UNIVERSITY OF MANITOBA

ResearchLIFE

WINTER 2020 | VOLUME 1

FREEHAND
Rethinking Design Impact

LESSONS ON LOSS:
Elders' Wisdom on Grieving

THE MEASURE OF MALTREATMENT
The Evidence on Spanking

ICE, ICE, MAYBE
River Ice Engineering

MESSAGE

FROM THE VICE-PRESIDENT (RESEARCH AND INTERNATIONAL)

WINTER HAS COME. DESPITE the cold temperatures and hibernation of both plants and animals, much is happening beneath the snow and ice. Spring will bring rejuvenation and change. Ice will melt, cracking and impacting waterways as it collides and pushes its way forward, sometimes destroying things in its path.

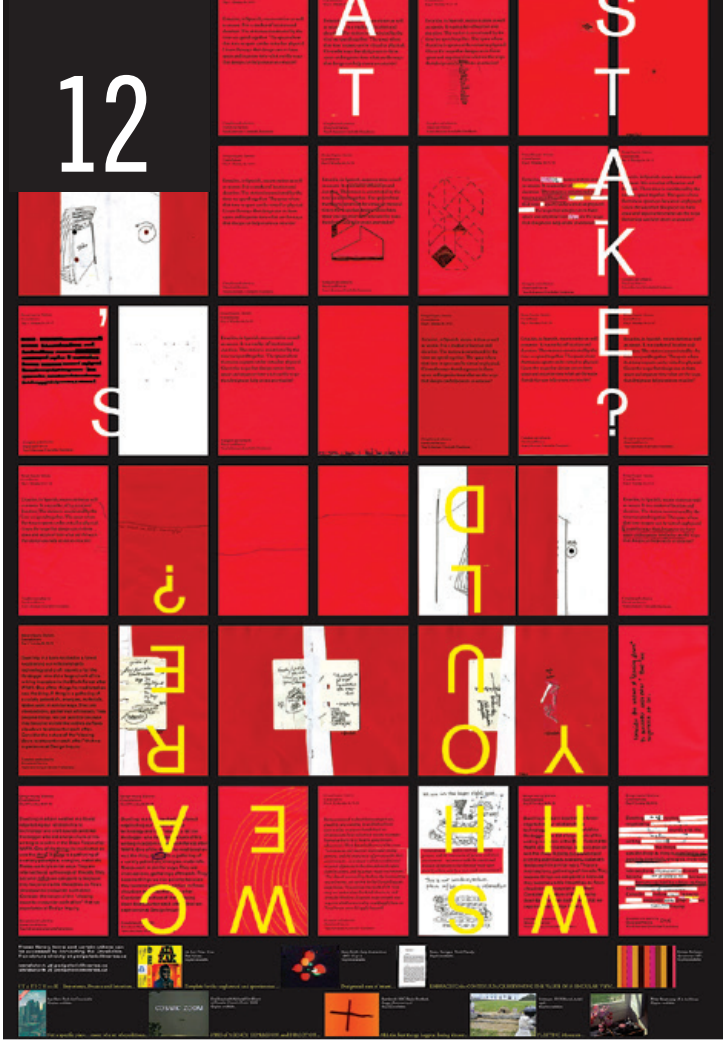
In this issue, you will learn about the research of river ice civil engineer Karen Dow who is studying the complexities of the conditions that influence the formation of ice and the unseen turbulent waters beneath.

The feature stories in this issue highlight early career researchers who are making great strides in their scientific, creative and scholarly investigations. Mary Kate Dennis is learning and listening to Indigenous Elders about their experiences with trauma and loss. Tracie Afifi's research into the harms that maltreatment causes to children has been recognized by the Canadian Institutes of Health Research with a Gold Leaf Prize for Early Career Research – but more importantly, is providing evidence for changes that are being adopted around the globe.

On the cover, you will see an image from the creative works of Daniel McCafferty. His practice "is more a form of inquiry, rooted in critique, that uses print, publishing, video, photography, data, mapping and programming, to explore relations between communication, community and power."

I invite you to explore the research explorations highlighted within this issue, from impactful award winners to budding undergraduate researchers.

—Digvir S. Jayas, OC, PhD, DSc, PEng, PAg, FRSC



ON THE COVER: Public Design Unit (PDU)
I am here: Mapping Detroit Water Shut-offs (detail)
Projection Map Museum of Contemporary Art Detroit
Photo: PDU

University of Manitoba

WINTER 2020 | VOLUME 1

IN EVERY ISSUE

FEATURES

ResearchLIFE

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Member of the University Research Magazine Association: www.urma.org

umanitoba.ca/research

Publication of this magazine is supported by funding from the Government of Canada's Research Support Fund, as is all research at the University of Manitoba.

ISSN# 1918-144

VOICES OF EMPOWERMENT

Two remarkable leaders were named Canada's Most Powerful Women in 2019 by Women's Executive Network (WXN) —F. GIGI OSLER AND TAYLOR MORRISEAU.

Osler is an associate professor of otolaryngology and physician at St. Boniface Hospital. Morriseau is a PhD student and Vanier Scholar in the Rady Faculty of Health Sciences.

As the past president of the Canadian Medical Association (CMA), Osler was the first female surgeon and the first woman of colour to take on the role. Through her leadership, the CMA began tackling equity, diversity and inclusion in medicine. Osler collaborated on projects such as The Lancet's work on advancing women in science, medicine and global health, and she led the first-ever CMA delegation to the 63rd Commission on the Status of Women at the United Nations.

On an early, lasting lesson she learned, Osler said, "I was told women have to work twice as hard to receive half the credit. That advice has served as a good reminder of the challenges that women continue to face and the barriers we must continue to break down."

"I was told women have to work twice as hard to receive half the credit. That advice has served as a good reminder of the challenges that women continue to face and the barriers we must continue to break down."

Morriseau's research centres on the genetic and environmental factors that contribute to early-onset of type 2 diabetes among Manitoban Indigenous youth, where incidences are approximately twenty times higher than the national average. She received the WXN's KPMG Future Leaders Award, which recognizes women under the age of 30 who have distinguished themselves early in their careers.

When asked by WXN, what advise she would give her younger self, she said, "Do not be afraid to create. In a world built on the foundation of extraction, create knowledge, create joy and create space for others to join you. The community you surround yourself with will be your greatest strength, so create connections and cultivate friendships as you grow."

"Do not be afraid to create. In a world built on the foundation of extraction, create knowledge, create joy and create space for others to join you."

PUSHING THE BOUNDARIES

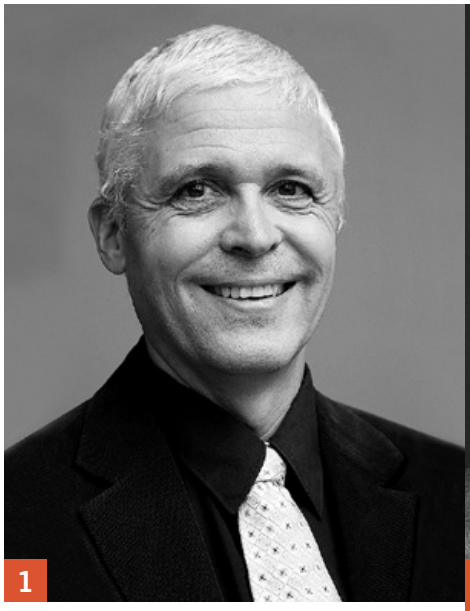
Four early career researchers are exploring ways to reverse frailty, allay anxiety using virtual reality, find new antibiotics, and assess the safety of northern infrastructure in the context of climate change with funding from the New Frontiers in Research Fund. The program supports high-risk, high-reward and interdisciplinary research to help Canadian researchers make the next great discoveries in their fields.

Renee El-Gabalawy (anaesthesia) is investigating a targeted preoperative virtual reality intervention using artificial intelligence integration for anxiety in patients undergoing breast cancer surgery.

Meaghan Jones (biochemistry and medical genetics) and Ayesha Saleem (kinesiology and recreation management) are studying how to turn back the clock on aging by treating old extracellular vesicles (EVs) in our blood with young EVs to adjust the epigenetic clock.

Sabine Kuss (chemistry) TOP & ABOVE: is seeking new insights into antibiotic resistance by using electrochemistry.

Pooneh Maghoul (civil engineering) is conducting threat assessments for northern civil infrastructure affected by climate change using an AI-based geomechanical model.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BEST IN CANADA

Eight researchers and scholars were recognized for their excellence, expertise, service and leadership in the fields of engineering, health and medicine, arts, and the humanities by election to Canada's senior academies and societies.

Canadian Academy of Engineering

1

Randy Herrmann (ENGINEERING) is director of the Engineering Access Program, which has graduated well over 100 engineers of Indigenous heritage that have gone on to demonstrate the importance of engineers who share the cultural heritage of Indigenous Peoples.

2

Ekram Hossain (ENGINEERING) is an internationally recognized expert in wireless communications and networking. His research on radio resource management for cellular wireless and cognitive radio networks has enabled advancement of broadband wireless communications technology.

Canadian Academy of Health Sciences

3

Ross Feldman (RADY FACULTY OF HEALTH SCIENCES; ST BONIFACE HOSPITAL ALBRECHTSEN RESEARCH CENTRE) has provided major contributions to our understanding of how to prevent and control hypertension, particularly in women.

4

Thomas Hack (NURSING; CANCERCARE MANITOBA; ST. BONIFACE HOSPITAL ALBRECHTSEN RESEARCH CENTRE) has made significant progress in our understanding of the psychological issues facing cancer patients and the end-of-life challenges that some will encounter.

Canadian Medical Hall of Fame

5

Distinguished Professor Harvey Max Chochinov (PSYCHIATRY; CANCERCARE MANITOBA) is one of the world's most innovative and influential proponents of improved and expanded palliative care across multiple dimensions of life-limiting or life-ending conditions.

Royal Society of Canada

6

Fellow - Distinguished Professor Dawne McCance (RELIGION) is an internationally recognized interdisciplinary scholar and critic recognized for her innovative and integrative research which engages religion, bioethics, feminism, philosophy, psychoanalysis, literary criticism, architecture, animal and disability studies, and the history of academic freedom.

College of New Scholars, Artists and Scientists of the Royal Society of Canada

7

Member - Frank Deer (EDUCATION) is Kanienkeha'ka from the Mohawk community of Kahnawake, and holds a Canada Research Chair in Indigenous Education. His research investigates and promotes the ways in which primary and secondary education supports an important dimension of the journey of Indigenous peoples toward the affirmation of their respective identities: Indigenous languages.

Sir William Dawson Medal Winner

8

Distinguished Professor Digvir Jayas (BIOSYSTEMS ENGINEERING) is a former Canada Research Chair in Stored-Grain Ecosystems. Over the last 30+ years, he has integrated principles of engineering and biology to revolutionize our understanding of grain storage and made major contributions to improving the practice of grain storage throughout the world.

ADVANCING KNOWLEDGE

Four research experts are furthering their investigations into renewable energy, linguistics, biodiversity, and stressed cells as new and renewed Canada Research Chairs. The program attracts and retains some of the world's most accomplished and promising minds.

Eric Collins
(CENTRE FOR EARTH OBSERVATION SCIENCE), chair in Arctic Marine Microbial Ecosystem Services, will answer the driving question of: How will sea ice loss, economic development, and other human impacts affect ecosystem services provided by Arctic marine microbes?

Carl Ho
(ELECTRICAL AND COMPUTER ENGINEERING), chair in Efficient Utilization of Electric Power, studies low voltage micro-grid technologies, power electronics grid-connected converters, and their controls. He is developing new technologies to support increased harvesting of renewable and clean energy, lower energy losses, higher power quality, and a more reliable platform for simulating power apparatuses in a grid.

Susan Logue
(HUMAN ANATOMY AND CELL SCIENCE), chair in Cell Stress and Inflammation, aims to understand how stressed cells "talk" to neighbouring cells. Using a range of cell biology and biochemical techniques Logue will study cell-to-cell communication during endoplasmic reticulum (ER) stress and determine how the unfolded protein response impacts on the wider cellular environment. Knowledge gained from this research program, while increasing our basic understanding of ER stress, will have applications in the treatment of diseases such as cancer.

Nicole Rosen
(LINGUISTICS), chair in Language Interactions, conducts advanced linguistic research on language interactions on the Canadian Prairies, including the influence of heritage and immigrant languages on official languages, and on the Michif language. Rosen will develop new methods for the visualization and dissemination of language variation and change, and will work with Métis youth and elders to co-create Michif resources to be used in documentation and revitalization efforts.

FOOD, FARM, DISCOVERY

BY CRYSTAL JORGENSON

FROM THE OUTSIDE, IT LOOKS A LOT LIKE THE REST of the red and white farm structures at the Glenlea Research Station (GRS).

However, when you walk through the doors of the Bruce D. Campbell Farm and Food Discovery Centre, you quickly realize it is much more than a traditional barn. The centre serves as a critical outreach portal for modern Canadian food production, and a conduit for sharing the Faculty of Agricultural and Food Sciences' research and education programs.

For centre manager Myrna Grahn, public trust in Canadian agriculture is a key driver to their mandate.

"We want visitors to receive accurate, balanced and current information about where their food comes from. We share the farmers' stories about how they care for the animals and the land. We provide balanced information on all farming styles and recent innovations in health and nutrition about foods grown and processed in Manitoba," Grahn says.

Opened in 2011, the centre offers a unique hands-on experience, which leads visitors from the farmer's field to the kitchen table. Windows provide views into a working swine barn, and interactive exhibits explore crop production and storage, environmental stewardship and food processing.

Over 8,000 people toured the centre 2019, chiefly school groups engaged in curriculum-linked field trips. Many of the programs culminate with students creating a food product using local ingredients. The centre also regularly hosts the UM's Science, Engineering and Technology (SET) Day and recently launched a "Food from the Land Day" aimed at high school students.

TOP: Visitors on the 'people mover' touring the farm

University students are frequent visitors to the centre and research station, from agricultural and food sciences to engineering and MBA students engaged in tours and training. The centre has also hosted international delegations, government and industry meetings, and the general public. Open Farm Day in 2019 drew over 800 visitors in one day.

"Our goal is to provide the knowledge translation from the science to the farm to the consumer's plate, helping ensure that they are eating food that is safe, healthy and affordable and produced in a way that is sustainable and enhances the environment,"

What makes the centre unique is its connection to GRS, which covers 500 hectares of land including dairy, beef and swine livestock facilities, pastures and field plots. It is home to Canada's longest-running study of organic crop systems. The station is also the site of the National Centre for Livestock and the Environment, which includes the Trace Gas Manitoba research project measuring cropland greenhouse gas emissions, and the Long Term Manure and Crop Management Field Laboratory.

A new avenue of exploration was added with the construction of the Dairy Farmers of Manitoba Discovery and Learning Complex. This new facility provides valuable research infrastructure for the faculty's animal scientists as well as a view into a modern dairy barn. The public can observe cows using the robotic milker, watch the automated feeding system and learn more about animal care.

"At the Discovery Centre, our goal is to provide the knowledge translation from the science to the farm to the consumer's plate, helping ensure that they are eating food that is safe, healthy and affordable and produced in a way that is sustainable and enhances the environment," says Grahn.

150 RESEARCH IMPACTS

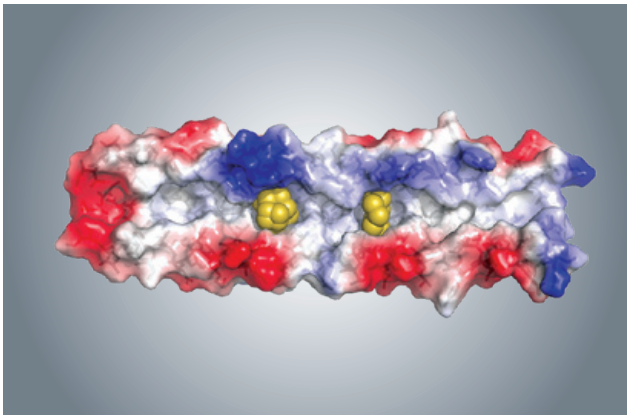
2020 marks the 150th anniversary of Manitoba's entry into Confederation. In recognition of this milestone, the U of M will be sharing 150 research impacts over the course of the year, beginning with the publication in this issue of the magazine.

Here's a sneak peak at a few of the research impacts.

INCREASING THE USE OF RENEWABLE energy and sustainability in manufacturing will require both making things cheaper and finding processes that add value. UM research has developed an electrochemical hydrogenation method that replaces petroleum-derived hydrogen gas with sustainable acids and renewable electricity to produce value-added organic molecules.

A SEIZURE THAT DOES NOT STOP ON its own is a medical emergency. Sometimes these seizures do not respond to medications – or to even medically induced comas. The Dreamspike Research Lab is using brain stimulation for the very first time to treat comatose seizure patients in intensive care units.

UM RESEARCHERS ARE STUDYING THE super-extremophile *Staphylothermus marinus* bacterial organism that lives at deep sea levels near underground volcanoes called black smokers—to better understand how life evolved despite extreme conditions which provides a unique view of the adaptive power of living organisms and the potential for extraterrestrial life on other planets.



Check throughout the year for new research impacts at **umanitoba.ca/researchimpacts**

IN LATE 2019, THE UM SHARED ITS ECONOMIC IMPACT REPORT. The UM is an indispensable driver of economic growth and development for our province and to the well-being of communities in Manitoba, as well as the people of Canada and the world.

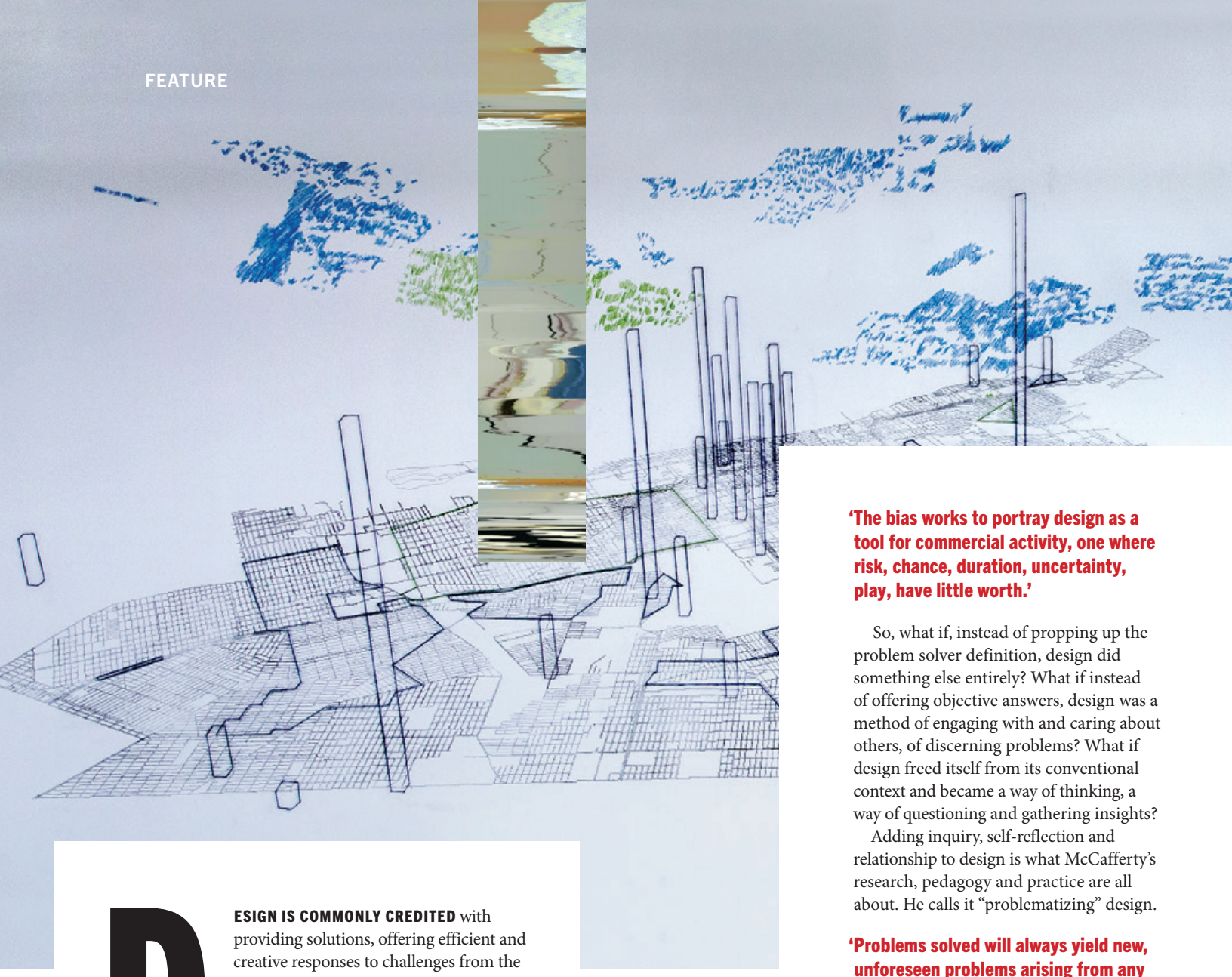
To learn more about how UM contributes to Manitoba's economy visit **manitoba.ca/economicimpact**


FREEHA

Rethinking design impact

BY MARIIANNE MAYS WIEBE
ADDITIONAL TEXT BY
DANIEL McCAFFERTY

It's pervasive to the point of invisibility. From the daily media we view to the products we consume, from the clothing we wear and the spaces we inhabit to the vehicles that transport us on the road systems we use and the weather data we rely upon in planning our day, design plays a role in almost everything. However, in its seemingly happily innocuous existence, it goes largely unnoticed. According to design professor Daniel McCafferty, "Design may be one of the most ubiquitous, yet least discussed—and possibly [least] understood—modes of communication."



DESIGN IS COMMONLY CREDITED with providing solutions, offering efficient and creative responses to challenges from the everyday to the profound. And design purports to understand itself as a problem-solving enterprise, he underscores.

'I feared that when designers see themselves as providers of solutions … that they bring a sense of right and wrong to the situations they are asked to consider. I think today it is fundamental for designers to be humble.'

The common equation, for McCafferty, evinces a potential hubris about what problems are and how they can be solved (even best solved)—hubris that made him increasingly uneasy—and shrouds a number of other equally troubling issues. Not least is that design is too readily positioned as a tool of consumerism, put in service to commerce, money and power—another aspect that disquieted McCafferty, who has a history of involvement in punk and social activism. These opaque, underlying assumptions can limit design to an instrumentalized practice and a linear procedure rather than unlocking its potential as a process, he adds.

ABOVE:
Public Design Unit (PDU). I am here: Mapping Detroit Water Shut-offs (detail) Projection Map Museum of Contemporary Art Detroit
Photo: PDU

LEFT INSET:
Daniel McCafferty Untitled Generative Video
Photo: Daniel McCafferty

PREVIOUS PAGE:
Public Design Unit (PDU) I am here: Mapping Detroit Water Shut-offs Projection Map Museum of Contemporary Art Detroit
Photo: PDU

'The bias works to portray design as a tool for commercial activity, one where risk, chance, duration, uncertainty, play, have little worth.'

So, what if, instead of propping up the problem solver definition, design did something else entirely? What if instead of offering objective answers, design was a method of engaging with and caring about others, of discerning problems? What if design freed itself from its conventional context and became a way of thinking, a way of questioning and gathering insights?

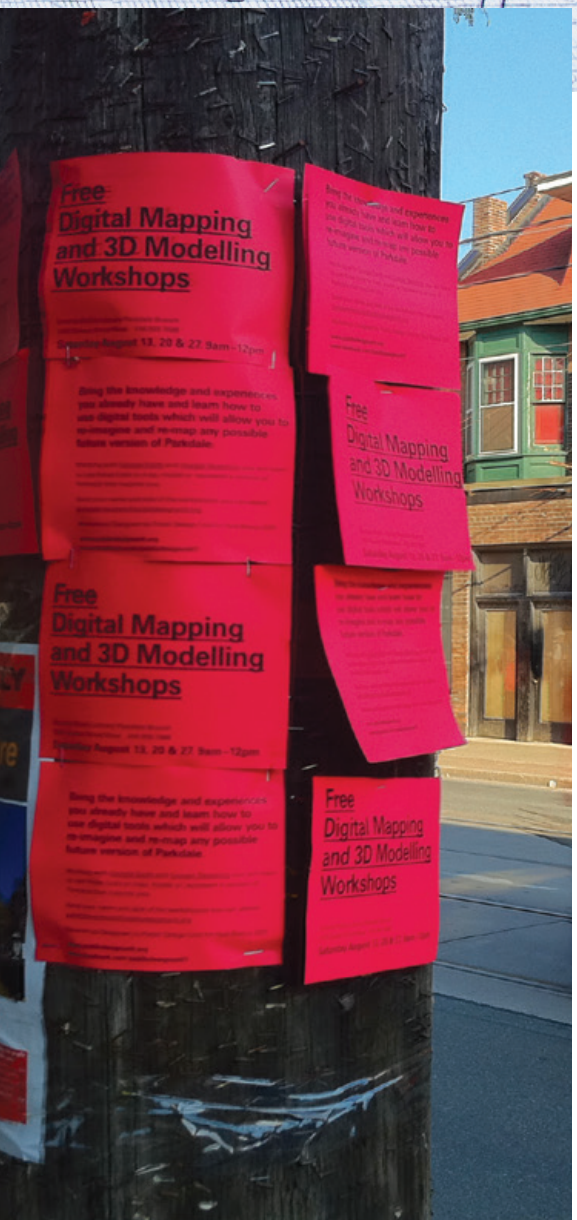
Adding inquiry, self-reflection and relationship to design is what McCafferty's research, pedagogy and practice are all about. He calls it "problematizing" design.

'Problems solved will always yield new, unforeseen problems arising from any given solution. The social world is a relational world.'

PROBLEMATIZING DESIGN: 'DESIGNER AS'

To shift the problem-solving equation to something more generative, Dan McCafferty looked at alternate ways of understanding design in a project entitled "designer as." Most recently, he's been adding the word "gardener," and thinking about design as nurture.

It's easy to see the appeal of this formulation. Instead of defining—and containing—a problem by capping it with a clean and simple solution, it releases entirely different possibilities for design—and for ways of thinking about problems and objectives—opening the field for engagement, cooperation and cross-pollination, for spurring productivity and shared growth.



LEFT:
Public Design Unit
Parkdale Versions,
Peripatetic Libraries
Toronto,
Scotiabank
Nuit Blanche
Photo: PDU

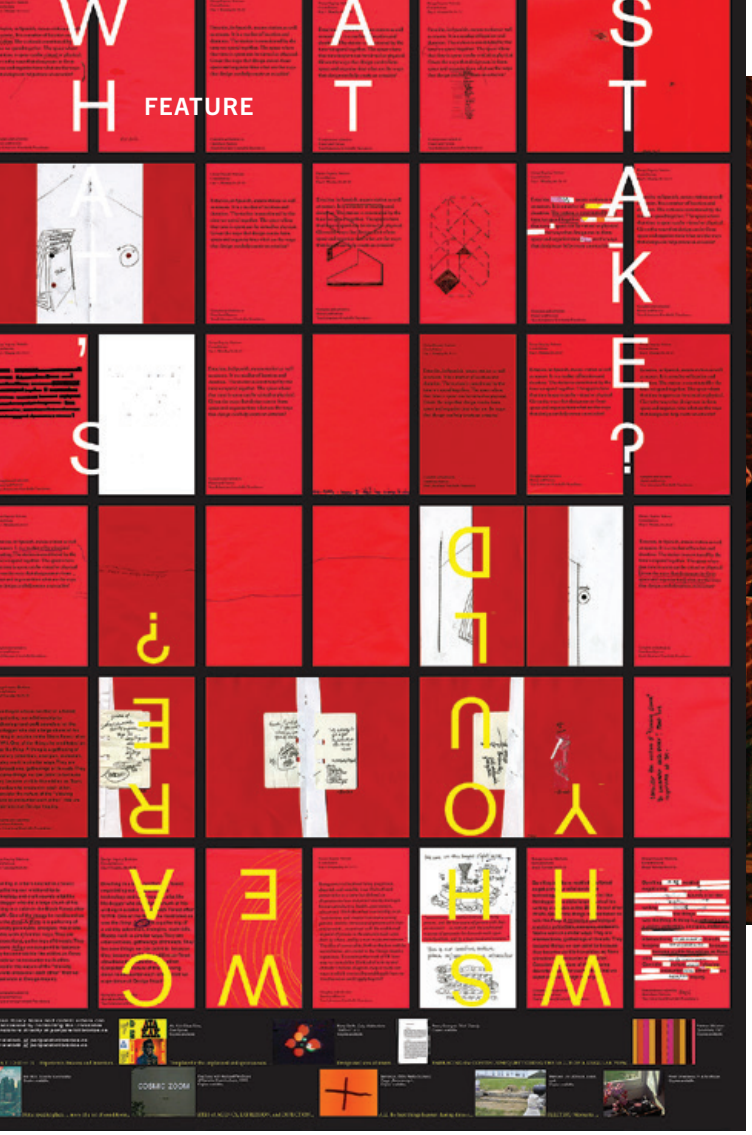
TOP RIGHT:
Different Data
Nordic Design
Research Conference
Exhibition Stockholm,
Sweden
Photo: Joshua Singer,
Different Data

'The project asks what would design do, whom would it serve, how would it change, if the metaphor was designer as gardener, design as nurture. The work produces results that are naturally vulnerable to dismissal; they are contingent on a willingness to reflect, consider. They are merely proposals. They are, of course, not solutions.'

He says the project speaks to an intensifying desire by some within design to sustain its role as "an agent of change," but pushing beyond its usual boundaries in order to better address today's complex problems and foster collaborations in areas of social and health services, data science and more.

It aims to critically engage from a decolonial and anti-racist perspective, refashioning design pedagogy and practice in ways that counter Eurocentric norms, including amplifying a diversity of voices rather than replicating existing structures and attendant privilege of the few with power, which design could quite easily be accused of doing, he says.

In 2017/18, McCafferty created the Indigenous Designer in Residence program so the School of Art could host Sébastien Aubin, an Indigenous graphic designer and artist from Montreal. During a six-month residency, Aubin's research and body of work culminated in the exhibition "Sébastien Aubin: no brighter at the middle" at the School of Art Gallery. Aubin also collaborated with students and faculty, and helped open up discussion on the decolonization of curriculum and research practices.



LEFT:
Daniel McCafferty
FutureSpective,
Portland, Maine

RIGHT:
Public Design
Unit, Parkdale
Versions
Toronto,
Scotiabank Nuit
Blanche
Photo: PDU

BOTTOM:
Daniel McCafferty
Untitled
Generative Video
Photo: Daniel
McCafferty

IMPACT BEYOND PROBLEM-SOLVING

After grad school, McCafferty cofounded a design research group called Public Design Unit (PDU) with other similar-minded practitioners. Working outside of the template, the project broadened design's impact.

The project deliberately confounded traditional frameworks, from timeframes to workspace, opening up the design process to the public by setting up at the local library. The group worked on one long-term project rather than several, and lengthened its time in the community—"recognizing that designers are often brought in to solve a problem, then they leave, without understanding the impact of their work, or seeing if and how it has changed anything," says McCafferty.

'PDU was interested in applying a critical approach to design and design process. This meant that we wanted to work against every convention in design that we could.'

Throughout the project, the designers were accessible to the community and their work was visible. After spending several weeks getting to know the neighbourhood better and speaking to the people who lived there, the group ran community workshops. They emphasized participation and local vernacular over designer control, using open source software and default typography and preferring less technically specialized tools such as Google Earth.

'When design operates in service to capitalism, exclusively, the problems it solves … are related to what [philosopher and sociologist] Bruno Latour might call matters of fact—rather than to matters of concern.'

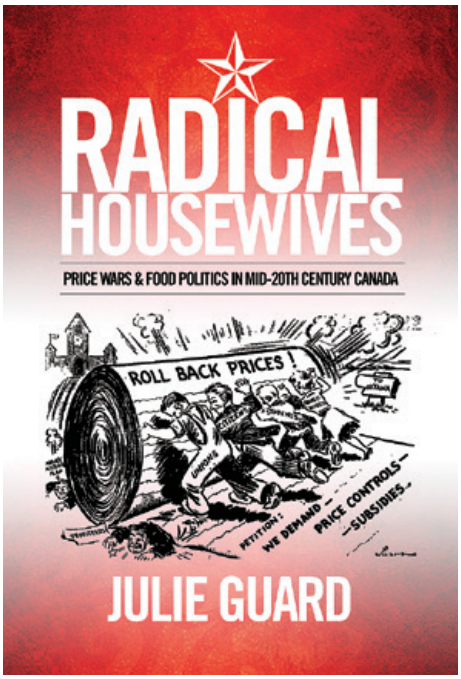
McCafferty uses an open source programming language called Processing that allows the user to create generative videos, diagrams, visualizations and data videos. The politics and the ethos of open source projects match his DIY/punk past; ideas about disruption present in his current work stem from those earlier days.

"The appeal of this programming language and learning how to write code for creative exploratory and visual purposes, rather than for functional practical outcomes, is that it forces a rethink in terms of how work is developed and visualized," he says.

The impulse is one that seems to come to him naturally. IR

RADICAL HOUSEWIVES:

Price Wars and Food Politics in Mid-Twentieth-Century Canada



Julie Guard (University of Toronto Press, 2019)

Julie Guard is professor of history and labour studies at the Faculty of Arts, University of Manitoba.

FOR OVER A DECADE, CANADA'S RADICAL Housewives—a community-based women's organization with ties to the communist and social democratic left—made front-page news. They stormed Parliament, exposed government lies and economic blunders, and called for state management of prices. Foreshadowing the contemporary food justice movement, they publicly accused food industry giants of profiteering and forming illegal trusts, demanding government investigations and prosecutions of corporate price-fixers. These actions sparked a fiery debate: were they devious Communists or politicized consumers?

Julie Guard's exhaustive research, including archival research and interviews with twelve former Housewives, recovers a history of women's social justice activism in an era often considered dormant. It adds a Canadian dimension to the history of politicized consumerism and of politicized materialism. *Radical Housewives* reinterprets the view of postwar Canada as economically prosperous and reveals the left's role in the origins of the food security movement.

Julie Guard's exhaustive research, including archival research and interviews with twelve former Housewives, recovers a history of women's social justice activism in an era often considered dormant.

"Housewives rarely get the attention they deserve," said Veronica Strong-Boag, in a review of the book. An historian and historical consultant, she is professor emerita, Institute for Gender, Race, Sexuality, and Social Justice/Educational Studies, University of British Columbia. "Julie Guard challenges that recurring contempt in this path-breaking volume. Homemaking women have not always been patsies when it comes to radical politics. Far from domestic goddesses, many have been thoughtful and brave observers of the world around them. From the Great Depression to the 1950s, Canada's Housewives Consumers Association channelled popular resistance to capitalism's poverty-making regime. While it [the Association] fell victim to character assassination and scare-mongering by Cold Warriors in the RCMP and political and economic elites [at the time], it left a history of courage and determination. Julie Guard's Radical Housewives tells us why this is important."

LESSONS ON LOSS

ELDERS' WISDOM ON GRIEVING

BY HELEN FALLDING

When losses are buried under more losses, how do you even begin to grieve? Dr. Mary Kate Dennis thinks Indigenous Elders who have survived the loss of language, land and, all too often, children and grandchildren, may have some of the answers. The social work assistant professor is interviewing Elders and other Indigenous Manitobans who have tried different methods of healing to gather best practices for addressing loss and grief.

"WE KNOW THAT INDIGENOUS FOLKS have layers and layers of loss—lots of deaths or losses related to the environment," she said, pointing to the community of Lake St. Martin, destroyed by flooding in 2011.

Dennis did her PhD research in Pine Ridge, South Dakota, where 150 families were abruptly displaced during the Second World War to create the Badlands Bombing Range. "No one has ever addressed it, named it."

Lakota health workers are perplexed about how to help Elders grieve that loss because the workers are used to turning to the Elders for help, Dennis said.

She incorporates cultural practices, including smudging and sweats, when she leads workshops in northern Manitoba or Winnipeg's inner city based on her training by the Grief Recovery Institute. However, that model was not designed for the "sheer vastness" of historical and current losses faced by Indigenous communities, Dennis said.

"Our people are in a constant state of grief and loss and they don't even know it," confirmed Cree Elder Ed Azure, who works with Dennis in the Master of Social Work based in Indigenous Knowledges program.

"ONE KEY IS BREAKING THROUGH OUR DISCOMFORT AND ENCOURAGING THE BEREAVED — INCLUDING CHILDREN — TO TALK, DENNIS SAID. "DON'T CARE-TAKE — JUST LET THE TEARS FALL."

Her new research seeks to create a grief recovery model for Indigenous communities where tragic losses often underlie suicide, addiction, family violence and even the ability of kids to concentrate at school.

Dennis said one thing Western models miss is how Indigenous communities mourn together. "When Tina Fontaine gets pulled out of the river … we all feel that loss in some way because we all have a Tina in our family."

The new model will need to be nimble enough to adjust to different traditions. Dennis points to a northwest U.S. coastal tribe where people mourn in the morning. "Then you put it away and get on with your day."

With remote communities such as God's Lake, Manitoba, facing suicide epidemics, it's important to develop a model that local Indigenous people can be trained to use in their own communities.

"It doesn't take a professional degree to talk about grief," Dennis said.

One key is breaking through our discomfort and encouraging the bereaved — including children — to talk, Dennis said. "Don't care-take — just let the tears fall."

Grief gets less attention than the trauma that is also at the root of many issues in Indigenous communities. Trauma has its own brain scientists and clinical methods, perhaps because it is sometimes related to a single event and therefore seems easier to "fix," Dennis said.

She was raised by an Athabaskan mother from the Alaskan interior who taught her to serve "the old ones," including her white grandparents across the street in Illinois. She learned that helping older people leads to hearing their life stories — stories that helped her grow and now help her solve research puzzles.

The gerontologist still makes a beeline for the oldest person in any room she enters. "I just love them, I guess."

It took a while for academia to accept the Indigenous research methods that come naturally to Dennis. She doesn't ask much in interviews with Elders, which sometimes happen while she's hanging out with them at a communal meal. They often ask her what she needs and then they direct their stories toward the answers. She has persuaded ethics committees to recognize oral consent rather asking Elders to sign complex written consent forms and instead of paying honoraria, she might pick fruit for the Elders.

Dennis has already written about grieving among Oglala Lakota Elders in South Dakota and Ojibwe Elders in Wisconsin, with some of that research funded by the National Institutes of Health.

Dr. Sandra Momper at the University of Michigan said Dennis is so humble that people might not realize how much she has published and that she's "at the cutting-edge of the whole issue of decolonizing the academy. She has already been doing that."

What secrets have Elders shared with Dennis so far about how to survive a life layered with loss? "They have each other," she said, describing how Lakota Elders in one of the poorest regions of the U.S. look out for each other, whether they're still living on the reservation or speaking their language together in care homes. They also have a spiritual core that nurtures them and a strong will to live so they can keep working hard for their families.

SHE SEES THE POTENTIAL TO APPLY HER GRIEVING MODEL IN CHILD WELFARE, WHERE KIDS LOSE THEIR PARENTS, HOMES AND TREASURED POSSESSIONS WHILE PARENTS AND FOSTER PARENTS LOSE CHILDREN.

Dennis is still early in her career. She was an assistant professor at the University of Kansas for four years before being drawn to the University of Manitoba by the unique opportunity to co-teach with Elders in the Indigenous Knowledges program.

She sees the potential to apply her grieving model in child welfare, where kids lose their parents, homes and treasured possessions while parents and foster parents lose children. It might also be useful in restorative justice, where people coming out of jail struggle with disconnection from their kids.

Azure said seeing a young woman be given so much by the Elders gives him hope. He thinks Dennis's research will "go a really long way in furthering resurgence in Indigenous health and well-being."

PAVING THE WAY

DR. MARY KATE DENNIS THINKS SOME of her biggest impact will be through her graduate students, as they incorporate the results of her research into their social work practice or pursue research of their own.

She's proud of three students whose master's theses she recently supervised:

Tammy Nelson studied a traditional road to healing for women who have experienced sexual exploitation.

Aura Lavallée explored how to overcome barriers to the participation of substance users in traditional ceremonies.

Heather Woodward experimented with holistic self-care for social workers who so frequently burn out, including yoga, fitness classes, Ojibwe full moon ceremonies, Indigenous sweat lodges, beading and kickboxing.

Dennis reminds her students to honour an earlier generation of Indigenous researchers who had to fight for approval of research methods her students can now use with her full support. Among those door-openers she includes Dr. Michael Yellow Bird, the new dean of her social work faculty.

NEW COLLISION SPACE

BY CHRIS RUTKOWSKI

THE SMARTPARK INNOVATION HUB (SIH) HAS OPENED IN summer 2019. SIH creates a one-stop location for commercialization and professional services, and fills a gap in space for the diverse research community on campus, the city and the province to network and collaborate and provide unique opportunities for student engagement in partnered projects.

"The community is excited about this new collision space where exchange and collaboration create ideas and potential that brings benefit to the lives of all peoples," said Dr. David Barnard, president and vice-chancellor of the University of Manitoba."

Tenants include: BOLD Commerce; North Forge Technology Exchange; Futurpreneur; Cibus Canada; Pembina Trails Early College School; UM's Partnership and Innovation office; and Backswath Management.

"The innovation hub is a reflection of our deep partnership and a reflection of the shared vision for economic growth and talent and to attract new entrepreneurs and business investment and keep them within Manitoba," said Jerin Valel, a North Forge board member. "This is an important driver for the Manitoba innovation ecosystem. It will help facilitate greater opportunities for research, it will help with entrepreneurs to co-locate with industry in tremendous facilities like this, and it will also help with what the university referred to as meaningful collisions within the community, companies supporting companies."

The new 75,000-square-foot building is made up of a ground floor atrium, meeting rooms, a multipurpose room with video walls, and a food service area, as well as two lab spaces. The second, third and fourth floors are tenant office spaces, with the fourth floor containing a Collision Corridor, where tenants can come together and network in the shared space.

ABOVE: Smartpark Innovation Hub at 100 Innovation Drive

"The community is excited about this new collision space where exchange and collaboration create ideas and potential that brings benefit to the lives of all peoples."

As the primary research and technology park in Manitoba, Smartpark is home to some of the most innovative companies in the province. It maintains and grows strong ties to post-secondary research institutions and in turn drives further innovation.

The facility was developed as a LEED Silver building following the Manitoba Green Building and Manitoba Hydro's Power Smart programs. Funding of more than $20 million was provided by the Government of Canada.

ARE YOU AS UNIQUE AS YOU THINK YOU ARE?

BY MEHMET YANIT

MY DOCTORAL RESEARCH FOCUSES ON SEPARATING FACT from fiction in the use of online recommendation services. In the digital world of the 21st century, companies have more information about their customers' tastes and preferences than their romantic partners. The accuracy of their content recommendations leads people to believe they genuinely want to know about each unique customer: not true. Companies instead use algorithms to group customers in clusters based on their similarities. Then, based on the data collected from other similar customers in the same cluster, they are able to make inferences/guesses about their preferences as a group. In this way, companies make the same or highly similar recommendations for each customer in the same cluster.

Recently, Netflix announced that it has an average of 72.9 million monthly users clustered in 1,300 different "taste" categories which can be roughly translated into 56,077 users per clusters. Similarly, to make song recommendations for its users, Spotify generates 75 million playlists from different musical genres weekly. Each of these playlists is followed by 250,000 users on average.

If people are grouped in each cluster in such vast numbers, how can they perceive recommendations made for them as being personally unique?

The answer to this question can change depending on the service setting. Current research about purchase motivations finds that if a shopping setting is framed with hedonic motivations—fun and pleasure—that people want to see larger assortments or options for the choices available to them. This happens because in hedonic settings people perceive their preferences to be more unique and harder to satisfy vs in utilitarian settings—where people focus more on functionality and ease—which leads them prefer to choose from smaller assortments to practically find what they need.

Mehmet Yanit is a doctoral student in the Asper School of Business and the recipient of a Canada Graduate Scholarship from the Social Sciences and Humanities Research Council of Canada. Mehmet holds a BSc in Industrial Engineering from Marmara University and a MA in International Competition and Trade from Bogazici University. He is highly interested in machine learning algorithms and their use in marketing to predict con sumer behaviour, specifically on social media.

I work under the supervision of Luming Wang (marketing). Our preliminary research data show that grouping users in larger recommendation clusters in hedonic service settings, for instance in the way that Netflix does, can increase the perceived uniqueness of the recommendations. This in turn, increases the users' willingness to use the service. This is because a larger group of similar people are a larger assortment of the preferences that the recommendations are derived from. This is not the same for utilitarian settings, such as job recommendations you receive on LinkedIn, where we found the inverse effect of the smaller clusters increasing the perceived uniqueness of the service and resulted in people to increase use of the service.

Our preliminary research data show that grouping users in larger recommendation clusters in hedonic service settings, for instance in the way that Netflix does, can increase the perceived uniqueness of the recommendations. This in turn, increases the users' willingness to use the service.

The size of the group is a significant influence on peoples' perceptions of the recommendation service. Despite this, no companies–so far–explicitly communicate the size of their clusters with their users. This is a missed targeted advertising opportunity to their desire audience of users, one that I hope my research will have an impact upon.

THE MEASURE OF MALTREATMENT

SPANKING. KICKING. BERATING. SEXUAL
SHOVING. SLAPPING. NAME-CALLING. VIOLATION.

BY ALISON MAYES

For nearly two decades, Dr. Tracie Afifi has studied the ways in which adults abuse children, the harms that can result, and what can be done to keep kids safe. The professor in the departments of community health sciences and psychiatry at the Max Rady College of Medicine is an international expert in the field of child maltreatment. She is often asked how she can bear to work in such a distressing subject area. But the Winnipeg-born scientist – a parent herself – is determined to make a difference in kids' and families' lives.

"OUR RESEARCH IS OFTEN USED TO advocate for children," she says. "It provides the scientific citation for why you should not hit kids."

In 2018, the American Academy of Pediatrics released, for the first time, an unequivocal policy statement saying children should never be hit or spanked. The statement was supported with scientific evidence of spanking's lifelong harms, including some of Afifi's findings.

"That was a really important moment for me," the professor says. "I thought, 'OK, this is a difficult area, but our work has contributed to positive change.'"

Afifi, a three-time U of M alumna, is an epidemiologist who analyzes Canadian and international health data, and collects her own. Since joining the faculty in 2010, she has been at the forefront of documenting the links between abuse in childhood – including spanking – and mental health problems in adulthood, such as depression, substance use disorders and suicidal behaviour.

Her research also shows that people who are abused as children are more likely to experience violence in adult relationships, and to have physical health concerns such as arthritis and migraines.

"TRACIE'S WORK HAS HIGHLIGHTED JUST HOW INCREDIBLY COMMON CHILD ABUSE IS. HER FINDINGS HAVE COMMUNICATED THAT THIS IS A MAJOR PUBLIC HEALTH PROBLEM THAT CROSSES ALL SECTORS."

In a landmark national study published in 2014, Afifi and her colleagues reported that as children, 32 per cent of Canadians have experienced physical abuse, sexual abuse, and/or been exposed to their parents' or guardians' violence.

"Tracie's work has highlighted just how incredibly common child abuse is," says Dr. Harriet MacMillan, a distinguished professor at McMaster University who studies family violence. "Her findings have communicated that this is a major public health problem that crosses all sectors."

In 2014, when basketball great Kareem Abdul-Jabbar wrote a column for Time magazine calling for action on family violence, he cited Afifi's research. In 2016, when John B. King, U.S. secretary of education, urged

state leaders to ban corporal punishment in schools, he referred to Afifi's findings.

That same year, the Public Health Agency of Canada produced a major report on family violence, citing 12 of Afifi's studies.

The professor sees her research as supporting a societal shift toward zero tolerance for violence against kids. She feels encouraged when parents say her work has influenced them.

"People say things like, 'I was considering spanking as a form of discipline, but I heard you on a podcast and I changed my mind.' People have told me about spouses disagreeing on spanking, and one spouse used our work to change the other's mind.

"PEOPLE SAY THINGS LIKE, 'I WAS CONSIDERING SPANKING AS A FORM OF DISCIPLINE, BUT I HEARD YOU ON A PODCAST AND I CHANGED MY MIND.' PEOPLE HAVE TOLD ME ABOUT SPOUSES DISAGREEING ON SPANKING, AND ONE SPOUSE USED OUR WORK TO CHANGE THE OTHER'S MIND.

"I've also had parents say they stopped spanking after they heard me being interviewed."

The investigator says her focus has evolved from documenting maltreatment to the question: "How do we prevent this from happening, and intervene when it does?"

Afifi, who is affiliated with the Children's Hospital Research Institute of Manitoba as well as the U of M, earned two recent, prestigious awards, each valued at $100,000: the 2018 Royal-Mach-Gaensslen Prize for Mental Health Research and the 2018-19 Canadian Institutes of Health Research Gold Leaf Prize for outstanding achievements by an early-career investigator.

The prizes are helping to fund a longitudinal cohort study in which Afifi is periodically surveying 1,000 Manitoba teens, plus one parent of each teen. She plans to keep amassing data as the youths grow into adulthood. The aim is to understand why some children who experience adversity are resilient enough to escape mental-health effects as adults.

"We want to identify protective factors that foster resilience at the family, school and community levels," Afifi says.

Linking the survey results from these 1,000 families with data stored at the Manitoba Centre for Health Policy that traces individuals' interactions with the health, education, social service and justice systems will allow Afifi's team to extract findings that are unique in the world.

The epidemiologist is also testing the effectiveness of parenting programs that could be used to educate moms and dads about non-physical forms of discipline.

"Our vision is to use data to identify real-world strategies to prevent maltreatment," Afifi says. "That will improve children's long-term health outcomes and strengthen families."

TELL A STORY WITH THE DATA

IF YOU WANT YOUR RESEARCH DISCOVERIES TO influence policy and change people's minds – especially about a controversial issue like spanking – it's not enough just to publish them in a reputable journal, says Dr. Tracie Afifi.

"You have to tell a story with the data," says the child-maltreatment expert, who tries never to turn down a media request and has done articulate interviews with outlets such as CNN, Time, the Washington Post and the Globe and Mail.

"I get described as an advocate, and I guess by definition I am," Afifi says. "I try to disseminate the data in a variety of ways. Twenty years ago, a researcher's job was to do the research, and it was someone else's job to disseminate it. Now, the researcher has to take it to the finish line."

One of Afifi's techniques for reaching the public is to write for non-scientist readers. In 2015, she argued in a column for Maclean's magazine that Canada should make spanking illegal – a step that's already been taken by 57 countries.

In 2017, she wrote a piece for The Conversation, a not-for-profit media website, headlined "Why parents should never spank children." It ranks as one of the site's all-time most-read stories.

"Tracie is a terrific communicator," says McMaster University family violence expert Dr. Harriet MacMillan. "She's been very innovative and has made a strong commitment to engaging with different audiences: the public, the scientific community, clinicians, policy-makers."

Afifi says she is strategic in submitting some studies to journals that have a broader reach than the specialty journals in her field. She pays fees to ensure that the public has free online access to her work.

Her research team also has a free, downloadable infographic created to transmit the key findings from each study. "We make them really simple, in French and English, and we're hoping to expand into other languages."

While the scientist believes in saying "yes" to opportunities, there's one kind of exposure about which she declares, "We're done with that." Like a physician who refuses to debate anti-vaxxers because there's no credible science on the anti-vaccination side, Afifi no longer accepts invitations to spar on a conference panel or radio show with anyone who supports spanking.

"I won't debate anymore," she says. "Standing firm in that makes a statement."

STUDENT RESEARCH EXPLORATIONS

EXCITEMENT WAS IN THE AIR AT THE 15TH UNDERGRADUATE Research Poster Competition this past fall, as 140 budding researchers answered probing questions from nearly 100 judges about the research projects they'd been working on over the past summer.

In addition to the cash prizes up for grabs, the participating students find the experience valuable in developing their communication skills, networking opportunities, learning how to create a poster, as well as a deep sense of pride in their research accomplishments.

Students compete in five categories: applied sciences, creative works, health sciences, natural sciences, and social sciences and humanities.

We caught up with first place winners Sasha Kullman (social sciences and humanities) and Nils Refvik (natural sciences) to learn about their projects and their experience doing research.

Kullman explains her project conducted under the mentorship of kinesiology and recreation management professor Shaelyn Strachan.

"Here's a scenario: Let's say Jennifer is a woman who believes that being an exerciser means working out five-times-a-week. This is her exercise identity. Jennifer has a baby, and now things are obviously much busier. She can exercise maybe twice a week now—if she's lucky. She feels bad because of this.

Sasha Kullman, undergraduate student in kinesiology and recreation management

We hypothesized that mothers who are more compassionate might be able to adapt their exercise identity and declare that being an exerciser means working out twice a week and they can accept that and maintain at least some exercise behaviour rather than giving up all together.

We found that mothers who are more self-compassionate felt better with their new exercise habits and felt less guilty about exercising less.

We found that mothers who are more self-compassionate felt better with their new exercise habits and felt less guilty about exercising less. They were able to adapt their identity and maintain their exercise behaviour after having children."

Nils Refvik, undergraduate student in Faculty of Science

Refvik explains his research conducted under the mentorship of physics and astronomy professor Jacob Burgess.

"What I am exploring right now are a class of fascinating materials known as multiferroics. Many of us are familiar with ferromagnetic materials which we use as permanent magnets to attach things to a fridge, or as the core of a transformer. There is a related class of materials called anti-ferromagnetic materials which have other, important, technological applications.

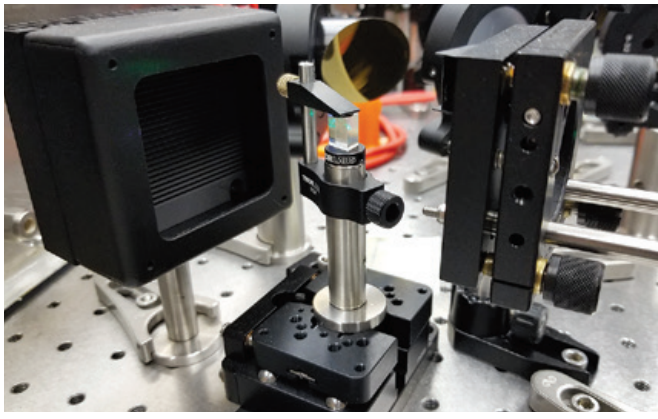
One big takeaway I had from this research was the value of continuing to think about the problem at hand and working through periods of little progress.

Multiferroic materials combine anti-or ferro-magnetic properties with the electrical "equivalent" of a ferromagnet—a ferroelectric system—where the structure of the material enforces what is called the electric polarization. In a ferromagnet, the orientation of the magnetic polarization can be manipulated with an external magnetic field. Likewise, an external electric field can be used to change the electric polarization in a ferroelectric material. In the experiments I conducted, we sent extremely short pulses of THz radiation through the sample. We measured changes to the light pulses as a result of the interaction with the multiferroic sample.

I worked on an algorithmic method to process experimental data and reduce the contribution from spurious reflections, allowing us to better see the underlying and more interesting material properties.

One big takeaway I had from this research was the value of continuing to think about the problem at hand and working through periods of little progress. What surprised me the most is that I felt my project was well-defined at the start of the summer, and it wasn't until we were looking at actual data results that I realized that assumptions needed to be adjusted." IR

(L-R): First place winners with Dr. Jay Doering (Associate VP Partnerships), Lindsay Mamchu, Ally Farrell, Nils Refvik, Jordan Krenkevich, Sasha Kullman, Dr. Digvir Jayas (VP Research and International)



Nils Refvik's research involving non-linear crystal lithium niobate where THz light is generated from infrared pulses

Sasha Kullman with her winning research poster

Judges and others viewing the posters


ICE
ICE
MAYBE

BY CHRIS RUTKOWSKI

People living along the Red River were understandably very concerned this past fall when flooding occurred during a normally quiescent time of year. Ice jams—called frazil ice pans—occurred for the first time ever, causing huge cement like blocks of ice to spillover the river banks and onto surrounding fields and farmland. Roads became unpassable—relatively common in the spring, but rare so late in the year. The unusually high river flows and higher turbulence of the water plus a sudden temperature drop created the perfect storm for this type of ice to form.

IF ONLY THERE WAS RESEARCH THAT COULD HELP understand how water flows under ice in such situations to help predict ice affected flooding in a more rigorous way so we might be better able to prepare for such emergencies. Surprisingly, there are few studies on river ice dynamics, despite prominent public and industrial concerns associated with flooding and other impacts of river ice processes.

Enter Dr. Karen Dow in civil engineering. Internationally recognized for her world leading research in hydraulic engineering on complex river ice processes, she studies ice jam formation and release, and their impact on river flow and hydropower generation.

"MY RESEARCH ON RIVER ICE ENGINEERING IS IN TRYING TO FURTHER OUR UNDERSTANDING OF DYNAMIC RIVER ICE PROCESSES. FOR SURE, IT'S CRITICAL FOR FLOODING."

"My research on river ice engineering is in trying to further our understanding of dynamic river ice processes," she says. "For sure, it's critical for flooding, and one of my projects is focusing on investigating ice jams on the Red River. It's also critical for Manitoba Hydro to ensure efficient operations, but also relates to public safety and infrastructure."

ABOVE: Civil engineering professor Karen Dow on the banks of the Red River in south Winnipeg.

RIGHT: The particle image velocimetry (PIV) equipment used to investigate the turbulent flow characteristics beneath a simulated partial ice-cover. (PIV funded by Canada Foundation for Innovation and Research Manitoba).

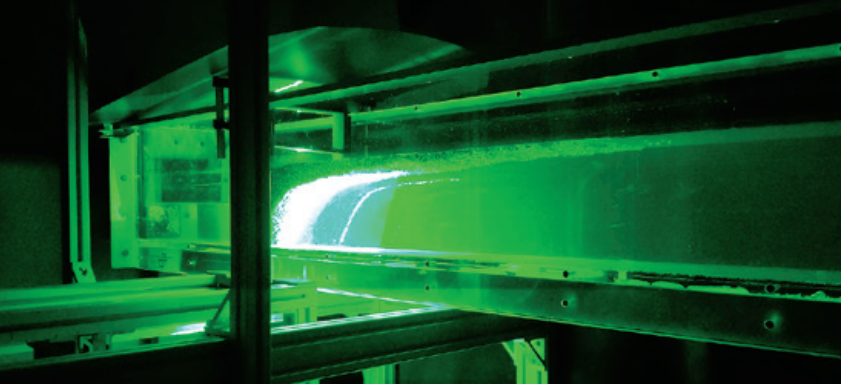
PREVIOUS PAGE: Frazil ice floes on the Nelson River at Sundance Rapids, Man. winter 2020.

With funding received for her research through CFI, Dow developed a particle image velocimetry (PIV) laboratory at UM where she can measure water movement under simulated ice as measuring in the field poses many logistical and safety challenges. She found that the water velocity beneath a floating ice block is related to pressure distribution beneath it, allowing a better understanding of the dynamics of ice blocks that have come to rest against an intact ice cover that impacts ice cover and ice jam formation processes. Her PIV system is the only one in the world used for river ice research, which uses a high powered laser combined with cutting edge cameras and software to obtain instantaneous velocity measurements in water containing tracer particles.

"It's a very accurate way of measuring flow under the ice," says Dow. "Plus—lasers are just super cool!!!"

Andrew Murray, a MSc student in civil engineering, notes: "In my undergrad program I didn't meet another professor who reached Karen's level of compassion for her students or enthusiasm for her work. It was practically contagious—to the point where just hearing the excitement with which she'd talk about her 'fancy lasers' convinced me to come back for a master's degree."

Dow began her career in ice dynamics as an undergraduate summer co-op student research



position at UM in 1998, then went on to earn her PhD at the University of Alberta before coming home to Manitoba. Although her main research focus is river ice hydraulics, she also has expertise in experimental hydraulics, computational hydraulics, and environmental fluid mechanics. Her most significant contribution in river ice engineering was her research on the physical behaviour of floating ice blocks, quantifying the forces that act on them by measuring pressure distribution underneath the ice block.

Since returning to UM, Dow has established a research program on the dynamics of river ice processes, initially focusing on the flow characteristics beneath partial ice covers, anchor ice formation and release, ice jam formation, and furthering the understanding of ice block stability. This has largely been through the work of graduate and postdoctoral students under her supervision, assisted by summer undergraduate research assistants doing similar work as she herself did at the beginning of her career.

DOW HAS EARNED MANY AWARDS FOR TEACHING AND MENTORING. SHE RECENTLY RECEIVED THE 2019 GRADUATE STUDENTS' ASSOCIATION TEACHING AWARD, THE FIRST FEMALE ENGINEER TO RECEIVE IT AT UM.

"It's pretty cool that I'm working on the Sundance Rapids anchor ice project that Karen spent researching as a summer student back in 1998," says Brittany Peters, one of Dow's students. "Not only is she a self-proclaimed 'super nerd,' Karen has been a great advisor to work with—she's knowledgeable, supportive, open, and wants to see her students succeed."

In fact, beyond her work on river ice, Dow has earned kudos for her work as a dynamic and inspiring educator, with an engaging personality and proven talent for building productive and diverse teams. She has a passionate dedication to promoting greater equity in engineering and academia by dedicating her prodigious skill to mentoring and advocacy for female students and professionals. She is known for her ability to inspire the people around her, particularly young women that are pursuing engineering as a profession.

Dow has earned many awards for teaching and mentoring—a testament to her educational style and dedication. She recently received the 2019 Graduate Students' Association Teaching Award, the first female engineer to receive it at UM.

Dow has actively engaged with outreach activities to increase the participation of women in engineering throughout her career. She has made this a personal issue based on her own personal experience and understanding of underlying issues related to young women considering engineering as a career. Dow has also formally served as a mentor in the Committee for Increasing the Participation of Women in Engineering (CIPWIE) trimentorship program since 2016, for the Girls in Science Day, and at the Faculty of Engineering Make your Move event.

As a role model in the Faculty, Dow receives frequent invitations to emcee outreach events, including the Welcome to Engineering and Engineering IS for Girls events. In addition to formal mentorship programs, she is an informal mentor to many current and former students as well as many of her colleagues.

DYNAMIC RIVER ICE

DOW'S STUDENTS ARE CURRENTLY engaged in several ongoing projects involving dynamic river ice processes. These include:

A historical analysis of ice jams on the Red River north of Winnipeg, including hydraulic and meteorological analysis to create an ice jam database. This analysis will be used to develop a prediction model for breakup ice jams in the reach.

Investigating the anchor ice formation and release at Split Lake/Clark Lake on the Nelson River. This study will help further understanding of anchor ice formation and release processes as well as assist Manitoba Hydro improve its operations on the river to further develop hydroelectricity generation models to better prepare for variations that would affect electricity customers further south.

Investigating the anchor ice/aufeis dam that forms at Sundance Rapids downstream of the Limestone Generating station, including possible mitigation measures. Limestone is currently the largest hydroelectric station in the province. The ice dam constricts the flow and causes the water levels to rise on the order of 1-3 meters, translating to a loss of generation revenue of approximately $1-3 million per year. This study will advance the science of anchor ice formation and investigate possible mitigation measures.

Using PIV to investigate seepage flow through ice jams and the velocity of water beneath the ice jam. This will further develop hydraulic models of water flow under ice and refine the theoretical knowledge in this field.

Dow explains: "River ice is something that clearly affects everyone in Canada and with climate change, the dynamics of the river ice processes is going to be more variable and arguably more dynamic as a result."

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BY THE NUMBERS

To learn more about the impact of the University of Manitoba, visit **umanitoba.ca/economicimpact**

30,319

students (Fall 2019) – 25,832 undergraduate; 3,761 graduate; 726 post-graduate medical education; 6,023 international students (19.9%) and 2,509 self-declared Indigenous students (8.3%)

5,485

Academic staff (2018/19) – 1,169 full-time faculty; 4,045 support staff

84

Endowed and sponsored research chairs – including an allocation of 52 Canada Research Chairs, a Canada 150 Research Chair, a CERC and a CERC Laureate

58

Royal Society of Canada Fellows (49) and Members (9)

49

Research centres, institutes, groups, shared facilities

29

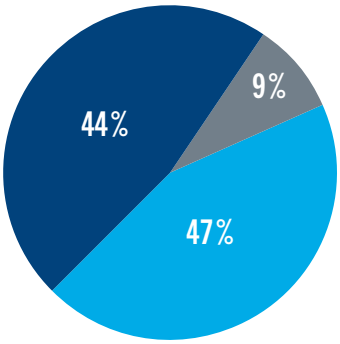
Canadian Academy of Health Sciences Fellows

18

Canadian Academy of Engineering Fellows

SPONSORED RESEARCH INCOME BY SOURCE (2018/19)

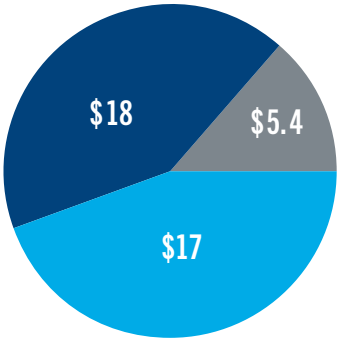
TOTAL: $160.2 MILLION



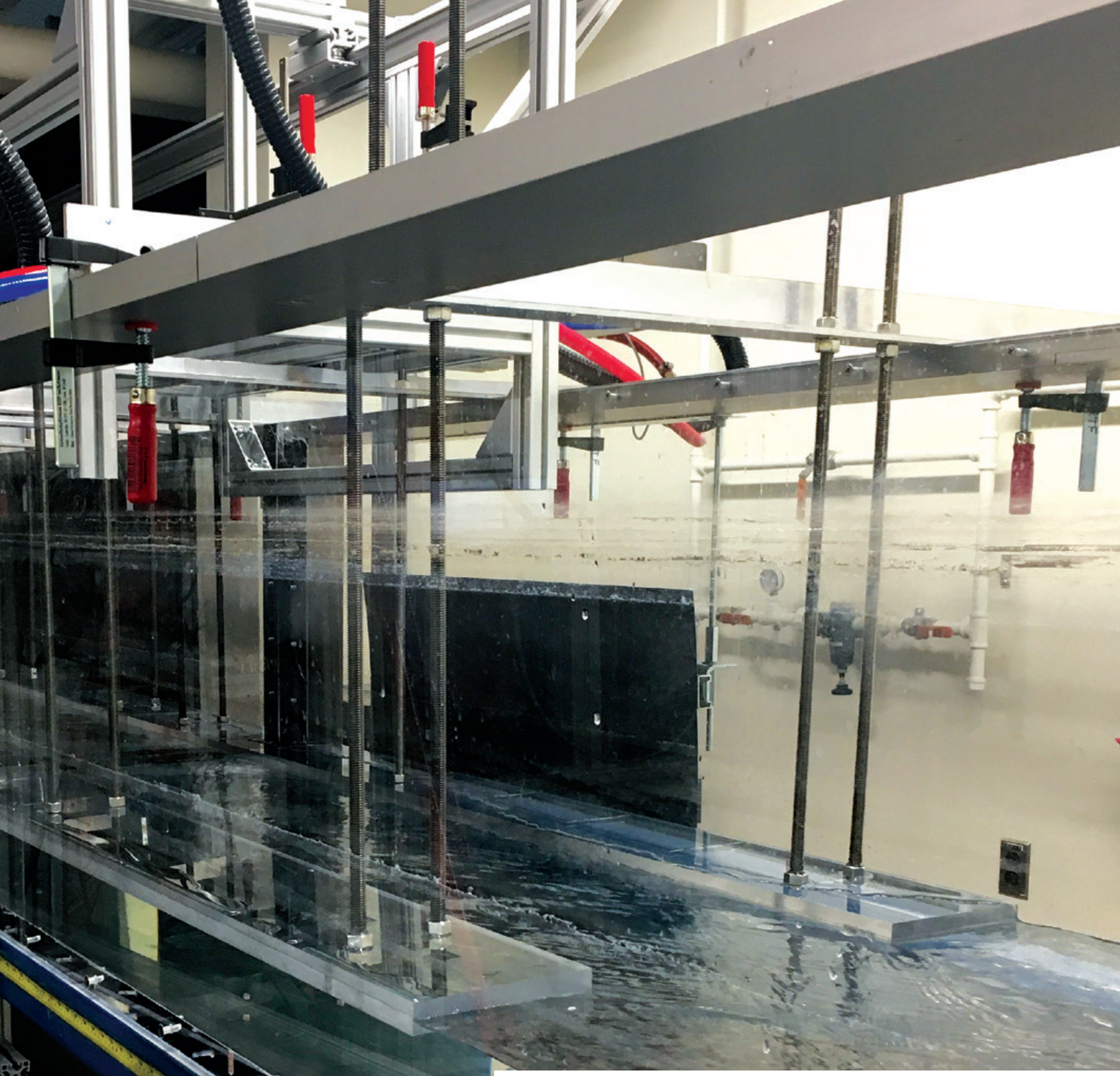
- **FEDERAL GOVERNMENT** 47%
- **PROVINCIAL GOVERNMENT** 9%
- **OTHER** 44%

TRI-COUNCIL FUNDING 2018/19

TOTAL: $40.4 MILLION



- **CIHR** (Canadian Institutes of Health Research) **$18M**
- **NSERC** (Natural Sciences & Engineering Research Council of Canada) **$17M**
- **SSHRC** (Social Sciences & Humanities Research Council of Canada) **$5.4M**



Turbulent flow characteristics beneath a simulated partial ice cover using PIV, see page 31 inside.

ResearchLIFE