OF THE PLANET, CANADA HAS BEEN HISTORICALLY BEHIND OTHER COUNTRIES GLOBALLY IN TERMS OF INFRASTRUCTURE AND SUPPORT FOR NORTHERN RESEARCH.



rently exist in Canada. This project aims to acquire that equipment and ultimately make it available to the Canadian scientific community. The equipment will allow scientists to make new observations with strong potential to revolutionize our understanding of polar science across disciplines, including glacier dynamics, glacier-ocean interactions and even the climate on Mars,” continues Criscitiello.

“The equipment we hope to develop will be critical in allowing us to better understand ice dynamics and constrain sea level rise projections, which is particularly important to Canadians given the huge percentage of our landmass affected by sea level rise. Climate science affects everyone on the planet.”

Despite the fact that we are a polar nation and changes in the Arctic are widely accepted as a harbinger for changes we may one day experience on the rest of the planet, Canada has been historically behind other countries globally in terms of infrastructure and support for Northern research.

These scientists and their supporters are hoping this project serves as a critical tipping point to shift that, with huge spinoff impact on collaborations and opportunities for Canadian scientists and for science in general.

“The W. Garfield Weston Foundation believes that this type of groundbreaking research is the key to advancing a global understanding of unique northern ecosystems,” says Geordie Dalglish, chair of the Northern Committee with The W. Garfield Weston Foundation. “We’re thrilled to be supporting the project team’s pioneering efforts to help unlock the mysteries of these subglacial lakes while advancing Canadian expertise on a global scale.”

In terms of what comes next, the scientists remain not only optimistic but also curious.

“I am still extremely excited about this discovery, but even more determined to continue researching this unique subglacial environment through interdisciplinary and state-of-the-art investigations,” concludes Rutishauser. “There are so many remaining questions about what lies beneath the Devon Ice Cap.” +



UALBERTA RESEARCH MAXIMIZES INDEPENDENCE
AND ROAD SAFETY WITH NEW COGNITIVE ASSESSMENT
FOR AGING DRIVERS.

By JULIE NAYLOR / Photography by JOHN ULAN

(NOT-SO) RISKY BUSINESS

ANTHONY SINGHAL, ASSOCIATE PROFESSOR AND
CHAIR IN THE DEPARTMENT OF PSYCHOLOGY
(PICTURED), IS TAKING THE WHEEL OF A PROJECT
INITIATED BY ALLEN DOBBS TO ASSESS COGNITION
IN SKILLED ENVIRONMENTS, INCLUDING DRIVING
AND OPERATING HEAVY MACHINERY.

Innovative assessments for drivers

IT MAY BE A CONVERSATION YOU'VE
CONSIDERED HAVING WITH AN AGING LOVED
ONE: HOW DO YOU KNOW IF IT'S NO LONGER
SAFE FOR THEM TO DRIVE ON THEIR OWN?
IT'S A COMPLICATED QUESTION OF GROWING
IMPORTANCE WITH CANADIANS LIVING LONGER
AND A GROWING AGING POPULATION—AND
IT'S ONE THAT UNIVERSITY OF ALBERTA
PSYCHOLOGY RESEARCHERS AND SPINOFF
DRIVEABLE ARE TAKING ON WITH NEW
RESEARCH.

ESTABLISHED AS A UNIVERSITY SPINOFF, DriveABLE
has been providing driver risk assessments across North America,
New Zealand, and South Korea for more than 15 years.

With deep roots in UAlberta research, DriveABLE's goals are
to protect competent drivers, identify cognitively unsafe drivers,
and help improve safety on our roads.

SAFETY IN NUMBERS

The idea was born when a team of physicians asked Allen Dobbs
(psychology) to develop a driving assessment that would help
them make the drive-or-no-drive decision for patients.

"Physicians see many patients who have cognitive
impairments due to dementia or other illness, and despite their
decline in mental abilities, they are still driving," explains
Dobbs, now a professor emeriti. "Diagnosis itself is a poor
predictor of driving competence, and at the time, there were no
validated tests to assess when the illness had made the patient
no longer safe to drive."

Dobbs' goal? To discover a scientifically defensible way to
evaluate the driving safety of those whose cognitive abilities
had been compromised.

When he set out to develop an in-car driving assessment, it
became clear that it was too dangerous to test some cognitively
impaired drivers on public roadways. Dobbs realized it was
essential to develop a test that was highly predictive of actual
in-car performance but could be administered in the safety of an
office setting—without the need for accessing public roadways.

Dobbs and his team recruited three groups of volunteers—a
group of dementia patients who were still driving and likely to be
a danger on the road, a group of age-matched cognitively normal
drivers, and a healthy group of younger drivers.

RESEARCH CAN BE HYPER SPECIALIZED, AND WE NEED TO BROADLY EXPAND THAT AND WORK WITH A MARKET THAT HAS VARYING NEEDS AND SCENARIOS.

“By comparing the driving errors of the three groups, we could isolate the kinds of unsafe driving errors made exclusively, or with a higher frequency, by the dementia patients,” explains Dobbs. “This told us what to score during a driving evaluation.

“Our breakthrough was recognizing that driving required multiple cognitive skills concurrently—memory, spatial judgments, attention, et cetera, and that executing a test in a safe office environment could simulate the experience while ensuring the safety of the driver and others on the road.”

Using a variety of statistical procedures, Dobbs developed a way to combine scores from those tests to provide a single outcome that resulted in a strong predictor of actual road-test performance.

THE BIRTH OF DRIVEABLE

The entire study took approximately eight years. And once the research was published, Dobbs was encouraged to champion a spinoff company that would transition the research results into practice. “We believed that the assessment could make a substantial contribution to road safety in Alberta and elsewhere,” he recalls. “So some of my research staff and I decided to accept the challenge.”

The result was DriveABLE, which at the time was the only assessment system worldwide that assessed a driver based on the level of cognitive impairment caused by their medical condition.

FUTURE WORK THROUGH DRIVEABLE WILL INVOLVE COLLECTING ELECTROENCEPHALOGRAPHY (EEG) AND FUNCTIONAL MAGNETIC RESONANCE IMAGING (fMRI) DATA AS BRAIN FUNCTION CORRELATES OF DRIVING AND COGNITION.

TAKING UP THE TORCH

Fast forward 15 years, and the partnership between DriveABLE and University of Alberta researchers has continued to flourish.

Anthony Singhal, associate professor and chair in the Department of Psychology, has carried on where Dobbs left off, expanding beyond driver assessments to develop reliable testing that takes into account a multitude of influences and can be applied to any skilled environment, be it operating a train, LRT, or heavy machinery.

“The early studies led by Dobbs looked at the relationships between cognition as objectively measured by tests and on-road performance,” says Singhal. “We are now working towards blueprinting the definition of impairment—not just for driving, but for any situation that requires focus.”

Singhal, along with postdoctoral fellow Reyhaneh Bakhtiari and graduate student Michelle Tomczak, has harnessed the power of machine learning for predictive modelling, using data sets supplied by DriveABLE as well as results from his own controlled experiments to determine if identifying certain aspects of cognitive performance would be predictive of passing a road test. The research focuses on the complexity of human behaviour and performance as our brain activity is influenced by different factors.

“For instance, we are now determining specific ways an elderly brain is different than a brain on drugs and how both are different from younger brains

Driving has been a consistent theme throughout Singhal's life. The avid car enthusiast even once drove a cab to pay for his tuition. His graduate work saw him working with the Canadian Space Agency to develop a multi-tasking instrument for testing on the space station for eventual human adaptation for a human mission to Mars.

Singhal now drives the future as chair of the Department of Psychology, which serves roughly 13,000 students representing roughly one-third of the entire undergraduate student population at the University of Alberta. The department ranks near the top 100 in the world for the study of psychology.

not on drugs,” Singhal explains. “Looking at how cognitive performance is influenced from all angles will allow us to build an algorithm to predict what should be tested to determine risk.”

Singhal wants to take the research one step further to include other kinds of studies—collecting brain waves and using magnetic resonance imaging (MRI)—and accessing other populations through DriveABLE and their network of partners to inform the analysis.

ROOTS IN RESEARCH

For their part, DriveABLE continues to take great pride in its strong connection to research.

“Science is the foundation of everything we do,” says Aaron Granley ('04 BA, '07 BCom), vice-president of research and development for DriveABLE. “The fundamental question we have always been trying to answer is how cognition relates to any safety-sensitive scenario—where one needs to pay attention, perform a task accurately, and perform well to be safe in the environment.”

Granley notes that DriveABLE's strength lies in connecting with their partners, such as UAlberta, to leverage expertise and get the answers needed to some of the big, and new, impairment questions. Over the last four years, Granley has seen a significant shift in the way people and organizations not only talk about impairment and risk but also deal with it.

“We are not focused on one thing,” he says. “There are complex scenarios and problems and we need to figure these out. Research can be hyper specialized, and we need to broadly expand that and work with a market that has varying needs and scenarios.

“Science is always changing, and so are markets. If you are not pushing to improve or find the next level, you are not going to be relevant in a year or two.”

The Faculty of Science is proud to foster a culture of innovation, putting research into action to improve safety, enhance quality of life, and create new technologies. Our strong track record of successful spinoff companies includes DriveABLE, Applied Quantum Materials, MedRoad, Nanolog Audio, Quantum Silicon Inc., Resolved Instruments, and 48Hr Discovery, among others. And Faculty of Science students are also leaders in turning research into real-world ideas through the Student Innovation Centre—where student groups AlbertaSat, the UAlberta International Genetically Engineered Machine (iGEM) team, NeurAlberta-Tech, and more embrace the culture of innovation outside the classroom. +



JENSEN VISITS CAMPUS IN SEPTEMBER 2019, SEEING HOW THE BIOLOGICAL SCIENCES BUILDING HAS CHANGED OVER THE YEARS.



IMAGE SUPPLIED

Susan Jensen has had many roles on campus, from student to department chair.

A FOUNDATION FOR THE NEXT GENERATION

“Our real legacy is our students. I’m proud of my contributions to research, of course—but I wanted to train students who love what they do,” says Jensen. “To me, more important than being in the lab around the clock was that they worked hard because they wanted to work hard—because they wanted to pursue what they found interesting, and that they would pass that excitement on to their own students.”

As a professor emerita, Jensen continues her support of today’s students with an annual donation to the Faculty of Science, expressing her personal philosophy of mentorship, science, and paying it forward.

“There are very few cases where one makes a discovery and that’s the end of the story. Science goes on and on and into other hands. It’s important that we remember we’re building a foundation for the next generation.” +

Want to find out how you can support initiatives like the Susan Jensen Indigenous Support Endowment? Visit ualberta.ca/science/alumni-and-giving to learn more.

endowment in the Faculty of Science for indigenous students, supporting students via undergraduate scholarships, bursaries, and fees for equipment and conferences.

“I have reached an age where I have begun to reflect back on my life and how fortunate I have been,” explains Jensen. “I attribute my good fortune in large part to my university education and my career as a staff member in the Faculty of Science.”

The first scholarships funded through the Susan Jensen Indigenous Support Endowment will be awarded later this year.

Heritage Foundation for Medical Research that gave me my original academic position. So much of that support was as a result of good fortune, and being in the right place at the right time.”

A CAUSE FOR REFLECTION

Jensen and her husband have been proud donors to the University of Alberta for more than 20 years, helping to support the next generation of students. And looking back on that good fortune, she was inspired to channel that support in a new way—with the Susan Jensen Indigenous Support Endowment, the first support

A THRIVING TECH ECOSYSTEM IN EDMONTON IS BEING BUILT BY PARTNERSHIPS BETWEEN UALBERTA RESEARCHERS SUCH AS NATHAN STURTEVANT (CENTRE), TECH LEADERS LIKE AARYN FLYNN OF IMPROBABLE (RIGHT), AND RECENT GRADUATES TURNED EMPLOYEES LIKE DEVON SIGURDSON (LEFT).



FINDING YOUR PATH

HOW THE EDMONTON VIDEO GAME INDUSTRY, UALBERTA RESEARCH, AND NEW GRADUATES STEP UP THEIR GAME TOGETHER

Collaboration between computing scientists and Edmonton tech company Improbable creates new research partnership—and opportunities for new grads.

By **ANDREW LYLE** / Photography by **JOHN ULAN**

How does a robot navigate around a room? How does it plan its movement to avoid furniture or falling down the stairs? If it moves outside, is it faster to go around a hill, or to climb over it?

These questions are the basis of pathfinding technology, and the techniques are applicable to more than just robots in the real world—they’re also of critical importance in video games. That’s why computing scientists at the University of Alberta are engaging in a

new research partnership with the Edmonton office of international games company Improbable.

“Research on pathfinding has broad applications, including helping vehicles or robots to navigate on their own,” says Nathan Sturtevant (computing science), who is heading up the collaboration with Improbable. “In video games, it’s the foundation for how characters move around the game world. As we improve this technology, the way those characters move becomes more efficient, more realistic, and more believable.”

Sturtevant runs the MovingAI lab on campus, where their artificial intelligence research is improving how programs determine how to move around three-dimensional space.

“There are many types of research. Some of our work is on more fundamental algorithms and is more abstract—with less obvious applications. But, as in cases like this, it’s always exciting to adapt our work so that millions of people can directly experience and benefit from the improvements we make,” says Sturtevant.

(RIGHT) AARYN FLYNN, GENERAL MANAGER (NORTH AMERICA) OF IMPROBABLE AND UALBERTA ALUMNUS, IS OVERSEEING CREATION OF A FLAGSHIP GAME IN EDMONTON—AND SEES UNIQUE STRENGTHS IN DOING SO HERE.

PATH FORWARD

Improbable opened its Edmonton studio in 2018. But the company isn't just focused on building games. Rather, its work centres on creating a new engine called SpatialOS. As general manager (North America) of Improbable and UAlberta computing science alumnus Aaryn Flynn ('96 BSc, '00 BSc) explains, it's a set of tools that other developers will be able to use to create their own games—and the Edmonton office is using it to develop a game to share its potential.

"Here in Edmonton, we're building a yet-unannounced flagship game to demonstrate the power of SpatialOS in a meaningful way. Deciding to do this in Edmonton really draws on the strengths of the talent here," says Flynn. "That goes for both people we can hire in the community as well as those in the talent network that we can collaborate with—and that's where the impressive research at UAlberta comes in."

BREAKING NEW GROUND

Sturtevant has already had applications for his research in the games industry, having collaborated with Edmonton video game developer BioWare to create the pathfinding used in the popular video game *Dragon Age: Origins*. Flynn has also worked with UAlberta in the past while general manager at BioWare, making the new collaboration an exciting opportunity to again work with his alma mater on technology for video games.



"We've begun our new collaboration by working on pathfinding. We've updated and improved approaches to pathfinding significantly," says Sturtevant. "This new work provides more flexibility at runtime and will support interesting character behaviours that weren't possible before."

Sturtevant sees opportunities for research collaboration with industry as just one way UAlberta research benefits the local community and industry. Providing a world-class education to students and building local talent are others.

FROM STUDENTS TO EMPLOYEES

The skills that students develop in their coursework and in leadership opportunities on campus make them well-suited for Edmonton's growing tech and games industries. Devon Sigurdson ('16 BSc, '18 MSc) is one such graduate, now working at Improbable.

"I originally met Aaryn when he visited the lab I worked in during grad school. Aaryn has always shown great interest in AI, and after seeing what we were working on he asked me what my plans were after graduation," says



Improbable's Sample Game demonstrates the core functionality of SpatialOS and is available for download.

Sigurdson. "After learning that Improbable was growing a team in Edmonton, I applied to join him there as a software developer. Now I work with a team developing our AI and animation systems."

Sigurdson's experience is just one example of how the connection between campus and the local video game industry doesn't end at research partnerships. And as Sturtevant—himself a recent addition to the research and teaching lineup on campus—reflects, UAlberta provides a critical component of the Edmonton tech ecosystem: training and seeding the pipeline of skilled people who work in it.

"There are a lot of interesting problems that industry can face that might not occur to us in the lab—working with industry helps us focus on problems that are both challenging and relevant. And in turn, UAlberta's video games certificate program has been very helpful to the local games industry," says Sturtevant.

"The education our students receive here at UAlberta gives them experience in multi-disciplinary teams and develops their skills—so they have the tools for success no matter where their path leads them." +

Interested in learning more about artificial intelligence research at UAlberta? Check out ualberta.science.ca/ai

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— NATHAN STURTEVANT

