

NEURO

DEPARTMENT OF CLINICAL NEUROSCIENCES

ANNUAL REPORT
2018-2019

ONE STEP AT A TIME

Crutch research
drives care for
clinic patients

Physiatrist and researcher
Dr. Ranita Manocha

VISION ISSUE

Aligning our
values and goals
for success!

Department Vision

Caring, Educating, Innovating. Together.

Department Mission

By building healthy teams, collaborating with patients, outstanding care providers, researchers, educators and health care administrators, the Department of Clinical Neurosciences will provide compassionate, equitable, and high-quality care to people dealing with neurological problems. While doing this, we will constantly strive to learn and to improve.



Cover photo

Physiatrist Dr. Ranita Manocha demonstrates motion-capturing equipment that she uses for her research into crutch use.

Department Goals

- Provide compassionate, timely and high quality care to patients and their families.
- Lead in neuroscience research.
- Build innovations in care delivery.
- Train the specialists and leaders of tomorrow.
- Flourish in a fulfilling collaborative work environment.
- Communicate transparently within and outside our organization.
- Measure and optimize patient outcomes.

Department of Clinical Neurosciences

Room 1195 – Foothills Medical Centre
1403 29th Street N.W.
Calgary, Alberta
T2N 2T9
403-944-1260

CLINICAL
NEURO
SCIENCES
CALGARY  CANADA



Alberta Health
Services



UNIVERSITY OF
CALGARY

Table of Contents

Message from the Department Head of Clinical Neurosciences 2
Recruitment at DCNS. 4

Clinical and Academic Metrics 5-11

The Section of Neurology
Neurology Overview — Dr. Lara Cooke 12
Epilepsy patient shares story of rare disease that steals memories 14
Reconciling with a diagnosis often a key step for patients. 17
Neurology Programs 19-35
Pediatric Neurosciences 36

The Section of Neurosurgery
Neurosurgery Overview — Dr. Steve Casha 38
For newest DCNS neurosurgeon, spine surgery should be personal 41
Neurosurgery Programs 42-51

The Section of Physical Medicine and Rehabilitation
Physical Medicine and Rehabilitation Overview — Dr. Christine McGovern 52
Physiatrist focused on fundamental MSK research. 54
Physical Medicine and Rehabilitation Programs 57-63

The Section of Translational Neuroscience
Translational Neuroscience Overview — Dr. V. Wee Yong 64
A world of collaboration 66

Undergraduate Medical Education 69

Residency Programs
Resident Research Day 70
Neurology Residency Update — Dr. Michael Yeung 71
Physical Medicine and Rehabilitation Residency Update — Dr. Gentson Leung 72
Neurosurgery Residency Update — Dr. Jay Riva-Cambrin 73

Fellowships and Research 74

Faculty Members 75-81

Message from the Department Head

Dr. Rajiv Midha

HOW DO YOU GET a passionate group of physicians, administrators and researchers to agree on a single vision for the department?



It's not an easy task—but it was certainly long overdue that Clinical Neurosciences revisit its mission, vision and goals and agree on the direction we want to steer our department.

Our 2019 departmental retreat was the perfect opportunity to have everyone in a room for a weekend to discuss what's important to us as individuals, physicians, health care operations leaders, researchers and academics.

In the end, with the help of facilitator Ivan Zendel, we accomplished much more than a mission and vision. As a group, we found there was consistent agreement on our core values and guiding principles.

There was consensus on how we could implement some of our immediate goals with concrete actions and quick wins.

We reinforced the importance of working in a collaborative team environment every day.

But most importantly, we discovered that we were all highly aligned on the things that we would never sacrifice: compassionate, high quality patient

VISION ISSUE
Aligning our
values and goals
for success!

care; our desire to train the specialists and leaders of tomorrow; and our leadership in neuroscience research.

We discovered this together—so it's fitting that our new departmental vision is:

Caring, Educating, Innovating. Together.

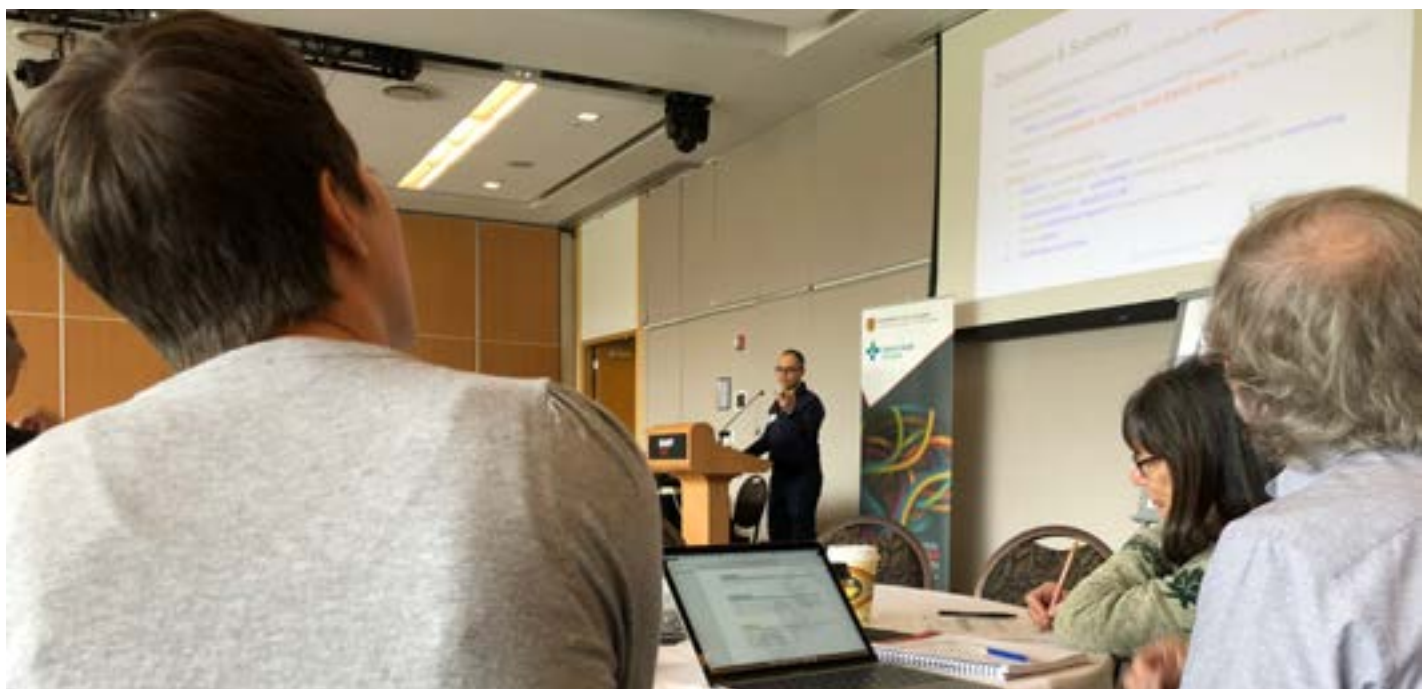
You'll find this vision on the inside cover of our annual report, along with our goals and our updated mission:

“By building healthy teams, collaborating with patients, outstanding care providers, researchers, educators and health care administrators, the Department of Clinical Neurosciences will provide compassionate, equitable, and high-quality care to people dealing with neurological problems. While doing this, we will constantly strive to learn and to improve.”

Thank you to everyone who participated in this important process and shared their own vision of neuroscience in Calgary.

You'll find some of these personal visions in stories in this issue.





▲ Dr. Gentson Leung shares his table's vision and mission ideas during retreat discussions.

Dr. Ranita Manocha shares her dedication to MSK research and her desire to answer fundamental questions about crutches. **(Page 54)**

Dr. David Cadotte is a champion of the Calgary Spine Program and how its striving to delivery personalized medicine to patients. **(Page 41)**

Dr. Minh Dang Nguyen, a prolific researcher in Translational Neurosciences, reminds us how collaboration (with clinicians and other scientists) can accelerate discovery. **(Page 66)**

Dr. Jason Chan is a resident neurologist who's passionate about helping patients and their families reconcile with difficult diagnoses. **(Page 17)**

Finally, a patient of **Dr. Colin Josephson** shares a powerful story about a rare form of epilepsy that is stealing his memories. **(Page 14)**

Our mission includes "building healthy teams," and we have continued to attract world-class physicians and researchers to Calgary.

Please see the list of seven exceptional new DCNS members on the following page. We are delighted to have them join us on our journey!

Thank you for taking the time to learn about our department. We hope you enjoy our annual report.

Dr. Rajiv Midha
Professor and Head
Department of Clinical Neurosciences

RECRUITMENT AT DCNS

The Department of Clinical Neurosciences has been very fortunate to recruit seven talented physicians.



Dr. Mohammed Almekhlafi is an assistant professor of Clinical Neurosciences, Radiology, and Community Health Sciences. He is an interventional stroke neurologist and clinical epidemiologist in the Calgary Stroke Program.



Dr. Lisa Hoyte is a clinical lecturer of neurology and works at the Alberta Neurologic Centre as well as in hospital service at Foothills Medical Centre and Peter Lougheed Centre.



Dr. Tyson Brust is a clinical assistant professor and multiple sclerosis neurologist in the Calgary MS Program. He has a general neurology practice at the Peter Lougheed Centre and sees patients in the Neuroimmunology Clinic at the South Health Campus.



Dr. Karl Martin Klein is a clinician scientist in the Departments of Clinical Neurosciences, Medical Genetics and Community Health Sciences as well as a member of the Hotchkiss Brain Institute and Alberta Children's Hospital Research Institute.



Dr. Alicja Cieslak is a clinical lecturer of neurology and a member of the Cognitive Neurosciences Clinic and the Movement Disorders Clinic. She also spends time in the General Neurology Clinic.



Dr. Ranita Manocha is a clinical assistant professor in the Department of Clinical Neurosciences. Her research interests involve the biomechanical effects of gait aids and braces, and her practice includes outpatient electromyography, orthotics and wheelchair seating.



Dr. Yanjun Duan is a clinical lecturer of neurology and works as a general neurologist in General Neurology, Urgent Neurology, EEG interpretation and Botulinum Toxin injection for chronic migraine.



Dr. Megan Yaraskavitch is a clinical assistant professor and general neurologist at the South Health Campus. She is the Program Lead for the General Neurology Program and Neurology Central Access and Triage, and Quality Improvement Lead for the Division of Neurology.

RESEARCH

HOT PAPERS

In 2018-2019, Clinical Neurosciences represented 45 of the Cumming School of Medicine's 526 FTEs — 8.5% of the total.

However, our "Hot Paper" ratio (defined as unique publications cited more than 49 times in a five-year window) was 16% last year.

45 FTEs (8.5%)



16%
DCNS
69

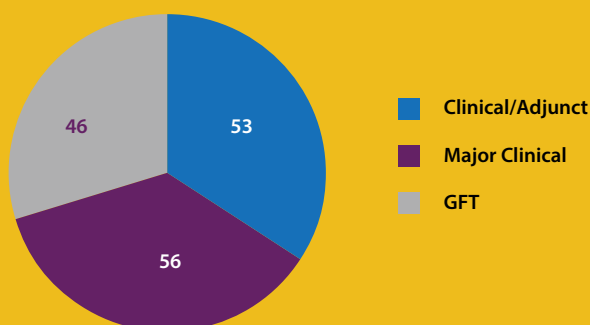
**Cumming School
of Medicine**
426 Hot Papers

Clinical and Academic Metrics

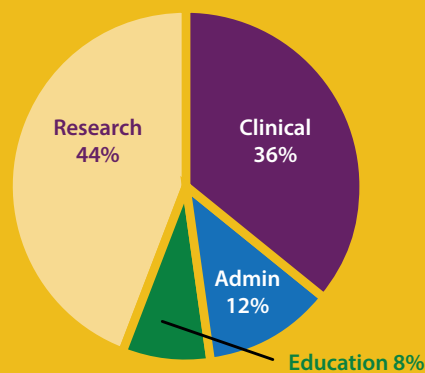
How our department stacked up over the past year — within the Cumming School of Medicine and Alberta Health Services

OUR DEPARTMENT

Appointments to Faculty in DCNS

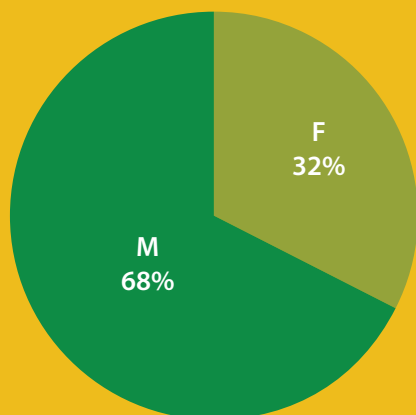


GFT -Activity Profile (41 FTE in DCNS)

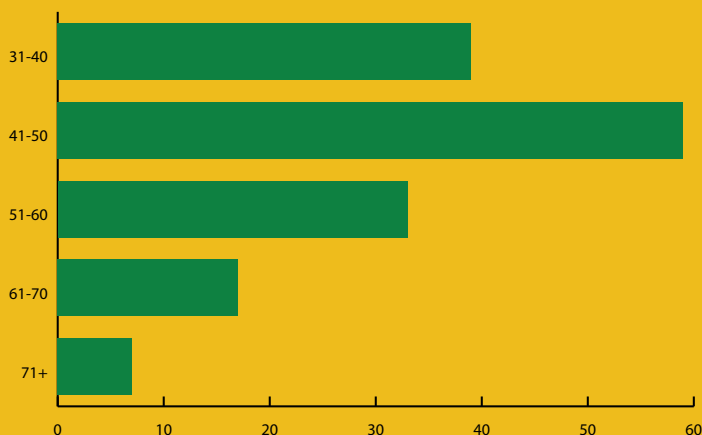


Source: Cumming School of Medicine

Gender

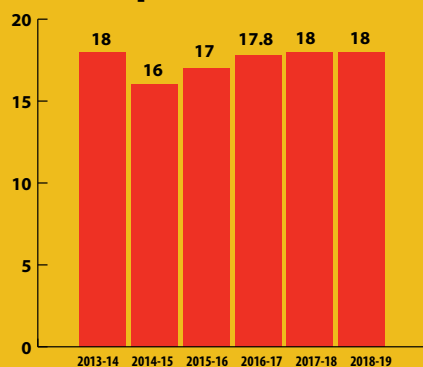


Age Distribution



RESEARCH & PUBLICATIONS

Number of Research Equivalents



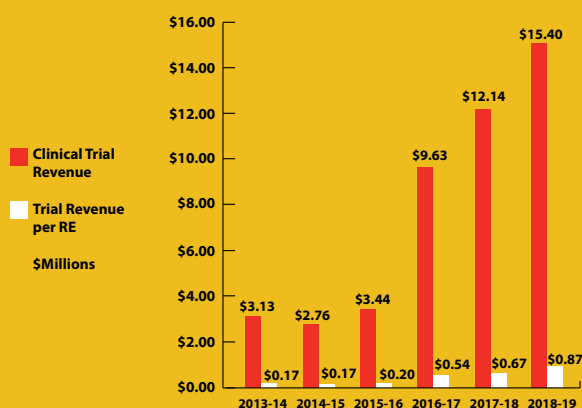
Source: Cumming School of Medicine

Research Revenue



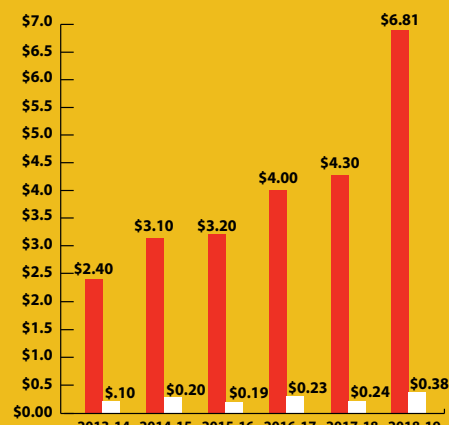
Source: Cumming School of Medicine

Clinical Trial Revenue



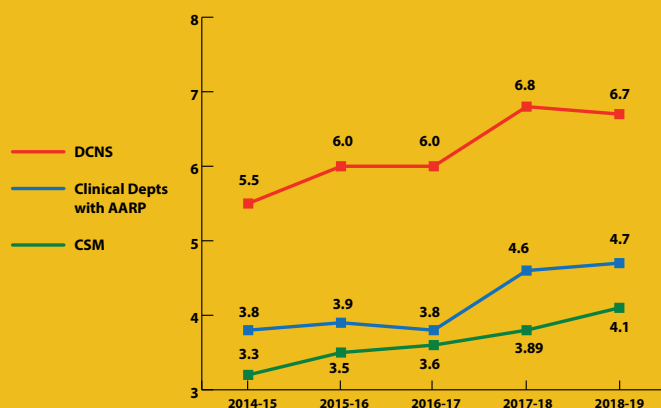
Source: Cumming School of Medicine

CIHR Revenue



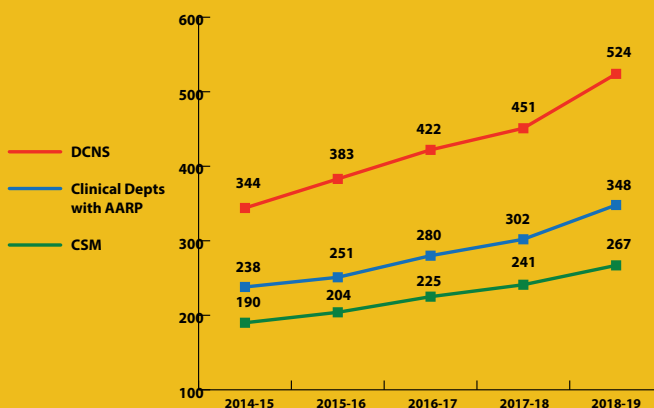
Source: Cumming School of Medicine

Publications (avg per FTE)



Source: Cumming School of Medicine

Publication Citations



Source: Cumming School of Medicine

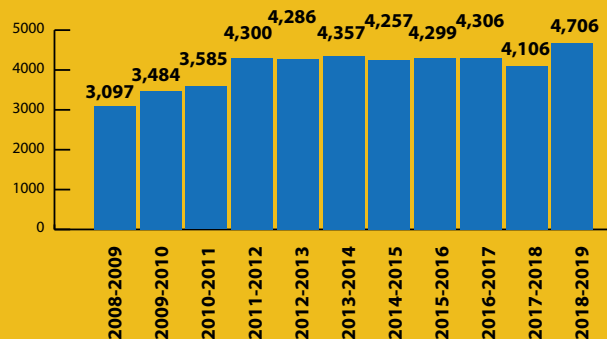
PATIENT VISITS, ADMISSIONS, SURGERY

DCNS – Total Outpatient Visits

Site	2014-2015	2015-16	2016-17	2017-18	2018-19
FMC	32,423	34,115	36,745	37,792	39,128
PLC	1,285	2,541	2,536	3,987	5,334
RGH	2,778	5,380	5,916	5,333	5,653
SHC	11,663	12,599	12,628	13,289	15,410
ACH (Ped NSx)	1,961	2,318	2,493	2,845	2,108
Total	50,110	56,953	61,229	64,411	69,251

Total includes off hospital site visits

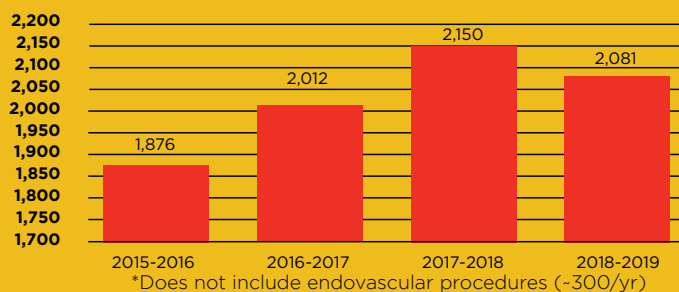
DCNS – Total Admissions All Hospitals



DCNS – Total Admissions Per Hospital

Site	2014-2015	2015-16	2016-17	2017-18	2018-19
FMC	3,753	3,836	3,825	3,597	4,180
ACH	184	168	170	176	160
SHC	318	295	311	333	366
RGH	2	0	0	0	0
Total	4,257	4,299	4,306	4,106	4,706

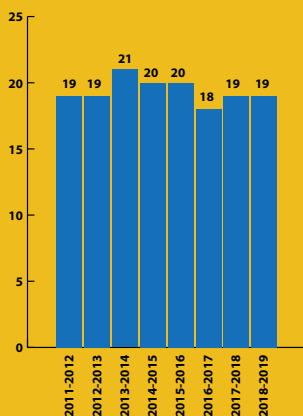
Surgical OR Cases Neurosurgery at FMC



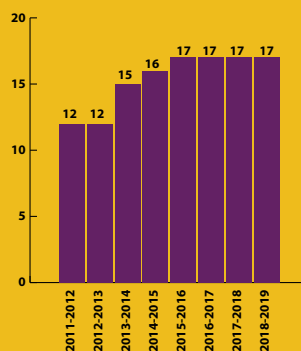
RESIDENT EDUCATION

The Department of Clinical Neurosciences is exceptionally proud of our three residency programs that are home to 46 talented residents doctors.

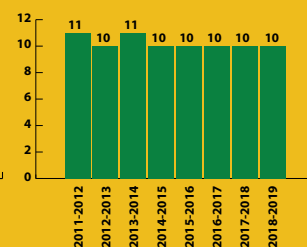
Number of Residents per Program



Neurology



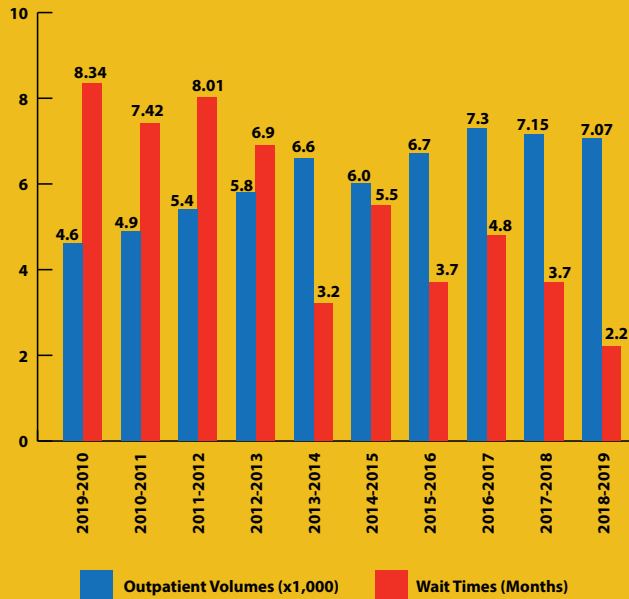
Neurosurgery



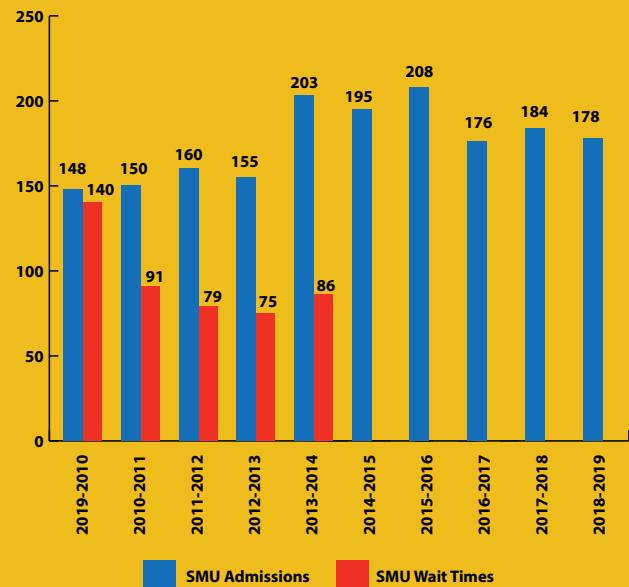
Physical Medicine & Rehabilitation

CLINIC WAIT TIMES

EMG Outpatient Volumes and Wait Times



Seizure Monitoring Unit Admissions and Wait Times



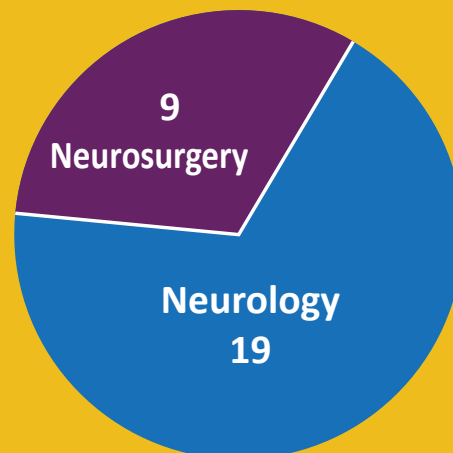
FELLOWS

Clinical Neurosciences Fellowship Program

Integral for service delivery and scholarly activity

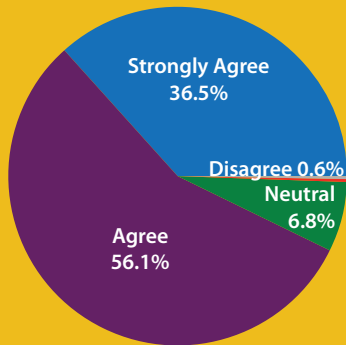
- Epilepsy & EEG
- Epilepsy Neurosurgery
- Headache
- Movement Disorders
- Multiple Sclerosis & Neuroimmunology
- Neuromuscular
- Pediatric Neurosurgery
- Peripheral Nerve
- Spine Surgery
- Stroke
- Cerebrovascular

(Chart excludes fellows in Pediatric Epilepsy and Pediatric Stroke)

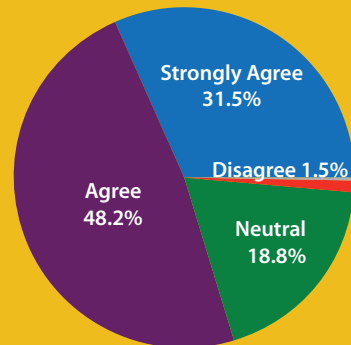


ROUNDS FEEDBACK

I learned a lot during the second hour presentation
(Series average responses)



My practice will change as a result of attending this session
(Series average responses)



◀ Dr. Eelco Wijdicks from the Mayo Clinic is congratulated by Dr. Luanne Metz and Dr. Keith Brownell after giving the Keith Brownell Lectureship in Ethics.

▶ Dr. Gary Gronseth is presented with the Sam Wiebe Lectureship in Evidence Based Medicine plaque by Dr. Wiebe and Department Head Dr. Rajiv Midha.



2018-2019 GRAND ROUNDS

The Department of Clinical Neurosciences hosts distinguished speakers from Calgary and around the world at Grand Rounds on Fridays. This tradition is a highlight of our week and is an unparalleled learning opportunity for all DCNS.

Sept. 14, 2018	John Whyte	ThomasJefferson University
Sept. 21, 2018	Keith Brownell Lectureship in Ethics Eelco Wijdicks	Mayo Clinic
Sept. 28, 2018	Virginia Vandall-Walker	University of Alberta
Oct. 5, 2018	Mark Hamilton	University of Calgary
Oct. 12, 2018	Christoph Helmstädter	University Clinic Bonn
Oct. 19, 2018	Mary Ann Lee Memorial Lecture Brian Litt	Penn Epilepsy Center
Oct. 26, 2018	Sanjay Kalra	University of Alberta
Nov. 2, 2018	Marcel Aries	Medical University Centrum Maastricht
Nov. 9, 2018	Resident Research Day	
Nov. 16, 2018	Antonio Strafella	University of Toronto
Nov. 23, 2018	Mark Keegan	Mayo Clinic College of Medicine
Nov. 30, 2018	Robert G. Lee Memorial Lecture Peter Dirks	University of Toronto
Dec. 7, 2018	Lara Cooke	University of Calgary
Dec.14, 2018	Michael Nicole	Western University
Jan. 11, 2019	Menon, Demchuk, Goyal	University of Calgary
Jan. 18, 2019	George Wittenberg	University of Pittsburgh
Jan. 25, 2019	Beth Lange	University of Calgary
Feb. 1, 2019	Charlotte Staggs	University of Oxford
Feb. 8, 2019	Bernard Brais	Montreal Neurological Institute
Feb. 15, 2019	Jeff Joseph	University of Calgary
Feb. 22, 2019	Carlos Camara-Lemarroy	University of Calgary
March 1, 2019	Adam Sachs	Ottawa Hospital Research Institute
March 8, 2019	Stéphane Guétin	Université Paris V-René Descartes
March 15, 2019	Paula De Robles, Andrew Daly	University of Calgary
March 22, 2019	Alik Widge	University of Minnesota
March 29, 2019	Andrew Capriello	University of Calgary
Apr. 5, 2019	David Langelier	University of Calgary
Apr. 12, 2019	Ranita Manocha	University of Calgary
Apr. 26, 2019	Toshiki Mizuno	Kyoto Prefectural University of Medicine
May 3, 2019	Mike Keogh	Northern Deanery, Newcastle, UK
May 10, 2019	Charles Taylor Lectureship Antonio Chiocca	Harvard Medical School
May 17, 2019	Walter Hader	University of Calgary
May 24, 2019	Chantel Debert	University of Calgary
May 31, 2019	Tamara Pringsheim	University of Calgary
June 7, 2019	Sam Wiebe Lectureship Gary Gronseth	University of Kansas Medical Center
June 14, 2019	Niccolo Mencacci	Northwestern University
June 21, 2019	Movement Disorders Symposium Emmanuel Roze Andreas Hartmann	Pierre et Marie Curie University Hopital de la Pitie-Salpetriere, Paris

The Section of Neurology

Section Head: Dr. Lara Cooke

THE SECTION OF NEUROLOGY is one of the largest groups in Canada, with 65 neurologists serving four hospitals and multiple community neurology and primary care clinics in Calgary. The group has experienced many changes in 2019: new leadership, new recruits, and a new strategic plan for the next five years.

In 2019, the section said a very big “Thank You!” to Dr. Luanne Metz, who finished her term as section head after five years. During her time in the role, Dr. Metz successfully recruited many new neurologists and fellows and delivered on her promise to find an accurate way to measure and report on clinical accountability in the AMHSP for its members.



Dr. Luanne Metz

She oversaw numerous changes to enhance the quality of care delivered to the people of Alberta and led a very successful collaboration between the Section of Neurology and the Calgary and Area Primary Care Networks.

This collaboration led to a number of clinical pathways for the primary care of

several common neurological conditions as well as the creation of the Neurology Specialist Link Program, which now receives 100 calls per month from family doctors who need to connect with a neurologist for advice. Dr. Lara Cooke stepped into the role in April 2019 and has very big shoes to fill!

During the 2018-2019 academic year, the department recruited seven talented individuals—all neurologists within our section:

- Dr. Mohammed Almekhlafi
- Dr. Tyson Brust
- Dr. Alicja Cieslak
- Dr. Yanjun Duan
- Dr. Lisa Hoyte
- Dr. Karl Martin Klein
- Dr. Megan Yaraskavitch



These new members bring expertise in stroke, MS, cognitive, movement disorders, genetics, urgent and general neurology. We are looking forward to watching these physicians flourish.

The Section of Neurology and its 24 four different clinical programs delivers neurological care to patients from throughout Southern Alberta. In the 2018-19 fiscal year, our teams delivered nearly 50,000 outpatient visits and took care of over 2,000 inpatients.

The section continues to conduct exceptional research across many disciplines in the field. In the 2018-19 fiscal year, members were project holders for over \$21 million in research revenues, of which over \$3 million represented funding from CIHR. Two-hundred and eighty-seven publications were released by our members.

Education remains a high priority for the section. In 2019 we hosted 22 clinical fellows, 85 elective medical students, and 127 residents from multiple disciplines on our services.



The Adult Neurology Residency Training Program remains one of the top programs in Canada, with unprecedented numbers of applicants to the program in the most recent CaRMS cycle.

What's Next?

In the summer of 2019, the members of the section collaborated on two major projects—the development of our strategic plan for 2019-2024, and a survey of physician health.

Through a multi-stakeholder, consensus process, the section developed a new Vision, Mission and Goals to lead us into the next decade.

The group emphasized delivery of excellent care, academic leadership, and a new focus on equity and the well-being of our members and teams. We have a clear roadmap to follow and lots to do in the next five years.

VISION (What we are aiming to achieve)

Caring, Educating, Innovating. Together.

MISSION (Why we are here)

Through building healthy teams, which integrate patients, outstanding care providers, researchers and educators, the Section of Neurology will provide compassionate, equitable, timely, and high-quality care to people living with neurological problems, while constantly striving to learn and to improve.

GOALS

- **Provide compassionate, high-quality care to every patient and their family.**
- **Lead in neurosciences research.**
- **Build innovations in care delivery.**
- **Train the neurologists of tomorrow.**
- **Flourish in a fulfilling work environment.**

I DON'T REMEMBER

Epilepsy patient shares story of rare disease that steals memories

JIM DUNCAN would rather be working. The 77-year-old former technology executive is an engineer, a problem solver, and an inventor.

But three years ago he had a seizure sitting in front of his family physician—what was supposed to be a routine visit.

“I could still hear. I could see. I just couldn’t respond or move and I had slumped over against my wife.”

His doctor sent him to the Emergency Department and the week that followed included 40 or 50 more seizures.

“That was the start of it,” he says.

It’s unusual to have uncontrollable seizures start in your 70s without any family history or obvious trigger. It’s even more unusual to have Transient Epileptic Amnesia (TEA), the diagnosis Jim ultimately received.

Neurologist and epileptologist Dr. Colin Josephson says the disease is rare and easily misdiagnosed. Each seizure can disrupt brain circuits, impairing the ability to encode or recall memories.

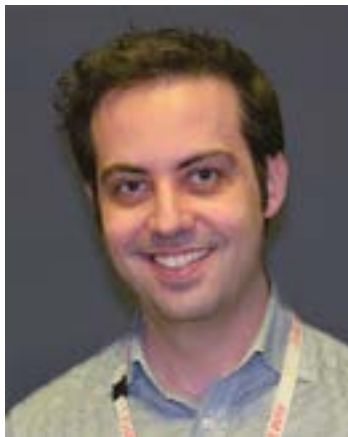
“It’s almost like hitting a reset button all the time,” he says. “Whatever memory circuits you had before are now being broken apart because there is ongoing seizure activity.”

Dr. Josephson says TEA is likely underdiagnosed because it can mimic other cognitive diseases like dementia and Alzheimer’s disease.

In fact, Dr. Josephson recalls that testing Jim was a complicated process—and he credits psychiatrist

Dr. Aaron Mackie for his exceptional clinic work.

“Most of our classic neuropsychological testing is all geared towards dementias—so executive function, language, and verbal and visuospatial memory,” says Dr. Josephson.



Dr. Colin Josephson

“Jim scored extremely well in neuropsychological testing, because it doesn’t tend to pick up things like autobiographical memory or accelerated long-term forgetting—where you might remember something today or tomorrow, but then you forget it three or four days from now. It is these features that define TEA.”

Autobiographic memory problems are the hardest for the retiree to deal with.

He doesn’t remember if he has grandchildren. He doesn’t remember their names. He sometimes doesn’t remember his wife’s name.

But, interestingly, he knows that he doesn’t remember.

“I describe it as having dementia, but knowing what you don’t know.”

It’s frustrating, he says, when you’re constantly fighting to find words or names. He gets upset when he’s told that he should remember something, or that he didn’t remember to do this or that.

“That, for me, is hard to deal with because it’s a constant reminder that I have a problem.”

CONTINUED ON PAGE 16



▲ Jim Duncan and his wife, Lorraine, after a followup visit to Foothills Hospital.

CONTINUED FROM PAGE 14

His wife, Lorraine, and their close friends help fill in gaps in the conversation. But with people he doesn't know as well, he can get stuck finding the right word.

"I can see in other people's faces that there's a problem here."

While it may take a few moments to come up with their names, he praises his medical team—including Dr. Josephson and Dr. Mackie—and credits them with keeping him going.

"I would say that I wouldn't be here now (without them)."

Jim says he's been told that Dr. Mackie once spent an hour with him talking about his disease. He has no idea what they talked about.

"Whatever he did or said is in my brain and it affected me in a way that's positive, even though I can't remember."

The former private pilot doesn't remember if he took his medication or where he and Lorraine went on their honeymoon, but his "technical" memory is impressive. He swears he could still fly a Cessna if he had the chance and he gets great pleasure from taking electronics apart, fixing them, and putting them back together.

He's grateful for his wife, who has supported him in coping with the disease—and struggling to keep their life as normal as possible. He knows that TEA is a condition that can't be managed alone.

"I try to be positive. I try to be happy. A big piece of it is humour."

Lorraine has encouraged him to share his story with medical trainees and he has given impromptu talks at Foothills Hospital about his experiences.

"I don't know whether they're training to be a neurologist or to be proctologist. It makes no difference."

"It's almost like hitting a reset button all the time. Whatever memory circuits you had before are now being broken apart because there is ongoing seizure activity."

— Dr. Colin Josephson

He just wants to share his story and play a part in finding answers.

It's a remarkable perspective for someone with such a devastating condition.

Dr. Josephson has prescribed multiple anti-seizure drugs, but so far they've all had terrible side effects at subtherapeutic doses. As with many powerful medications, finding the balance between help and hinder is difficult.

"What do you accept in terms of seizures versus what do you accept in terms of side effects?" asks the neurologist.

But it hasn't deterred Jim.

When he's not taking apart or building gadgets at home, he's writing about his experience in the hopes that others will find some understanding—or researchers might be inspired to study the issue.

He volunteers once a week at a care centre for people with dementia and Alzheimer's disease and says the visits give him great pleasure.

"There's a bunch of us old farts who sit around and tell lies and drink coffee," he laughs. "I so look forward to Fridays because I have something I can do that will help someone else."

[Click to read Jim Duncan's story "I Don't Remember"](#)

Reconciling with a diagnosis often a key step for patients

AFTER A COMBINED

MD-PhD program at Western University and three years of residency training, Dr. Jason Chan is fascinated by the brain's translation of thought into action — and its inability to do so.

But he understands that for some patients, such as those with newly diagnosed movement disorders or neurodegenerative disorders, there may be no restorative treatment or cure. Patients and their families are faced with a potentially devastating diagnosis and the impact that it will have on their lives.

"I think one of most beautiful things about working in medicine and health care is being able to help people reconcile with their condition," he says.

"There is a huge component in medicine of wanting to treat a patient and wanting to cure disease. But as we know in the clinical neurosciences, learning to live with a condition is also important."

Dr. Chan has soaked up an incredible amount of neurological knowledge during this training and he says the patient is often a valuable teacher.

"We learn about neurological disorders from patients because they're the ones who are experiencing it first-hand," he says.

CONTINUED ON PAGE 18

Resident Dr. Jason Chan ►



CONTINUED FROM PAGE 17

“We learn about how these disorders impact their lives in very multifaceted ways, from their day-to-day function, to their sense of self, to how they interact with people and the environment around them. We learn about how it impacts families and society in general.”

Dr. Chan says that first-hand knowledge inspires him to not only treat patients and learn from them, but — one day as a clinician scientist — to think about research to answer questions that could help them.

“There’s a lot we don’t know about how the brain functions and why dysfunction occurs. For example, how do we create memories, focus our attention, or generate purposeful movements? What happens when we’re unable to do so? What are the mechanisms involved at the genetic, neuronal or network level? I think these are fascinating questions that have important implications for people affected by neurological disorders.”

Despite the difficult work and long hours, he says that finding opportunities for learning keeps him excited to come to work every day.

“There’s always something new to be learned—whether it’s from a patient or a colleague. The entire

PERSONAL VISION

“There’s always something new to be learned — whether it’s from a patient or a colleague.”

— Dr. Jason Chan

health care team contributes, whether it be a student, resident, staff physician, nurse, physical therapist, occupational therapist, pharmacist, or so on.”

And one of those learnings is that patients with a life-changing diagnosis are often unable to process everything that they first hear. At this very vulnerable point in their lives, a conversation is often the first prescription.

“When people become sick, they may not necessarily realize all that it is involved,” he says. “It’s a shock to the system—so I think that helping them understand their condition and come to terms with what that means for them moving forward is a key factor.”



The Calgary Comprehensive Epilepsy Program

Program Lead: Dr. Samuel Wiebe

Overview

Through its strong academic and clinical arms, the Calgary Comprehensive Epilepsy Program (CEP) focuses on achieving the best outcomes for patients suffering from epilepsy. This is accomplished through new developments in clinical research, quality improvement initiatives, and comprehensive, interdisciplinary clinical care. The interdisciplinary team includes a highly skilled group of specialists in epilepsy comprising neurologist epileptologists, epilepsy neurosurgeons, neuropsychiatrists, clinical psychologists, neuropsychologists, neuroradiologists, nuclear medicine specialists, clinical assistant physicians, nurses, EEG technologists, clinical neurophysiologists and administrative staff.



Dr. Samuel Wiebe

The research team has strong collaborations with the Hotchkiss Brain Institute (HBI), the O'Brien Institute for Public Health, and the Alberta Children's Hospital Research Institute. The team includes basic scientists (HBI), health outcomes and health services researchers, and advanced imaging researchers. The CEP clinical research team also continues to have strong collaborations with, and support from, the Brain and Mental Health Research Clinics; an initiative partially funded by DCNS.

As a tertiary care centre, the CEP provides care for a wide breadth of persons with epilepsy, including those with complex epilepsies, and those requiring complex surgical investigations and interventions. Complex and surgical adult and pediatric cases are discussed weekly in multidisciplinary conferences in conjunction with pediatric epilepsy colleagues.

Core clinical facilities available at the CEP include:

- State-of-the-art neurophysiologic assessment, including long-term video-EEG monitoring, day-time video-EEG monitoring, 24-hour ambulatory EEG monitoring, intracranial EEG using multiple

modalities of implantation and electrodes, electrocorticography, functional brain mapping, and intraoperative monitoring and evoked potentials. Analysis of high frequency oscillations (HFOs) is available and automated detection of HFOs has been developed to facilitate EEG source localization.

- Advanced functional imaging includes PET, SPECT, functional MRI with capacity for mapping of cortical function, voxel-based relaxometry and arterial spin labeling, as well as EEG-fMRI interictal and ictal studies.
- The EEG laboratory operates at four hospital sites and the Seizure Monitoring Unit (SMU) operates at the Foothills Medical Centre and the South Health Campus. Continuous video-EEG monitoring is provided at all hospital sites for diagnostic purposes in hospitalized patients, and for seizure management in critically ill patients at all four adult sites in the Calgary Zone.
- Neuropsychologists, clinical psychologists and neuropsychiatrists focusing on epilepsy provide care to patients in the CEP.
- Epilepsy surgery for drug-resistant epilepsy is guided by scalp and intracranial EEG. Surgical techniques include subdural and depth electrodes, stereo-EEG, cortical mapping, the entire breadth of procedures for cortical resection and disconnection, and electrical stimulation/neuromodulation.

Research and Leadership

The CEP houses world-class research teams in prediction models, health services research and outcomes research (Dr. Samuel Wiebe and Dr. Colin Josephson), genomics (Dr. Karl Martin Klein), and in advanced imaging in epilepsy (Dr. Paolo Federico). Members of the CEP serve in leadership positions in organizations such of the Canadian League Against Epilepsy, the International League Against Epilepsy (ILAE), the North American Commission of the ILAE, the Latin American Commission of the ILAE, the Commission on Diagnostics of the ILAE, and the Task Forces on Big Data, epilepsy in the elderly, and guidelines of the ILAE.

CONTINUED ON PAGE 20

CONTINUED FROM PAGE 19

Important initiatives spearheaded this year by Dr. Wiebe as president of the International League Against Epilepsy include: 1) the development and publication of the Competencies-Based Curriculum for Education in Epileptology. This systematically developed curriculum and learning objectives are now being used internationally to develop a large variety of educational tools, including distance learning, that can lead to an Assessment-Based Certificate in Epileptology in countries around the world. 2) Creation of the ILAE Academy, a comprehensive portal for online education in epilepsy; 3) Creation of ILAE Councils on Education, Congresses, Publications and Global Outreach. 4) Producing, in collaboration with the WHO and the International Bureau for Epilepsy, the first Global Report on Epilepsy. 5) Creation of the Next Generation Initiative in Epilepsy to engage young professionals in the field of epilepsy.

Dr. Federico is the chair of ILAE Neuroimaging Task Force. As chair, he organized a full day Neuroimaging of Epilepsy course at the 2019 International Epilepsy Congress in Bangkok. The course addressed learning objectives of the new ILAE educational curriculum and it was very well-received.

Quality of Care

The CEP has developed a thriving quality of care program that systematically evaluates clinical care and patient outcomes in the SMU and in the epilepsy clinics. This year, the CEP database has expanded significantly in scope and aims to promote patient outcomes through integrating clinical, EEG, MRI, genomic, and electronic health records data. Additionally, funding has been secured to create a multicentre consortium on epilepsy clinical data, led by Drs. Josephson and Wiebe, using the CEP clinical database model and structure.

Highlights

- The CEP held a very successful second Banff International Epilepsy Symposium in February 2019 on the topic of “Epilepsy Across the Lifespan.” In addition to our local speakers, the one-day symposium featured four renowned national and international researchers in the field.

- The 2018 Mary Anne Lee Memorial lecturer in epilepsy was Dr. Brian Litt from University of Pennsylvania, who spoke about “Big Data, Machine Learning and Collaboration in Translational Epilepsy Research.”
- The CEP held its annual epilepsy research retreat, in conjunction with the HBI, with presentations by trainees and prizes for best trainee presentations.
- Dr. Paolo Federico in 2017 co-led the Hotchkiss Brain Institute’s Epilepsy NeuroTeam and leads a world-class team which uses fMRI techniques to solve problems of complex epileptogenesis. His research focuses on intracranial EEG-fMRI recordings, Arterial Spin Labeling MRI, and automated High Frequency Oscillation detection algorithms to identify the seizure focus. He is conducting a clinical trial looking for a new indication for ibuprofen and nifedipine to prevent postictal hypoperfusion.
- Dr. Walter Hader continues to implement robotic implantation of intracranial EEG electrodes in children and adults using the Rosa System, acquired through a donation from Bob and Brenda McNeil. He continues to attract international epilepsy surgery fellows. Importantly, Dr. Hader has garnered support for the acquisition and implementation of state of the art Stereotactic Laser Interstitial Thermal Therapy in epilepsy, later in 2019.
- Drs. Sophia Macrodimitris and Ruby Sharma run a successful cognitive behavioural therapy program for epilepsy patients with anxiety and depression, and they offer much needed psychological support for epilepsy patients. They train psychology practicum students through the University of Calgary and residents through the Calgary Clinical Psychology Residency Program. They also provide support for patients with functional neurological symptom disorder (Conversion Disorder) presenting as epileptic seizures. Dr. Joanne Stephen provides psychological services for epilepsy patients at the South Health Campus.
- Drs. Lisa Partlo and Kim Goddard use standardized procedures for neuropsychological testing in epilepsy patients across hospitals, providing a uniquely strong team for our CEP. Drs. Brienne McLean and Aaron Mackie, neuropsychiatrists affiliated to the CEP, provide invaluable support to our many patients with psychiatric comorbidities.

We were fortunate to recruit a new fulltime neurologist clinical epileptologist to the adult CEP. Dr. Andrea Salmon, who trained at Western University, will be participating in the full scope of activities of the CEP. Dr. Julie Krom, a neurologist neurointensivist with full training in EEG, joined our group in continuous video-EEG monitoring of patients in the intensive care unit.

There are important developments in pediatric epilepsy this year:

- Dr. Juan Pablo Appendino was the chair of the Canadian Board of Registered EEG Technologists and held a successful Canadian examination this year again.
- Dr. Julia Jacobs from Freiburg, Germany has accepted a position as director of the pediatric epilepsy program and will be starting shortly.

Dr. Pierre Levan, also from Freiburg, has been jointly recruited by Alberta Children's Hospital Institute and the Hotchkiss Brain Institute to continue his work on advanced imaging in epilepsy.

In the basic sciences, the Hotchkiss Brain Institute continues to be a strong partner in various fronts:

- Dr. Cam Teskey's CIHR-funded research program discovered that a severe hypoperfusion/hypoxic event follows a seizure, which has implications for postictal behavioural dysfunction including paralysis, memory disturbances and Sudden Unexpected Death in Epilepsy.
- Dr. Quentin Pittman's lab employs multiple approaches to investigate neuronal function from the entire organism to the single cell.

This year we graduated two neurophysiology fellows who will be certified in EEG by the Canadian Society of Clinical Neurophysiology—Dr. Joseph Peedicail from India, and Dr. Amal Al-Mohawes from Saudi Arabia.

Dr. Karl Martin Klein has successfully established his research program in epilepsy genetics and genomics, as well as precision medicine. He retains a special interest in multiplex families with epilepsy as well as adult and pediatric patients with epileptic encephalopathies. He coordinates an international consortium (RAISE-GENIC, funded by the ERA PerMed Cofound) which aims to develop tools that help physicians to select the anti-seizure drug with the best chance of success in individual patients.

Dr. Billie Au (Medical Genetics), Dr. JP Appendino (Pediatrics) and Dr. Karl Martin Klein have established the Genetic Epilepsy Clinic for patients with unsolved genetic epilepsies.

Dr. Wiebe continues to lead the overall CEP. Dr. Paolo Federico is lead of the EEG laboratories, epilepsy clinics, and the SMU. Drs. Shaily Singh and Colin Josephson are the co-directors of education and fellowships. Dr. William Murphy oversees clinical assistants and clinical trials.

Dr. Wiebe chairs the Clinical Research Unit for the Cumming School of Medicine, and is serving his second year as president of the International League Against Epilepsy.

Members

Adult Epileptology: Dr. Paolo Federico, Dr. Alexandra Hanson, Dr. Colin Josephson, Dr. Brain Klassen, Dr. Karl Martin Klein, Dr. William Murphy, Dr. Andrea Salmon, Dr. Shaily Singh, Dr. Samuel Wiebe
 Pediatric Epileptology: Dr. Juan Pablo Appendino, Dr. Alice Ho, Dr. Morris Scantlebury, Dr. Julia Jacobs
 Neurosurgery: Dr. Walter Hader, Dr. Yves Starreveld
 Neuropsychiatry: Dr. Aaron Mackie, Dr. Brienne McLean
 Clinical psychology: Dr. Sophia Macrodimitris, Dr. Ruby Sharma, Dr. Joanne Stephen
 Adult Neuropsychology: Dr. Lisa Partlo, Dr. Kim Goddard
 Neuro-Intensive Care: Dr. Julie Krom
 Pediatric Neuropsychology: Brian Brooks, Marsha Vasserman, Naddley Desire, Sandra Mish, Taryn Fay-McClymont, William MacAllister
 Adult Neuroradiology: Dr. James Scott
 Nuclear Medicine: Dr. Christine Molnar, Dr. Leonard Numerow, Amar Suchak
 Pediatric Neuroradiology: Dr. Xing-Chang Wei
 Basic Science: Dr. Cam Teskey, Dr. Quentin Pitmann, Dr. Pierre Levan
 Clinical Assistants: Dr. Reynaldo Avendano, Dr. Salma Hanna
 Adult Epilepsy Fellows: Dr. Joseph Peedicail (graduated), Dr. Amal Al-Mohawes (graduated)
 Pediatric Epilepsy Fellows: Dr. Natarie Liu (graduated)
 Epilepsy Nurses: Meliza Camerino, Amira Jivraj, Jackie Martini, Michele Zulinick, Andrea Palmer, Wendy Chen

The Calgary Stroke Program

Program Lead: Dr. Andrew Demchuk

Overview

The Calgary Stroke Program (CSP), a collaboration between the University of Calgary (DCNS and Hotchkiss Brain Institute) and Alberta Health Services (AHS), continues to lead and contribute to the field of stroke care. Our program figured prominently nationally and internationally on a number of fronts. We continue to strive to meet our vision of “Creating the Future of Stroke Care.”



Dr. Andrew Demchuk

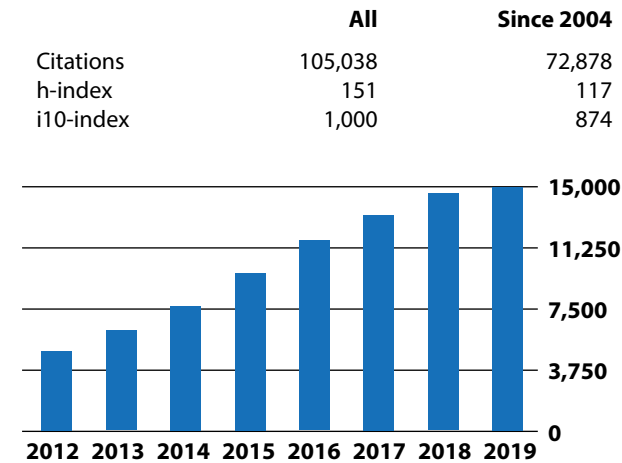
Highlights/Key Publications

As the major CSP led publication of the year, Dr. Shelagh Coutts (PI) and colleagues published the main results of the five-year CIHR-funded DOUBT study entitled: Rate and Prognosis of Brain Ischemia in Patients With Lower-Risk Transient or Persistent Minor Neurologic Events. JAMA Neurology 2019 Sep 23. doi: 10.1001/jamaneurol.2019.3063.

An ongoing achievement of the program continues to be a leadership role in the HERMES Collaboration, led by Dr. Mayank Goyal. The collaboration successfully brought together all seven predominantly stent retriever based randomized clinical trials of mechanical thrombectomy in stroke (five published in NEJM 2015). This HERMES collaboration continues to roll out many publications—Lancet (1), JAMA (1), Lancet Neurology (3), JAMA Neurology (1), Stroke (6), Int J Stroke (1) and JNIS (2)—that are influencing guidelines for EVT care throughout the world by clarifying when and how endovascular treatment is effective. Several of these manuscripts have been first or senior authored by CSP members, including Dr. Goyal, Dr. Michael Hill, Dr. Bijoy Menon and Dr. Mohammed Almekhlafi.

Dr. Coutts was also senior author of the SpecTRA study publication entitled: Sex Differences in Presentation and Outcome After an Acute Transient or Minor Neurologic Event. JAMA Neurology 2019 May 22. doi: 10.1001/jamaneurol.2019.1305.

Dr. Hill and Dr. Andrew Demchuk each co-authored



Calgary Stroke Program publication statistics.

commissioned review articles in Lancet on the topic of acute ischemic stroke (Lancet. 2018 Oct 6;392(10154):1247-1256.) and intracerebral hemorrhage (Lancet. 2018 Oct 6;392(10154):1257-1268).

The collective H-index of the clinician scientists within the program now exceeds 150, with over 105,000 citations and 1,000 publications cited at least 10 times.

Clinical Trials

Dr. Coutts (PI) is leading the multicentre TEMPO-2 trial examining Tenecteplase (2nd generation tPA) for patients with mild stroke with a proven intracranial occlusion. Sites are active in Canada, UK, Ireland, Austria, Spain and Australia with further sites soon active in Brazil and Israel. 414 subjects have been enrolled.

Dr. Hill and Dr. Goyal (PIs) continue to lead the ESCAPE NA-1 trial which is a collaboration between The Calgary Stroke Program and NoNO Inc (Toronto) to study a novel neuroprotectant (NA-1) in patients undergoing endovascular treatment for acute stroke. This trial has now completed enrollment of 1,105 subjects with a rapid ramp up to twice daily enrollment achieved from over 50 sites in multiple countries. Results will be presented in early 2020.

Main results of two major randomized clinical trials

supported at steering committee level by members of the Calgary Stroke Program were published. STOP-IT/SPOTLIGHT trials (JAMA Neurol. 2019 Aug 19) and CLOTBUST-ER trial (Lancet Neurol. 2019 Apr;18(4):338-347.)

Dr. Menon, Dr. Hill, Dr. Goyal, Dr. Brian Buck and Dr. Rick Swartz received funding for “Alteplase Compared to Tenecteplase in patients with Acute Ischemic Stroke: QulCR & OPTIMISE Registry based Pragmatic Randomized Controlled Trial”. The award for the grant was \$1,277,550 over three years. It ranked second out of 37 applications to the Randomized Controlled Trials 2 committee. Recruitment to the ACT-QulCR trial is expected to begin before year end.

Dr. Demchuk (co-PI) will soon initiate recruitment of a phase 2/3 randomized trial of endovascular treatment in mild stroke entitled ENDOLOW in conjunction with co-PIs at Emory University (Atlanta), University of Cincinnati (Ohio) and Heidelberg University (Germany). This is a 200 patient study at 30 centres in four countries.

Dr. Almekhlafi and Dr. Goyal (PIs) received funding for “Evaluating oral peri-operative acetylsalicylic acid in patients undergoing endovascular coiling-only of unruptured brain aneurysms. A Phase 3 Multicenter Randomized Placebo-Controlled Trial”. The award for the grant was \$569,926 over three years. Ranking 2nd out of 40 applications in Clinical Investigation D committee. Recruitment to the EVOLVE trial is expected to begin shortly.

Dr. Phil Barber received a Grant-in-Aid from Heart and Stroke Foundation of Canada: “Predementia Neuroimaging of Transient Ischemic Attack (TIA) – PREVENT Study” for \$300,000 over three years.

Team Grant/Core Lab Progress

The QulCR Alberta Stroke Program is an Alberta Innovates CRIO grant that has just completed its funding cycle supporting a number of quality improvement and clinical trial activities.

Dr. Demchuk continues to lead the implementation of the “CaSTOR Canadian Stroke Trials for Optimized Results” national stroke clinical trials network funding by CIHR/ Institute of Circulatory and Respiratory Health. This \$1.5 million emerging networks grant (2015-2020) is a collaboration with the Canadian Stroke Consortium and Canadian Partners for Stroke Recovery. A second early career workshop is planned for WSC/ESOC 2020 in

Vienna to followup from the first one led by GAINS.

The Stroke Imaging Core Lab coordinates brain MRI and CT imaging for observational studies and clinical trials, with more than 15,000 brain scans analyzed. Imaging endpoints include strokes, hemorrhages, vascular occlusions, brain perfusion, and others. These endpoints are critical for understanding the natural history of stroke and the effectiveness of new treatments. The most recent accomplishment from the imaging core lab was the volumetric analysis of intracranial hemorrhages for a new antidote to direct Factor Xa inhibitors published in NEJM 2019 and two recent presentations of MRI substudies for the NAVIGATE and COMPASS trials.

The acute stroke imaging research program has expanded to now have research fellows from countries as diverse as The Netherlands, South Korea, UK, Switzerland, Saudi Arabia, Japan and China. The program has a full time imaging scientist, post docs and graduate students along with stroke fellows, neurology and radiology residents and summer students.

The program also recruited the first intern from the Bio-Medical Imaging Department to do a one-year internship on stroke image processing. New research focuses on using deep learning and machine learning tools for analysis of large imaging datasets, automating image interpretation and understanding neuro-cognitive aspects of image interpretation.

Personal Achievements/Appointments

Dr. Goyal successfully defended his PhD thesis at Erasmus University in Rotterdam, Netherlands.

Dr. Demchuk was one of seven scientists at University of Calgary named as a “Web of Science highly cited researcher (top 1%).”

Dr. Sean Dukelow and Dr. Demchuk were named co-leads of the Leadership Council for Canadian Partnership for Stroke Recovery which replaces the role of Chief Scientific Officer with CPSR.

Dr. Julie Kromm joined the Department of Critical Care as a neurointensivist. She will also partake in stroke service care as an attending stroke physician after completing one year of combined fellowship in stroke and neurocritical care at Columbia University.

CONTINUED ON PAGE 24

CONTINUED FROM PAGE 23**Clinical Care Achievements**

Initial planning of a new integrated stroke unit at Foothills Medical Centre has begun. Architectural firm Group 2 and AHS (Nora Smith, lead) have led the planning sessions. The goal remains to complete a functional plan document within six months that describes the critical elements needed for a new unit and architectural renderings of how it might look. This is a critical first step toward a future capital fundraising campaign and ultimate build of a new world-class integrated stroke unit.

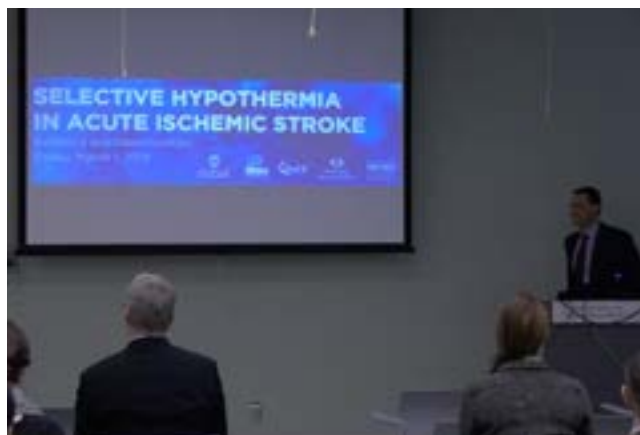
The Stroke Program has once again completed another cycle of Stroke Accreditation and received full accreditation for acute, prevention and rehabilitation activities for four years.

The acute stroke endovascular program continues to grow with a further increase in thrombectomy rates in fiscal year 2018-2019. We now also have admin data measurement of outcomes after thrombectomy, called “home time” (number of days in first 90 that patient is back home from stroke admission). This data reveals a remarkable 37 per cent rate of 85-90 day home time amongst severe strokes treated with this intervention performed at FMC. This means that more than one in three endovascular treatment patients are returning home with little or no disability within five days of stroke admission.

Conference Leadership

The program successfully hosted our fourth 5T Stroke Conference in Kananaskis in June 2019 with over 200 participants in attendance.

The CSP has taken a leadership role, bringing together global collective expertise in selective hypothermia treatment. The first ever selective hypothermia symposium was organized by Dr. Almekhlafi and hosted in Calgary on March 1, 2019. This academic and commercial consortium plans to continue to collaborate in hopes to accelerate foundational science knowledge and technological development so that a human clinical trial protocol to cool the ischemic hemisphere can be safely implemented and tested in large efficacy trials. Two foundational science grants on the topic of selective hypothermia were recently successfully funded by CIHR (Dr. Fred Colbourne) and HSF (Dr. Ting Lee) with Drs. Almekhlafi and Demchuk as co-investigators.



▲ **Dr. Mohammed Almekhlafi opens the hypothermia symposium in March.**

Education

As of June this year, our program is training and/or has graduated 86 stroke fellows, from 21 countries including Canada. Last year we trained eight fellows, including three Canadians. In addition, we have seen a major increase in applications to our fellowship program, with on average three applicants per month.

Our research fellow/sabbatical and observership program has expanded substantially with 14 individuals from nine countries spending at least a week or much longer with the CSP in 2018-2019.

Members

Stroke Neurology: Dr. Mohammed Almekhlafi, Dr. Simer Bal, Dr. Phil Barber, Dr. Philippe Couillard, Dr. Shelagh Coutts, Dr. Andrew Demchuk, Dr. Michael Hill, Dr. Adam Kirton (Pediatrics), Dr. Gary Klein, Dr. Bijoy Menon, Dr. Alekys Mineyko (Pediatrics), Dr. Steve Peters, Dr. Eric Smith, Dr. Peter Stys, Dr. Suresh Subramaniam, Dr. Julie Kromm
 Stroke Physical Medicine and Rehabilitation: Dr. Sean Dukelow, Dr. Ken Lam, Dr. Gentson Leung, Dr. Steve McNeil
 Physician Assistant: Allen Szabon
 Vascular Neurosurgery: Dr. Alim Mitha, Dr. Garnette Sutherland, Dr. John Wong
 Interventional Neuroradiology: Dr. Muneer Eesa, Dr. Mayank Goyal, Dr. Will Morrish
 Nurse Practitioner: Nancy Newcommon
 Stroke Program Manager: Samantha Arnott
 Stroke Fellowship Program Administrator: Emily Collins
 Stroke Observership/Sabbatical Program Administrator: Lori Herard

The Cognitive Neurosciences Program

Program Lead: Dr. Eric Smith

Overview

The Cognitive Neurosciences Clinic provides expert medical consultation for patients with cognitive disorders; educates undergraduate and postgraduate learners; and conducts research on the causes, medical evaluation, and treatment of cognitive disorders and dementia. The program is directed by Dr. Eric Smith.



Dr. Eric Smith

Our multidisciplinary physician workforce is a unique aspect of our program, allowing us to provide comprehensive evaluations for complex neurological and psychiatric disorders as well as overlap syndromes. There are six neurologists (Drs. Philip Barber, Alicja Cieslak, Bijoy Menon, David Patry, Dawn Pearson, and Eric Smith) and four psychiatrists (Drs. Robert Granger, Zahinoor Ismail, Aaron Mackie and Brienne McLane) who see patients at the two clinic sites at Foothills Medical Centre and the South Health Campus.

Our research team is located at the Ron and Rene Ward Foundation Centre for Healthy Brain Aging at the University of Calgary. The team includes a project manager, MRI physicist, two research nurses, five research assistants, one post-doctoral fellow, two PhD students, and four master's students. Dr. Smith co-leads, with basic scientist Dr. Roger Thompson, the Hotchkiss Brain Institute Dementia and Cognitive Disorders Neuroteam. Eligible clinic patients are offered participation in clinical trials and the observational COMPASS-ND cohort study of the Canadian Consortium on Neurodegeneration in Aging.

Clinical Care Highlights

We received 577 new referrals last year. A similar number of patients are seen in followup. Next year we will welcome Dallas Seitz, a geriatric psychiatrist from Sunnybrook Hospital in Toronto, as our newest clinic physician.

Focus on education

Medical students and residents participate in the Cognitive Neuroscience Clinic at the Foothills and South Health Campuses as part of ambulatory and elective rotations. We run a practice examination station on cognitive disorders to help prepare our neurology residents for their final year qualifying examination by the Royal College.

Research training is another important aspect. We train graduate students, residents, and fellows in methods for researching cognitive disorders. Drs Smith, Ismail, and Barber combined to supervise a post-doctoral fellow, three PhD students, and six master's students in neurosciences and community health sciences at the University of Calgary.

Research Highlights

Dr. Eric Smith holds the Katthy Taylor Chair in Vascular Dementia from the University of Calgary and is funded by a Canadian Institutes of Health Research Foundation Award. Drs. Philip Barber and Zahinoor Ismail hold competitive peer-reviewed awards from the Canadian Institutes of Health Research and the Heart and Stroke Foundation of Canada. Dr. Ismail is the new Director of the Board of the Canadian Conference on Dementia. The next Canadian Conference on Dementia will be in Quebec in October 2018 and the following conference will be in Calgary in October 2020.

Members

Neurology: Dr. Eric Smith (Director), Dr. Philip Barber, Dr. Alicja Cieslak, Dr. Bijoy Menon, Dr. David Patry, Dr. Dawn Pearson

Psychiatry: Dr. Robert Granger, Dr. Zahinoor Ismail, Dr. Aaron Mackie, Dr. Brienne McLane

Nursing: Karyn Fischer, Heather Jones, Patricia Mueller, Brenda Pomerance, Courtney Leitch

Neuropsychology: Dr. Catherine Burton, Dr. Kim Goddard

Calgary Headache Assessment and Management Program

Program Lead: Dr. Lara Cooke

CHAMP has seen a year of growth with two new neurologists and a series of new workshops now available to support headache patients seen by neurologists around the city. The program saw over 2,300 patients in the fiscal 2018-19 year.

CHAMP welcomed Dr. Wei Liu and Dr. Laura Baxter to South Health Campus in the summer of 2019 to care for patients with complex headaches.

In addition, the program's Nurse Practitioner, Jennifer Kirker, developed and now delivers monthly self-management workshops and lifestyle management workshops tailored to the needs of headache patients. The program has made these sessions available for patients of neurologists across Calgary; now more patients can access CHAMP's multidisciplinary, behaviourally focused programs.



Dr. Lara Cooke

To round out our multidisciplinary programs, we now have monthly education sessions on medication for headache, and through a collaboration with Dr. James Kim, a family physician at MOSAIC PCN, headache education sessions are offered regularly to headache patients in Northeast Calgary.

On the research front, CHAMP continues to lead several research trials, and Dr. Farnaz Amoozegar was awarded a catalyst grant for an investigator-initiated clinical trial looking at the role of cannabis in the treatment of migraine headache.

What's next? In 2020, the CHAMP program will develop a headache registry in collaboration with Dr. Serena Orr, a new pediatric headache specialist at Alberta Children's Hospital. The goal of the registry will be to support longitudinal research on the natural history of migraine, quality improvement projects in the program, reduction of practice variation, and exploration of the relationships between adult migraineurs and their children who develop migraine.



The General Neurology Program

Program Lead: Dr. Megan Yaraskavitch

Overview

The General Neurology Program involves many of the members of the Section of Neurology. These members provide outpatient clinical services to patients at each of the four adult hospital sites and in the community.



Dr. Megan Yaraskavitch

Highlights

Over the past several years the General Neurology Program in Calgary has implemented many innovations in care delivery and system processes. Our Neurology Central Access and Triage (NCAT) has expanded to involve all specialties within neurology (with the exception of Stroke and Urgent Neurology) to simplify the referral process for referring practitioners.

Additionally, we have worked with the Primary Care Network to provide a telephone consult service, Specialist Link, which includes timely telephone advice for referring physicians who have general neurology questions about their patients.

Additional innovations have been implemented to help improve quality of care and access, including increased usage of multidisciplinary services for general neurology patients and an active locum general neurologist program.

Education

Residents, clerks and medical students commonly spend time in the general neurology clinics.

Members

Dr. Katie Wiltshire, Dr. Brian Klassen, Dr. Jodie Burton, Dr. Ronak Kapadia, Dr. Alexandra Hanson, Dr. Michael Hill, Dr. Phil Barber, Dr. Lara Cooke, Dr. Kevin Busche, Dr. Jephtha Davenport, Dr. Sam Chhibber, Dr. David Patry, Dr. Farnaz Amoozegar, Dr. Dawn Pearson, Dr. Gary Klein, Dr. William Murphy, Dr. Scott Wilson, Dr. Jagdeep Kohli, Dr. Hamid Ebadi, Dr. Simer Bal, Dr. Scott Jarvis, Dr. Yanjun Duan, Dr. Shaily Singh, Dr. Bijoy Menon, Dr. Megan Yaraskavitch, Dr. Steven Peters, Dr. Alicja Cieslak, Dr. Wei Liu, Dr. Tyson Brust, Dr. Gerald Pfeffer, Dr. Veronica Bruno, Dr. Lisa Hoyte, Dr. Scott Wilson, Dr. Nick Cothros



Neurologist Dr. Farnaz Amoozegar, who received a grant to study headache and cannabis, is recognized at an event hosted by the Dean of the Cumming School of Medicine in May 2019.

The Multiple Sclerosis (MS) Program, MS and Neuroimmunology Clinics

MS Program Lead: Dr. Michael Yeung

Neuroimmunology Lead: Dr. Katayoun Alikhani

Overview

The Multiple Sclerosis (MS) Program provides multidisciplinary, population-based care to people with MS and other Central Nervous System (CNS) demyelinating disorders living in Southern Alberta and Southeastern British Columbia. We are “one program on two sites” with clinics at both Foothills Medical Centre and South Health Campus.

The services provided by our specialized clinical team, based on a chronic disease management approach, include medical, nursing, rehabilitation and counseling. Our goal is to prevent or lessen disability and optimize wellness. Our team also provides leadership in care delivery and regularly provides advice regarding policies related to MS care.

The Neuro-Immunology Clinic provides multidisciplinary care to patients with various neuro-inflammatory disorders, including neurosarcoidosis, vasculitis, and other systemic immune-mediated disorders affecting the nervous system. Both the MS Program and the Neuro-Immunology Clinic continue to expand in terms of numbers of patients and numbers of physicians.

Education

The MS Program supports the education of trainees at all levels. Neurology residents do MS Clinic rotations in their junior and senior years. MS fellows are involved in care and research. There are currently three MS fellows: Dr. Laura Baxter (University of Calgary), Dr. Myriam Levesque-Roy (McGill University), and Dr. Jacinthe Comtois (Universite de Montreal). MS fellowships at the University of Calgary MS Program can be either clinical- or research-based, and can be from one to two years.



**Dr. Michael
Yeung**



**Dr. Katayoun
Alikhani**

Research

The MS program is well recognized for its research strengths. In association with the Hotchkiss Brain Institute, research includes translational research, clinical and epidemiological research, basic science, innovations in imaging and trial design, and clinical trials. Several investigator-initiated trials are ongoing in RRMS and progressive MS.

Dr. Luanne Metz's translational research trial of minocycline in clinically isolated syndrome was published in the New England Journal of Medicine in 2017. This was a multi-centre clinical trial that was funded by the MS Society of Canada. The risk of conversion from a clinically isolated syndrome to MS was significantly lower with minocycline versus placebo over six months. This research is expanding into further clinical trials of minocycline.

Members

Neurologists: Katayoun Alikhani, Tyson Brust, Jodie Burton, Kevin Busche, Carlos Camara-Lemarroy, Jonathan Fridhandler, Chris Hahn, Marcus Koch, Scott Jarvis, Wei-Qiao Liu, Luanne Metz, David Patry, Michael Yeung

Physiatrists: Dan McGowan

Neuro-psychiatrists: Aaron Mackie, Scott Patten, Rory Sellmer

Basic and Imaging Scientists: Jeff Biernaskie, Lenora Brown, Jeff Dunn, Richard Frayne, Bradley Goodyear, Hedwich Kuipers, Shalina Ousman, Bruce Pike, Quentin Pittman, Pere Santamaria, Peter Stys, Robin Yates, V. Wee Yong, Yunyan Zhang

The Movement Disorder Program

Program Lead: Dr. Davide Martino

Overview

The Movement Disorders Program at the University of Calgary is a multi-disciplinary team comprised of neurologists, psychiatrists, a geriatrician, a psychologist, a neurosurgeon, a social worker, specialist nurses and basic scientists. The clinical team provides treatment for a variety of movement disorders, including Parkinson's disease, essential tremor, dystonia, Huntington's disease, Tourette syndrome, drug-induced movement disorders, and ataxias.



Dr. Davide Martino

Highlights

The MR-guided High-intensity Focused Ultrasound surgical treatment for refractory tremor has been active for two and a half years, in collaboration with the FUS Research Team. This ablative procedure has been life-changing for patients. Future applications for this treatment include refractory tremor-predominant Parkinson's disease and dystonia.

The clinical program is subdivided into the following subspecialty clinics:

- Botulinum toxin clinics for the treatment of hyperkinetic movement disorders, including ultrasound- and EMG-guided injections
- General movement disorders clinics – primary focus being treatment of Parkinson's disease
- Multidisciplinary Huntington's disease clinics – comprehensive management of Huntington's disease through collaborative care by neurology, psychiatry, nursing and social work
- Drug-induced movement disorder clinic
- Deep brain stimulation assessments for a variety of movement disorders
- Pre- and post-operative assessment for MR-guided high-intensity focused ultrasound thalamotomy for medically refractory essential and dystonic tremor
- Duodopa program for the advanced treatment of Parkinson's disease

Research

The Movement Disorders Program has a research registry and database that will benefit the members of the Movement Disorders NeuroTeam and facilitate collaborations with other centres provincially, nationally and internationally. This is part of a larger initiative named the Calgary Parkinson's Research Initiative (CaPRI). Two large-scale studies led by the Tourmaline Oil Chair in Parkinson's disease (Dr. Oury Monchi) and involving various researchers and clinicians of the Movement Disorders NeuroTeam are underway:

- An observational, longitudinal study that aims to identify biomarkers (including neuroimaging, clinical, genetic and other molecular ones) that are predictive of dementia in Parkinson's disease (PD) and compare cognitive decline in PD with mild cognitive impairment found at the prodromal stages of other neurodegenerative diseases, such as Alzheimer's disease.
- An interventional study about the effect of multiple sessions of high frequency transcranial magnetic stimulation (theta-burst paradigm) on the cognitive deficits in PD-MCI, and associated patterns of functional activity and connectivity as observed with task-based and resting-state fMRI.

A large scale study led by Dr. Martino, currently ongoing, focuses on the analysis of kinematic, electrophysiological and imaging endophenotypes related to the progression of idiopathic isolated dystonia and of the psychiatric spectrum of idiopathic dystonia.

An observational study led by Dr. Martino is exploring the gut microbiome diversity and its association with immune-inflammatory markers in relation to cognitive progression in Parkinson's disease. An observational study of high intensity focused ultrasound thalamotomy for tremor is currently underway, led by Dr. Zelma Kiss.

CONTINUED ON PAGE 30

CONTINUED FROM PAGE 29

An interventional study is currently ongoing (led by Dr. Martino) about the effect of multiple sessions of cathodal transcranial direct current stimulation of the bilateral supplementary motor area during the application of habit reversal strategies on the severity of tics in adolescents and adults with Tourette syndrome, and associated patterns of functional activity and connectivity as observed with resting-state fMRI.

An interventional study of the effect of botulinum neurotoxin on off-dystonia in PD, and a larger multidisciplinary observational study to investigate pain phenomenology and pathomechanisms in PD are led by Dr. Veronica Bruno.

Dr. Bin Hu's Ambulosono trial now encompasses other national and international sites.

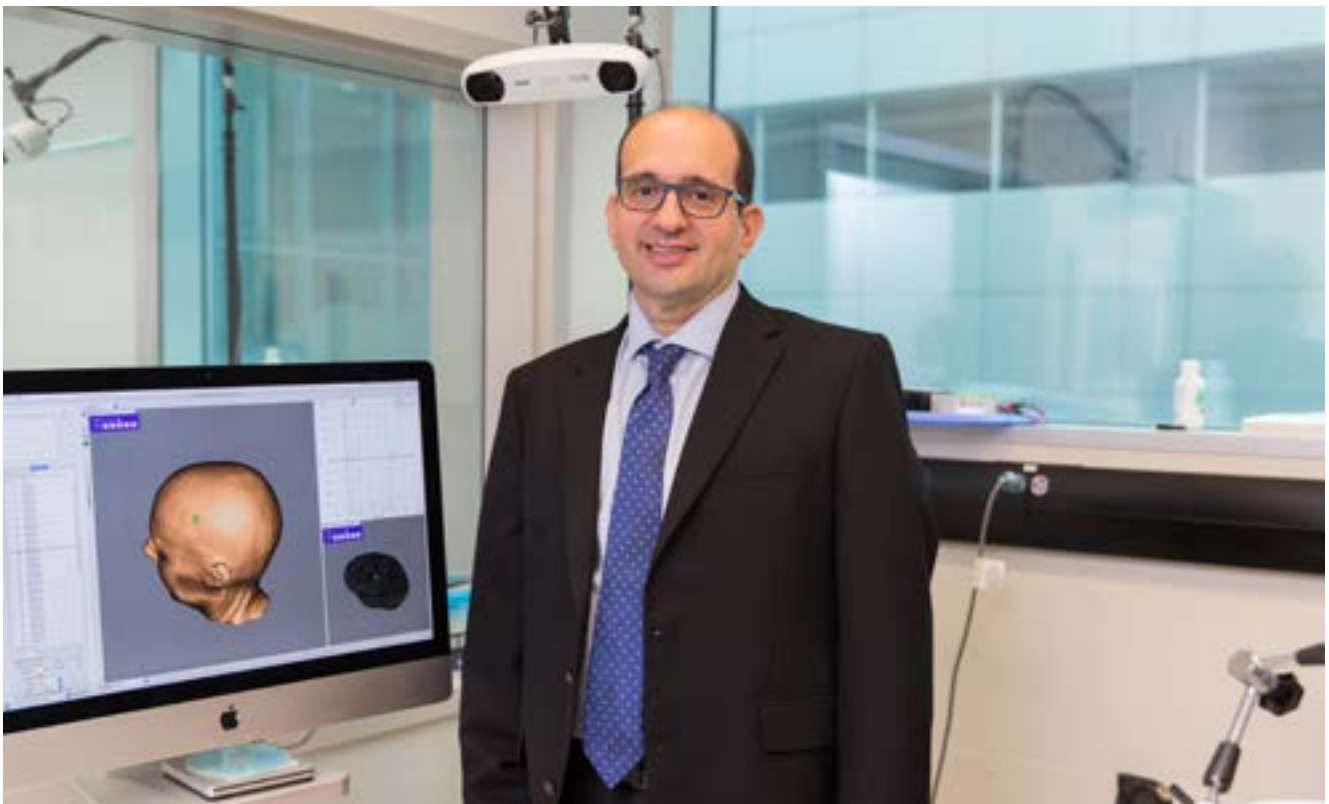
Other multicentre clinical trials include:

- A randomized, double-blind, placebo-controlled multiple dose study to assess efficacy, safety, tolerability and pharmacokinetics of intravenous ABBV-8E12 in Progressive Supranuclear Palsy

- COSMOS – co-medication study assessing mono- and combination therapy with levodopa carbidopa intestinal gel
- CADENCE – observational study in patients treated with Duodopa to assess long-term outcomes
- Observational study of Huntington's disease (ENROLL-HD trial) – recruitment ongoing

Members

Neurologists: Dr. Veronica Bruno, Dr. Alicja Cieslak, Dr. Sarah Furtado, Dr. Scott Kraft, Dr. Davide Martino, Dr. Tamara Pringsheim, Dr. Justyna Sarna
 Psychiatrists: Dr. Jeremy Quickfall, Dr. Aaron Mackie, Dr. Brienne McLane
 Neurosurgeon: Dr. Zelma Kiss
 Geriatrician: Dr. Zahra Goodarzi
 Psychologist: Dr. Angela Haffenden
 Social Worker: Melinda Hatfield
 Researchers: Dr. Bin Hu, Dr. Oury Monchi, Dr. Taylor Chomiak, Dr. David Park
 Nurses: Karen Hunka, Nancy Labelle, Meliza Camerino, Pia Lawrence, Carol Pantella, Eric Tse
 Research Co-ordinator: Lorelei Tainsh
 Administrative Staff: Bonita Woytowich, Jordana Fife



▲ Dr. Oury Monchi in the PCAN lab where transcranial magnetic stimulation is being studied.

The Neuro-Oncology Program

Program Lead: Dr. Paula de Robles

Overview

The Neuro-Oncology Program focuses in the diagnosis, treatment and followup of patients with primary central nervous system tumours, neurological complications of cancer, and neurological paraneoplastic syndromes. We are a multidisciplinary program that works closely with the surgical neuro-oncology, neuropathology, and palliative care programs.

The majority of referrals are seen within 14 days. Cases are reviewed in weekly neuro-oncology multidisciplinary rounds, which include the participation of neuro-oncology, radiation oncology, neuroradiology, neurosurgery, neurology, neuropathology, pharmacy, psychosocial services, nursing, research staff, and trainees. Brain tumour patients are then seen in a multidisciplinary clinic.



**Dr. Paula
de Robles**

Research

Our brain tumour patients are offered participation in multiple investigator-initiated and multi-centre clinical trials. Trainees have the opportunity to gain

wet lab experience in the Clark Smith Brain Tumour Centre in the Charbonneau Cancer Institute at the University of Calgary.

Education

The Neuro-Oncology Program trains medical oncology, radiation oncology, internal medicine, and neurology residents. We also provide fellowship training in neuro-oncology.

Members

Neuro-Oncologists: Dr. Roger Tsang,
Dr. Gloria Roldan Urgoiti, Dr. Gregory Cairncross,
Dr. Paula de Robles
Radiation Oncologists: Dr. Gerald Lim,
Dr. Salman Faruqi, Dr. Shaun Loewen
Neurologist: Dr. Alexandra Hanson
Neurosurgeons: Dr. Mark Hamilton,
Dr. John Kelly, Dr. Yves Starreveld
Clinical Psychologist: Dr. Guy Pelletrier
Nurses: Caroline Warner, Deenar Alwani,
Cindy Yorke, Ginny Holm, Diane Jahraus
Nurse Practitioner: Catriona Leckie
Research Nurse: Luanne Crawford
Pharmacist: Frances Cusano
Clinical Trial Co-ordinator: Sonali Deshpande

The Neuromuscular Program

Program Lead: Dr. Lawrence Korngut

Overview

The Department of Clinical Neurosciences Neuromuscular Program provides health care services for people with disorders of the peripheral nervous system. The Neuromuscular Program clinical activity is consolidated at the South Health Campus, which provides a unique opportunity to provide patient-centred multidisciplinary care, including a broad range of expert Allied Health services. The program includes the following clinics:

ALS and Motor Neuron

Disease Clinic: For people with amyotrophic lateral sclerosis (ALS) and related motor neuron diseases.

Neuromuscular Clinic:

For people with disease of nerve, neuromuscular junction and muscle. Examples include Guillain-Barré syndrome, myasthenia gravis, and inclusion body myositis.



Dr. Lawrence Korngut

Neuromuscular Genetics Interdisciplinary Clinic:

A clinic that focuses on improving function in people with neuromuscular diseases while receiving further genetic diagnostic evaluations and followup (combined rehabilitation team, physiatry and neurology).

Neuromuscular Rehabilitation Clinic: A clinic that focuses on improving function in people with neuromuscular disease. Dr. Stephanie Plamondon and the clinic were recognized by Muscular Dystrophy Canada for their innovative model and tremendous care provided to patients.

Peripheral Nerve Clinic: A clinic to serve people with nerve injuries or disorders that may benefit from surgical intervention.

Electromyography Clinics: Diagnostic clinics for those with disorders of the peripheral nervous system.

All of the above clinics are multi-disciplinary. Depending on clinic needs, patients may see

multiple physicians (neurologist, physiatrist, respirologist, palliative care doctor, plastic surgeon, or neurosurgeon), nurses, Allied Health care providers (physiotherapist, occupational therapist, speech and language pathologist, dietitian, social worker, neuropsychologist, respiratory therapist) or EMG technologist.

Research

The Neuromuscular Research Program is composed of two parts. The clinical program, led by Dr. Lawrence Korngut, had several important contributions this past year. It conducted four randomized clinical trials in ALS and Facioscapulohumeral Muscular Dystrophy (FSHD). The Canadian Neuromuscular Disease Registry (CNDR) continued to operate under Dr. Korngut's leadership and promote collaborative research and clinical care excellence across Canada. Dr. Rodney Li Pi Shan developed a tool to simplify the level of certainty in the diagnosis of ALS.

The basic science program, led by Dr. Gerald Pfeffer, investigates genetic causes of hereditary neuromuscular disorders using next-generation sequencing studies of families with undiagnosed conditions and in carefully phenotyped clinical cohorts. Dr. Pfeffer's lab also performs mechanistic studies using human cellular models to understand how gene mutations cause disease. Other projects are investigating RNA-based biomarkers for neurogenetic disorders.

Education

The Neuromuscular Education Program is headed by Dr. Sam Chhibber. The program provides education in neuromuscular disease diagnosis and management, including EMG. The outstanding performance of our trainees is a testament to the training program. This year, neurologists Dr. Daniel Fok and Dr. Theo Mobach completed their training as neuromuscular fellows.

Members

We welcomed Dr. Mobach to the program after he completed a joint neuromuscular fellowship between the University of Ottawa and our program.

The Urgent Neurology Clinic

Program Lead: Dr. Alexandra Hanson

Overview

The Urgent Neurology Clinic was established in 2000. Outpatient clinics are held at both the Foothills Hospital and at the South Health Campus.

The Urgent Neurology Clinic's mandate is to see adult patients with a new, acute neurological issue within one week. Further tests are then expedited and completed in a timely manner.

The Urgent Neurology Clinic works in conjunction with Neurology Central Access and Triage (NCAT) to ensure all patients are seen at the most appropriate clinic.

While the Urgent Neurology Clinic sees patients with a myriad of neurological disorders, the most common referrals are for seizures and complex migraine or headache. Approximately half of the referrals came from the Emergency Department or Urgent Care centres, and the other half were from family doctors, with a few from other specialists.



Dr. Alexandra Hanson

The Urgent Neurology Clinic is an excellent clinic for both resident teaching and evaluation (STACERs).

Highlights

For the July 2018-June 2019 year, the Urgent Neurology clinic saw 1,532 new patients (approximately two-thirds at the Foothills Hospital and one-third at the South Health Campus).

Members

FMC: Janet McNamara RN, Dale Gyonyor, Uche Odili (clerks)

Physicians: Dr. Tyson Brust, Dr. Jodie Burton, Dr. Jephtha Davenport, Dr. Paula de Robles, Dr. Yanjun Duan, Dr. Sarah Furtado, Dr. Alexandra Hanson, Dr. Jagdeep Kohli, Dr. Serraj Makkawi, Dr. Steve Peters, Dr. Michael Yeung.

SHC: Lorraine Sorge RN, Echo Morasch (clerk)

Physicians: Dr. Katayoun Alikhani, Dr. Farnaz Amoozegar, Dr. Alicia Cieslak, Dr. Bill Murphy, Dr. Dawn Pearson, Dr. Dave Patry, Dr. Shaily Singh, Dr. Katie Wiltshire.

Neuromuscular Neurology: Dr. Sam Chhibber, Dr. Hamid Ebadi, Dr. Chris Hahn, Dr. Lawrence Korngut, Dr. Theo Mobach, Dr. Gerald Pfeffer, Dr. Chris White

Neuromuscular Physiatry: Dr. Rodney Li Pi Shan, Dr. Stephen McNeil, Dr. Stephanie Plamondon

Neuromuscular Respiriology: Dr. Karen Rimmer, Dr. Andrea Loewen

Peripheral Nerve Surgery: Dr. Rajiv Midha, Dr. Christiaan Schragg, Dr. Brett Byers, Dr. Kate Elzinga, Dr. Robertson Harrop

Palliative Care: Dr. Marisa Dharmawardene

Clinic Nurses: Kris Jagt, Jodie Gill, Christine Roberts, Helena Ogilvie

ALS Clinic Coordinator: Denise Hartley

Allied Health: Cristiane Yamabyashi PT, Jay Cooling PT, Monic Brunet OT, Stephanie Molzan

SLP, Leon Mitchell SW, Dr. Kim Goddard, Neuropsychology, Sandy Jensen DH, Tiffany LaFleur RD, Brianna Panasiuk, SLP Ray Tye RT, Margaret Hass PT

Pharmacists: Darcy Padula, Robert Hou, Wenli Zhou

Fellows: Dr. Daniel Fok, Dr. Theodore Mobach

Clerical Team: Lindy Wright (ALS and Peripheral Nerve Clinics), Jennifer Coish (NMC), Samantha Tallerico (NMC), Paula Baumann (NMC)

Clinical Research Team: Janet Petrillo, Jose Martinez, Josh Lounsberry, Victoria Hodgkinson

Basic Science Research Team: Kristina Martens (lab manager), Carly Pontifex (PhD candidate in neuroscience), Robyn Wells (PhD student in neuroscience), Matthew Joel (MSc student in neuroscience), Mehul Gupta (BSc researcher), Jamie Leckie (BSc researcher)

The Neuro-Ophthalmology and Neurovestibular Programs

Program Lead: Dr. Suresh Subramaniam

Overview

The Neuro-Ophthalmology Program, located at the Rockyview General Hospital Eye Clinic, focuses on disorders of vision and eye movement caused by neurological diseases such as multiple sclerosis, brain tumour and stroke. The Neurovestibular Program, located at South Health Campus, focuses on vertigo and dizziness. Both programs provide state-of-the-art diagnosis and treatment, including lab testing and physical and occupational therapy.



Dr. Suresh Subramaniam

Highlights

In the past year, there were over 2,800 visits to the Neuro-Ophthalmology and Neurovestibular Clinics. Most patients in the Neuro-Ophthalmology Clinic are referred by specialists in ophthalmology, neurology or neurosurgery. The Neurovestibular Program tested over 2,000 patients in the vestibular laboratory and provided over 1,300 vestibular physiotherapy visits.

Education

The Neuro-Ophthalmology Program trains specialty residents learning to be neurologists or ophthalmologists. The Neurovestibular Program trains neurology and otolaryngology residents. Both programs hold regular educational rounds, provide learner evaluations, and teach medical students and Allied Health staff.

Research

Projects in Neuro-Ophthalmology include studies of the rehabilitation of homonymous hemianopia; the roles of hormones, vitamin D and novel therapies in optic neuritis; structural changes related to pituitary tumours, pregnancy and cardiovascular health; and the role of optical coherence tomography in monitoring patients with multiple sclerosis or tumours affecting the optic nerves or chiasm. Projects in the Neurovestibular Program include the study of a prototype rotary chair in the diagnosis of vestibular dysfunction and the role of physiotherapy in vestibular migraine.

Members

Medical Staff: Dr. William Fletcher, Dr. Fiona Costello, Dr. Suresh Subramaniam, Dr. Beth Lange (Otolaryngology), Dr. Euna Hwang (Otolaryngology)

Allied Health and Administrative Staff:
Neuro-Ophthalmology Program – Cindy Koberlenz-Slade, Tracy Ducharme.

Neurovestibular Program – Melanie Oszust, Gina Quinn, Michelle Pushka, Jacqueline Townsend, Cristiane Yamabayashi.

The Tourette Syndrome and Pediatric Movement Disorders Program

Program Lead: Dr. Tamara Pringsheim

Overview

The Tourette Syndrome and Pediatric Movement Disorders Clinic provides consultation and continuing care for children and adults with Tourette syndrome and children with movement disorders such as dystonia, tremor, cerebral palsy and complex motor stereotypies.



Dr. Tamara Pringsheim

Research

Research at the clinic is focused on:

- Promoting rational and safe use of medications in children with neurodevelopmental and disruptive behaviour disorders
- Exploring novel therapeutic strategies for tics
- Understanding longitudinal outcomes and sensorimotor function in children with tics and tremor

Thanks to the generosity of the Owerko family and the Owerko Centre on Neurodevelopment and Child Mental Health, we received funding to support clinical research activities at the Tourette Syndrome and Pediatric Movement Disorders Clinic. With this support, we have launched several new research studies.

Current studies at the clinic include:

- The role of diet, exercise and sleep on tic severity in children with chronic tic disorders
- Investigation of the gut microbiome in children with chronic tic disorders
- Longitudinal outcomes in children with tics
- Dietary fibre to reduce antipsychotic induced metabolic effects in children with tics
- Clinical and neurophysiological characterization of essential tremor in children
- Examination of sensorimotor function in children with tics using the KINARM

In 2019, we received funding from the Maternal, Newborn Child and Youth Strategic Clinical Network to develop the Tourette OCD Alberta Network. Currently, the only specialized clinics for children with Tourette syndrome and obsessive-compulsive disorder in Alberta are in Calgary at the Alberta Children's Hospital, resulting in a provincial service delivery gap.

The goal of the Tourette OCD Alberta Network is to increase capacity and improve access to comprehensive patient and family centered care for children and youth with TS and OCD provincewide. We will accomplish this by providing a range of support services to patients and families, including education, support and care navigation, and by working with community-based addiction and mental health clinic health care professionals to improve their knowledge and skills in this area.

In addition, we are collaborating with neuroscientist Dr. Frank McMaster on a CIHR-funded randomized controlled trial of the addition of transcranial magnetic stimulation to habit reversal therapy for the treatment of tics.

Education

We provide training to medical students, residents in pediatrics and neurology as well as fellows in movement disorders. Residents in neurology spend time in the clinic as a part of their movement disorders rotation and residents in pediatrics during their developmental pediatrics rotation.

Members

Neurologists: Dr. Tamara Pringsheim,
Dr. Justyna Sarna, Dr. Davide Martino

Nursing: Tracy Hammer

Research Co-ordinator: Elaheh Nosratmirshekarlou

Clinical and Research Fellows: Dr. Nicholas Cothros,
Dr. Alex Medina

Pediatric Neurosciences

Program Lead: Dr. Michael J. Esser

THE SECTION OF PAEDIATRIC NEUROLOGY

based at the Alberta Children's Hospital (ACH) provides comprehensive neurological care to infants and children from Southern Alberta and neighboring Saskatchewan/ British Columbia. The section is also actively engaged in point of care research that is transforming knowledge and care. Currently, our faculty is comprised of staff neurologists with subspecialty expertise in epilepsy, neurotrauma, stroke, neurocritical care, headache, demyelinating and other neuro-immune conditions, neonatal neurology and brain malformations, neuromuscular diseases and movement disorders, as well as developmental and cognitive, neurogenetic and metabolic diseases.



Dr. Michael Esser

As an integral part of the section, an extensive team of trainees and Allied Health professionals engage in both inpatient and outpatient clinical programs, as well as globally recognized clinical and translational research.

New to the program, the ACH Headache Clinic was launched in May 2019 by Dr. Serena Orr, who is a pediatric neurologist, headache subspecialist and the physician leader of this program. The goal of the ACH Headache Clinic is to provide evidence-based, patient-centered, multimodal care to children and adolescents with headache disorders and to educate care providers and the community about how to optimize headache care.

Dr. Orr and her research colleagues are establishing a clinical research program that aims to improve the current standard of practice by establishing a foundation for personalized, evidence-based headache care. Though a majority of children and adolescents with headache disorders improve with the current standard of care, a significant proportion of patients develop refractory headache

disorders and suffer from substantial disability. By better understanding baseline risk factors that predict a refractory course in pediatric headache disorders, Dr. Orr and her colleagues will be able to chart the course for a more personalized approach to headache care and improve outcomes for patients at risk for a refractory clinical course. In addition, Dr. Orr and her adult neurology colleagues in the Calgary Headache Assessment and Management Program are working to establish an integrated pediatric and adult headache research program that will further the field's understanding of the developmental trajectory of headache disorders, especially as pertains to the transition from adolescence to adulthood.

Other ongoing research and program advances from various members of the section include:

The Calgary Pediatric Stroke Program (CPSP)

includes the world's largest population-based cohort of children and families with perinatal stroke. Advanced brain mapping techniques are defining human models of developmental plasticity after early injury that are translated into novel non-invasive neuromodulation approaches including the first multicenter Phase 3 clinical trial currently underway. The program also leads the University of Calgary's Non-invasive Neurostimulation Network (N3), and recently founded the ACH Pediatric Brain Computer Interface (BCI) Program—a patient-centred clinical research team focused on developing BCI to advance independence and quality of life for severely disabled children.

The Pediatric Neuromuscular Program continues to expand its role and the clinical workload of the program has significantly increased due to the recent approval of intrathecal nusinersen injections for children and youth with spinal muscular atrophy (SMA), funded by Alberta Health. We are also providing early access to other potential disease modifying treatments for pediatric patients with SMA, Duchenne muscular dystrophy, and other neuromuscular disorders through their



participation in clinical trials. Future efforts include starting an SMA newborn screening program for Alberta (funded by ACHF, the Love for Lewiston Foundation, and other community partners).

The Pediatric Neurocritical Care (NCC) Program

has rapidly evolved since its inception in July 2016. The NCC provides exceptional service to the ACH PICU and NICUs in Calgary, and imbedded research program are improving outcomes through advanced technologies, clinical algorithms and educational initiatives. Under the NCC program, a research-oriented biobanking and bioanalytical core facility (i.e., the ACH BioCore; funded by ACHF) is actively servicing many research projects through the ACH, ACHRI and CSM. The state-of-the-art analytical platforms enable measurements of a variety of markers in any human specimen. These advances will accelerate the development of disease biomarkers that will enhance the care of all patients and will also facilitate innovative translational research to better understand and treat a multiplicity of conditions encountered in clinical pediatric practice.

The Calgary Childhood Epilepsy Program

continues to be a leader in research and clinical care for all children, but particularly those with refractory epilepsy and those needing surgical evaluation and intervention. The program has

recently undergone a change in leadership with the arrival of Dr. Julia Jacobs Levan as the new director of the program, and who has a very established research program in EEG monitoring. Other ongoing efforts include areas such as sleep and epilepsy, a targeted infantile spasms clinic and research program, and animal modelling platforms.

The Paediatric Neurology Royal College of Physicians and Surgeons of Canada (RCPSC)-accredited direct entry Residency Training Program is among the oldest and largest in Canada. The program continues to maintain a 100 per cent success rate on the Royal College exam. All section members are actively engaged in teaching through undergraduate, medical school, residency, graduate student, and post-doctoral and clinical fellowship levels.

A rich educational environment now includes more than 10 academic rounds and conferences per week. Recent graduates have taken on a variety of positions and capacities, including Dr. Jaden Wright (community neurologist, Lethbridge), Dr. Natarie Liu (assistant professor of pediatrics, University of Alberta), Dr. Kara Murias (assistant professor of pediatrics at the Cumming School of Medicine and the Owerko Centre at the University of Calgary), and Dr. Megan Crone (assistant professor at the University of Saskatchewan in Saskatoon).

The Section of Neurosurgery

Section Head: Dr. Steve Casha

THE SECTION OF NEUROSURGERY at the University of Calgary and Alberta Health Services is fully integrated with its partner sections of Neurology, Physical Medicine and Rehabilitation (PM&R) and Translational Neurosciences within the Department of Clinical Neurosciences.

With its highly integrated and collaborative programmatic approach, the section provides sub-specialized care to the patient population. That population includes the geographic region of Southern Alberta as well as Eastern British Columbia in the Kootenay Region and Western Saskatchewan, encompassing an approximate catchment population of 2.5 million. Care is provided by 16 sub-specialist academic neurosurgeons, all of whom also provide general and emergency neurosurgical services.

Specialized programs include cerebrovascular and endovascular neurosurgery, epilepsy neurosurgery, adult hydrocephalus surgery, neuro-oncology, skull base surgery, pediatric neurosurgery, peripheral nerve surgery, functional neurosurgery, stereotactic radiosurgery and spine surgery.

In partnership with neurology, rehabilitation medicine, orthopedic surgery, neuroradiology, and radiation oncology, our members provide the highest quality of sub-specialized care for this patient population.

The total operative volume delivered by neurosurgeons was 2,240 cases in 2018-19. There were approximately 100 cases of bedside and Intensive Care Unit procedures, about 300 cases of endovascular procedures in the neuro-interventional suite, and about 100 radiosurgery cases. In addition, the section saw 11,590 out-patient visits in 2018-19.



Highlights

- We remain very proud that the Charles Taylor Memorial Lectureship pays homage to Calgary's first neurosurgeon. In 2019, Dr. Antonio Chiocca (chairman of the Department of Neurosurgery at the Brigham and Women's Hospital in Boston, and the Harvey W. Cushing professor of Neurosurgery at the Harvard Medical School) was the 15th annual Charles Taylor lecturer.
- Numerous other respected professors and neurosurgeons visited us this past academic year: Dr. Marcel Aries (University of Groningen, The Netherlands), Dr. Peter Dirks (University of Toronto), Dr. David Clarke (Dalhousie University), Dr. Adam Sachs (University of Ottawa), Dr. Darrel Brodke (University of Utah), and Dr. Chris Ogilvie (Brain Aneurysm Institute, Beth Israel Deaconess Medical Center, Boston).
- For the 12th year running, the highly regarded Spine and Peripheral Nerve Anatomy and Surgery Course exposed neurosurgery and



▲ Visiting professor Dr. Antonio Chiocca from Harvard Medical School celebrates with neurosurgery residents at Festa Bianca in May 2019.

orthopedic residents from across the country to the nuances of spine and peripheral nerve surgery in a hands-on, supportive environment using didactic and cadaveric methods.

Education

The neurosurgery residency training program continues to be the pride of the section. Two new residents are accepted each year, within a current allotment of 16 trainees. The program is known for providing training in a collaborative and collegial environment where the highest quality of service and education are delivered.

In addition to hands-on and didactic teaching of residents, the faculty contributes significantly to undergraduate medical education teaching in the small group curriculum, as well as clerkship rotations.

Numerous fellows joined our section in various sub-specialties, which is another positive indicator of Calgary's strong reputation for excellent training and care.

Research

Members continue to be involved in intensive research, with several of them conducting peer-

reviewed and funded basic science and/or clinical research programs. Collectively, the section benefited from over \$2.5 million in funding revenue in 2018-2019 and published 63 manuscripts.

Many of these members partner with the Hotchkiss Brain Institute and the Alberta Children's Hospital Research Institute, and several faculty members have been granted full or affiliated membership.

Areas of research strength and accomplishment include clinical trials in spinal cord injury research, basic bench research in nerve regeneration, functional neurosurgery and deep brain stimulation, traumatic brain injury, laboratory work using brain tumour-initiating stem cells, and intravascular stent development, pain management and hydrocephalus. We also proudly house one of the world's foremost laboratories in surgical robotics.

Notable recognitions in 2018-19 were received by: Dr. Garnette Sutherland, who was awarded the 2019 Governor General's Innovation Award; Dr. Jay Riva-Cambrin and collaborators, who were awarded a \$9.6 million NIH grant for a randomized control trial in pediatric hydrocephalus; and Dr. Alim Mitha and Dr. John Wong, whose startup venture, Fluid Biotech, received the top prize at the Inventures' Tenet i2c competition.



Neurosurgeon
Dr. David Cadotte

For newest DCNS neurosurgeon, spine surgery should be personal

DR. DAVID CADOTTE HAS BEEN A

faculty member in Calgary for only two years, but he's become an ardent champion of the Calgary Spine Program and all that it has to offer patients.

The program is Canada's largest spine group operating in one hospital. And the size of the team—17 surgeons from orthopedic surgery and neurosurgery—has huge advantages.

"When you have a big group like this, it changes the way you practise," he says. "You work in a more subspecialized setting, which allows for better research and better patient care ultimately."

The neurosurgeons in the group, for example, have recently started a myelopathy clinic on the 12th floor of Foothills Hospital. Orthopedic colleagues are running a sciatica clinic examining the role of serum biomarkers.

"They're trying to discover who's going to get better in a short time period, and who might need surgery."

Dr. Cadotte says his PhD work in medical imaging is allowing him to use sophisticated techniques when making clinical decisions and then delivering personalized medicine to his patients. It's an approach, he says, that puts Calgary at the forefront of spine surgery in Canada.

"We have within our means to become the first major spine centre in the country that delivers personalized medicine."

It's a bold vision, but it's achievable, he says.

"All of the elements are in place with the spine group in Calgary to achieve this."

Dr. Cadotte's lab is also striving to make research more personal by engaging more with patients.

These patients volunteer to answer a myriad of surveys and forms, and then undergo clinical tests that researchers can use in their studies. More and more, Dr. Cadotte says, patients want to stay connected to the research even after their part is complete.

PERSONAL VISION

"We have within our means to become the first major spine centre in the country that delivers personalized medicine."

— Dr. David Cadotte

"They want to know the results of these experimental treatments. And this is where the personalized medicine comes in."

To harness that enthusiasm, the neurosurgeon is developing summary reports that he can share with volunteers and keep them engaged.

"They want to learn about how we're trying to change the way that these conditions are managed."

The data that patients provide is incredibly valuable for researchers and critical to their ability to improve care in the clinic.

In a recent public lecture at the McCaig Institute's Wood Forum, Dr. Cadotte shared an example of how the relationship between patients and researchers has evolved in Canada.

His father-in-law, a retiring surgeon in Toronto, was challenged by what to do with boxes and boxes of medical information from his years of practice. Some had to be stored for 10 years, but much was destined to be shredded.

"What a waste," says Dr. Cadotte, determined to ensure the contributions made by his patient volunteers aren't lost when he retires decades from now.

"That's one of my jobs: To make the process more fluid."

Alberta Radiosurgery Centre

Program Leads: Dr. Gerald Lim, Dr. Yves Starreveld

Overview

This radiosurgery program was the first of its kind in Canada to use an innovative technology called the Novalis system. It is a collaborative effort between the sections of Neurosurgery and Radiation Oncology.

The technology offers focused radiation treatment for diseases of the brain and spinal cord in single or multiple sessions as appropriate. This avoids lengthy hospital stays associated with standard surgical treatments. By reducing risks of therapy, and allowing a rapid return to normal activities, this treatment offers greater patient satisfaction.

Since its inception in 2002, the program has served an increasing number of patients in Alberta and across the western provinces.

Highlights

Referrals to our spine radiosurgery program are increasing. We have started to treat patients with

epilepsy, including mesial temporal lobe epilepsy.

Education

The program provides fellowship training for both radiation oncologists and neurosurgeons.

Research

Projects include a study on the effect of contouring variability on dosimetric parameters for brain metastases. Our quality improvement initiative has led to impressive gains in efficiency of treatment, and ongoing revisions to our patient care pathways.

Members

Neurosurgery: Dr. Yves Starreveld, Dr. Zelma Kiss,
Dr. John Kelly, Dr. Brad Jacobs, Dr. John Wong
Radiation Oncology: Dr. Gerald Lim, Dr. Rob Nordal,
Dr. Jon-Paul Voroney, Dr. Shaun Loewen
Medical Physics: David Spencer, Alana Hudson,
Nicholas Ploquin, Greg Pierce
Nursing: Rhonda Manthey

Calgary Spine Program

Program Lead: Dr. Bradley Jacobs

Overview

The University of Calgary Spine Program is a multidisciplinary clinical and academic group focused on the care of individuals affected by conditions of the spinal column and spinal cord. Our mission is to provide world quality health care to individuals with spinal disorders through the pursuit of excellence in research, teaching and bedside clinical care.

The program is centered at the Foothills Hospital and Alberta Children's Hospital within Alberta Health Services.

Members of the Spine Program have joint appointments in the Section of Neurosurgery, Department of Clinical Neurosciences and Section of Orthopedic Surgery, Department of Surgery. The Spine Program provides care for patients with spinal injury, infection, neoplasia and degenerative disease. Clinical care is closely linked to clinical education and research in a supportive academic setting.

The program has representation from Neurological Surgery, Orthopedic Surgery, Nursing, and Orthotics. The program offers spine surgery fellowship, combining orthopaedic and neurosurgical clinical experiences. Foothills Medical Centre is the tertiary referral centre for Southern Alberta, Saskatchewan and Southeastern British Columbia, and the Spine Program provides support for the programs such as Trauma, Cancer and Bone and Joint.

Members

Dr. W. Bradley Jacobs, Program Lead
Dr. Fred Nicholls, Fellowship Director
Dr. Ken Thomas, Research Director
Dr. Fábio Ferri-de-Barros, Pediatric Fellowship Director
Dr. Jacques Bouchard, Dr. David Cadotte,
Dr. Steven Casha, Dr. Roger Cho,
Dr. Stephan du Plessis, Dr. Peter Lewkonja,
Dr. David Parsons, Dr. Paul Salo,
Dr. Alex Soroceanu, Dr. Ganesh Swamy,
Dr. Paul Salo, Dr. Alex Soroceanu,
Dr. Ganesh Swamy

The Hydrocephalus Program

Program Lead: Dr. Mark Hamilton

Overview

In 2003, the University of Calgary's adult hydrocephalus clinic was established with the goal to standardize and enhance the care for adult patients with hydrocephalus. Hydrocephalus patients had typically been assessed and cared for by individual physicians in an unstructured and unfocused clinic environment. The population of adult patients with hydrocephalus is increasing as diagnostic and therapeutic techniques improve identification and survival. Hydrocephalus represents a treatable cause for approximately five per cent of adult patients with a diagnosis of dementia.

The Adult Hydrocephalus Program was developed in response to the strengths of the adult hydrocephalus clinic. A clinical research program was initiated and a basic science research program is in development. Targeting the care of adult patients with hydrocephalus in a specialty clinic has aided in understanding the natural history of adults with both treated and untreated hydrocephalus.

The program has helped to standardize the treatment strategies for patients with a potential diagnosis of hydrocephalus and it has helped to improve the management of patients using shunts and endoscopic techniques. In 2019, there were about 3,000 patients followed in the adult hydrocephalus clinic. There were approximately 1,500 outpatient assessments and 180 surgical procedures performed.

Highlights

- Dr. Hamilton is the chair for the Adult Hydrocephalus Clinical Research Network (AHCNRN), which has two centres in Canada, five in the United States and one in England. AHCNRN has enrolled 1,600 patients in 48 months and has starting a clinical trial for patients with normal pressure hydrocephalus (www.AHCNRN.org).
- Dr. Hamilton is a board member and president of the Hydrocephalus Society—The International Society for Hydrocephalus and Cerebrospinal Fluid disorders (www.ISHCSF.com).
- Dr. Hamilton is a member of the board of directors of the Hydrocephalus Association and the vice-chair of the medical advisory board of the Hydrocephalus Association (www.hydroassoc.org).

- Dr. Hamilton is helping to develop a Canadian hydrocephalus strategy and he is a member of the board of directors of Hydrocephalus Canada, which was inaugurated in November 2017.
- Multiple quality improvement projects have been undertaken to improve patient access, surgical techniques for hydrocephalus care, and surgical outcomes.
- A formal protocol has been established to facilitate transition of care for pediatric patients with hydrocephalus when they turn 18 years of age.

Education

The Hydrocephalus Program offers fellowship training for neurosurgeons interested in subspecialty training in the diagnosis and management of adult patients. The first trainee completed his fellowship training in June 2012.

Research

- Initiation of the Adult Hydrocephalus Clinical Research Network
- Epidemiology of hydrocephalus
- Transition care for pediatric patients with hydrocephalus
- Neuroendoscopy treatment and outcome for adult patients with hydrocephalus
- Neuropsychological effects of endoscopic treatment of patients with hydrocephalus
- Infections in patients with ventricular catheters and shunts
- Improving surgical outcomes for treatment with ventriculoperitoneal and ventriculoatrial shunts
- Treatment of patients with idiopathic normal pressure hydrocephalus
- Endoscopic management of patients with ventricular brain tumours

Members

Neurosurgeons: Dr. Mark Hamilton,
Dr. Clare Gallagher, Dr. Walter Hader
Medical and Surgical Assistant: Dr. Geberth Urbaneja
Neuro-ophthalmologists: Dr. Fiona Costello,
Dr. Suresh Subramaniam
Geriatrician: Dr. David Hogan
Nurse Practitioner: Ron Prince, Patti Long
Research Coordinator: Jarred Dronyk

Image-Guided Medical Robotics Program

Program Lead: Dr. Garnette Sutherland

Overview

With the successful launch of the world's first intraoperative MRI (iMRI) technology based on ceiling-mounted moveable high field magnet (Siemens, Germany) developed by Dr. Garnette Sutherland, the Seaman Family MR Research Centre at University of Calgary - Foothills Medical Centre was established in the mid 1990s. In addition to the iMRI suite, the centre houses an interlinked MR research program based on a fixed 3.0T magnet (GE, USA). While the latter has expanded to a world-class entity on advanced clinical imaging research including stroke and more recently MR-guided focus ultrasound technology for patient care, the iMRI system enjoyed global uptake through a Canadian spin-off, IMRIS Inc. (now IMRIS-Deerfield, MN, USA), with over 76 international sites servicing >40,000 patients.



Dr. Garnette Sutherland

The iMRI environment further gave rise to another world's first—the image-guided MR-compatible robot called neuroArm. Again developed by Dr. Sutherland in collaboration with MacDonald, Dettwiler and Associates, Brampton ON, (MDA built Canadarm and Dextre), neuroArm is Canada's gift to the world of medical robotics, in particular for microsurgery and stereotaxy within the iMRI suite. Project neuroArm, the internationally visible Image-guided Medical Robotics Program at the University of Calgary, was born through this technology and continues to advance robotics and smart technologies for surgery. With neuroArm continuing to be used in neurosurgical patients at the Foothills Medical Centre, and SYMBIS (second generation neuroArm, FDA approved for stereotaxy, IMRIS-Deerfield MN, USA), the team has just launched the build of the third generation neuroArm robot called the neuroArmPLUS.

Pipeline Technologies - Robotics and Intelligent Systems

The neuroArmPLUS: Year 2018 marked the 10-year anniversary of the neuroArm robot performing its first surgery in a young Calgarian mother with

complex brain tumour. Endorsed as a strategic priority project of the University of Calgary, and through a targeted fundraising initiative and recruitment, its first project milestone came in December 2019 (critical design requirement for final blue print). The neuroArmPLUS is a compact, efficient and intelligent robotic system for brain surgery and whole body applications. The system will incorporate the recently developed microsurgery-specific haptic handcontroller, Excalibur, as the intuitive human-machine interface. Funded through the CHRP-NSRC grant and now with a patent and four manuscripts at various stages of review, the team is completing manipulator design, smart software and control algorithms. OrbSurgical Ltd., in deploying neuroArmPLUS for global adoption, has once again used the Build Local – Go Global Calgary! mantra and brought together three other Calgary-based companies in this exciting journey. Sustained collaborations-consultation with MDA Canada, IMRIS USA, Medtronic USA, Bissinger Germany and Stryker USA remain important for marketing strategy, quality assurance and regulatory standards.

The SmartForceps System: Year 2019 saw the medical grade clinical translation of the SmartForceps System—a force-sensing surgical bipolar forceps for real-time measurement, recording and display of tool-tissue interaction forces during surgery. It was systematically tested and validated with multiple pre-clinical and clinical publications in multiple high impact journals, including JAMA Surgery. The technology has also received approval from provincial (German Canadian Centre for Innovation & Research) and federal funding agencies (CIHR). A partnership was forged with Bissinger GmbH Germany and Quadrus Inc. Calgary, to produce a minimum viable product, owned by OrbSurgical Ltd. (a Project neuroArm spin-off), and it is being reviewed by Health Canada. It is approved for ethics and in use at the Foothills Medical Centre. The technology is projected to hit the market in the first quarter of 2020.

Linked research & Development (R&D): The principle theme of Project neuroArm remains “Seeing what you cannot see; Feeling what you

cannot feel; Hearing what you cannot hear—the augmented reality for robotics and linked technologies”. All ongoing R&D fall under one or more of these principal philosophy and include but are not restricted to:

- i) Molecular Neuroscience-Brain Tumour and Trauma (Seeing what you cannot see): Years of investigation and innovation, and patent protected collaborative work with NRC Ottawa, has allowed the ongoing molecular and genetic interrogation of CNS disorders, including brain tumour, trauma and neurodegenerative disease. This venture is well aligned to develop ideal cell-specific contrast agents for intra-operative visualization and/or diagnostics.
- ii) Computer Science/Simulation/Software (Feeling what you cannot feel): In-house and acquired haptic technologies and interfaces allow for advanced surgical performance and training paradigms.
- iii) Atomic Force Microscopy-Vibrational Profiling of CNS Neoplasia (Hearing what you cannot hear): Internal collaboration with a microscopy and imaging facility has enabled the translation-modulation of nanoscale cellular frequency to the hearing domain. Inclusion of this acoustic signature into the ongoing evolution of the smart toolset and probes for neuroArmPLUS remains a formidable yet exciting pursuit.
- iv) Back to Space (perhaps: Being where you cannot presently be!): In tune with the University of Calgary's New Earth-Space Technologies (NEST), and as an homage to the space heritage of neuroArm technology, the project RAST (Robot-Assisted Space Telemetry) has a long-term vision of advancing and applying the neuroArm telerobotic platform back to space! Aligning with NASA's Deep Space Exploration and recent Lunar Gateway Mission (CSA-MDA for Canadarm3), the team has aspirations of a lightweight tele-operated robot (a version of neuroArmPLUS) in the International Space Station or beyond—with a control station here on Earth.

Recognition-Highlight: In May 2019, Dr. Garnette Sutherland was awarded (along with six other recipients) the Governor General Innovation Award for his technological innovations in improving patient care. This recognition from Her Excellency the Right Honourable Julie Payette, Governor

General of Canada and the Rideau Foundation, highlight and celebrate the far-reaching implications of these Calgary led innovations.

Contemporary interest in robotics and linked digital innovation for surgical performance and training was further endorsed through an invited lectureship (Dr. Garnette Sutherland – a Minnesota Life Science Alley Luminary Award Recipient 2011) to foster the NeuroRobotics Network at the University of Minnesota in November 2019.

Members (Includes only active collaborators and students/trainees)

Engineering: Hamidreza Hoshyarmansh, Amir Baghdadi, Mohammadaleh Razmi, Mojtaba Esfandiari, Starr Tze (Chief Consultant), Chris Macnab, Qiao Sun, Yaoping Hu, Salvatore Federico, Mahdi Tavakoli, Ekram Hossein, Kazi Ishfaq Ahmed, Rachael L'Orsa, Don Peterson,
 Science: Dustin Proctor (in Clinical Biochemistry sabbatical), Jordan Huang, Fahad Iqbal, Sonny Chan, Boguslaw Tomanek, Mehdi Arbabi, Frank van Veggel, Matthias Amrein, Guido van Marle
 Medicine: Andrea Becking, Melissa Nielsen, Joseph Dort, Francis Sutherland, Andrew Kirkpatrick, Paul McBeth, Abdulrahman Albakr, Madeleine de Lotbiniere-Bassett, Fangwei Yang, Phil Park, Sanju Lama, Garnette Sutherland
 Administrative Support: Miwa Shibuya, Caara Kardell
 Industrial Partners: MDA (Brampton, ON); Deerfield-IMRIS (Minnetonka, MN); Medtronic (Minneapolis, MN); Stryker Corporation (Kalamazoo MI); Bissinger GmbH (Teningen Germany); Quadrus Devt. Inc. (Calgary); OrbSurgical Ltd. (Calgary)
 Institutional Partners: National Research Council Canada, Canadian Space Agency, University of Manitoba, University of Alberta, University of Victoria, Queen's University, University of Vienna - Austria, Hokkaido University School of Medicine - Sapporo, Japan.
 The Project neuroArm (and OrbSurgical Ltd.) team acknowledges the multiple funding institutions (provincial, federal, international), individuals, families and foundations for their generous support and trust in Project neuroArm's ongoing endeavours; special thanks to all DCNS, and section of neurosurgery members for support and participation in ongoing clinical integration and projects.

Neuromodulation Program

Program Lead: Dr. Zelma Kiss

Overview

Neuromodulation is the altering/modulation of nervous system function by means of implantable devices or neural prostheses. It includes peripheral nerve, spinal cord and brain electrical stimulation, as well as drug delivery devices. Many conditions are treated, including movement disorders, epilepsy, pain, angina, depression, spinal cord injury, headache, and spasticity.



Dr. Zelma Kiss

Education

Drs. Darren Clark and Elliot Brown completed their AIHS fellowships, with Dr. Clark moving on to receive a Parkinson Alberta fellowship. Rachel Sondergaard and Linda Kim continued in their PhD programs studying the pathophysiology of dystonia and new targets for DBS in humans and animal models. Catherine Wiener joined as a new PhD student and is studying DBS vs. focused ultrasound in rodent brain slice. Dr. Vishal Varshney started his residency in pain medicine and was very active in screening and managing patients for spinal cord stimulation. The Neuromodulation Program funded several summer students from Mount Royal, Queens, and the University of Calgary. Importantly, we established methods to provide funding for trainees, nursing, and Allied Health to attend neuromodulation conferences in the future.

Research

We continued collecting prospective data on all patients undergoing stimulator procedures. For example, we completed our local study of occipital nerve region stimulation for headache and craniofacial pain syndromes and embarked upon a study of predictors of outcome in thalamic DBS for essential tremor. Publications included a collaboration with a group in the US sharing cases of a particular type of hereditary dystonia and their response to DBS (Movement Disorders 2019), a review article about medical methods patents (Neuromodulation 2019), transcranial magnetic stimulation protocols to inhibit cerebellar activity (Cerebellum 2019), and a paper in the Journal of Neuroscience (2019) identifying a novel potential mechanism of action of DBS for dystonia comparing

responses in rodent brain slice to electrophysiology in patients undergoing DBS surgery. Our trainees figured prominently in these papers, with the program's summer student being first author on one paper and six trainees contributing to the others. Dr. Varshney published two reviews on intrathecal drug delivery for pain management.

Trainees presented posters at the Brain Stimulation meeting and oral presentations at the Alberta Motor Control meeting. A Neuromodulation summer student won a best presentation prize at the Biomedical Engineering Undergraduate Research Symposium. We were invited to give two talks and sit on a panel at the NYC Neuromodulation Conference & NANS Summer Series in New York City and give one workshop, one plenary, and chair a symposium at the International Brain Stimulation Conference. Our team presented five posters at the Society for Biological Psychiatry, as well as an oral presentation at the International Neuromodulation Society and the Canadian Neuromodulation Society meetings.

Future Directions

Based on the positive results of our DBS for treatment resistant depression study (to be published in Lancet Psychiatry), we plan to implant very selected patients with DBS for this condition.

Members

Cardiology: Dr. Todd Anderson
 Neurology: Dr. Werner Becker, Dr. Veronica Bruno, Dr. Davide Martino
 Neurosurgery: Dr. Walter Hader, Dr. Mark Hamilton, Dr. Zelma Kiss
 Nursing: Laina McAusland (UofC research), Cheri Gray, Kara Hallett, Colleen Harris, Brittany Hoffarth-Palchewich, Karen Hunka, Pia Lawrence, Jackie Martini, Raj Parmar, Valerie Sherwood, Sandy Stephen, Meredith Wild
 Pain Physicians: Dr. Ted Findlay, Dr. John Pereira, Dr. Kelly Shinkaruk (Chronic Pain Centre)
 Physical Medicine and Rehabilitation: Dr. Rebecca Charbonneau, Dr. Dan McGowan
 Physiotherapy: Philis Heffner
 Psychiatry: Dr. Aaron Mackie, Dr. Brienne McLane, Dr. Raj Ramasubbu
 Psychology: Dr. Arlene Cox, Dr. Angela Haffenden
 Respiriology/Thoracic surgery: Dr. Sean McFadden, Dr. Karen Rimmer

Neurovascular Program

Program Lead: Dr. John Wong

Overview

The Neurovascular Program is a collaborative effort of specialists and Allied Health staff from multiple disciplines to combat stroke and neurovascular disease. Many patients are treated in a single day using minimally invasive endovascular approaches, thereby avoiding long hospital stays.

Expertise is maintained in the provision of open cerebrovascular neurosurgery to Albertans. In conjunction with our internationally recognized Calgary Stroke Program, the Neurovascular Program has become an important partner in stroke care and research.



Dr. John Wong

Highlights

We have seen continued growth in the number of procedures, especially mechanical stroke thrombectomy, and now about 400 patients are treated annually via minimally invasive endovascular means such as aneurysm coiling, vascular malformation embolization, carotid stenting and endovascular stroke treatment.

An integrated relationship with the Alberta Radiosurgery Centre has allowed the non-invasive and safe treatment of patients with complex arteriovenous malformations. Over the years we have consolidated the outpatient experience and launched the Neurovascular Clinic in Calgary in conjunction with specialists from neurosurgery, neurology, radiology and nursing. This has allowed the rapid, same-day triage and evaluation of stroke patients to provide high-quality care and further opportunities for teaching and clinical studies.

Approximately 1,700 patients with neurovascular disease were seen in the past year in our specialized outpatient clinic for evaluation and followup.

Education

Our brain aneurysm patient support network, led by our nursing team, continues to enjoy widespread acceptance amongst patients, their families, and the community. Our growing reputation for clinical care, teaching, and research has enabled the competitive selection and recruitment of clinical fellows in endovascular training and open neurosurgical techniques.

Research

Academic initiatives have centered upon Dr. Alim Mitha's biomedical engineering laboratory for developing new intravascular devices for brain aneurysm therapy. Technology from the laboratory is being spun out into a startup venture, Fluid Biotech, which aims to commercialize a new bio-absorbable stent for treating brain aneurysms.

Our annual fundraiser, Bowling for Brains, continues to attract community attention for brain aneurysm awareness and research. We continue to participate with the Calgary Stroke Program in multiple clinical research projects that have led to numerous publications and grants.

Members

Dr. John Wong
Dr. Alim Mitha
Dr. Garnette Sutherland
Dr. William Morrish
Dr. Mayank Goyal
Dr. Muneer Eesa
Dr. Mohammed Almekhlafi

Nursing: Michelle Gillies, Leslie Zimmer

Fellows: Dr. Saad Al-Qahtani,
Dr. Mohammed Suheel

Pediatric Neurosurgery Program

Program Lead: Dr. Walter Hader

Overview

The Pediatric Neurosurgical Program offers all aspects of neurosurgical care in children including: management of hydrocephalus, brain and spinal injury, myelomeningocele, other forms of spinal dysraphism, refractory epilepsy surgery, spasticity, craniofacial disorders, and pediatric brain tumour. While pediatric neurosurgery operates within the section of Pediatric Surgery at Alberta Children's Hospital, all members' primary affiliation is with the Department of Clinical Neurosciences,



Dr. Walter Hader

Highlights

Dr. Jay Riva-Cambrin, as co-investigator and with members of the Hydrocephalus Clinical Research Network, was recently awarded a \$9,907,242 USD NIH grant for completion of a randomized controlled trial of Endoscopic Versus Shunt Treatment for Hydrocephalus in Infants. The Alberta Children's Hospital Foundation's board of directors approved a grant in the maximum amount of \$1,272,719 for the

establishment of Laser Interstitial Thermal Therapy epilepsy surgery program.

Dr. Clare Gallagher was the invited chair of a session on multimodality neuro monitoring at the 2019 Canadian Neurological Sciences Federation meeting in Montreal.

Research

The Pediatric Neurosurgery division continues to be an active participant in the Hydrocephalus Clinical Research Network and the Canadian Pediatric Neurosurgery research study group, with Dr. Riva-Cambrin co-ordinating the efforts. The creation of the Calgary Shunt Protocol, an adaptation of the Hydrocephalus Clinical Research Network protocol, was shown to significantly reduce the incidence of shunt infections in children. The work, authored by resident Dr. Michael Yang, was published in the Journal of Neurosurgery: Pediatrics in February 2019.

Members

Neurosurgeons: Dr. Walter Hader,
Dr. Clare Gallagher, Dr. Jay Riva-Cambrin
Nurse Practitioner: Kelly Bullivant
Nurse Clinician: Kelly Hogue

Skull Base and Endoscopic Surgery Program

Program Lead: Dr. Yves Starreveld

Overview

In conjunction with colleagues from the Section of Otolaryngology, the skull-base surgery group combines clinical expertise with novel approaches to offer patients the best surgical treatment and long-term medical care for these challenging lesions.

In addition, close ties to both the Section of Endocrinology and the Alberta Radiosurgery Centre ensures that the nonsurgical aspects of treatment are also managed appropriately. Endoscopic approaches to pituitary and anterior skull base lesions are also offered when appropriate.

The program offers fellowship training to neurosurgeons.

Research

Specific research initiatives include:

- clinical epidemiology, image guidance, robotic surgery, and surgical simulation;
- comparison of outcomes following different endoscopic approaches to pituitary tumours.

Members

Neurosurgery: Dr. Yves Starreveld, Dr. Alim Mitha,
Dr. Garnette Sutherland

Otolaryngology: Dr. Brad Mechor, Dr. Phil Park,
Dr. Luke Rudmik, Dr. Joe Dort

Electrophysiology: Erin Phillips, Michael Rigby

Peripheral Nerve Program

Program Lead: Dr. Rajiv Midha

Overview

The Surgical Peripheral Nerve Program is a multi-disciplinary and inter-disciplinary program encompassing clinical, physiotherapy and electro-diagnostic services. Our program focuses on the diagnosis and non-operative and surgical treatment of a variety of peripheral nerve problems including complex peripheral nerve injuries, nerve tumours, brachial plexus surgery and advanced nerve repair, and nerve transfer techniques. Our goal is to minimize pain and to maximize function, providing a better quality of life for patients with these disabling disorders.



**Dr. Rajiv
Midha**

Highlights

The Multidisciplinary Peripheral Nerve Clinic is seeing more patients with spinal cord injuries, offering nerve transfer procedures to improve function. We are part of a funded multi-centre study to evaluate the benefits of extensive rehab after nerve transfers in this patient population.

Research

Research is an important aspect of the Peripheral Nerve Program. Dr. Midha runs an independent CIHR-funded basic science research laboratory,

in association with the Hotchkiss Brain Institute, investigating various facets of peripheral nerve regeneration and repair. For more information on these research initiatives, visit www.hbi.ucalgary.ca.

Education

We support the educational initiatives of residents within the three clinical sections of DCNS, neuromuscular fellows, and residents and fellows in plastic surgery. We have a robust fellowship program. The following are recent peripheral nerve fellows within the program:

Dr. Sudheesh Ramachandran (2016-17)
Dr. Toby Loch-Wilkinson and
Dr. Vanessa Sammons (2017)
Dr. Saud Alzahrani (2018-19)

Members

Medical Neurologists, Physiatrists &
Electrodiagnostics: Dr. Chris White,
Dr. Stephen McNeil
Neurosurgeon: Dr. Rajiv Midha
Plastic Surgeons: Dr. Christiaan Schrag,
Dr. Robertson Harrop, Dr. Brett Byers,
Dr. Kate Elzinga, Dr. Justin Yeung
Physiotherapy: Margaret Hass
Intraoperative Electrophysiology Support:
Jamie Johnston, Joy Boldt,
Michael Rigby, Erin Mercer

PITNET

Program Leads: Dr. Fiona Costello, Dr. Yves Starreveld

Overview

The Pituitary Inter-disciplinary Team-based Endocrine Treatment Program (PITNET) has been active for over six years, bringing together neurosurgery, neuro-ophthalmology, otolaryngology and endocrinology to facilitate the care of patients with pituitary tumours.

Our combined neurosurgery/neuro-ophthalmology new patient and followup clinics have reduced clinic visits for many patients.

This year, we are excited to announce Dr. Kirstie Lithgow is joining us as a staff endocrinologist from her fellowship training in the United Kingdom.

Research

Current research directions are focused on cost-effectiveness, the role of optical coherence tomography in patient management, comparisons of surgical approaches, and the publication of the results on fMRI in optic compressive neuropathy funded by a PFUN seed grant.

Education

Due to the high concentration of surgical patients, we have been able to provide focused training on the diagnosis and management of these lesions to residents and visiting neurosurgical fellows, and residents in the Section of Neurosurgery.



**Dr. Fiona
Costello**



**Dr. Yves
Starreveld**

Members

Endocrinology:

Dr. Shelly Bhayana
Dr. Bernard Corenblum
Dr. Alun Edwards
Dr. Kirstie Lithgow
Dr. Munish Khosla
Dr. Sue Pedersen
Dr. Doreen Rabi

Neurology:

Dr. Fiona Costello
Dr. Bill Fletcher
Dr. Suresh Subramaniam

Neurosurgery:

Dr. Garnette Sutherland
Dr. Alim Mitha,
Dr. Yves Starreveld

Otolaryngology:

Dr. Brad Mechor
Dr. Luke Rudmik

The Surgical Neuro-oncology Program

Program Lead: Dr. Mark Hamilton

Overview

As a multi-disciplinary program in DCNS, the Surgical Neuro-oncology Program was established to focus on neurosurgical care for brain tumour patients. The program provides excellent care and it improves care in the future through education, research and advocacy.

Our patients have both low grade and malignant brain tumours, including those involving the brain and the skull base. Neurosurgeons work in concert with neuro-oncologists, neuroradiologists, neuropathologists, and radiation oncologists specializing in the treatment of brain tumours. Regular clinical meetings and teaching rounds occur to co-ordinate care plans for patients. We are also able to offer access to unique treatment modalities, such as the intraoperative MRI theatre for assisting in the surgical treatment of brain tumour and intraoperative monitoring or cortical mapping for complex brain tumour resection.



Dr. Mark Hamilton

Our program provides:

- Surgical treatment of patients with malignant brain tumour
- Surgical management of patients with low-grade glioma
- Clinical trials for adjuvant treatment of patients with malignant brain tumour
- Treatment wait times and outcomes for brain tumour patients
- Endoscopic treatment of patients with skull base or pituitary tumours

Education

The program provides fellowship training for neurosurgeons who want to develop special skills in surgical neuro-oncology.

Research

Members of the program are actively involved in clinical research to test new and innovative therapies to treat patients with brain tumours. Dr. Mark Hamilton and Dr. John Kelly are members of the Arnie Charbonneau Cancer Institute and the Hotchkiss Brain Institute.

All neurosurgeons have been participants in multi-centre clinical trials, including those involving convection-enhanced delivery of agents into the brain to treat brain tumours and brain tumour vaccines. In addition, the Brain Tumour Tissue Bank is available to store tissue from consenting patients for current and future research.

Members

Neurosurgeons: Dr. Mark Hamilton,
Dr. Yves Starreveld, Dr. John Kelly,
Dr. Garnette Sutherland
Neuro-Oncologists: Dr. Paula de Robles,
Dr. Greg Cairncross, Dr. Gloria Roldan
Radiation Oncologists: Dr. Rob Nordal,
Dr. Gerald Lim
Nurse Clinician: Crystal Tellett
Surgical Neuro-Oncology Nurse: Chelsea Demler

The Section of Physical Medicine & Rehabilitation

Interim Section Head: Dr. Christine McGovern

THE SECTION OF PHYSICAL MEDICINE

AND REHABILITATION provides care to individuals relating to neurologic and musculoskeletal difficulties. Our focus is on improving an individual's function. Practices are diverse and include inpatient work on acute care units and tertiary rehabilitation units, community practice consultations and management. We have 37 members in our section. We provide clinical service, program planning and support, research and education to Alberta Health Services and University of Calgary programs.

Highlights

We held a retreat to help identify clinical, research, and education priorities for the section.

We participated in successful accreditations for the stroke and trauma programs this year.

We welcomed the first person to complete a fellowship with our section, Dr. Marcin Partyka. This was a fellowship sponsored by the Merz Fellowship Program.

The Neuro, Rehab and Vision Strategic Clinical Network was started and is lead by Dr. Chester Ho, the previous section head for PM&R. Many of our members are core committee members within this network now.

Dr. Chris Grant won an Alberta Health Services President's Award of Excellence for his work in the area of delirium in the intensive care unit.

Dr. Chantel Debert won a mid career investigator award.

Dr. Stephanie Plamondon won an award from the Muscular Dystrophy Association of Canada for Excellence in Health Care Delivery.



Dr. Dan McGowan won a Service Recognition Award from the Foothills Medical Centre Medical Staff Association.

Recruitments and Leadership

We were fortunate to experience further recruitment in 2018.

Dr. Ranita Manocha joined our section. She has an interest in musculoskeletal rehabilitation and bracing and will be collaborating with our colleagues in rheumatology and orthopedics to promote further research in these areas.

Dr. Andrew Malawski started practice in the community following his residency completion, and predominantly focuses on providing musculoskeletal care.

Dr. Ashley Smith joined our section as an adjunct



▲ Drs. Ken Lam, Sean Dukelow and Gentson Leung (far left), celebrate accreditation success with the Calgary Stroke Program.

research assistant professor. He is a physiotherapist by background, with a PhD from the University of Queensland, who is doing interdisciplinary research relating to musculoskeletal health. He has a particular interest in cervical pain.

Dr. Brian Rambaransingh joined our section as an adjunct associate professor. He is a previous graduate of our residency program who now works with the University of Alberta. He is involved in teaching and supervising students and residents from Calgary as well.

Education

We have 10 residents within our PM&R Residency Program. Drs. Rebecca Iwanicka and Jennifer Litzenberger graduated from the program this year and were successful with their Royal College examinations.

Dr. Rodney Li Pi Shan organized a course in ultrasound guided injections for the third year in a row.

Dr. Ken Lam and Dr. Sean Dukelow once again collaborated with physiotherapist Stuart Miller to put on an education course targeted towards an Allied Health audience. Previously, they have participated in multiple courses related to functional electrical stimulation. This year they put on an education session related to stroke and

aerobic exercise at the Vernon Fanning Centre. They also participated in Stroke Education Day.

We are continuing to participate in Simulation Scenarios. These are educational opportunities which involve multiple disciplines involved in clinical care scenarios on the neurorehabilitation unit.

We reformatted our journal clubs to include some evening time frames to further promote staff and resident interactions.

Research

We have been building a more robust research component to our section over time. We have significant ongoing research projects occurring in multiple areas, including stroke, brain injury and concussion, spinal cord injury, burns, and music therapy. Future projects are planned relating to gait and bracing.

Clinical

We have many clinical programs, both inpatient and outpatient, which continue to operate. The numbers of outpatients seen has continued to grow both within hospital based clinics and within community clinics, which has helped us to improve care to our community. We collaborate with other programs in the community to try and optimize care.

Physiatrist focused on fundamental MSK research

ANYONE WHO'S EVER BROKEN A LEG or twisted an ankle knows that, while crutches are great at getting you moving again, the mobility aids can be awkward to use and painful under the arms.

Is that because we're using them incorrectly? Or because they're the wrong size? Or perhaps they're the wrong bracing solution...

These questions attracted physiatrist Dr. Ranita Manocha to Calgary from Western University—along with an opportunity to be a trailblazer for crutch research.

"Compared to lots of other areas in medicine, rehabilitation doesn't have a lot of evidence behind what we do," she says. "There's never been a study that says which crutch is best for you."

In fact, most patients in North America have only ever used one type of crutch—the under-the-arm "axilla" crutch. Ask someone in Europe what a pair of crutches looks like and they'll describe supports that are held by the wrists and kept in place by forearms. Armpits? Why would you support your body weight there?

Dr. Manocha's recruitment to Calgary aims to start answering some of those questions.

PERSONAL VISION

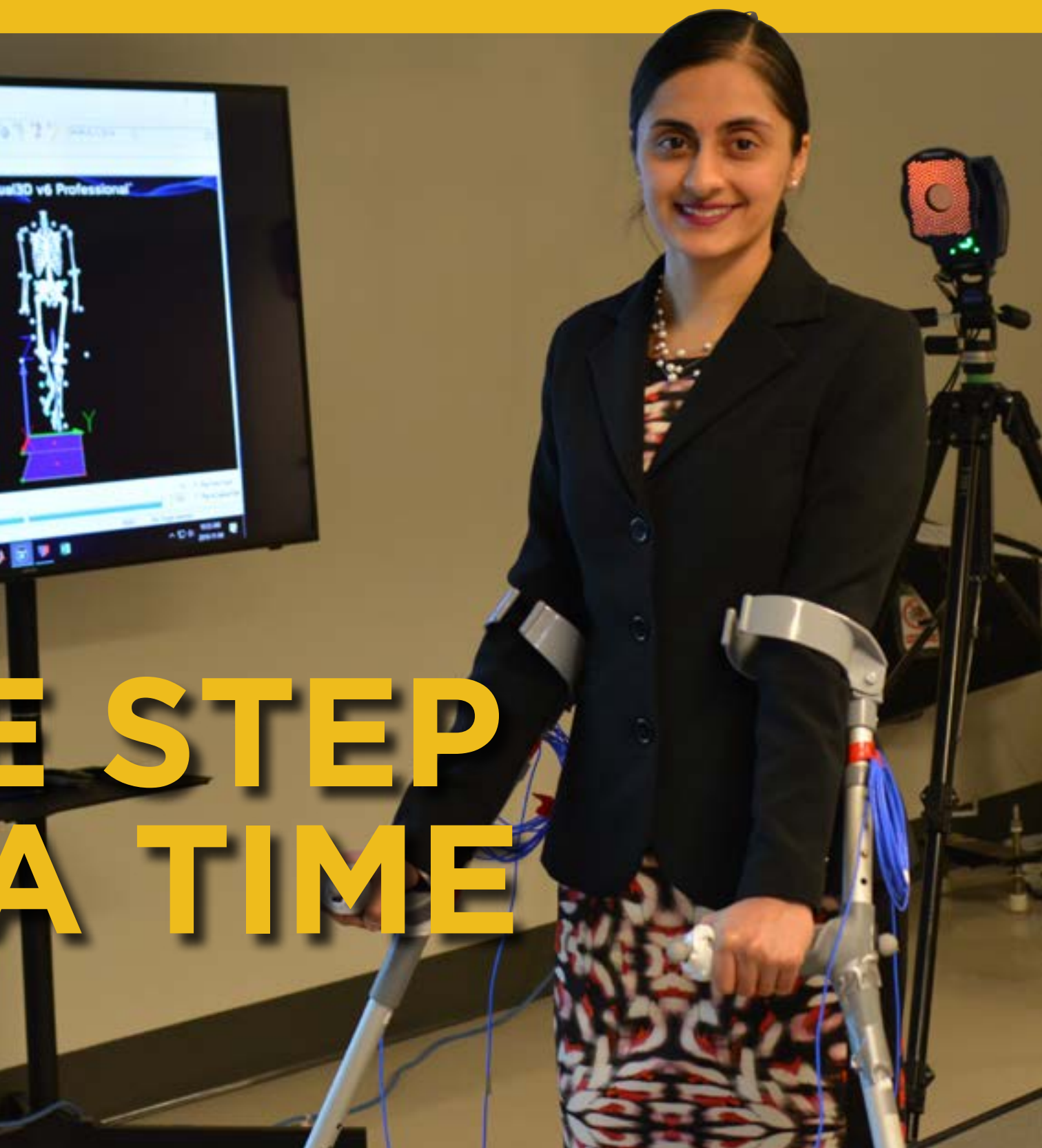
"What excites me is that you actually have the potential to change how care is delivered."

— Dr. Ranita Manocha

CONTINUED ON PAGE 56



▶
Dr. Ranita Manocha demonstrates forearm crutches in the gait lab.



THE NEXT STEP
A TIME

CONTINUED FROM PAGE 54

"I'm really interested in bracing and wheelchairs and there was no one doing anything like that out here—so it was an opportunity to start something like that, which is scary but kind of fun."

Working with other researchers and students in a motion-capture gait laboratory at the McCaig Institute, the DCNS physiatrist has recorded volunteers using a variety of crutches and studied how the length of the supports affect movement.

A subsequent study will look at patients with anterior cruciate ligament (ACL) reconstructions or knee replacements, says Dr. Manocha. They'll use electromyography and dozens of optical markers on the arms and legs to track upper body motion and muscle activity, and then survey participants about pain and discomfort.

"It takes a lot more time to process it than it does to collect. It's a lot of data!"

Previous studies found that the two biggest causes of crutch injury were not being trained on how to use them properly and not being fit properly.

"That's kind of what drove this next biomechanics study in terms of assessing those differences by crutch length," she says.

It's not hard to understand the value of the research. Walk around any hospital and you'll see dozens of patients with crutches, canes or walkers.

"I've been told that crutches are not a very sexy topic," she smiles, "but it's important."

Even simple questions such as "How long should you use crutches for?" don't have a lot of research behind them.

"Let's look at the simple things that we're doing," she says. "Let's see if there's actually evidence for it—or maybe we should be doing something different."

"Let's look at the simple things that we're doing. Let's see if there's actually evidence for it—or maybe we should be doing something different."

— Dr. Ranita Manocha

Dr. Manocha says her clinic work is a huge advantage when she's in the lab. Her patients benefit from what she learns in the lab and vice versa.

But one of her first challenges was building bridges in the community and spreading the word about how her clinic can help. She's reached out to rheumatologists, orthopedic surgeons and sports medicine docs—and has gradually built a referral network in Calgary and Southern Alberta.

Her patient list has grown and now includes everything from sports medicine injuries to people with chronic rheumatoid arthritis or peripheral nerve injuries.

Educating others about musculoskeletal issues has also led her to presenting at DCNS Grand Rounds and sharing her expertise within the department.

A lot of neurology and neurosurgical patients have secondary musculoskeletal problems that she can help with, says Dr. Manocha.

"So this week we're presenting someone who came in who's already seen spine surgery, orthopedic sports medicine

and vascular surgery and they can't figure out why this patient is walking funny," she says. "It turns out they have a very rare musculoskeletal problem in their hip."

Dr. Manocha teaches her students that MRIs and X-rays aren't always better at diagnosing issues than the human eye. Sometimes watching a patient walking in from the waiting room can tell you a lot about the problem, she says.

"(A few months ago) someone was referred to me because their gait did not get better after having corrective foot surgery for cerebral palsy and I watched them walk in. And I knew right away they probably didn't have cerebral palsy," she recalls.

"After talking to them and examining them, they probably had something called spinocerebellar ataxia. But you can learn valuable things like that just from watching your patients walk in."

The Amputee Rehabilitation Program

Program Lead: Dr. Kenneth Lam

Overview

The Amputee Rehabilitation Program provides comprehensive care to patients with limb loss across the continuum of care. Both inpatient and outpatient services are provided. In 2016, over 100 new patients with limb loss entered the program. Amputation occurs at all hospital sites so peri-amputation consultative services are provided citywide.

One of the key components of this program is to optimize the timing and level of amputation by close partnership with our surgical colleagues.

Outpatient rehabilitation is organized through the Community Accessible Rehabilitation (CAR) Program. With close partnership with the CAR Program we have garnered expertise in managing complex amputees. We have started a new collaboration with our local plastic surgeons in



Dr. Kenneth Lam

looking at novel approach to neuroma treatment and targeted muscle reinnervation.

We are also exploring the use of the Bento Arm, developed by the University of Alberta, for upper limb myo-electric prosthetic training.

Education

The program is dedicated to medical education and training. Physiatry residents complete a mandatory three-month period in the program during their residency. Vascular surgery residents are now spending one month in the program during their residency.

The program is also involved in the education and certification of prosthetists in training. In-service lectures are also delivered to Allied Health and nursing staff on a regular basis.

Members

Dr. Kenneth Kui Sai Lam
Dr. Gentson Leung

The Burn Rehabilitation Program

Program Lead: Dr. Vincent Gabriel

Overview

The Burn Rehabilitation program continues to increase inpatient volume.

The program implemented outcomes from our previous year quality improvement program to facilitate clinic processes and patient flow through the outpatient clinic.



Dr. Vincent Gabriel

Trainees from multiple faculties rotate through the clinical facilities in their development. We continue to work in partnership with the Calgary Firefighters Burn Treatment Society and our burn survivor support program. This year we have initiated a project that we hope leads to expanded patient treatment through laser resurfacing of burn scar.

Our research program continues to be productive, with several publications this year and an ongoing long-term cohort study of burn patients requiring split thickness skin grafting.

The Calgary Brain Injury Program

Program Lead: Dr. Rodney Li Pi Shan

Overview

The Calgary Brain Injury Program addresses the rehabilitation needs of individuals with acquired brain injuries which may arise from trauma, infection, aneurysm rupture, hypoxia, tumour resection or other causes. The affected individuals cross the spectrum from mild to severe levels of injury.

Service

The service includes both an inpatient and an outpatient component. The inpatient service includes a psychiatry consultation service for individuals in acute care, as well as 15-16 inpatient beds on a tertiary neurorehabilitation unit at the Foothills Hospital. The patient experience team continues to provide one-on-one peer support on the neurorehabilitation unit. There is also a facilitated group meeting every two weeks for individuals as well as their families to provide an opportunity for connection and support. The music therapy program on the neurorehabilitation unit has also been well received and funding to continue the program has been established.



**Dr. Rodney
Li Pi Shan**

The Early Supported Discharge Program is a home-based program where people discharged from hospital can receive interdisciplinary rehabilitation. This service allows them to leave hospital earlier and apply their rehabilitation to practical goals that are immediately relevant to them. Evaluation of the program showed it was equally effective to tertiary inpatient rehabilitation and saved a significant number of inpatient bed days and associated costs. The program is now ongoing, in association with the stroke early supported discharge program.

The outpatient service is based upon a centralized referral system which provides triage and advice from our community case manager for access to several different services, including:

- Sub-acute concussion education sessions delivered approximately every two weeks. This consists of symptom management advice in a group format to individuals affected by concussion within three months of injury. An

early concussion education module for patients is also available at <https://myhealth.alberta.ca/learning/modules/Early-Concussion>.

- A Brain Injury Rehabilitation Clinic provides assessment and treatment by physiatrists. Social workers are also associated with the clinic.
- Liaising with the Community Accessible Rehabilitation program in order to arrange interdisciplinary rehabilitation for individuals as required.
- Contracting for services with the Association for Rehabilitation of the Brain Injured, a community-based program, to provide rehabilitation services for appropriate individuals.

Education

We continue to be actively involved in teaching at many different levels. We support learning by medical students, residents, graduate students, Allied Health students, and nursing students.

Many of our members contribute to undergraduate medical teaching. Drs. Grant, Francis, McGovern and Li Pi Shan all teach the physical exam portion of the Neuroscience course and small group sessions. As well, Dr. Debert provides an hour-long lecture on concussion. Our members provide teaching for post-graduate training programs and we provide lectures for our residents in half day as well as for psychiatry and neurology.

Grants and Research

The CBIP research program, led by Dr. Debert, allows residents, graduate students, and undergraduate students to participate in clinical and basic science research. Researchers lead and collaborate on grants funded by the Cumming School of Medicine, Hotchkiss Brain Institute (HBI), Foundations for Physical Medicine and Rehabilitation and New Frontiers Funding.

We have a relationship with the Integrative Concussion Research Program and we are actively involved in the non-invasive neurostimulation initiative and the Brain and Mental Health Research Clinics—both HBI funded research initiatives. Members of the Calgary Brain injury Program are also involved with the HBI TBI neuroteam.

CONTINUED ON PAGE 61

Pediatric and Young Adult Rehabilitation Medicine Program

Program Lead: Dr. Lee Burkholder

Overview

The program provides inpatient and outpatient rehabilitation medicine services at the Alberta Children's Hospital (ACH) to pediatric populations, including children with neurological disorders such as brain injury, cerebral palsy, myelomeningocele/spinal cord injury, neuromuscular conditions, and other neurodevelopmental disorders, as well as musculoskeletal disorders such as limb deficiency and arthrogryposis.

The program is also responsible for the Young Adult Rehabilitation Clinics, outpatient clinics located at the Sheldon M. Chumir Health Centre and Foothills Medical Centre, which are dedicated to adult patients with child-onset neurological and musculoskeletal conditions. These clinics provide comprehensive rehabilitation medicine management and assist patients transitioning from pediatric care to the adult world.



Dr. Lee Burkholder

Clinical Care Updates

The Pediatric Rehabilitation Medicine inpatient consultation service treated 54 children, many within the context of the ACH interdisciplinary neuro-rehabilitation team, while admitted to hospital. An additional 21 patients were followed during admission to the ACH Dr. Gordon Townsend School (GTS) Rehabilitation and Education Program. The program also provided 1,024 pediatric outpatient consultation and followup appointments through various ACH rehabilitation clinics. A further 336 outpatient appointments were attended by adult patients through the Young Adult Rehabilitation Clinic. The program continued as a primary contributor to the interdisciplinary ACH Spasticity Assessment Program (SAP), which provides comprehensive assessment and management recommendations to children with complex hypertonicity issues. The SAP assessed three children for possible neurosurgical tone management with intrathecal baclofen via pump implant or selective dorsal rhizotomy. Gait analysis, collaborative with Orthopedic Surgery,

Physiotherapy and Orthotics, continued through the C.H. Riddell Movement Assessment Centre at the ACH with 44 patients undergoing evaluation.

Education

Educational pursuits were related to post-graduate medical education as well as research training for a clinical fellow and an undergraduate student. The program had four medical post-graduate trainees, including PM&R and pediatric neurology residents, on service for eight of 13 academic blocks.

Dr. Gnanakumar is a member of the PM&R Residency Training Committee and is the physician lead for PM&R medical student clinical electives. She gave a lecture on the integrated assessment and treatment of children with somatoform disorders at the scientific meeting of the Canadian Association of PM&R.

Dr. Burkholder is a member of the Pediatric Neurology Residency Training Committee.

Dr. Condliffe provided research mentorship and academic supervision for the PM&R spasticity clinical fellow and one undergraduate student participating in rehabilitation-focused research projects.

Research

Construction of Dr. Condliffe's Pediatric Onset of Neuromotor Impairment laboratory (PONI-lab) was completed at the ACH in close proximity to outpatient neurosciences and musculoskeletal clinic areas and will enable sophisticated neurophysiologic and functional assessments. The research program involves the University of Calgary, the University of Alberta and the University of Copenhagen.

Dr. Gnanakumar is the Calgary site lead for a clinical study focused on optimizing the management of pain and irritability in children with severe neurological impairments. Dr. Burkholder is a Calgary site co-lead for the Canadian Cerebral Palsy Registry.

Members

Dr. Lee Burkholder, Dr. Elizabeth Condliffe, Dr. Vithya Gnanakumar, Dr. Janet Tapper

PM&R Musculoskeletal and Chronic Pain Programs

Program Lead: Dr. Noorshina Virani

Musculoskeletal (MSK) Program

Musculoskeletal physiatry continues to grow in Calgary. We welcomed Dr. Rebecca Iwanicki and Dr. Jennifer Litzenberger, who have interests in general PMR, MSK and electrodiagnostic medicine. Both received Royal College Specialty Certification in 2019. They have joined the expanding team at Kinesis Medical Centre, which now has 10 physiatrists in community practice. Kinesis physicians continue to collaborate and run interdisciplinary clinics with neurosurgery, plastic surgery and with senior physiatrist residents. These clinics include:

- Spine Triage and Assessment Clinic (STAC) at FMC (four days per week)
- Hand Clinic at PLC
- Senior Resident Clinic at FMC



Dr. Noorshina Virani

Research

AM Smith, PA Alford, M Aubry, B Benson, A Black, A Brooks, C Burke, R D'Arcy, D Dodick, M Eaves, C Eickhoff, K Erredge, K Farrell, J Finnoff, DD Fraser, C Giza, RM Greenwald, M Hanzel, B Hoshizaki, J Huston, J Jorgenson, M Joyner, D Krause, N LaVoi, M Leaf, J Leddy, J Leopold, K Margarucci, S Margulies, J Mihalik, T Munce, A Oeur, S Podein, C Prideaux, WO Roberts, F Shen, D Soma, M Tabrum, MB Stuart, J Wethe, JR Whitehead, D Wiese-Bjornstal, MJ Stuart. Proceedings from the Ice Hockey Summit III: Action on Concussion. Exercise Medicine 2019; 3:1: <https://doi.org/10.26644/em.2019.001>.

Debert CT, Stilling J, Wang M, Sajobi TT, Kowalski K, Benson BW, Yeates KO, Dukelow SP. Athletes with a history of multiple sport-related concussions may be at risk of mild cognitive impairment on the Montreal Cognitive Assessment (MOCA). Canadian Journal of Neurological Sciences 2019; 46(3):311-318.

Mang CS, Whitten TA, Cosh MS, Scott SH, Wiley JP, Debert CT, Dukelow SP, Benson BW. Robotic

assessment of motor, sensory and cognitive function in acute sport-related concussion and recovery. J Neurotrauma 2018. <http://doi.org/10.1089/neu.2017.5587>.

Mang CS, Whitten TA, Cosh MS, Scott SH, Wiley JP, Debert CT, Dukelow SP and Benson BW. Test-retest reliability of the KINARM end-point robot for assessment of sensory, motor and neurocognitive function in young adult athletes. PLoS One 2018; 13, e0196205.

Whitten TA, Mang CS, Cosh MS, Scott SH, Dukelow SP, Benson BW. Spatial working memory performance following acute sport-related concussion: A novel robotic assessment task. J of Concussion 2018. <https://doi.org/10.1177/2059700218797818>.

Benson BW, Leclerc S, Richards D, McCluskey P, McCormack R, Wilkinson M, Kolb J. Sport-Related Concussion Guidelines for Canadian National and National Development High-Performance Athletes. Canadian Olympic and Paralympic Sport Institute Network, 2018.

Peer-reviewed conference poster presentations:

Mang CS, Whitten TA, Cosh MS, Scott SH, Dukelow SP, Benson BW. Assessment of postural movements while performing a rapid bimanual motor task after sport-related concussion. SPIN 2018. Montreal. Oct. 31, 2018.

Education

Several learners, locally and from abroad, including medical students, residents and graduate physicians, are eager to participate in neuromusculoskeletal clinical educational opportunities through the AHS Chronic Pain Centre and Kinesis Medical Centre.

Kinesis has expanded those opportunities to include 10 medical students and 46 residents from various disciplines, including PMR, rheumatology, geriatrics, family medicine and internal medicine.

CONTINUED ON PAGE 61

PM&R MUSCULOSKELETAL AND CHRONIC PAIN PROGRAMS CONTINUED FROM PAGE 60

Invited conference podium presentations:

Benson BW, Keynote Plenary. New Concussion Guidelines. 4th Annual MSK Pearls Course, Alberta Medical Association (AMA) Section of Sports Medicine. Red Deer, Alberta. March 9, 2018.

Chronic Pain Program

There are three streams of patient delivery at the AHS Chronic Pain Centre (AHS CPC) in Calgary, including the neuromusculoskeletal (NMSK), pelvic and headache teams. Currently, 626 patients are on the NMSK wait list as of Sept. 30, 2019. An additional 124 patients are on the pelvic and headache team waitlists. NMSK physicians assessed 595 new patients in the reporting period, while pelvic and headache teams assessed 125 and 75 new patients respectively. Average wait time until the first patient-physician visit to the NMSK team, has reduced by six months since the year prior, and is now approximately 14 months. Wait times for the other teams have also reduced. The wait time for patients to see a physician on the pelvic team is now 5.1 months and on the headache team is 10.8

months. This does not include visits to lectures, groups or other Allied Health providers, which may occur prior to the first physician visit.

The CPC is a mandatory rotation for family medicine and physiatry residents. Additional learners include psychiatry residents, medical students (locally and across Canada), as well as CME observers, graduate family physicians and foreign trained graduates. As such, the centre is full of learners every clinic day of the year.

Members

AHS Chronic Pain Centre (AHS CPC):

Dr. Nwamara Dike, Dr. Noorshina Virani

Community Practitioners:

Dr. Maryana Apel, Dr. Darren Chiu,
Dr. David Flaschner, Dr. George Francis,
Dr. Tony Giantomaso, Dr. Arun Gupta,
Dr. Chris Huang, Dr. Rebecca Iwanicki,
Dr. Les LaPlante, Dr. Daniel LeBlond,
Dr. Jennifer Litzenberger, Dr. Serge Mrkobrada,
Dr. David Nabeta, Dr. Daniela Porter,
Dr. Paul Reglin, Dr. Jordan Raugust,
Dr. Vishal Tuls, Dr. Andrew Malawski

CALGARY BRAIN INJURY PROGRAM CONTINUED FROM PAGE 58

The program also has two research assistants, post-graduate trainees, two undergraduate trainees, and graduate students, including two PhD candidates and one MSc candidate involved in the Calgary Brain Injury Program.

As well, over the last fiscal year Dr. Debert's team was involved in 10 peer reviewed publications.

Members

Managers: Jason Knox, Lisa Patel, Kim Kennedy
Community Case Manager: Heather Murison,
Alison Barnfather

Inpatient Brain Injury Nurse Clinician: Jill Congram
Physiatrists: Dr. Christine McGovern,

Dr. Rodney Li Pi Shan, Dr. Chantel Debert,
Dr. Christopher Grant, Dr. George Francis,
Dr. Ranita Manocha

Psychiatrist: Dr. Jeremy Quickfall

Clinic Social Workers: Valerie Bunz, Leianne Bouillet

Neuropsychologists: Dr. Stewart Longman,

Dr. Amy Siegenthaler, Dr. Ashley Fischer

Administration Support: Kendra McDonald,

Susan Morson, Ashley Derksen, Marj Moon,
Shelby O'Connell, Charmaine McLean,
Kristie Chow

The Spinal Cord Injury Rehabilitation Program

Program Lead: Dr. Denise Hill

Overview

The Spinal Cord Injury (SCI) Rehabilitation Program provides tertiary inpatient and outpatient rehabilitation services to persons with traumatic and non-traumatic SCI for Southern Alberta and Southeastern British Columbia.

The outpatient rehabilitation SCI clinic offers consultation services for people with spinal cord injuries. This clinic held 448 physician-patient visits, 118 physician-patient phone call followups, 125 nurse or nurse practitioner visits, and 93 nurse or nurse practitioner phone call followup visits (for a total of 566 patient encounters) between July 1, 2018 and June 30, 2019. Sixty-seven patients were admitted for acute inpatient rehabilitation on Unit 58.



Dr. Denise Hill

Highlights

Planning for a Foothills Medical Centre (FMC) SCI symposium got underway this year. The design of the symposium aims to foster networking among acute care and tertiary neurorehab staff and to provide education pertaining to care of the person with SCI across the continuum.

The Spinal Cord Injury registry—which was originally funded by Brain Canada with support from the Alberta Paraplegic Foundation, the Praxis Spinal Cord Institute (previously Rick Hansen Institute), the University of Alberta's Neuroscience & Mental Health Institute and the University of Calgary's Hotchkiss Brain Institute—is no longer conducted by the SCI rehabilitation program. However, work continues to embed aspects of the registry into standard clinical care and to expand enrollment opportunities to all persons living with an SCI in Alberta. The registry serves as a foundational platform to continue to track, evaluate and address patient outcomes and concerns.

In late 2018, the SCI Program was invited by the Toronto Rehabilitation Institute/University Health Network to participate in a sub-grant study supported by the Craig H. Nielsen Foundation to validate a newly developed pressure injury risk screening instrument called the SCI Pressure Sore

Onset Risk Screening (SCI-PreSORS). In order to evaluate the generalizability of the SCI-PreSORS to other sites and to calculate its sensitivity and specificity, they requested access to previously collected data (from the Spinal Cord Injury Knowledge Mobilization Network project, 2011-2016) and supplemented it with additional data (i.e., demographics and functional independence measure scores). This work continues and a manuscript will be submitted for publication within the next year.

In March 2019, Dr. Charbonneau and the SCI teams on both the Tertiary Neurorehabilitation Unit at FMC and the SCI Unit at the Glenrose Rehabilitation Hospital completed a project standardizing bladder management practices for SCI patients. The project was supported by an award of a provincial seed grant from the Alberta Paraplegic Foundation. The primary project goal was to standardize bladder management practices to support equitable, optimal, evidence-informed care. This was accomplished through the development and implementation of decision-making pathways and resource guides for staff and patients/families as well as training and coaching for staff. Learnings from this project will support future projects pertaining to bowel management and the management of autonomic dysreflexia.

Physiatry contributes to the diaphragm pacing program, neuromodulation meetings, the Alberta Functional Electrical Stimulation Interest Group, and the local activities of the Praxis Spinal Cord Institute. The program, through Dr. Charbonneau, published the following papers this year:

- Hubbard ME, Phillips AA, Charbonneau R, Squair JW, Parr AM, Krassioukov A. PRES secondary to autonomic dysreflexia: A case series and review of the literature. *Journal of Spinal Cord Medicine*. 2019 May 31.
- Squair JW, Dhaliwal R, Cragg JJ, Charbonneau R, Grant C, Phillips AA. National Survey of Bladder and Gastrointestinal Dysfunction in People with Spinal Cord Injury. *J Neurotrauma*. 2019 June 17.

Members

Dr. Denise Hill, Dr. Rebecca Charbonneau, Dr. Dan McGowan, Raj Parmar (Nurse Practitioner)

The Stroke Rehabilitation Program

Program Lead: Dr. Sean Dukelow

Overview

Stroke rehabilitation services at both the Foothills Medical Centre and the Dr. Vernon Fanning Care Centre are provided by physiatry. Our group also provides support for outpatient stroke rehabilitation in the community through Early Supported Discharge (ESD), Community Accessible Rehabilitation (CAR), Association for Rehabilitation of the Brain Injured (ARBI), and other private rehabilitation providers. We accept referrals from across Southern Alberta for patients who require stroke rehabilitation expertise.



**Dr. Sean
Dukelow**

Highlights

The stroke rehabilitation team was successful in obtaining funding from the Heart and Stroke Foundation for the REMAP trial. REMAP will examine the use of Transcranial Magnetic Stimulation (TMS) and Multi-Modal Aphasia Therapy (M-MAT) in 100 participants in an attempt to enhance aphasia outcomes following stroke.

Education

Our team was busy this past year teaching several physiatry and neurology residents, acute stroke fellows, and medical students in our clinics. Further, our members spent time teaching on the ward and in classroom sessions.

Dr. McNeil taught at the Canadian Resident Spasticity Course in London, Ontario. Dr. Lam helped to co-ordinate a zone-wide education day on aerobic exercise at the Dr. Vernon Fanning Care Centre. The latest studies and approaches in cardiovascular training following stroke were reviewed and a wide range of clinicians from across the Calgary Zone shared highlights from their work in the area.

Research

The Stroke Rehabilitation Program published 17 papers last year. Dr. Dukelow published a manuscript entitled "Taking proportional out of Stroke Recovery". The paper details the substantial methodologic flaws with a common and popular theory call proportional recovery that has garnered considerable attention. This publication spurred some open debate in the journal Stroke as well as garnered a public debate at the annual American Society for Neurorehabilitation meeting.

The CIHR-funded RESTORE trial examining robotic rehabilitation early after stroke continues to enroll participants, as does the Brain Canada funded FLOW trial examining Fluoxetine and its effect on lower extremity motor recovery.

Members

Dr. Sean Dukelow
Dr. Ken Lam
Dr. Steve McNeil
Dr. Gentson Leung
Allen Szabon, Physician Assistant

The Section of Translational Neuroscience

Section Head: Dr. V. Wee Yong

THE SECTION OF TRANSLATIONAL NEUROSCIENCE (STN)

in the Department of Clinical Neurosciences consists of seven primary members distinguished by their PhD background. Research areas for members include neurodegenerative diseases, movement disorders and multiple sclerosis (MS), with a focus on understanding the pathogenesis of these disorders and the discovery and translation of new therapies into the clinic. These therapies include those that may reduce injury to the compromised nervous system and those to promote brain repair.

- **Dr. V. Wee Yong** is a professor who co-directs the Multiple Sclerosis (MS) NeuroTeam at the Hotchkiss Brain Institute (HBI) and he is the director of the Alberta MS Network. His research interests have been guided by MS, spinal cord injury and malignant gliomas, and findings have been translated into clinical trials in these conditions. Dr. Yong's publications have been cited over 21,000 times (Web of Science, h index: 81). His research activities are supported by CIHR, the MS Society of Canada, and the Alberta Innovates - Health Solutions (AIHS) CRIO Team program. He recently folded his four CIHR Project grants into a CIHR Foundation grant that will run through 2026. Dr. Yong is the recipient of the 2017 Allyn Taylor International Prize in Medicine for "transformational discoveries in MS". He is a fellow of both the Royal Society of Canada and the Canadian Academy of Health Sciences.
- **Dr. Minh Dang Nguyen** received an Alberta Prion Research Institute award—Alzheimer's Research Program grant—to investigate the ApoE/ApoER2 axis in cerebrovascular dysfunction in Alzheimer disease (\$150K for two years, 2019-2021). The funded project is complementary to the CIHR Operating Grant he secured in 2018 (~\$987K for five years) that studies the roles of the Alzheimer's disease predisposition factor CD2AP in cerebrovascular dysfunction. Dr. Nguyen is currently collaborating with Dr. Eric Smith and Dr. Gerald Pfeffer to understand the impact of CD2AP polymorphisms in human patients with cognitive dysfunction and dementia. He has also extended his basic research on the gut-brain axis in amyotrophic lateral sclerosis (ALS) to the study of the oral microbiome in ALS patients in collaboration with Dr. Gerald Pfeffer and Dr. Lawrence Korngut.
- **Dr. Shalina Ousman** is an associate professor and a member of the Multiple Sclerosis (MS) and Spinal Cord/Nerve Injury and Pain Brain and Mental Health Teams at HBI. Her research is focused on investigating endogenous protective mechanisms in MS and peripheral nerve regeneration. In regards to her MS work, Dr. Ousman is investigating the molecular factors that drive dysfunction of astrocytes as well as sex dimorphism in the disease. Her peripheral nerve injury studies are focused on understanding why Schwann cells become dysfunctional in the injured aging peripheral nervous system. Her research is currently funded by CIHR and the MS Society of Canada.



- **Dr. Bin Hu** is a professor specializing in Parkinson's disease (PD) research. He is a member of the HBI, and directs an international program of rehabilitation therapy for patients living with PD. The Ambulosono program currently has a large group of active users in seven countries, which has attracted broad attention not only from academic institutions but business and art communities that support music and mind research. Dr. Hu's research has been supported by CIHR, Parkinson Association of Alberta, AIHS and Branch-out Foundation for Neurological Diseases. Dr. Hu has been invited by the world famous soprano Renee Fleming and Yale University to embark on a multi-city tour of Asia to promote the international program on music, brain and health.
- **Dr. Oury Monchi** is a professor, the Clinical Research Director of DCNS, the CaPRI/ Movement Disorders Brain and Mental Health team lead, the Tourmaline Oil Chair in Parkinson's disease and the Canada Research Chair (Tier 1) in non-motor symptoms of PD. In fall 2018 he obtained a platform grant from Brain Canada-Parkinson Canada for the creation of the Canadian-Open Parkinson Network which he directs. This network has 10 PIs and more than 50 members—mostly in Canada but also abroad. Dr. Monchi's lab was the first to show that the Mild Behavioral Impairment-checklist (MBI-C), a tool to measure rapidly sustained changes in neuropsychiatric symptoms in populations over 50 years, strongly correlates with cognitive deficits in Parkinson's disease. This work was published in the Journal Neurology in 2019. Dr. Monchi and his colleagues obtained a project grant in the spring 2019 CIHR competition to study whether the MBI-C is predictive of cognitive decline longitudinally in PD using a combination of clinical assessments, neuroimaging and machine learning.
- **Dr. Hedwich Kuipers** is an assistant professor of neuroimmunology and joined the HBI MS NeuroTeam in April 2018, holding a membership at the Snyder Institute for Chronic Diseases as well. Her research is aimed at understanding the interaction between immune cells entering the CNS and its resident cells. Her main focus is on astrocytes, whose role in neuroinflammation is often overlooked. She has shown before that these cells, which are highly abundant in the brain, can release factors that help T lymphocytes infiltrate into CNS tissue. She currently investigates how astrocytes interact with these T cells and how they shape their responses, using molecular and cell biology approaches, as well as animal models of MS. Dr. Kuipers's research is supported by the MS Society of Canada, the Canadian Foundation for Innovation and the HBI.
- **Dr. David Park** is a professor and Director of HBI. His research program focuses on the mechanism of neural injury in stroke and Parkinson's disease (PD) as well as some fundamental aspects of neural development. He is also the lead of the Brain and Mental Health Strategy for the University of Calgary and he chairs Campus Alberta Neuroscience which knits together the three major sites of brain research in Alberta (Calgary, Edmonton, and Lethbridge). Since 2018, he has published eight papers in journals such as PNAS, J Biological Chemistry, J Neuroscience and Science Translational Medicine. His current interests are focused on understanding how genes associated with PD function or dysfunction to lead to disease progression. In this regard, he has recently shown that the LRRK2 gene may play a critical role in immune function regulation and he is currently screening drugs for potential candidates for human trials.

Education

Members offer graduate and postdoctoral fellowship studies in basic and translational neurosciences, as well as year-round research projects for senior undergraduates and summer research programs.

Translational Program

STN is in a unique position to foster cutting edge translational neuroscience research. We are somewhat different from the basic science departments in that our program has a clear mandate to facilitate and integrate research and education between the clinic and the laboratories.

Work by our members, in collaboration with our neurology, neuro-oncology and neurosurgery colleagues, has resulted in a successful Phase III clinical trial in MS, an ongoing Phase III trial in traumatic spinal cord injury, and a soon-to-start Phase I/IIa trial of niacin in glioblastoma. A \$5 million team grant from AIHS, led by one of our members, and which includes several clinical colleagues, has enabled us to initiate and continue clinical trials of potential remyelinating therapies in MS.

A WORLD OF collaboration

TRANSLATIONAL NEUROSCIENCES

member Dr. Minh Dang Nguyen will tell you that luck is part of the success in science. He could be talking about a happy-accident-in-the-test-tube kind of luck or luck receiving a grant or getting a stellar graduate student.

What is not left to chance, however, are the collaborations that he routinely seeks out and the relationships he has developed over the years.

With these, you could argue, he makes his own luck.

After receiving a grant from the ALS Society of Canada to study bacteria in the gut and mouth with Dr. Gerald Pfeffer, Dr. Nguyen concluded that samples from another country would be valuable since diet is a key factor in the microbiome of the gut and mouth.

The associate professor asked his master's student, Suzie Lee, if she could introduce him via email to an ALS researcher in Seoul.

"So I wrote to the guy that I was referred to—who runs the biggest ALS clinic in South Korea," he recalls.

"He never replied to me."

"So I asked Suzie to write to him in Korean. He replied to her."

Soon after, Dr. Nguyen was in

PERSONAL VISION

"If I have an idea, I just let it out. I don't care if I'm not the first to test it, but at least someone will do it. That's how I see science."

— Dr. Minh Dang
Nguyen

Seoul for the International Brain Research Organization (IBRO) World Congress of Neuroscience and made a point of meeting with the researcher and pitching a collaboration.

"He said okay, we'll do it. We'll collect samples for you."

For some, sharing research and ideas with an unknown lab on the other side of the globe could be seen as risky. But the risk was well worth the reward, says Dr. Nguyen.

"I believed that the researcher was authentic and that's why I went for it."

His long list of collaborators

would indicate that this approach seems to be fruitful.

He's working with a colleague in Quebec on the molecular mechanisms underlying cerebrovascular dysfunction in Alzheimer's disease, a project funded by CIHR for which he is the lead PI. He met Dr. Matthew Stephens, a postdoc researcher at a HBI/Snyder symposium this year, and this meeting has spurred the ALS research.

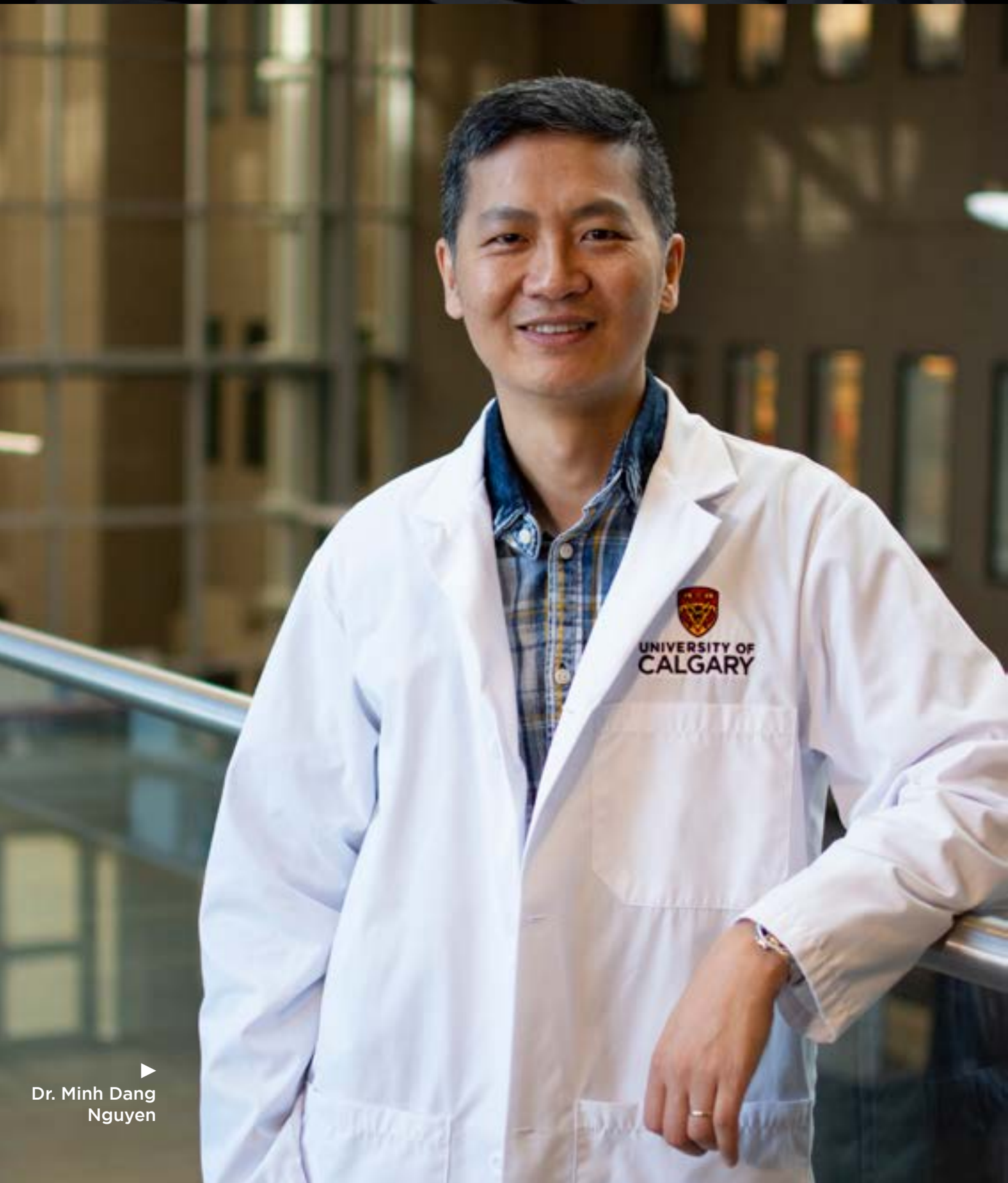
And critically, Dr. Nguyen has undertaken several collaborations within DCNS members—including with clinician-scientists Dr. Eric Smith and Dr. Pfeffer—and former member Dr. Jong Rho.

In fact, the questions and research ideas seem to be multiplying faster than the grants available to study them. But that doesn't bother him.

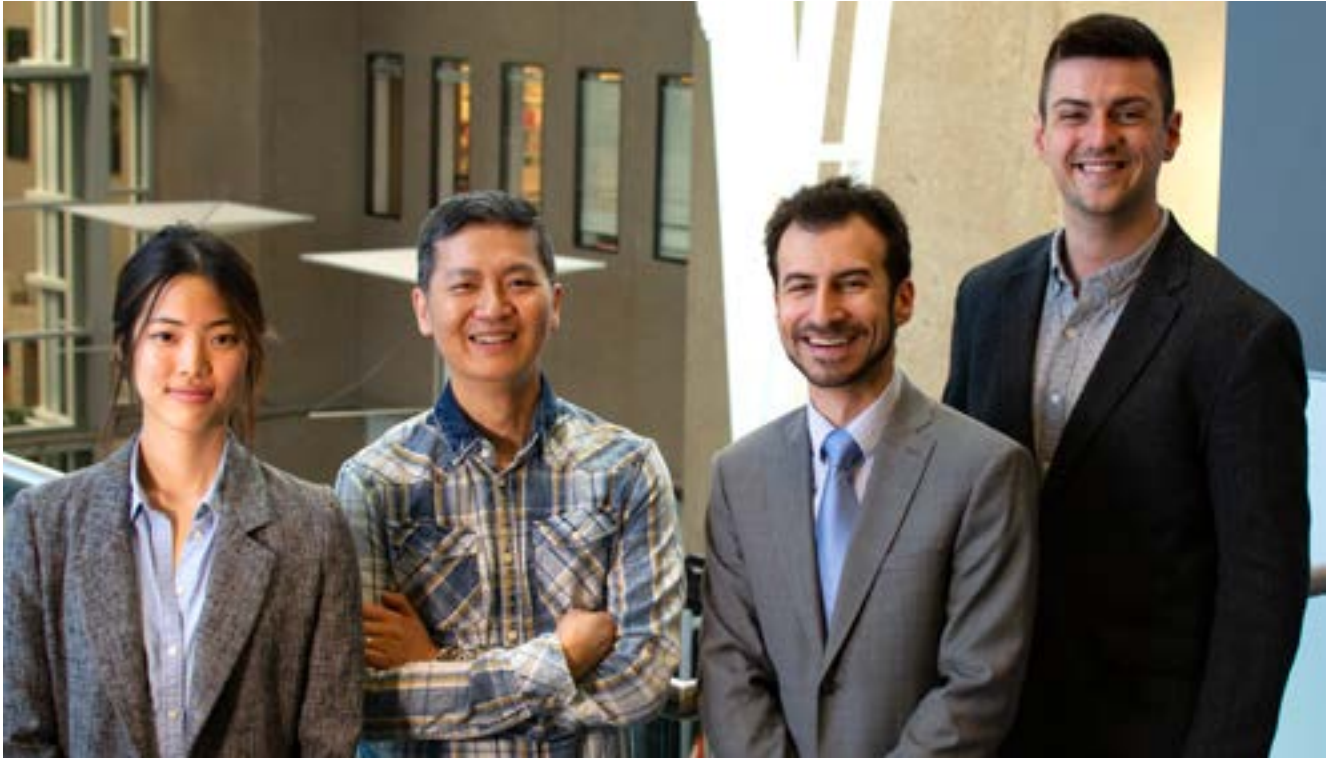
"If I have an idea, I just let it out. I don't care if I'm not the first to test it, but at least someone will do it. That's how I see science," he says.

"Of course, I have to protect what my students are working on because they get the publication, the degree and their future is ahead. But if I have other ideas, and I don't have the resources that someone else has—go ahead," he says.

CONTINUED ON PAGE 68



▶
Dr. Minh Dang
Nguyen



▲ Dr. Minh Dang Nguyen with lab trainee Suzie Lee, (left), post doc researcher Dr. Matthew Stephens (far right) and clinician-scientist Dr. Gerald Pfeffer.

CONTINUED FROM PAGE 66

This ability to focus on the questions that really intrigue him—and let the others go free—is also part of his philosophy of research.

“I have a lot of freedom, actually. If you look at my career path, I have been able to work on almost anything I like ranging from neurodegeneration to neurodevelopment to cancer research. I just like to go where the research drives me.”

It’s something he tells his students. “Do what you like. Go where your passion takes you. If you don’t like it, forget it.”

The other advice he shares is how he approaches research in the lab.

Your scientific journey should reflect who you are, he says. Depending on your background, personality and influences, you can do science in different ways—as long as the procedure is rigorous.

And those young, inspired scientists in his lab—each with different backgrounds—are also great to collaborate with, he says.

“That’s the most exciting part.”

“I have a lot of freedom, actually. If you look at my career path, I have been able to work on almost anything I like ranging from neurodegeneration to neurodevelopment to cancer research. I just like to go where the research drives me.”

— Dr. Minh Dang
Nguyen

Undergraduate Medical Education in Clinical Neurosciences

Co-Chairs: Dr. Erika Dempsey and Dr. Philippe Couillard

Evaluation Coordinator: Dr. Scott Jarvis

Anatomy Coordinator: Heather Jamniczky PhD

Course Coordinator: Kelsey O'Donnell

Overview

Medical students learn about neurosciences and aging during August, September and October each year, in the first course of the second year of the undergraduate curriculum. The neurosciences component is combined with content from geriatrics, otolaryngology, ophthalmology, pain and palliative care.

The Undergraduate Medical Education office of the Cumming School of Medicine at the University of Calgary oversees the course, entitled Course V – Neurosciences, Aging and Special Senses.

The neurosciences content in the course begins with a series of lectures on the functional anatomy and physiology required to evaluate patients presenting with neurological complaints. The remainder of the content covers clinical presentations of neurological illness, as well as sessions devoted to specific neurological conditions. The curriculum is taught by approximately 130 teachers, including 60 from the Department of Clinical Neurosciences.

Course content is delivered via a combination of lectures, patient presentations, small group seminars and bedside teaching sessions. A group of approximately 15 teachers from the department have taken some further faculty development training and have committed to supervising many of the small group and clinical teaching sessions.

Course V Committee:

Andrea Melanie Kuczynski (class rep)
Dan McGowan
Dawn Pearson
Erika Dempsey
Gary Klein
Jeptha Davenport
Martina Kelly
Alice Ho
Christopher Hahn
Clare Gallagher
Darren Burbuck
David Patry
Gerald Pfeffer
Heather Jamniczky
John Huang
Lori Montgomery
Paolo Federico
Paul Marck
Paula Pearce
Ron Spice
Ronak Kapadia
Scott Jarvis
Vivian Hill

Resident Research Day

RESIDENT RESEARCH DAY, which was held on Nov. 9 last year, is celebrated within the Department of Clinical Neurosciences and is a highlight of our Grand Rounds calendar.

Residents from Neurology, Neurosurgery, Physical Medicine & Rehabilitation and Pediatric Neurology have their abstracts and presentations judged by a panel of faculty members and the strongest are chosen for two prestigious awards.

Abstracts from 14 residents were presented and, for the first time, two fellows shared their research: Dr. Carlos Camara-Lemarroy and Dr. James Dimou.

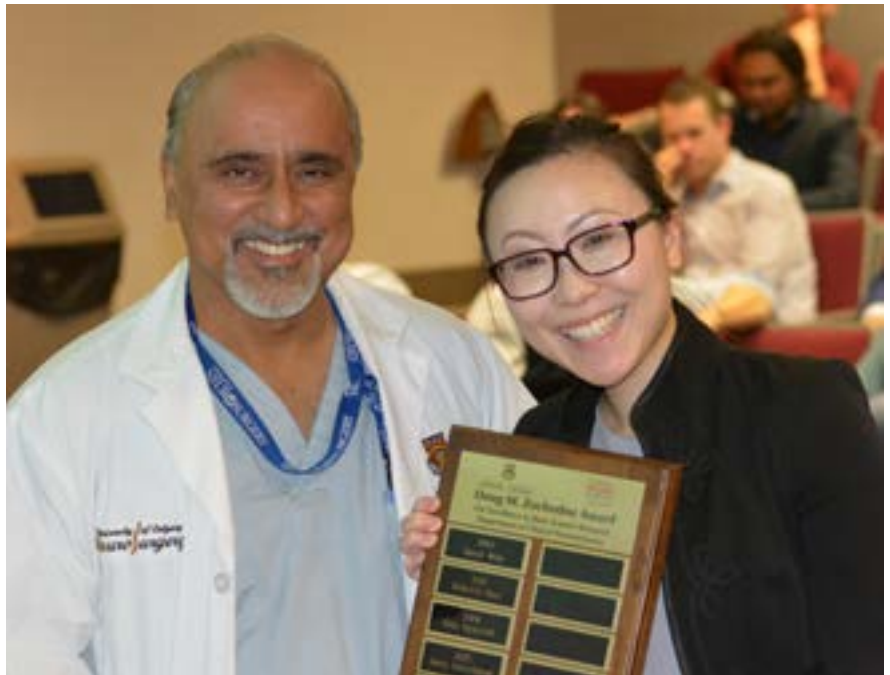
For 2018, the J. Gregory Cairncross Award for Excellence in Clinical Research was awarded to Dr. Joan Stilling for her presentation "TOPiCS rTMS trial: Treatment of persistent headache attributed to mild traumatic injury to the head (PHATIH) in patients with persistent post concussion symptoms (PPCS) using repetitive transcranial magnetic stimulation (rTMS)."

The Doug W. Zochodne Award for Excellence in Basic Science Research was won by Dr. Candice Poon for her work "Single-cell level comparison of histopathologic features and single-cell RNA-seq databases between IDH-MUT and -WT previously untreated glioblastomas reveals distinct innate immune microenvironments that can be exploited for therapeutic gain."

Congratulations to all who participated!



Resident Research Day winners with Dr. Rajiv Midha: Dr. Joan Stilling (above) and Dr. Candice Poon (below).



Neurology Residency Program

Program Director: Dr. Michael Yeung

Program Administrator: Christopher Smith

Number of positions per year: 3-4

Accreditation: Royal College of Physicians and Surgeons of Canada

Length of Training: 5 years

The University of Calgary Adult Neurology Residency Training Program is dedicated to educating residents in neurology. The program has trained over 50 neurologists since its inception in 1981 and these specialists practise neurology in community and academic institutions throughout the world. The program currently has 17 residents from across Canada.



Dr. Michael Yeung

Upon completion of training in neurology, a resident is expected to be an expert in the prevention, diagnosis and management of patients with diseases of the nervous system; and to integrate all of the CanMEDS roles (Medical Expert, Communicator, Collaborator, Leader, Health Advocate, Scholar and Professional) to provide optimal, ethical and patient-centred medical care.

We emphasize the pursuit of excellence in clinical and academic neurology and instill intellectual curiosity of the discipline for the academic leaders of tomorrow.

As with all neurology programs across Canada, we will be launching Competence by Design—the Royal College of Physicians and Surgeons of Canada's revamp of medical education within residency programs—in July 2020. This will facilitate learning through timely and specific feedback to learners and faculty.

Our residents have presented their research at national and international conferences and have been the recipients of grants and scholarships for their clinical and academic pursuits. Our residents also support the learning of medical students throughout their training, either on the inpatient units, the outpatient clinics, or through teaching at the medical school. They have also participated in outreach programs to elementary and high school students to learn about the human brain.

The Neurology Residency Training Program at the University of Calgary prepares residents to become specialists in neurology, whether their primary interest is clinical or academic.

Physical Medicine and Rehabilitation (PM&R) Residency Program

Program Director: Dr. Gentson Leung

Program Administrator: Selena Smith

Number of positions per year: 2

Accreditation: Royal College of Physicians and Surgeons of Canada

Length of Training: 5 years

The University of Calgary Physical Medicine and Rehabilitation (PM&R) Residency Training Program strives to provide excellent educational experiences to both undergraduate and postgraduate learners to help them excel in their clinical and academic pursuits. We recognize the unique privilege and responsibility of training the next generation of physiatrists, and are excited to continue to improve upon the training we provide.



Dr. Gentson Leung

To that end, the PM&R residency program will be launching the Competence by Design (CBD) curriculum in July 2020. Our program has been actively planning, training, and preparing both staff and residents for this major shift in medical education. This includes leveraging electronic tools and platforms to facilitate more timely and specific feedback to the trainees and faculty.

In addition to the training of psychiatry residents, the Section of PM&R continues to provide support to the University of Calgary medical school in Course 2 (Musculoskeletal Medicine) and Course 5 (Neurology) teaching for small groups, lectures, and clinical skills. Many of the faculty and residents participate in teaching medical students.

The use of simulation as a teaching and educational tool is growing in medical education, and our program has been actively pursuing opportunities to implement its use. Simulation can be used to supplement the training our residents receive and is useful for addressing rare but important clinical situations, as well as improving interdisciplinary communication in a low-stakes environment. There are a number of PM&R faculty members who have attended the Royal College Module Simulation Scenario Development Training, and have successfully implemented interdisciplinary simulation training scenarios involving PM&R faculty, residents, nurses, hospitalists and Allied Health in partnership with the Advanced Technical Skills Simulation Laboratory (ATSSL) at the University of Calgary.

Since the residency program's inception in 2004, our graduating PM&R residents have all successfully passed their Royal College Certification examinations. As well, all of our trainees who have challenged the licensing examination for EMG (electromyography) have been successful, which is a reflection of the strong partnership that Psychiatry has with our neuromuscular colleagues and the excellent training that our residents receive.

Further information about the PM&R Residency Training Program can be viewed at <https://cumming.ucalgary.ca/departments/dcns/education/residency/physiatry>

Neurosurgery Residency Program

Program Director: Dr. Jay Riva-Cambrin

Program Administrator: Patti Sullivan

Number positions per year: 2

Accreditation: Royal College of Physicians and Surgeons of Canada

Length of Training: 6 years

Mandatory Research: 1 block in PGY1; entire PGY4 year or more

Education of our postgraduate and undergraduate students remains one of the highest priorities of DCNS and the Section of Neurosurgery. The teaching faculty consists of a large complement of dynamic key opinion leaders representing all subspecialties of neurosurgery, including vascular, interventional, intracranial lesions, skull base, epilepsy, functional and peripheral nerve. In addition, the University of Calgary boasts the largest comprehensive spinal surgery program in Canada with a total of 11 full-time spine surgeons coming from both neurosurgical and orthopedic backgrounds.



Dr. J. Riva-Cambrin

From the moment residents enter the program, they are continuously involved in research and education initiatives. Considerable resources are dedicated each year to facilitating academic activities through faculty participation, existing peer-reviewed grants, project funding from sectional and department sources and a minimum of 12 months of clinical or basic science research. The neurosurgery educational half-day runs each week for three hours on Monday afternoons and incorporate neuroanatomy and the simulation lab. Sessions are led by the residents and supervised by the faculty, creating a learning environment within the realm of neurosurgical expertise.

A number of our residents continue to garner awards and scholarships for their outstanding clinical and academic endeavors in addition to

a few celebrating engagements, marriages, and births. Some of these include:

- **Dr. Stefan Lang** was awarded and presented the top abstract award at the annual World Society for Stereotactic and Functional Neurosurgery in New York. As well, he was recently awarded the JB Hyne Award for research innovation, awarded by the Faculty of Graduate Studies.
- **Dr. Candice Poon** was awarded the 2019 K.G. McKenzie Memorial Prize for Basic Research at the Canadian Neurological Science Federation annual meeting in Montreal. She successfully defended her PhD thesis in addition to having a number of publications and her second child.
- **Dr. Michael Yang** had a number of publications and was successful in achieving his master's degree. He was also the recipient of a Charles Kuntz Scholar Award for an abstract that he presented at the Joint Section on Disorders of the Spine and Peripheral Nerves annual meeting in Miami.

Team relationships outside the hospital are of equal importance to the Section of Neurosurgery as they are within the hospital. The program offers a well-rounded exposure to all aspects of neurosurgery within a close and collegial environment.

Non work-related, team-building events held throughout the year provide a healthy balance against a busy lifestyle choice.

The end result is a recipe for one of the most cohesive, dedicated and high-performing resident groups in all of Canada and a group that we are proud to call our own.

Research in Clinical Neurosciences

Overview

The Department of Clinical Neurosciences (DCNS) was founded in 1981 on the premise that excellence in patient care and excellence in research go hand in hand. We see them not only as inseparable, but synergistic.

Many of the physicians and surgeons in Clinical Neurosciences are actively engaged in research, however some focus exclusively on patient care. The spirit of research and innovation are integral to our team and are continuously fostered. Members lead a variety of research programs—facilitated by strong partnerships with the Hotchkiss Brain Institute, clinical departments within the Calgary Zone of Alberta Health Services, as well as other public and private organizations. Our members' research efforts focus on the following areas:

- **Basic Research:** The study of biology and mechanisms of disease.
- **Translational Research:** Involves taking findings from basic research and moving them quickly and efficiently into medical practice to improve disease treatment or other health outcomes.

- **Clinical Trials Research:** The comparative testing of new treatment ideas against current standards of care to determine which is superior.
- **Health Services Research:** The study of health care access and health care delivery to detect deficiencies and design improvements. Health services research often involves careful analysis of databases.
- **Population Health Research:** The study of disease in populations to find risk factors and design prevention methods.

Our research-focused doctors and scientists are also members of the Cumming School of Medicine, Alberta Health Services and the Hotchkiss Brain Institute, from which they receive invaluable assistance, mentorship and support. Indeed, much of our success in research as a clinical group can be traced to these very strong linkages.

Our faculty members publish the results of their studies in the top medical and scientific journals and they play leading roles in local, national, and international academic and professional organizations. Their efforts are supported by grants from a wide range of external agencies.

Fellowships in Clinical Neurosciences

Overview

The Department of Clinical Neurosciences (DCNS) at the University of Calgary offers one and two year basic science, clinical and/or research fellowships designed to provide enhanced broad-based clinical training and responsibility beyond the certification level, as well as clinical research opportunities.

DCNS averages 30 fellows each year who work and study in the following specialties:

- Stroke
- Spinal Neurosurgery
- Peripheral Nerve
- Functional Neurosurgery
- Stereotactic and Functional Neurosurgery
- Neuro-oncology
- Endovascular Neurosurgery
- Epilepsy
- Headache
- Multiple Sclerosis
- Neuromuscular

As a joint department in both the University of Calgary and Alberta Health Services, DCNS is uniquely positioned to advance research from the laboratory directly to the patient's bedside.

These opportunities have helped the department attract fellows from a wide variety of backgrounds seeking further subspecialty experience. Their presence has enriched the clinical and academic environment for all.

We are also pleased that many of our fellows have received international awards during their fellowship training and numerous have gone on to faculty positions worldwide.

For more information on fellowship opportunities, please contact us at <https://cumming.ucalgary.ca/departments/dcns/education/fellowships>

NEUROLOGY



Yahya Agha-Khani



Katayoun Alikhani



Mohammed Almekhlafi



Farnaz Amoozegar



Simerpreet Bal



Philip Barber



Veronica Bruno



Tyson Brust



Jodie Burton



Kevin Busche



Greg Cairncross



Sameer Chhibber



Alicja Cieslak



Lara Cooke



Fiona Costello



Shelagh Coutts



Jephtha Davenport



Andrew Demchuk



Paula de Robles



Yanjun Duan

NEUROLOGY



Hamid Ebadi



Paolo Federico



William Fletcher



Sarah Furtado



Chris Hahn



Alexandra Hanson



Michael Hill



Lisa Hoyte



Scott Jarvis



Colin Josephson



Ronak Kapadia



Brian Klassen



Gary Klein



Karl Martin Klein



Marcus Koch



Jagdeep Kohli



Lawrence Korngut



Scott Kraft



Davide Martino



Bijoy Menon

NEUROLOGY



Luanne Metz



William Murphy



David Patry



Dawn Pearson



Steven Peters



Gerald Pfeffer



Neelan Pillay



Tamara Pringsheim



Justyna Sarna



Shaily Singh



Eric Smith



Peter Stys



Suresh Subramaniam



Chris White



Samuel Wiebe



Scott Wilson



Katie Wiltshire



Megan Yaraskavitch



Michael Yeung

NEUROSURGERY



David Cadotte



Steven Casha



Stephan du Plessis



Clare Gallagher



Walter Hader



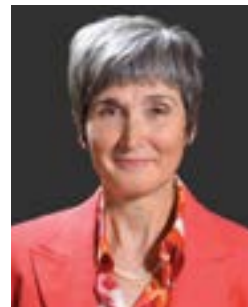
Mark Hamilton



Bradley Jacobs



John Kelly



Zelma Kiss



Rajiv Midha



Alim Mitha



Jay Riva-Cambrin



Yves Starreveld



Garnette Sutherland



John Wong

PHYSICAL MEDICINE & REHABILITATION



Lee Burkholder



Rebecca Charbonneau



Darren Chiu



Elizabeth Condliffe



Chantel Debert

PHYSICAL MEDICINE & REHABILITATION



Nwamara Dike



Sean Dukelow



George Francis



Vincent Gabriel



Vithya Gnanakumar



Chris Grant



Arun Gupta



Denise Hill



Chris Huang



Ken Lam



Les LaPlante



Daniel LeBlond



Gentson Leung



Rodney Li Pi Shan



Andrew Malawski



Ranita Manocha



Christine McGovern



Dan McGowan



Stephen McNeil



Serge Mrkobrada

PHYSICAL MEDICINE & REHABILITATION



Dave Nabeta



Stephanie Plamondon



Daniela Porter



Jordan Raugust



Paul Reglin



Janet Tapper



Vishal Tulsi



Noorshina Virani

TRANSLATIONAL NEUROSCIENCE



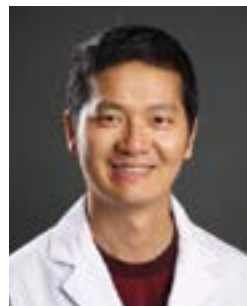
Bin Hu



Hedwich Kuipers



Oury Monchi



Minh Dang Nguyen



Shalina Ousman



David Park



Boguslaw Tomanek



V. Wee Yong



Zonghang Zhao

EMERITUS



Werner Becker



Keith Brownell



Tom Feasby



Manuel Hulliger



John Latter



Francis LeBlanc



Robert G. Lee



Terry Myles