



DJAVAD
MOWAFAGHIAN
CENTRE FOR
BRAIN HEALTH

ADVANCING BRAIN
HEALTH THROUGH
RESEARCH
AND CARE

YEAR IN REVIEW
2017/2018

ENABLING COLLABORATION, ENRICHING THE COMMUNITY

A REPORT ON THE **FOURTH YEAR** OF ACTIVITIES
AT THE DJAVAD MOWAFAGHIAN CENTRE FOR BRAIN HEALTH



working clinics

Canada
Research Chairs

donor-funded
research chairs

students

PhD

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active researchers

upcoming faculty hires

donor-funded professorships

MSc



A Message From

DR. BRIAN MACVICAR AND DR. JON STOESSL, CO-DIRECTORS OF THE DJAVAD MOWAFAGHIAN CENTRE FOR BRAIN HEALTH

If our first three years were about establishing ourselves and fueling growth, this fourth year at the Djavad Mowafaghian Centre for Brain Health has been about embracing our voice and opening up opportunities for dialogue. Whether our researchers are teaching the fundamentals of brain anatomy and injury pathology to sold-out crowds at the HR MacMillan Space Centre, or bringing the origins of modern neuroscience to the Morris and Helen Belkin Art Gallery, or spreading messages in support of funding basic science in Ottawa and at home in our labs, our voice has never been clearer or more recognizable.

The Djavad Mowafaghian Centre for Brain Health is a force, and it is changing the future of brain health and basic science in real time.

In 2017 we welcomed authors, artists, philosophers, politicians, and colleagues from research centres around the world to interact with us. Our students are reaching new and diverse audiences online and on stage via YouTube, blogs, and podcasting, and presenting their research in unconventional venues, such as art galleries and nightclubs. In a time when funding for research and the future of early career scientists in Canada has never been more uncertain, the urgency of getting the word out about the value of discovery research has driven the most creative among us to find new ways to dispel the mysteries of laboratory science and invite the world in for a peek.

We've grown, and we are only getting bigger.

In 2018 we will welcome four new faculty members into our community, filling our wet labs and research offices. With recent Canada Foundation for Innovation funding, we are well on our way to opening our new imaging facility, which will sport cutting edge technology—construction has already begun on the space within our walls and on infrastructure connecting us more closely to our partners at TRIUMF. Our biobank is bustling, with new staff hired this year to help support research projects connecting clinicians and basic scientists across disciplines.

We would not be who we are without our community, and we are grateful for the enduring support of our donors and funding agencies. Together, we are fueling innovations in brain health, treatment, and novel diagnostic and assistive technologies. As we begin our fifth year, we are proud of how much we've accomplished, and are looking forward to seeing our brain research community continue to grow.

Dr. Brian MacVicar



Dr. Jon Stoessl



BUILDING A HEALTHIER FUTURE—TOGETHER

The Djavad Mowafaghian Centre for Brain Health continues to prove that incredible things happen when we work together.

The centre's mandate—to bring together the best in research and care under one roof so we can build a healthier future for British Columbians of all ages—is being realized every day. We see it in the groundbreaking basic research the centre enables. We see it in the clinics, where children, families, and seniors come to receive top-of-the-line care. And we see it in the collaborations that bring together scientists and clinicians to advance the search for cures to devastating brain diseases.

This year, we celebrated 20 years of brain health research at UBC—but it is the last four years, with the establishment of the Djavad Mowafaghian Centre for Brain Health, that has truly made UBC the Canadian leader in brain health research and care.

"Life is sustained through relationships—the human connections that depend on the millions of routine and unique interactions taking place in every moment of a given day. The Djavad Mowafaghian Centre for Brain Health is a special place because it has created the conditions for the free-flow and interchange of people, knowledge, and ideas that have inspired some of our greatest discoveries about the brain. I am proud to count the centre among our community, which is enriched through a shared determination to better understand and support the relationships that give shape and meaning to our lives.

Dermot Kelleher | Dean, Faculty of Medicine | The University of British Columbia

"The Djavad Mowafaghian Centre for Brain Health is a great source of pride for UBC. It embodies the three pillars of Inspire, UBC's new strategic plan: collaboration, inclusion, and innovation. I greatly enjoyed seeing these core values in action firsthand when I toured the centre this year. Inside, patients throughout BC have improved access to treatment, students are better equipped to tackle the future of brain research, and cures to devastating diseases are closer to being discovered. The outcomes at the Djavad Mowafaghian Centre for Brain Health are remarkable—and UBC is deeply grateful for Dr. Mowafaghian's generosity in making it possible."

Santa J. Ono | President and Vice Chancellor





Facility Highlights

In 2017, we began some exciting building upgrades that will greatly improve patient care in the Djavad Mowafaghian Centre for Brain Health.

Most notably, the Faculty of Medicine has secured funding from multiple sources, including donors, industry, and government, to build the state-of-the-art brain imaging suite that will give scientists the tools they need to advance research and provide individuals with the best care possible. The funding also allows for the purchase of two critical instruments: the PET/MRI (funded by a \$4.3 million grant from the Canada Foundation for Innovation) and the 3T MRI. By revealing details about intricate processes of the brain, researchers expect this equipment to give them a better understanding of most, if not all, brain diseases.

The first phase of construction began in Fall 2017, and the suite is expected to be operational by early 2019.

BUILDING RECEIVES S-LAB AWARD

The Djavad Mowafaghian Centre for Brain Health was awarded the 2017 S-Lab Award for Translational Research Building. S-Lab, a non-profit that promotes best practice in laboratory design, operation, and management, cited the building's focus on promoting collaboration and innovation as part of the reason for its selection.

Groundbreaking Research

The Djavad Mowafaghian Centre for Brain Health continues to attract some of the world's best researchers. These scientists are leading the fight for cures and better treatments for the diseases that affect future generations most, including autism spectrum disorder, Alzheimer's disease, and stroke.

CENTRE ATTRACTS NEW FUNDING TO ACCELERATE RESEARCH

Dr. Cheryl Wellington was among three members of the Djavad Mowafaghian Centre for Brain Health to receive more than \$10 million in new funding through the Canada Foundation for Innovation this year.

The federal Minister of Justice and Attorney General of Canada Jody Wilson-Raybould visited the Djavad Mowafaghian Centre for Brain Health on October 13, 2017, to announce an investment of more than \$67.5 million for new research laboratories and equipment at UBC.

Dr. Wellington has received a total of \$11.4 million in new funding this year toward the development of a platform for investigating traumatic brain injury.

The Honourable Jody Wilson-Raybould (third from left) poses with Dr. Cheryl Wellington (third from right) and her lab during a visit in October.



This surge in infrastructure funding is enabling Dr. Wellington to purchase new equipment to study traumatic brain injury and more accurately predict recovery and long-term consequences.

DMCBH HOME TO THREE OF THE TOP-CITED RESEARCHERS IN CANADA

The Djavad Mowafaghian Centre for Brain Health has three researchers listed on the 2017 Thomson Reuters list of Highly Cited Researchers: Howard Feldman, Ian Mackenzie, and Lakshmi Yatham. They are part of the 10 UBC Faculty of Medicine members on the 2017 list—the most of any Canadian medical school. Inclusion on the list is a mark of a researcher having exceptional influence in their field.

“THE INNOVATION FUND IS ENABLING ME TO BRING NEW TECHNOLOGIES TO UBC TO HELP SEE HOW THE BRAIN CHANGES AFTER CONCUSSION. THIS IS A CRUCIAL STEP FOR ACCURATE DIAGNOSIS AND TO EVALUATE NEW TREATMENT OPTIONS.”

Dr. Cheryl Wellington



Dr. Helen Tremlett

HOWARD FELDMAN

Affiliate Professor of Neurology

Dr. Feldman is a prolific researcher known for his original research on frontotemporal dementia (FTD), Alzheimer's disease and other geriatric cognitive disorders. In 2016, he was named head of the Alzheimer's disease Cooperative Study at University of California, San Diego—extending his influence even further.

IAN MACKENZIE

Professor of Pathology and Laboratory Medicine & Head, Division of Neuropathology at Vancouver General Hospital

Dr. Mackenzie is one of Canada's foremost researchers on FTD and amyotrophic lateral sclerosis (ALS). His research has "pulled back the curtain" on the pathology of these diseases, which has led to better care for patients. In 2017, he was awarded UBC's Margoless National Brain Disorders Prize to recognize his outstanding contributions to the treatment of brain disorders.

LAKSHMI YATHAM

Professor of Psychiatry

Dr. Yatham is one of Canada's foremost researchers on bipolar disorder and depression. He co-led the original development of treatment guidelines for bipolar disorder

and its latest revision in 2005, and is still actively educating psychiatrists, family physicians, and the general public about the disorder. Dr. Yatham was recently voted president-elect of the World Federation of Societies of Biological Psychiatry.

RESEARCH PROMOTES THE SAFETY AND UNDERSTANDING OF THOSE WITH MS

More than 90,000 Canadians live with MS, a chronic disease affecting the brain and central nervous system. Canada has some of the highest known rates of MS in the world. In 2017, Dr. Helen Tremlett published multiple studies on her research aimed at understanding this debilitating condition and ensuring the safety of treatments for patients:

- Dr. Tremlett and her team studied Canadian health records over 20 years, discovering the likelihood of consistent symptoms that appear before the onset of MS. This discovery will help researchers as they search for the true cause of MS.
- Dr. Tremlett published one of the most extensive assessments of the risks of a common family of drugs prescribed to MS patients. The study found that there is a slightly higher risk of stroke with these drugs.

- She also collaborated on a study reviewing research into the role that the human microbiome plays in neurodegenerative disease risk and progression.
- Two papers explored the occurrence of other chronic conditions alongside MS, which can lead to delayed treatment or relapse. Understanding these issues can help clinicians more effectively treat MS patients.

To continue her outstanding work, Dr. Tremlett was recently awarded \$1.2 million from CIHR to study the long-term safety and effectiveness of commonly prescribed MS drugs.

AUTISM “GROUP OF 7” FOCUS IN ON UNDERLYING CAUSES

From bedside to bench, a team of researchers is bringing clinical data on autism spectrum disorders (ASD) back to the lab so that they can help patients and better understand what triggers symptoms of ASD.

“Scientists have identified hundreds of gene variants in patients with ASD, but it is still unclear which of these genetic variants actually contribute to the disorder,” says Dr. Shernaz Bamji. “Our team of seven labs [works] to rapidly determine which variants impact the function of each gene and how this may lead to disruptions in brain development and cognition.”

The investigators involved in this collaboration include Dr. Bamji, Dr. Doug Allan, Dr. Kurt Haas, Dr. Christopher Loewen, Dr. Tim O’Connor, Dr. Paul Pavlidis, and Dr. Catharine Rankin.

RE-WIRING THE BRAIN AFTER STROKE OR INJURY

For Dr. Tim Murphy, unravelling the brain’s wires and understanding how they connect offers potential for healing after stroke or brain injury. In the Murphy lab, researchers are observing how sensory and motor circuits compensate for damage.

“By understanding how the living brain ‘re-wires’ itself after injury, we’re hopeful that we can strengthen those connections and improve outcomes for people who have suffered stroke or other brain trauma,” says Dr. Murphy.



Dr. Tim Murphy. Image credit: Penelope Slack.



Dr. LP Bernier and Dr. Chris Groten. Image credit: Paul Joseph/UBC.

Serving Communities

The Djavad Mowafaghian Centre for Brain Health has always been about more than research: it's about bringing people together to support each other and grow in knowledge. Serving the community remains at the heart of what we do.

CLINIC UPDATES

The Djavad Mowafaghian Centre for Brain Health's six clinics continued serving patients across the Lower Mainland and beyond, providing care and hope to those experiencing some of the body's most challenging diseases. The centre uniquely combines clinical care, education, and research to serve thousands of patients and their families each year.

YOUTH LIVING WELL WITH BIPOLAR DISORDER

Once Amir was diagnosed with bipolar disorder, he was eager to understand this brain disorder that causes unusual shifts in mood, energy and activity levels. He didn't need to look any further than Vancouver to find

Dr. Erin Michalak, network leader of CREST.BD, a team that studies psychosocial issues in bipolar disorder with youth ages 15 to 22.

Dr. Michalak, a Djavad Mowafaghian Centre for Brain Health researcher, quickly recognized Amir's talents and involved him in making a video about how people with bipolar disorder manage school. Before long, he was interviewing scientists at the largest annual bipolar conference and posting what he learned from them on social media.

"The best part for me was being around other people who have bipolar disorder and are doing well," says Amir, who studies cognitive systems in the UBC Faculty of Science. "It sounds simple, but when you're first diagnosed and learn about it, it's not positive. But all of the people I've met at CREST have given me hope and shown me not to limit myself in what I can do."

Dr. Michalak's goal is to help people with bipolar disorder improve their own health and wellness, and she makes it happen by engaging them in research and knowledge exchange.

"One of the secrets to success is adapting the way we work together according to where each person is at and where they're going," says Dr. Michalak.

Natasha met Dr. Michalak when she was an undergraduate student in psychology at UBC. She got involved with CREST.BD by posting research results for a wide audience on social media and went on to develop the project's blog (www.crestbd.ca/blog).



Dr. Erin Michalak with Amir and Natasha.



Dr. Aarthi Gobinath (left) and Rand Mahmoud (right).

"If I remember how it happened, Erin asked me if I wanted to make a blog, I said yes, and we did it," says Natasha with a laugh. "It was a fantastic experience to connect with so many people with different backgrounds—researchers, health care providers, supporters, and people with lived experience—and be able to share knowledge."

HOSTING COMMUNITY EVENTS

With your tremendous support the Djavad Mowafaghian Centre for Brain Health has continued to connect with community members from throughout the Lower Mainland and beyond. The centre once again hosted an impressive number of events, including lectures, symposia, and public outreach events. Here is just a small sample of what took place in 2017.

THE BEAUTIFUL BRAIN

In conjunction with UBC's Morris and Helen Belkin Art Gallery, the Djavad Mowafaghian Centre for Brain Health presented *The Beautiful Brain: The Drawings of Santiago Ramón y Cajal*. The work coincided with celebrations for the 20th anniversary of the creation of the Brain Research Centre (now the Djavad Mowafaghian Centre for Brain Health) at UBC. The event was a wonderful way to draw the larger community into the work of the centre.

The Beautiful Brain is the first North American museum exhibition to present the extraordinary drawings of Santiago Ramón y Cajal (1852-1934), a Spanish pathologist, histologist, and neuroscientist renowned for his discovery of neuron cells and their structure, for which he was awarded the Nobel Prize in Physiology and Medicine in 1906.



Students from Stratford Hall visiting Dr. Kurt Haas' lab. Image credit: Kerry Blackadar/UBC.



"This was an incredible opportunity for the neuroscience and visual arts communities at the university and Vancouver," said Dr. Brian MacVicar. "Without Cajal's impressive body of work, our understanding of the anatomy of the brain would not be so well-formed; Cajal's legacy has been of critical importance to neuroscience teaching and research over the past century."

Neurologists from around North America—including centre member Dr. Claudia Krebs—spoke at an opening symposium for the exhibit, held at UBC's Robert H. Lee Alumni Centre. Cajal's work remained on display at the Belkin Gallery from September 5 to December 3.

The Beautiful Brain drew the highest attendance of any exhibition in the Belkin Gallery's history, with close to 8,400 visitors viewing the exhibition. Many international visitors came from across North America expressly to see the exhibition.



Dr. Lara Boyd

ANNIVERSARY SYMPOSIUM

On November 25, 2017, UBC commemorated 20 years of neuroscience research and brain health discovery with an anniversary symposium. The day looked back at the accomplishments of researchers, students, and staff under the former Brain Research Centre and current Djavad Mowafaghian Centre for Brain Health banners, and ahead to a bright future for brain research and care in British Columbia and beyond. Dr. Lara Boyd was master of ceremonies for the event.

WELCOMING STUDENTS TO THE CENTRE

For many scientists, their earliest interest in science is sparked by someone else. Before they can even conceive of a career in research or medicine, they have to understand that it is possible. Igniting a young person's passion for science or medicine is often as simple as someone showing them that opportunity is out there. In 2017, the centre welcomed many children from across the Lower Mainland to be that spark:

- On January 22, 140 Grade 10 students from Prince of Wales Secondary School (Vancouver) visited the Djavad Mowafaghian Centre for Brain Health, hosted by the UBC MS & NMO Research Program.
- A group of Grade 11 students from Southridge School (Surrey) visited as part of their Career Experience Day.
- International Baccalaureate students from Stratford Hall (pictured) toured the MacVicar, Haas and Boyd labs as part of an immersive learning day.
- Two Grade 11 students from Vancouver toured the Galea lab with PhD student Aarthi Gobinath as part of the YWCA High School Mentorship Program.

UNDERGRADUATE NEUROSCIENCE CONFERENCE

In January 2018, the Djavad Mowafaghian Centre for Brain Health hosted its second annual Undergraduate Neuroscience Conference. Undergraduate researchers gave 19 poster presentations and eight student talks. They represented nine different departments: an example of the collaborative nature of the centre.

"We were happy that we were able to provide an environment for our scientists-in-training to showcase their work and for the student community to engage the student presenters about their research. That moment of engagement and discussion between students was our reward." —Alireza Kamyabi, student organizer

UNIVERSE OF THE BRAIN

In June 2017, the Djavad Mowafaghian Centre for Brain Health hosted "Universe of the Brain," a sold-out event at the H.R. Macmillan Space Centre. The two showings of this interactive event invited participants to consider the brain as a universe of mysteries that are still being

"THE ENTIRE TOUR WAS VERY GOOD AND ALLOWED ME TO UNDERSTAND THE INNER WORKINGS WITHIN THE BRAIN. EVERYONE THAT WE MET WAS VERY FRIENDLY AND PASSIONATE ABOUT WHAT THEY DO."

Grade 11 Southridge student on visiting Dr. Catharine Winstanley's lab

"LOOKING UP AND BEING SURROUNDED BY THE NEURAL NETWORKS IN A DOME SHAPE WAS INCREDIBLE!"

Universe of the Brain attendee

unrevealed. The show included state-of-the-art visuals and an interpretation of neural processes through dance, all under the dome of the planetarium star theatre. Centre researchers Dr. Cheryl Wellington and Dr. Claudia Krebs hosted, and a team of dancers led by Cashman lab MSc student Sarah Louadi performed.

MP TOURS

The Djavad Mowafaghian Centre for Brain Health drew visitors from all over intrigued by its unique approach to brain health. These included a visit from MP Francis Drouin, who came from his riding near Ottawa to learn about the innovative ALS research in Dr. Neil Cashman's lab. As mentioned previously, federal Minister of Justice Jody Wilson-Raybould also came to the centre for a tour of the Galea and Wellington labs to announce \$67.5 million in federal investment in research and equipment. These visits give researchers a chance to invite people into the centre and share the human story of research.

BUILDING GLOBAL PARTNERSHIPS

The Djavad Mowafaghian Centre for Brain Health's philosophy of working together extends far beyond its walls: the centre continued to encourage global collaboration to accelerate research, transform treatment, and influence policy.

APEC DIGITAL HUB FOR MENTAL HEALTH CONFERENCE AND CHINA PARTNERSHIP

In June 2017, the Djavad Mowafaghian Centre for Brain Health, in conjunction with the University of Alberta and Mood Disorders Society of Canada, formally launched the Asia-Pacific Economic Cooperation (APEC) Digital Hub for Mental Health. The APEC Digital Hub, led by Dr. Raymond Lam, also hosted its first conference in Vancouver in June 2017 and received \$2 million from CIHR to begin a project linking Canadian and Chinese researchers with partners the United States and Australia.

The five-year Canada-China collaboration will study the potential benefits of using innovative digital technologies to enhance measurement-based care for depression in Shanghai, and to share Canadian expertise with the goal of advancing healthcare and healthcare systems in China.

The Digital Hub, comprising more than 15 core Asia-Pacific partners from academic, government, and corporate health and policy organizations, is an online

platform with a mission to ensure the mental health of citizens in its member nations is included in the promotion of economic growth.

INTERNATIONAL COLLABORATION LEADS TO ALZHEIMER'S BREAKTHROUGHS

In 2017, Dr. Weihong Song worked with international collaborators to publish a number of studies that further reveal the mechanisms of Alzheimer's disease. One, alongside a researcher from Third Military Medical University in Chongqing, China, discovered a link between Vitamin A deficiency in utero and the development of Alzheimer's disease late in life. Another, with a researcher from Children's Hospital of Chongqing Medical University, looked at the possibility that Alzheimer's disease originates not in the brain—as has been assumed—but elsewhere in the body: a finding that could lead to early treatments that don't need to target the brain at all.

This expansive work builds on other discoveries from UBC scientists and others around the world to bring us closer to curing one of our world's most tragic diseases.



Dr. Weihong Song



Training the Next Generation

The students in the Djavad Mowafaghian Centre for Brain Health are the future clinicians, researchers, and teachers who will continue the important work of the centre.

A MESSAGE FROM LIISA GALEA

The Graduate Program in Neuroscience at UBC benefits from its position under the umbrella of the Djavad Mowafaghian Centre for Brain Health where our students have the advantage of pursuing their research questions in a truly interactive and interdisciplinary setting. Since taking over leadership of the program this past summer, I have been thoroughly impressed by the calibre of our students; our students are creative problem-solvers with abundant energy and drive, and they will work tirelessly to solve the most urgent problems affecting the brain health of Canadians young and old.

This generation of graduate students is uniquely poised to affect real change. They are influenced by faculty in disciplines as diverse as neuroethics, neuroimaging, psychology, psychiatry, neurology, physics, cellular physiology and anatomy. They are media savvy, active on social networks, and understand the value of engaging the public in brain health issues. We can consider ourselves fortunate that the students we train here will be the leaders of the future.

Liisa Galea, Director | Graduate Program in Neuroscience

Dr. Liisa Galea began her tenure as Director of the Graduate Program in Neuroscience on July 1, 2017, taking over for Dr. Tim O'Connor, who had served in the position since 2011.



HEATHER YONG

Undergraduate Student

Heather Yong is a Directed Studies student in the Faculty of Medicine at the University of British Columbia. She has been volunteering with the UBC MS & NMO Clinic and Research Group at the Djavad Mowafaghian Centre for Brain Health since 2013.

In her final year of her undergraduate studies, Yong is already volunteering in the multiple sclerosis (MS) clinic, conducting epidemiological research with Dr. Helen Tremlett, and publishing her findings in scientific journals. She is primarily interested in MS and plans to apply to the MD/PhD program in UBC's Faculty of Medicine, where she hopes her experience in engaging patients and conducting population health research will inform the way she provides care.

Her paper, published in the journal *Pharmacoepidemiology and Drug Safety*, looked at pharmacological treatments associated with MS risk and reviewed the scientific literature to determine risk of MS associated with exposure to certain drugs. She found seven drug classes, and despite associations with the disease in some cases, she found no conclusive evidence that a drug increased the risk of MS. Interestingly, there was suggestion that some drugs might actually lower the risk of developing MS. Evaluating the data is no small feat: the work took three years, and while her findings represent an important

piece in understanding factors that can contribute to neurological disease, her effort represents a drive you can't simply teach.

"My dad, a neuroimmunologist in Calgary, suggested I try volunteering as a way to figure out what I wanted to do," says Yong. "I've been lucky to get to work with the UBC MS & NMO Research Program, where research and clinical care are so well integrated; I've been able to do a little bit of everything, from consenting patients for research to conducting my own studies in partnership with some of the faculty and postdocs."

Yong has been exposed to a wide range of research areas, from epidemiology with Dr. Tremlett, to clinical trials with Dr. Anthony Traboulsee, to pathology and immunology with Dr. Jacqueline Quandt.

"Recently I've been working with Dr. Shannon Kolind and Dr. Roger Tam, who have been teaching me conventional MRI and advanced myelin water imaging techniques," says Yong.

Heather Yong's experience is unique in part because she is entirely self-motivated.

"For the average undergraduate student, the path to this kind of immersive research experience is not straightforward; these types of opportunities are generally only made available to people in co-op programs," explains Yong. "If you want to get involved in research at the undergraduate level, you often have to pursue it for yourself. But the great thing is that once you are in, there's a lot of support from both faculty and administrative staff to become whatever it is you're working toward."

For Yong, the experience with the MS clinic has been invaluable.

"I knew that I wanted to be in research, but I thought I was headed toward basic science," she says. "Interacting with patients has really shown me the bigger picture; talking to people with MS every day has given me a depth of understanding I might not have been able to attain until much later in my academic career, and it has given me a clearer sense of where I want to go on the road ahead."

"Heather really impressed my team," says Dr. Tremlett. "It is not often you get the privilege of working with an undergraduate who not only completes a study but to a sufficient level and quality to get published in a high-impact peer-review journals, such as *Pharmacoepidemiology and Drug Safety*. What an outstanding achievement."

TROY MCDIARMID

PhD Candidate

To understand how gene mutations affect neurodevelopment and learning in people with Autism Spectrum Disorder (ASD), PhD candidate Troy McDiarmid is looking at microscopic worms. McDiarmid, a graduate student in Dr. Catharine Rankin's lab, was recently awarded a Frederick Banting and Charles Best Canada Graduate Scholarships Doctoral Award from the CIHR for his proposal to characterize ASD-associated gene mutations in worm models of the disorder.

ASD is a genetic disorder encompassing a range of behavioural symptoms including impairments in cognition, motor skills, sensory processing, social interaction, and language. A challenge in studying genes associated with the disorder is that there hasn't been a model system to efficiently and cost-effectively characterize the large and rapidly growing number of risk genes.

Caenorhabditis elegans is a species of nematode widely used in neuroscience research because of the relative simplicity of their brains (just 302 cells!), ease of genetic engineering, and because they share similarities in cell biology with humans. As a model of a neurodevelopmental disorder such as ASD, *C. elegans* holds promise in enhancing our understanding of how mutations in ASD-associated genes lead to changes at the molecular and cellular levels that then lead to changes in sensory and learning behaviours.

"Using genetic screens and precise genetic engineering, we believe we can determine how specific genetic mutations disrupt typical neurodevelopment and learning," says McDiarmid. "By characterizing the biological pathways of specific genes, we hope to create a rich data set to inform future research across model organisms, and to identify new targets for reducing the effects of particular genetic subtypes of ASD."

Researchers in the Rankin lab have developed an automated machine vision system — The Multi-Worm Tracker — to rapidly collect dozens of distinct measures of development, sensory behaviours, and learning impairment in strains of worms with mutations in ASD-associated genes.

"Using the Multi-Worm Tracker, we will be able to look at how mutations in hundreds of ASD-associated genes affect different behaviours and neurodevelopmental processes," says McDiarmid. "This system is incredibly

efficient, and we'll be able to characterize hundreds of variables, generating a large amount of data. Through that data, we hope to prioritize specific sets of genes for more detailed network and circuit analyses, and potentially screen for drugs that reverse the mutations effects as well."

"One of the best aspects of working at UBC and specifically the Djavah Mowafaghian Centre for Brain Health is all of the opportunities for collaboration," says McDiarmid. He currently works with seven different UBC labs interested in ASD and two other UBC worm labs on a weekly basis.

"The chance to work with leading bioinformaticians, genetic engineers, and neuroscientists makes UBC an awesome environment to be a graduate student. I feel really grateful to my supervisor Dr. Catharine Rankin, my supervisory committee Dr. Kurt Haas, Dr. Paul Pavlidis, and Dr. Kota Mizumoto, and several others who keep giving me opportunities to learn new techniques and ways of thinking so I can accelerate and improve my research through collaboration."

For McDiarmid, this project and the CIHR funding that goes along with it offers an opportunity to focus exclusively on the complexity of autism genetics.

"Troy is an excellent researcher, he is careful and systematic in his experiments, he reviews his data carefully and he does not jump to conclusions without considering all of the possibilities," says Dr. Rankin. "He is passionate about research, and his strong work ethic and contagious enthusiasm for science set a great tone for the rest of the lab. I foresee an amazing future for him in neuroscience!"





NICK WEILINGER

Postdoctoral Fellow

"In theory, cerebral edema is a very simple issue; it's the movement of water from the blood into the brain by osmosis, causing brain swelling. When water is drawn into nerve cells, the brain expands in the skull and that's where you see severe complications from stroke or traumatic brain injury," explains Dr. Nick Weilinger. "My work in the MacVicar Lab is focused on trying to understand the underlying causes of brain swelling. What are the mechanisms driving the edema?"

Dr. Weilinger, Michael Smith Foundation for Health Research (MSFHR) trainee and Vancouver Coastal Health Research Institute Postdoctoral Fellow awardee, joined Dr. Brian MacVicar's lab in 2015 to pursue novel targets for cerebral edema during stroke. He is the recent recipient of a Banting Postdoctoral Fellowship from the Canadian Institutes for Health Research (CIHR) for his work in understanding why the brain swells.

Brain swelling is a gradual process that becomes life-threatening within hours to days after stroke or brain injury, and is caused by an imbalance of sodium and chloride ions that leads to water accumulation in nerve cells. This swelling can put excess pressure on the brain stem, the part of the brain controlling breathing and heart rate, which can be fatal.

Despite cerebral edema being a hallmark feature of stroke, the third leading cause of death in Canada, there is currently no treatment targeting the ionic imbalance in nerve cells to mitigate neural swelling.

Dr. Weilinger is currently investigating the role of proteins in regulating salt, and thereby water into the brain's cells, with the hope that he'll be able to pinpoint the proteins responsible for swelling, reduce osmotic pressure into cells, and mitigate the swelling as it happens.

"Working in Dr. MacVicar's lab presents a unique opportunity to follow this particular line of research, as I access to proprietary equipment, developed in house, that is not available anywhere else."

"Using the MacVicar Lab imaging systems, I'm able to measure salt content in cells under highly specific circumstances, like stroke," explains Dr. Weilinger.

"My hope is that we can use this imaging technology to determine the protein conduit responsible for moving salt in and out of cells during swelling, which will help inform novel treatments."

"Once we have a target, we'll be able to screen drug candidates that could block these proteins from triggering edema," says Dr. Weilinger.

Dr. Weilinger, who received a CIHR Brain Star award last year for his 2015 *Nature Neuroscience* publication *Metabotropic NMDA receptor signaling couples Src family kinases to pannexin-1 during excitotoxicity*, looks forward to continuing his research at UBC and the Djavad Mowafaghian Centre for Brain Health under the guidance of Dr. MacVicar.

"Dr. Weilinger is an innovative, creative young researcher who has been invaluable to the research my lab is doing toward understanding neuronal death triggered by edema," says Dr. MacVicar. "Nick has shown he excels not only at the technical demands of experiments but also at the creative design of the discovery path. I look forward to watching his stellar research career unfold."

STAFF HIGHLIGHT:

SWARNI SUNNER

Swarni Sunner has been a cornerstone of the neuroscience community at the University of British Columbia since 2002 when she joined the then-named Brain Research Centre at UBC Hospital as Executive Assistant to Dr. Max Cynader.

As the centre has grown, so has Swarni's impact on the research and public relations that occurs here. Swarni has been the point of contact for a community of nearly 200 faculty members, plus an untold number of students, staff, donors and international guests.

Since 2014, Swarni has been the Executive Assistant to the Co-Directors of the Djavad Mowafaghian Centre for Brain Health, Dr. Brian MacVicar and Dr. Jon Stoessl.

Swarni was integral to the process of transitioning the Brain Research Centre into the Djavad Mowafaghian Centre for Brain Health, providing important insight and unwavering support as the centre has grown and evolved over the years.

Swarni embodies the best qualities of the centre. She goes out of her way to establish relationships with stakeholder groups and service providers. One only has to mention a need — whether a short-notice breakfast for visiting foreign dignitaries in the co-directors' office (at 9:00 a.m.) or assistance in planning a retirement celebration for a colleague in another department — and Swarni commits to meeting that need efficiently, while appearing to do so effortlessly. She knows everything, and the scope of her contributions to the centre is immeasurable.

"SWARNI IS RESPONSIVE, HELPFUL, AND RESPECTFUL TO ALL AND CONSISTENTLY MAKES A CRITICAL CONTRIBUTION TO IMPLEMENTING NEW INITIATIVES, AND ENSURED SMOOTH OPERATIONS OF EXISTING PROGRAMS. SHE IS EXEMPLARY IN HER ROLE."

Dr. Lynn Raymond



Swarni Sunner

In addition to being a valuable member of the team, she is also a role model for newer staff. She is a model of professionalism; the way she conducts herself sets the tone for younger, newer employees who are keen to follow her example. She is calm in the face of difficult situations, and reassuring to students who just need someone to listen.

"With Swarni in the office, people feel comfortable, confident and empowered. Her sense of purpose is infectious," says Dr. Brian MacVicar. "She is the core of our administrative team; not just professionally, but personally as well. She is truly the life of the office."

Partnerships

The Djavad Mowafaghian Centre for Brain Health represents a partnership between Vancouver Coastal Health and the Faculty of Medicine at the University of British Columbia. The centre was made possible with a generous donation from the Djavad Mowafaghian Foundation, as well as contributions from other philanthropists and leaders, as well as those of the federal and provincial governments.



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Vancouver Coastal Health provides a full range of health care services, ranging from hospital treatment to community-based residential, home health, mental health and public health services, to residents of Vancouver, North Vancouver, West Vancouver, Richmond, and in the coastal mountain communities. www.vch.ca



Vancouver Coastal Health Research Institute (VCHRI), a world leader in translational health research, is the research body of Vancouver Coastal Health Authority. VCHRI includes three of BC's largest academic and teaching health sciences centres - Vancouver General Hospital, UBC Hospital, and GF Strong Rehabilitation Centre - as well as many other hospitals and public health agencies across Vancouver Coastal Health. VCHRI is academically affiliated with UBC Faculty of Medicine and is one of Canada's top funded research centres receiving between \$80-100 million in research funding annually. Over 1500 personnel are engaged in a variety of research centres, programs and evolving research areas. www.vchri.ca



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