

# NEURO



DEPARTMENT OF CLINICAL NEUROSCIENCES

ANNUAL REPORT 2016-2017

## THE ROLE OF **RESEARCH**

### **MINOCYCLINE**

A 20-year commitment to  
advancing MS research

### **TREMOR TREATMENT**

Focused ultrasound procedure  
changing lives for patients

# Department Goals

- 1** To provide excellent clinical care in Neurology, Neurosurgery and Physiatry to patients in our referral area.
- 2** To develop clinical-academic programs in the Clinical Neurosciences of national and international stature. These programs will provide special assessment and treatment, develop and test new forms of treatment and explore disease mechanisms.
- 3** To provide excellent educational programs in the Clinical Neurosciences and related basic neurosciences including undergraduate courses, clerkship, residency training, postgraduate training and continuing medical education.
- 4** To promote and conduct clinical research and clinically relevant basic science research into diseases of the nervous system.



## Cover photo

Neurosurgery resident Dr. Michael Avery conducts bioengineering research as part of his residency training program.

# Table of Contents

**Message from the Department Head of Clinical Neurosciences . . . . . 2**  
Department celebrates visionary leader . . . . . 2  
Today’s research guides tomorrow’s patient care . . . . . 5

**Clinical and Academic Metrics . . . . . 6-9**

**The Section of Neurology**  
Neurology Overview — Dr. Luanne Metz, Section Head . . . . . 10  
Minocycline: A 20-year commitment to MS research . . . . . 12  
Brain and mental health initiative links patients, clinicians and researchers . . . . . 15  
**Neurology Programs . . . . . 16-31**  
**Pediatric Neurosciences . . . . . 32**

**The Section of Neurosurgery**  
Neurosurgery Overview — Dr. John Wong, Section Head . . . . . 34  
MR-guided ultrasound delivers life-changing tremor treatment . . . . . 36  
Resident takes time out to tackle a fundamental question of neuroscience . . . . . 38  
**Neurosurgery Programs . . . . . 40-49**

**The Section of Physical Medicine and Rehabilitation**  
Physical Medicine and Rehabilitation Overview — Dr. Chester Ho, Section Head . . . . . 50  
Physiatrist finding answers for patients with concussion . . . . . 52  
Hands-on MSK symposium draws participants from across Canada . . . . . 56  
**Physical Medicine and Rehabilitation Programs . . . . . 58-65**

**The Section of Translational Neuroscience**  
Translational Neuroscience Overview — Dr. V. Wee Yong, Section Head . . . . . 66  
Embracing the yin and yang of research . . . . . 68

**Undergraduate Medical Education . . . . . 70**

**Residency Programs**  
Resident Research Day: Competition proves fierce for research awards . . . . . 71  
Neurology Residency Update — Dr. Michael Yeung . . . . . 72  
Physical Medicine and Rehabilitation Residency Update — Dr. Gentson Leung . . . . . 73  
Neurosurgery Residency Update — Dr. Jay Riva-Cambrin . . . . . 74

**Fellowships and Research . . . . . 75-76**

**Faculty Members . . . . . 76-82**

# Message from the Department Head

Dr. Rajiv Midha

**FOR MANY YEARS**, the Department of Clinical Neurosciences has been fortunate to attract world-class physicians, educators and researchers to join our faculty.



This past year, we're delighted to have welcomed **Dr. Chris Hahn, Dr. Elizabeth Leroux, Dr. Davide Martino, Dr. Steven Peters** and **Dr. Shaily Singh**.

All five are either new to Calgary or returning to our city after specialist training at other centres—and each of these talented doctors could have chosen to

practise anywhere in the world. The fact that they chose Calgary is likely a result of many factors: our links to the Cumming School of Medicine and the Hotchkiss Brain Institute; the depth of clinical care we deliver to patients; the reputation of our faculty members; and the dynamic nature of the city we call home.

But we also believe our recruitment success is partly a result of the research opportunities that we can offer to new members.

We are a department that is respected for advancing medicine through basic science and clinical trials—and our publication and citation

## Department celebrates visionary leader

**DR. ROBERT G. LEE** was a physician, a teacher, a scholar – and also dedicated to sharing his knowledge with physicians in remote parts of the world.

Dr. Lee was recruited to Calgary by the Faculty of Medicine on January 1, 1974 to become the first academic neurologist in Calgary.

He was a proud member of the “highly secretive” Corkscrew Club, which held “clandestine meetings” after hours with the aim of uniting Neurology and Neurosurgery at the Foothills and Calgary General Hospitals.

“We all had a common interest in (uniting)—not just neurology and neurosurgery, but neuropathology and neuroradiology and the basic neurosciences,” said Dr. Lee in October 2015.

The Corkscrew Club (named for the 16th Avenue restaurant where they met—now the Keg), included Drs. Frank Leblanc, Peter Seland and Mike Hunter, and they drew up plans to create a neuroscience institute in Calgary. Their idea was pitched to then-Premier Peter Lougheed at a party in Airdrie, but

was ultimately rejected. Instead, they were given the go-ahead to create the Department of Clinical Neurosciences by the Dean.

“Looking back on it, I think we were pretty ambitious!” said Dr. Lee, who became the first chairman (head) of Department of Clinical Neurosciences when it was founded in 1981.

“I think we were very fortunate to be in a new medical school with a new approach to teaching and to research,” he recalled. “I think it would have been much more difficult to do this at one of the older, established universities.”

As part of a University of Calgary program, he visited Laos in SE Asia over a dozen times and helped create a family medicine training program that has graduated over a hundred new doctors.

Dr. Lee was awarded Professor Emeritus status by the Cumming School of Medicine and had a lecture series named in his honour in December 2016.

Dr. Robert G. Lee passed away in Calgary on Friday, March 31, 2017. He will be deeply missed.



statistics speak to the quality of our work.  
(See Page 7 for details)

Last year's ESCAPE trial and this year's Minocycline trial (See story on Page 12) are but two examples that have made international headlines recently. But there are dozens more stories in our department and we've featured a few in this annual report.



We've also captured a selection of these on video so you can hear directly from the researchers involved.

Click the red "Watch the Interview" button if you're

reading this online or in a PDF. Otherwise, be sure to visit [www.ucalgary.ca/dcns/2017](http://www.ucalgary.ca/dcns/2017).

Thank you for visiting and taking a few minutes to learn about our department. We hope you enjoy our annual report.

Dr. Rajiv Midha  
Professor and Head  
Department of Clinical Neurosciences





▲  
Dr. Candice Poon  
conducts  
bench research  
into brain tumour  
as part of the  
neurosurgery  
residency  
program.

►  
Neurosurgery  
resident Dr. Mike  
Avery works on  
a bioengineering  
vascular project.





# TODAY'S RESEARCH GUIDES TOMORROW'S PATIENT CARE

**THANK YOU FOR TAKING THE TIME** to review our latest annual report.

Our report is an opportunity for us—as clinicians, scientists and educators—to celebrate our achievements and update the community on our programs and activities. Whether you are a student, academic colleague, patient or donor, we are confident that you will find something of interest in the stories and videos this year.

**WATCH THE  
INTERVIEW**  
[ucalgary.ca/  
dcns/2017](http://ucalgary.ca/dcns/2017)

Our theme this year is **The Role of Research**—and it's a story that we believe is critical to our success and is important to tell.

We should also note that our research occurs in partnership with and in the supportive environment provided by the Hotchkiss Brain Institute, Cumming

School of Medicine, and Alberta Health Services.

Members of our department wear many hats—we care for patients with life-changing conditions and we are dedicated to training the next generation of neurologists, neurosurgeons and physiatrists.

But equally important is our work to advance medicine and improve the care that we can provide for our patients tomorrow. Some research makes headlines—like the Phase 3 minocycline trial led by **Drs. Luanne Metz and Wee Yong**. (It should be noted that their success, which we are incredibly proud of, was 18 years in the making!)

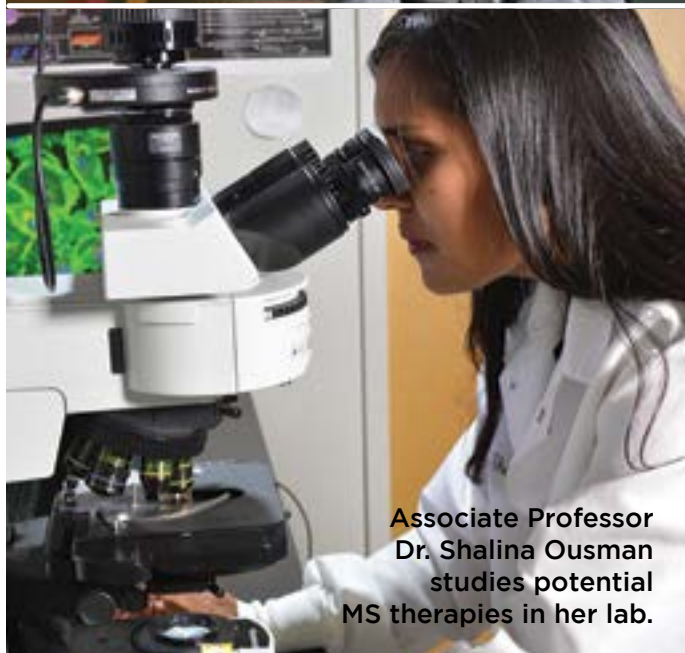
But much of the research we carry out is done quietly and without fanfare. And it's important that we take the time to celebrate it as well.

As in other professions, our progress is not usually made with great leaps, but with small, deliberate and hard-earned steps.

Those steps lead to advances in treatments—like **Dr. Zelma's Kiss's** high frequency ultrasound—or better diagnoses—like the work done by **Dr. Chantel Debert** in sports injury and concussion. I'm sure you'll find their stories in this year's report fascinating.

Thank you for visiting. And thank you for supporting our research through organizations such as the Cumming School of Medicine's Fund Development Office and the Calgary Health Trust.

**Department Head  
Dr. Rajiv Midha**



**Associate Professor  
Dr. Shalina Ousman  
studies potential  
MS therapies in her lab.**

**Neurosurgery resident Dr. Stefan Lang explores  
the brain's responses to magnetic stimulation.**

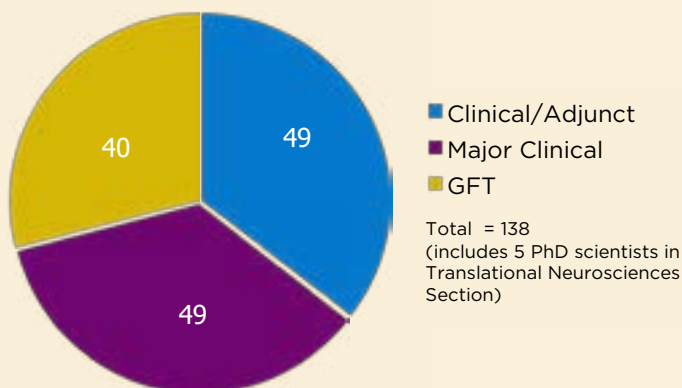


# Clinical and Academic Metrics

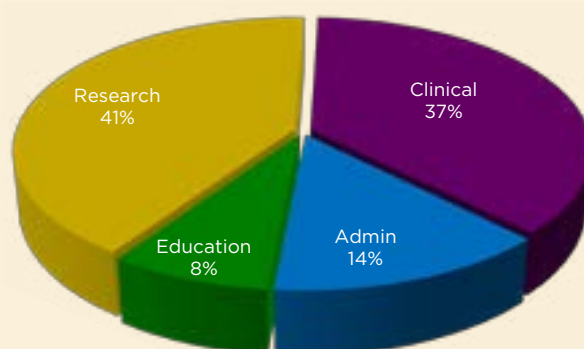
How our department stacked up over the past year — within the Cumming School of Medicine and Alberta Health Services

## OUR DEPARTMENT

### Appointments to Faculty in DCNS

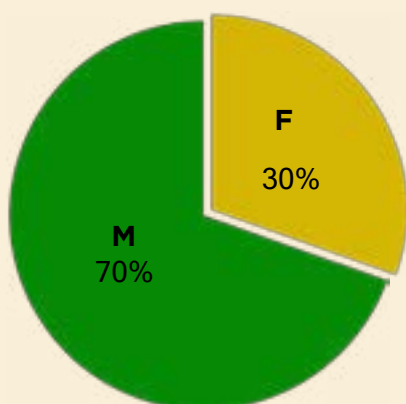


### GFT -Activity Profile (43 FTE in DCNS)

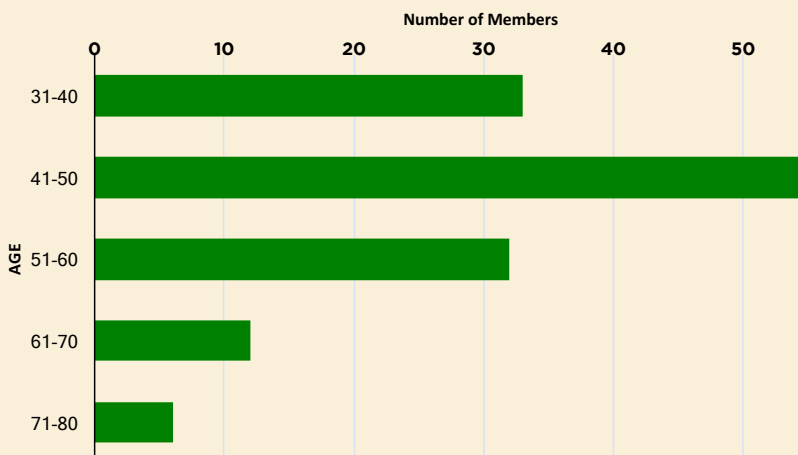


Source: Cumming School of Medicine

### Gender



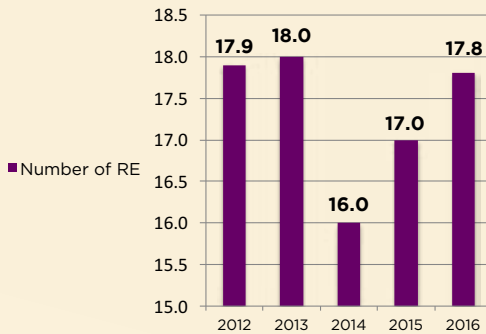
### Age Distribution



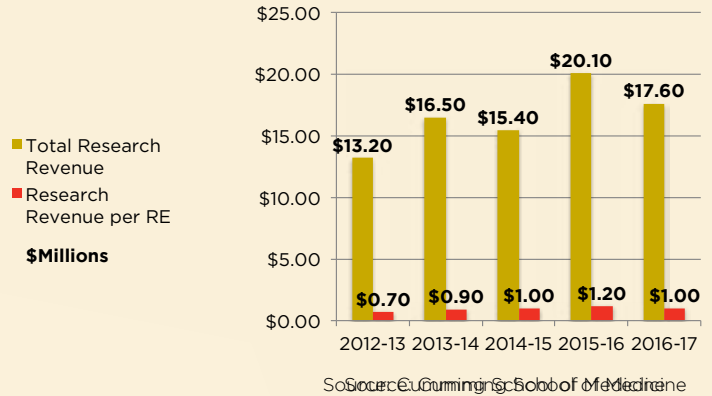


## RESEARCH & PUBLICATIONS

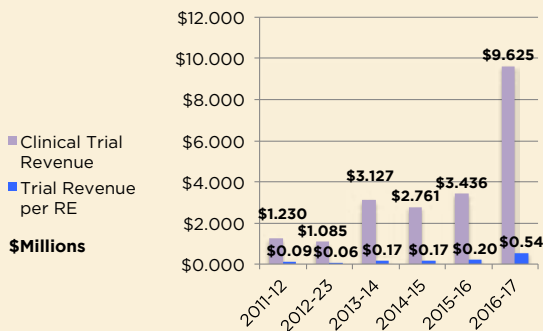
### Number of Research Equivalents



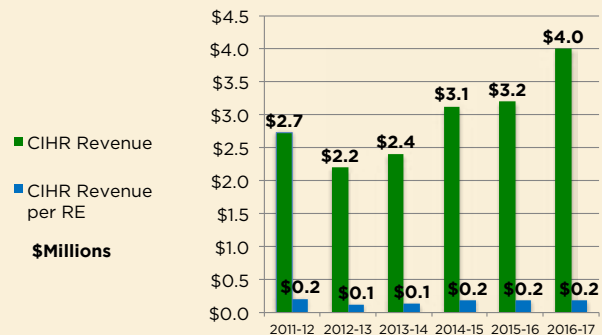
### Research Revenue



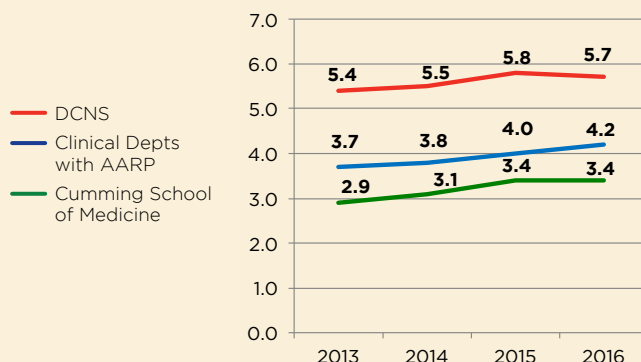
### Clinical Trial Revenue



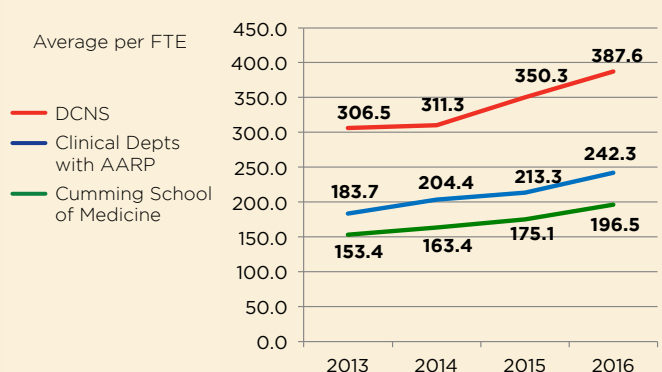
### CIHR Revenue



### Publications (avg per FTE)



### Publication Citations



## PATIENT VISITS, ADMISSIONS, SURGERY

### DCNS – Total Outpatient Visits

Site	2013-2014	2014-2015	2015-2016	2016-2017
FMC	31,159	32,423	34,115	36,745
PLC	1,289	1,285	2,541	2,536
RGH	2,821	2,778	5,380	5,916
SHC	13,798	11,663	12,599	12,628
ACH (Ped NSx)	1,849	1,961	2,318	2,493
<b>Total</b>	<b>50,916</b>	<b>50,110</b>	<b>56,953</b>	<b>61,229</b>

\* Excludes off hospital sites

### DCNS – Total Admissions All Hospitals

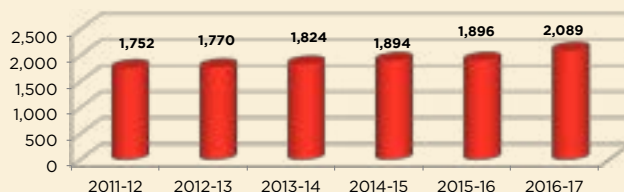


### DCNS – Total Inpatient Admissions

Site	2013-2014	2014-2015	2015-2016	2016-2017
FMC	3,803	3,753	3,836	3,825
ACH	211	184	168	170
SHC	340	318	295	311
RGH	3	2	0	0
<b>Total</b>	<b>4,357</b>	<b>4,257</b>	<b>4,299</b>	<b>4,306</b>

Note: Excludes off hospital sites

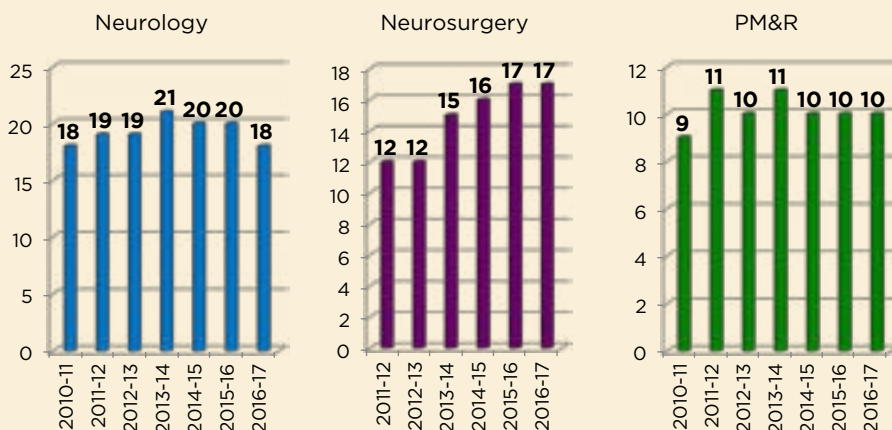
### Surgical OR Cases Neurosurgery at FMC



## RESIDENT EDUCATION

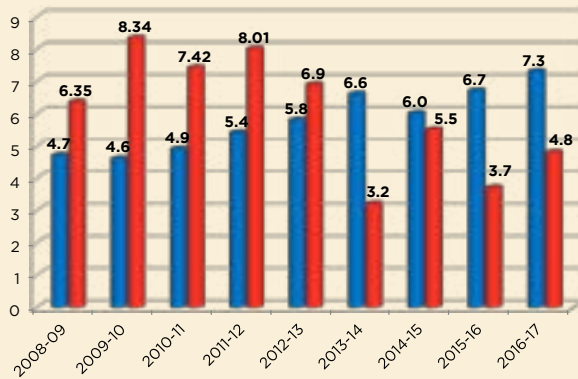
The Department of Clinical Neurosciences is exceptionally proud of our three residency programs that are home to 45 talented residents doctors.

### Number of Residents per Program



## CLINIC WAIT TIMES

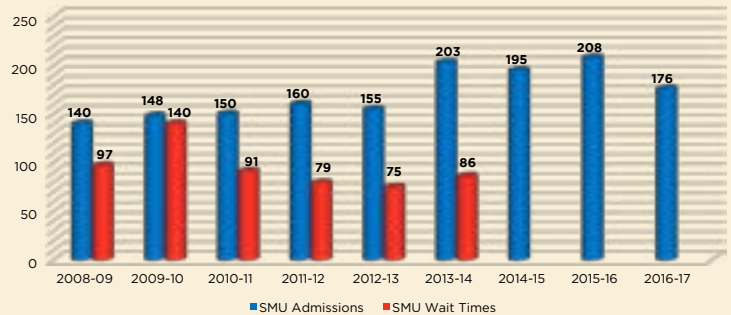
### EMG Outpatient Volumes and Wait Times



■ Outpatient Volume  
(x 1000)

■ Waiting Times  
(months)

### Seizure Monitoring Unit Admissions and Wait Times



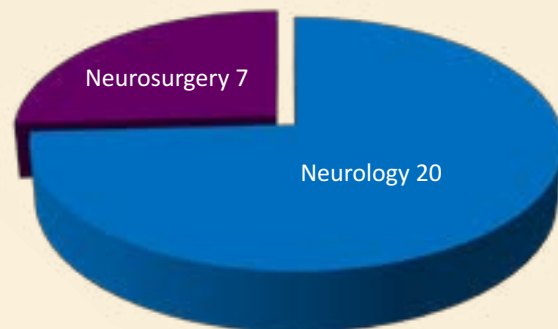
■ SMU Admissions ■ SMU Wait Times

## FELLOWS

### Clinical Neurosciences Fellowship Program

Integral for service delivery and scholarly activity

- EEG
- Stroke
- Epilepsy
- MS
- Neuroimmunology
- Peripheral nerve
- Pediatric neurosurgery
- Epilepsy neurosurgery
- Cerebrovascular and endovascular
- Chart excludes fellows in spine (with orthopedics - Department of Surgery)



# The Section of Neurology

Section Head: Dr. Luanne Metz

**THE SECTION OF NEUROLOGY** included 65 neurologists during the 2016-17 academic year. There were 54 neurologists based at the University of Calgary or one of four adult acute care hospitals within the Calgary Zone of Alberta Health Services, and two neurologists based in the community. There

were also nine locums, six of whom were part time while completing subspecialty neurology fellowships and/or advanced degrees. Most neurologists are funded through an Academic Alternative Relationship Plan.

## Vision:

To improve quality of life and daily function for our patients by reducing the burden of neurological disorders.

## Mission:

To be an international leader in neurological patient care, education and research.

Members continued to lead projects and innovations in clinical care, research, and education. We were delighted to add three new residents to our five-year neurology residency program and were proud of the

success of all our graduating residents on their Royal College exams. A faculty member who trained outside Canada was also successful on his Royal College exams (Dr. Bijoy Menon).

## Education

Excellence in education is highly valued in our section. Dedicated neurologists lead our residency program (Dr. Michael Yeung), the undergraduate neuroscience course (Drs. Gary Klein, Philippe Couillard, David Patry, Scott Jarvis), the neurology clerkship (Dr. Chris Hahn), and continuing medical education (Dr. Justyna Sarna). Members in the section are regularly involved in the education of medical students and residents in neurology, neurosurgery, physical medicine and rehabilitation, pediatric neurology, internal medicine, psychiatry, radiology, ophthalmology, medical genetics, family medicine and emergency medicine.

The Section of Neurology has several popular subspecialty fellowship programs. In 2016-17



there were eight fellows in stroke, four in multiple sclerosis/neuroimmunology, two in neuromuscular/EMG, and one each in epilepsy/EEG, cognitive neurology, and neuro-oncology.

Neurologists are involved in the undergraduate neuroscience and Bachelor of Health Science programs and supervise graduate students. Many section members provide continuing medical education to practicing physicians, pharmacists, nurses, psychologists, and Allied Health professionals. Neurologists also hold senior leadership positions in education: Dr. Kevin Busche is Associate Dean of Undergraduate Education and Dr. Lara Cooke completed a term as Associate Dean of Continuing Medical Education.

## Research

The Section of Neurology is recognized for research excellence and productivity and for the major clinical impact of our research endeavours. We continue to demonstrate that care can be



improved through innovative research. Our researchers include clinician scientists and population health investigators who spend up to 80 per cent of their time undertaking research, as well as clinician researchers who spend 20-50 per cent of their time doing research.

Neurologists also hold major research leadership positions within the University of Calgary: Dr. Sam Wiebe is Associate Dean of Clinical Research and Dr. Gregory Cairncross is Director of the Arnie Charbonneau Cancer Institute.

### Health Care

We continue to develop and lead innovative care programs in collaboration with our colleagues in other specialties and disciplines. In partnership with community primary care providers, we provide specialized neurologic care to people in southern Alberta and southeastern British Columbia. Most neurologists are based at one of four adult acute care hospitals in the Calgary to support outpatient clinics and neurophysiology labs.

Neurology is organized into a citywide general neurology program and subspecialty programs that often include our colleagues in PM&R, Neurosurgery, and Psychiatry. We provide inpatient and outpatient EMG, evoked potentials, and EEG services in all adult acute care hospitals in the Calgary Zone and continuous EEG monitoring to all of Calgary's intensive care units. Section members also play important roles in Calgary's neuro-oncology and chronic pain programs and provide outreach services to the Calgary Urban Project Society (CUPS) and 'The Alex' medical clinics. Some of our programs are regional or national resources for clinical expertise.

Several innovations were implemented over this academic year.

**Neurology Central Access and Triage:** We began development of this citywide program to manage all non-acute neurology referrals. The goal is to allow all non-urgent neurology referrals to be sent to one place to be triaged by neurologists to ease the referral burden on primary care providers, suggest alternatives to a neurology consult, and get patients to the right place at the right time. Information may be provided to referring physicians to replace a referral or support interim care or a telephone consult with the physician may be suggested. Consults are forwarded to subspecialty programs when appropriate.

**Enhanced Hospital Care:** To enhance continuity of care and safety, a nurse practitioner, Jessica Jenkins, joined the inpatient team at Foothills Hospital to support and further develop high quality care. Dr. Steven Peters, Medical Director of the Hospital Neurology Program, along with Jessica and the care team, implemented the first improvement—a project to improve the weekly hand over of neurology inpatients. We expect this new team and new processes will improve care, safety, resident education, and patient satisfaction.

**Specialist Link:** Neurologists also began participation in Specialist Link, an innovative program led by Primary Care to enhance system integration in the Calgary Zone. Neurologists are available to family physicians (or other specialists) for telephone consultations while patients wait in their physician's office. Neurology has become the second most frequently utilized specialty.

### Other Individual Highlights

- Dr. Eric Smith was elected to the Royal College of New Scholars, Artists and Scientists.
- Dr. Sam Wiebe was featured in a full-page profile in April's edition of The Lancet Neurology.
- The Calgary Stroke Program received the 2017 Partners in Health Award.
- Nancy Newcommon (nurse practitioner) won CARNA's 2017 Committee's Choice Award
- Dr. Chris White assumed an AHS role as clinical design lead for the Provincial Clinical Information System.
- Dr. Suresh Subramaniam took over as the medical director of the Neuro-Ophthalmology program.
- Dr. Lawrence Korngut assumed the role of medical director of the Neuromuscular Program.

In the past year, we welcomed Drs. Ronak Kapadia, Christopher Hahn, Shaily Singh, Steven Peters, Davide Martino, and Elizabeth Leroux to our team. Dr. Kapadia joined the general neurology program after a year as a locum. He started a procedure clinic for residents focusing on teaching of spinal taps, occipital nerve blocks and botox for migraine. Dr. Hahn joined the neuromuscular, neuro-immunology, and MS programs and has taken on the role as clerkship director. Dr. Singh joined the epilepsy program and will co-lead epilepsy education for residents and fellows. Dr. Peters is leading development of inpatient services, Dr. Martino is leading the Movement Disorders Program, and Dr. Leroux is leading the Headache Program.



# MINOCYCLINE

## A 20-year commitment to MS research

**PROFESSOR V. WEE YONG** has opened a lot of doors in his remarkable career. With over 280 peer reviewed publications, which have been cited over 24,000 times, it's little wonder that the head of the Section of Translational Neuroscience talks about his research as a passion.

"Research is never ending. You open one door and it leads to many other questions. You make a discovery and you end up with a lot of unexpected surprises."

Dr. Yong's extraordinary collaboration with neurologist Dr. Luanne Metz, however, should have come as no surprise.

Their common interest in multiple sclerosis research and a dedication to improving treatments for patients led to a partnership that has spanned almost 20 years.

It started in the lab, trying to understand the mechanisms by which immune cells cross barriers—including the blood-brain barrier into the central nervous system.

"We came upon a group of enzymes that we thought were critical in that process and needed to be inhibited," recalls Dr. Yong. "And we then looked for generic medications that could affect that process."

The work began with one question, which led to numerous scientific twists and turns, more

**WATCH THE  
INTERVIEW**  
[ucalgary.ca/  
dcns/2017](http://ucalgary.ca/dcns/2017)

questions and, ultimately, clinical trials to confirm their findings in humans.

“When we start off on a project, we are often not thinking about where the end point is,” says Dr. Yong. “And what we know from our experience is that the process of discovery, the process of translating that into human use, will take a long time.”

It was a journey that ran in parallel with other research and clinical work for Drs. Yong and Metz.

For Dr. Metz, she was balancing patient care, leadership responsibilities and other research projects. For Dr. Yong, he had to oversee a lab of between 15 and 20 researchers working on a diverse set of projects.

“We are involved, at any one time, somewhere between 30 to 40 projects,” says Dr. Yong, “and the majority of these do not deal with minocycline.”

Despite all of the distractions, the two scientists published the results of their Phase 3 trial of minocycline in multiple sclerosis in May 2017—and the world was watching.

Their research showed that minocycline can slow the progress of relapsing-remitting multiple sclerosis (MS) in patients who have recently experienced their first symptoms. The discovery—compounded by the fact that minocycline is an extremely affordable medication and was already approved by regulators—received global media coverage.

The findings could directly benefit thousands of patients. For much of the world, existing MS medications are far too expensive for those without insurance.

“Even in an affluent country like Canada,” Dr. Yong notes, “when one has been diagnosed with possible MS, it takes a while before medications can be applied (because of insurance approvals).”

Minocycline can be started right away and was found to be as effective as other MS therapies—when they’ve been used at a first attack—to decrease the chance that a person evolves to have multiple sclerosis.

Other medications cost about \$20,000 per year, says Dr. Metz.

CONTINUED ON PAGE 14





## CONTINUED FROM PAGE 13

"The nice thing about minocycline is that it costs between \$500 and \$600 per year, so it's vastly less expensive."

As a clinician treating MS patients, Dr. Metz says that getting a patient on medication quickly is critical because a second attack can happen at any time.

"Studies are showing that the sooner people get on treatment, the more likely they'll get benefit from treatment."

Dr. Metz, head of the Section of Neurology, remembers that publishing their research in a prestigious journal came with its own challenges.

"Getting it published in the New England Journal of Medicine adds a lot of impact because we know it's been very thoroughly reviewed. It isn't simply the title of the journal, but it's the very rigorous process that you go through."

The paper was submitted, peer-reviewed and re-written over the course of many months, ensuring Dr. Metz knew the science and statistics inside and out by the time it was accepted.

But she says the research process—even studies done by others—benefits her work with patients in the clinic.

"You know better how to interpret the safety and benefits of treatment because you know it from a very deep level," she says.

"You also know the opinions of people around the world as to varying drugs and where things might be going and what's happening that isn't even published yet."

The minocycline research also demonstrated how the translational science and clinical sections of the department are uniquely positioned to produce results that they couldn't have achieved on their own.

"In fact," says Dr. Metz, "this is the first treatment in the world of MS that has come all the way from an academic bench through to a Phase 3 trial without the involvement of the pharmaceutical industry. That's not been done anywhere ever before!"

---

"This is the first treatment in the world of MS that has come all the way from an academic bench through to a Phase 3 trial without the involvement of the pharmaceutical industry.

That's not been done anywhere ever before!"

— Dr. Luanne Metz

---

The collaboration results in accelerated research because members of the team don't need to wait for publication before beginning the next phase.

Or, as was done with minocycline, that blood samples from earlier research can be revisited in future experiments.

It also means that the MS research is far from complete for Drs. Yong and Metz.

For many researchers, a New England Journal of Medicine publication might be the cap of an extraordinary career. But the MS team is pushing ahead with new experiments and planning future trials. Their work will benefit patients in Calgary at the Multiple Sclerosis Clinic—and countless others who depend upon their ongoing curiosity.

Dr. Yong won't say what inning they are playing, but there are clearly many left to come.

"We do not think of home runs. We think of making base hits that move the knowledge from one stage to another—allowing others to build upon that knowledge."



# Brain and mental health initiative links patients, clinicians and researchers

**THEY'RE KIND OF LIKE** The Avengers for research clinics. If you need help battling regulatory approvals, taking on consent forms, or spawning data visualizations—they're the team you want on your side.

The Brain and Mental Health Research Clinics, funded by the Hotchkiss Brain Institute in partnership with the Departments of Clinical Neurosciences and Psychiatry, is all about sharing

experiences and new technologies for the benefit of researchers, clinicians and patients.

The initiative has helped clinician researchers develop or expand patient registries in more than 14 clinics so far, and that experience is being used to benefit all clinics, says Program Manager Pamela Roach.

"We find ways to optimize that knowledge and use it to bring patients and researchers and physicians together."

Roach says that the groups they work with have unique requirements, but they also have much in common.

"We can see what's working in one clinic and, if we see a similar need somewhere or a different need—then we can help them."

Dr. Eric Smith, who sits on the initiative's steering committee, says his clinic has already benefitted from the knowledge-sharing approach.

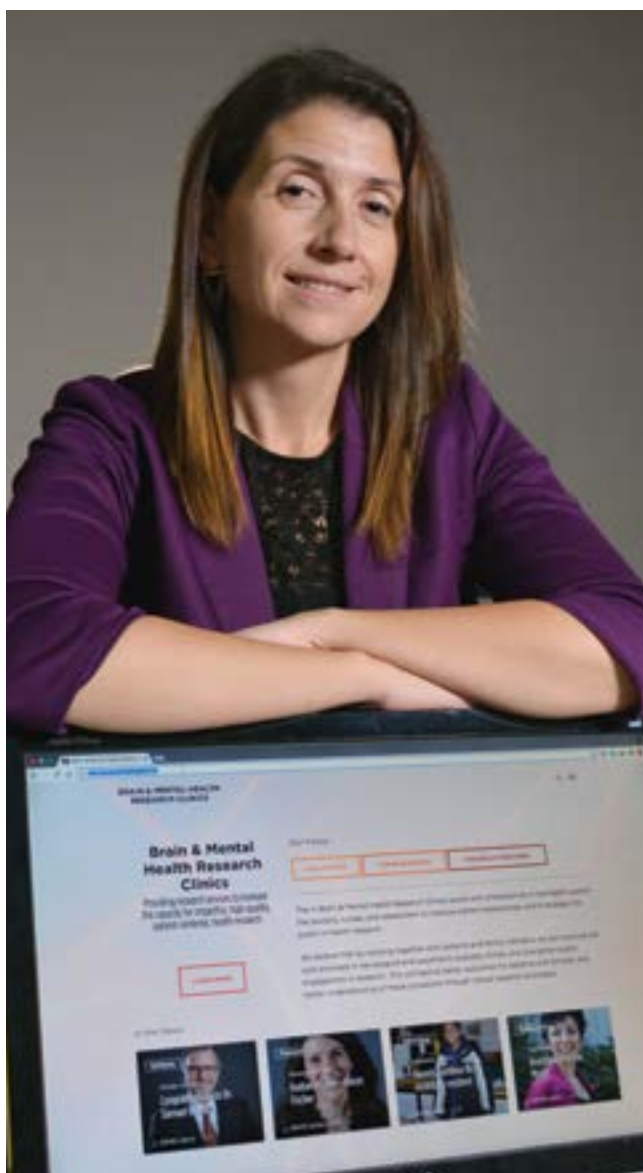
"As Medical Director of the Cognitive Neurosciences Clinic, the initiative has helped us develop a patient registry with more than 1,300 participants that we have used to understand the frequency of behavioural problems in persons with mild cognitive impairment and how it affects the patients and their families."

Families are a stakeholder group that is firmly in the sights of the initiative. "Ultimately, we will be successful if we improve the experiences of our patients with disease, and their health outcomes," says Dr. Smith.

A new website, [www.brainandmentalhealthclinics.ca](http://www.brainandmentalhealthclinics.ca), intends to bring these groups together and connect the dots between patients, registries and the researchers who run them.

"We want to be a trusted resource where we can point patients in the right direction," says Roach.

"We want to engage patients in the research and bring everyone together—a place that facilitates research for health care providers and researchers."



▲ Pamela Roach with the new website.



Dr. Eric Smith

# The Calgary Comprehensive Epilepsy Program

Program Lead: Dr. Samuel Wiebe

## Overview

Through its strong academic and clinical arms, the Calgary 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 an epilepsy programme administrator.



**Dr. Samuel Wiebe**

The research team has strong collaborations with the Hotchkiss Brain Institute, 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.

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 for epilepsy. Complex and surgical cases are discussed weekly in our multidisciplinary conferences in conjunction with our 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,

functional brain mapping, and intraoperative monitoring and evoked potentials. Analysis of high frequency oscillations (HFOs) is available and automated detection of HFOs is being developed.

- 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.
- Led by Dr. Yahya Agha-Khani, 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 simultaneously. 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, deep brain stimulation, and vagus nerve stimulation.

## Research and Leadership

The CEP houses world-class research teams in health services research and outcomes research (Dr. Jetté, Dr. Wiebe and Dr. Josephson) and in advanced imaging in epilepsy (Dr. Federico). Members of the CEP serve in leadership positions of the Canadian League Against Epilepsy, the International League Against Epilepsy (ILAE), the North American Commission of the ILAE, as well as in other international neurological organizations.

## 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. Through collaborations with Alberta Health Services, linkage with administrative health data allows for broader analyses of health resource use and the impact of health care in epilepsy. This year, the CEP database moved towards producing patient-specific information services and dashboards, which will be gradually implemented in the clinic.

## Highlights

- The CEP held a very successful 7th International Epilepsy Symposium in October 2016, focusing on “Autoimmunity and Inflammation in Epilepsy.” In addition to our local speakers, the one-day symposium featured four renowned international researchers in the field including Dr. Stéphane Auvin (Paris), Dr. Jeffrey Britton (Mayo Clinic Rochester), Dr. Josep Dalmau (Barcelona) and Dr. Alon Friedman (Dalhousie University).
- The 2016 Mary Anne Lee Memorial lecturer in epilepsy was Dr. Josep Dalmau from the Universities of Pennsylvania and Barcelona, who spoke about “Anti-NMDA Receptor Encephalitis: Symptoms and Mechanisms of Disease”. In addition, the CEP held its annual epilepsy research retreat, with presentations by trainees from the various clinical and basic science epilepsy research teams.
- Dr. Nathalie Jetté in 2015-2016 led the Hotchkiss Brain Institute Epilepsy NeuroTeam and Neuro-Research Clinics initiative. She is the Canada Research Chair in Neurological Health Services Research, President of the Canadian League Against Epilepsy, elected secretary of the International League Against Epilepsy North American Commission, chaired numerous international committees, published over 35 peer-reviewed articles, and continues to lead a world-renowned health services research program.
- Dr. Paolo Federico leads a world-class team which uses fMRI techniques to solve problems of complex epileptogenesis in patients. He leads the way in intracranial EEG-fMRI recordings, and is now implementing Arterial Spin Labeling MRI, and automated High Frequency Oscillation detection algorithms to identify the seizure focus. He serves on international committees for diagnostic studies in epilepsy and continues to be highly productive academically.
- Dr. Walter Hader implemented robotic implantation of intracranial EEG electrodes in children and adults using the Rosa System, acquired through a donation from Bob and Brenda McNeil.
- Dr. Sophia Macrodimitris and Dr. Ruby Sharma run a successful cognitive behavioural therapy program for epilepsy patients with anxiety and depression, a unique offering of the CEP. They also continue to supervise students and collaborate in peer-reviewed publications, and they contribute substantially to the Quality Improvement program in the Seizure Monitoring Unit. Dr. Lisa Partlo and Dr. Kim Goddard have standardized procedures for neuropsychological testing in epilepsy patients across hospitals, providing a uniquely strong team for our CEP. Dr. Brienne McLean joined the CEP team as our second neuropsychiatrist, with Dr. Aaron Mackie.
- Our pediatric epilepsy colleagues have made great progress in clinical informatics. Dr. Jeff Buchhalter implemented outcomes-oriented structured epilepsy notes in the SCM electronic health record, with over 1,000 unique patients already entered and clinical dashboards re-calculated every 24 hours. The neuro-metabolic program has been re-designed using efficient, patient-parent centric care pathway. Dr. Juan Pablo Appendino was recruited to the epilepsy program with a mandate to develop clinical and educational initiatives.

CONTINUED ON PAGE 18

**CONTINUED FROM PAGE 17**

- This year we graduated two epilepsy fellows (Dr. Yanjun Duan and Dr. Yaser Al-Malik) and one international trainee (Dr. Aidin Shariatzadeh), who also became certified in EEG by the Canadian Society of Clinical Neurophysiology. The CEP also hosted four international clinical observers and held over 40 educational sessions on EEG and epilepsy-related topics.
- Dr. Colin Josephson was recruited this year to establish a research program examining novel approaches to clinical prediction and outcomes research. His primary interest is in the application of novel analytical techniques to 'Big Data' derived from a variety of sources, including cohort studies, electronic health records and administrative health data. He is currently examining somatic and psychiatric co-morbidities, pharmacoepidemiology, and predictors of seizure-free outcomes in epilepsy. Ultimately, his aim is to use novel machine learning techniques to develop precision medicine models that will be applied for clinical decision-making at the point of care.
- Dr. Shaily Singh was recruited this year as a major clinical epilepsy neurologist with expertise in cortical clinical electrophysiology, clinical epilepsy, and presurgical evaluation. She will also take on important collaborative roles in clinical research, education, and clinical data management.
- With Dr. Neelan Pillay's retirement, Dr. Wiebe assumed the leadership of the CEP. Dr. Yahya Agha-Khani took on the directorship of the EEG laboratories. Dr. Paolo Federico assumed the directorship of education and fellowships. Dr. Jetté led quality improvement, seizure monitoring units and epilepsy clinics, and she leads the Neuro-Research initiative. Dr. William Murphy oversees clinical assistants and clinical trials.

- Dr. Wiebe continues to serve as associate dean of Clinical Research, chair of the Clinical Research Unit for the Cumming School of Medicine, and serves on the executive board of the International League Against Epilepsy. This year he was elected as incoming president of the International League Against Epilepsy. Dr. Wiebe continues to focus on outcomes and health services research.

**Members**

Epileptologists: Dr. Yahya Agha-Khani, Dr. Paolo Federico, Dr. Alexandra Hanson, Dr. Nathalie Jetté, Dr. Colin Josephson, Dr. Brian Klassen, Dr. William Murphy, Dr. Neelan Pillay, Dr. Shaily Singh, Dr. Samuel Wiebe

Neurosurgeons: Dr. Walter Hader, Dr. Yves Starreveld

Neuropsychiatrists: Dr. Aaron Mackie, Dr. Brienne McLean

Clinical psychologists: Dr. Sophia Macrodimitris, Dr. Ruby Sharma

Neuropsychologists: Dr. Lisa Partlo, Dr. Kim Goddard

Neuroradiology: Dr. James Scott

Nuclear Medicine: Dr. Christine Molnar, Dr. Leonard Numerow

Clinical Assistants: Dr. Reynaldo Avendano, Dr. Salma Hanna

Epilepsy Fellows (current): Dr. Seraj Makkawi, Dr. Joseph Peedical

Epilepsy Nurses: Meliza Camerino, Amira Jivraj, Jackie Martini, Michele Zulinick



# 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 grow 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”.

## Highlights

An extraordinary achievement of the program this year was the continued leadership role in the HERMES collaboration. The collaboration brought together all seven predominantly stent-retriever-based randomized clinical trials of mechanical thrombectomy in stroke (five published in NEJM 2015). This HERMES collaboration has been led by Dr. Mayank Goyal and continues to roll out high-impact major publications (Lancet, JAMA, Lancet Neurology and Stroke) that are influencing/changing guidelines to endovascular treatment (EVT) throughout the world.



**Dr. Andrew Demchuk**

The QuICR Alberta Stroke Program is an Alberta Innovates CRIO grant. It is a provincial program led by Drs. Hill, Demchuk and, from Edmonton, Drs. Jeerakathil and Shuaib. The quality improvement section of the program, led by Dr. Noreen Kamal has focused on acute stroke treatment. Over the past year we have been very close to achieving our goal of a 30-minute-median-door-to-needle time for all stroke patients treated in the province. We can boast the fastest door-to-needle times of any large jurisdiction in the world. This remarkable provincial achievement is a result of collaboration between the QuICR Alberta Stroke Program and the Stroke and Cardiovascular Health Strategic Clinical Network of AHS.

Dr. Andrew Demchuk leads implementation of the CaSTOR Canadian Stroke Trials for Optimized Results network with 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. Two major accomplishments as part of the grant were the first ever Global Alliance of Independent Networks in Stroke (GAINS) meeting hosted by CaSTOR at Niagara on the Lake in December 2016; and the catalyst grant competition that led to six successful applications nationally—all aimed to create Canadian investigator-led stroke clinical trials to change practice globally when completed.

The Endovascular Reperfusion Alberta (ERA) project is an initiative led by Dr. Demchuk through the Stroke and Cardiovascular Health Strategic Clinical Network of AHS whose goal was to improve access to endovascular treatment for rural patients with larger geographic barriers. Major system changes were made through partnership with numerous provincial stakeholders, leading to a launch of the new pathway in January 2017. Rural patients are now getting treated more often and faster than any jurisdiction in the world with the time efficiency savings that have been implemented. The novel rural field consultation is one example of this efficiency whereby the stroke neurologist is patched into the EMS provider at scene and communicates with this provider and a transport physician in remote regions to determine the best destination and mode of transport to use based on patient/location/weather factors.

Dr. Shelagh Coutts (PI) is leading the multicentre TEMPO-2 trial examining Tenecteplase (second generation tPA) for patients with mild stroke with a proven intracranial occlusion. Sites are active in Canada, United Kingdom, Ireland, Austria, Spain and soon Australia. Over 123 patients have been enrolled to date.

Dr. Michael Hill (PI) has successfully initiated the ESCAPE NA-1 trial which is a collaboration between University of Calgary/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 enrolled over 75 subjects with a rapid ramp up to now daily enrollment. It is being led in Calgary and run in multiple countries worldwide.

**CONTINUED ON PAGE 20**

**CONTINUED FROM PAGE 19**

The Stroke Imaging Core Lab co-ordinates 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 acute stroke imaging research program has expanded to have research fellows from countries as diverse as the Netherlands, South Korea, United Kingdom, Switzerland, Saudi Arabia 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 on understanding neuro-cognitive aspects of image interpretation.

Dr. Bijoy Menon received the Michael S. Pessin Award from the American Academy of Neurology. Dr. Demchuk received the Killam Annual Professor Award. Dr. Hill received the Heart & Stroke Foundation of Canada Award of Merit. Nancy Newcommon received the Committee's Choice Award from CARNA. The Calgary Stroke Program medical team at Foothills Medical Centre received the Partner in Health CARNA award.

Dr. Bijoy Menon renewed another term as the Heart and Stroke Professorship in Stroke Imaging and also passed the FRCPC neurology examinations.

Dr. Eric Smith received a foundation award from the Canadian Institutes of Health Research to study silent cerebrovascular disease and how it contributes to cognitive decline and risk for dementia. He has been named to a second term as the Katthy Taylor Chair in Vascular Dementia at the University of Calgary.

Dr. Sean Dukelow and the stroke physiatry team were successful in securing funding to conduct

the T-MAT study. This study will explore the use of transcranial magnetic stimulation in an attempt to enhance speech therapy in individuals with chronic stroke and aphasia.

Dr. Tim Watson left our program and relocated to Victoria, B.C. We thank Dr. Watson for many excellent years of service. He was always a superb clinician who also demanded the program provide the highest quality of care.

The clinical management team, with the support of Nancy Newcommon, created a process/protocol to evaluate and provide post-procedural care on U100  $\geq 6$  hours of carotid stent placement to help overcapacity in the recovery room and U112.

The program successfully hosted our second 5T Banff Conference in March 2017 with over 200 participants. This was a collaboration with the University of California Los Angeles.

The program also hosted delegations from South Korea and New Zealand for training courses on all things mechanical thrombectomy related.

Dr. Phil Barber was successfully awarded a Grant in Aid by the Heart and Stroke Foundation of Canada for the Predementia Neuroimaging of Transient Ischemic Attack (TIA) – PREVENT Study. This prospective longitudinal case control study explores the vascular and neurodegenerative contributions of cognitive decline in patients presenting with TIA, and aims to advance our understanding of early disease leading to cognitive decline that occurs later in life.

Dr. Suresh Subramaniam is involved in a quality improvement initiative with the South Health Campus Emergency Department. The goal is to reduce door-in-door-out times for acute stroke patients presenting to South Health Campus who may be eligible for endovascular treatment at Foothills Medical Centre.

Dr. Subramaniam was named the Medical Director for the Neuro-Ophthalmology and Neurovestibular Program. He will be the PI for the Surgical Idiopathic Intracranial Hypertension Trial (SIGHT) study funded by Neuro-Ophthalmology Research Disease Investigator Consortium (NORDIC) with



▲ Nurse Practitioner Nancy Newcommon checks on a stroke patient before an endovascular procedure.

the support of the National Eye Institute of the National Institutes of Health. The study is expected to start recruiting patients in early 2018.

### Education

As of June this year, our program has trained and/or graduated 75 stroke fellows from 18 countries, including Canada. Last year we trained eight fellows, including three Canadians. In addition, we have seen a major increase in applications to our fellowships with on-average three applicants per month.

### Research

Research is the core of the CSP. Significant progress has been made over the last year to further establish the CSP as a leader in stroke clinical trials and an internationally respected clinical research program and imaging core lab facility for large stroke trials. The collective H-index of the clinician scientists within the program now approaches 100 (ISI Web of Science).

### Members

Stroke Neurology: 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. Eric Smith, Dr. Peter Stys, Dr. Suresh Subramaniam

Stroke Physical Medicine and Rehabilitation: Dr. Sean Dukelow, Dr. Ken Lam, Dr. Gentson Leung, Dr. Steve McNeil

Vascular Neurosurgery: Dr. Alim Mitha, Dr. Garnette Sutherland, Dr. John Wong

Interventional Neuroradiology: Dr. Muneer Eesa, Dr. Mayank Goyal, Dr. Will Morrish

Nursing: Nancy Newcommon

Stroke Program Managers: Shelly Bohn, Samantha Arnott

# The Cognitive Neurosciences Program

Program Lead: Dr. Eric Smith

## Overview

The Cognitive Neurosciences Clinic provides expert medical consultation for cognitive disorders; educates undergraduate and postgraduate learners; and conducts research on the causes, medical evaluation and treatment of cognitive disorders and dementia.



**Dr. Eric Smith**

Clinic members include neurologists, psychiatrists, nurses, neuropsychologists, research staff, and Allied Health professionals at the Foothills Medical Centre and South Health Campus sites.

The 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 five neurologists (Drs. Eric Smith, David Patry, Dawn Pearson, Bijoy Menon and Philip Barber) and three psychiatrists (Drs. Zahinoor Ismail, Aaron Mackie and Robert Granger) who see patients in the clinic.

Common syndromes and diagnoses include mild cognitive impairment, Alzheimer's disease, frontotemporal dementia, and vascular cognitive impairment. Where appropriate, we obtain screening or detailed neuropsychological assessments, brain imaging including MRI or FEG-PET, and cerebrospinal fluid analysis.

Our clinical care is integrated with an internationally recognized research program focusing on vascular contributions to cognitive decline and risk for dementia, and neurobehavioural complications of the early stages of neurodegeneration. Three clinic members have major investigator-initiated research programs in cognitive disorders, supported by external funding from the Canadian Institutes of Health Research, Brain Canada, Alzheimer Society of Canada, European Union Joint Programme-Neurodegenerative Diseases, and other agencies. We collaborate internally with researchers from the Departments of Clinical Neurosciences, Radiology,

and Community Health Sciences. Externally, we have multiple collaborations with researchers at most of the major Canadian universities as well as international centers (e.g. Edinburgh, Munich, Boston).

Our research team is located at the Healthy Brain Aging Laboratories at the University of Calgary. The team includes a project manager, MRI physicist, two research nurses, three research assistants, one post-doctoral fellow, one PhD student, and four master's students.

Dementia research at the University of Calgary is co-ordinated by the Dementia and Cognitive Disorders NeuroTeam of the Hotchkiss Brain Institute. Our program research activities are aligned with the NeuroTeam, with many within-team collaborations. The NeuroTeam is co-led by Dr. Eric Smith along with Dr. Lorraine Venturato from the Faculty of Nursing. It includes 14 members from different departments and faculties (medicine, nursing, social work) with shared interests in early diagnosis and health services research for dementia care.

Program members play critical roles in the Canadian Consortium on Neurodegeneration and Aging (CCNA). The CCNA is Canada's national research strategy, led by the Canadian Institutes of Health Research. Within the CCNA there are 25 different teams organized into three themes. One of the major projects of the CCNA is a patient cohort study called COMPASS-ND, for which we began recruiting patients in 2017. Dr. Smith leads the Vascular Illness team of the CCNA and directs the core lab for visual review of COMPASS-ND brain MRIs. Dr. Ismail is a member of the Neuropsychiatric team and Dr. Barber is a member of the Vascular Illness team.

Many of the causes of dementia are neurodegenerative diseases without disease-modifying treatments. We maintain an active program in pharmaceutical company-sponsored clinical trials, led by Dr. David Patry. In the last year, patients with Alzheimer's disease and mild cognitive impairment participated in these trials.



## Highlights

In the last year the clinic provided consultations to more than 350 new patients with cognitive disorders and saw a similar number of patients in followup.

Most patients in the clinic agree to have their clinical information recorded in our Prospective Memory Symptoms (PROMPT) registry, led by our research nurse, Karyn Fisher. The registry now has data from more than 1,300 patients. Registry data is used to identify patterns in referral diagnosis, quality of care, and risk factors for cognitive outcomes.

Dr. Zahinoor Ismail led a research team that published the Mild Behavioural Impairment (MBI) Checklist. This questionnaire helps clinicians diagnose MBI, a syndrome of acquired neurobehavioural changes that may predict risk for dementia and can sometimes precede any cognitive symptoms. The MBI Checklist garnered extensive media attention with articles and appearances in The New York Times, Washington Post, London Daily Mail, Yahoo News, CBC, Global and CTV. It has since been translated into 12 languages and is in use as a clinical and research instrument in the Cognitive Neuroscience Clinic.

## Education

Dr. Alicja Cieslak completed her Cognitive Neurosciences fellowship in April 2017 and has now joined the department, providing care to patients in the Cognitive Neurosciences Clinic, Movement Disorders Clinic, and General Neurology.

## Research

Dr. Eric Smith was renewed as the holder of the Katthy Taylor Chair in Vascular Dementia for another five years.

Dr. Ismail received the University of Calgary Peak Scholars in Entrepreneurship, Innovation and Knowledge Engagement award.

Dr. Eric Smith received a prestigious Foundation Grant from the Canadian Institutes of Health research, providing seven years of funding for research into early diagnosis and prevention of cognitive impairment.

Dr. Eric Smith was funded by the European Union Joint Programme—Neurodegenerative Diseases to carry out the project HARmoNising Brain Imaging METHodS for VaScular Contributions to Neurodegeneration (HARNESS). In the project, Dr. Smith and colleagues developed tools to facilitate harmonized MRI acquisition and analysis in the context of multi-center studies, available at [www.harness-neuroimaging.org](http://www.harness-neuroimaging.org).

## Members

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

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

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

Neuropsychology: Dr. Catherine Burton, Dr. Kim Goddard

# The General Neurology Program

Program Lead: Dr. Katie Wiltshire

## 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. Katie Wiltshire**

## 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 be able to provide a telephone consult service, Specialist Link, which provides timely telephone advice for referring physicians who have general neurology questions about their patients.

Additional innovations in care 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. Caitlin Holtby, Dr. Alicja Cieslak, Dr. Wei Liu, Dr. Tyson Brust, Dr. Wajid Sayeed, Dr. Gerald Pfeffer, Dr. Amy Yu, Dr. Chris Hahn



# The Headache Program

Program Lead: Dr. Elizabeth Leroux

## Overview

The Headache Program is a collaboration between DCNS and the Calgary Pain Program. The program has two clinics: the Calgary Headache Assessment & Management Program (at the South Health Campus) and the Headache Group of the Chronic Pain Centre (at the Richmond Road Diagnostic & Treatment Centre).



**Dr. Elizabeth Leroux**

## Highlights

The Headache Program follows a patient-centered, team approach with interdisciplinary collaboration. In total, the program receives over 2,000 patient referrals per year and we provide access to a greater number of patients each year. The program offers group education sessions, telephone consultations with referring physicians and patients, and telehealth visits for patients living outside of Calgary.

## Education

We provide training to headache fellows from Canada and abroad, residents in anesthesiology and family practice, and medical students. We are also welcoming observers from other countries. The Headache Program emphasizes the role of patient and family education in coping with headache disorders, many of which are chronic diseases with episodic manifestations.

Headache Program members have participated at the national level in the Canadian Headache Society National Neurology Residents Headache Course held in Montreal each October; in the headache courses held at the Canadian Neurological Sciences Federation meeting each June; and at the Launch Resident Teaching Course in Toronto each February. At the international level, our members also contributed to the last International Headache Conference in Vancouver.

## Research

The Headache Program is invested in clinical research which includes Phase 2, 3 and 4 medication trials, an exercise trial, and a bridging preventive medication trial. Program members have also been active in publishing guidelines and other articles on headache diagnosis and treatment.

## DCNS Members

Dr. Farnaz Amoozegar, Dr. Werner Becker  
Dr. Lara Cooke, Dr. Jephtha Davenport  
Dr. Elizabeth Leroux (team leader)  
Dr. Caitlin Holtby (fellow)

## Physicians

Neuropsychiatrist: Dr. Aaron Mackie

Family physician: Dr. Lori Montgomery

Psychiatrist support services:  
Dr. Stephen Amadala, Dr. Pamella Manning

Nurses: Irene O'Callaghan, Rachelle Ellis,  
Helene Kiriakopoulos, Carrie Robertson,  
Anquan Liao, Courtney Gail

Occupational therapist: Allison McLean

Physiotherapists: Kate Gerry, Philis Heffner

Psychologists: Dr. Penny Ford, Dr. Colleen Miller,  
Joanna Jewell

Pharmacist: Joyce Côté

Kinesiologist: François Gagnon

Dietitian: Kelly Sullivan

Administration Support: Leatha Semrick,  
Lydia Gallo, Lisa LeBlanc, Carolyn Baldwin

Operational Managers: Suzanne Basiuk, Vanessa Swanson, Georgia Tabler, Carla Loder

# 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. The clinical program holds the designation of Center of Excellence through the National Parkinson Foundation (NPF).

## Highlights

The second Calgary Movement Disorders Symposium was held in September 2017 and included:

- Dr. Mark Edwards – St. George's University of London, London, UK
- Dr. Francesca Morgante – University of Messina, Italy
- Dr. Andrea Cavanna – University of Birmingham, UK
- Dr. Lucia Ricciardi – St. George's University of London, London, UK

The clinical program is subdivided into the following subspecialty clinics:

- Botulinum toxin clinics for the treatment of hyperkinetic movement disorders
- 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, including essential tremor, Parkinson's disease and dystonia among others
- 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

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) 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 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 TMS (theta-burst stimulation) 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 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 of high intensity focused ultrasound thalamotomy for tremor is currently underway, led by Dr. Zelma Kiss, functional neurosurgeon in the program.
- Dr. Bin Hu continues to work on the Ambuloso program. The trial now encompasses other national and international sites.
- Participation in other multicentre clinical trials includes:
  - Steady PD3 trial investigating efficacy of isradipine as a disease-modifying agent in early Parkinson's disease.

CONTINUED ON PAGE 27



# 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.

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 Neuroimmunology Clinic provides multidisciplinary care to patients with various neuro-inflammatory disorders, including neurosarcoidosis, vasculitis, and other systemic immune-mediated disorders affecting the nervous system.



**Dr. Michael  
Yeung**



**Dr. Katayoun  
Alikhani**

## 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. 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.

## Members

Physicians: Katayoun Alikhani, Nadeem Bhanji, Jodie Burton, Kevin Busche, Chris Hahn, Marcus Koch, Scott Jarvis, Dan McGowan, Aaron Mackie, Luanne Metz, William Murphy, Scott Patten, David Patry, Rory Sellmer, Michael Yeung

Basic and Imaging Scientists: Jeff Dunn, Shalina Ousman, Bruce Pike, Peter Stys, V. Wee Yong, Yunyan Zhang

## CONTINUED FROM PAGE 26

- Global Phase 3 trial of istradefylline in moderate to advanced Parkinson's disease for the treatment of wearing off phenomena.
- A randomized, double-blind, placebo-controlled multiple dose study to assess efficacy, safety, tolerability, and pharmacokinetics of intravenous ABBV-8E12 in Progressive Supranuclear Palsy.
- Observational study of Huntington's disease (ENROLL-HD trial).

The Movement Disorders Program is also highly committed to training neurology residents and fellows. An international fellowship program in movement disorders, jointly with the Pediatric Movement Disorders program, is currently active.

## Members

Neurologists: 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

Nurses: Karen Hunka, Nancy Labelle, Meliza Camerino, Pia Lawrence, Carol Pantella, Eric Tse

Research Co-ordinator: Lorelei Tainsh

Administrative Staff: Bonita Woytowich, Hanna Mogos, Vanesa Perte, Lydia Poulin

# 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. The South Health Campus 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.

### 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.

**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, 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. Two randomized clinical trials of pimozide and tirasemtiv for ALS were completed. The Canadian Neuromuscular Disease Registry (CNDR) and the Canadian Neuromuscular Disease Network (CAN-NMD) continued to operate under Dr. Korngut's leadership and promote collaborative research and promotion of clinical care excellence across Canada. 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, we say goodbye to neurologists Peter Dobrowolski (Edmonton) and Christine Stables (Vancouver) and welcome Megan Crone (Calgary), Seraj Makkawai (Saudi Arabia), and Mark Ng (Winnipeg).

## Members

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

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

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

# 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.



**Dr. Paula  
de Robles**

The majority of referrals are seen within 14 days. Most cases are reviewed in our 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.

## 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. Robert Nordal, Dr. Shaun Loewen

Neurologist: Dr. Alexandra Hanson

Neurosurgeons: Dr. Mark Hamilton, Dr. John Kelly, Dr. Yves Starreveld

Neuro-Oncology Fellow: Dr. Wajid Sayeed

Clinical Psychologist: Dr. Guy Pelletier

Nurses: Jill Bullock, Crystal Tellet, Cindy Yorke, Sally Lim, Ginny Holm, Diane Jahraus

Nurse Practitioner: Catriona Leckie

Research Nurses: Barbara Gawley, Luanne Crawford

Pharmacist: Frances Cusano

Clinical Trial Co-ordinator: Mailin Deane

## CONTINUED FROM PAGE 28

Peripheral Nerve Surgery: Dr. Rajiv Midha, Dr. Christiaan Schragg

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, Monic Brunet OT, Stephanie Molzan SLP, Dr. Kim Goddard, Neuropsychology, Sandy Jensen DH, Tiffany LaFleur RD, Gina Kroetsch OT, Nicole Mullen SW, Ray Tye RT

Fellows: Dr. Megan Crone, Dr. Seraj Makkawi, Dr. Mark Ng

Clerical Team: Lindy Wright (ALS and Peripheral Nerve Clinics), Jennifer Coish (NMC), Kelsey Collins (NMC)

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

Basic Science Research Team: Kristina Martens (lab manager), Carly Pontifex (master's student in neuroscience), Robyn Wells (PhD student in neuroscience)

# 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**

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)

Neuro-Ophthalmology Program: Kimberley Ade, Sarah Keeler. Neurovestibular Program: Melanie Oszust, Gina Quinn, Michelle Pushka, Dominique Le Blanc, Veronique St. Georges, Jacqueline Townsend, Craig Mulroney

## 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

# The Urgent Neurology Clinic

Program Lead: Dr. Alexandra Hanson

## Overview

The Urgent Neurology Clinic (UNC) was established in 2000. UNC's mandate is to see adult patients with a new and acute neurological issue, requiring an urgent outpatient consultation with a neurologist, within one week. Further tests are then expedited and completed in a timely manner. UNC holds clinics at both FMC and SHC and works in conjunction with Neurology Central Access and Triage (CAT) to ensure all patients are seen in the most appropriate clinic.

Exclusion criteria: Patients who have a neurologist or were seen by neurology in the ED; have a chronic neurological condition; require followup or ongoing surveillance; inpatients. UNC does not see patients for second opinions, WCB, or medicolegal issues.

## Highlights

For the July 2016 – June 2017 year, UNC saw 1,700 new patients; approximately two-thirds at FMC and one-third at SHC. FMC had 455 clinics and SHC had 245 clinics.



# 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:

- improving antipsychotic safety monitoring in children
- promoting rational pharmacotherapy in children with neurodevelopmental and disruptive behaviour disorders
- knowledge synthesis and translation
- exploring novel therapeutic strategies for tics

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

## 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

While UNC sees a myriad of neurological disorders, the most common referrals were for seizures and migraine/headache. The Urgent Neurology Clinic is an excellent clinic for resident teaching and for STACERS – observed clinical assessment for resident evaluation.

## Members

FMC: Janet McNamara RN, Dale Gyonyor, Cynthia Sanchez

Physicians: Dr. J. Burton, Dr. P. de Robles, Dr. Y. Duan, Dr. S. Furtado, Dr. C. Hahn, Dr. A. Hanson, Dr. J. Kohli, Dr. S. Peters, Dr. M. Yeung, Dr. A. Yu

SHC: Lorraine Sorge RN, T. Tyrrell

Physicians: Dr. K. Alikhani, Dr. F. Amoozegar, Dr. W. Murphy, Dr. D. Pearson, Dr. D. Patry, Dr. S. Singh, Dr. K. Wiltshire

# Pediatric Neurosciences

Dr. Jong M. Rho

**THE SECTION OF PEDIATRIC NEUROLOGY** based at the Alberta Children's Hospital (ACH) provides comprehensive neurological care to infants and children from Southern Alberta and neighbouring Saskatchewan/British Columbia.

**WATCH THE  
INTERVIEW**  
[ucalgary.ca/  
dcns/2017](http://ucalgary.ca/dcns/2017)

Last year, we added one more pediatric epileptologist to our group—Dr. Juan Pablo Appendino, who trained originally in Argentina but did his neurology and epilepsy fellowship at the SickKids Hospital and the University of Toronto. His arrival brought the

number of pediatric epileptologists to six.

Our research projects are mainly focused around brain injury—concussion, traumatic brain injury, stroke and brain inflammation. We have a number of different collaborative investigators, mostly within child neurology, but also in other sections within Pediatrics. These researchers have focused primarily on brain injury, in multiple contexts, including long-term outcomes, neuroimaging and therapeutic interventions. One in particular is the transcranial magnetic stimulation paradigm and TCDS intervention that Dr. Adam Kirton has been spearheading over the last seven to eight years.

On the clinical front, for epilepsy we continue to evolve our ketogenic diet treatment program and now we have a tertiary program developed at the hospital where we titrate different types of dietary treatments—so-called neurometabolic therapies—for patients with medically intractable epilepsy.



▲ Dr. Jong M. Rho

To highlight what we're doing research-wise, we hosted the fifth Global Symposium on Ketogenic Therapies in Banff in September 2016. This drew nearly 600 participants from around the world and, arguably, was the largest and most successful meeting of its kind ever held. Importantly, it's not just epilepsy that the ketogenic diet might be useful for. It also touches upon brain cancer, autism, cognitive disorders, such as Alzheimer's disease, and a host of others. These were all topics that were explored at the conference.



We also have made some strides in collaboration with Deborah Kurrasch in the Department of Medical Genetics. Our experimental therapeutics platform revolves around genetically engineered zebrafish and using them as a high-throughput platform for uncovering new medications. Over the last year we've been able to screen more than 900 compounds that are already FDA- and Health Canada-approved, and have identified some lead compounds. The main one is now the topic of a manuscript currently in press in *Brain*.

Concussion and traumatic brain injury are a widespread problem throughout the world and certainly here in Alberta. We have some of the world's leading experts on both adult and pediatric fronts, studying the biology of brain injury as well as the clinical problems that manifest from this and novel treatment options that can be developed as a consequence of that knowledge.

One example is the use of melatonin as a treatment for concussion to reduce the symptomatology that we see. Dr. Karen Barlow, who has been the lead investigator on a CIHR-funded project, has enrolled the last patients and now the data analysis will be underway and we'll have some new information about whether this readily available therapy works in patients with concussion.

Between the Department of Clinical Neurosciences and the Section of Pediatric Neurology at Alberta Children's Hospital, which is under the Department of Pediatrics, there's been growing collaboration—not just in terms of sharing conferences and giving rounds in each centre—but having adult neurologists just working side by side with pediatric neurologists at ACH.

For example, Dr. Yahya Agha-Khani and the Epilepsy Program hold a transition clinic for patients who become of age and need to find an adult physician. In movement disorders, Dr. Tamara Pringsheim is conducting multiple clinics and has established a program in pediatric movement disorders and co-morbid neurodevelopmental disorders within our neurosciences clinic area.

Last September, Dr. Adam Kirton was one of the lead organizers for a national NeuroDevNet conference on brain development in Calgary. It was the first time that Calgary took the lead in terms of organizing this multi-day conference on brain development, long-term outcomes, and the impact of injuries and the trajectories as a consequence.

Another of our faculty members, Dr. Harvey Sarnat, was awarded the most prestigious child neurology award in the world at the Child Neurologist Society meeting in Vancouver in October 2016. He won the distinction of giving the Bernard Sachs Lecture, which is a lifetime achievement award for all of the contributions in the neurosciences—both clinical, basic and transitional.

One of the things we've been very proud of at ACH is the rapid growth of our program over the last five years and, in particular, developing subspecialty programs. One example that emerged last year and grew very quickly was a pediatric neurocritical care program. This is being led by Dr. Michael Esser and involves pediatric neurologists with intensivists in the PICU as well as neonatologists in the NICU. The idea here is to have a very regular presence, providing neurologic expertise on a day-to-day basis, where joint rounds and conferencing on patients takes place.

And we have a pediatric neurocritical care program where patients get migrated to the outpatient clinic and then followed in specialty clinics in longitudinal followup. This will serve the basis for important questions that can be answered through clinical research. The other part of pediatric neurocritical care was the establishment of a research-oriented biobank and a bioanalytical core at ACH, which also took root last year.

We have state-of-the-art analytical tools such as Time of Flight (TOF) mass spectrometry that can measure virtually any molecule in any human specimen, biobank it, and then hopefully develop biomarkers for clinical diagnosis and clinical applications. This will serve as a great tool in terms of taking care of patients with critical and life-threatening neurologic conditions.

# The Section of Neurosurgery

Section Head: Dr. John Wong

## THE SECTION OF NEUROSURGERY AT THE

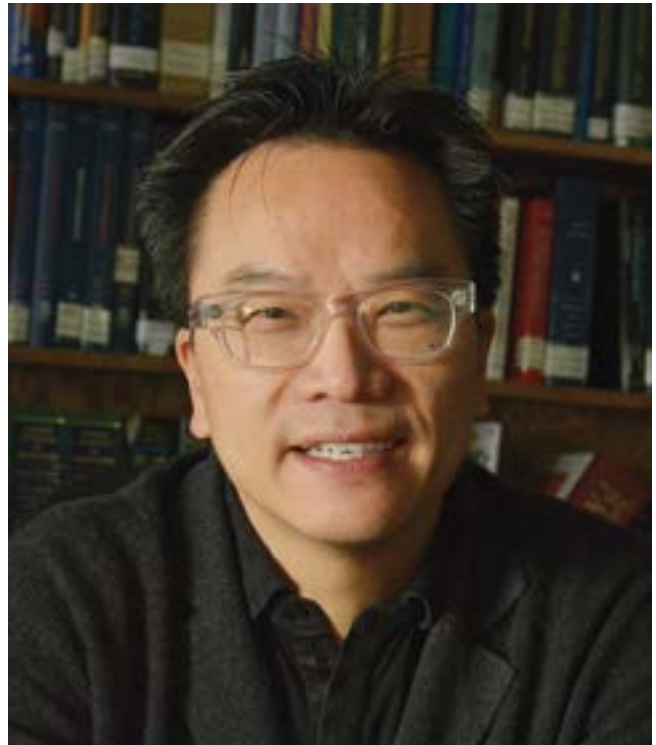
University of Calgary and Alberta Health Services is fully integrated with its partner sections of Neurology, Physical Medicine and Rehabilitation (PM&R) and Translational Neurosciences within the Department of Clinical Neurosciences.

With this highly integrated and programmatic approach, sub-specialized care is provided to our patient population. This 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 neurosurgeons, all of whom are sub-specialists and also provide general and emergency neurosurgical services.

Specialized programs include cerebrovascular and endovascular neurosurgery, epilepsy neurosurgery, adult hydrocephalus, 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 2,697 cases in 2016-17, with 2,012 cases in the operating theatres at Foothills Medical Centre and 185 at Alberta Children's Hospital. 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.



## Highlights

- In partnership with the Hotchkiss Brain Institute and philanthropy, the section played an important role in launching the MRI-guided Focused Ultrasound program. Calgary joins a select few centres around the world in acquiring this innovative technology to treat brain disorders without incisions.
- Our academic highlight remains the Charles Taylor Memorial Lectureship that pays homage to Calgary's first neurosurgeon. In 2017, Dr. Edward Benzel, Chairman Emeritus of the Cleveland Clinic, was the 13th Annual Charles Taylor lecturer.
- Numerous respected professors and neurosurgeons visited us this past academic year, including Dr. Menashe Zaaroor (Rambam Health Care Campus, Israel), Dr. Andres Lozano (University of Toronto), Dr. Brian Hoh (University



of Florida), Dr. Allan Levi (University of Miami), and Dr. Jim Drake (University of Toronto).

- For the 10th year running, the highly regarded Spine and Peripheral Nerve Anatomy and Surgery Course exposed neurosurgery and 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 18 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 having peer-reviewed and funded basic science and/or clinical research programs.

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, deep brain stimulation, traumatic brain injury, laboratory work using brain tumour-initiating stem cells, and intravascular stent development. We also proudly house one of the world's foremost laboratories in surgical robotics.



◀  
**Dr. Menashe Zaaroor from the Rambam Health Care Campus in Israel was a special guest of the Hotchkiss Brain Institute and the Section of Neurosurgery.**

Neurosurgeon ►  
Dr. Zelma Kiss attaches a  
frame to patient  
Elias Pharaon.

Mr. Pharaon completes  
a drawing test after the  
treatment is finished. ▼



Dr. Zelma Kiss, centre, and  
Dr. Bruce Pike, left, use the MRI  
machine to confirm the precise  
location of lesioning  
during the procedure. ▲

Mr. Pharoan's essential tremor  
is monitored between  
ultrasound treatments. ►



# MR-guided ultrasound delivers life-changing tremor treatment

## ESSENTIAL TREMOR IS A DEVASTATING

neurological disorder that means patients can't complete the simplest of tasks without assistance—drinking a cup of water, signing their name or holding a toothbrush.

Traditional treatment includes an invasive surgical procedure to implant an electrode in the brain that's used to burn tissue using radio frequencies.

**WATCH THE  
INTERVIEW**  
[ucalgary.ca/  
dcns/2017](http://ucalgary.ca/dcns/2017)

But clinical research being led by neurosurgeon Dr. Zelma Kiss and scientist Dr. Bruce Pike is solving the same problem in a much less invasive way—using high frequency ultrasound.

"This is a completely new way of doing the same operation using totally non-invasive (technology)," says Dr. Kiss.

And while they're still burning tissue to correct the tremor, the new ultrasound machine is able to reach the thalamus without the use of a single scalpel.

"So far, all of our patients have done very well, so we've managed to eliminate or almost eliminate any tremor that we can see in the patient on that day," she says.

The procedure, which begins with the patient having their head shaved, requires a special frame and water-filled rubber membrane to be attached to the skull. The water provides a medium for the ultrasound to travel through while the patient is tucked inside an MRI machine for the three- to four-hour procedure.

"We start making test lesions and we ask him whether or not he's feeling something when we apply it," explains Dr. Kiss. "We increase the intensity of the sonications—that are all focused on that one area—and then we start testing for tremor effects."

It's an interactive cycle of ultrasound lesioning and assessments that measure progress after each round by asking the patient to draw spirals on a piece of paper or pour water from one cup to another.

Over the course of a morning, the researchers narrow the focus of the treatment to the specific area of the brain that's causing the essential tremor.



**Dr. Bruce Pike,**  
professor of radiology  
and clinical neurosciences

"Once we think that we've stopped their tremor entirely, then we take them off the MRI table, I take the frame off, we repeat the testing with the spirals, with the writing their name and drinking water."

The results are life-changing and, for the patient, often lead to tears of joy.

"Obviously, the idea of neurosurgery in an awake patient without breaking

the skin is revolutionary," says Dr. Bruce Pike, a professor of radiology and clinical neurosciences. The research program—a joint initiative between the Hotchkiss Brain Institute, Cumming School of Medicine and Alberta Health Services—is starting with essential tremor cases, he says. But the future applications are equally exciting.

"My own vision is that this is the foundation of a much larger research platform."

Epilepsy and Alzheimer's disease are potential targets for ultrasound research; as is the delivery of drugs directly to tumours by transiently and focally opening up the blood-brain barrier.

But it all started with an essential tremor trial. And the patients who have undergone the procedure are walking testaments to the value of research.

"To see them come in and lie in the MRI scanner, and two hours later get up and walk out and take a drink of water and sign their name—it's impressive," says Dr. Pike.

"And that's extremely gratifying!"



# Resident takes time out to tackle a fundamental question of neuroscience

**MANY NEUROSURGERY TRAINEES OPT** to take time out from their six-year residency program to do an advanced degree. But Dr. Stefan Lang has chosen the ultimate subject to tackle during his PhD—cognition.

“I’ve always been interested in doing a PhD – it was just a matter of determining the best timing for it,” he says.

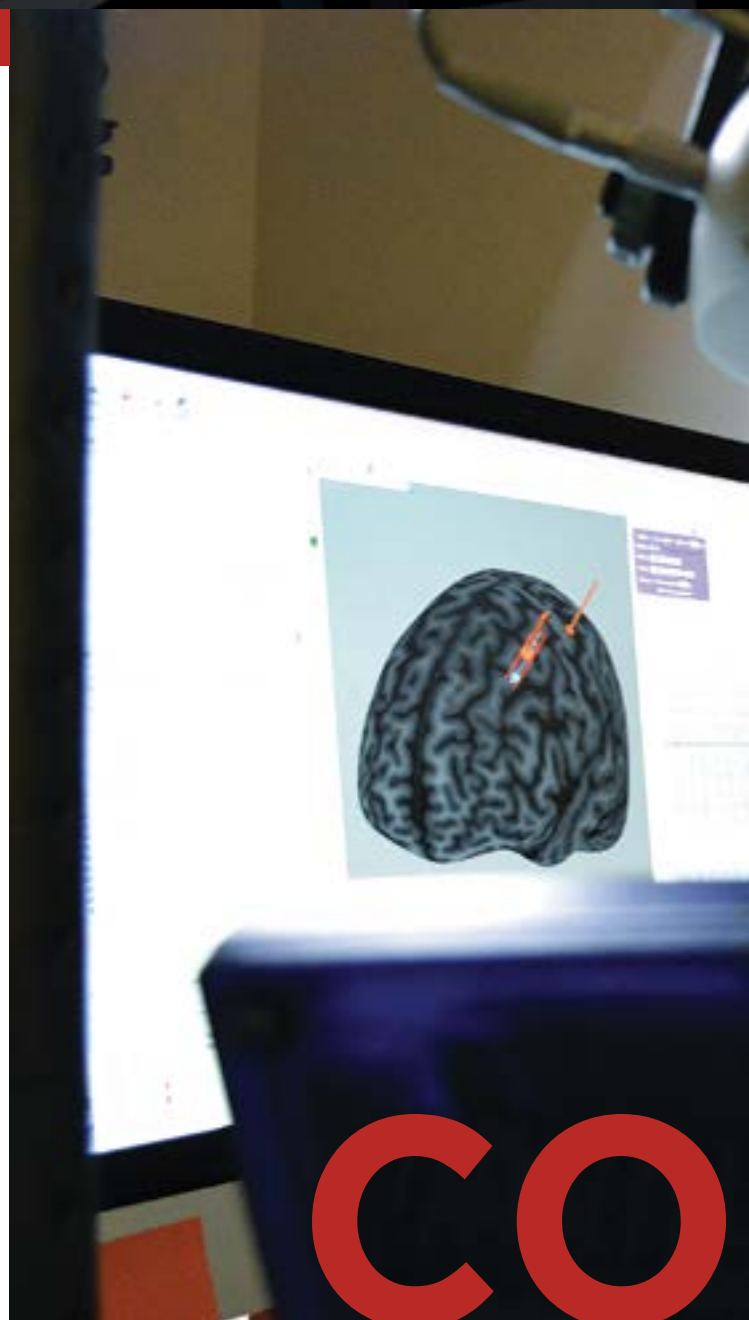
It’s also an important step toward his goal of becoming an academic neurosurgeon and combining his interest in clinical work with running a science lab.

“Luckily, here at the University of Calgary, we have the Clinical Investigator Program which provides financial support for doing a couple of years of research,” says Dr. Lang.

That support has allowed him to focus his energies on work with Dr. Oury Monchi, using advanced neuroimaging to gain insight into the brain networks implicated in cognitive functioning, and how they might be modified using transcranial magnetic stimulation (TMS).

The technology in Dr. Monchi’s lab gives researchers the ability to interact with and modulate brain networks in a non-invasive manner.

“In Parkinson’s disease, and dementia in general, those networks are not working properly,” says Dr. Lang. “They’re dysfunctional and we use TMS to try to bring them back online or to try to increase the



connectivity or the integrity of these networks.”

It’s time-consuming research that requires the contributions of patient volunteers undergoing TMS, fMRI and cognitive assessments over a two-week period. “We can’t do this work without the involvement of the neurologists who see these patients and we really appreciate help recruiting these patients to our study.”

The possible applications extend beyond Parkinson’s and overlap with many of the issues Dr. Lang has faced in his residency training.





▲ **Neurosurgery resident Dr. Stefan Lang is researching how transcranial magnetic stimulation could affect cognition in Parkinson's patients.**

"There is lots of clinical disease where cognition is impacted, like dementia, which we're studying in the lab, but also in other things that are relevant to neurosurgery such as brain tumours, epilepsy, traumatic brain injury," he says.

"All of those things have potential to impact cognitive functioning."

Dr. Lang hopes his work is the start of a lifetime of research into a fundamental area of neuroscience—

beginning with his doctoral question: Can transcranial magnetic stimulation improve cognition in people with Parkinson's disease and cognitive impairment?

"I think we can make some progress towards understanding how cognition works in the brain and how we can develop treatments to improve cognition or develop biomarkers that predict cognitive decline."

# 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



▲ Dr. Yves Starreveld checks in with nursing colleagues on Unit 112.

# 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 of treated patients. 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 with hydrocephalus using shunts and endoscopic techniques. In 2017, there were approximately 2,000 patients followed in the adult hydrocephalus clinic. There were approximately 1,600 outpatient assessments and 200 surgical procedures performed.

## Highlights

- Dr. Hamilton is the Chair for the Adult Hydrocephalus Clinical Research Network (AHCN), which has two centres in Canada, five in the United States and one in England. AHCN has enrolled approximately 800 patients in 24 months and is starting a clinical trial for patients with normal pressure hydrocephalus ([www.AHCN.org](http://www.AHCN.org)).
- Dr. Hamilton is a member of the board of directors and president-elect of the International Society for Hydrocephalus and Cerebrospinal Fluid disorders ([www.ISHCSF.com](http://www.ISHCSF.com)).
- Dr. Hamilton is a member of the board of directors of the Hydrocephalus Association and the medical advisory board of the Hydrocephalus Association ([www.hydroassoc.org](http://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.
- CTV News aired a report on normal pressure hydrocephalus issues and treatment featuring Dr. Hamilton and the Calgary Adult Hydrocephalus Program in April 2017.

## 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

Neurologist: Dr. David Patry

Neuro-ophthalmologists: Dr. Fiona Costello, Dr. Suresh Subramaniam

Geriatrician: Dr. David Hogan

Nurse Practitioner: Ron Prince, Crystal Wilson

# Image-Guided Medical Robotics Program

Program Lead: Dr. Garnette Sutherland

## Overview

The Intraoperative MRI (iMRI) Program, developed by Dr. Garnette Sutherland in collaboration with the National Research Council (NRC), uses a ceiling mounted 3.0T magnet and 2017 marks the 20th anniversary of this technology now adopted internationally. At the Foothills Medical Centre, together with the original 1.5T iMRI system, over 2,000 patients have benefitted from the iMRI system used for surgical planning, inter-dissection imaging and quality assurance. The Canadian spin-off IMRIS (Now IMRIS-Deerfield, USA) has translated the system to 70 international sites, with over 22,000 patients benefitting.

Into this environment we have integrated neuroArm, the world's first image-guided, MR-compatible robot, also developed by Dr. Sutherland and team in collaboration with MacDonald, Dettwiler and Associates (MDA). The robot is capable of both microsurgery and stereotaxy and continues to be used in patients with neurosurgical disease. The commercial version (SYMBIS), with FDA approval for stereotaxy, is undergoing hardware/software optimization at the Project neuroArm research facility.

With endorsement from the University of Calgary, Office of the Vice President Research, Dr. Sutherland's team has begun fundraising and preliminary concept design and planning for the CellArm Surgical System, a third generation neuroArm. CellArm will be a compact, economical and efficient robot for whole body application, with the ability to operate at cellular level and the potential to move robotic procedures from highly specialized tertiary care hospitals to smaller community centres. Dr. Sanju Lama, Clinical Integration for neuroArm Technologies, has been overseeing the initial aspects of the project, working with engineers and surgeons and liaising with the University of Calgary development team. This ambitious and disruptive venture is poised to transform surgery from organ to cellular level.

## Highlights

**SmartForceps Technology:** For the past five years the research group has been actively developing SmartForceps, a force sensing bipolar forceps

for microsurgery (patent under review). The technology not only allows measurement and quantification of tool-tissue interaction forces, but also, through recent discrimination analysis, is able to classify surgeons based on their skill level and experience. This discovery, based on 26 patients has been published in JAMA Surgery. Through a recently awarded Alberta-Germany Collaboration Fund (GCCIR 2017) for commercialization, the team is working with two German companies, Bissinger and TROUT GmbH, towards an Intelligent Module based on machine learning that is capable of automatically recording, quantifying and analyzing force data, and prompting or warning the surgeon should force levels reach sub-optimal levels.

## Microsurgery-specific Haptic Hand-controller:

With the support of CIHR-NSERC, the project has developed a second iteration of the haptic hand controller, Excalibur, for robot-assisted surgery. Upon testing and review of the prototype, the aim is to begin manufacturing. With a patent filed recently and publication in preparation, the team is in the process of identifying Canadian and German companies to collaborate and expedite commercial manufacture.

## Molecular Neuroscience-Brain Tumour and Trauma:

The Project neuroArm Molecular Neuroscience platform is focused on the molecular genetics of meningioma and brain tumour tissue interrogation with vibration profiling using atomic force microscopy and molecular imaging for traumatic brain injury (TBI). Following initial publications, the team is working on a black box paradigm of an innovative brain tumour tissue interrogator for streamlined, compact, fast, high-fidelity, and automated intra-operative tumour diagnostics and therapy. Support from staff neurosurgeons at the Foothills Medical Centre has expedited and expanded sample collection, including pituitary tumours, vestibular schwannoma and epilepsy. With recent patent filed in North America and Europe, the tau-specific single domain antibody work, in collaboration with NRC, is undergoing licensing.

**Computer Science/Simulation:** Project neuroArm hosts multiple commercially available and in-house surgical simulators used for educating resident



surgeons and medical students. A recent PhD project investigating the effect of transcranial magnetic stimulation on surgical performance is using the virtual reality surgical simulator.

**Robot-Assisted Space Telemetry (RAST):** From a recent endorsement from the University of Calgary's New Earth-Space Technologies (NEST) initiative, Dr. Sutherland and his multi-disciplinary team have launched the preliminary work on calculating time delay between earth and the International Space Station (ISS) towards a future ability to conduct surgical tasks using a robot on the ISS by a surgeon at a workstation on earth. This work, in collaboration with University of Manitoba and engineers and surgeons from the University of Calgary, is well aligned to endeavours related to moon colonization and deep space exploration by the Canadian Space Agency (CSA), the National Aeronautics and Space Administration (NASA) and international space agencies.

### Recognition

Dec. 4, 2017 marks the 20th anniversary of the ceiling-mounted intra-operative MR imaging technology based on a high field moveable magnet. The Seaman Family MR Research Centre, with its two inter-related MR research programs, has now become an international beacon of excellence! The iMRI technology has given rise to many linked innovations, notably the MR-compatible OR table, sterilizable multi-channel RF coil and the neuroArm neurosurgical robot.

To commemorate this, Dr. Sutherland and team hosted an evening reception in the Project neuroArm research space to acknowledge all the people and groups that turned this idea into a reality!

### Education

In May 2017, following collaboration with the University of Vienna and industrial partner Medtronic, Dr. Sutherland was invited for a plenary lecture on technology creation at the International DTI Tractography Workshop in Vienna, Austria. Dr. Sutherland was awarded an Honorary Staff appointment in the Department of Neurosurgery at the University of Vienna.

Project neuroArm hosted Professor Menashe Zaaroor from the Rambam Health Care Campus in Haifa, Israel, who was invited in spring 2017 by the Hotchkiss Brain Institute to help with the setup of the MR-guided Focused Ultrasound program at Foothills Medical Centre. Dr. Sutherland and his team have forged a Canada-Israel collaboration on cell-specific contrast agent, nanotechnology and immunotherapy for malignant brain tumour.

With University of Calgary Chancellor Robert Thirsk, Dr. Sutherland was hosted by the University Alumni-Ismaili community in Burnaby, BC. He shared his clinical and innovative research initiatives and how they may affect our communities, our present and our future.

### Members

(Includes only active collaborators and senior students/trainees)

Engineering: Kourosh Zareinia, Yaser Maddahi, Hamidreza Hoshyarmansh, Chris Macnab, Qiao Sun, Yaoping Hu, Salvatore Federico, Mahdi Tavakoli, Ekram Hossein, Shanlin Jiao, Rachael L'Orsa, Canaan Ng, Don Peterson, Renate Ng, Ahmad Ghasemloonia

Science: Dustin Proctor, Sonny Chan, Desmond Larsen-Rosner, Kowther Hassan, Boguslaw Tomanek, Calvin Bewsky, Mehdi Arbabi, Frank van Veggel, Michael Colicos, Matthias Amrein, Sultan Nelson, Jade Huang, Jessica McKee, George Wang

Medicine: Sanju Lama, Andrew Ryu, Justin Liu, Stefan Wolfsberger, Fang Wei Yang, Andrea Becking, Phillip Park, Seok Keun Choi, Joseph Dort, Francis Sutherland, Andrew Kirkpatrick, Paul McBeth, Garnette Sutherland

Administrative Support: Heidi Rubba

Industrial Partners: MDA (Brampton, ON); Deerfield-IMRIS (Minnetonka, MN); Medtronic (Minneapolis, MN); OrbSurgical Ltd. (Calgary)

Institutional Partners: National Research Council Canada, Canadian Space Agency, University of Manitoba, University of Alberta, University of Victoria, University of Vienna, Austria, Hokkaido University School of Medicine, Sapporo, Japan.

# 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, spasticity, gastroparesis and urinary incontinence. Specialists from DCNS and other departments are part of the program.

## Clinical Care

This year continued our successful deep brain stimulation (DBS) for treatment-resistant depression study. Our Alberta Innovates-funded pilot study completed patient accrual with 22 patients, the last one implanted in October 2016. We have maintained an approximate 50 per cent response rate (meaning a 50 per cent reduction in depression severity scores). This is a remarkable improvement in quality of life for these people, including an ability to return to work/school for several.

The movement disorders program recruited a new director, Dr. Davide Martino, who is very interested in maintaining and developing the neuromodulation program further. We received 40 new referrals, implanted 13 new patients, replaced 21 batteries and followed about 140 people in total. The sacral nerve stimulation (SNS) program has reduced its capacity based on clinician time and alternative therapies such as bladder botox. While they still assess about 20 new patients per year, new implants and revisions are down to one of each this year. The pain program has been troubled by the loss of another neuromodulation pain physician from the Chronic Pain Centre and turn-over of nursing staff in this setting.

The major activity for the baclofen pump program this past year was the development of a program for pediatric patients graduating from Alberta Children's Hospital to Foothills Hospital clinics.

A highlight of this past year was the beginning of our MR-guided focused ultrasound program. While this technology at present is designed to make lesions, its future is in the arena of

neuromodulation. We treated two patients with tremor and have one booked each month for the remainder of the year.

## Education

There is significant interest in neuromodulation by trainees at post-doc, graduate and summer student levels. Drs. Darren Clark and Elliot Brown, both AIHS fellows, remain with the DBS for depression study. Dr. Nick Strzalkowski received both Parkinson Alberta and Parkinson Foundation USA fellowships this past year. A new PhD student with biomedical engineering background, Rachel Sondergaard, has joined Linda Kim and Sohail Noor, studying mechanisms and new targets of DBS in humans and animal models. A psychiatry resident presented our accrual/screening data for our DBS for depression study. We are looking forward to helping train a neurologist fellow in movement disorders and a resident in pain medicine this coming year.

## Research

Neuroethics of patenting in the neuromodulation field is a new research direction we have embarked upon in collaboration with the UBC Neuroethics Centre. We published a paper in Nature Biotechnology this year and funded a summer law student to continue this project this summer.

A systematic review on DBS for dystonia has been completed and is under revision for Movement Disorders. We presented our study of occipital nerve stimulation for various craniofacial pain syndromes and will be submitting it for publication soon. In the lab we are studying how DBS affects motor maps in dystonia patients (funded by an HBI pilot grant), using transcranial magnetic stimulation to alter cerebellothalamic circuits in Parkinson's patients (funded by Parkinson Foundation), and developing new technologies to study how DBS works in animal models (funded by NSERC). We are making strides in learning the biomarkers of response to DBS for depression.

Our team members had poster or oral presentations at several international meetings, including the Society of Biological Psychiatry, Society for Neuroscience, Brain Stimulation, International Basal Ganglia Society, and World Society for Stereotactic and Functional Neurosurgery.



▲ The focused ultrasound machine has been used, in conjunction with MRI, to treat tremor.

### Future Directions

In the coming year we will be developing the low intensity focused ultrasound system for new conditions including neuromodulation. This program has already saved significant cost and risk for tremor patients who have opted to have outpatient high intensity focused ultrasound treatments.

### Members

Cardiology: Dr. Jim Stone

Neurology: Dr. Yahya Aghakhani, Dr. Werner Becker, Dr. Scott Kraft, Dr. Davide Martino

Neurosurgery: Dr. Walter Hader, Dr. Mark Hamilton, Dr. Zelma Kiss

Nursing: Sandra Golding (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. Jenni Joo, Dr. John Pereira, Dr. Kelly Shinkaruk (Chronic Pain Centre)

Physical Medicine and Rehabilitation: Dr. Chester Ho, Dr. Dan McGowan

Physiotherapy: Cliona Corbett

Psychiatry: Dr. Aaron Mackie, Dr. Jeremy Quickfall, Dr. Raj Ramasubbu

Psychology: Dr. Arlene Cox, Dr. Angela Haffenden

Respirology/Thoracic surgery: Dr. Sean McFadden, Dr. Karen Rimmer

Urogynecology: Dr. Shuhana Kim-Fine, Dr. Magali Robert

## 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 stroke team, the Neurovascular Program has become an important partner in stroke care and research.

### Highlights

Approximately 700 patients with neurovascular disease were seen in the past year in our specialized outpatient clinic for evaluation and followup. Currently, about 300 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, which was the first to use special shaped-beam focused radiotherapy techniques in Canada, 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.

### Education

Educational highlights have included the recruitment of clinical fellows in endovascular training and open neurosurgical techniques.

### Research

Academic initiatives have centered upon the development by Dr. Alim Mitha of a basic science laboratory for creating new intravascular devices for stroke care and the pioneering, Calgary-led international multi-centre study of acute stroke intervention (ESCAPE and ESCAPE NA-1).

### Members

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

Nursing: Leslie Zimmer, Michelle Gillies

Fellows: Dr. Saad Al-Qahtani,  
Dr. Javed Khader-Eliyas

## 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. All members' primary affiliation is with the Department of Clinical Neurosciences, while the pediatric neurosurgery section operates within the Division of Pediatric Surgery at Alberta Children's Hospital.

### Highlights

Dr. Jay Riva-Cambrin was successful in establishing Calgary as a new site in the Hydrocephalus Clinical Research Network (HCRN), which comprises nine locations across North America. Calgary now is an active participant in the Quality Assurance prospective database in addition to the multi-centre randomized controlled Entry Site Trial.

### Research

The Pediatric Neurosurgery division continues to be an active participant in the Canadian Pediatric



# 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 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.

## Highlights

The Multidisciplinary Peripheral Nerve Clinic started seeing more patients with spinal cord injuries, offering innovative nerve transfer procedures to improve function.

## Research

Research is an important aspect of the Peripheral Nerve Program. Dr. Midha runs an independent 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](http://www.hbi.ucalgary.ca).

## Education

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

Dr. Tarek El Madhoun (2014)  
Dr. Yuval Shapira (2015)  
Dr. Mustafa Nadi (2016)  
Dr. Toby Loch-Wilkinson and  
Dr. Vanessa Sammons (2017)

## Members

Medical Neurologists, Physiatrists &  
Electrodiagnostics: Dr. Chris White,  
Dr. Stephen McNeil

Neurosurgeon: Dr. Rajiv Midha

Plastic Surgeons: Dr. Christiaan Schrag,  
Dr. Robertson Harrop, Dr. Justin Yeung

Physiotherapy: Margaret Hass

Intraoperative Electrophysiology Support:  
Michael Rigby, Erin Phillip

Neurosurgery research study group, with Dr. Riva-Cambrin co-ordinating the scientific program annually. Dr. Riva-Cambrin, in addition to being the site co-ordinator for the HCRN, heads the network study into ventricle size involvement in neuropsychological outcomes in pediatric hydrocephalus. Dr. Hader recently completed a survey of all Canadian pediatric epilepsy surgical centres which documented programmatic resources available and all epilepsy surgical procedures performed in children in 2015. This follows a previous survey completed in 2003. The data will be presented at the upcoming Canadian League

Against Epilepsy meeting in Vancouver in the fall of 2017. The pediatric epilepsy surgery program at Alberta Children's Hospital is now the most active program in Western Canada and second only to the Hospital for Sick Children in Canada.

## Members

Neurosurgeons: Dr. Walter Hader,  
Dr. Clare Gallagher, Dr. Jay Riva-Cambrin

Nurse Practitioner: Kelly Bullivant

Nurse Clinician: Kelly Hogue

## 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 five 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.

### Highlights

- Sasha Rogers, our new fellow, joined us from Brisbane, Australia in July 2017.
- Miki Katzir will be joining us in 2018 from the Rambam Medical Centre in Haifa, Israel.
- The PITNET team is working with Guideline Utilization Resource Unit (GURU) and CancerControl Alberta, to revise existing guidelines in the management of pituitary tumours.
- Kirstie Lithgow, a fellow in endocrinology, has undertaken a project looking at the endocrine outcomes of our pituitary surgery cases in Calgary.

### Research

Current research directions are focused on cost-effectiveness, the role of optical coherence tomography in patient management, comparisons

of surgical approaches, and an exciting new project on fMRI in optic compressive neuropathy funded by a PFUN seed grant.

Dr. David Ben-Israel's "Long-term Structural Changes of the Anterior Visual Pathway after Pituitary Tumor Resection" was selected as the top tumour poster at the 2017 Congress of Neurological Surgeons.

### 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.

### Members

Endocrinology:

Dr. Shelly Bhayana, Dr. Bernard Corenblum, Dr. Alun Edwards, 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

## 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.

# 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.

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. Hamilton and Dr. Kelly are members of the Clark H. Smith Brain Tumour Centre, The Southern Alberta Cancer Research Institute, and the Hotchkiss Brain Institute, as well as participants in the Terry Fox Research Initiative.

All neurosurgeons are 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

## 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

# The Section of Physical Medicine & Rehabilitation

Section Head: Dr. Chester Ho

## THE SECTION OF PM&R HAS 29 MEMBERS

working in diverse settings from tertiary acute care hospitals to community practice. Our practice focuses on the diagnosis, management and rehabilitation of patients with neurological conditions (e.g. brain injury, spinal cord injury, stroke) and those with musculoskeletal problems (e.g. back pain, burn injuries, amputation).

We serve the needs of both children and adults in southern Alberta, eastern British Columbia and western Saskatchewan.

## Highlights

- The 2017 Canadian Neuromusculoskeletal Ultrasound Symposium was hosted in Calgary March 30 – April 1, 2017. There were almost 60 participants. (See story, Page 56).
- Evaluation of the Early Supported Discharge program for acquired brain injury showed that outcomes were as good as inpatient neurorehabilitation care, and there were significant numbers of inpatient bed days saved—in addition to significant cost savings from reducing length of inpatient hospitalization. The Early Supported Discharge program for stroke and acquired brain injury patients is ongoing.

## Recruitments and Leadership

- Dr. Janet Tapper joined our section and provided support to the Pediatric and Brain Injury Rehabilitation programs.
- Dr. Chantel Debert is co-lead of the Hotchkiss Brain Institute Brain Injury Neuroteam, along with Dr. Keith Yeates.



- Dr. Rodney Li Pi Shan was past president of the Canadian Physical Medicine and Rehabilitation Association.
- Dr. Denise Hill was past president of the Alberta Physiatrists' Association.

## Education

- Postgraduate medical education training: There are 10 residents in the PM&R program. We filled two first-year positions from the CaRMS match.
- Both graduating residents (Dr. Paul Reglin and Dr. Dave Nabeta) passed the Royal College exams, maintaining the 100 per cent pass rate for the PM&R residency program.



## Research

Our research program has become more robust and we now have multiple post doc students, graduate students, residents and undergraduate students working directly under our physiatrists.

Research in areas related to stroke, acquired brain injury, spinal cord injury and burn care continued. Some specifics included the start of a transcranial magnetic stimulation program for post traumatic headaches and research relating to stem cells in split thickness skin grafts.

## Clinical Care

The Music Therapy program being delivered on the neurorehabilitation unit was evaluated and found to be well received, and continuing operating funds were received.

An after-hours gym program for our tertiary neurorehabilitation inpatients has been started.

A new tool to help predict length of stay on the inpatient neurorehabilitation unit was trialed and has now been adopted by all three neurorehabilitation teams (brain injury, spinal cord injury and stroke).

**Music therapist Sam Harber (right) and research student Julie Joyce (centre) work with patient Denise Gettis as part of her rehabilitation at Foothills Hospital. ▼**





▲ Dr. Chantel Debert says education about concussion has come a long way in the past 20 years.

“Having these symptoms for three months and not being able to go back to work, not being able to go back to school, is incredibly difficult because it’s a silent injury. So you look normal but you don’t feel normal.”

— Dr. Chantel Debert

# Physiatrist finding answers for patients with concussion

Dr. Chantel Debert is researching objective diagnostic tools and helping clinicians predict how a patient will recover

## FROM HER UNDERGRADUATE YEARS

at the University of California Berkeley to her master's degree and psychiatry residency, Dr. Chantel Debert has witnessed the evolution of concussion understanding.

Twenty years ago, she says, sports medicine doctors realized concussion was an issue. But there weren't stringent protocols in place to prevent athletes from continuing to play after an injury.

"Some of those decisions were easily swayed by: 'Well, this is the last game of the season—you've got to get in there.'"

Concussion wasn't thought to be as serious an injury as it is now and few researchers were interested in studying the subject.

"People didn't decide to make that link or bring it to the forefront of research and medical care for decades afterwards," she says.

Fortunately, public awareness about concussion—or mild traumatic brain injury—has evolved and the risks are better understood by athletes, parents and coaches.

"I think people are more hyper-aware. So I'm seeing more and more patients who know they've hit their head—know they're not right—and they are symptomatic."

Most of those patients make a full recovery and don't develop long-term symptoms, says the assistant professor of physical medicine and rehabilitation.

"On average, a patient should get better or feel like

they can go back to work, school, physical activity within a month or so following their injury."



It's the patients that aren't getting better that Dr. Debert spends much of her clinic time with; patients with symptoms for months and months and who show little sign of recovery.

"Having these symptoms for three months and not being able to go back to work, not being able to go back to school, is incredibly difficult because it's a silent injury. So you look normal but you don't feel normal."

Those injuries stem from a range of causes: sports, motor vehicle accidents, work-related incidents and falls—especially in those over age 65.

Among the sports-related injuries, the statistics show a spike in concussions between the ages of 18 and 24.

Awareness about concussion among teachers and coaches, however, is helping to catch many cases before they become more serious.

"For example," says Dr. Debert, "if they see a player who's hit and they look disorientated, they'll pull them from play right away. And if that happens, then you can do the appropriate assessment. And these players probably aren't going to go on to have persistent symptoms because you're doing the appropriate things right at the start."

It's also important that players understand the consequences.

CONTINUED ON PAGE 54

**CONTINUED FROM PAGE 53**

“You know if you hit your head. Take yourself out of play—it’s not that important. You need your brain when you’re 50!”

Diagnosing a concussion is challenging and largely dependent on the clinician, she says.

Neurological exams and questionnaires assist physicians, but there are currently few objective measures of who has suffered a concussion and who hasn’t.

“If you had a concussion and I had you do a CT, it wouldn’t show it. Or an MRI wouldn’t necessarily show it,” she says.

That diagnosis question has driven Dr. Debert’s research and drawn her into collaborations with other researchers with similar questions.

“I see patients day after day and I often wondered: How can I predict who’s going to get better? And who truly had a brain injury? And who had an injury that’s mimicking a brain injury?”

One such collaboration included the Hotchkiss Brain Institute, DCNS physiatrists Dr. Sean Dukelow and Dr. Brian Benson, and Drs. Tony Montina and Gerlinde Metz from the University of Lethbridge.

The group recruited and followed 400 young athletes, between the ages of 15 and 25, over two years.

They used Dr. Dukelow’s robotics expertise to measure motor skills, they completed functional imaging and they took urine samples from all—before and after any diagnosed concussions.

Dr. Debert’s part of the study was looking at molecular biomarkers to see if they could predict who was going to get better and who wasn’t—and who had a head injury and who didn’t.

The study collected over 40 post-concussion urine samples and samples after the participants were asymptomatic and had returned to play.

“What we found was that there were a handful of molecules that actually changed after they hit their head,” says Dr. Debert.

The findings allowed the study to conclude, with up to 85 per cent specificity and sensitivity, that these molecules will change after an athlete hits their head—and it could be used to diagnose concussion.

It’s a dramatic finding—but currently difficult to implement due to the long turnaround times on the results and the specialized equipment required to analyze the samples.

But it’s one step closer to an answer to some of Dr. Debert’s questions and may be part of the ultimate solution.

**“I see patients day after day and I often wondered: How can I predict who’s going to get better?”**

— Dr. Chantel Debert

“I don’t think there’s going to be one objective measure; it’s going to be a group of objective measures that we put together and say, if you put these things together with all these things combined, I’m 99 per cent sure that you’ve had a concussion and I’m 98 per cent sure you’re going to recover within 12 days.”

The research led Dr. Debert to another study, called Safe to Play, with Dr. Carolyn Emory and Dr. Kathryn Schneider from the University of Calgary’s Faculty of Kinesiology.

“I was very much interested in inflammatory markers after concussion—and if they could allow us to understand what type of injury happened in the brain immediately afterwards and how severe the injury was and if it could prognosticate how these patients improve.”

By studying cortisol levels in peewee hockey players they hoped to find another objective





**▲ Increasing education among players, parents and coaches is resulting in more athletes stepping off the field after a concussion instead of returning to play immediately.**

measure of what's going on in the brain after a concussion—something that could be more easily diagnosed within hours of injury with a saliva or blood test.

“What we found was that those athletes that had lower cortisol levels in their serum had more symptoms and took longer to return back to playing their sport than athletes who had higher cortisol levels—which is very interesting,” she says.

It meant that the hockey players whose bodies didn't mount that inflammatory response to the

injury weren't healing as quickly as those who did.

All the research, says Dr. Debert, is driven by her clinical practice but also “makes me a better clinician—and hopefully makes me a better researcher.”

And it's appreciated by the patients she sees in her clinic.

“We're at the forefront of concussion research here at the University of Calgary. And I think it gives them hope.”

# Hands-on MSK symposium draws participants from across Canada

**IT HAD BEEN FIVE YEARS SINCE** a national conference on neuromusculoskeletal ultrasound had been held in Canada.

With this in mind, physiatrist Dr. Rodney Li Pi Shan along with Dr. Arun Gupta and Dr. Ken Lam determined that the time was right to host another event on a larger scale. At the end of March 2017, they welcomed 60 participants to Calgary for the Canadian Neuromusculoskeletal Ultrasound Symposium.

“Given the evolving nature of our specialty, we really felt the need to provide residents and staff with exposure to additional training in the field of ultrasound,” says Dr. Li Pi Shan. “Fortunately, everything came together in terms of the funding and we were lucky to have world-renowned speakers come and help us.”

Their keynote presenter, Jonathan Finnoff D.O., visited from the Mayo Clinic, and the participants came from across the country—including physiatrists, physiatry residents and students looking for a unique, hands-on learning experience.

The newly renovated Theatre One in the Health Sciences Centre was an ideal location for the lectures and ultrasound demonstrations—and

allowed for multiple video streams to be projected and recorded wirelessly. The small group live-scanning sessions were held in nearby classrooms and encouraged interaction among presenters and learners. And participants had the opportunity to practice injection skills at the University of Calgary’s state-of-the-art Advanced Technical Skills Simulation Laboratory (ATSSL).

“We really tried to offer more in terms of the number of stations and the quality of the presentations compared to the previous course. We had a mixture of more advanced stations but also taught basic techniques ensuring that there was something to be gained by trainees at all levels. In total, we were able to produce 43 HD-quality videos and these were made available online to all of our participants after the course.”

Based on feedback collected after the symposium, participants were very pleased with the event. And this likely means more work in the future for the three physiatrists.

“Given the enthusiasm of our participants and instructors, we have every intention of holding the symposium again, and we almost certainly won’t wait another five years for the next one.”







▲ Dr. Rebecca Iwanicki receives hands-on training in Health Sciences Centre's Theatre One.

Keynote presenter Jonathan Finnoff teaches at the Canadian Neuromusculoskeletal Symposium in March 2017.

## 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.

Out-patient rehabilitation is organized through the Community Accessible Rehabilitation (CAR) Program. With close partnership with the CAR



**Dr. Kenneth Lam**

Program we have garnered expertise in managing complex amputees. Those with hemi-pelvectomies and high above knee amputation are receiving the latest prosthetic components like microprocessor knee and novel socket designs.

### 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 Calgary Brain Injury Program

Program Lead: Dr. Christine McGovern

### Overview

The Calgary Brain Injury Program addresses the rehabilitation needs of individuals with acquired brain injuries (ABI) 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.

The Early Supported Discharge (ESD) Program, where people discharged from hospital can receive interdisciplinary rehabilitation within their homes and community, was started last year. This service allows patients to leave hospital earlier and apply their rehabilitation to practical goals that are immediately relevant to the affected individual and their family. Evaluation of the program this year showed it was equally effective to tertiary inpatient rehabilitation and saved a significant number of inpatient bed days as well as associated costs. The program is now ongoing,



**Dr. Christine McGovern**

in association with the stroke early supported discharge program.

A pilot project involving music therapy on the neurorehabilitation unit was found to be well received and funding to continue the program has been received.

### Service

The service includes both an inpatient and an outpatient component.

The inpatient service includes a physiatry consultation service for individuals in acute care, as well as 15 inpatient beds on a tertiary neurorehabilitation unit at Foothills Hospital. The INTENZ program has been well received and continues to run. It was developed to increase the amount of rehabilitation services delivered to our neurorehabilitation inpatients, and involves therapy assistants practicing skills with the patients during evenings and weekends, when traditionally less therapy has been delivered. The Cumming & Gillespie patient experience team continues to support



# The Burn Rehabilitation Program

Program Lead: Dr. Vincent Gabriel

## Overview

The Burn Rehabilitation program continues to increase inpatient volume and had approximately 1,000 outpatient visits this year.

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.

SynAPSE (SYNcing ABI Peer Support & Education), a one-on-one peer support program available on the neurorehabilitation unit. There is also a facilitated group meeting monthly for individuals, as well as their families, to provide an opportunity for connection and support.

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:

- Acute concussion education sessions, delivered approximately every two weeks, which consist of symptom management advice in a group format to individuals affected by concussion within three months of injury.
- A Brain Injury Rehabilitation Clinic which provides assessment and treatment by physiatrists. We also have social workers associated with our clinic.
- Liaising with the Community Accessible Rehabilitation (CAR) program in order to arrange interdisciplinary rehabilitation for individuals as required.
- Contracting for services with the Association for Rehabilitation of the Brain Injured (ARBI), 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 have medical students and residents, Allied Health students, and nursing students learning at various locations within the program.

## Members

Managers: Jason Knox, Lisa Patel, Shauna Brady

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

Psychiatrist: Dr. Jeremy Quickfall

Clinic Social Workers: Carol Lawson, Valerie Bunz

Neuropsychologists: Stewart Longman, Amy Siegenthaler, Ashley Fischer

Administration Support: Kendra McDonald, Susan Morson, Ashley Derksen, Shabina Moledina, Marj Moon, Shelby O'Connell

# Pediatric and Young Adult Rehabilitation Medicine Program

Program Lead: Dr. Lee Burkholder

## Overview

The program provides inpatient and outpatient rehabilitation medicine services at 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.

The program is also responsible for the Young Adult Rehabilitation Clinic, an outpatient clinic at the Sheldon M. Chumir Health Centre dedicated to adult patients with child-onset neurological and musculoskeletal conditions, which provides comprehensive rehabilitation medicine management and assists patients transitioning from pediatric care to the adult world.



**Dr. Lee Burkholder**

## Highlights

The Pediatric and Young Adult Rehabilitation Medicine Program continues to provide leadership and assist in the development of various interdisciplinary rehabilitation services associated with the Vi Riddell Children's Pain and Rehabilitation Centre at ACH.

In November 2016, the interdisciplinary ACH Somatic Rehabilitation Clinic was officially launched. This pilot clinic treats patients with somatic symptom disorders causing significant functional impairment. Disciplines represented include Physical Medicine & Rehabilitation, Psychiatry, Adolescent Medicine, Nursing, Psychology, Family Therapy, Physical Therapy, Occupational Therapy, Speech Language Pathology, and Education. The clinic has already successfully completed treatment on several children with somatic symptom disorders.

The program also introduced a psychiatrist to the interdisciplinary ACH Adolescent Transition Clinic (ATC). The ATC was established to provide

ongoing medical care, identify and implement each youth with an individualized transition plan, facilitate each patient's adaptive functioning and self-determination and increase youth knowledge and confidence regarding medical literacy, self-management and system navigation. The ATC has been integral in addressing existing system deficiencies known to complicate the transition process from pediatric to adult services.

## Clinical Care Updates

The Pediatric Rehabilitation Medicine inpatient consultation service assessed and treated 50 patients, many within the context of the ACH interdisciplinary neuro-rehabilitation team, while admitted to hospital. An additional 19 patients were followed during admission to the ACH Dr. Gordon Townsend School Rehabilitation and Education Program for management of medical and rehabilitation issues. The program also provided 942 pediatric outpatient consultation and followup appointments through various ACH rehabilitation clinics. A further 303 outpatient appointments were attended by adult patients through the Young Adult Rehabilitation Clinic. The program continued as a significant 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 four children. Gait analysis, collaborative with Orthopedic Surgery, Physiotherapy and Orthotics, for recommendation of therapeutic interventions continued through the C.H. Riddell Movement Assessment Centre at ACH with 25 patients undergoing evaluation.

## Education

Program educational pursuits were largely related to post-graduate medical training. The program had 14 medical post-graduate trainees, including PM&R, Pediatric Neurology and Developmental Pediatric residents, on service for 13 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. Dr. Burkholder is a member of the Developmental Pediatrics Residency Training Committee.

### Future Direction

Dr. Elizabeth Condliffe was recruited to the program clinician-scientist position, starting in late August 2017, with support of the Alberta Children's Hospital Research Institute. Dr. Condliffe has been mandated to build an original pediatric

rehabilitation medicine research program in collaboration with established Vi Riddell Children's Pain and Rehabilitation Centre research programs and research institutes.

### Members

Dr. Lee Burkholder  
Dr. Vithya Gnanakumar  
Dr. Janet Tapper

## PM&R Musculoskeletal and Chronic Pain Programs

Program Lead: Dr. Noorshina Virani

### MSK Program

The PM&R MSK program, the AHS Chronic Pain Program and the South Calgary Primary Care Network (SCPCN) completed the Pilot "Back 2 Health" family physician training program in the fall of 2016. This program focused on neuromusculoskeletal assessment and management of non-surgical low back pain (LBP) cases, with emphasis on the physical examination, myofascial, facetogenic, sacroiliac/pelvic girdle LBP and interventional/active rehabilitation strategies. Dr. Noorshina Virani is continuing to facilitate these workshops to engage more physician learners within the PCN.

A second program objective was to embark on multi-disciplinary patient education in LBP management within the SCPCN community. This was accomplished in spring 2017 through two pilot programs (12 patients), exploring six sessions:

- Orientation
- Brain 2 Back (self-management strategies)
- Myofascial Pain
- Back 2 Motion (posture and ergonomics)
- Core Counts 2 (Pelvic girdle function/core strength)
- Back 2 Practice (feedback on program/review)

Significant increases in self-efficacy were observed in those who completed the program. Due to the success of the pilot programs, a full referral program for patients with low back pain in the SCPCN will be launched in fall 2017.

Other program development initiatives include Dr. Jordan Raugust's involvement in an innovative Pediatric Sports and Exercise Medicine Clinic at Alberta Children's Hospital.

Two senior residents, Drs. David Langelier and Andrew Malawski, have initiated a Bracing and Orthotics clinic at FMC under the supervision of Dr. Raugust.

Musculoskeletal Physiatry continues to grow in Calgary. We welcomed new physiatrists Dr. David Nabeta and Dr. Paul Reglin, who have interests in musculoskeletal and electrodiagnostic medicine and both trained at the Cumming School of Medicine. Dr. George Francis also sees musculoskeletal patients in addition to his cancer rehabilitation program. All three have joined the Kinesis community PM&R practice. Dr. Daniela Porter has joined the PM&R MSK community transferring from London, Ont. She has set up a general MSK clinic through Lifemark Clinics.

**CONTINUED FROM PAGE 61****Research**

Gerschman T, Raugust J, et al. Evaluating Levels of Activity and Health-Related Quality of Life in a Pilot Cohort of Youth Athletes with Juvenile Idiopathic Arthritis. Poster Presentation. 2017 Pediatric Rheumatology Symposium. Houston, Texas. May 17-20, 2017. Arthritis Rheum. 2017;69:S4.

**Chronic Pain Program**

Referrals to the AHS Chronic Pain Centre (CPC) continue to escalate with 2,318 patients on the wait list as of April 30, 2017. Average wait time until the first patient visit at CPC is 227 days. The CPC is a mandatory rotation for Family Medicine and Psychiatry residents. Additional learners may include Psychiatry residents, medical students, (local and interprovincial), as well as CME Observers, (graduate Family Physicians) and foreign trained graduates.

Through their involvement in the Calgary Pain Education Foundation (CPEF) and the AMA Section of Sport and Exercise Medicine executive committees, Drs. Arun Gupta and Noorshina Virani were part of planning a successful joint conference held in March 2017. The Calgary Pain and MSK Clinical Pearls Combined Course: Spine, Pelvis and Hip was offered to a large multi-disciplinary audience. The success of this joint initiative will lead to future collaborations, alternating between northern and southern Alberta.

**Members**

AHS Chronic Pain Centre (AHS CPC):  
Nwamara Dike, Noorshina Virani

Performing Arts Medicine (PAM): Arun Gupta

Community Practitioners:  
Maryana Apel, Darren Chiu,  
David Flaschner, George Francis,  
Tony Giantomaso, Arun Gupta,  
Chris Huang, Les LaPlante,  
Daniel LeBlond, Serge Mrkobrada,  
David Nabeta, Daniela Porter,  
Paul Reglin, Jordan Raugust, Vishal Tuls



# The Spinal Cord Injury Rehabilitation Program

Program Lead: Dr. Denise Hill

## Overview

The Spinal Cord Injury (SCI) Rehabilitation Program provides inpatient and outpatient rehabilitation services to persons with traumatic and non-traumatic SCI for southern Alberta, eastern British Columbia and western Saskatchewan.

## Highlights

The SCI program admitted 62 persons for acute inpatient rehabilitation on Unit 58. There were 684 outpatient visits in the SCI Physical Medicine & Rehabilitation Clinic between July 1, 2016 and June 30, 2017.

This year we saw the transition of our clinical nurse specialist, Raj Parmar, to Nurse Practitioner, with great benefits already being experienced by both inpatient and outpatient SCI patient care. We also experienced the departure of division head and SCI program lead Dr. Chester Ho to Edmonton. Thank you for a job well done, Chester!

The diaphragm pacer system continues to operate at the Foothills Medical Centre. One potential recipient from Saskatchewan was considered this past year but was not deemed to be appropriate.

The exoskeleton research study has been ongoing since obtaining Ethics approval from the University of Calgary in June 2016. The main outcome is to measure the safety and feasibility of its use for gait training shortly after an acute spinal cord injury. To date, 11 participants have been recruited into the study with three currently completing their exoskeletal training regime. Recruitment will be completed by the end of this year with data analysis and a completed paper expected to be ready for submission for publication by early 2018. Early results of this research were presented in September 2017 at the annual Academy of Spinal Cord Injury Professionals conference in Denver, and at the International Spinal Cord Society conference in Dublin in October 2017. The study continues to be funded by the Alberta Paraplegic Foundation, Calgary Health Trust, Cumming School of Medicine and Hotchkiss Brain Institute.

Campus Alberta Neuroscience has been sponsoring the SCI Partners Committee to develop a provincial strategy for SCI clinical, research and community

engagement. For the research strategy, the focus will be on SCI pain and rehab (led by Karim Fouad and Patrick Whelan); for clinical (led by Chester Ho, Jason Knox, Gail Aguillon and Michelle Wallace) the focus will be on the development of a provincial SCI network to narrow the gap between SCI service delivery in urban and rural areas, and between specialty and community.

The provincial SCI registry initiative entered its third year in 2017. The main achievements of this project include the development and pilot testing of a patient reported tool for spasticity, the collection of information on non-traumatic SCI patients during the rehabilitation phase, the development and validation of an algorithm to leverage administrative data, and a redesign of long-term community follow-up (CFU) for persons with SCI. The algorithm work resulted in the publication of four manuscripts, and the development and implementation of the new CFU will be presented at the SCI Canada Conference in Niagara, Ont., in November 2017. Collaborations were strengthened with individuals and groups from Campus Alberta Neuroscience, universities of Calgary, Edmonton, and Toronto, Alberta Health Services, AHS Analytics, Spinal Cord Injury Alberta, the Clinical Research Unit, and the Neuro Mental Health Research Clinic. This registry initiative was funded by Brain Canada with support from the Alberta Paraplegic Foundation, Rick Hansen Institute, University of Alberta's Neuroscience & Mental Health Institute, and the University of Calgary's Hotchkiss Brain Institute.

Jason Knox, Michelle Wallace, Tanya McFaul and Rebecca Charbonneau were awarded a provincial seed grant from the Alberta Paraplegic Foundation to look at standardized, best practice implementation of neurogenic bladder management within a care plan template across the province. The goal of the implementation of standardized provincewide protocols is to ensure patients are receiving evidence-informed care in Alberta's two major urban spinal cord injury rehabilitation centres.

## Members

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

# The Stroke Rehabilitation Program

Program Lead: Dr. Sean Dukelow

## Overview

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

## Highlights

Dr. Dukelow's research team earned CIHR funding for a project called RESTORE, which will use early and intensive robotic rehabilitation in an attempt to improve recovery after stroke. This trial will explore the importance of timing of rehabilitation interventions and the ability of specific biomarkers (neuroimaging, robotic assessments, brain stimulation) to predict recovery.

## Education

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

Dr. Lam participated in the Allied Health staff education day at Foothills Medical Centre on May 4, 2017 where innovative methods of stroke treatment were presented. We also entered the first stages of developing the new "competency by design" curriculum for PM&R residents, which will be implemented in 2019.

## Research

Members of the Stroke Rehabilitation Program published 14 papers last year. Results of the EVREST multi-centre study examining virtual reality in which our group participated, were published in Lancet Neurology.

The team earned funding for a trial using transcranial magnetic stimulation as a tool to augment speech therapy for patients with aphasia after stroke. Further, we are part of a \$2.75 million Brain Canada/Canadian Partnership for Stroke Recovery grant-funded, multi-centre trial that will examine the use of Fluoxetine in stroke 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 (DCNS) consists of five primary members, distinguished by their PhD background. A sixth member has been recruited from Stanford University to start in spring 2018. In addition, Dr. Manuel Hulliger enjoys Professor Emeritus status. Research areas of STN 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.

Members of STN include:

- **Dr. V. Wee Yong** is a professor who co-directs the MS NeuroTeam of Hotchkiss Brain Institute (HBI). He is the Canada Research Chair in Neuroimmunology (Tier 1), the director of the Alberta MS Network, and he was the president of the International Society of Neuroimmunology (2014-2016). Dr. Yong's research interests lie in the area of neuroimmunology, neuroprotection and CNS regeneration. His projects have been guided by MS, spinal cord injury and malignant gliomas. Dr. Yong's research has been translated into Phase III clinical trials in MS and spinal cord injury. He is an elected fellow of the Royal Society of Canada and the Canadian Academy of Health Sciences. His research, cited over 18,000 times (Web of Science, h index: 75) has been supported by Canadian Institutes for Health Research (CIHR), the MS Society of Canada, and the Alberta Innovates - Health Solutions (AIHS) CRIO Team program.
- **Dr. Minh Dang Nguyen** is an associate professor and a member of the HBI. The main goal of his research is to understand the roles of the cytoskeleton, the physical backbone that maintains the architecture of the cell, in neurological diseases. His research has been funded by AIHS, Alberta Cancer Foundation, CIHR, the Human Frontier Science Program



Organization, the Brenda Strafford Foundation Chair in Alzheimer research, the Amyotrophic Lateral Sclerosis Association and the Austrian Academy of Sciences.

- **Dr. Shalina Ousman** is an associate professor and a member of the MS and Spinal Cord/Nerve Injury & Pain Programs of 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 aging injured 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 research. He is a member



of the HBI, he directs a basic research laboratory and he oversees an experimental therapeutic program for patients living with Parkinson's disease. His scholarly activities and research interests are focused on brain attention networks, especially those related to sensorimotor learning and memory. His research has been supported by CIHR, Parkinson Association of Alberta, AIHS and Branch-out Foundation for Neurological Diseases.

- **Dr. Oury Monchi** is a professor, the Clinical Research Director of DCNS, the Research Director of the Movement Disorders Program of HBI, and the Tourmaline Oil Chair in Parkinson's disease. His laboratory has been a pioneer in using different neuroimaging techniques to study the origins and evolution of cognitive deficits in Parkinson's disease with the ultimate goal of the early prediction of dementia in the disease. Interactions between cognitive and neuropsychiatric symptoms, and non-medication therapies such as transcranial magnetic stimulation and cognitive training are also being explored. Dr. Monchi is the Canada Research Chair (Tier 1) in non-motor symptoms of Parkinson's disease. His research is funded by CIHR, NSERC, and Parkinson Canada.

## Highlights

Dr. Yong is the recipient of the 2017 Allyn Taylor International Prize in Medicine. He organized the second Americas School of Neuroimmunology in Charlottesville, Va, to impart knowledge of neuroimmunology to trainees. He held the inaugural school in Calgary in 2015.

Dr. Nguyen continues to co-ordinate the Principles of Neuroscience I graduate course for the department. His post-doctoral trainee, Dr. Milene Vandal, secured a CIHR post-doctoral fellowship, an AIHS post-doctoral top-up fellowship, a fellowship from the Alzheimer Society of Canada (declined due to CIHR funding) and HBI recruitment funds. Her project focuses on the predisposition factor CD2AP in Alzheimer's disease.

Dr. Ousman successfully graduated two PhD candidates in the past year and has one other PhD student who is scheduled to defend his thesis work in early 2018. Her lab published original manuscripts in PNAS and Neurobiology of Aging with a review in Frontiers in Neuroscience in 2017.

She was recognized as a University of Calgary Peak Scholar in Entrepreneurship, Innovation & Knowledge Engagement based on her lab's peripheral nerve regeneration work. She recently assumed the role of co-leader of the HBI Spinal Cord/Nerve Injury & Pain NeuroTeam and has also been profiled by CIHR in its Canada 150 Celebrating Health Researchers program.

Dr. Hu continues to direct an international multi-centre study of Ambuloso, a sensorimotor contingency-based music walking program for people living with Parkinson's disease. He helped establish the Canada-China Alliance for Translational Medicine (CCATM), with 26 research and business organizations and support from the provincial and federal governments.

Dr. Monchi renewed his NSERC Discovery grant which will allow him to explore fronto-striatal and fronto-temporal circuits with TMS, TDCS and neuroimaging. He was the course leader of an international workshop organized at the University of Calgary with the Parkinson's disease and Movement Disorders Society on Neuroimaging and Movement Disorders. He was a plenary speaker at the Second International Conference on Educational Neuroscience, Abu Dhabi, UAE.

## Education

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

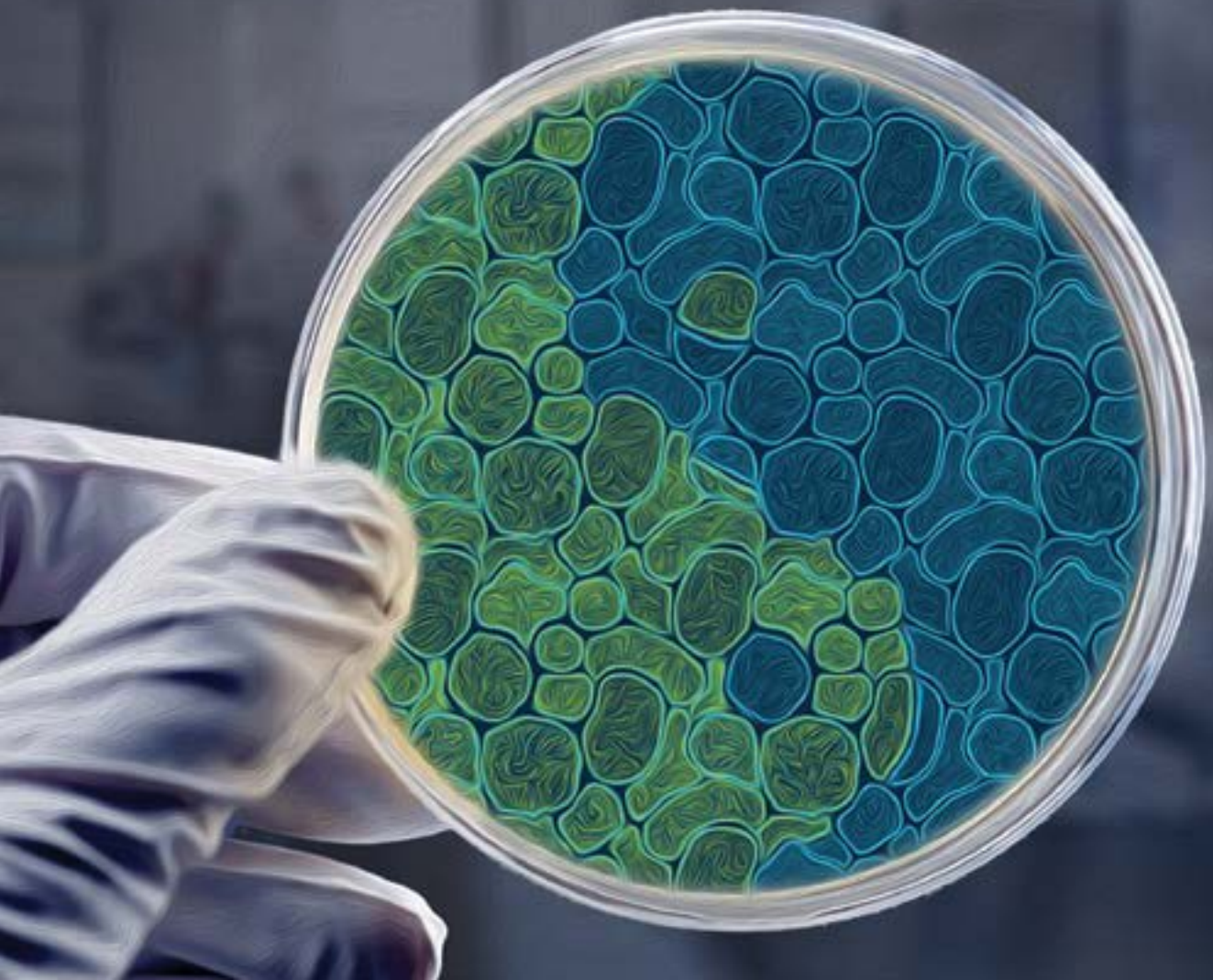
## Future Directions

The section 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 and to ensure that discoveries in basic and clinical research can lead to innovative health solutions for Canadians. In that light, work by our members, in collaboration with our neurology and neurosurgery colleagues, has resulted in a successful Phase III clinical trial in MS, and an ongoing Phase III trial in traumatic spinal cord injury. 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.

# EMBRACING THE YIN & YANG OF RESEARCH

**ASSOCIATE PROFESSOR DR. SHALINA OUSMAN** admits that becoming a researcher wasn't on her radar when she started her undergrad biology degree at Queen's University. But during a fateful physiology lecture, a professor made a comment in passing that changed her career track.

"Central nervous system (CNS) neurons don't regenerate after injury; peripheral nervous system (PNS) neurons do," he stated—and then continued with the lecture.



“And I was like-WHY!?” recalls Dr. Ousman.

A few weeks later she followed a friend to a Physiology Department open house and got talking with a group of researchers.

“It turned out that not one, but two PIs in that department were studying the problem of CNS vs PNS regeneration after injury,” she says.

The spark was lit – a spark that ultimately led to a master’s degree at Queens, a PhD at McGill, and two postdoctoral fellowships.

Dr. Ousman’s doctorate work on spinal cord injury was funded by the MS Society, so multiple sclerosis research caught her attention when she moved to the University of Calgary in 2008.

“In my lab, the primary focus is MS, but I’ve never gotten rid of this nerve injury interest,” she says.

The two research areas—multiple sclerosis and peripheral nerve injury—keep overlapping and competing for her attention.

“There’s actually a crossover because, in a peripheral nervous system injury, the immune system is very beneficial to that scenario. The immune system cells come in, they clear debris, and then they leave,” says Dr. Ousman.

“It’s a good thing. But in MS, the immune system is a bad thing. So they’re sort of the yin and the yang of each other.”

Others might find the competing sides a distraction, but Dr. Ousman embraces the dual tracks in her lab of 5 people and says the synergies created are invaluable.

“One person on the MS side is doing an experiment and then suddenly the regeneration person says ‘Hey! This makes sense for the question I’m asking.’ ”

Both sides learn from each other and she encourages them to follow their intuition (and results) wherever it takes them.

“To have the freedom to think anything—that’s the fun part of research,” she says.

One of her research projects involves a molecule called alphaB-crystallin, which is also attracting the attention of colleagues in the Netherlands and may have therapeutic use in MS. The molecule has been shown to be safe in a small trial, but much more research, including a Phase III trial, is needed.

“Whether this becomes a therapy or not—who knows—but I never dreamed that one of my discoveries would make it into human beings!”

But, of course, that’s not the end of the story for the alphaB.

Dr. Ousman’s other major focus—nerve regeneration—is studying Schwann cells that create myelin sheaths which protect peripheral nerves and allow conduction to occur.



▲ Dr. Shalina Ousman

Schwann cells are critical for regrowing axons but they can’t survive away from the axons for too long. After injury, they sit and patiently wait for the axons to come back, but it’s an extremely slow process and after about six weeks they begin to die off and lose their regenerative abilities.

“So we asked: Is there a way that we can maintain their beneficial function for a longer period of time until the axons reach them?”

AlphaB-crystallin may play a role in extending the protective ability of Schwann cells.

There is lots more work to be done, but Dr. Ousman credits her entire team with their successes to date.

“You can have all the great ideas in the world, but if you don’t have someone who’s able to implement it and believe in it and make it their own and drive it, I don’t think your ideas are going to go anywhere.”



# Undergraduate Medical Education in Clinical Neurosciences

Co-Chairs: Dr. Gary Klein and Dr. Darren Burbuck

Evaluation Co-ordinator: Dr. Scott Jarvis

Anatomy Co-ordinator: Heather Jamniczky PhD

Course Co-ordinator: Kelsey O'Donnell

## Overview

Medical students learn about neurosciences and aging during August and September 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 course, entitled Course V – Neurosciences, Aging and Special Senses, is overseen by the Undergraduate Medical Education office of the Cumming School of Medicine at the University of Calgary.

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:

Dr. Darren Burbuck  
Dr. Jephtha Davenport  
Dr. Paolo Federico  
Dr. Karen Fruetel  
Dr. Clare Gallagher  
Dr. Walter Hader  
Dr. Vivian Hill  
Dr. Alice Ho  
Dr. Heather Jamniczky  
Dr. Scott Jarvis  
Dr. Ronak Kapadia  
Dr. Martina Kelly  
Dr. Gary Klein  
Dr. Paul Marck  
Dr. Dan McGowan  
Dr. Lori Montgomery  
Ms. Kelsey O'Donnell  
Mr. Mike Paget  
Dr. David Patry  
Dr. Paula Pearce  
Dr. Gerald Pfeffer  
Dr. Ron Spice  
Dr. Karen Verstraten



## Resident Research Day

### Competition proves fierce for research awards

#### RESIDENT RESEARCH

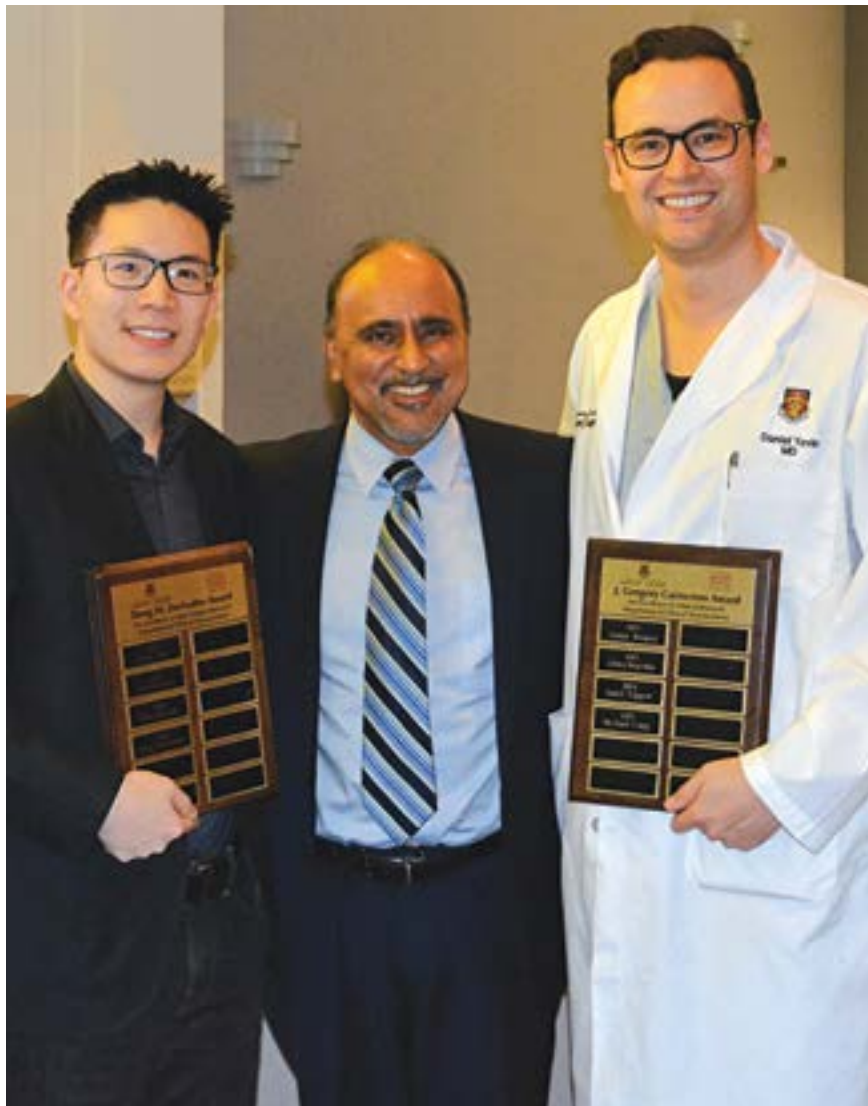
**DAY**, which is held each November, is celebrated within the Department of Clinical Neurosciences and is a highlight of our Grand Rounds calendar.

It is always well attended by faculty and the number of submissions each year speaks to the dedication our residents have for advancing the boundaries of neuroscience.

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.

In 2016, the J. Gregory Cairncross Award for Excellence in Clinical Research was awarded to Dr. Daniel Yavin for his presentation “Intrathecal morphine following lumbar fusion: A randomized, placebo-controlled trial.”

The Doug W. Zochodne Award for Excellence in Basic Science Research was won by Dr. Michael Tso for his work “Whole genome expression profiling of blood-brain barrier endothelial cells



▲ Resident Research Day winners Dr. Michael Tso, left, and Dr. Daniel Yavin, right, with Clinical Neurosciences Department Head Dr. Rajiv Midha.

after experimental subarachnoid hemorrhage.”

Dr. Tso says he enjoys training in an environment that encourages independent and critical thinking.

“Research is an important aspect for me as a trainee and as a clinician,” he says.

“It helps me think about the reasons why we do certain things in clinical medicine and how we can do it better.”

Dr. Tso adds: “DCNS Resident Research Day is great forum to showcase what clinical problems need to be addressed and what advancements are required.”

## Neurology Residency Program

Program Director: Dr. Michael Yeung

Program Administrator: Elizabeth Martens

Number of positions per year: 3

Accreditation: Royal College of Physicians and Surgeons of Canada

Length of Training: 5 years

Mandatory Research Block: 3-6 months

The University of Calgary Adult Neurology Residency Training Program is dedicated to educating residents in Neurology.

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.

The program facilitates learning through an atmosphere of collegiality and mutual respect that fosters active communication between residents and faculty.

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



**Dr. Michael Yeung**

We strive to create a level of excitement that will stimulate our residents to seek further education and pursue careers in academic and community neurology. Our program aims to serve both the present and future requirements of our patients, communities, and discipline.

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.

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.

The program has trained over 50 neurologists since its inception in 1981; these specialists practice neurology in community and academic institutions throughout the world.

## 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

Within the 2016-2017 academic year, the section of Physical Medicine and Rehabilitation (PM&R) supported 10 post-graduate residents in its Royal College of Physicians and Surgeons of Canada (RCPSC) accredited PM&R training program.

In addition, there were a variety of off-service and visiting residents from a number of different training programs, including neurology, geriatrics, rheumatology, pediatrics, vascular surgery, and sports medicine. The interest in PM&R electives and shadowing opportunities from medical students continues to increase each year, and is reflected in the growing numbers of applicants to our residency program.

The Section of PM&R provides 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 providing this education.

The Physiatry Bracing and Orthotics Clinic has been developed to meet the clinical needs of various rehabilitation populations as well as the educational objectives for our trainees, as this clinic provides a focused opportunity for residents to see a variety of patients with orthotic needs. The clinic occurs one half day per week. Two PM&R residents in their final year of training provide outpatient consultation and followup in this longitudinal clinic while supervised by a staff physiatrist. This allows for further outpatient clinic exposure, experience in continuity of care, development of managerial



**Dr. Gentson Leung**

and time management skills, opportunity for Royal College examination preparation, teaching medical elective students, and on top of orthotic issues, provides exposure to varied clinical diagnoses that may not be typically seen in the subspecialty clinics and inpatient services.

PM&R is to launch the RCPSC's Competence by Design (CBD) curriculum in July 2019. Our program has begun educating and training faculty around the principles of CBD at multiple levels, including educational retreats and other training sessions.

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. There are a number of PM&R faculty members who have attended the Royal College Module Simulation Scenario Development Training, with the goal of developing 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 program's inception in 2004, all of our graduating PM&R residents have successfully passed their Royal College Certification examinations (100 per cent pass rate). As well, all of our trainees who have challenged the licensing examination for EMG (electromyography) have passed, which is a reflection of the strong partnership that Physiatry has with our neuromuscular colleagues and the excellent training that our residents receive.

## 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 PGY-1; entire PGY-4 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 interests. 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 endeavours in addition to a few celebrating engagements, marriages, and births.

- **Dr. Albert Isaacs** won the prestigious Killam Award from the University of Calgary.
- **Dr. Stefan Lang** was awarded the K.G. McKenzie Memorial Prize Basic Neuroscience Research at the 2017 CNSF Congress.
- **Dr. David Ben-Israel** achieved the top Neuro-oncology poster award at the 2017 CNS annual meeting.
- **Dr. Andrew Ryu** won second prize at the 2017 University of Calgary Simulator Symposium.
- **Dr. Michael Tso** won the Doug W. Zochodne Award for Excellence in Basic Science Research at the 2016 DCNS Resident Research Day as well as the Basic Science award at the Alberta Neurosurgical Society meeting in Banff.
- **Dr. Dan Yavin** won the J. Gregory Cairncross Award for Excellence in Clinical Research at the 2016 Resident Research Day as well as the Clinical Science award at the Alberta Neurosurgical Society meeting in Banff.
- **Dr. Michael Avery** was awarded a master's degree in neuroscience from the University of Calgary.
- **Dr. Ahmed Alaqeel** obtained his master of business administration from Cornell University in New York.

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.





▲ Dr. Andrew Demchuk (centre) is surrounded by stroke fellows at Foothills Hospital.

## 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 [www.ucalgary.ca/dcns/education/fellowship-program](http://www.ucalgary.ca/dcns/education/fellowship-program)

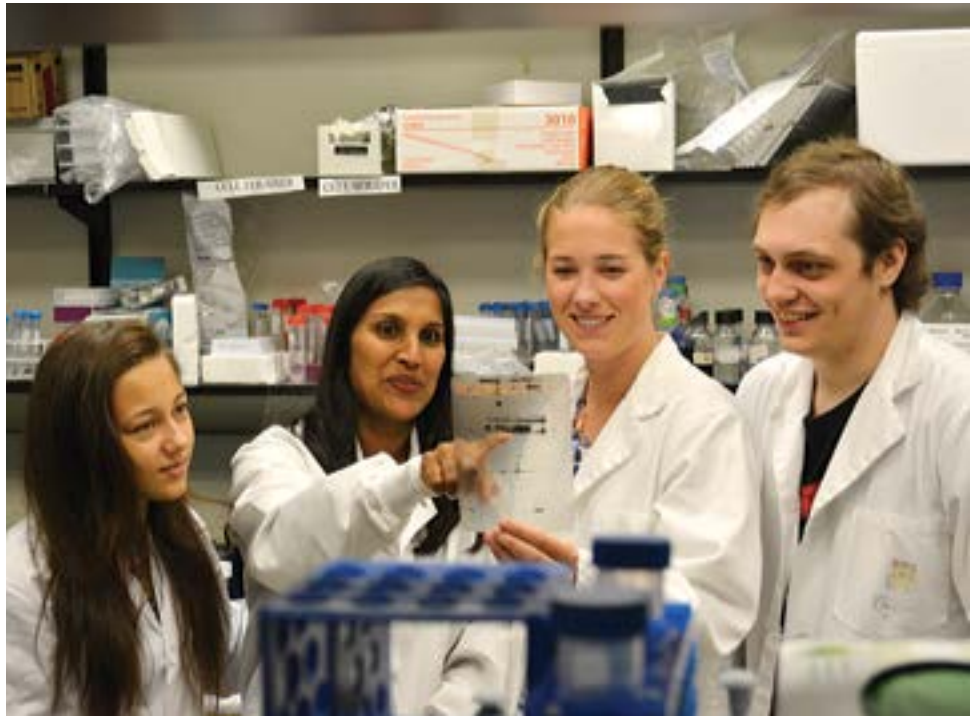
# Research in Clinical Neurosciences

## Overview

The Department of Clinical Neurosciences (DCNS) was founded 35 years ago 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 of our department lead a variety of research programs and our research is facilitated by strong partnerships with the Hotchkiss Brain Institute (HBI), 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:** Which 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.



▲ Dr. Shalina Ousman with her research team.

- **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 (AHS) 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 a wide variety of local, national, and international academic and professional organizations. Their efforts are generously supported by grants from a wide range of external agencies.

## NEUROLOGY



Yahya Agha-Khani



Katayoun Alikhani



Farnaz Amoozegar



Simerpreet Bal



Philip Barber



Jodie Burton



Kevin Busche



Greg Cairncross



Sameer Chhibber



Lara Cooke



Fiona Costello



Shelagh Coutts



Jephtha Davenport



Andrew Demchuk



Paula de Robles



Hamid Ebadi



Tom Feasby



Paolo Federico



William Fletcher



Sarah Furtado



## NEUROLOGY



Chris Hahn



Alexandra Hanson



Michael Hill



Scott Jarvis



Nathalie Jetté



Colin Josephson



Ronak Kapadia



Brian Klassen



Gary Klein



Marcus Koch



Jagdeep Kohli



Lawrence Korngut



Scott Kraft



Elizabeth Leroux



Davide Martino



Bijoy Menon



Luanne Metz



William Murphy



David Patry



Dawn Pearson



## NEUROLOGY



Steven Peters



Gerald Pfeffer



Neelan Pillay



Tamara Pringsheim



Justyna Sarna



Shaily Singh



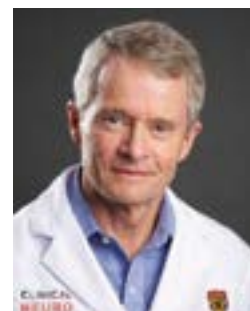
Eric Smith



Peter Stys



Suresh Subramaniam



Tim Watson



Chris White



Samuel Wiebe



Scott Wilson



Katie Wiltshire



Michael Yeung

## NEUROSURGERY



Steven Casha



Stephan du Plessis



Clare Gallagher



Walter Hader



Mark Hamilton

## NEUROSURGERY



Bradley Jacobs



John Kelly



Zelma Kiss



Rajiv Midha



Alim Mitha



Jay Riva-Cambrin



Yves Starreveld



Garnette Sutherland



John Wong

## PHYSICAL MEDICINE & REHABILITATION



Lee Burkholder



Chantel Debert



Darren Chiu



Nwamara Dike



Sean Dukelow



Vincent Gabriel



Vithya Gnanakumar



Chris Grant



Arun Gupta



Denise Hill

## PHYSICAL MEDICINE & REHABILITATION



Chester Ho



Chris Huang



Ken Lam



Les LaPlante



Daniel LeBlond



Gentson Leung



Rodney Li Pi Shan



Christine McGovern



Dan McGowan



Stephen McNeil



Serge Mrkobrada



Stephanie Plamondon



Jordan Raugust



Vishal Tulsi



Noorshina Virani



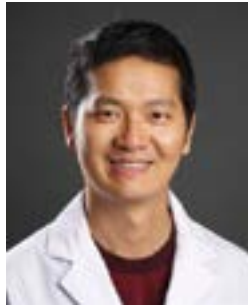
# TRANSLATIONAL NEUROSCIENCE



Bin Hu



Oury Monchi



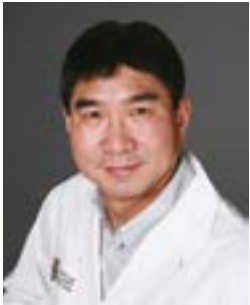
Minh Dang Nguyen



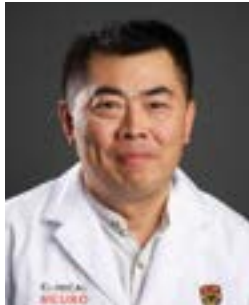
Shalina Ousman



Boguslaw Tomanek



V. Wee Yong



Zonghang Zhao

# EMERITUS



Werner Becker



Keith Brownell



Manuel Hulliger



John Latter



Francis LeBlanc



Robert G. Lee



Terry Myles



