UNIVERSITY OF MANITOBA
ResearchLIFE
SUMMER 2017 | VOLUME 1

WHERE CREATIVITY THRIVES
FROM CAROL SHIELDS TO IVAN EYRE

BIG PLANS FOR GOING SMALL
Subatomic physics

KIDNEY TRANSPLANT
Improving outcomes

ARCTIC ENVIRONMENTAL CHEMISTRY
Identifying the contaminants

MESSAGE

FROM THE VICE-PRESIDENT (RESEARCH AND INTERNATIONAL)

Research at the University of Manitoba has been front and centre in our province, this country and the globe for 140 years. We have a rich history of contributing to research and innovation resulting in impacts on society that are innumerable.

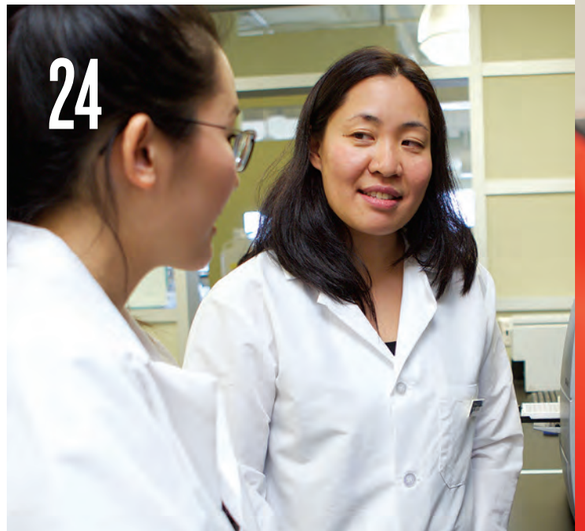
This issue of the magazine is one of the two issues that will highlight our strengths and legacy of research in areas such as time of flight spectrometry, Rh disease in the newborn, creative works, and Arctic climate change to name just a few.

Our research enterprise has grown exponentially from its humble beginnings in 1877. Our researchers attracted $190.6 million in sponsored research income (funding) in 2015/16. A short 30 years ago, our research income was $52.7 million—a 360 per cent increase.

This issue is not so much a look at the past, but a glimpse at where we came from to where we are now, that hints at what the future of the many exciting investigations may hold. Enjoy the journey.

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

On the cover: From *Atmospheric Resonance* by Leigh Bridges. TOP: *Colourfield Cookstove* (Spring, 6am), Acrylic spray paint on aluminum 17" x 28" x 28" deep; MIDDLE: (Early Spring, 7am) 10.5"x 10.5"x 6" deep; BOTTOM: (Late Spring, 8am), 2016. *See story on page 16.*



UNIVERSITY OF MANITOBA

SUMMER 2017 | VOLUME 1

4 **HAPPENINGS & KUDOS**
An array of research news & events

9 **CENTRES & INSTITUTES**
Spinal Cord Research Centre

10 **BIG PLANS FOR GOING SMALL** FEATURE
Subatomic Physics

14 **INSIGHTS**
Werner Ens

15 **BOOKS OF NOTE**
MOSAIC 50th Anniversary

16 **WHERE CREATIVITY THRIVES** FEATURE
Carol Shields to Ivan Eyre

22 **IDEAS TO INNOVATION**
Smartpark Innovation Hub

23 **VIEWPOINT**
Measuring (and Increasing) Political Solidarity

24 **KIDNEY TRANSPLANT** FEATURE
Improving Outcomes

28 **SPOTLIGHT ON STUDENTS**
Valuable Experience

30 **ARCTIC ENVIRONMENTAL CHEMISTRY** FEATURE
Identifying the contaminants

34 **JUST THE FACTS**
Research Facts and Figures

35 **ON THE HORIZON**
Events coming up in Fall 2017

ResearchLIFE

RETURN UNDELIVERABLE CANADIAN ADDRESSES TO:

UNIVERSITY OF MANITOBA
Office of the VP
(Research and International)
207 Administration Building
Winnipeg, MB Canada R3T 2N2
Tel: 204-474-7300

ResearchLIFE@umanitoba.ca

VICE-PRESIDENT (RESEARCH AND INTERNATIONAL)
Digvir S. Jayas

EDITOR Janine Harasymchuk

ART DIRECTION
Carisa Laturnus Romans
DESIGN Metric Marketing

CONTRIBUTORS: Sharon Chisvin, Werner Ens, Melni Ghattora, Janine Harasymchuk, Jack Rach, Chris Rutkowski, Katelin Vit, Thomas Wright

PHOTOGRAPHY: Gerald Auten, Leigh Bridges, Warren Cariou, Erik Cederlof, George Cibinel, Charles Egerton, Ally Gonzalo, Dan Gwozdz, Phil Hossack, Donna Jones, Mike Latschislaw, David Lipnowski, Richard Lyons, Søren Rysgaard

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

TAKING THEIR SEATS

TWO NEW CANADA RESEARCH CHAIRS (CRC)—Kathryn Sibley and Feiyue Wang—are advancing our understanding of evidence informed health care and Arctic environmental chemistry. A third CRC, Jason Treberg, had his chair in Environmental Dynamics and Metabolism renewed so that he can continue his investigations into mitochondrial responses in animals during times of stress, and the corresponding way in which those responses limit the animals' ability to adapt and survive.

Sibley, chair in Integrated Knowledge Translation in Rehabilitation Science, is determined to ensure that solid, evidence-based scientific research is put to timely and practical use, especially when it has the potential to enhance quality of life among older adults in rehabilitative settings.

Wang—chair in Arctic Environmental Chemistry—examines the natural processes that control the release of contaminants in Arctic ecosystems, demonstrating that the changing sea ice environment, a direct consequence of climate change, affects how contaminants are transported, where they end up and what damage they ultimately do *(see related story on page 30)*.

(L-R) Digvir Jayas, MP Maryann Mihychuk, Dean Norman Halden, CRCs Feiyue Wang, Kathryn Sibley and Jason Treberg, at the CRC announcement December 2016.

OUR COUNTRY'S BEST

David Barber

Janice Ristock

Quan Wang

Ekram Hossain

Andrew Woolford

THEIR INTERESTS AND AREAS OF expertise vary widely, but David Barber, Janice Ristock and Quan (Abraham) Wang, now share in common much more than their U of M employment. In the fall of 2016, the three professors became Fellows of the Royal Society of Canada (RSC). At the same time, their colleagues Ekram Hossain and Andrew Woolford became Members of the RSC's College of New Scholars, Artists and Scientists. Royal Society recognition is the highest honour a Canadian academic can achieve in the arts, humanities and sciences.

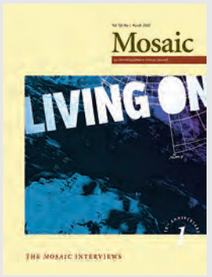
Barber, a Canada Research Chair in Arctic-System Science, conducts research on how climate change alters Arctic sea ice dynamics, and how those changes, in turn, affect marine ecosystems, the oil and gas industry, and the lives and livelihood of northern peoples. Ristock, the Provost and Vice-President (Academic) is a trailblazer in the area of LGBQT studies and intimate partner violence. Wang, a mechanical engineer, is a pioneer in the use of smart materials and wavelets, and his application of nonlocal continuum theory to enhance structural health monitoring and structural repair. Fellow engineer Ekram Hossain is an emerging leader for his research and development in the field of wireless communications and networking, and in particular, broadband wireless technology. Woolford, head of the Department of Sociology, is an expert on Indigenous issues and at the forefront of the movement to rethink the role of genocide in Canadian settler colonialism.

NOT A BAND-AID SOLUTION

POTHOLES, THE BANE OF WINNIPEG DRIVERS, might soon become a thing of the past thanks to the recent creation of a new municipal infrastructure research chair jointly funded by the City of Winnipeg, the Province of Manitoba and 14 local construction industry companies. The inaugural chair holder is Ahmed Shalaby, a professor of civil engineering and head of the university's Pavement Research Group. A specialist in pavement design and highway materials, he is intent on creating a safer, more sustainable and efficient city infrastructure. With the support of his engineering team, Shalaby will focus his research on developing innovative methods and materials to incorporate into the design, construction, maintenance and management of Winnipeg roads, bike lanes, bridges and all active transportation facilities.

Once in place, these new systems and components will significantly improve the overall performance and permanency of the city's pavement structures and road materials. They will make local infrastructure more durable and cost-effective, and ensure that all the design and construction practices within Winnipeg meet the same high standards. Ultimately, these changes will enhance all modes of and experiences of travel and transportation within the city, no matter the season and no matter how much road freezing, thawing and re-freezing inevitably takes place.

LIVING ON



Mosaic: an interdisciplinary critical journal, one of the best of its kind, celebrated its 50th anniversary with a symposium this past March.

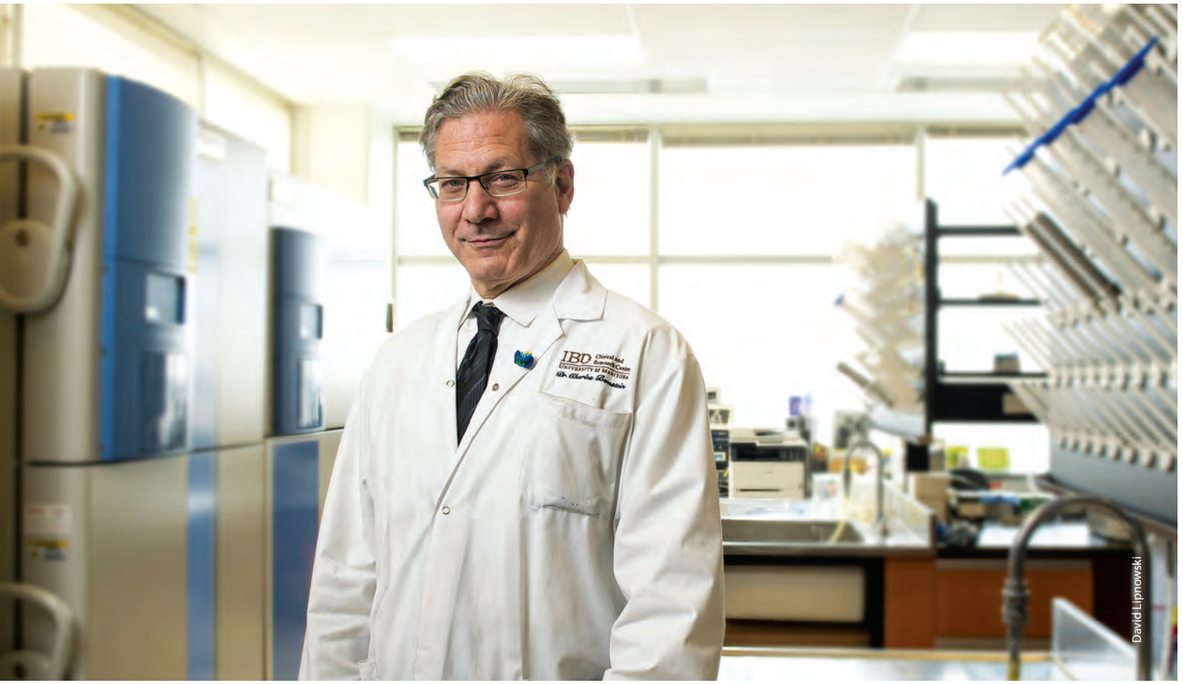
MOSAIC COMBINES RIGOROUS scholarship with cutting-edge exploration of theory and literary criticism. It publishes contributions from scholars around the world and it distributes to 25 countries. In North America, Mosaic is read by subscribers in almost every state and province. It can be found in 226 of the world's major university and college libraries.

The symposium's theme of movement in trans- comes from Jacque Derrida's "Living On / Borderlines" and brought together 20 participants from architecture, art, film, literature, music, and philosophy to reflect on the continuing life of their fields into the next fifty years.

"As have the previous four international interdisciplinary conferences I have organized as editor of Mosaic, this event brought together leading scholars and graduate students from Europe and North America to explore connections that might be bridged across their fields and into the next half century," said Distinguished Professor Dawne McCance, editor of Mosaic.

Speakers at the symposium included the world-renowned architect and U of M alumna Patricia Patkau [BID/73] who, alongside her husband John Patkau [BA/69, BES/69, Arch/72], were this year's recipients of the university's Distinguished Alumni Award for Lifetime Achievement, and a previous recipient of the Governor General's award for architecture for the U of M's ARTlab building. Additional speakers included early modern literary and music scholar Daniel Fischlin, philosopher Alphonso Lingis, and Dutch photographer Lidwien van de Ven.

Part of Mosaic's year-long 50th-anniversary celebration, included a special issue which gathers between two covers all of the "Crossings" interviews the journal has featured since 2001. In addition to 16 interviews led by Dawne McCance, Editor, with leading scholars, artists, and writers, the issue also includes a new interview with Rebecca Comay, Professor of Philosophy and Comparative Literature at the University of Toronto.



LEFT: Charles Bernstein, with his IBD research team (below).

ADVANCING UNDERSTANDING OF IBD

WHY DO SO MANY CANADIANS suffer from Inflammatory Bowel Disease (IBD)?

That question has been at the forefront of Charles Bernstein's research and practice for almost 25 years. While Bernstein's ongoing search for the answer has brought comfort and relief to thousands of Manitobans debilitated by the ill effects of Crohn's disease and ulcerative colitis, it also has garnered the gastroenterologist significant recognition, awards and accolades.

Most recently, the Winnipeg born and raised Bernstein, one of only 25 Distinguished Professors at the University of Manitoba, was awarded the 2016 Dr. John M. Bowman Memorial Winnipeg Rh Institute Foundation Award. The award is presented annually to a U of M faculty member for outstanding contributions to scholarship and research in any field.

Working out of the Inflammatory Bowel Disease Clinical and Research Centre at the university, which he established in 1994 and where he has served as director ever since, Bernstein has developed one of the world's largest epidemiological databases of IBD, a complex, chronic, painful, uncomfortable and often inconvenient illness.

While documenting the incidence and prevalence of IBD among Manitobans, this database also has been highly effective in examining trends and helping to determine the burden, cost and comorbidities of the disease, as well as its root causes.

Dividing their time and focus between numerous treatment based clinical drug trials and medicine-free observational studies, Bernstein and his multi-disciplinary team are constantly seeking to improve their patient outcomes and diagnostic techniques, while also advancing their scientific knowledge of IBD.

Bernstein was awarded the 2016 Dr. John M. Bowman Memorial Winnipeg Rh Institute Foundation Award.

As they explore the connection between anxiety and IBD flare-ups, the relationship between mental wellness and chronic physiological conditions, the clinical intersection between different chronic inflammatory diseases, and whether or not patients with IBD are at a higher than usual risk for bone fractures, among a host of other research projects, they are also continually searching for that one big answer—the answer that will explain why Canada has the highest rate of IBD in the world.

Given Bernstein's longevity, commitment, determination and successes to date, it is likely that answer will one day become part of his formidable U of M medical legacy.

HISTORY OF Rh DISEASE OF THE NEWBORN

BACK IN 1944, WITH WORLD WAR still raging, Paediatrician-in-Chief of the Winnipeg Children's Hospital, Bruce Chown, and his newly hired laboratory assistant, Marion Lewis, were spending their days hunched over microscopes at the nascent Winnipeg Rh Laboratory in the basement of the old Children's Hospital. Supported by a $1,200 grant from the Canadian National Research Council, Chown and Lewis were examining blood group antibodies for a study on Rh Disease of the Newborn, a devastating illness that typically occurred when a pregnant Rh-negative mother unwittingly developed antibodies against the foreign and incompatible Rh-positive blood of her fetus.

The duo's early research on Rh blood grouping methods and treatment protocols, combined with later studies Chown undertook with his Winnipeg colleagues Alvin Zipursky and John M. Bowman, eventually led to the ground breaking development in 1968 of an Rh disease vaccine. Proving an effective prevention against the newborn disorder, the Rh Immune globulin vaccine ultimately led to the almost complete eradication of the disease and the saving of thousands of babies' lives around the world.

As a result of that considerable success, which remains today one of Canada's greatest contributions to the field of medicine, the Winnipeg Rh Lab gained international repute as a state-of-the-art research centre. More than 70 years later—although it is no longer tucked away in the basement of the Children's hospital—the lab, now known as The Manitoba Rh Clinical Program, remains at the forefront of blood disorder research and Rh management and prevention techniques.

EMERGING RESEARCH LEADERS

In the dozen years that Terry Falconer spent as vice-president of administration at the U of M, he devoted countless hours to mentoring academics and researchers and helping them hone their talents and skills. He would be immensely proud of the seven recipients of the 2016 Terry G. Falconer Memorial Rh Institute Foundation Emerging Researcher Awards, an award that was renamed in his memory after his passing in 2015.

Applied Sciences
Puyan Mojabi

Electrical and computer engineer Puyan Mojabi is advancing the development of electromagnetic inversion, a process that uses external electromagnetic field observations to locate internal properties in a particular domain of interest. What does that mean? It means that his research can lead to improved microwave imaging and remote sensing that will, in turn result in enhanced breast tissue imaging, oil exploration, antennae design, and numerous other advances.

Health Sciences
Ji Hyun Ko

An assistant professor in the department of human anatomy and cell science, Ji Hyun Ko is employing his aptitude for both engineering and mathematics to create new functional brain imaging methods. These methods will make it possible to better explore, understand, diagnose, treat and monitor brain abnormalities in neurological and psychiatric disorders such as Parkinson's disease, Alzheimer's disease and post-traumatic stress disorders.

Health Sciences
Kathryn Sibley

In her determination to enhance patient outcomes by improving communication between researchers and health practitioners, Kathryn Sibley has developed what she calls an integrated knowledge translation research approach. Using this approach, the assistant professor in community health sciences identifies troubling research-to-practice gaps and subsequently creates, tests and implements different means of closing those gaps.

Humanities
Étienne-Marie Lassi

How do people view themselves, experience life and relate to other humans, environment and cultures? Those are some of the questions that fuel associate professor of language Étienne-Marie Lassi's research on the idea of identity. Lassi, who has always had a keen interest in people, conducts much of his research by reading, watching and studying novels, plays, films and what he likes to refer to as other imagined realities.

Interdisciplinary
Neil Bruce

A computer scientist by training, Neil Bruce borrows from several other sciences, including neuroscience, psychology and chemistry, to better understand how people view, sample, and process information. Relying heavily on artificial intelligence, imaging and statistics, he is searching for answers to computer vision problems such as object recognition, scene understanding, and how best to focus attention on certain parts of an image.

Natural Sciences
Juliette Mammel

Physicist Juliette Mammel is looking for explanations. Why do we live in a matter universe instead of an antimatter one and what exactly are dark energy and dark matter? Delving into the most fundamental properties of matter, she uses high energy, polarized electron beams to scatter electrons, measure nuclear and nucleon properties, and guide her research to the possibility of discovering some new universal force.

She uses high energy, polarized electron beams to scatter electrons, measure nuclear and nucleon properties, and guide her research to the possibility of discovering some new universal force.

Social Sciences
Chad Lawley

An understanding of the interplay of economics, the environment and agriculture is critically important to Chad Lawley's research. Among many other areas of investigation, the associate professor of agriculture is assessing the pros and cons of pre-emptive invasive species trade measures, supply management in both the dairy and poultry industries, and the dynamic that exists between farmland use, ownership and habitat conservation.

SPINAL CORD RESEARCH CENTRE

BY SHARON CHISVIN

"YOU CANNOT FIX SOMETHING THAT IS BROKEN IF YOU DON'T KNOW HOW IT WORKS."

THAT MANTRA, INDIRECTLY HANDED DOWN from Dr. Larry Jordan, founder of Winnipeg's Spinal Cord Research Centre (SCRC) to its current director, Dr. Phillip Gardiner, informs all of the research that takes place at the world class U of M centre.

That research—multi-disciplinary, complex, frustrating, painstaking, exhilarating and rewarding—is currently the purview of 10 principal investigators determined to better understand spinal cord activity and spinal cord injury.

While at any given time these investigators, and their respective research teams and labs, are conducting dozens of different experiments, clinical trials and studies, they are all working towards a common objective. That objective is to restore a measure of function to individuals who have been impaired by spinal cord damage, no matter the cause, and in the process, to enhance the quality of life for those individuals.

"A large part of our goal is to understand the basics of movement so that interventions can be developed that are evidence-based," explains Gardiner, a professor in the university's Faculty of Kinesiology and Recreation Management and department of physiology and pathophysiology, who took over leadership of the SCRC last summer.

"Cell survival, cell regeneration, and cell replacement therapies, including stem cell use, in combination with training and pharmacological activation of specific functional systems, are some of the areas currently being pursued to restore function," he elaborates.

The promise of restored function has been the centre's key motivator since its establishment in 1987, shortly after Rick Hansen's initial visit to Winnipeg during his worldwide fund and awareness raising Man in Motion tour.

In the 30 years since, the SCRC has celebrated numerous breakthroughs and successes.

"The centre's nucleus of excellence is unparalleled," says Gardiner, whose own research focuses on neural and neuromuscular plasticity.

"Many fundamental discoveries have been generated by our members over the years."

"Many fundamental discoveries have been generated by our members over the years."

Among many others, these include revolutionary findings about the spinal and brain control of urination, the critical role that transmitter serotonin plays in generating movement, the mechanisms by which spinal neurons can adjust their excitability during movement, and the role of electric coupling in controlling sensory transmissions.

"I should point out," Gardiner adds, "that many of these discoveries, even those that do not appear to have a rationale for immediate application, can have unforeseen impacts."

Research on the role of different neuron types and circuits in locomotion, for example, are currently being applied to the robotics industry.

"The uniqueness of the individual expertise of the SCRC members, who are all internationally known in the field, make the SCRC at U of M highly unique compared to other centres," Gardiner says proudly.

And that uniqueness, of course, holds tremendous promise for everyone affected by and constrained by spinal cord damage.

BIG PLANS

FOR GOING SMALL

SUBATOMIC PHYSICS AT THE U OF M

Juliette Mammei does research on fundamental symmetries in subatomic nuclear and particle physics. She is seeking answers to one of the world's most fundamental questions:

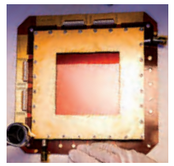
"WHAT ARE WE MADE OF?"

BY CHRIS RUTKOWSKI

SHE EXPLAINS: "The Standard Model of particles and interactions summarizes our current knowledge of fundamental particles and the types of interactions they can undergo. Using particle detectors, subatomic physicists perform experiments at accelerator facilities that allow them to test the Standard Model and to measure properties of nuclei and nucleons. They accelerate electrons up to velocities close to the speed of light, slam them into a target and then measure the scattered electron properties to learn about the particles in the target."

She adds, "This is pure research—some of the most fundamental research that can be done."

The Standard Model is a comprehensive theory that explains what everything in the universe is made of (including us) and what holds everything together. Although physicists have discovered many hundreds of particles and complex interactions, it all boils down to a universe made up of only six quarks, six leptons (such as the electron), their anti-particles and a few "force carrier" particles (like the photon). All other particles are combinations of quarks and leptons, and they interact by exchanging force carrier particles.



Examining the inside of a gas electron multiplier (GEM) detector in the clean room to avoid exposure to dust. Made of planes of mylar vacuum windows and sheets with holes that amplify the electric fields.

TOP: Sakib Rahman, a second year PhD student with Mammei in the clean lab.

"THIS IS PURE RESEARCH—SOME OF THE MOST FUNDAMENTAL RESEARCH THAT CAN BE DONE."

The Standard Model is a pretty good theory; experiments have verified it with a high degree of accuracy, and all the particles predicted by it have been detected. But it's not complete, because it leaves some things out, such as gravity. Physicists are not sure how that fits into the Standard Model. Also, about 95 per cent of the universe is made of material called dark matter, which doesn't interact with other particles and doesn't give off light (hence its name).

So there's still much work to be done on testing the Standard Model, such as looking for new particles or by making more precise measurements. Both of these approaches require more powerful devices or more accurate instruments.

This is complemented by strategic theoretical efforts and supported through agreements with the TRIUMF National Laboratory and international facilities including Argonne and Jefferson Labs (U.S.). A new collaboration has also been formed recently to do experiments in fundamental neutron physics at the Spallation Neutron Source in Oak Ridge, Tennessee. The group plays a leadership role in large collaborations including a proposal to create a world-leading ultra-cold neutron facility at TRIUMF.

Mammei is working to develop highly sensitive detectors in a "clean space" that can then be used in large multinational subatomic physics experiments designed to search for physics beyond the Standard Model and answer the question of what makes up the universe.

The immense scope of her projects require collaboration with researchers and dozens of institutions from around the world, including the U.S. Germany, Italy and France. She works with groups at Jefferson National Laboratory on Qweak and PREX II experiments, and with laboratories in the U.S. and Japan on fundamental neutron experiments.

"THE UNIVERSITY OF MANITOBA HAS A VERY STRONG REPUTATION IN THE FIELD OF 'BEYOND THE STANDARD MODEL' PHYSICS, PARTICULARLY IN THE INTERNATIONAL ELECTRON SCATTERING COMMUNITY."

MOLLER, a proposed experiment to make ultra-precise measurements of the weak charge of the electron, is one of the internationally recognized discovery potential experiments to be run with collaborators at Jefferson Labs with Mammei as the Canadian principal investigator. The project is part of the Subatomic Physics Long-Range Plan of the Natural Sciences and Engineering Research Council of Canada.

"These experiments are highly collaborative because they require massive efforts in manpower (or womanpower) as well as infrastructure and funding," says Mammei. "The diverse international collaborations allow for different perspectives to be brought to bear on these fundamental questions. The University of Manitoba has a very strong reputation in the field of 'Beyond the Standard Model' physics, particularly in the international electron scattering community. It is one of the reasons I came here—to work with the Jefferson Lab group that has and continues to be essential to the development of the magnetic spectrometers, beam diagnostics and detector development necessary for advancements in this field."

Through the dedication of subatomic physicists such as Mammei, complimented by a team of internationally recognized scientists and graduate students in the university's department of physics and astronomy, and in concert with researchers literally around the world, the University of Manitoba could be on the verge of discovering of something really small—with big implications for the universe.

MANITOBA PHYSICS GROUP HISTORY

The Manitoba Subatomic Physics Group is the pre-eminent university-based group in this field within Canada.

- Faculty of Science established in 1904 with physics among one of its first programs.
- Department of Physics established in 1912.
- First graduate degree in physics in 1922 and first PhD awarded in 1930.
- Department of Mathematical Physics created in 1950.
- By 1956 the physics department had become a leading centre in Canada for nuclear spectroscopy and its applications.
- Clyclotron planning began in 1957, and construction in 1959, underneath the parking lot beside the Allen Physics building that was concurrently under construction.
- The Allen [physics] Building opened in 1960.
- The cyclotron facility officially opened in 1965.
- It was the second cyclotron in Canada and the first in Western Canada. The U of M cyclotron was considered a pioneer model of cyclotron design during that period, and was the only negative hydrogen ion cyclotron operating between 20 MeV and 50 MeV in North America. It produced beams of high quality and intensity in order to tackle some of the problems in atomic and subatomic physics.
- The ion source was housed in a building at ground level while the cyclotron was situated two floors below. The cyclotron vault, the shielding and the two experimental areas together occupied 5,000 square feet, while the control room and the electrical room took up another 2,000 square feet of floor area.
- From 1965 to 1985, the cyclotron attracted many physicists, engineers and students to the university to help assist with the project and made it a major turning point within the department.
- In 1986, under the directorship of Dr. Jasper McKee, the cyclotron's uses expanded to other areas of research other than nuclear physics and the Cyclotron Laboratory changed its name to Accelerator Centre to serve as the University Research Centre where interdisciplinary and applied research could be carried out in conjunction with external laboratories and/or the private sector.
- The Accelerator Centre ceased operation in 1989. In 2016, the Manitoba Institute for Materials was constructed in its location.

TIME OF FLIGHT

MASS SPECTROMETRY RESEARCH

BY WERNER ENS, PhD

AROUND THE TURN OF THE CENTURY, a revolution in identifying and characterizing biomolecules (particularly proteins) resulted from the convergence of three dramatic technological developments.

New ionization methods were discovered in the late 1980s, which produce gas-phase ions from biomolecules with unprecedented sensitivity, universality, and mass range —inventions recognized by a Nobel prize in 2002.

Developments in mass spectrometry have dramatically improved the mass range, and the simultaneous access to high sensitivity and high resolution and accuracy.

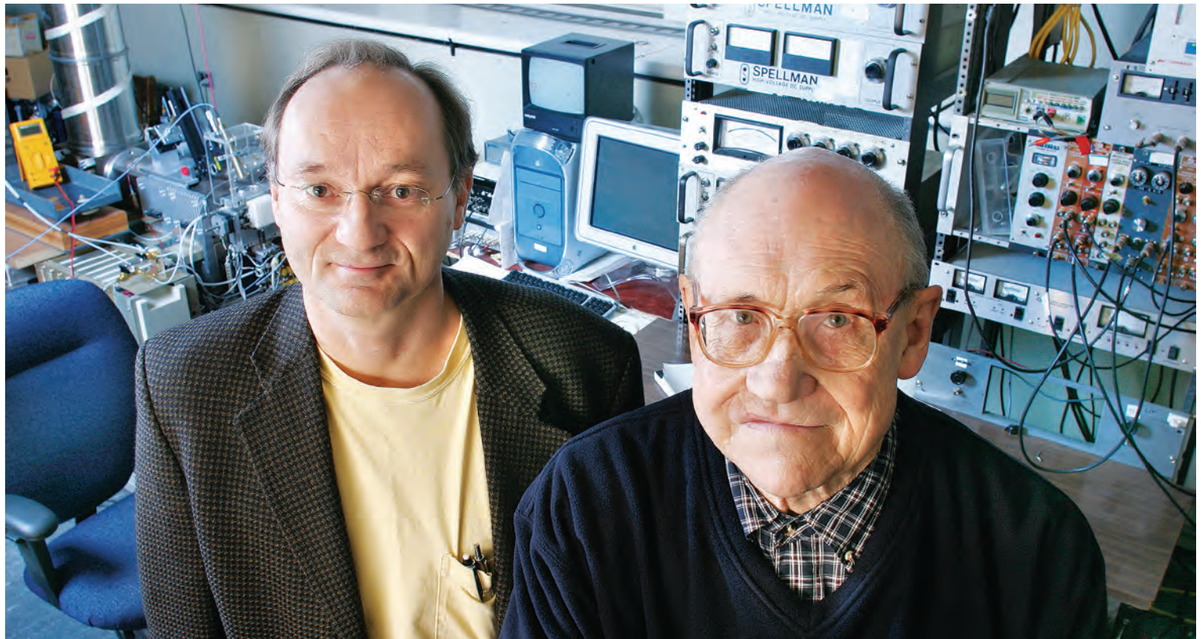
The completion of genome sequences for an increasing number of organisms allowed the generation of protein databases, which significantly constrain the interpretation of complex mass spectra.

MANITOBA HAS MADE significant contributions in the mass spectrometry component of this proteomics revolution. Ken Standing, who was the founding director of the proton accelerator in the university's physics department, began to turn his attention from protons to proteins in the late 1970s, and for the next 30 years or so, led a highly productive group developing time-of-flight (TOF) and related technologies for applications to biomolecules. The contributions have been recognized by many awards, including the NSERC Synergy Award for Innovation in 2000, the Brockhouse Canada Prize in 2006, and the Principal Manning Innovation Award in 2010.

In mass spectrometry, the composition of a sample is determined from the masses of the original atoms or molecules or their fragments. These are formed and ionized in the "source" of the mass spectrometer, and separated in the "analyzer" according to their charge-to-mass ratio. The combination of molecular fragments associated with a particular sample can often be used as a "fingerprint" to identify the original molecule or molecules present.

In a TOF analyzer, the molecular fragments are separated because they travel through a field-free region at different speeds. This method had been largely abandoned in traditional mass spectrometry applications, but it has particular advantages for the study of biomolecules because of its high sensitivity and mass range. The development of fast digital electronics and progress with soft-ionization methods contributed to the beginning of a renaissance of the method in the 80s. During this time, Manitoba was first to couple a SIMS (secondary ion mass spectrometry) source to TOF, and made significant progress in extending the mass range and in improving mass resolution with an electrostatic ion mirror.

Initially, this progress was not directly applicable to the two revolutionary ion sources introduced around 1990. Electrospray ionization (ESI), a continuous source not naturally suited to TOF, was demonstrated with quadrupole mass filters, but with limited mass range. Matrix-assisted laser desorption ionization (MALDI) produced pulses of ions compatible with TOF, but in dense plumes with large energy spreads which resulted in poor mass resolution.



Physics professors Ken Standing (now emeritus) and Werner Ens (LEFT). Ens was Standing's PhD student in the early 80s, and later became his long-time colleague in the TOF group.

MANITOBA MADE SIGNIFICANT CONTRIBUTIONS TO CHARACTERIZING THE SARS VIRUS BY PROVIDING SEQUENCE INFORMATION FOR MUCH OF THE PROTEIN STRUCTURE BEFORE THE GENOME WAS SEQUENCED.

Following developments in Russia, the Manitoba group used orthogonal injection (OTOF) to couple electrospray with TOF, but improved it substantially with a collisional cooling stage, demonstrating mass spectra of protein complexes with unprecedented mass above a million daltons. The Manitoba configuration led to the first commercial ESI-TOF instrument, and to the first tandem quadrupole-TOF instrument (QqTOF) with an electrospray source, the latter in a joint project with MDS Sciex in Canada.

As it happens, the technology developed for ESI-TOF, also presented a solution for the low resolution in MALDI. Collisional cooling was adapted to disperse and cool the dense MALDI ion plume, which could then be used in an OTOF configuration. This decoupling of the ion formation process from the analyzer greatly improved the performance. Furthermore, the decoupled source allowed ions produced via either ESI or MALDI to be analyzed in the same QqTOF instrument. Orthogonal MALDI was patented in 1998, and licensed to Sciex, and has provided a substantial royalty stream for the university for the 20 year life of the patent.

The TOF lab was also involved in many collaborations that took advantage of the new capabilities. A notable example was the collaboration with Frank Plummer at the National Microbiology Lab during the SARS outbreak in 2002 and 2003. Manitoba made significant contributions to characterizing the virus by providing sequence information for much of the protein structure before the genome was sequenced.

The development of instrumentation for biological mass spectrometry has matured and to some extent saturated in the 30 years since ESI and MALDI ignited widespread excitement and activity. There is still some interest in the much-contracted TOF group in developing instrumentation for mass-selected imaging using MALDI, and some of the instrumentation is still used by other groups on campus.

But perhaps the more important legacy of Standing's TOF lab is the Manitoba Centre for Proteomics and Systems Biology led by professor John Wilkins at Health Sciences Centre. Wilkins was an active and valuable collaborator with the TOF group during its most productive years. As such, he got early access to highly specialized capabilities, and this in part motivated the establishment of the centre. Some alumni of the TOF lab have joined the proteomics centre, and it is now well-equipped with commercial instruments that have capabilities exceeding those of their laboratory prototypes.

WHERE CREATIVITY *Thrives*

BY SHARON CHISVIN

"HAVE YOU EVER LOOKED AT, SAY, a picture or a great building or read a paragraph in a book and felt the world suddenly expand and, in the same instant, contract and harden into a kernel of perfect purity? Do you know what I mean? Everything suddenly fits, everything's in its place."

-FROM *THE STONE DIARIES* BY CAROL SHIELDS

How many such 'kernels of perfect purity' have been created at, inspired by or encouraged by the University of Manitoba in its 140 year history? It is impossible to count. There is all of Carol Shields' literary output. There are hundreds of paintings by visual artist Ivan Eyre, and scores of musical compositions and concerts by former and current music students and teachers. There are the Glee Club's comedic operas of the past and the Black Hole Theatre Company mainstage plays of the present. There are films, chapter books and sculpture, poetry, photography, drawings, graphic design and architectural installations.

Creative arts help to preserve history and culture. They pay tribute and jog memory, expand horizons, and spur discussion and debate. They entertain and educate, provoke laughter and tears, celebrate diversity, connect communities to one another, and bring beauty into the world. Creative works, creative expression and creative learning have always been, and will continue to be, integral to the U of M's identity, legacy and vitality.

Structures (Yellow Light) by Leigh Bridges, Acrylic on Canvas, 48"x42", 2016.

CREATIVE WORKS, CREATIVE EXPRESSION AND CREATIVE LEARNING HAVE ALWAYS BEEN,

AND WILL CONTINUE TO BE, INTEGRAL TO THE U OF M'S IDENTITY, LEGACY AND VITALITY.

LITERARY CANON

She wasn't born or raised here, but Canada, Winnipeg and the University of Manitoba all proudly claim Carol Shields as their own. Shields joined the [then] department of English in 1980, serving as a beloved mentor to hundreds of students during almost two decades of teaching. But Shields is best known for her extraordinary writing and the effortless way in which she saw and conveyed beauty, strength and uniqueness in the most ordinary of people and events. That empathy, always graced with humour, is evident in her poetry, plays, short stories, and each of her 10 novels. In 2016 the university installed a memorial bust of Carol Shields in Innovation Plaza, a fitting tribute to an artist whose life work has found a home within the world's great literary canon.

(RIGHT) Memorial bust of Carol Shields unveiled at Innovation Plaza on September 2016

(LEFT) Ivan Eyre, Green Blade, 1993, acrylic on canvas, 152.4" x 142.2". School of Art Permanent Collection

IVAN EYRE

Ivan Kenneth Eyre is renowned as one of Canada's most important artists of the 20th century. In a career that has spanned 60 years he has created paintings, drawings and sculptures that are exhibited, collected and admired in private and public collections around the world. Eyre was a 1957 graduate of the [then] U of M School of Art and an esteemed and demanding professor of painting and drawing in that school for more than three decades. With an eye for detail, an individualistic approach and a strong sense of place, Eyre created panoramic landscapes, still lifes and figurative works that merge the abstract with the realistic while reflecting his personal mythology and search for the meaning of life.

STORIES ON THE PATH TO PEACE

Storytelling has tremendous power and potential to teach and entertain, bridge cultures and communities, and promote social justice and global citizenship. The power and potential of this art form was clearly evident at the 11th annual International Storytelling Festival. The festival, sponsored by the U of M's Arthur J. Mauro Centre for Peace and Justice, invited storytellers from around the world to share their fiction, folktales and experiences at both student and public events. Using puppetry, pantomime, sign language and song, the storytellers mesmerized their audiences with tales on a variety of topics, many of them related to Indigenous rights and world views, peacemaking and conflict resolution.

Inspired by her Kiowa Apache grandmother's stories and experiences of Residential schools, featured storyteller, Dovie Thomason shares her stories with students from the Winnipeg School Division at the festival. This event was a partnership between the Mauro Centre, the Winnipeg School Division Project *Everybody Has The Right*, and the Canadian Museum for Human Rights.

A PRAIRIE BOY'S LIFE

Laura Loewen loves collaborating with other musicians. An associate professor in the Desautels Faculty of Music, she coaches voice, teaches collaborative piano and performs as a collaborative pianist around the world. In February 2017, Loewen took to the stage for the premiere of *A Prairie Boy's Life*, a vocal work that she had commissioned from composer and U of M alumnus John Greer two years before. The 70-minute piece, inspired by Manitoba writer William Kurelek's classics *A Prairie Boy's Winter* and *A Prairie Boy's Summer*, cycles through 10 movements to capture the idyllic passing of the seasons and the title character's coming of age.

Premiere, featuring faculty and alumni of the Desautels Faculty of Music. Performers (L-R): Laura Loewen, John Greer (piano), Momica Huisman (soprano), Lois Watson-Lyons (mezzo-soprano), Mel Braun (baritone).

"EVERYTHING SUDDENLY FITS, EVERYTHING'S IN ITS PLACE."

PASSION FOR THE MOVIES

George Toles knows movies. He knows what makes them good and he knows what goes into the making of them, and for decades he has been passing this knowledge on to students studying film at the U of M. A Distinguished Professor and Chair of the English, Film and Theatre program, Toles is the force behind what he calls the most ambitious and complex undergraduate film course in North America. That course, Film Production: Advanced Camera Acting, Directing, Scriptwriting, requires students to do everything. They work the cameras, lights and sound, write the script, act, direct and produce. And the end result is always the same - an accomplished feature length video narrative and a passion for the movies that only George Toles can inspire.


Mike Latschislaw

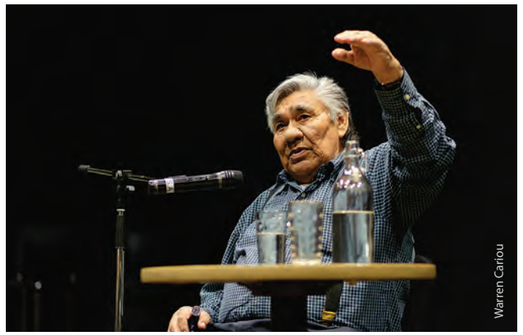

Mike Latschislaw

BLACK HOLE THEATRE COMPANY

Every time that the Black Hole Theatre Company takes to the stage, it honours the legacy of the Dramatic Society that flourished on campus a hundred years ago. Named tongue-in-cheek for the dingy basement corner where it was founded, the Black Hole has always served as a beacon of light for student dramatists, directors and actors. In 2016, the iconic company moved into new sunlit digs in the Gail Asper Performing Arts Hall and performed for the first time in a new theatre named for U of M alumnus and newspaper drama critic John J. Conklin. Both the state-of-the-art hall and the 150 seat, reconfigurable performance space are part of the university's ambitious redevelopment of the century old Taché Hall.

CAPTURING THE STORY

The Centre for Creative Writing and Oral Culture is a place where words matter. Whether those words are spoken or written, they convey a sense of identity, history and possibility to everyone who reads or hears them. Founded in 2008, the centre welcomes artists, scholars and students from diverse disciplines to explore the transformative power of the spoken and written word, and to learn from one another. The centre hosts a writers/storytellers-in-residence program and regularly brings in other masters of the craft to advise, inspire and share their stories. In February 2017 it invited Omushkego Cree Elder and storyteller Louis Bird, from the remote community on James Bay, to share his knowledge of Cree oral tradition, perform his stories, and record them for future generations.


Warren Cariou


Erik Cederlof

COMPUTER-ASSISTED COMPOSITION

Örjan Sandred is constantly exploring the boundaries of contemporary musical expression. A professor of composition in the Desautels Faculty of Music since 2005, he is the founder of Studio FLAT, an on campus centre for the research and production of computer music. At Studio FLAT, student composers and performers explore, experiment with and create interactive computer music and computer assisted composition, while redefining the rules that have guided composition structure for centuries. In March 2017, Sandred returned to his homeland of Sweden to debut a portrait concert of his music, featuring five acoustic and electroacoustic pieces that he composed in his music studio.

BODY POLITIC:
HEX-AGONAL MASQUE FOR THREE

Lisa and Ted Landrum have been collaborating on thought-provoking architectural ideas, interpretations and designs for many years. Their most recent project funded by a U of M Creative Works Grant and completed in 2016, is the revision of their *Hex-agonal Masque for Three*. The Masque is a mixed media interactive installation that invites three participants at a time to join in close conversation with one another, while three other participants silently gaze out into the distance. The intent of the Masque is to encourage civil discourse and debate, alternate modes of perception, and the reimagination of the potential of the *Body Politic*.


Gerald Auren


Leigh Bridges

ATMOSPHERIC RESONANCE

Leigh Bridges is intrigued by light and color, and her most recent major art exhibition, *Atmospheric Resonance*, uses that intrigue to great effect. Merging elements of painting, graphic design and sculpture, *Atmospheric Resonance* explores the intersection of modernist form, landscape and backyard do-it-yourself sustainable technology. Trained in Canada and influenced by research in Germany, where she focused on aspects of the sublime in landscape depictions, Bridges joined the School of Art in 2014 as an assistant professor in graphic design. She recently returned from participating in an international residency in London England where she exhibited in the group show, *The Hidden, The Mysteries*, organized by BecomeBecome.

TOP: Film Studies class at work. **MIDDLE:** Cree Elder Louis Bird performing the story of Chakapesh at the Millenium Library. **BOTTOM:** Lisa Landrum + Ted Landrum, *Body Politic: Hex-agonal Masque for Three* (right), exhibited as part of the *Species Exhibition*, Strauss Gallery, Hopkins Center for the Arts, Dartmouth College, NH, summer 2016.

TOP: *Doubtful House* play performed at the grand opening of the John J. Conklin Theatre on March 15, 2016. **MIDDLE:** Örjan Sandred (centre) at the performance of his portrait concert in Sweden on March 10, 2017. **BOTTOM:** Installation photos from Paul Petro Contemporary show in Toronto, September 2016.

SMARTPARK INNOVATION HUB

BY JACK RACH


George Cibinel, CIBINEL ARCHITECTURE Ltd

AS THE ONLY 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 Smartpark Innovation Hub will serve to further this growth. Currently under construction, the hub is scheduled to open in spring 2018. It will serve as a central gathering place for the Smartpark community, for province-wide university researchers and for the local technology industry. By allowing the research and entrepreneurial community to grow in this way, the facility will support commercialization and professional services, encourage new partnerships and drive the creation of new technologies.

"The core principle of the Smartpark Innovation Hub is to help form and foster a sense of community," says Smartpark's director, Larry Paskaruk. "This principle is missing from the existing nine buildings in the park, which have virtually no common areas. The new facility will have an atrium, meeting rooms, a video teleconferencing room and a food service to help bring the community of innovators at Smartpark together. It will provide a much-needed space for the diverse research community on campus, the city and the province to network, enabling a collision of opportunities and drive innovation."

The development of a one-stop location for commercialization and professional services will ensure that industry partners have the ability to efficiently access new technologies and expertise to bring their ideas to market.

"The core principle of the Smartpark Innovation Hub is to help form and foster a sense of community,"

When fully operational the Smartpark Innovation Hub will have a huge economic impact as well. The long-term economic impact model suggests the hub will generate an estimated $30.4 million in the Winnipeg economy and add $37.4 million in the provincial economy.

The facility is being developed as a LEED Silver building following the Manitoba Green Building and Manitoba Hydro's Power Smart programs. It will feature intelligent environmental controls that will reduce the cost of lighting, ventilation and overall electrical consumption. The advanced building envelope will regulate the amount of sunlight admitted into the building, helping to minimize excess solar gain and offset energy consumption during warm, sunny summer months as well as during cold and temperate winter months. The integrated design allows for maximum flexibility in reconfiguration of spaces with no structural changes required.

All landscaping will be designed with input from the U of M's Indigenous Advisory Council and benefit from the university's Indigenous Planning and Design Guidelines.


David Lipnowski

MEASURING (AND INCREASING) POLITICAL SOLIDARITY

BY KATELIN NEUFELD

ALTHOUGH WE'VE MADE A LOT OF PROGRESS towards equality in Canada, many minority groups are still seeking equitable treatment. Women earn less than men do, even when they have the same experience and training. Transgender youth are more likely to be bullied at school than their peers. And compared to others in Canada, Indigenous peoples face many disparities, including harsher sentences from the justice system, poorer health care, and worse water and sanitation services.

One way to address these issues is to build political solidarity—the degree to which a person "stands" with a disadvantaged outgroup (a group they aren't part of) and commits to working with them for social change. This sort of solidarity is important because it can increase awareness of and support for addressing inequities facing minority groups.

To date, there isn't a comprehensive way to measure political solidarity. Without one, it's difficult for advocates and researchers to compare the levels of political solidarity across different issues. A measure could also help to track changes in political solidarity. For example, measuring political solidarity before and after an advocacy campaign would help determine the campaign's effectiveness.

Along with my supervisors professors Katherine Starzyk (U of M) and Danielle Gaucher (University of Winnipeg), I'm creating a measure of political solidarity. My initial dissertation studies suggest political solidarity includes feeling allyship with a minority outgroup, identifying with that group's

When people join minority outgroups in their struggle to gain fair treatment, they can together create substantial social change.

"cause," and committing to help them create social change. These nuances are all captured in the measure.

In terms of format, the measure looks similar to a short questionnaire or survey: You read a series of statements and indicate your agreement with each. But this isn't your average Buzzfeed quiz. Principles from measurement science guided every step, from rigorous testing to ensure the questions match the theory, right down to the number of words per question. We also designed the measure so it can be useful to as many people as possible—the questions can be adapted to various groups and issues.

In a complimentary line of research, my supervisors, Gregory Boese (doctoral candidate at Simon Fraser University), and I are working to understand how to increase support for social justice issues. Across a series of experiments, we find that asking people to reflect on their connection to their own community increases their support for addressing injustices facing other groups. The next step is to test whether these reminders of community connection strengthen political solidarity specifically.

When people join minority outgroups in their struggle to gain fair treatment, they can together create substantial social change. Measuring and increasing political solidarity may help deepen understandings of when and why people come together, and inform strategies to create a more equitable country.

Katelin H. S. Neufeld is a PhD candidate studying social and personality psychology in the Faculty of Arts.

IMPROVING KIDNEY TRANSPLANT OUTCOMES

BY MELNI GHATTORA

A NEW CLINICAL TRIAL LED BY RESEARCHERS at the U of M could change the current standard of care for monitoring kidney transplant patients and potentially increase the longevity of successful kidney transplants. Principal investigator Julie Ho says many Canadians don't realize that kidney disease is a silent killer.

"IT'S ACTUALLY REALLY SAD… When patients tell their families they have kidney disease, it doesn't have the same implication as if they were to say 'I have cancer.' But the mortality rate with kidney disease is actually just as bad as with many cancers, although there is less public awareness about it," says Ho, an associate professor of internal medicine and immunology in the Max Rady College of Medicine.

Doctors currently monitor the function of transplanted kidneys, but a transplant recipient has to lose a lot of renal function before routine tests pick it up. As Ho puts it, a patient can have organ rejection and significantly damage his or her new kidney before routine tests detect that there is anything wrong.

"The problem right now is we're not picking up all the rejections," she says. "There are some types of rejections where the serum creatinine (a blood test to gauge kidney function) never changes, but we actually find it on biopsy. So we know they have rejection that our routine tests didn't detect."

HO'S TEAM HAS RECEIVED A NEW FIVE-YEAR CIHR PROJECT GRANT OF $2.6M.

A new method of testing is set to hit the trial stage in a year. Ho and a team of researchers have been working on a protein found in urine that detects rejection before routine clinical tests, as part of a previous grant funded by the Canadian Institutes of Health Research (CIHR). This has laid the groundwork for a multi-centre, randomized controlled clinical trial for which Ho's team has received a new five-year CIHR project grant of $2.6M.

Ho shares principal investigator status with an extended team including Peter Nickerson, David Rush, Ian Gibson, Atul Sharma and Chris Wiebe, all from the U of M, and Patricia Hirt-Minkowski from University Hospital Basel. Co-investigators are: Sacha De Serres (Université Laval), Anthony Jevnikar (Western University), Sang Joseph Kim (University of Toronto) and Gregory Knoll (Ottawa Hospital Research Institute).

"We noticed that the CXCL10 protein rises in people who have rejection, before we actually are able to detect rejection with our current standard of care monitoring. This protein reflects early inflammation or rejection in the kidney transplant," the researcher explains.

Dan Gwozdz

Julie Ho in her lab at the Manitoba Centre for Proteomics and Systems Biology, a joint centre of the U of M and Health Sciences Centre.

"THE OVERARCHING GOAL OF THE TRIAL IS TO SEE IF WE CAN DETECT REJECTION EARLIER, AND TREAT REJECTION TO IMPROVE TRANSPLANT OUTCOMES."

In the clinical trial, urine testing for the protein will be done throughout the first year after transplant surgery.

When a patient undergoes a transplant, his or her life expectancy is much higher than it would be on continuing dialysis, says Ho. "If your kidneys fail, the option of choice is usually transplant, if the patient is suitable or qualified… simply because they'll live longer, feel better and have a better quality of life, compared to being on dialysis."

Ho also points to economic implications. Dialysis treatment can cost anywhere from $60,000 to $100,000 per patient, per year. "It is one of the most expensive healthcare modalities out there, but it keeps people alive. When you have a kidney transplant, the first year is an equivalent expense, but beyond that, there is a massive cost saving—in the tens of thousands of dollars per patient for every year that a transplant is functioning," she says.

Patient recruitment for the clinical trial is expected to launch in a year. The trial will take place through the Transplant Manitoba Adult Kidney Program at Health Sciences Centre, where Ho is a transplant physician. All new adult transplant patients from Manitoba will be considered, subject to study criteria.

"The overarching goal of the trial is to see if we can detect rejection earlier, and treat rejection to improve transplant outcomes," says Ho.

END-STAGE KIDNEY DISEASE

END-STAGE KIDNEY DISEASE is the primary cause of kidney failure, which affected more than 36,000 Canadians in 2015. For decades, researchers at the University of Manitoba have been committed to pursuing research that will lead to the prevention, or early detection and treatment, of kidney transplant rejection in order to provide the highest possible quality of kidney transplant care to Canadians. Our research teams have developed one of the best translational research programs in clinical transplant nephrology in North America.

5,438
New cases of end stage kidney disease in Canada

36,251
Canadians living with end stage kidney disease

2,208
Manitobans living with end stage kidney disease

SOURCES: Canadian Institute for Health Information, Research Manitoba

VALUABLE EXPERIENCE

BY THOMAS WRIGHT

Science, Engineering and Technology (SET) Day is held annually for grade 11 and 12 students and their teachers in Manitoba. Participants visit campus to learn about research through a series of hands-on activities and presentations. What follows is this year's SET Day Essay winner's experience of SET Day. Thomas Wright is a grade 12 student from Kelvin High School.

SET DAY TURNED OUT to be more enriching and more fun than I had even imagined! All my life, I have gravitated towards science and math. They have always been my strongest subjects and the ones that most fascinated me. For as long as I can remember, I have wanted to be a veterinarian. Last spring, I suddenly felt drawn to medicine… and then economics… and finally math and computer science. Being uncertain of what you want to do with your life for the first time ever is terrifying. SET Day helped subdue all my irrational worries, as well as help me find what I truly am passionate about.

After a surprisingly delicious breakfast, my experience started with three incredible presentations from three equally incredible individuals. Hearing about Teri de Kievit's unorthodox route to becoming a professor of microbiology was extraordinarily insightful. She emphasized the importance of appreciating all experiences, positive or not, because there is always a take-away and they are all beneficial in the end. Derek Oliver's presentation was equally inspiring, giving us insight into phenomenal research going on at the university. Hearing about innovations such as the silicon rods studied by Derek Oliver's team that could make for a brighter more environmentally friendly future is one of the many reasons that I love science! Kayla Moore gave a wonderful lecture on how one can make the most of your university experience through internships, exchanges and more.

(TOP TO BOTTOM):
SET Day gets underway, Teresa de Kievet *(SET Talk)*

Aging and technology, Alzheimer's with Oculus and Zahra Moussavi

Bridge building in the civil structures lab, Derek Oliver *(SET Talk)*

Planning the bridge build

Pizza 101, Kayla Moore *(SET Talk)*

Photos: Dan Gwozdz

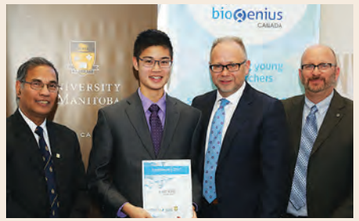
I had the opportunity to have a casual conversation with like-minded people studying in my field of interest is what made this day truly extraordinary.

his experience with the program, the amazing and potentially life-saving projects that he is working on and his plans for the future was just what I needed to help me feel confident in my plan to pursue math and computer science. The opportunity to have a casual conversation with like-minded people studying in my field of interest is what made this day truly extraordinary.

SET Day provided many students, myself included, a glimpse into our future. I am extremely grateful for the opportunity to take part in such a rewarding and valuable experience. Meeting like-minded peers, hearing about others' experiences in science, engineering and technology and learning new and exciting things made for a perfect day. I would encourage everyone to take advantage of such an opportunity should you be presented with it. No matter how many university brochures you read, nothing can beat a firsthand experience like the one provided by SET Day. I am very thankful to have gotten to be a part of it.

Thomas Wright, grade 12 student from Kelvin High School. Photo: Ally Gonzalo

SANOFI BIOGENIUS CANADA REGIONAL COMPETITION



(L-R) Digvir Jayas (U of M), Justin Lin, Robert Lee (Sanofi Canada), Brent Peltola (Partners in Research) Photo: Mike Latschislaw

APRIL 3 MARKED THE FIRST TIME the University of Manitoba hosted the Sanofi Biogenius Canada (SBC) Manitoba competition. SBC is a national science research competition open to high school students, which saw 14 competitors from Manitoba schools vie for a chance to go to the national SBC event in Ottawa.

This year's schools represented included Acadia Junior High, Fort Richmond Collegiate, Grant Park High School, Vincent Massey Collegiate and St. John's Ravenscourt. One of the country's most prestigious science competitions, SBC pairs exceptional young students with academic mentors to pursue real-world research projects, and participants have produced many promising scientific breakthroughs.

Justin Lin, a Grade 12 from St. John's Ravenscourt School, earned top honours at the competition. He was chosen by judges for his research project that explores a potential diagnostic test for ALS. Currently, there is no definitive diagnostic for the disease, and Justin's project proposes a new tool that could assist with early detection and improved patient prognosis. Lin's mentor was U of M professor at the Max Rady College of Medicine Jiming Kong in the department of human anatomy and cell science.

The runners-up of the SBC 2017 Manitoba regional final were Jacob Harvey (2nd), a Grade 11 student at Grant Park High School, Jasmine Cheng (3rd), a student at Acadia Junior High School.

Lin received a cash prize of $2,000, a portion of which will go to his high school. He took second place at the Sanofi Biogenius Canada National final. He was a big winner with a Gold Medal at the Canada-Wide Science Fair and has accepted an entrance scholarship at the U of M for Fall 2017.

ARCTIC ENVIRONMENTAL CHEMISTRY°

BY KATELIN VIT

Soren Rysgaard

A COLD LAB IN THE WALLACE BUILDING at the University of Manitoba's Fort Garry campus allows scientists to conduct Arctic research all year round. The lab has rooms of different temperatures: -4° C, -20° C and -40° C.

To work there researchers bundle up, wearing gloves and parkas, just like they do when in the Arctic. "We started to wear Canada Goose a long time ago, for practical reasons," says Feiyue (Fei) Wang, a professor of environmental chemistry and biogeochemistry. "In the last five years, suddenly it's become very fashionable. Everyone is wearing them."

TOP: Feiyue Wang (foreground) controlling the inductive coupled plasma mass spectrometry (ICPMS) which measures total metal concentrations and discussing results with (L-R) Debbie Armstrong (UCTEL technician) and Kathleen Munson (post-doctoral fellow). Photo: Mike Latschislaw

WANG IS A PROFESSOR in the department of environment and geography and at the Centre for Earth and Observation Science in the Clayton H. Riddell Faculty of Environment, Earth, and Resources. He is also a newly appointed Canada Research Chair (CRC – Tier 1) in Arctic Environmental Chemistry, receiving $1.4 million over seven years to support his research.

He directs the Ultra-Clean Trace Elements Laboratory (UCTEL), leads the Sea-ice Environmental Research Facility (SERF)—the first experimental sea ice facility in Canada—and co-leads the contaminants research program in the Arctic under ArcticNet (a Network of Centres of Excellence of Canada, based out University of Laval).

Quite a few CRCs have mentored Wang, and he says he's thrilled and humbled to be named one himself. When he heard the news, he says he sent an email to his current and past students.

"They are the ones who make me look good," he says with genuine pride in his voice.

Wang's research explores the chemical processes happening in the cryosphere—the frozen parts of Earth, like snow, sea ice and permafrost—and what their implications are.

"We always think once you freeze something, nothing happens," he says. "That's how we keep our food in the freezer and so on."

But as it turns out, there's more to it.

Because of the high concentration of salts, frozen sea ice has different properties than frozen lake ice. When seawater freezes, it doesn't become a solid piece of ice—a small amount of liquid remains, filling the tiny spaces between ice crystals.

Salts and contaminants concentrate in these pockets of water, which can result in unusual chemical processes. These processes may change the cycling of contaminants, like mercury, making them more prone to deposition in the environment and accumulation in organisms. Or sometimes these brine channels create products, such as ikaite, a mineral that acts as a new pathway for carbon dioxide exchange between the atmosphere and the ocean.

We need to understand these processes so we know how to clean up contaminants like oil spills in the Arctic, Wang says. So far, technology to clean up oil spills is used in open oceans, not oceans covered in ice. Wang and his team need to determine if the same processes can be used in either place. The Churchill Marine Observatory (CMO), a new national marine research base on the shores of the Hudson Bay, now under construction, will facilitate this research in a controlled environment.

"Working in the environmental field… we're driven by curiosity, but we're also driven by real world problems and problem solving."

A new research consortium, spearheaded by Wang with Carl Brown of Environment and Climate Change Canada, on Oil Spills in Ice-Covered Arctic Waters (OSICA) was set up in mid-March at the U of M. Taking advantage of

"WE ALWAYS THINK ONCE YOU FREEZE SOMETHING, NOTHING HAPPENS," HE SAYS. "THAT'S HOW WE KEEP OUR FOOD IN THE FREEZER AND SO ON. BUT AS IT TURNS OUT, THERE'S MORE TO IT."

the soon-operational CMO, the goal of the OSICA Consortium brings together researchers and stakeholders across the country to generate scientific knowledge, develop effective technologies, and support decision-making for evidence-based policy to respond to oil spills in ice-covered Arctic waters.

Wang has travelled on the Canadian research icebreaker CCGS *Amundsen*, the icebreaker on the Canadian $50 bill. There are labs where researchers can conduct experiments right on the vessel, after collecting samples in the field.

An aquatic chemist by training, Wang's research interests range from the molecular level interactions of metal ions across environmental interfaces, to global-scale interactions between chemical contamination and climate change.

Wang's research at SERF—the main feature is an outdoor seawater pool measuring 60 feet long, 30 feet wide and 8 feet deep—allows for the control of seawater chemistry, snow cover and ice growth, and various sensors and instruments for real-time monitoring. The facility was originally constructed with funding from the Canada Foundation for Innovation and the Province of Manitoba.

"SO FAR, TECHNOLOGY TO CLEAN UP OIL SPILLS IS USED IN OPEN OCEANS, NOT OCEANS COVERED IN ICE."

He calls the large in-ground outdoor pool at SERF a "big beaker." Since its opening in 2011, SERF has seen the formation of pancake ice, frost flowers of varying sizes, and young ice. More than 15 scientific papers have been published based on studies carried out at SERF.

Since Wang started working at the U of M in 2000, one of his major research interests has been on mercury as a global contaminant, particularly in the Arctic. People living there rely on marine mammals as part of their diet, which can have high concentrations of mercury.

Thanks to Wang and other researchers, there is now an international treaty—the Minamata Convention on Mercury—protecting people and the environment from anthropogenic emissions and releases of mercury. To date, 128 signatories, with 43 ratifications [including Canada], have become future parties to the treaty. The legally-binding treaty is expected to enter into force later this year. And Wang is part of an experts team working with the United Nations Environment Programme (UNEP) on the next Global Mercury Assessment set for release in 2018.

"The Minamata Convention was a long time coming," says Wang. "It is rewarding to see the research we conduct having an impact on policy."

In terms of further mercury research, Wang's team will focus on whether or not the environment and ecosystems will recover after emission controls, and if it can, how long will it take.

TOP LEFT: Feiyue Wang at SERF.

ABOVE: polypropylene sample tubes

RIGHT: Wang preparing samples for analysis. Photos: Mike Latschislaw

ARCTIC RESEARCH LEGACY

Over the past 15 years, our University has worked with other Canadian universities, private sector companies, and federal, provincial and territorial governments to coordinate a national network of Arctic marine science.

It began with networks such as Marine Baysys, North Water Polynya, Canadian Arctic Shelf Exchange Study (CASES), Sea-ice Environmental Research Facility (SERF), Collaborative Mercury Research Network (COMERN), International Polar Year Circumpolar Flaw Lead System Study (IPY-CFL), The Churchill Marine Observatory (CMO), and the ArcticNet Networks of Centres of Excellence (NCE). Manitoba played a leading role in these networks, always in the fields of sea ice, oceanography, climate, and contaminant research.

Similarly, we are leading or partnering in several international partnerships and networks including: SEARCH (U.S.), ARCTOS (Norway), DEFROST (Europe), CHINAIR (China) and IAPP (pan-Arctic). The IPY program was the largest ever conducted from 2006-2011, that brought together 120 researchers from 27 countries to study in the southern Beaufort Sea, overwintering on the Canadian research icebreaker CCGS *Amundsen*.

This national and international experience led to the successful recruitment of Søren Rysgaard, our Canada Excellence Research Chair (CERC), in 2010. He was instrumental in the development of the Arctic Science Partnership (ASP) which began in 2012. This partnership fully integrates the Arctic research programs at the U of M, the Greenland Institute of Natural Resources, and at Aarhus University in Denmark. This intensive research collaboration fosters a critical exchange of knowledge and provides scientists with a joint platform, drawing on the numerous facilities administered by each institution, including research vessels, field stations, technical support staff, laboratories and a common graduate level curriculum.

The CERC unit has played a leadership role in several major Arctic research initiatives, including: BaySys (Variability and change of freshwater-marine coupling in the Hudson Bay System), the Churchill Marine Observatory, GENICE (investigate the potential for native microbial communities to mitigate oil spills), and Network of Experts in Transportation in Arctic Waters (NEXTAW).

BY THE NUMBERS

29,987
students (Fall 2016)
25,611 undergraduate; 3,700 graduate;
676 post-graduate medical education

5,034
academic staff (2015/16)
1,185 full-time faculty;
3,943 support staff

$629.5 M
annual
operating budget
(2015/16)

67
Endowed and sponsored research chairs – including 34 Canada Research Chairs and the highly prestigious Canada Excellence Research Chair

54
research centres, institutes and shared research facilities

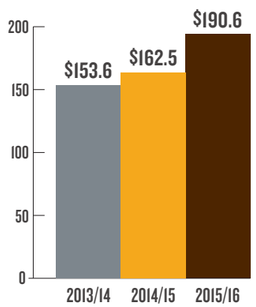
45
Royal Society
of Canada Fellows

16.9%
of students are international students, representing 116 countries

8
National Synergy Awards
for Innovation

SPONSORED RESEARCH INCOME THREE YEAR COMPARISON ($ MILLION)

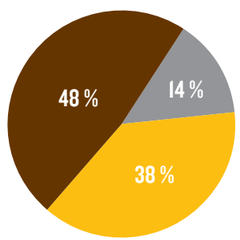
- 2013/14: $153.6M
- 2014/15: $162.5M
- 2015/16: $190.6M



SPONSORED RESEARCH INCOME BY SOURCE (2015/16)

TOTAL: $190.6 MILLION

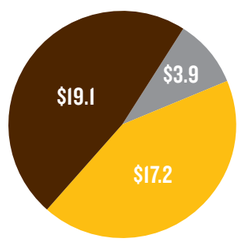
- FEDERAL GOVERNMENT 48 %
- OTHER 38%
- PROVINCIAL GOVERNMENT 14%



TRI-COUNCIL FUNDING 2015/16

TOTAL: $40.2 MILLION

- **CIHR** (Canadian Institutes of Health Research) $19.1 M
- **NSERC** (Natural Sciences & Engineering Research Council of Canada) $17.2M
- **SSHRC** (Social Sciences & Humanities Research Council of Canada) $3.9M



IT STARTS WITH AN IDEA.

GAME CHANGER
MANITOBA'S IDEA COMPETITION

WIN UP TO $10,000 FOR YOUR CREATIVE IDEAS!

Game Changer: Manitoba's Idea Competition is an exciting contest that will give all Manitobans an opportunity to identify global problems and work in teams to devise innovative, game-changing solutions.

DON'T MISS YOUR CHANCE! PROBLEM SUBMISSION DEADLINE: SEPTEMBER 20, 2017

The chosen problems will be announced via the University of Manitoba Facebook page (live broadcast) on September 26, 2017 at 12 noon.

For more information visit
UMANITOBA.CA/GAMECHANGER

UNIVERSITY OF MANITOBA

CAFÉ SCIENTIFIQUE

Join us in talking and learning about different research taking place at the university. These Café Scientifiques bring together experts with non-researchers (you, me, neighbours and friends) in a relaxed atmosphere at McNally Robinson Booksellers, to talk about their research and the questions it raises. Come and join the discussion!

UMANITOBA.CA/CAFESCIENTIFIQUE

Canada Research Chair in Arctic Environmental Chemistry **Feiyue Wang** preparing samples for analysis in the Ultra-Clean Trace Elements Lab. *(see page 30 inside).*

ResearchLIFE