MAKING CONNECTIONS

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2024 Krembil Annual Report

The Krembil Research Institute (Krembil) is the research arm of Toronto Western Hospital (TWH) at University Health Network (UHN). Krembil's research programs focus on the brain and spine, vision and arthritis. Its laboratories are located at the Krembil Discovery Tower and at TWH's Main, McLaughlin and Fell Pavilions. Prior to November 13, 2015, Krembil was known as the Toronto Western Research Institute.

We acknowledge that the land on which we work is the traditional territory of many nations, including the Mississaugas of the Credit, the Anishnabeg, the Chippewa, the Haudenosaunee and the Wendat peoples, and is now home to many diverse First Nations, Inuit and Métis. We also acknowledge that Toronto is covered by Treaty 13 with the Mississaugas of the Credit. We remember and honour the legacy of the peoples who have been here before us and all who strive to make the promise and the challenge of Truth and Reconciliation real. We are grateful to have the opportunity to live and work on this land.

We are committed to championing inclusion, diversity, equality, equity and accessibility in the learning, work and service environments. We believe that our differences enrich our ability to develop creative and innovative approaches to delivering exemplary scientific discoveries, patient care and education.

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About the cover: At the Krembil Research Institute, driven people and creative ideas come together to spur discovery. *Cover design: Jose Onpgin, UHN-KITE Studio*

Inside

Making Connections

As we reflect on another year of transformative research, I am struck by a resounding truth: our strength lies in the power of our connections.

Across Krembil Research Institute, we are united by a shared commitment to forging connections—not only among people, teams and institutions, but also among ideas. We know that it is through these connections that we drive progress and, ultimately, change lives.

In this year's report, we delve into the myriad ways in which connections shape and define our mission. From nurturing collaborations among research institutions and teams to bridging the gap between basic science and clinical practice, we are steadfast in our commitment to building lasting connections that foster innovation and unlock discovery.

Here, we explore just some of the recent fruits of this effort.

We showcase the discovery of a promising new approach to treating glioblastoma—a testament to the power of cross-disciplinary collaboration among basic and clinical scientists, clinical trialists, surgeons, nurses and patients.

We also share our finding of potential biomarkers for a form of inflammatory arthritis, which could yield improved diagnostic tools and therapies—a clear reflection of our efforts to connect ideas from the bench to bedside.

Lastly, we explore the intricate processes by which developing cells interact with one another to find their place within the nervous system—an example of the importance of connectivity at the most basic, cellular level.

These scientific achievements underscore the transformative outcomes that are possible when diverse teams come together to exchange ideas in pursuit of a common goal.

Importantly, our connections extend far beyond our laboratories and clinics—they touch the heart of our community. I am immensely proud of our many outreach initiatives that connect our talented scientists, clinicians, trainees and staff members with the public.

This year, we fought stigma by teaching the public about epilepsy and what our Institute is doing to understand and treat the condition. We reached more than 2,800 students from over 100 classrooms around the world through our educational livestream to celebrate the International Day of Women and Girls in Science. And we launched the third season of our acclaimed podcast *Your Complex Brain*, which has garnered over 43,000 downloads and the *2023 People's Choice Award for Best Science & Medicine Podcast*.

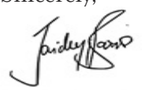
We see every day that the invaluable support that we receive from our community and our many research collaborators, participants, patients, advocates, donors and other partners is the lifeblood of our Institute.

We are driven by a shared vision of a healthier future and inspired by the knowledge that, when we come together in purpose and passion, we can make a profound difference.

As you peruse this report, I invite you to not only witness the impact of our diverse connections but to become a part of them—at every level, in every endeavour.

Thank you for your unwavering support and your belief in the power of connections.

Sincerely,



Dr. Jaideep Bains
Director, Krembil Research Institute
University Health Network

Trainee and Staff Spotlight

Lingdi (Lydia) Nie

Postdoctoral Researcher supervised by Dr. Karun Singh, Donald K. Johnson Eye Institute

In Dr. Singh's lab, I use stem cells to build 3D brain and eye tissues, called organoids, to study neurological and vision disorders.

As part of my research, I collaborate with the Neurophotonics Centre at Laval University. We are working with this research facility to develop viral tools to visualize the activity and connectivity of cells in patient-derived organoids. This unique approach gives us insights into the disease processes at play in individual patients.

I previously completed my doctoral training in neuroscience in a China-UK joint graduate program, where I learned to identify mechanisms of neurological disorders and drug targets using pre-clinical models. Now, I am building skills in culturing stem cells and organoids and using these models to study disease processes. I am also collaborating with other Krembil labs to refine these techniques and unlock their potential.

What I love most about my job is that I get to apply powerful research techniques, like neural circuit tracing and transcriptomics, to study diseases and develop new therapeutics.

My goal is to use organoids and other tools to advance personalized medicine and help UHN achieve its goal of creating a healthier world.

James Young

Postdoctoral Researcher supervised by Drs. Anthony Perruccio and Michael Zywiel, Schroeder Arthritis Institute

I work in the field of Integrated Arthritis Care, focusing on surgical and non-surgical models of care for knee and hip osteoarthritis and other musculoskeletal disorders. My research involves identifying which patients are most likely to benefit from each of these treatment options and when, and applying this information to provide the most effective and cost-efficient care.

I completed my PhD at the University of Southern Denmark, where I explored integrated care options for a variety of musculoskeletal disorders. During my studies, I was fortunate to be offered a position at the World Health Organization (WHO) to help develop its first musculoskeletal disorder program. This work recently led to high-level WHO meetings to put musculoskeletal disorders on the global health agenda and to the development of a strategy to improve musculoskeletal health worldwide.

I am really pleased that the Schroeder Arthritis Institute is taking a leadership role in improving musculoskeletal health and supports my efforts in this area. The Institute is actively promoting connections among a wide range of health care providers and research professionals, which is key to addressing musculoskeletal disorders. We are now working together more than ever, unlocking insights that will improve patient care.

Kabriya Thavaratnam

PhD Candidate supervised by Dr. Mohit Kapoor, Schroeder Arthritis Institute

My research focuses on building an atlas of the cell types that are present in the synovium—the soft tissue that lines certain joints like the knee. My goal is to determine the roles of different cells, such as fibroblasts, in knee osteoarthritis, the most common form of arthritis.

Throughout my graduate studies, I have been building a network to support my professional development. After I finished my undergraduate studies at the University of Toronto, I got my Master's Degree at the University of Zurich. I learned a lot from my mentors and peers in Zurich, and we are still in touch today.

To support my current project, Dr. Kapoor and I are collaborating with Dr. Eric Gracey, a postdoctoral researcher at the University of Ghent, in Belgium, who completed his PhD with Dr. Robert Inman at UHN. Dr. Gracey has been an amazing guide for my experiments. He has been incredibly helpful, and his knowledge and determination inspire me to be a better scientist.

I am so proud to be a part of the Kapoor lab, where I get to work with an exceptional team and have access to so many professional development opportunities. I particularly love attending conferences to network with other scientists and learn about their projects and career journeys.

Brenden Rabinovitch

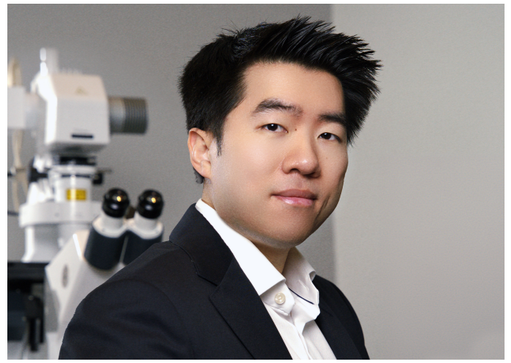
MSc student supervised by Dr. Peter Carlen, Krembil Brain Institute

As a graduate student in Dr. Carlen's lab, I use intracranial electroencephalography, brain slice recordings and behavioural analyses to study how psychedelic drugs alter neural activity and rhythms. These compounds have great potential for treating brain disorders, but there is still a lot to learn about them. My goal is to establish a safety profile for their use in people with seizure disorders and to understand how they affect communication between brain regions.

Every day in the lab involves collaboration. Currently, I am working with Dr. Liang Zhang to perform brain slice recordings to assess seizure dynamics and determine how psychedelics affect brain rhythms. This partnership allows me to gain unique research skills and advance our understanding of the effects of these drugs.

I am really proud of the work I do. I love being able to ask new questions and design unique experiments to answer them. My intracranial recordings are especially neat because I get to witness changes in brain activity immediately as they occur, right before my eyes.

It has been particularly rewarding to see the hundreds of hours that I have dedicated to my experiments begin to generate insights that could eventually improve the way we treat patients.



Xiaotian (Tag) Yu

Research Associate, Advanced Optical Microscopy Facility

In the Advanced Optical Microscopy Facility (AOMF), I work with researchers to apply optical microscopy approaches in their experiments and help them acquire consistent and reliable data.

I am dedicated to making sure that our teams have access to the best equipment and software—and training and support—so they can focus on pushing boundaries in their fields.

During a collaborative project, I saw first-hand some of the challenges that researchers face relating to cell imaging. I provided advanced software that automates cell counting to expedite the process and reduce error. This experience underscored the critical role of teamwork and having access to the right tools in research.

One thing that I love about working at Krembil is the breadth and depth of resources and assistance that I get to offer to our teams—whether they work in the areas of neuroscience, vision research or musculoskeletal health. I got my PhD in neuroscience, and I remember grappling with new techniques and methodologies largely on my own because there was no readily available expert guidance. Now, I find it very rewarding to share my experience to help others.

One of the most fulfilling parts of my job is engaging with our research teams and learning about their projects. I love connecting with our scientists, offering guidance and support, and hearing about their progress and interests.

Cassandra D'Amata

Research Technician, Donald K. Johnson Eye Institute

My role as a research technician in Dr. Brian Ballios' lab is multifaceted. I manage daily lab operations, help train new team members, support projects and run my own experiments.

My professional goal has always been to conduct hands-on research related to regenerative medicine. I obtained my Master's degree in Cell and Systems Biology at the University of Toronto, where I studied neural stem cells.

Before joining UHN, I worked as a research technician at The Hospital for Sick Children, where I contributed to research into spinal cord regeneration and glioblastoma. I am thrilled to now be able to apply everything that I have learned to support research into stem cell therapies and inherited retinal diseases, with the goal of developing treatments to cure blindness.

The Ballios lab was quite new when I joined—I was the only lab member! Fortunately, working with other Krembil staff and trainees helped me learn the ropes and made me feel like part of a community, for which I am very grateful.

Working in the Ballios lab, I often get to develop and validate my own protocols. I am very pleased to have pioneered some of our lab's techniques and I find it satisfying to watch team members gain their own technical skills. I love that I get to support large-scale team projects, while having the freedom to ask and find answers to my own research questions.

Luis Montoya

Research Manager, Schroeder Arthritis Institute

As a Research Manager in the Division of Orthopaedic Surgery, I guide a dynamic team of 16 individuals to oversee a variety of research activities. My role involves developing operational plans, policies and budgets, as well as crafting grant proposals, reviewing contracts and liaising with research partners to support our programs.

My diverse experiences have instilled in me the value of collaboration in health care, which I carry into my work every day. I have a Master of Science and additional degrees in health care and project management, and have authored more than 20 publications in peer-reviewed journals. Before relocating to Canada in 2008, I worked as an Endodontist in Colombia and provided dental care to vulnerable communities as part of a social project, led by the Colombian Navy.

I am very proud to be part of a team where surgeons, scientists and research staff work hand in hand to transform the health care system. My experience working with Dr. Mohit Kapoor has been particularly enriching. His commitment to curing arthritis sets a high standard and inspires everyone around him to strive for excellence.

I love that my job gives me a lot of opportunities to connect with others, especially our patients. Talking to them about their experiences fills me with purpose. I am always amazed by their willingness to participate in research studies to help others. Their enthusiasm reminds me that we are making a difference.

Altagracia Cantos

Medical Administrative Assistant, Krembil Brain Institute

As a Medical Administrative Assistant for Dr. Suneil Kalia in the Neurosurgery Division, I manage and organize clinical and administrative schedules and serve as a point of contact for patients. I also support Dr. Kalia's lab by helping his team prepare grant applications and manuscripts and organizing social events.

I studied Psychology at Lyceum of the Philippines University, and then Office Administration in Health Services at Centennial College. I first met Dr. Kalia when I was doing an internship at UHN. It was inspiring to see him doing incredible work to manage movement disorders, epilepsy and pain, while also conducting highly original research. Joining #TeamKalia quickly became my favourite chapter professionally.

An exciting aspect of my job is helping Dr. Kalia and our other neurosurgeons bring new treatments and technologies to UHN. I am also very proud that I build trust and positive connections with our patients and their families, clinical colleagues, researchers and staff.

The best part of my job is meeting patients for follow-ups after deep brain stimulation surgery to treat movement disorders. They are always so excited to show me the skills that they have regained—how they can button their shirts, hold their cups and write—and I am so excited to see it. Watching them reclaim independence after years of relying on others is a miracle. Seeing them improve often brings me tears of joy.

Krembil Brain Institute

PROMISING NEW THERAPY

New treatment for glioblastoma prolongs patient survival in an early-phase clinical trial.

Magnetic resonance imaging (MRI) scans of the brain of a patient with glioblastoma.

In a potentially game-changing early phase clinical trial, Krembil Brain Institute neurosurgeons Drs. Gelareh Zadeh and Farshad Nassiri show that a novel therapy for recurrent glioblastoma is well-tolerated and prolongs patient survival.

Glioblastoma is a notoriously difficult-to-treat primary brain cancer. Despite aggressive therapy, which typically involves surgical removal of the tumour and multiple chemotherapy drugs, the cancer often returns.

Once tumours recur, treatment options are limited. To meet the urgent need for new treatments, Dr. Zadeh and her colleagues evaluated an innovative therapy in 49 patients with recurrent disease from 15 hospital sites across North America. UHN was the only Canadian institution and treated most of the patients enrolled in the trial.

The novel therapy involves the combination of an oncolytic virus—a virus that has been engineered to selectively infect and kill cancer cells—and a type of targeted immunotherapy called immune checkpoint inhibition.

First, the team slowly injected the cancer-killing virus directly into the tumour using stereotactic techniques. Patients then received an immune checkpoint inhibitor intravenously once every three weeks, starting one week after surgery.

Immune checkpoint inhibitors are effective treatments for a variety of cancers, but they have had limited success with recurrent glioblastoma.

"These drugs work by preventing cancer's ability to evade the body's immune response, so they have little benefit when the tumour is immunologically inactive, as is the case in glioblastoma," explains Dr. Zadeh, former Co-Director of Krembil Brain Institute and Senior Scientist at UHN's Princess Margaret Cancer Centre.

"Oncolytic viruses can help us overcome this limitation by creating a more favourable tumour microenvironment, which then helps to boost anti-tumour immune responses."

- Dr. Gelareh Zadeh

The combination of these viruses and immune-checkpoint inhibitors results in a "double hit" to the tumours.

The virus directly kills cancer cells and stimulates local immune activity that makes the cancer cells more vulnerable to targeted immunotherapy.

The trial showed that the therapy had no major

→
Dr. Gelareh Zadeh, former Co-Director, Krembil Brain Institute; Senior Scientist, Princess Margaret Cancer Centre

unexpected adverse effects and prolonged patient survival—with a median survival of 12.5 months, considerably longer than the 6-8 months typically seen with existing therapies.

"We're very encouraged by these results," says Dr. Farshad Nassiri, a Staff Neurosurgeon at Krembil Brain Institute.

"We saw some remarkable responses to the treatment, with tumours shrinking and some even disappearing completely."

- Dr. Farshad Nassiri

Over half of the patients achieved a clinical benefit—stable disease or better.

"In general, the drugs that are used in cancer treatment do not work for everyone, but we believe that there is a subpopulation of glioblastoma patients that will respond well to this treatment," explains Dr. Zadeh.

"We believe this translational work, combining basic bench science and clinical trials, is key to moving personalized treatments for glioblastoma forward."

This is one of only a few clinical trials with promising results for glioblastoma over the last decade, and it was a team effort.

"The trial would not have been possible without our incredible operating room teams, research safety teams, researchers, and our brave patients and their families," says Dr. Zadeh.

This work was supported by DNATrix Inc., Merck & Co. Inc., the Princess Margaret Cancer Centre Foundation and UHN Foundation. Dr. Zadeh is a Professor at the Department of Surgery at the University of Toronto and holds the Dan Family Chair in Neurosurgery and the Wilkins Family Chair in Neurological Brain Tumour Research.

Nassiri F et al. Nat Med. 2023. doi: 10.1038/s41591-023-02347-y.

Dr. Farshad Nassiri, Staff Neurosurgeon, Krembil Brain Institute, and Scientist, Princess Margaret Cancer Centre

MAKING A MARK ON DEPRESSION

Study identifies markers of treatment response in people with depression.

Approximately one-third of people with major depressive disorder do not respond to medications or other types of therapy. Repetitive transcranial magnetic stimulation (rTMS) is a non-invasive form of brain stimulation that helps some individuals who are treatment-resistant—with a response rate of approximately 50%.

Despite a growing understanding of how this therapy works, it is unclear why some individuals respond to it and others do not.

To identify treatment-related changes in brain activity, Dr. Daphne Voineskos and her team analyzed data from 90 adults with treatment-resistant depression who received up to 30 rTMS sessions over up to 6 weeks.

Before and after the treatment, participants underwent a brain stimulation and recording procedure called transcranial magnetic stimulation and electroencephalography. Using this method, the team studied changes in two markers of cortical inhibition, known as the N100 and N45 signals.

The team discovered that both markers changed following rTMS in individuals who responded to treatment. Specifically, these individuals showed a weaker N100 signal and a stronger N45 signal after treatment compared to non-responders.

The team also found that as participants' levels of depression decreased, their N100 and N45 signals began to more closely resemble those of healthy individuals.

The team also learned that features of the N100 signal before treatment can help to predict whether a patient will benefit from rTMS.

"With these findings, we are getting closer to developing a non-invasive test to guide treatments for our patients," says Dr. Voineskos.

"Our study has revealed a robust way to identify which patients will benefit from rTMS and could lead to improved protocols that reduce the frustration that comes with current trial and error approaches for treating depression."

Full Story / *Scientific Article*

→ *(R) Dr. Daphne Voineskos, Clinician Investigator, Poul Hansen Family Centre for Depression, Krembil Brain Institute*

A NEW PATH TO DIAGNOSIS

Researchers uncover markers of ankylosing spondylitis by studying cellular packages and their cargo.

Exosomes (depicted here) are tiny bubble-like structures released by cells that contain molecules like proteins and genetic material. Their cargoes carry critical signals that can stimulate or suppress immune reactions, depending on the situation. Image provided by Dr. Robert Inman, Schroeder Arthritis Institute.

Researchers at the Schroeder Arthritis Institute have clarified the biological basis of ankylosing spondylitis, a debilitating form of arthritis that affects the spine.

Ankylosing spondylitis is a very challenging condition to manage, in part because the underlying disease processes are not well characterized and there is no definitive test for its diagnosis.

To improve patient care, efforts are underway to identify gene and protein changes that contribute to the condition and could serve as disease signatures, called biomarkers.

One type of biomarker that is generating interest among researchers is microRNAs (miRNAs)—short strings of RNA that can alter gene expression.

According to Dr. Robert Inman, Co-Director and Senior Scientist at the Schroeder Arthritis Institute, altered expression of certain miRNAs and proteins can play a key role in ankylosing spondylitis by triggering immune dysfunction, but it is unclear how this occurs.

"Clarifying the genetic and immunologic features of the condition is a critical step towards developing reliable diagnostic tests and targeted therapies," he says.

Dr. Inman and his team analyzed miRNAs and proteins that are present in exosomes—tiny molecule-containing vesicles that cells produce and release to communicate with other cells.

The team studied exosomes because their role in intercellular communication implicates them in dysregulation of the immune system.

"Exosomes' cargo carries critical signals that either stimulate or suppress immune reactions, depending on the situation. They are like cellular carrier pigeons, helping cells coordinate immune defences."

- Dr. Robert Inman

(L-R) Dr. Fataneh Tavasolian, Postdoctoral Researcher in Dr. Inman's lab; Dr. Robert Inman, Co-Director and Senior Scientist, Schroeder Arthritis Institute

"By analyzing exosomes and their molecular contents, we can begin to unravel the molecular processes that underlie symptoms of ankylosing spondylitis," explains Dr. Fataneh Tavasolian, a Postdoctoral Researcher in Dr. Inman's lab.

The team isolated exosomes from the plasma of 40 men and women with and without the condition and analyzed their miRNAs, proteins and effects on immune cells.

Exosomes from people with ankylosing spondylitis had elevated levels of two surface proteins that are linked to inflammation. When exposed to a type of immune cell called T cells, these exosomes triggered the release of other proteins that promote inflammatory processes. The exosomes also decreased the activity of regulatory T cells—a specialized subpopulation of T cells that suppress runaway immune responses.

These findings suggest that exosomes in people with ankylosing spondylitis have unique protein profiles, which could contribute to chronic immune activation.

The team also identified 24 miRNAs that were differentially expressed in people with and without the condition—22 of which were consistently elevated in those with the condition.

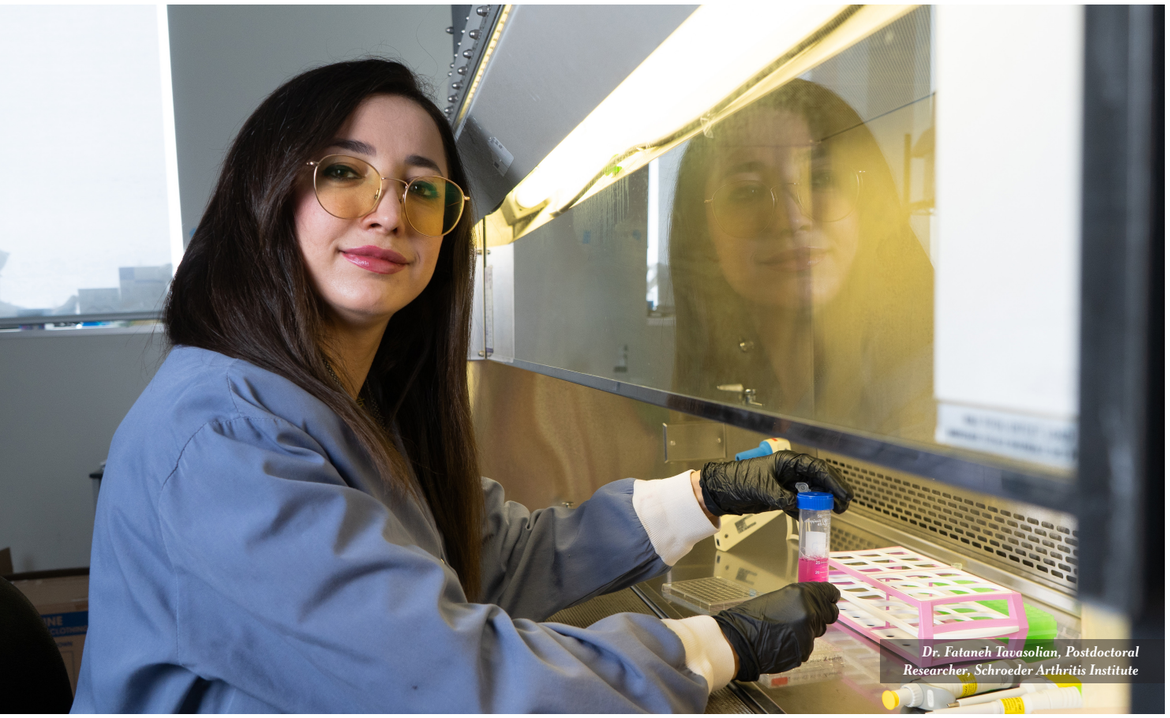
Pinpointing miRNAs that differ between people with and without the condition could ultimately help researchers resolve the genetic basis of the disease and restore a patient's immune balance.

"Our insights could help us identify reliable biomarkers that support earlier disease detection and intervention."

- Dr. Fataneh Tavasolian

This work was supported by the Spondyloarthritis Research Consortium of Canada, the Schroeder Arthritis Institute, the Krembil Foundation, Arthritis Society Canada and UHN Foundation. Dr. Inman is a Professor in the Departments of Medicine and Immunology at the University of Toronto.

Tavasolian F et al. Ann Rheum Dis. 2023. doi: 10.1136/ard-2022-223791.



Dr. Fataneh Tavasolian, Postdoctoral Researcher, Schroeder Arthritis Institute

BLUEPRINTING FLARES

Researchers identify immune profiles associated with disease activity in lupus.

Schroeder Arthritis Institute researchers have deciphered the immunological signature of flares in people with systemic lupus erythematosus (SLE), paving the way for improved treatments.

SLE is a chronic autoimmune disease that affects many body systems. SLE can be a complex puzzle for clinicians because most patients have intermittent flares in disease activity interspersed with symptom-free periods.

Managing SLE can be quite challenging due to the unpredictable nature of the condition. Pre-empting flares is important for preventing tissue damage, but we have a limited arsenal of tools to predict whether a given patient will experience a flare and when this will occur.

A major goal for researchers is to identify the immune processes that drive changes in SLE to allow clinicians to closely monitor high-risk patients and offer pre-emptive treatments.

To accomplish this, Schoeder Arthritis Institute Senior Scientist Dr. Joan Wither and her team examined the immune cells present in blood samples from men and women with or without SLE. The team grouped people with similar immunological profiles and tracked their immune changes at 6- and 12-month follow-up visits.

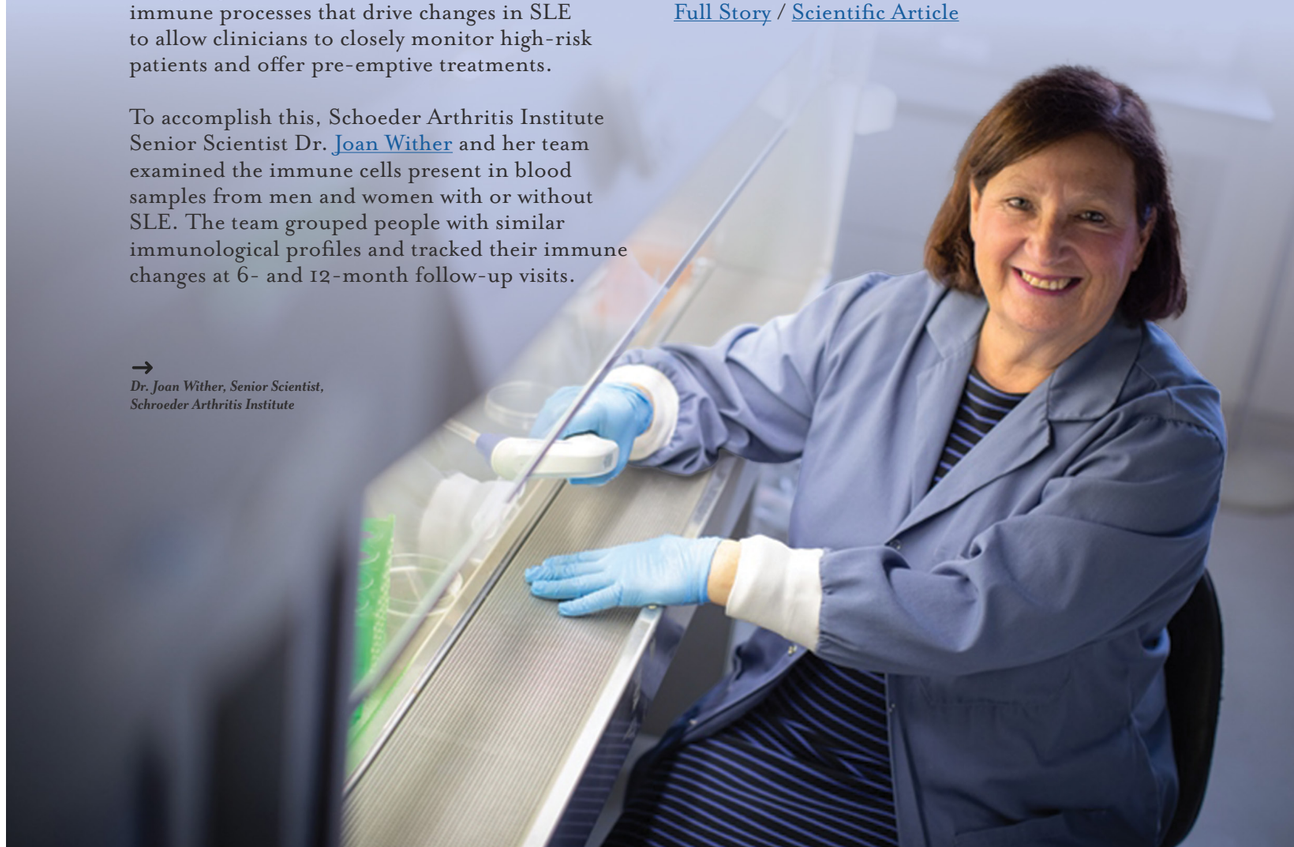
The team studied 47 distinct cell populations in samples from patients who were and were not experiencing flares, as well as healthy controls.

The study revealed a spectrum of immunologic profiles linked to SLE activity. Based on their profiles, participants fit into five clusters, each characterized by unique disease features.

The study also showed that levels of particular immune cells, such as age-associated B cells and T peripheral helper cells, predicted SLE activity one year later.

These findings underscore the role of altered immune responses in driving SLE flares and suggest that certain immune cells could serve as biomarkers for ongoing or recurrent flares.

Full Story / Scientific Article



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Dr. Joan Wither, Senior Scientist, Schroeder Arthritis Institute

Donald K. Johnson Eye Institute

EVERYTHING IN ITS PLACE

Study uncovers processes that govern the arrangement of light-sensitive cells in the retina.

Fluorescent microscopy image of the retina with rod photoreceptors shown in green and cone photoreceptors shown in red. Image provided by Dr. Valerie Wallace, Donald K. Johnson Eye Institute.

All brain functions, from thinking to controlling movement, hinge on precise communication between neurons. To communicate properly, these cells must move to particular positions and connect with nearby cells to form specialized circuits.

Fundamental questions in neuroscience are how neurons find their place and form neural circuits, and how this process goes awry.

To answer these questions, researchers led by Dr. Valerie Wallace, Donald K. Johnson Eye Institute (DKJEI) Co-Director and Senior Scientist, explored the mechanisms underlying circuit formation in the retina, the neural tissue that lines the back of the eye.

"The human brain has billions of neurons, so it is extremely challenging to study how circuits form and change," explains Dr. Wallace.

"The retina is an extension of the brain that has a much simpler structure, where different cell types reside in distinct layers. This arrangement makes it easy to pinpoint when cells are out of place."

To clarify the factors that govern circuit formation, Dr. Wallace's team studied how light-sensitive cells called photoreceptors migrate and connect with other cells during development. The team was particularly interested in rod photoreceptors—a type of neuron that responds to dim light.

The researchers tracked the location and behaviour of rods in response to changes in the activity of genes that contribute to cell development and migration.

According to Dr. Akshay Gurdita, a former postdoctoral researcher in Dr. Wallace's lab and the lead author of the study, the team first likened the photoreceptor layer to a cobblestone street—where stones can be added from any direction—but their findings indicated otherwise.

"We learned that this layer is more like a brick wall, with younger cells added on top of older ones."

- Dr. Akshay Gurdita

The team also learned that multiple factors guide cell movement. Initially, younger cells push older cells downwards as they jostle for space. Then,

→ *(L-R) Valerie Wallace, Co-Director and Senior Scientist, Donald K. Johnson Eye Institute; Dr. Akshay Gurdita, former Postdoctoral Researcher in Dr. Wallace's lab*

cells move to their final positions as they mature and connect with one another.

If either of these processes is disrupted, photoreceptors fail to position properly.

"Our findings highlight the importance of two factors for determining rod positioning, namely the process of cell maturation and wiring with other cells and cell proliferation and resulting space constraints," explains Dr. Gurdita.

In addition to deepening our understanding of retinal development, these findings have implications for developing cell-based therapies to treat neuron loss resulting from various forms of retinal degeneration.

"Our findings are very exciting because they point us to processes that we can target to coax donor cells to form functional connections with host cells," says Dr. Wallace. If researchers transplant more mature donor cells that readily form connections or if they modify the environment of the host retina, they might be able to improve cell integration.

"Eventually, we might be able to assess donor cell maturity and connectivity to predict the success of cell transplantation before vision changes occur."

- Dr. Valerie Wallace

This work was supported by the Canada First Research Excellent fund–Medicine by Design University of Toronto, the Natural Sciences and Engineering Research Council, the Government of Ontario, the UofT–UHN Vision Science Research Program, the Ontario Institute for Regenerative Medicine, Fighting Blindness Canada, the Krembil Research Institute, the Krembil Foundation and UHN Foundation. Dr. Wallace is a Professor in the Department of Ophthalmology and Vision Sciences and holds a Tier I Canada Research Chair in Retina Regeneration.

Gurdita A et al. Proc Natl Acad Sci U S A. 2023. doi: 10.1073/pnas.2308204120.

Dr. Akshay Gurdita, former Postdoctoral Researcher, Donald K. Johnson Eye Institute

REHABILITATION FOR VISION LOSS

Virtual reality-based therapy effectively treats a form of vision loss.

Donald K. Johnson Eye Institute (DKJEI) researchers have shown, for the first time, that biofeedback therapy can improve vision in people with homonymous hemianopsia.

Homonymous hemianopsia—or hemianopsia—is a form of vision loss in which a person sees only one side of the visual field from each eye. The condition typically results from a brain injury or tumour that affects the nerves connecting the eyes to the brain's visual processing centres.

Unfortunately, there are no standardized vision rehabilitation protocols for this condition.

Biofeedback training is a rehabilitation technique that improves vision by enhancing eye control and shifting the focus of the visual field.

Although this therapy is gaining popularity for vision rehabilitation, it has never been used to treat hemianopsia. To test the impact of biofeedback training on hemianopsia, Drs. Michael Reber and Monica Daibert-Nido engaged 12 participants with the condition.

For five weeks, the participants completed biofeedback training that involved completing computer-assisted tasks based on auditory or visual cues.

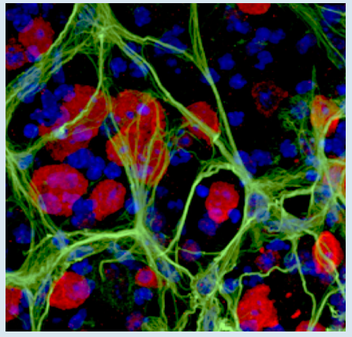
During training sessions, participants focused on a small circle on a screen while listening to an intermittent beep and had to move their eyes towards a target, guided by changes in the frequency of the beeps.

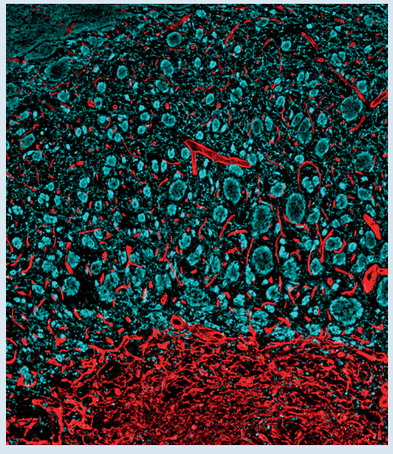
After training, participants had better visual functions, such as increased ability to detect contrast and focus on targets.

These findings suggest that biofeedback training is an effective treatment for hemianopsia, which can significantly improve patients' quality of life.

Full Story / Scientific Article

→ *(L-R) Dr. Monica Daibert-Nido, Clinician Investigator, and Dr. Michael Reber, Senior Scientist, Donald K. Johnson Eye Institute*






Dr. Tina Felfeli, Research Trainee and Resident Physician, Donald K. Johnson Eye Institute


Dr. Nardin Samuel, Postdoctoral Researcher and Resident Physician, Krembil Brain Institute


Dr. Nikita Looby, Scientific Associate, Metabolomics Core Facility, Schroeder Arthritis Institute


Dr. Chika Stacy Oriuwa, physician, spoken word poet and advocate

Inspiring Women in STEM

More than 4,500 people, including over 2,800 students from more than 100 classrooms, attended the Krembil Research Institute's 2024 virtual event to celebrate the International Day of Women and Girls in Science!

The event was viewed live by middle and high school students from 14 Ontario school boards, including the Toronto District School Board and Durham District School Board.

Moderated by Dr. Chika Stacy Oriuwa, one of Time magazine's 2021 Next Generational Leaders and an accomplished physician, spoken word poet and advocate, the event featured three women scientists and health care providers working in the areas of brain, vision and arthritis:

- Dr. Tina Felfeli described the importance of mentors and the people who supported her journey to becoming an ophthalmologist and researcher
- Dr. Nardin Samuel advised listeners to share their passions with others and explained her role as a budding neurologist, scientist and entrepreneur
- Dr. Nikita Looby explained how her love of nature and problem-solving led her to become a scientist in the field of metabolomics.

Each speaker gave a short TED-style talk about their careers and inspirations, and answered questions submitted by attendees.

The livestream also featured appearances from Canadian inventor Andini Makosinski and Canadian aerospace engineer Natalie Panek, who shared inspiring messages about the importance of dreaming big and refusing to set limits for yourself.

Sharing her advice for young science enthusiasts, Makosinski said, "Be bold in your passions and pursue them fearlessly."

"We hope that hearing from some of the incredible women on our team inspires young people of all genders and backgrounds to break barriers and apply their unique perspectives to answering pressing scientific questions," said Krembil Director Dr. Jaideep Bains.

Epilepsy Awareness

On March 26, 2024, the Krembil Brain Institute's Epilepsy team hosted an interactive event at Toronto Western Hospital to celebrate Purple Day, an international day to increase awareness about epilepsy, fight stigma and dispel misconceptions about the disorder.

The event showcased the comprehensive epilepsy research and clinical programs at UHN and the community partners who help advance our work.

Attendees had the opportunity to interact with scientists, trainees, physicians and nurses, explore ongoing epilepsy research, and learn how clinicians monitor and study seizures.

The event also featured a free concert by artists involved in the Lullaby Project, a musical initiative that enables new and expecting parents and caregivers to work with musicians to write personal lullabies for their babies.

The Lullaby Project recently worked with Krembil Brain Institute neurologist Dr. Esther Bui to adapt their unique program for pregnant women with epilepsy.

The event was a wonderful way to showcase how the Krembil Brain Institute is striving to provide the best care for people living with epilepsy.

Krembil Brain Institute trainees and staff celebrating Purple Day at Toronto Western Hospital

Krembil Research Day

The 2024 Krembil Research Day hosted 230 trainee researchers, faculty and staff who showcased the breadth of talent within our Institute and our collective dedication to advancing scientific knowledge.

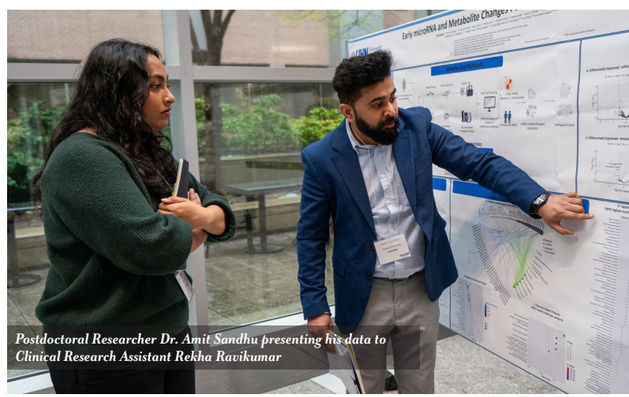
The event kicked off with opening remarks from Krembil Director Dr. Jaideep Bains, who praised trainees for their diverse talents and outstanding contributions to the Institute.

The event featured nine oral and 74 poster presentations that highlighted research achievements relating to the brain and spine, vision, and bone and joints.

This year's Research Day also featured a special "Lunch and Learn" event, where communications expert Bri McWhorter, Founder and CEO of Activate to Captivate, shared valuable insights into science communication and storytelling.

The event concluded with a keynote address from Dr. Anne-Marie Malfait, Professor of Internal Medicine and The George W. Stuppy, MD, Chair of Arthritis at Rush University.

"This event was an inspiring celebration of the talent at Krembil and the collaborative spirit that fuels our success," said Dr. Bains.


Postdoctoral Researcher Dr. Amit Sandhu presenting his data to Clinical Research Assistant Rekha Ravikumar

Advancing Arthritis Research and Education

Specialized training programs are nurturing the next generation of scientists, clinicians and industry leaders.

The Schroeder Arthritis Institute (SAI) is dedicated to propelling advancements in musculoskeletal disease research, education and patient care. At the heart of this mission lies a commitment to nurturing future scientists and health care professionals. Among SAI's key initiatives are two specialized training programs: the *Spondylitis Fellowship Program* and the *Internship Program for Schroeder Arthritis Institute Staff and Trainees*.

Through initiatives like these, SAI continues to foster a culture of collaboration, innovation and continuous learning. By offering advanced training in research and clinical practice and expanding career pathways, these programs are attracting top talent, fostering interdisciplinary collaboration and helping to shape the future of arthritis care.

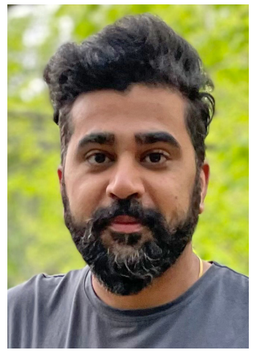
As they continue to empower emerging talent, these programs stand at the forefront of the fight against musculoskeletal diseases.

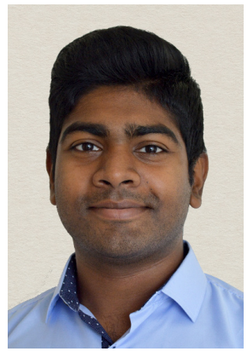
Spondylitis Fellowship and Preceptorship Programs

Led by SAI Co-Director and Senior Scientist Dr. Robert Inman and Rheumatology Chief and Senior Scientist Dr. Nigil Haroon, the Spondylitis Fellowship Program embodies the Institute's dedication to advancing spondylitis research and patient care while fostering interdisciplinary collaborations.

This fellowship program is a key element of the Institute's broader Spondylitis Program, which Dr. Inman launched nearly 20 years ago to bring

Drs. Nigil Haroon and Robert Inman with Brazilian Rheumatologists participating in the Spondylitis Program's comprehensive Continuing Medical Education offering



(L-R) Participants in the 2023-2024 Internship Program for Schroeder Arthritis Institute Staff and Trainees, Postdoctoral Researchers Drs. Amit Sandhu and Behdad Ravarian, Scientific Associate Dr. Darshini Ganatra and Project Coordinator Selvin Leenus.

together scientists, clinicians and allied health professionals to improve spondylitis research and patient care. This program has a major positive impact on clinicians in Canada by providing unique Continuing Medical Education (CME) opportunities. It also offers preceptorships that provide valuable learning opportunities for physicians from abroad. For instance, in April 2024, the program hosted a cohort of Rheumatologists from Brazil for a comprehensive CME event focused on ankylosing spondylitis. These training opportunities are valuable platforms for sharing information to advance academic health science.

The Spondylitis Fellowship Program gives Rheumatology fellows specialized training in spondylitis with a focus on clinical research. The program has welcomed more than 35 fellows from 16 countries, including Chile, Libya, Japan, Korea and Australia. Not only is this program nurturing the development of future health care and research leaders, but it is empowering them to elevate the standards of research and patient care in their home countries.

Internship Program for Schroeder Arthritis Institute Staff and Trainees

Run by Dr. Katerina Oikonomopoulou, SAI Research Education Lead, the Internship Program for Schroeder Arthritis Institute Staff and Trainees gives SAI members opportunities to explore diverse career paths beyond traditional research and academic settings.

The program provides short-term internships tailored to individuals' interests and goals. Participants have the flexibility to engage in in-person, virtual or hybrid internships to collaborate with biotechnology firms, therapeutic discovery and development companies, scientific journals and funding agencies.

Interns from various departments and with diverse backgrounds and experiences are brought together under unified mentoring teams. Through hands-on experiences, interns gain meaningful insights into science communication and academic writing, peer-reviewing, patenting, commercialization and other research-related fields outside of academia.

In the first term of this year's program, Dr. Darshini Ganatra, a Scientific Associate in SAI's Psoriatic Arthritis Research Program, visited the Danish biotechnology company Nordic Bioscience. There, she learned about the process of translating biomarkers from discovery to commercialization, as well as some of the cutting-edge automated platforms that are used for high-throughput assays in the industry sector.

During the second term, three interns—Postdoctoral Researchers Drs. Amit Sandhu and Behdad Ravarian and Project Coordinator Selvin Leenus—have been working alongside the Editor-in-Chief of the scientific journal *Critical Reviews in Clinical Laboratory Sciences*, gaining a deep understanding of science communication and academic publishing.

Neuronto Research Symposium

Joint research event marks a milestone in uniting leading neuroscientists at UHN and SickKids.

If you want to go fast, go alone; if you want to go far, go together.

This basic truth applies to so many aspects of life, and advancing science, medicine and education is no exception.

To foster collaborations and drive scientific advancements, researchers from UHN's Krembil Brain Institute, Donald K. Johnson Eye Institute, and The Hospital for Sick Children's (SickKids) Neurosciences & Mental Health (NMH) program came together to participate in the inaugural Neuronto Research Symposium.

The unique event, held at the MaRS Centre on June 4, 2024, welcomed more than 150 research trainees, faculty, and staff who showcased the depth and breadth of neuroscience research being conducted at UHN and SickKids.

The symposium kicked off with opening remarks from Co-Organizers Drs. Jaideep Bains, Co-Director and Senior Scientist at Krembil Brain Institute, and Donald Mabbott, NMH Program Head and Senior Scientist at SickKids.

"Toronto is a global hub for basic, translational, and clinical neuroscience, and there are so many opportunities for synergy between our institutions."

- Dr. Jaideep Bains

Throughout the event, 12 researchers gave talks focused on four research themes: molecular therapeutics; brain cells, circuits, and networks; cell profiling and personalized medicine; and brain imaging and neurocomputation. Talks covered a variety of topics, including:

- The use of neuromodulation for autism, attention-deficit/hyperactivity disorder and other neuropsychiatric conditions
- Innovative approaches to diagnosing and treating glioblastoma
- Strategies to enhance neuroregeneration following spinal cord injury
- The role of glial cells and white matter plasticity in information storage, and
- The transformative potential of organoids and assembloids in neuroscience research

The event also featured 31 poster presentations from trainees and research staff that fostered in-depth intellectual discussions and idea sharing.

"The symposium was a perfect platform for researchers at all career stages to come together, share insights, and lay the groundwork for lasting scientific partnerships," says Dr. Mabbott.

The highlight of the event was the announcement of a new scholarship designed to provide support for trainees engaged in cross-institution research, called the Krembil/SickKids NMH Collaborative Studentship Award. Funded by the Krembil Foundation, this award will be available to two PhD students—one working primarily at UHN and one at SickKids—who are co-supervised by principal investigators at both institutions.

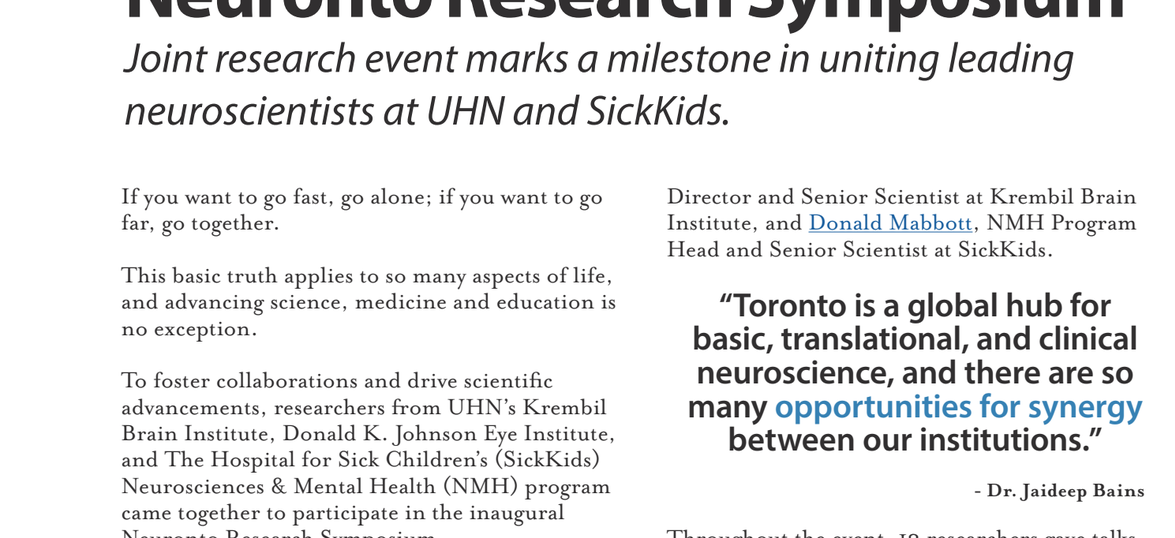
"This new scholarship is a great opportunity for us to pool our expertise and better leverage our collective resources," says Dr. Bains.

"Many of our researchers are already engaged in collaborative projects; this scholarship will provide a structured framework to nurture these existing relationships and spur new ones."

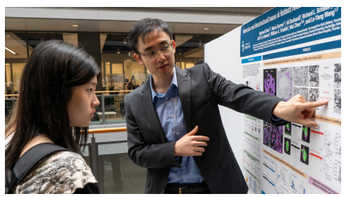
The symposium concluded with a lively wine and cheese networking event at the Peter Gilgan Centre for Research and Learning, where attendees continued scientific discussions and explored ideas for future collaborations.

We look forward to growing the Neuronto program and inviting more institutions to join us in our mission to transform neuroscience research, education and patient care.

The Krembil community thanks the many individuals who made this event possible, including the Krembil Research Administration and Communications teams, and SickKids Research Institute staff members Julie Ruston, Theresa Dudley, Delina Romano and Francesca Pak. We also extend our sincere gratitude to the oral presentation session moderators—Drs. Homeira Moradi, Flavia Gouveia, Alan Diaz and Emily Mills—and to the Krembil Foundation for their generous funding of the new graduate student scholarship.



Krembil Research Institute staff and trainees at the 2024 Neuronto Symposium



Boost for Vision Research

Vision researchers receive $2.5 million in funding from the Canada Foundation for Innovation.

Vision loss is a growing concern worldwide, impacting millions of people and significantly straining health care systems. Every 12 minutes, a Canadian receives a diagnosis of visual impairment or disease, and this number is projected to double over the next two decades.

This alarming trend underscores the urgent need for innovative research and effective treatments.

Inherited and acquired retinal diseases are among the major causes of progressive and irreversible vision loss. Current treatments are limited due to significant gaps in our understanding of underlying disease mechanisms.

To combat this growing health issue, a research team led by Donald K. Johnson Eye Institute (DKJEI) Senior Scientists Drs. Valerie Wallace and Philippe Monnier has received over $2.5 million from the Canada Foundation for Innovation to develop novel platforms for studying inherited and acquired degenerative retinal diseases and developing therapeutics.

To better understand and treat these diseases, the multidisciplinary research team, which includes DKJEI researchers Drs. Brian Ballios, Michael Reber, Karun Singh and Jeremy Sivak, as well as investigators from The Hospital for Sick Children (SickKids) and the University of Toronto (UofT), brings together expertise in retinal biology, stem cell biology, regenerative medicine, and biomedical engineering.

The team's diverse expertise spans from proving the mechanisms underlying retinal development and the genetic underpinnings of retinal diseases to leveraging cutting-edge biomaterials and developing novel drug and cell-based therapies.

"Toronto has a tight-knit and powerful vision research community. This grant will help us integrate basic, translational and clinical research to drive innovation for patients."

- Dr. Philippe Monnier

By delving into the cellular and molecular processes involved in retinal development and disease, the researchers will shed light on fundamental disease mechanisms and identify potential targets for new therapies.
The team will leverage the funding to acquire cutting-edge research infrastructure, including equipment for retina imaging, stem cell experiments, eye surgeries and vision assessments, to model retinal diseases and test potential therapeutics.

→ *The team will use the funding to obtain advanced microscopy systems, such as this AX R confocal microscope, and other instruments.*

The funding will also support collaborations with other researchers in Canada and abroad, as well as partnerships with biotechnology companies to accelerate therapeutic development and testing.

"There was already a lot of support for our work at UHN, particularly philanthropic support from Mr. Donald K. Johnson and other generous donors, but this grant will help us grow our programs and attract world-class scientists to advance our mission," says Dr. Monnier.

According to the team, vision loss was seen as an intractable problem not that long ago, but today—with a deeper understanding of retinal development and disease—the future is bright.

"We envision a world where we don't merely manage retinal diseases but comprehensively understand and treat them. We aim to redefine the landscape of eye care."

- Dr. Valerie Wallace

This funding is part of more than $515 million that the Canada Foundation for Innovation is investing to support 100 research projects across the country.

→ *(L-R) Drs. Philippe Monnier and Valerie Wallace, co-leads of the research team*

Dr. Brian Ballios, Scientist, Donald K. Johnson Eye Institute

Dr. Elise Heon, Staff Director of the Ocular Genetics Program, SickKids

Dr. Julie Lefebvre, Senior Scientist, SickKids

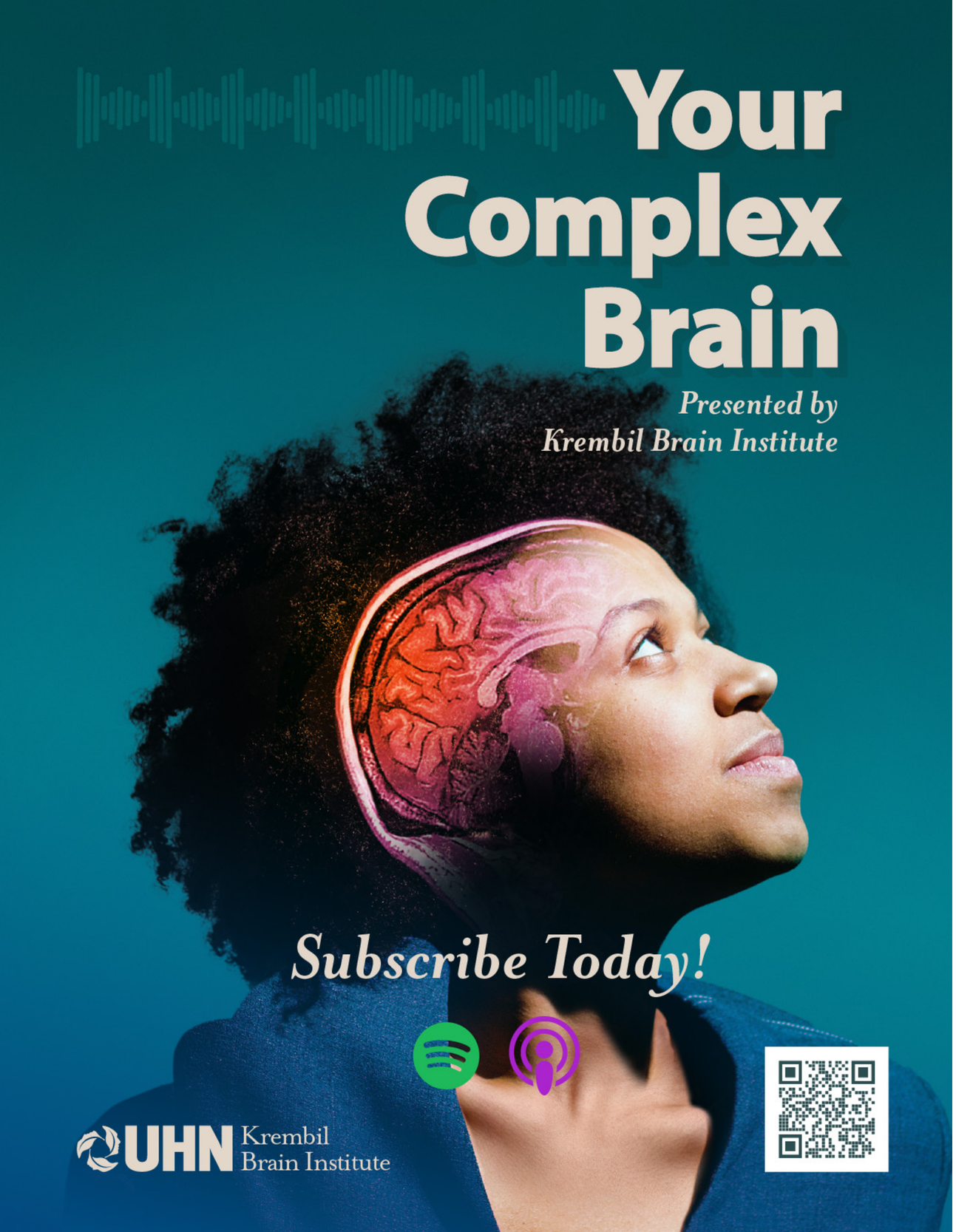
Dr. Michael Reber, Senior Scientist, Donald K. Johnson Eye Institute

Dr. Molly Shoichet, University Professor, Institute of Biomedical Engineering, UofT

Dr. Karun Singh, Senior Scientist, Donald K. Johnson Eye Institute

Dr. Jeremy Sivak, Senior Scientist, Donald K. Johnson Eye Institute

Dr. Vincent Ajoy, Staff Ophthalmologist, SickKids






Season 3 of Your Complex Brain features interviews with (L–R) Dr. Ryan Thomas, Family Physician and Clinical Associate at UHN's Elisabeth Raab Neurofibromatosis Clinic; Maria Martinez, Social Worker at UHN's Memory Clinic; Matthew Cote, Teacher and Reading Disabilities Advocate; and Dr. Hayley Hamilton, Senior Scientist at the Centre for Addiction and Mental Health.

On March 19, 2024, the Krembil Brain Institute proudly launched Season 3 of its acclaimed podcast, *Your Complex Brain*. This educational podcast delves into the mysteries, myths and science related to the brain and brain diseases, such as Alzheimer's disease, Parkinson's disease, epilepsy and chronic pain.

With one-on-one interviews, in-depth scientific discussions and powerful personal stories of brain disease, injury and recovery, the podcast takes listeners on a guided journey into the fascinating world of brain science and the unique perspectives and experiences of researchers, clinicians, patients and their loved ones.

Your Complex Brain also showcases some of the Krembil Brain Institute's rising talents in research and health care and its collaborations with leading scientists, advocacy organizations and other leading research institutions, such as the University of Toronto, The Hospital for Sick Children, the Centre for Addiction and Mental Health, and the University of Waterloo.

Whether you have faced the challenges of a brain disease or injury firsthand or you are simply curious about the innovative brain research and patient care that is underway at UHN, this podcast is for you.

Prepare to be captivated by the world of cutting-edge neuroscience and inspiring testimonials that will stay with you long after the episode ends.

Episodes in this season cover a wide range of topics, including:

- strategies to prevent Alzheimer's disease
- exercise to manage Parkinson's disease
- advancements in spinal cord injury research
- the impact of loneliness on the brain
- stroke prevention and recovery

This season also takes listeners to the frontline of artificial intelligence-powered brain research, dives into the link between genetics and reading disabilities, and explores why getting a good night's sleep is crucial for brain health.

"There are countless amazing things about the brain, and we are so excited to explore them with our listeners."

- Heather Sherman, podcast host

Your Complex Brain is available on all major podcast platforms, including Apple Podcasts and Spotify.

Your Complex Brain has garnered over 43,000 downloads and won the 2023 People's Choice Award for Best Science & Medicine Podcast. The podcast is hosted by Krembil's Manager of Communications, Heather Sherman, and produced by Jessica Schmidt, Dr. Amy Ma, Kim Perry, Sara Yuan, Alley Wilson, Meagan Anderi, Liz Chapman and Lorna Gilfedder. For more information, visit www.uhn.ca/Krembil/Complex-Brain-Podcast.

Krembil by the Numbers

209
Principal Investigators

305
Staff Members

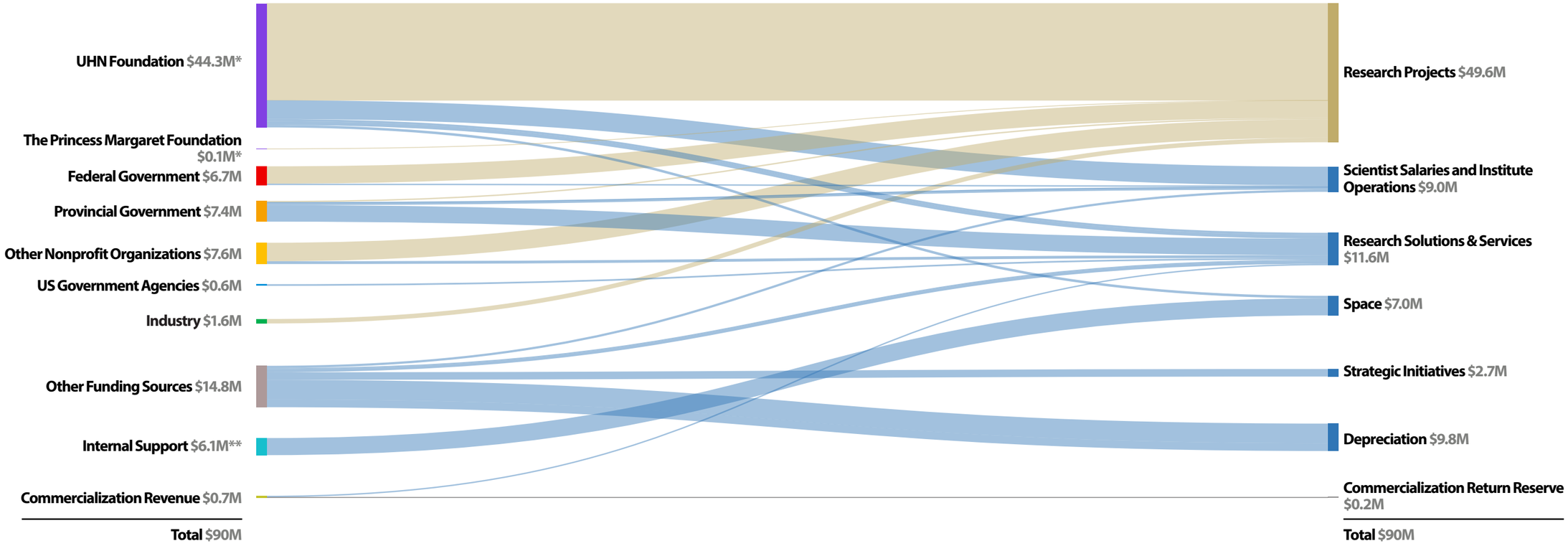
346
Trainees

138.5k
sq. ft. of Research Space

1,023
Publications

$90M
Funding

Research Funding



**These values are based on expenses incurred at UHN and categorized according to research-specific spending.*

***These funds do not originate from the Ontario Ministry of Health or the Ontario Ministry of Long-Term Care.*

The financials graph shows how research funding was used towards the Krembil Research Institute's research mission for the fiscal year ending on March 31, 2024. Values are rounded to the nearest $100,000. For UHN's audited financial statements, please visit www.UHN.ca.

Awards and Distinctions

Vincent Chan
2023 Emeritus Membership Award, Canadian Anesthesiologists' Society

Frances Chung
Inventor of the Year, University Health Network

Karen Davis
Tier 1 Canada Research Chair in Acute and Chronic Pain Research

Kenneth Fung
Distinguished Fellow, American Psychiatric Association

Nigil Haroon
Asianet News Health Care Excellence Award—Best Doctor, Asianet News and Ontario Heroes

Mojgan Hodaie
Fellow, Canadian Academy of Health Sciences

Robert Inman
Research Career Achievement Award, Spondyloarthritis Research and Treatment Network

Igor Jurisica
Top 100 AI in Oncology Leaders, Deep Pharma Intelligence Ltd.

Mohit Kapoor
Robin Poole Investigator Award, Canadian Connective Tissue Society

Sidney Kennedy
Lifetime Achievement Award, International Society for Affective Disorders

Massieh Moayedi
Tier 2 Canada Research Chair in Pain Neuroimaging

Philip Peng
Recognition of Education in Pain Medicine Award, The European Society of Regional Anaesthesia & Pain Therapy

Jorge Sanchez-Guerrero
Master of the American College of Rheumatology, American College of Rheumatology

Frank Silver
Member of the Order of Ontario

Charles Tator
Bruce Prentice Family Legacy Award, The Ontario Sport Legends Hall of Fame Inc.

Michael Tymianski
Fellow, Canadian Academy of Health Sciences

Fluorescent microscopy image of the inner retina, with blood vessels labelled in white, astrocytes labelled in red and retinal ganglion cells labelled in green. Image provided by Dr. Jeremy Sivak, Donald K. Johnson Eye Institute.

(L–R) Drs. Frances Chung, Krmbil Clinician Investigator, and Frank Silver, Clinican Investigator, Krembil Brain Institute

Krembil Researchers

Senior Scientist
Jaideep Bains
Cathy Barr
Peter Carlen
Robert Chen
Karen Davis
James Eubanks
Michael Fehlings
Dafna Gladman
Nigil Haroon
Mojgan Hodaie
William Hutchison
Martin Ingelsson
Robert Inman
Igor Jurisica
Lorraine Kalia
Suneil Kalia
Mohit Kapoor
Armand Keating
Sidney Kennedy
Lakshmi Kotra
Gabor Kovacs
Anthony Lang
Andres Lozano
Nizar Mahomed
Rosemary Martino
Mary Pat McAndrews
David Mikulis
Philippe Monnier
Anthony Perruccio
Ivan Radovanovic
Michael Reber
Karun Singh
Jeremy Sivak
Frances Skinner
Antonio Strafella
Shuzo Sugita
Michael Tymianski
Kâmil Uludağ
Taufik Valiante
Valerie Wallace
Donald Weaver
Joan Wither

Scientist
Brian Ballios
Vinod Chandran
Melanie Cohn
Maurizio De Pittà
Christopher Kim
Milad Lankarany
Luka Milosevic
Olga Lucia Rojas
Zahi Touma
Sowmya Viswanathan

Affiliate Scientist
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Brenda Gallie
Walter Kucharczyk
Massieh Moayedi
Behdin Nowrouzi-Kia
Vitor Mendes Pereira
Naomi Visanji

Emerita/Emeritus Scientist
Elizabeth Badley
Vincent Chan
Charles Tator

Krembil Clinician Scientist
Michael Brent
Rajiv Gandhi
Aylin Reid

Krembil Clinician Investigator
Danielle Andrade
Heather Baltzer
Mark Bernstein
Anuj Bhatia
Yvonne Buys
Frances Chung
Hance Clarke
Robert Devenyi
Dean Elterman
Alfonso Fasano
Susan Fox
Kenneth Fung
Yasmine Hoydonckx
Timothy Leroux
Efrem Mandelcorn
Daniel Mandell
Roger McIntyre
Renato Munhoz
Laura Passalent
Yoga Raja Rampersaud
David Rootman
Cheryl Rosen
Mandeep Singh
Allan Slomovic
David Tang-Wai
M. Carmela Tartaglia
Christian Veillette
Jean Wong
Mateusz Zurowski

Clinician Scientist
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Tania Di Renna
Sindhu Johnson
Timo Krings
Laurie Connie Marras
David Mathew
Victoria McCredie
Kieran Murphy
Peter St George-Hyslop
Irene Telias
Bourke Tillmann

Clinician Investigator
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Paula Alcaide-Leon
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Philip Gerretsen
Laura Giron Arango
David Gold
Emma Hapke
Raed Hawa
Julien Hebert
Everardus (Eef) Hendriks
Timothy Jackson
Cheryl Jaigobin
Barbara Jemec
Hans Katzberg
Irfan Kherani
Kyle Kirkham
Stephen Kraft
Hatem Krema
Cindy Lam
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Sarah Levitt
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Edward Margolin
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Shaun Singer
Jeffrey Singh
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P. Maxwell Slepian
Elizabeth Slow
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Mohamed (Sabri) Soussi
Emily Swinkin
Khalid Syed
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Daphne Voineskos
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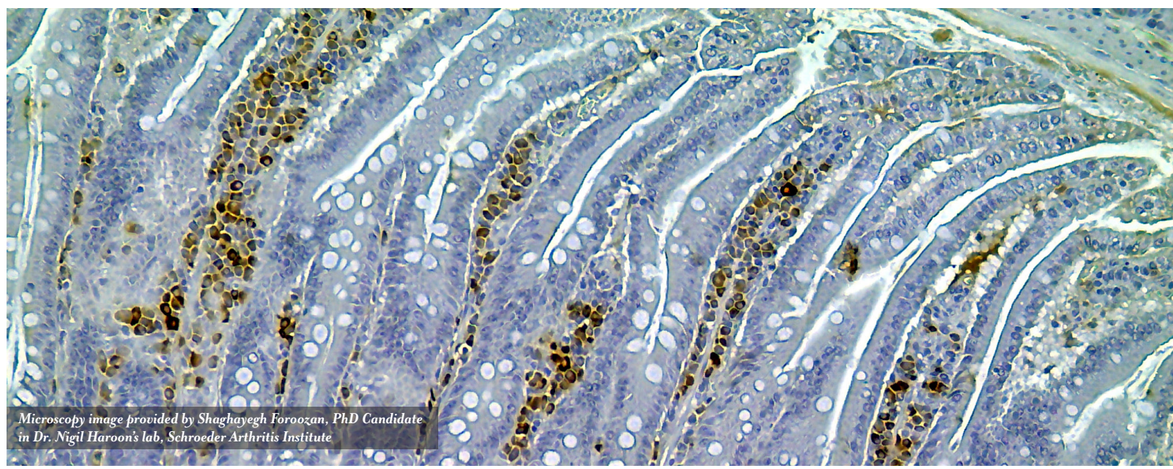
Grace Yoon
Michael Zywiel



Microscopy image provided by Shaghayegh Foroozan, PhD Candidate in Dr. Nigil Haroon's lab, Schroeder Arthritis Institute

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Arthritis Society Canada
Asia Pacific League of Associations for Rheumatology
Astellas Pharma
AstraZeneca
Atuka
Aurinia Pharmaceuticals
Autism Research Institute
Avicanna
Avir
Axoltis
Banting Research Foundation
Bayer
Biogen
BioNTech
Bluerock Therapeautics
Boston Medical Center
Boston Scientific
Brain Aneurysm Foundation of Canada
Brain Canada
Bright Focus Foundation
Bristol Myers Squibb
Canada Research Chairs
Canadian Blood Services
Canadian Initiative for Outcomes in Rheumatology cAre
Canadian Institutes of Health Research
Canadian Rheumatology Association
Canadian Stroke Consortium
Cannscience Innovations
CDLK5 Canada
Celgene
Celixir
Centre for Aging + Brain Health Innovation
Cerenovus
Cerevel
Cervical Spine Research Society
Christopher & Dana Reeve Foundation
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Cure Parkinson's
Dravet Syndrome Foundation
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Fresenius Kabi
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Genentech
Gilead Sciences
Glaucoma Research Society of Canada
GlaxoSmithKline
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Green Valley
Hamilton Health Sciences
Health Canada
Heart and Stroke Foundation of Canada
HebeCell
Immunex
INSIGHTEC
Insmed
International Spine Study Group Foundation
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Johnson & Johnson
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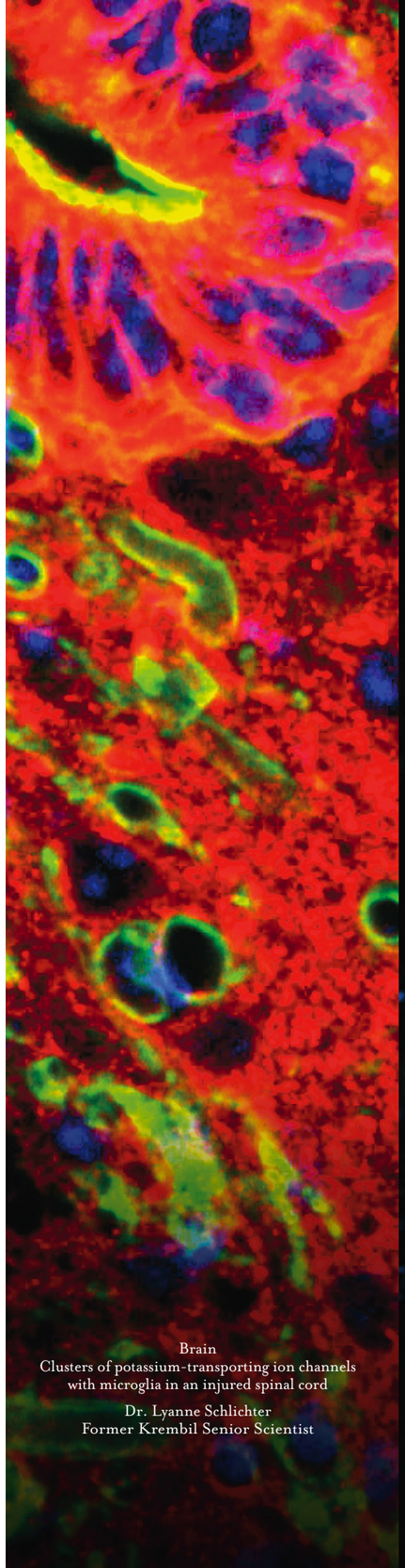
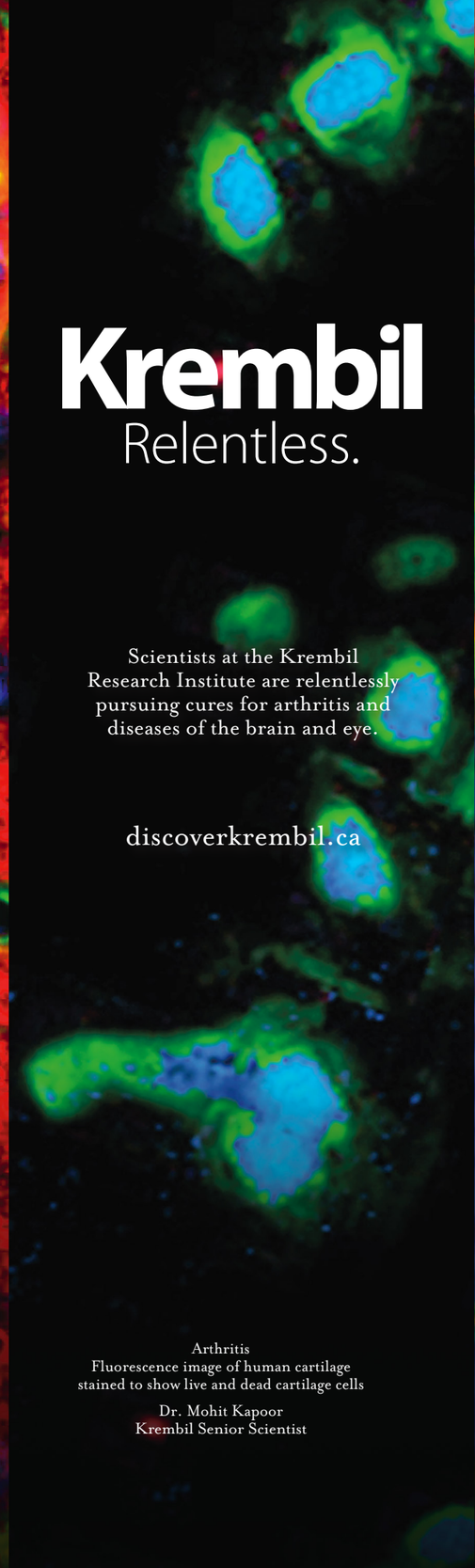
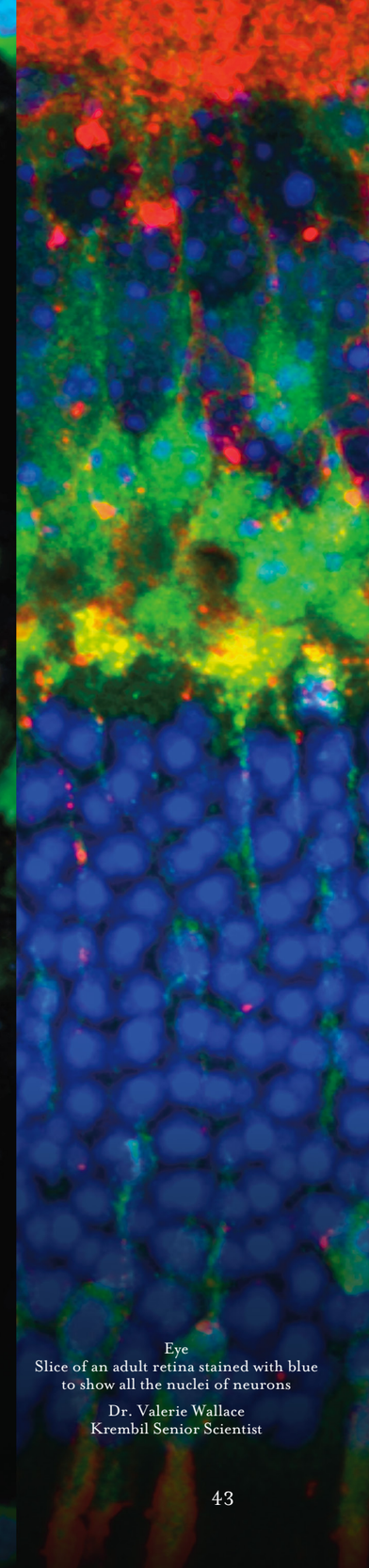


Brain
Clusters of potassium-transporting ion channels with microglia in an injured spinal cord
Dr. Lyanne Schlichter
Former Krembil Senior Scientist



Arthritis
Fluorescence image of human cartilage stained to show live and dead cartilage cells
Dr. Mohit Kapoor
Krembil Senior Scientist



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Slice of an adult retina stained with blue to show all the nuclei of neurons
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