DEPARTMENT OF CLINICAL NEUROSCIENCES

ANNUAL REPORT 2017-2018

TRANING & EDUCATION

Preparing the next generation of physician specialists and scientists

Department Goals

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.

> To promote and conduct clinical research and clinically relevant basic science research into diseases of the nervous system.

Department Mission

To deliver excellence in patient care through intensive research, new knowledge creation, outstanding teaching, and constant improvement and innovation in health care service.

CLINICAL NEURO SCIENCES

CALGARY 🍁 CANADA



Cover photo

Neurology resident Dr. Gordon Jewett (left) practises administering the stroke medication TPA in the e-SIM lab under the guidance of Dr. Chris Hahn.

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Message from the Department Head Dr. Rajiv Midha

AS CLINICIANS AND SCIENTISTS we strive to provide excellence in patient care and—through research—to develop new treatments that we can bring to our clinics and share with others.



But one of our great responsibilities is to train and educate the physicians and researchers of tomorrow—and this is the theme of our report for 2017-18.

As a department, we've invested our time and resources in training and

education programs this year, including as a large part of our departmental retreat this fall.

At the retreat we were very fortunate to have the participation of the new director of the Hotchkiss Brain Institute, Dr. David Park, deputy director Dr. Richard Frayne and education director Dr. Sarah McFarlane as we discussed ways to engage residents and support their research.

We also benefited from facilitation by Dr. Kelly Millar, Dr. Amanda Roze des Ordons and Dr. Alexandra Harrison on how we can improve trainee feedback as we transition to Competency By Design. Our residents—in neurology, neurosurgery, and physical medicine and rehabilitation—are an impressive group of physicians.

As Dr. Brad Jacobs notes in **A New Take on Competency (page 40)**: "By the time they start our program—(they) are really highly screened and they're by and large excellent individuals from an academic intelligence perspective and interpersonal skill perspective."

Competency by Design is a significant change being adopted by the neurosurgery residency program next year. It is being introduced by the Royal College of Physicians and Surgeons and will eventually apply to all residency programs.

Though it will initially only affect the two new PGY1 trainees in 2019, the entire neurosurgery section has been learning about the benefits of Entrustable Professional Activities and we are confident our residents will thrive under the new system. "For a lot of them, we're just basically guiding them down a path with nudges and pushes along the way," says Dr. Jacobs.

Indeed, our role often involves ensuring trainees have the tools they need to succeed and finding the best way to encourage their self-driven passion for learning.



Dr. Alexandra Harrison engages members of the department at our 2018 retreat while discussing ways to provide trainee feedback.

RECRUITMENT **AT DCNS**

That was very evident in Stroke Sandbox

(page 14), which highlights a comprehensive stroke simulation created by Dr. Chris Hahn and Dr. Simer Ball to teach neurology residents critical stroke skills in an environment where they can make mistakes without risking patient safety.

This tool has been well received by residents and will undoubtedly be a huge benefit to our neurology trainees.

The story of how one of our physiatry residents came to DCNS is also worth reading: **Physiatrist Resident Embraces Being a 'Lifetime Student'** (page 57). Dr. Lauren Capozzi is an outstanding example of the dedication that we find in many of our residents. Lauren is surely an inspiration for us all is a future leader in cancer rehabilitation.

And while much of our educational efforts are focused on residents and undergraduates, Dr. Brian Klassen reminds us in **Reaching Out** (page 17) that education doesn't end with residency. Dr. Klassen uses his consultations with family physicians to help them with patient guidance, but he also squeezes in CME while he's on the phone. His dedication to Specialist LINK is appreciated by frontline physicians, his colleagues in Urgent Neurology and certainly the doctors in the Emergency Department.

Congratulations to Dr. Klassen and all our learners and educators. The future of health care in Calgary has never been so bright!

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

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Dr. Rajiv Midha Professor and Head Department of Clinical Neurosciences

Though we said goodbye to a number of valued colleagues in the past year (Dr. Chester Ho, Dr. Nathalie Jetté, and Dr. Tim Watson), the Department of Clinical Neurosciences has been very fortunate to recruit six talented physicians and researchers to Calgary.

Dr. Veronica Bruno is a clinical assistant professor of neurology with a subspecialty in movement disorders. She did her training in the University of Toronto, at the Harvard TH Chan School of Public Health and in Buenos Aires.

Dr. David Cadotte is an assistant professor of neurosurgery. In addition to clinical work, he researches advanced imaging of the human spinal cord and spinal column to better understand traumatic and degenerative conditions.

Dr. Rebecca Charbonneau is a clinical assistant professor of physical medicine and rehabilitation and is interested in the field of spinal cord injury, including pressure ulcers, neuropathic pain, FES, exoskeleton, and spasticity.

Dr. Elizabeth Condliffe is a clinical assistant professor of physical medicine and rehabilitation and is a clinician-scientist at Alberta Children's Hospital interested in improving the care of patients with cerebral palsy and neuro-disabilities.

Dr. George Francis is a clinical assistant professor of physical medicine and rehabilitation and is working in conjunction with the Tom Baker Cancer Centre to provide service and build programming in cancer rehabilitation.

Dr. Hedwich Kuipers is an assistant professor of neuroimmunology and a scientist in the Section of Translational Neurosciences. She has a PhD from Leiden University in the Netherlands and a postdoctoral fellowship from Stanford University.

Dr. David Park, a professor in Translational Neurosciences, is director of the Hotchkiss Brain Institute. He is an internationally recognized expert in molecular biology, focussing on the cellular mechanisms involved in Parkinson's disease and stroke-related neurodegeneration.









Rebecca Charbonn







Hedwich Kuipers



David Park

Department manager ready to take on Clinical Neurosciences

DOLLY KIM, OUR NEWEST RECRUIT to Clinical Neurosciences, is actually returning to her roots at Foothills Medical Centre.

The DCNS Department Manager received a bachelor of nursing from the University of Calgary and was an RN from 2008 to 2011 and relief Site Manager from 2011 to 2014 at FMC

"I've always been very much drawn to serving from both clinical and administrative sides of healthcare," she says.

Coincidentally, during that time one of the units she worked on was Psychiatry, which she's now also managing in her new role.

Dolly completed her second bachelor's degree (in management) from the Athabaska University and started exploring various leadership roles within Alberta Health Services. Before returning to FMC this year, Dolly worked at ACH and RGH from 2014 to 2018.

In addition, she's enjoyed teaching nursing students at Mount Royal University.

Leadership roles brought her back to Alberta Health Services—and Foothills, Alberta Children's Hospital and Rockyview General Hospital—and she's currently completing a master of arts in leadership at Royal Roads University.

The new manager role comes with a steep learning curve, but Dolly says she's ready for the challenge.

"Seeing the big picture while knowing and understanding the details of different projects is important to me."

She will be juggling projects from two offices, in DCNS and Psychiatry, but encourages staff and faculty to contact her.

"I'm always happy to meet team members and help solve issues if you're nearby 1195. Or drop me an email and I'll book some time."



▲ Dolly Kim joined DCNS in October 2018.

HOT PAPERS

Hitting ABOVE our weight

In 2018, Clinical Neurosciences represented 43 of the Cumming School of Medicine's 518 FTEs — 8% of the total. However, our "Hot Paper" ratio (defined as unique publications cited more than 49 times in a five-year window was 16% last year.



43

8%

518

Clinical and Academic Metrics

OUR DEPARTMENT



Clinical/Adjunct

Major Clinical

GFT - Activity Profile (43 FTE in DCNS)



Gender

M 67% F

33%



Age Distribution

RESEARCH & PUBLICATIONS

Number of Research Equivalents

2012-13 2013-14 2014-15 2015-16 2016-17 2017-18 Source: Cumming School of Medicine

Clinical Trial Revenue

Source: Cumming School of Medicine

Publications (avg per FTE)

Research Revenue

2012-13 2013-14 2014-15 2015-16 2016-17 2017-11 ning School of Medicine

CIHR Revenue

Source: Cumming School of Medicine

Total Research

CIHR Revenue

Publication Citations

Source: Cumming School of Medicine

Source: Cumming School of Medicine

PATIENT VISITS, ADMISSIONS, SURGERY

DCNS – Total Outpatient Visits

Site	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
FMC	31,159	32,423	34,115	36,745	37,792
PLC	1,289	1,285	2,541	2,536	3,987
RGH	2,821	2,778	5,380	5,916	5,333
SHC	13,798	11,663	12,599	12,628	13,289
ACH (Ped NSx)	1,849	1,961	2,318	2,493	2,845
Total	50,916	50,110	56,953	61,229	64,411

Excludes off hospital sites

DCNS - Total Inpatient Admissions

Site	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
FMC	3,803	3,753	3,836	3,825	3,597
ACH	211	184	168	170	176
SHC	340	318	295	311	333
RGH	3	2	0	0	0
Total	4,357	4,257	4,299	4,306	4,106

DCNS – Total Admissions All Hospitals

08-09 2009-10 2010-11 2011-12 2012-13 2013-14 2014-15 2015-16 2015-17 2017-18

Surgical OR Cases Neurosurgery at FMC

RESIDENT EDUCATION

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

Number of Residents per Program

11 11 10 10 1

CLINIC WAIT TIMES

EMG Outpatient Volumes and Wait Times

Waiting Times (months)

Seizure Monitoring Unit Admissions and Wait Times

FELLOWS

Clinical Neurosciences Fellowship Program

Integral for service delivery and scholarly activity

▲ Dr. Jon Stossel from the University of British Columbia gives the Robert G. Lee Memorial Lectureship.

ABOVE: Dr. Stossel with DCNS head Dr. Rajiv Midha.

RIGHT: Neurology section head Dr. Luanne Metz with guest presenter Dr. Lewis Morgenstern and Dr. Samuel Wiebe at the Sam Wiebe Lectureship in June.

GRAND ROUNDS

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

Sept. 8, 2017	Tyler Cluff	University of Calgary			
Sept. 15, 2017	Gwen Sowa	University of Pittsburgh			
Sept. 22, 2017	Movement Disorders Symposium				
	Lucia Ricciardi	St. George's University of London			
	Mark Edwards	St. George's University of London			
	Andrea Cavanna	University of Birmingham			
	Francesca Morgante	University of Messina/St. George's University of London			
Sept. 29, 2017	Michael H. Thaut	University of Toronto			
Oct. 6, 2017	Elizabeth Condliffe	University of Calgary			
Oct. 13, 2017	Robert Gaunt	University of Pittsburgh			
Oct. 20, 2017	Robert Coffey				
Oct. 27, 2017	Mary Ann Lee Memorial Lecture				
	Lara Jehi	Cleveland Clinic			
Nov. 3, 2017	Rob Brownstone	University College London			
Nov. 10, 2017	Agessandro Abrahão	University of Toronto			
Nov. 17, 2017	George Francis	University of Calgary			
Nov. 24, 2017	Resident Research Day				
Dec. 1, 2017	Robert G. Lee Memorial Lecture				
	Jon Stossel	University of British Columbia			
Dec. 8, 2017	Francesca Morgante	St. George's University of London			
Jan. 12, 2018	Raymond Tellier	University of Calgary			
Jan. 19, 2018	Eric Smith	University of Calgary			
	Carlos Camara-Lemarroy	University of Calgary			
Jan. 26, 2018	Philip Peng	University of Toronto			
Feb. 2, 2018	Suneil Kalia	University of Toronto			
Feb. 9, 2018	Garnette Sutherland	University of Calgary			
Feb. 16, 2018	Jeffrey F. Dunn	University of Calgary			
Feb. 23, 2018	David Brandman	Brown University			
Mar. 2, 2018	Kevin Busche, Sylvain Coderre,	University of Calgary			
	Lara Cooke, Deirdre Jenkins,				
	Franco Pizzuti, Sylvia Mawovo				
Mar 9 2018	Steve Lownie	Western University			
Mar. 16, 2018	Paolo Federico	University of Calgary			
Mar. 23. 2018	Wee Yong	University of Calgary			
,	Paula DeRobles	University of Calgary			
Apr. 6, 2018	Luanne Metz, Erin Barrett,	University of Calgary			
	Georgia Tabler				
Apr. 13, 2018	Deborah M. Kurrasch	University of Calgary			
Apr. 20, 2018	Wilson Ray	Washington University			
Apr. 27, 2018	Tamara Pringsheim	University of Calgary			
May 4, 2018	Jerry Shih	University of California San Diego			
May 11, 2018	Mandar Jog	Western University			
May 18, 2018	Lara Cooke	University of Calgary			
June 1, 2018	Sam Wiebe Lectureship				
	Lewis Morgenstern	University of Michigan			
June 8, 2018	Elizabeth Leroux	University of Calgary			
June 15, 2018	Charles Taylor Lectureship				
	Ben Warf	Harvard Medical School			
June 22, 2018	Vincent Gabriel	University of Calgary			

12 Neurology

The Section of Neurology

Section Head: Dr. Luanne Metz

SIXTY-THREE NEUROLOGISTS contributed to the clinical and academic programs of the Section of Neurology during the 2017-18 academic year. Neurologists continued to lead projects and innovations in clinical care, research, and education. We were delighted to add three new residents to our five-year residency program and are proud of the success of all graduating neurology residents on their Royal College exams.

Education

Dedicated neurologists lead our residency program (Dr. Michael Yeung), the undergraduate neuroscience course (Drs. Gary Klein, Philippe Couillard, Scott Jarvis), the neurology clerkship (Dr. Chris Hahn), and continuing medical education (Dr. Dawn Pearson).

Members in the section are very 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. During 2017-18 there were 10 stroke fellows, three MS/neuroimmunology fellows, two neuromuscular/EMG fellows, and one each in headache, epilepsy/EEG, and movement disorders.

Neurologists have also been involved in the undergraduate Neuroscience and Bachelor of Health Science programs and many supervise graduate students. Many members provide continuing medical education to practicing physicians, pharmacists, nurses, psychologists, and Allied Health professionals. Neurologists also hold leadership positions in education: Dr. Kevin Busche is Associate Dean of Undergraduate Education and Dr. Lara Cooke is leading development of Competence by Design (CBD) for the Royal College. So many neurologists volunteer for undergraduate teaching opportunities that none of us get as much teaching time as requested!

Research

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

through innovative research. Our members include clinician scientists who spend 50-80 per cent of their time undertaking research, and clinician researchers who spend 30-50 per cent of their time doing research. Neurologists 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. Neurology is organized into a citywide general neurology program and subspecialty programs. 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 neuro-oncology 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.

Neurology provides four inpatient services at Foothills Medical Centre (FMC): two neurology teaching services, a seizure monitoring unit (SMU), and a stroke service. FMC is the lead site for several subspecialty programs: Stroke, Epilepsy, MS, Movement Disorders, Cognitive Neuroscience, and the Urgent Neurology Clinic (UNC). It is a secondary site for outpatient general neurology. Thirty-four neurologists were based at either FMC or the adjacent University of Calgary medical complex (20 academic faculty, 14 clinical faculty). There is also an inpatient neurology teaching unit with two SMU beds at South Health Campus (SHC).

Neurology Central Access and Triage (NCAT) and several subspecialty programs are based at SHC: Neuromuscular, ALS, Headache, Neuroimmunology, Neuro-vestibular, and Outpatient General Neurology. It is a secondary site for MS, Epilepsy, Cognitive Neuroscience, and Stroke. Fourteen neurologists were based at SHC (one academic faculty, 13 clinical faculty). Neurology provides consulting services at Rockyview General Hospital (RGH) and the Peter Lougheed Center (PLC). RGH is home to Neuro-ophthalmology and the neurology fellow-locum program and is a secondary site for Outpatient General Neurology. Eight neurologists were based at RGH (one academic faculty, three clinical faculty and four locums). The PLC is the highest volume site for Outpatient General Neurology and is a secondary site for Epilepsy. Five neurologists were based at PLC (three clinical faculty and two locums). FMCbased adult neurologists also run the Tourette's and Pediatric Movement Disorders clinic, a small neuro-genetics epilepsy clinic, and an epilepsy transition clinic at ACH. Two division members practice in the community. Neurologists commonly work at more than one site for inpatient and outpatient care.

Clinical Innovations:

Neurology Central Access and Triage (NCAT) manages all non-acute neurology referrals. This program has allowed the neurology wait list to continue to drop. It allows non-urgent neurology referrals to be sent to one place where they are triaged by neurologists. Specialist Link: Neurologists participation in Specialist Link has continued and call volumes have increased gradually to about 90 per month. This program is led by Primary Care and enhances system integration in the Calgary Zone.

Standardization of Outpatient Clinic Processes: The division began a process to standardize referral management in our neurology outpatient clinics. This work is ongoing but clinic manager across all four adult acute care sites worked together to assure that clinic processes follow best practices.

Enhanced Hospital Care: We continue to improve hospital care by improving the hand over process, by monthly inpatient service meetings that focus on processes, and by developing a plan to restructure the FMC service. The new service structure was planned in the 2017-18 academic year but will be implemented in July 2018.

Individual Highlights

- Dr. Tom Feasby, former head of the department and former dean of the Cumming School of Medicine, was named a Member of the Order of Canada on Dec. 30, 2017.
- Dr. Werner Becker was honoured with a 2018 Lifetime Achievement Award from the Headache Cooperative of New England.
- Dr. Tamara Pringsheim was honoured with the Richard Stein Memorial Award (Quality of Life) from Tourette Canada.
- Dr. Fiona Costello was named President of the Canadian Neurological Society.
- Dr. Shaily Singh, a clinical faculty member who completed her neurology training in India before joining us, successfully challenged the Canadian Royal College exam in 2018.
- Neurology resident Dr. Theo Mobach was recognized by PARA with the Resident Physician of the Month Award for April 2018.
- Dr. Colin Josephson received the Junior Investigator Award from the Canadian League Against Epilepsy.
- Sharon Peters was awarded the 2018 June Halper Award for Excellence in MS Nursing from the International Organization of Multiple Sclerosis Nurses.
- Dr. Veronica Bruno joined the Movement Disorders Clinic and is developing a program of clinical research in Parkinson's disease.

STROKE SANDBOX

Simulator allows residents to learn in low-risk environment

ASK ANY RESIDENT and they'll tell you that the days are long and the amount of information to absorb is endless. Rotations often require learning while dealing with patients in crisis and—during stroke call—the "Time is Brain" clock adds to the stress level.

Sometimes, the rapid interventions that are required when a stroke patient arrives in the Emergency Department can mean faculty have to pause teaching and take over a situation, says Dr. Chris Hahn.

"In these sorts of emergency scenarios it's hard to take the time to stop and teach because you want the best outcome for the patient and so you're more worried about getting things done quickly and appropriately," he says.

To address the dilemma, Dr. Hahn and fellow stroke neurologist Dr.

Simer Bal have built a stroke simulation with the co-ordinators in the Advanced Technical Skills Simulation Laboratory (ATSSL).

"We wrote up the scenario and then we ran through it, with us being the students and learners and the different roles," says Dr. Hahn.

Dr. Jodie Roberts

Their scenario went through many iterations and refinements and, in September, they debuted the simulator with second-year neurology residents.

"What we were trying to do with the simulation is basically show them how to run through an acute

stroke code where the question is whether or not to give a patient TPA," he says.

Residents start with a patient exam, which includes taking a history from a volunteer playing the role of a family member, then they gather lab results and imaging and decide if the clotbusting drug is appropriate.

And if the "patient" happens to have a heart attack or intracranial hemorrhage in the middle of procedure...

PGY2 resident Dr. Jodie Roberts was one of the first to run through the simulator.

"It allows you to practice consenting a patient for treatments like TPA and endovascular therapy as well as breaking the news to a patient when a complication has occurred."

In her scenario, the family member was played by pediatric neurology resident and best-supportingactor Dr. Kristine Woodward.

▲ Dr. Chris Hahn, left, runs through a stroke simulation with resident Dr. Gordon Jewett in the ATSSL.

"Kristine played the family member and I think she probably could have received an Oscar for her performance. There were real tears and she was a fairly 'in your face' family member, which made it more of a difficult scenario to navigate."

The comprehensive nature of the stroke "sandbox" makes it even more valuable to residents, says Dr. Hahn.

"We're trying to give people the same experience as they would get learning with an acute stroke case in the hospital, but without potential risks to the patient with somebody who's never done it before." "We're trying to give people the same experience as they would get learning with an acute stroke case in the hospital, but without potential risks to the patient with somebody who's never done it before."

– Dr. Chris Hahn

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The safe environment of the ATSSL—a joint initiative of Alberta Health Services and the Cumming School of Medicine—allows learners to make mistakes and correct them before working with a real patient.

"When they have to do it for the first time in real life, they're familiar with the process.

"They know the ins and outs; they know the potential complications. And so hopefully they're a little more confident going into their first call as stroke fellow." Dr. Roberts, who ran her first stroke code three weeks after working on the simulator, credits Dr. Hahn and Dr. Ball with designing an excellent scenario.

"I think the opportunity to make errors in simulation is invaluable because now I have that learning experience in the back of my mind when I'm dealing with real life scenarios," she says.

"I feel substantially more calm, organized and prepared having recently done the simulation."

Specialist LINK delivers benefits beyond physician consultations

FOR DR. BRIAN KLASSEN, a joint initiative with seven Calgary and area Primary Care Networks to connect family physicians with a neurologist could have been viewed as yet another request to add to his already long days.

Specialist LINK allows family docs with a concern about a patient to call a phone number and page an on-call neurologist (which currently rotates between Peter Lougheed Centre and Rockyview General Hospital).

It could be a question about how headache is managed or whether a patient should be referred for an MRI.

"It's trying to provide directed advice either to help them solve a clinical problem or at least help them to navigate which investigations should be done or who should be seen in person and, if so, with what sort of priority," says Dr. Klassen.

The patient may not necessarily still be the family physician's office, but the contact is timely enough that the physician still has the case at top of mind. Specialist LINK, however, is not a way to expedite a referral or jump any queues, notes Dr. Klassen. "Often it's, 'I've got someone with an odd headache or funny spells'," he says. "It really is to try and help them solve a question."

The service is available during the day, Monday to Friday, and is connected to the neurologist at the PLC or RGH who's on consult service that week.

"I typically take 25-30 calls on Specialist LINK over the week. Each of them is probably about a 10 to 15-minute commitment by the time I make notes afterwards and document what's going on. But it's usually a five to 10-minute phone conversation."

The service has also become part the formal neurology triage process, he says, so a routine request for a consultation may be instead referred to Specialist LINK.

After a year of Specialist LINK, Dr. Klassen says the response has very positive and the word is spreading throughout Calgary and area. The most common comment is: We want other specialties to participate!

Statistics	P value
1.74	0.18
5.86	0.02 ¹
0.88	0.35
0.02	0.89
0.83 ²	0.54
	1.74 5.86 0.88 0.02 0.83 ²

Specialist LINK awareness and utilization among Primary Care Networks

Source: Alberta Health Services Specialist LINK Evaluation Survey 2018

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"Especially when resources are strained and waiting lists get longer, it's a nice way to give some people direction and ease some of the stress."

In some cases, he says, a concerned physician (and ultimately patient) can be reassured that the symptoms do not point to a more serious issue. Or they can be referred to treatments that can quickly help the issue. The questions that he receives cover a range of neurological areas. What should we do with this? Does it need to be seen? Should I try medication for this? With someone having facial pains, could this be trigeminal neuralgia?

"It's good for family physicians in terms of getting the questions answered," he says. "And hopefully it's good for patients because we can get them treatments or investigations or at least a pathway to care that's appropriate earlier."

Though the requests are in addition to his busy clinic at Peter Lougheed Centre, Dr. Klassen says he enjoys Specialist LINK as part of his week on call.

"It's something that feels really worthwhile."

One win for the system would be worth cheering, but Specialist LINK is delivering numerous other benefits. The opportunity to connect with frontline physicians is also beneficial for specialists, he says. "Most of the docs that I see patients for, I've never met—never spoken to them. It's a nice way to build relationships with our referring doctors in the community."

Win No. 3 is the opportunity to help physicians with on-the-spot CME: "You've got a patient with a headache? Can you tell me about the headache?" Then, says Dr. Klassen, the conversation progresses to: "This is migraine and this is how we think about migraine and this is how we manage that."

Finally, reducing uncertainty in the family physician's clinic has a tremendous unseen benefit down the line.

"If they're frustrated with the process and they have no other means to get some advice or get a sense of what should be done, the knee jerk response is: 'Well, the patient's in my office again this week. I'm just going to tell him to go to Emergency and ask to see Neurology.'

"If we can try and alleviate some of that and provide some care and direction then I think we get another win there as well."

At the end of a busy day, Dr. Klassen has improved patient care, built bridges in the community, completed a little CME and—almost as importantly—reduced the amount for work to be done tomorrow—especially in the ED.

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

Dr. Samuel Wiebe

assistant physicians, nurses, EEG technologists, clinical neurophysiologists and an epilepsy program administrator.

The research team has strong collaborations with the Hotchkiss Brain Institute (HBI), the O'Brien Institute for Public Health, and the Alberta Children's Hospital Research Institute. The team includes basic scientists (HBI), health outcomes and health services researchers, and advanced imaging researchers.

As a tertiary care centre, the CEP provides care for a wide breadth of persons with epilepsy, including those with complex epilepsies, and those requiring complex surgical investigations and interventions. Complex and surgical 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, daytime 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 has been developed to facilitate EEG source localisation.

- Advanced functional imaging includes PET, SPECT, functional MRI with capacity for mapping of cortical function, voxel-based relaxometry and arterial spin labeling, as well as EEG-fMRI interictal and ictal studies.
- The EEG laboratory operates at four hospital sites and the Seizure Monitoring Unit (SMU) operates at the Foothills Medical Centre and the South Health Campus 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, and vagus nerve stimulation.

Research and Leadership

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

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Dr. Wiebe led the development of the Competencies-Based Curriculum for Education in Epileptology for the International League Against Epilepsy. This systematically developed curriculum and learning objectives are now being used internationally to develop a large variety of educational tools, including distance learning, that can lead to an Assessment-Based Certificate in Epileptology in countries around the world.

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 and using the data managing services at the Cumming School of Medicine's Clinical Research Unit, a 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 has expanded significantly in scope and aims to promote patient outcomes through integrating clinical, EEG, MRI, genomic, and electronic health records data. Additionally, funding has been secured to create a multicentre consortium on epilepsy clinical data. led by Drs. Josephson and Wiebe, using the CEP clinical database model and structure.

Highlights

- The CEP held a very successful First International Banff Epilepsy Symposium in February 2018, focusing on "New Frontiers in Mapping the Epileptogenic Zone". In addition to our local speakers, the one-day symposium featured four renowned national and international researchers in the field, including Dr. Jean Gotman (McGill University), Dr. Christoph Helmstaedter (University Clinic Bonn), Dr. William Gaillard (George Washington University) and Dr. Samden Lhatoo (Case Western Reserve University).
- The 2017 Mary Anne Lee Memorial lecturer in epilepsy was Dr. Lara Jehi from the Cleveland Clinic, who spoke about "Achieving and maintaining seizure freedom after epilepsy surgery".

- The CEP held its annual epilepsy research retreat, in conjunction with the HBI, with presentations by trainees from the various clinical and basic science epilepsy research teams.
- Dr. Paolo Federico in 2017 co-led the Hotchkiss Brain Institute's Epilepsy NeuroTeam and leads a world-class team which uses fMRI techniques to solve problems of complex epileptogenesis. His research focuses on intracranial EEG-fMRI recordings, Arterial Spin Labeling MRI, and automated High Frequency Oscillation detection algorithms to identify the seizure focus.
- Dr. Walter Hader continues to implement robotic implantation of intracranial EEG electrodes in children and adults using the Rosa System, acquired through a donation from Bob and Brenda McNeil. Dr. Raghunath Avanali is the current epilepsy surgery fellow and has had extensive training in pediatric and adult epilepsy surgeries and invasive monitoring under the guidance of Dr. Hader.
- 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.
 Dr. Joanne Stephen provides similar services at the South Health Campus. 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 with Dr. Aaron Mackie are neuropsychiatrists affiliated to the CEP and provide invaluable support to our many patients with psychiatric comorbidities.

There are important developments in Pediatric Epilepsy:

- Dr. Luis Bello Espinosa is the interim leader of the epilepsy program after the retirement of Dr. Jeff Buchalter. There are vigorous recruitment efforts for a new leader.
- Dr. Juan Pablo Appendino is the chair of the Canadian Board of Registered EEG Technologists and held a successful Canadian Examination this year again.

 Dr. Rho's research focus is on the molecular and cellular mechanisms underlying the clinical anti-seizure and neuroprotective effects of the ketogenic diet (KD), an established nonpharmacological treatment for medically intractable epilepsy.

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

- Dr. Cam Teskey's CIHR-funded research program examines how seizures alter brain function. His laboratory has recently discovered that a severe hypoperfusion/hypoxic event follows seizures.
- Dr. Quentin Pittman's lab employs multiple approaches to investigate neuronal function from the entire organism to the single cell.

The CEP runs a unique transition clinic for pediatric patients who are graduating into adulthood. This ensures continuity of care and provides support for patients and families in this significant transition of care. Dr. Yahya Agha-Khani has been running this clinic for the last several years.

This year we graduated one neurophysiology fellow (Dr. Seraj Makkawi) who also became certified in EEG by the Canadian Society of Clinical Neurophysiology. We currently have two international fellows (Dr. Joseph Peedicail from India, and Dr. Amal Al-Mohawes from Saudi Arabia) who actively contribute to a busy program involving outpatient clinics, routine EEG interpretation, and presurgical evaluations including long-term video-EEG monitoring.

A highlight this year was the recruitment of Dr. Karl Martin Klein who will establish a program in epilepsy genetics and genomics, as well as precision medicine. He retains a special interest in multiplex families with epilepsy as well as adult and pediatric patients with epileptic encephalopathies and thus will be an immediate asset to the program.

Dr. Wiebe continues to lead the CEP. With Dr. Agha-Khani's departure, Dr. Paolo Federico took on the directorship of the EEG laboratories, epilepsy clinics, and the SMU. Drs. Shaily Singh and Colin Josephson are the co-directors of education and fellowships. Dr. William Murphy overviews clinical assistants and clinical trials.

Dr. Wiebe served his final term as associate dean of Clinical Research. He continues to chair the Clinical Research Unit for the Cumming School of Medicine, and was elected President of the International League Against Epilepsy. Dr. Wiebe continues to focus on outcomes and health services research.

Members

Adult Epileptologists: Dr. Paolo Federico, Dr. Alexandra Hanson, Dr. Colin Josephson, Dr. Brain Klassen, Dr. Karl Martin Klein, Dr. William Murphy, Dr. Shaily Singh, Dr. Samuel Wiebe Pediatric Epileptologists: Dr. Jong Rho, Dr. Juan Pablo Appendino, Dr. Alice Ho, Dr. Morris Scantlebury, Dr. Luis Bello-Espinosa Neurosurgeons: Dr. Walter Hader, Dr. Yves Starreveld Neuropsychiatrists: Dr. Aaron Mackie. Dr. Brienne McLean Clinical psychologists: Dr. Sophia Macrodimitris, Dr. Ruby Sharma, Dr. Joanne Stephen Adult Neuropsychologists: Dr. Lisa Partlo, Dr. Kim Goddard Pediatric Neuropsychologists: Brian Brooks, Marsha Vasserman, Naddley Desire, Sandra Mish, Taryn Fay-McClymont, William MacAllister Adult Neuroradiology: Dr. James Scott Nuclear Medicine: Dr. Christine Molnar. Dr. Leonard Numerow Pediatric Neuroradiology: Dr. Xing-Chang Wei Clinical Assistants: Dr. Reynaldo Avendano, Dr. Salma Hanna Adult Epilepsy Fellows: Dr. Seraj Makkawi (graduated), Dr. Joseph Peedicail, Dr. Amal Al-Mohawes Pediatric Epilepsy Fellows: Dr. Natarie Liu Epilepsy Nurses: Meliza Camerino, Amira Jivraj, Jackie Martini, Michele Zulinick, Andrea Palmer, Wendy Chen

The Calgary Stroke Program

Program Lead: Dr. Andrew Demchuk

Overview

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

Key Publications

An extraordinary achievement of the program this year continues to be a leadership role in the HERMES Collaboration led by Dr. Mayank Goyal. The collaboration successfully brought together all seven predominantly stent retrieverbased randomized clinical trials of mechanical thrombectomy in stroke (five published in NEJM 2015). This HERMES collaboration

Dr. Andrew Demchuk

continues to roll out many major publications — Lancet (1), JAMA (1), Lancet Neurology (3) and JNIS (2) — that are influencing/changing guidelines for EVT care throughout the world by clarifying when and how endovascular treatment is effective. The most recent publication in Lancet Neurology clarified the ASPECTS cutoff for benefit of EVT (ASPECTS 3 and above). Several of these publications list CSP faculty as first or senior authors.

The AURORA collaboration has also been created of which Drs. Goyal, Hill and Demchuk are on the executive committee. This brings together the five mechanical thrombectomy trials that enrolled patients in the late time window. The first two initial analyses have now been presented at major conferences.

Drs. Bijoy Menon and Andrew Demchuk completed and published in JAMA the INTERRSeCT study main result. This prospective cohort study was funded by a three-year CIHR operating grant. 575 subjects from 12 centres in five countries were recruited to the study. The study has provided unique insights into when, how often and how fast IV TPA successfully recanalizes an intracranial occlusion. The UNMASK-EVT study has now been completed. It is a large survey led by Dr. Saposnik and the CSP on physician decision making in acute stroke with 603 respondents from 38 countries.

A number of additional significant original contributions were published in the past year. The collective H-index of the clinician scientists within the program now exceeds 140 with over 90,000 citations from over 800 publications cited at least 10 times.

Clinical Trials

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, the United Kingdom, Ireland, Austria, Spain and Australia, with further sites being considered in Chile, Brazil and Israel. So far, 257 subjects have been enrolled with a major step up in enrollment of late.

Drs. Michael Hill and Mayank Goyal (PIs) continue to lead the ESCAPE NA-1 trial which is a collaboration between the University of Calgary/ Calgary Stroke Program and NoNO Inc to study a novel neuroprotectant (NA-1) in patients undergoing endovascular treatment for acute stroke. This trial has now enrolled 644 subjects with a rapid ramp up to twice daily enrollment achieved from over 50 sites in multiple countries. It is expected to complete enrollment of 1,120 subjects by summer 2019, with final results available in early 2020.

New trials to be launched: Dr. Andrew Demchuk (co-PI) will soon launch a Phase 2/3 randomized trial of endovascular treatment in mild stroke entitled ENDOLOW in conjunction with co-PIs at Emory University (Atlanta), University of Cincinnati (Cincinnati) and Heidelberg University (Germany). This is a 200-patient study at 30 centres in four countries. Dr. Bijoy Menon (co-PI) will soon begin the ACT-QuICR trial using the infrastructure of the QuICR registry to test Tenecteplase as a new thrombolytic stroke drug. Dr. Mohammed Almekhlafi (co-PI) will soon begin the EVOLVE trial to examine antiplatlet therapy in the peri-operative management of unruptured aneurysms.

Team Grant/Core Lab Progress

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 remained very close to achieving our goal of a 30 minute median door-to-needle time for all stroke patients treated in the province.

Dr. Demchuk continues to lead the implementation of the "CaSTOR Canadian Stroke Trials for Optimized Results" national stroke clinical trials network in Canada, with funding by the CIHR/ Institute of Circulatory and Respiratory Health. This \$1.5 million emerging networks grant (2015-2020) is a collaboration with the Canadian Stroke Consortium and Canadian Partners for Stroke Recovery. A global high impact accomplishment this year as part of the grant was the first ever Global Alliance of Independent Networks in Stroke (GAINS) WSO Early Career Investigator Workshop held just prior to the World Stroke Congress 2018 in Montreal in which 102 very promising early career clinician researchers attended from 23 countries. This workshop provided a truly unique opportunity for these individuals to be inspired and build connections with peers across the world with similar interests.

The CaSTOR grant also held a capacity building competition throughout Canada with eight successful applications receiving funding. The competition aimed to create new stroke trial recruitment capacity at Canadian stroke centres previously inactive or without prior experience in trial recruitment.

The Stroke Imaging Core Lab coordinates brain MRI and CT imaging for observational studies and clinical trials, with more than 15,000 brain scans analyzed. Imaging endpoints include strokes, hemorrhages, vascular occlusions, brain perfusion, and others. These endpoints are critical for understanding the natural history of stroke and the effectiveness of new treatments.

The acute stroke imaging research program has expanded to now have research fellows from countries as diverse as the Netherlands, South Korea, the United Kingdom, Switzerland, Saudi Arabia, Japan and China. The program now 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.

Personal Achievements

Dr. Mayank Goyal received the 2018 CAR Distinguished Career Achievement Award from the Canadian Association of Radiologists for his outstanding contributions to clinical research in acute stroke triage, diagnosis and endovascular therapy. Dr. Goyal also became a fellow of the Canadian Academy of Health Sciences.

Dr. Bijoy Menon first authored papers this year in JAMA, Lancet Neurology and Circulation. Three students of his (Lexi Wilson, Moiz Hafeez and Moe Najm) successfully entered medical school. His HSF Professorship in stroke imaging was also renewed.

Dr. Eric Smith chaired an Evidence Review Committee for the American Heart Association that synthesized evidence in two areas of uncertainty in clinical stroke care: the accuracy of pre-hospital stroke severity scales for identifying ischemic stroke patients with large vessel occlusion for transport to endovascular thrombectomy-capable hospitals and the efficacy of screening stroke patients for dysphagia. One of the stroke severity scales identified in the review, the Los Angeles Motor Scale, has been implemented by ambulance services across Alberta as part of the ERA project to increase access to endovascular thrombectomy for acute ischemic stroke.

Dr. Sean Dukelow and colleagues received CIHR funding for the RESTORE trial which will investigate the role of early robotic rehabilitation in upper extremity stroke recovery in 132 patients at two centres in Canada. The trial will also evaluate the utility of neuroimaging and transcranial magnetic stimulation in predicting recovery after stroke.

Dr. Mohammed Almekhlafi joined our program after relocating from Jeddah, Saudi Arabia. Dr. Almekhlafi is well known to the program having completed his neurology residency and three years of stroke and interventional training in Calgary. Dr. Almekhlafi is the first interventional neurologist in Canada with an academic appointment.

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Dr. Philip Barber is leading the multisite REPERFUSE NA-1 which is a longitudinal MRI study of acute stroke patients participating in the ESCAPE NA-1 study. Sites are currently active in Canada and USA, and other sites coming on board are from Korea and Germany. The study has recruited 30 stroke patients to date.

Dr. Barber is leading the PREVENT Dementia study, a prospective longitudinal cohort study of agematched TIA patients and healthy controls which aims to address the crucially important population health question, "Can we reliably identify dementia risk in TIA patients by using valid biological markers of disease thereby optimizing vascular risk management to reduce the risk of dementia?" The study has recruited 331 TIA patients and controls to date, of which 150 have completed followup visits.

Clinical Care Achievements

The Endovascular Reperfusion Alberta (ERA) project led by CSP and Edmonton Stroke Program through the Stroke and Cardiovascular Health Strategic Clinical Network continues to result in improvements in access to endovascular treatment for rural patients with large geographic barriers. The three zones of transport are now fully functional throughout the province. Patient outcomes are being monitored and mirror results obtained in clinical trials of EVT despite the added distances and more liberal criteria for treatment.

Samantha Arnott and the clinical management team has successfully launched a patient flow/care improvement project entitled CARROT (Carotid Artery Rapid Revascularization Optimization Team) aimed at achieving carotid revascularization within 72 hours of admission to hospital for symptomatic carotid stenosis patients.

The Calgary Health Trust provided a significant donation to support the initial planning of a new integrated stroke unit at Foothills Medical Centre. Architectural firm Group 2 has been secured to lead the FMC Stroke Unit Development Study. A committee of multiple stakeholders has been struck and first meetings have taken place. The goal is completion of a functional plan within six to nine months that describes the critical elements needed for a new unit and architectural renderings of how it might look. This is a critical first step toward a future capital fundraising campaign and ultimately build a new world class integrated stroke unit.

The Stroke Program has once again completed a cycle of Stroke Accreditation and is expected to receive full accreditation for acute, prevention and rehabilitation activities in December 2019.

Conference Leadership

The program successfully hosted our third 5T Stroke Conference in Banff in May 2018 with over 200 participants in attendance.

The program also hosted two delegations from several thrombectomy centres in Canada and China/Korea/Australia in a training course on all things mechanical thrombectomy related.

Education

As of June this year, our program is training and/or has graduated 86 stroke fellows from 19 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.

Our research fellow/sabbatical and observership programs has expanded substantially with 17 individuals from 12 countries spending at least a week or much longer with the CSP in 2017-2018.

Members

Stroke Neurology: Dr. Mohammed Almekhlafi, Dr. Simer Bal, Dr. Phil Barber, Dr. Philippe Couillard, Dr. Shelagh Coutts, Dr. Andrew Demchuk, Dr. Michael Hill, Dr. Adam Kirton (Pediatrics), Dr. Gary Klein, Dr. Bijoy Menon, Dr. Alekys Mineyko (Pediatrics), Dr. Steve Peters, Dr. Eric Smith, Dr. Peter Stys, Dr. Suresh Subramaniam

Stroke Physical Medicine and Rehabilitation: Dr. Sean Dukelow, Dr. Ken Lam,

- Dr. Gentson Leung, Dr. Steve McNeil Physician Assistant: Allen Szabon
- Vascular Neurosurgery: Dr. Alim Mitha, Dr. Garnette Sutherland, Dr. John Wong
- Interventional Neuroradiology: Dr. Muneer Eesa, Dr. Mayank Goyal, Dr. Will Morrish
- Nurse Practitioner: Nancy Newcommon
- Stroke Program Managers: Lara Osterreicher, Samantha Arnott

The Cognitive Neurosciences Program

Program Lead: Dr. Eric Smith

Overview

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

Dr. Eric Smith

Our multidisciplinary physician workforce is a unique aspect of

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

Commonly diagnosed syndromes and disease include mild cognitive impairment, Alzheimer's disease, vascular cognitive impairment, frontotemporal dementia, primary progressive aphasia, and Lewy body disease. When appropriate, we obtain detailed neuropsychological assessments, brain imaging including MRI or FDG-PET, and cerebrospinal fluid analysis.

Our clinical care is integrated with an internationally recognized research program focusing on vascular contributions to cognitive decline and dementia, and neurobehavioural complications of the early stages of neurodegeneration. Three clinic members have major investigator-initiated research programs in cognitive disorders (Eric Smith, Zahinoor Ismail, and Philip Barber), supported by external funding from the Canadian Institutes of Health Research. Brain Canada, 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. Currently, 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 coordinated by the Dementia and Cognitive Disorders NeuroTeam of the Hotchkiss Brain Institute. The NeuroTeam is co-led by Dr. Eric Smith along with Dr. Lorraine Venturato from the Faculty of Nursing. Our program research activities are aligned with the NeuroTeam, with many withinteam collaborations.

Program members play critical roles in the Canadian Consortium on Neurodegeneration and Aging (CCNA). The CCNA is Canada's national research strategy and is funded 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.

Clinical trials are an important component of our research program. Trials are needed because 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.

Clinical Care Highlights

We continue to see increasing numbers of referrals, with 533 new referrals in the last year. A similar number of patients are seen in follow up.

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In the past year our clinical innovations focused on helping our patients get better access to supportive care in the community and providing additional resources on living well with cognitive impairment and dementia. Nurse Karyn Fischer led an effort to identify community resources. She created a package of information on multiple services including home care, day programs, the Alzheimer Society FirstLink program and others, as well as information on what to expect when living with cognitive impairment or dementia.. We also uncovered significant gaps in information on services, most particularly on driving safety, which can be impaired by cognitive disorders. We created Alberta Health Services-approved pamphlets with information on how to self-evaluate driving safety, how to get assessed for safety, and how to cope when driving is unsafe including how to access alternative means of transportation.

Most patients in the clinic agree to have their clinical information recorded in our Prospective Memory Symptoms (PROMPT) registry, on of the Hotchkiss Brain Institute Brain and Mental Health Research Clinics. led by our research nurse Karvn Fisher. The registry now has data from more than 1,360 patients. We use these data identify patterns in referral diagnosis, quality of care, and risk factors for cognitive outcomes. Focus groups were convened last year to explore patient and care partner attitudes and experiences with the registry. The results were analyzed using mixed qualitative and quantitative methods. The dominant theme that emerged was "If it helps someone, then I want to do it". These results have been presented at two scientific conferences and are now submitted for publication.

We have implemented the Mild Behavioural Impairment (MBI) Checklist into our clinic assessment battery. This questionnaire, developed and validated by Dr. Ismail, helps us to assess previously under-recognized behavioural symptoms of cognitive disorders even in their early stages. The important of these symptoms to care partners was investigated by Dr. Ismail and colleagues and published in International Psychogeriatrics (2018;2:233-244).

Focus on Education

Medical students and residents participate in the Cognitive Neuroscience clinic at the Foothills and South Health Campuses as part of ambulatory and elective rotations. We run a practice examination station on cognitive disorders to help prepare our neurology residents for their final year qualifying examination by the Royal College. Dr. Cieslak was invited to lecture on cognitive neurology at the nationwide LAUNCH education program for neurology residents, reflecting our strong national reputation in education.

Education in research is another important aspect. We train graduate students, residents, and fellows in methods for researching cognitive disorders. Drs Smith, Ismail, and Barber combined to supervise a post-doctoral fellow, two PhD students, and six Master's students in Neurosciences and Community Health Sciences at the University of Calgary.

Dr. Ismail supervised a psychiatry resident to write a paper on mild behavioural impairment and its association with care partner care burden (International Psychogeriatrics 2018;2:233-244). Dr. Smith supervised a clinical fellow and PhD student to write a paper showing that patients with dementia have worse outcomes following hospitalization for stroke (Canadian Journal of Neurological Sciences 2018:1-5). Dr. Smith supervised a Master's student to write a paper showing the microinfarcts are highly prevalent in patients with the small vessel disease cerebral amyloid angiopathy (Stroke 2018.)

We educate other practicing clinicians through continuing medical education courses, lectures and presentations, and authoring reviews and book chapters. Dr. Smith authored the section on Vascular Dementia Diagnosis on the UpToDate website, the world's leading online "textbook" for doctors.

Research Highlights

Dr. Eric Smith holds the Katthy Taylor Chair in Vascular Dementia from the University of Calgary and is funded by a CIHR Foundation Award.

Dr. Ismail was awarded a five year grant to a fiveyear CIHR project grant for the PARADIGM study (Pre-dementia at-risk states: a longitudinal study of cognition and neuroimaging biomarkers in Mild Behavioural Impairment (MBI).

Dr. Ismail is the site principal investigator of a U.S. National Institute on Aging sponsored clinical trial of escitalopram for treating agitation in Alzheimer's disease, which began recruitment in 2018. Agitation is a common symptom in Alzheimer's disease that causes much distress for patients and their care partners, and for which there are no effective treatments.

Dr. Ismail and colleagues discovered that behavioural symptoms are common and increase care partner burden even in patients considered only mildly impaired cognitively (International Psychogeriatrics 2018;2:233-244).

Dr. Smith and colleagues discovered that microinfarcts can be identified frequently on MRI in patients with cerebral amyloid angiopathy (Stroke 2018;49:1899-1905). This finding suggests that new strategies are needed to prevent them.

Dr. Smith and colleagues performed the first Canadian nationwide study on the prevalence of dementia in patients hospitalized with stroke. They found that more than 10 per cent of patients admitted with stroke have a history of dementia, and that they are at higher risk for poor outcomes.

Members

Neurology: Dr. Eric Smith (Director),

- Dr. Philip Barber, Dr. Alicja Cieslak,
- Dr. Bijoy Menon, Dr. David Patry,
- Dr. Dawn Pearson
- Psychiatry: Dr. Robert Granger, Dr. Zahinoor Ismail, Dr. Aaron Mackie, Dr. Brienne McLane

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

Neuropsychology: Dr. Catherine Burton, Dr. Kim Goddard

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.

Highlights

Over the past several years the General Neurology Program

Dr. Katie Wiltshire

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. Jeptha 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

Calgary Headache Assessment and Management Program

Program Lead: Dr. Elizabeth Leroux

It is estimated that over 600,000 Albertans suffer from migraine headache, a disabling, chronic condition that has a substantial socioeconomic burden in our province due to lost time from

work and family activities and decreased educational and employment opportunities. Population data suggests that as many as 125,000 Albertans may have chronic daily headache.

The CHAMP program is a tertiary headache referral centre, specializing in complex headaches ranging from migraines to spontaneous intracranial hypertension,

Dr. Elizabeth Leroux

trigeminal autonomic cephalalgias, and other rare headache conditions. The team is comprised of four headache subspecialty neurologists, a fellow, and a group of incredibly compassionate nurses, LPNs, and administrative staff who take a special interest in our patients with headache.

In 2017 the CHAMP program was reunited with the Department of Clinical Neurosciences. It was a busy and productive year. We were pleased to train neurologist, Dr. Caitlin Holtby, to join the ranks of Canadian headache sub-specialists and to recruit Dr. Alexander Melinyshyn as the 2018-2019 Canadian Headache Society Fellow in our program.

In 2017 the CHAMP team focused on finding innovative ways to enhance access to the headache clinic for the many patients in Alberta who have complex headache disorders. Given the small number of headache sub-specialists and the large number of patients with complex headaches, access to subspecialty care remains our biggest challenge. Through collaborative work with the Calgary and Area Primary Care Networks, Dr. Elizabeth Leroux supported the development of a clinical pathway for headache. This pathway, co-created with family doctors, was designed to support the management of patients with migraine in the medical home with improved connectivity between the family doctor and neurologists.

CHAMP has also continued to be active in clinical research in headache neurology. With 12 actively recruiting clinical trials, a registry for patients with spontaneous intracranial hypotension, and ongoing projects on health services research our team continued with a robust academic program under the strong research leadership of Dr. Farnaz Amoozegar. In 2017, the outcomes from our health services research project showed that patients enrolled in CHAMP had decreased healthcare utilization overall during their time with the program compared to the three years before.

Last, but certainly not least, in 2017 we saw the advent of the first new medication to treat migraine in a decade. We saw the arrival of monoclonal antibodies targeted towards specific molecules believed to be involved in the pain of migraine headaches. These treatments will begin to be available in 2018 and the CHAMP program will look forward to working with general neurologists and family doctors in Calgary to ensure that appropriate patients can get access to the compound.

2018 will be an exciting year for CHAMP as we anticipate more clinical trials, additional new therapeutic compounds coming to market, and the launch of a series of new educational and behavioural management program opportunities for our headache patients.

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, populationbased care to people with MS and other Central Nervous System (CNS) demyelinating disorders living in southern Alberta and southeastern British Columbia. We are "one program on two sites" with clinics at both Foothills Medical Centre and South Health Campus.

Dr. Michael Yeung

Research

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

trials are ongoing in RRMS and

Dr. Katayoun Alikhani

Dr. Luanne Metz's translational research trial of minocycline in clinically isolated syndrome was published in the New England Journal of Medicine in 2017. This was a multi-centre clinical trial that was funded by the MS Society of Canada. The risk of conversion from a clinically isolated syndrome to MS was significantly lower with minocycline versus placebo over 6 months.

progressive MS.

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

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

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

Education

The MS Program supports the education of trainees at all levels. Neurology residents do MS Clinic rotations in their junior and senior years. MS fellows are involved in care and research. There are currently two MS Fellows, Dr. Carlos Camara-Lemarroy from Mexico, and Dr. Wei-Qiao Liu from UBC. MS Fellowships at the University of Calgary MS Program can be either clinical- or researchbased, and can be from one to two years.

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.

Highlights

The MR-guided High-intensity Focuses Ultrasound surgical treatment for refractory tremor has

Dr. Davide Martino

been active for 18 months, in collaboration with the FUS Research Team. This ablative procedure of limited invasiveness has been life-changing for more than a dozen patients and targets a highly unmet therapeutic need. Future applications for this treatment include refractory tremor-predominant Parkinson's disease and dystonia.

Dr. Veronica Bruno has joined our program! Dr. Bruno's competencies span across the whole field of movement disorders, with special interests in the assessment and management of non-motor symptoms. Welcome, Veronica!

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

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

Dr. Bin Hu continues to work on the Ambulosono program. The trial now encompasses other national and international sites.

Other multicentre clinical trials include:

• Steady PD3 trial investigating efficacy of isradipine as a disease-modifying agent in early Parkinson's

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 neurooncology 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. Salman Faruqi, Dr. Shaun Loewen Neurologist: Dr. Alexandra Hanson Neurosurgeons: Dr. Mark Hamilton, Dr. John Kelly, Dr. Yves Starreveld Clinical Psychologist: Dr. Guy Pelletrier Nurses: 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: Sonali Deshpande

disease - study now completed

- Global Phase 3 trial of istradefylline in moderate to advanced Parkinson's disease for the treatment of wearing off phenomena – study now completed
- A randomized, double-blind, placebo-controlled multiple dose study to assess efficacy, safety, tolerability and pharmacokinetics of intravenous ABBV-8E12 in Progressive Supranuclear Palsy – ongoing; recruitment now closed
- COSMOS co-medication study assessing monoand combination therapy with levodopa carbidopa intestinal gel
- CADENCE observational study in patients treated with Duodopa to assess long-term outcomes
- Observational study of Huntington's disease (ENROLL-HD trial) – recruitment ongoing

The Program is also committed to training residents and fellows. An international fellowship program

in movement disorders, jointly with the Pediatric Movement Disorders program, is active.

Members

Neurologists: Dr. Veronica Bruno, Dr. Alicja Cieslak, Dr. Sarah Furtado, Dr. Scott Kraft, Dr. Davide Martino, Dr. Tamara Pringsheim, Dr. Justyna Sarna
Psychiatrists: Dr. Jeremy Quickfall, Dr. Aaron Mackie, Dr. Brienne McLane
Neurosurgeon: Dr. Zelma Kiss
Geriatrician: Dr. Zahra Goodarzi
Psychologist: Dr. Angela Haffenden
Social Worker: Melinda Hatfield

Researchers: Dr. Bin Hu, Dr. Oury Monchi

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

Research Co-ordinator: Lorelei Tainsh Administrative Staff: Bonita Woytowich, Hanna Mogos,

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.

Dr. Lawrence Korngut

Neuromuscular Genetics Interdisciplinary Clinic:

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

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

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

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

All of the above clinics are multi-disciplinary. Depending on clinic needs, patients may see multiple physicians (neurologist, physiatrist, respirologist, palliative care doctor, plastic surgeon, and 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. Conducted four randomized clinical trials in ALS and Facioscapulohumeral Muscular Dystrophy (FSHD). 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. Dr. Li Pi Shan developed a tool to simplify the level of certainty in the diagnosis of ALS.

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

Education

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

The Urgent Neurology Clinic

Program Lead: Dr. Alexandra Hanson

Overview

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

The Urgent Neurology Clinic's mandate is to see adult patients with a new, acute neurological issue within one week. Further tests are then expedited and completed in a timely manner. The Urgent Neurology Clinic works in conjunction with Neurology Central Access and Triage (CAT) to ensure all patients are seen at the most appropriate clinic.

Dr. Alexandra Hanson

While the Urgent Neurology clinic sees patients with a myriad of neurological disorders, the most common referrals are for seizures and complex migraine or headache. Approximately half of the referrals come from the Emergency Department or Urgent Care Centres, and the other half are from family doctors with a few are from other specialists. The Urgent Neurology Clinic is an excellent clinic for both resident teaching and evaluation (STACERs).

Highlights

For the July 2017 – June 2018 year, UNC saw approximately 1,600 new patients; two-thirds at the Foothills Hospital and one-third at the South Health Campus.

Members

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

Physicians: Dr. Tyson Brust, Dr. Jodie Burton, Dr. Jeptha Davenport, Dr. Paula de Robles,

- Dr. Yanjun Duan, Dr. Sarah Furtado,
- Dr. Alexandra Hanson, Dr. Jagdeep Kohli,
- Dr. Steve Peters, Dr. Michael Yeung.

SHC: Lorraine Sorge RN, Echo Morasch (clerk) Physicians: Dr. Katayoun Alikhani,

- Dr. Farnaz Amoozegar, Dr. Bill Murphy,
- Dr. Dawn Pearson, Dr. Dave Patry,
- Dr. Shaily Singh, Dr. Katie Wiltshire

Members

Neuromuscular Neurology:

- Dr. Sam Chhibber, Dr. Hamid Ebadi,
- Dr. Chris Hahn, Dr. Lawrence Korngut,
- Dr. Gerald Pfeffer, Dr. Chris White,
- Dr. Seraj Makkawai (ALS Clinic Locum)
- Neuromuscular Physiatry: Dr. Rodney Li Pi Shan, Dr. Stephen McNeil, Dr. Stephanie Plamondon
- Neuromuscular Respirology: Dr. Karen Rimmer, Dr. Andrea Loewen
- Peripheral Nerve Surgery: Dr. Rajiv Midha,
 - Dr. Christiaan Schragg, Dr. Brett Byers,
- Dr. Kate Elzinga, Dr. Robertson Harrop Palliative Care: Dr. Marisa Dharmawardene Clinic Nurses: Kris Jagt, Jodie Gill,
- Christine Roberts, Helena Ogilvie ALS Clinic Coordinator: Denise Hartley

- Allied Health: Cristiane Yamabyashi PT, Jay Cooling PT, Monic Brunet OT, Michele Spurvey OT, Stephanie Molzan SLP, Leon Mitchell SW, Dr. Kim Goddard, Neuropsychology, Sandy Jensen DH, Tiffany LaFleur RD, Ray Tye RT, Margaret Hass PT Pharmacists: Darcy Padula, Robert Hou,
 - 'harmacists: Darcy Padula, Robert Wenli Zhou
- Fellows: Dr. Daniel Fok, Dr. Theodore Mobach
- Clerical Team: Lindy Wright (ALS and Peripheral Nerve Clinics), Jennifer Coish (NMC), Kelsey Collins (NMC), Marion Schmaltz (NMC)
- Clinical Research Team: Janet Petrillo, Jose Martinez, Josh Lounsberry, Victoria Hodgkinson, Emily-Ann Butler
- Basic Science Research Team: Kristina Martens (lab manager), Carly Pontifex (master's student in neuroscience), Robyn Wells (PhD student in neuroscience)

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

Dr. Suresh Subramaniam

treatment, including lab testing and physical and occupational therapy.

Highlights

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

Education

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

Research

The Neuro-Ophthalmology Program will be participating in the Surgical Idiopathic Intracranial Hypertension Treatment (SIGHT) Trial funded by Neuro-Ophthalmology Research Disease Investigator Consortium (NORDIC) and National Institutes of health (NIH). This trial is being conducted to compare medical treatment and two types of surgical treatments for Idiopathic Intracranial Hypertension. The trial will be enrolling patients soon. Projects in Neuro-Ophthalmology include studies of the rehabilitation of homonymous hemianopia, the roles of hormones, vitamin D and novel therapies in optic neuritis, structural changes related to pituitary tumours, pregnancy and cardiovascular health, and the role of optical coherence tomography in monitoring patients with multiple sclerosis or tumours affecting the optic nerves or chiasm. Projects in the Neurovestibular Program include the study of a prototype rotary chair in the diagnosis of vestibular dysfunction and the role of physiotherapy in vestibular migraine.

Members

- Medical Staff: Dr. William Fletcher, Dr. Fiona Costello, Dr. Suresh Subramaniam, Dr. Beth Lange (Otolaryngology), Dr. Euna Hwang (Otolaryngology)
- Allied Health and Administrative Staff: Neuro-Ophthalmology Program - Kimberley Ade. Neurovestibular Program - Melanie Oszust, Gina Quinn, Michelle Pushka, Jacqueline Townsend, Craig Mulroney

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.



Research

Dr. Tamara Pringsheim

Research at the clinic is focused on:

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

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

Current studies at the clinic include:

- The role of diet, exercise and sleep on tic severity in children with chronic tic disorders
- Investigation of the gut microbiome in children with chronic tic disorders
- · Longitudinal outcomes in children with tics

- Dietary fibre to reduce antipsychotic induced metabolic effects in children with tics
 - Clinical and neurophysiological characterization of essential tremor in children
 - Examination of sensorimotor function in children with tics using the KINARM

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

Education

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

Members

Neurologists: Dr. Tamara Pringsheim, Dr. Justyna Sarna, Dr. Davide Martino Nursing: Tracy Hammer Research Co-ordinator: Elaheh Nosratmirshekarlou Clinical and Research Fellows: Dr. Nicholas Cothros, Dr. Alex Medina

Pediatric Neurosciences

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 neighboring Saskatchewan/British Columbia. Currently, our faculty is comprised of over a dozen staff neurologists with subspecialty expertise in epilepsy, neurotrauma and stroke, neurocritical care, headache, demyelinating and other neuroimmune conditions, neonatal neurology and brain malformations, neuromuscular and movement disorders, as well as developmental and cognitive, neurogenetic and metabolic diseases.

An extensive team of trainees and Allied Health professionals engage in both inpatient and outpatient clinical programs, as well as globally recognized clinical and translational research.

The ACH Neuromuscular Clinic Team was recently awarded the prestigious Muscular Dystrophy Canada Provincial Distinction in Service Delivery Award. This multidisciplinary program provides comprehensive evaluation and management of children and youth with neuromuscular disorders.

Dr. Jean Mah is the current physician leader of this program, which is further supported by Dr. David Parsons (orthopedic surgeon), Dr. Adetayo Adeleye (respirologist), Dr. Steven Greenway (cardiologist), Dr. Vithya Gnanakumar and Dr. Stephanie Plamondon (physiatrists), and many other specialists in gastroenterology, endocrinology, general surgery, ophthalmology, pathology, radiology, clinical psychology, and psychiatry.

Multidisciplinary residents and fellows, along with many Allied Health professionals (among others, registered nurse Shannon Searle; physiotherapists Angela Chiu and Vanessa D'Souza; occupational therapist Courtney Mantovani; pharmacist Curtis Claassen; social workers Benjamin Fong and Sandi Huynh) also contribute. Besides evidence-based medical care, the team provides anticipatory guidance, vocational exploration, independent



A Dr. Jong M. Rho

health care, palliative care, leisure activities, and recreation.

Finally, a separate clinical research team is involved in a multitude of national and international research projects that provide experimental treatments and address priority support needs of children with neuromuscular disorders. Current therapeutic targets include novel anti-inflammatory agents, anti-myostatin therapies, and exon-skipping strategies for Duchenne muscular dystrophy, as well as drugs to modify gene splicing for spinal muscular atrophy. The neuromuscular research team members are: Tiffany Haig, Brenda Turley, Megan MacInnis, Megan Mah, Natalia Rincon, Dr. Jean Mah, and Dr. Alice Ho, as well as research nurses, including Jonas Vaskas and Karla Sanchez.

Our Royal College of Physicians and Surgeons of Canada (RCPSC)-accredited Residency Training





Program is among the oldest and largest in Canada, and continues to maintain a 100 per cent success rate on the Royal College exam. All Section members are actively engaged in teaching through undergraduate, medical school, residency, graduate student, and post-doctoral and clinical fellowship levels.

A rich educational environment now includes more than 10 academic rounds and conferences per week. Recent graduates have taken on a variety of positions within the southern provincial zone,



▲ The ACH Neuromuscular Clinic Team was recently awarded the Muscular Dystrophy Canada Provincial Distinction in Service Delivery Award. Picture are: Annelies VanderLaan (MDC Staff) Angela Chiu (physiotherapist), Shannon Seal (nurse), and Dr. Jean Mah. including Dr. Jaden Wright (who launched a private practice in Lethbridge), Dr. Natarie Liu (who began clinical fellowship training in epilepsy at ACH), Dr. Kara Murias (who was appointed an Assistant Professor of Pediatrics at the Cumming School of Medicine and the Owerko Centre at the University of Calgary), and Dr. Megan Crone (who completed a fellowship in pediatric neurocritical care and neuromuscular disorders, and who assumed a position as an Assistant Professor at the University of Saskatchewan in Saskatoon). Furthermore, Dr. Mary Dunbar continues as a pediatric stroke fellow.

The Pediatric Neurocritical Care (NCC) Program at ACH, led by Dr. Michael Esser, has rapidly grown since its inception a couple of years ago. The NCC program has matured in a highly impactful manner, providing exceptional service to the ACH PICU and NICUs in Calgary. Under the NCC initiative, a research-oriented biobanking and bioanalytical core facility (i.e., the ACH BioCore) was successfully launched and is servicing many subspecialty sections at ACH.

State-of-the-art analytical platforms have become fully operational and have enabled measurements of virtually any molecule in any human specimen. Such advances will accelerate the development of disease biomarkers and will enhance the care of patients with, not only critical and life-threatening medical conditions, but will also facilitate innovative translational research to better understand and treat a multiplicity of conditions encountered in clinical pediatric practice.

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 2,335 cases in 2017-18, with 2,150 cases in the operating theatres at Foothills Medical Centre and 182 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

- We remain very proud that the Charles Taylor Memorial Lectureship pays homage to Calgary's first neurosurgeon. In 2018, Dr. Ben Warf, a pediatric neurosurgeon and prior recipient of the MacArthur Fellowship recipient from Harvard Medical School, was the 14th Annual Charles Taylor lecturer.
- Numerous respected professors and neurosurgeons visited us this past academic year, including Dr. Robert Harbaugh (University of Pennsylvania), and Dr. Steve Lownie (Western University).
- For the 11th 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.



▲ Visiting professor Dr. Ben Warf from Harvard Medical School celebrates with graduating neurosurgery residents Dr. Daniel Yavin and Dr. Michael Tso.

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 17 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 peerreviewed 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.

Neurosurgery prepares for CBD and a culture shift in learning

THE WAY THAT RESIDENTS COMPLETE their years of training is changing in Canada—and the section of neurosurgery is preparing to be the first in DCNS to adopt the new Competency By Design program in July 2019.

Competency By Design, or CBD, is being instituted by the Royal College of Physicians and Surgeons of Canada and replaces the current system of In Training Evaluation Reports (ITERs) that measure the progress of residents. Instead, more frequent but less time-intensive Entrustable Professional Activities (EPAs) will guide learners as they progress through the program, says Dr. Brad Jacobs, who chairs the neurosurgery competency committee.

Dr. Jacobs says the CBD program will start next

year with only the incoming PGY1 residents. Current residents are grandfathered into the old ITER system.

"Our plan for academic year 2019-20 is to do it with just those first two residents to see how it works—and work out the inevitable kinks."

Whether existing residents will be added to CBD—or allowed to progress through the old system—has not yet been decided.

The whole evaluation process, says Dr. Jacobs, is going to be bit of a culture shift for the surgeons.

"We all inherently think change is bad and I'm the first person to say that. But I really think that ultimately it's going to be a good thing and it's going to make us more aware of resident education on a day-to-day basis."

The current system, he says, requires infrequent but high-stakes evaluations to be completed by faculty members at the end of a three-month rotation.

With CBD, instead of ITERs three or four times a year, every resident could potentially be doing an EPA twice a day. And each mini-evaluation "Let's face it, in neurosurgery and all of medicine—everyone's a high achiever. No one's ever failed an exam in their life. And then the resident is going to do an EPA and they're going to get a '2'."

– Dr. Brad Jacobs

is repeated multiple times as they evolve from novice trainee to senior resident.



The fact that EPAs are designed to track progression, instead of measuring success at the end, may catch residents off guard.

"Let's face it, in neurosurgery and all of medicine everyone's a high achiever," he says.

Dr. Brad Jacobs

"No one's ever failed an exam in their life. And then the

resident is going to do an EPA and they're going to get a '2'." In the EPA-world, a '2' means I had to talk the resident through it.

"But you're supposed to get '2'. You're not supposed to be in your first year and be able to do everything in neurosurgery!"

Those EPAs must be driven by residents, who have to gain competency in 61 unique "activities" (many multiple times each) over their six-year journey. And though not every case or procedure will lead to an EPA, Dr. Jacobs expects surgeons may be asked once a day to do an EPA on a resident.

CONTINUED FROM PAGE 41

"A resident may say, 'I want to do an EPA on lumbar microdiscectomy'."

After the procedure and brief discussion, a score from a 1 to a 5 is entered into the Royal College Web app by the surgeon on their phone, tablet or PC—and brief discussion follows.

"I think it will really add to the teachable moment for residents—and help identify residents that need more guidance early on."



Program Director Dr. Jay Riva-Cambrin

'Competence' is defined by the program as getting a 4 or 5, but the EPAs don't stop once you reach that threshold. Each EPA must be completed five or six times—so the EPA total over the course of six years is going to add up. Dr. Jacobs is heading the Competency Committee, which also includes program director Dr. Jay Riva-Cambrin, and is responsible for all aspects of Competency By Design.

"The Competency Committee says 'yes, this resident has met the competency criteria' and then sends that back to the residency training committee, chaired by the program director," says Dr. Jacobs. Ultimately, the residency program director decides if the resident is ready to progress to the next level.

It's a lot to absorb, for both faculty and trainees, but Dr. Jacobs doesn't expect CBD will have a major impact on the vast majority of residents.

"The residents, by the time they start our program, are really highly screened and they're by and large excellent individuals from an academic intelligence perspective and interpersonal skill perspective," he says.

"For a lot of them, we're just basically guiding them down a path with nudges and pushes along the way."

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 lead 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

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 2018, there were about 3,000 patients followed in the adult hydrocephalus clinic. There were approximately 1,500 outpatient assessments and 180 surgical procedures performed.

Highlights

- Dr. Hamilton is the Chair for the Adult Hydrocephalus Clinical Research Network (AHCRN), which has two centres in Canada, five in the United States and one in England. AHCRN has enrolled 1,200 patients in 36 months and has starting a clinical trial for patients with normal pressure hydrocephalus (www.AHCRN. org).
- Dr. Hamilton is a board member and president-elect of the International Society for Hydrocephalus and Cerebrospinal Fluid disorders (www.ISHCSF.com).
- Dr. Hamilton is a member of the board of directors of the Hydrocephalus Association and the medical advisory board of the Hydrocephalus Association (www.hydroassoc.org).

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

Education

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

Research

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

Members

Neurosurgeons: Dr. Mark Hamilton,

Dr. Clare Gallagher, Dr. Walter Hader

- Medical and Surgical Assistant: Dr. Geberth Urbaneja
- Neuro-ophthalmologists: Dr. Fiona Costello, Dr. Suresh Subramaniam
- Geriatrician: Dr. David Hogan

Nurse Practitioner: Ron Prince, Patti Long

Research Coordinator: Jarred Dronyk

Image-Guided Medical Robotics Program

Program Lead: Dr. Garnette Sutherland

Overview

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 marked the 20th anniversary of this technology, which is now adopted internationally. At the Foothills Medical Centre, together with the original 1.5T iMRI system, over 2,200 patients have benefited 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 75 international sites, with over 24,000 patients benefiting.

Into this environment we have integrated neuroArm, the world's first image-guided, MRcompatible robot, also developed by Dr. Sutherland and team in collaboration with MacDonald, Dettwiler and Associates (MDA). Following the development and FDA approval (stereotaxy) of SYMBIS, Dr. Sutherland's team is rapidly solidifying the development of third generation neuroArm, called *neuroArmPLUS* (CellArm). The system will be a compact, economical and efficient robot for whole body application, with the ability and potential to move robotic procedures from highly specialized tertiary care hospitals to smaller community centres worldwide. Through inclusion of augmented vision, haptics, acoustics and machine learning, this ambitious and disruptive venture is poised to transform surgery from organ to *cellular* level.

This University of Calgary Office of the Vice President Research-endorsed initiative has allowed the team to already raise ~\$1.2M in donations and grants. Dr. Sanju Lama, Clinical Integration for neuroArm Technologies, who oversees the project and liaises with the University Development team, has been helping Dr. Sutherland also consolidate a multi-national joint venture with parties in Shenzhen, China. Indeed, a decade since neuroArm was first used in a young Calgarian in May 2008 at the Foothills Medical Centre, the next few years will see the team readying the next generation robotic technology neuroArmPLUS for surgical suites worldwide.

Project Highlights

SmartForceps Technology: The technology, a forcesensing surgical bipolar forceps, not only allows measurement and guantification of tool-tissue interaction forces, but also, through recent discrimination analysis, is able to classify surgeons based on their skill level and experience. Following publication in JAMA Surgery (March 2018), and with recent funding support for commercialization from the Alberta-Germany Collaboration Fund (GCCIR 2017) and the CIHR, the team is well on its way towards completing the software platform/ Intelligent Module. In addition to Bissinger GmbH. a German manufacturer of bipolar forceps, the team has recently contracted a Calgary-based tech group (Quadrus Development Inc.) for an intuitive and immersive user interface v1.0. First clinical application will gather continuous-prospective data towards creation of the Intelligent Module-a machine learning paradigm capable of smart display, automated quantification and analyses of force data, together with a force error warning system.

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. With a patent filed and manuscripts under submission, the team is finalizing design blueprints towards manufacturing. This novel device will form the unique human-machine interface for microsurgery in the evolving neuroArmPLUS surgical robot. Lead engineer Hamidreza Hoshyarmanesh, neurosurgery resident Dr. Madeleine de Lotbiniere-Bassett and visiting vascular surgeon from S. Korea Dr. Seok Keun Choi have been completing a series of surgeon evaluation of the technology for validation and streamlined translation to clinical domain.

Molecular Neuroscience-Brain Tumour and Trauma: The patent generated from Dr. Lama's PhD work in collaboration with NRC Ottawa was granted in November 2018! Dr. Dustin Proctor, who leads the molecular neuroscience arm of the project, has made an interesting discovery of novel immune-check point proteins in meningioma and macrophage expression. The work has produced multiple high impact publications



▲ Dr. Garnette Sutherland and Project neuroArm host Her Excellency the Right Honourable Julie Payette, Governor General of Canada.

(Oncolmmunology 2018), grant applications and new intellectual property. Support from all staff neurosurgeons at the Foothills Medical Centre has been most valuable!

Computer Science/Simulation: Project neuroArm hosts multiple commercially available and inhouse surgical simulators used for educating resident surgeons and medical students. Working with Sonny Chan (Assistant Professor Computer Science), neurosurgery chief resident Dr. Andrew Ryu continues to innovate on surgical simulation for spine and skull base surgery, including designingdeveloping the app *Cranium4D* (with Justina Lem and Arthur Volpato Batista) for young residents to enhance surgical training and education.

Robot-Assisted Space Telemetry (RAST): Since the first grant by the University of Calgary's New Earth-Space Technologies (NEST), Dr. Sutherland and collaborators at the University of Manitoba have successfully completed the development of an

emulator to account for variable real time delay from Earth to the International Space Station (ISS). With surgeon testing of the emulator underway, the team is also developing an immersive and robust workstation control system for performing robotassisted surgical tasks on the ISS.

Recognition

In May 2018, Project neuroArm was most honoured to host *Her Excellency the Right Honourable Julie Payette, Governor General of Canada*, together with Chancellor Emeritus Bob Thirsk. Enquiring and learning about various aspects of robot-assisted surgery such as increased patient safety, simulation for training/education, interplanetary application for astronaut health etc., Her Excellency also emphasized the potential for health care delivery to remote Canadian destinations, e.g. the Northwest Territories.

CONTINUED FROM PAGE 45

Education

In March 2018, with University of Calgary Chancellor Emeritus Bob Thirsk, Dr. Sutherland was hosted by the Toronto Ismaili community. He shared his clinical and innovative research and how it may affect the health of our communities, including space exploration. Other highlights included: lectureships in science and innovation in the Chinese cities of Hefei, Guangzhou and Shenzhen, China; Creative Destruction Lab Rockies Dinner Lecture; the Calgary Tesla Society; and the Weekend Robotics Course at the CNS annual meeting in Houston.

Members

(Active collaborators and students/trainees)

Engineering: Hamidreza Hoshyarmanesh (Chief Engineer), Amir Baghdadi (Eyes High post-doc scholar), Mojtaba Esfandiari, Starr Tze (Chief Consultant), Chris Macnab, Qiao Sun, Yaoping Hu, Salvatore Federico, Mahdi Tavakoli, Ekram Hossein, Kazi Ishfaq Ahmed, Rachael L'Orsa, Mitchell Bashnick, Don Peterson, Renate Ng, Mitchell Park, Hooman Khosravi

Science: Dustin Proctor, Sonny Chan, Kowther Hassan, Desmond Larsen-Rosner,Justina Lem, Arthur Volpato Batista, Zeel Patel, Corrina Fowlow, Jordan Huang, Shanshan Wang, Boguslaw Tomanek, Mehdi Arbabi, Frank van Veggel, Michael Colicos, Matthias Amrein, Guido van Marle

Medicine: Andrew Ryu, Justin Liu, Madeleine de Lotbiniere-Bassett, Fang Wei Yang, Andrea Becking, Melissa Nielsen, Joseph Dort, Francis Sutherland, Andrew Kirkpatrick, Paul McBeth, Fangwei Yang, Seok Keun Choi, Phil Park, Sanju Lama, Garnette Sutherland

Administrative Support: Miwa Shibuya

Industrial Partners: MDA (Brampton, Ont.); Deerfield-IMRIS (Minnetonka, Minn.); Medtronic (Minneapolis); Stryker Corporation (Kalamazoo, Mich.); Bissinger GmbH (Teningen, Germany); Quadrus Dev. Inc, (Calgary); OrbSurgical Ltd. (Calgary)

Institutional Partners: National Research Council, Canadian Space Agency, University of Manitoba, University of Alberta, University of Victoria, Queen's University, University of Vienna, Hokkaido University School of Medicine

Neuromodulation Program

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,



Dr. Zelma Kiss

headache, and spasticity. Specialists from DCNS and other departments are part of the program.

Clinical Care

Unfortunately most of this year involved discussions with management about pathways-ofcare, waitlists, and budgets. We were stopped from implanting new patients because we were overbudget half-way through the year. We then had to explain to patients that they had to wait until the new fiscal year. Despite our successful deep brain stimulation (DBS) for treatment-resistant depression study, achieving an approximate 50 per cent response rate, we are no longer allowed to implant patients with this indication, unless the Department of Psychiatry pays for the implants.

Dr. Veronica Bruno joined the movement disorders program and her focus is on DBS clinically and scientifically. We implanted only nine new patients with bilateral systems, and follow about 150 people in total. The pain program has been assessing about two to three new patients a month, trialing one to two and implanting one new patient a month. We follow about 70 patients with implanted neuromodulation systems for pain. Ongoing physician availability issues have reduced the interest in stimulation for headache in Calgary.

Education

There is ongoing interest in neuromodulation by trainees at fellowship, graduate and summer student levels. Drs. Darren Clark and Elliot Brown, both AIHS fellows, remained with the DBS for a depression study. Dr. Nick Strzalkowski completed his Eyes

Program Lead: Dr. Zelma Kiss

High and Parkinson Foundation fellowships, moving on to a faculty position in Juy 2018. Dr. Sohail Noor defended his PhD and received a post-doc at Case Western with the Neural Prosthesis group. Rachel Sondergaard and Linda Kim continued in their PhD programs studying mechanisms and new targets of DBS in humans and animal models. We are looking forward to helping train a neurologist fellow in movement disorders and a resident in pain medicine this coming year. The Neuromodulation program funded several summer students from Dalhousie, MRU, Queens, and UofC, in addition to an international MITACS summer student from Mexico. We hosted visiting speakers from University of Pittsburgh (Dr. Rob Gaunt 13-Oct-17), University College London (Dr. Rob Brownstone 3-Nov-17), and Brown University (Dr. David Brandman, 23-Feb-18).

Research

We published a systematic review on DBS for dystonia in Parkinsonism and Related Disorders, another one on DBS for depression in Frontiers in Psychiatry, as well as a group publication on this topic in the Journal of Neurology, Neurosurgery and Psychiatry. There are several papers on DBS for depression in progress and our results were presented at several meetings. We studied patients with stimulators for both pain and movement disorders to develop a new psychometric questionnaire for reporting of somatosensory percepts in the Journal of Neural Engineering.

Trainees presented posters at the International Neuroethics Society meeting—winning a travel award— and the Neural Interfaces conference, with another travel award. Preliminary data about using transcranial magnetic stimulation to alter cerebellothalamic circuits in Parkinson's patients with DBS was presented at the Parkinson Foundation annual meeting.

In collaboration with engineering, we continued to develop new technologies to study how DBS works in animal models and we presented at the International Society for Optics and Photonics conference. Trainees presented posters at the Society for Biological Psychiatry, Federation of European Neuroscience Societies, and the European Neuropsychopharmacology meeting on the imaging biomarkers of response to DBS for depression. Collaborators from University of Alberta presented at Human Brain Mapping. Dr. Kiss received a grant to study the cost effectiveness of movement disorder surgery by MR-guided focused ultrasound and deep brain stimulation (DBS). She was named Deputy Editor for Brain Stimulation, the preeminent journal in the field (impact factor 6).

Future Directions

In the coming year we hope to have our budgets stabilized and develop other creative methods to assure funding for our patients. We look forward to working with Dr. Aaron Phillips, a new physiologist in the Libin and HBI, interested in spinal cord stimulation for spinal cord injury autonomic dysfunction, and hosting professors from Lausanne who are leading the international efforts in this field.

Members

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

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

Neurovascular Program

Program Lead: Dr. John Wong

Overview

The Neurovascular Program is a collaborative effort of specialists and Allied Health staff from multiple disciplines to combat stroke and neurovascular disease. Many patients are treated in a single day using minimally invasive endovascular approaches. Expertise is maintained in the provision of open cerebrovascular neurosurgery to Albertans. In conjunction with our internationally recognized Calgary Stroke Program, the Neurovascular Program has become an important partner in stroke care and research.

Highlights

We were fortunate to recruit Dr. Mohammed Almekhlafi to the program as one of the country's first interventional neurologists. He will aid in the clinical service, education, and research—especially related to that of ischemic stroke. We have seen continued growth in the number of procedures. especially mechanical stroke thrombectomy, and now about 350 patients are treated annually via minimally invasive endovascular means such as aneurysm coiling, vascular malformation embolization, carotid stenting and endovascular stroke treatment. An integrated relationship with the Alberta Radiosurgery Centre has allowed the noninvasive 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. Approximately 700 patients with neurovascular disease were seen in the past year in our specialized outpatient clinic for evaluation and follow-up.

Education

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

Research

Academic initiatives have centered upon Dr. Alim Mitha's biomedical engineering laboratory for developing new intravascular devices for brain aneurysm therapy. Our annual fundraiser, Bowling for Brains, continues to attract community attention for brain aneurysm awareness and research. We continue to participate with the Calgary Stroke Program in multiple clinical research projects.

Members

Dr. John Wong, Dr. Alim Mitha, Dr. Garnette Sutherland, Dr. William Morrish, Dr. Mayank Goyal, Dr. Muneer Eesa, Dr. Mohammed Almekhlafi Nursing: Michelle Gillies, Leslie Zimmel Fellow: Dr. Saad Al-Qahtani

Pediatric Neurosurgery Program

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 is an active participant in the Quality Assurance prospective database in addition to the multicentre 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 electrodiagnostic services. Our program focuses on the diagnosis and non-operative and surgical treatment of a variety of peripheral nerve problems including complex peripheral nerve injuries, nerve tumours, brachial plexus surgery and advanced nerve repair, and nerve transfer techniques. Our goal is to minimize pain and to maximize function, providing a better quality of life for patients with these disabling disorders.

Highlights

The Multidisciplinary Peripheral Nerve Clinic is seeing more patients with spinal cord injuries, offering nerve transfer procedures to improve function. We published a peer reviewed paper on two patients with these innovative procedures this past year.

Research

Research is an important aspect of the Peripheral Nerve Program. Dr. Midha runs an independent CIHR-funded basic science research laboratory, in association with the Hotchkiss Brain Institute, investigating various facets of peripheral nerve regeneration and repair. For more information on these research initiatives, visit www.hbi.ucalgary.ca.

Education

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

Dr. Mustafa Nadi (2015-6)

- Dr. Sudheesh Ramachandran (2016-17)
- 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. Brett Byers, Dr. Kate Elzinga, Dr. Justin Yeung Physiotherapy: Margaret Hass Intraoperative Electrophysiology Support: Jamie Johnston, Joy Boldt, Michael Rigby, Erin Mercer

Program Lead: Dr. Walter Hader

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.

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.

Research

Current research directions are focused on costeffectiveness, 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.

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 longterm 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 convectionenhanced 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

Interim Section Head: Dr. Christine McGovern

THE SECTION OF PM&R HAS 34 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

We had many new members join the section, allowing us to provide more care to patients in hospital as well as within the community.

We started provincewide Physiatry Rounds, with monthly presentations originating from Calgary and Edmonton and shared by telehealth at both sites, as a provincial collaboration between the Universities of Calgary and Alberta.

We ran a series of multidisciplinary simulation training scenarios on our inpatient tertiary neurorehabilitation unit as a mechanism of increasing confidence and competence in clinical scenarios that can arise. This was a very successful pilot that was organized with the assistance of the simulation unit at the University of Calgary. It involved physicians, residents, nurses, Allied Health, and administrative staff. It arose out of some potential scenarios raised at our Quality of Care Committee, and was so successful that more simulation training events are being planned to address further scenarios.



We co-hosted the Canadian Physical Medicine and Rehabilitation annual conference in Whitehorse along with the University of British Columbia and the University of Alberta.

Recruitments and Leadership

Dr. Elizabeth Condliffe joined the section as a clinical researcher. She works at the Alberta Children's Hospital and her research is predominantly focused on individuals with cerebral palsy.

Dr. George Francis joined the section. He has fellowship training in cancer rehabilitation and is working in conjunction with the Tom Baker Cancer Centre to provide service and build programming in this area.



Dr. Stephanie Plamondon talks with media about the music therapy program at Foothills Medical Centre in March 2018.

Dr. Rebecca Charbonneau joined the section and is working in the spinal cord injury rehabilitation program.

Dr. Paul Reglin started practice in the community following his residency completion, predominantly focusing on providing musculoskeletal care.

Dr. Dave Nabeta started practice in the community following his residency completion, predominantly focusing on providing musculoskeletal care.

Dr. Chris Grant was voted president of the Alberta Physiatrists' Association. He is also co-chair of the Neurosciences Area Council for the Connect Care project that is being developed within Alberta Health Services.

Dr. Maryana Apel retired from clinical practice.

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 (Drs. David Langelier and Andrew Malawski) 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 related to rehabilitation of individuals with stroke, spinal cord injury, brain injury, and cerebral palsy is ongoing. We were approved to have a spasticity fellowship take place in Calgary in the coming year.

Research in areas related to stroke, acquired brain injury, spinal cord injury and burn care continued.

Clinical Care

Simulation scenarios were developed and piloted on our inpatient neurorehabilitation unit to enhance safety of care on the unit, with further scenarios being developed to improve quality of care. 54 Physical Medicine & Rehabilitation Department of Clinical Neurosciences 2017-2018

Dr. Lee Burkholder and the physiatrists at ACH work to build health and life skills in their patients.

Smoothing the transition to an adult world

Dr. Lee Burkholder and the physiatrists at Alberta Children's hospital are planning ahead with patients and families

FOR CHILDREN FACING NEUROLOGICAL

or musculoskeletal challenges, Alberta Children's Hospital (ACH) is an incredible hub of health care professionals working hand in hand with patients and their families to improve their lives.

Physical Medicine and Rehabilitation physicians work side by side with neurologists, neurosurgeons, psychiatrists, nurses, social workers and a multitude of other professionals to deliver care that is patient and family-centred.

The challenge, says Dr. Lee Burkholder, arises when patients must transition their health care into the adult world.

Historically, this transition occurs at the age of 18, and it can be a challenging process for patients. Over the course of a year, their entire world is turned upside down, he says.

"They tend to leave the school that they've known forever. All their physicians change over. All the community-based services change over in terms of home care or family support for children ... and you're introduced to these new programs like Persons with Developmental Disabilities, adult home care, AISH."

Dr. Burkholder, along with fellow physiatrists Dr. Vithya Gnanakumar, Dr. Janet Tapper and Dr. Elizabeth Condliffe, have been working to smooth the transition by collaborating with patients and families to plan for their adult needs and build a foundation for their future care.

"It is such a huge undertaking because, once you turn 18, most of these families go from single-site comprehensive management to the intricacies of that adult world," says Dr. Burkholder.

Instead of a dedicated health care team that sees them at ACH, patients must now book individual

appointments and travel around Calgary to be seen at various specialist clinics.

"The Adolescent Transition Clinic started two to three years ago—an interdisciplinary clinic including one of our physiatrists, occupational therapy, social work, neuropsychology, and nursing as well as consultative physiotherapy if needed."

The key, he says, has been starting early and slowly chipping away at the obstacles. Instead of beginning the transition at 18, they're now starting at 14—or even 12 in some cases.

Each year the Adolescent Transition Clinic has been dropping the age at which youth are introduced to the clinic, he says, and the objectives reach far beyond the healthcare needs of teens. At "Camp Independence", for example, youth between the ages of 14 and 19 spend five full days, assisted by therapists and nurses, learning life skills they will need in the adult world.

"They will go downtown to the Youth Employment Centre to learn about creating a resume and looking for a job. They will also work with Calgary Transit with regards to not only getting on and off the bus or the C-Train but also planning your trip."

Simple things like grocery shopping are critical for these teens who may have never been to a grocery store by themselves.

Dr. Burkholder, who credits the Vi Riddell Children's Pain and Rehabilitation Centre for its support of the Functional Independence Transition Program, hopes to expand the current training modules of community accessibility and food preparation to include medical self-management and adapted physical activity/recreation; skills that many teens take for granted.

CONTINUED FROM PAGE 55

This approach, he says, recognizes that rehabilitation for youth is very different than working with adults. They are learning new skills and building abilities that likely never existed before.

When an adult is recovering from a neurological condition, such as stroke or a traumatic injury, physiatrists focus on getting the patient "back to normal."

"When I did my adult Physiatry training, it was always that assumption that when we see patients with stroke, spinal cord injury or brain injury, they're coming from a point where they were healthy before something has occurred to them and then getting them back to where they used to be."

How can the patient be assisted in returning to work? What changes need to be made in the kitchen so they can cook for themselves? Can they drive if modifications are made to their vehicle?

With youth, however, many of those traditional rehabilitation benchmarks do not exist. They not only need to learn to drive with a disability, but also need to learn the basic skills to drive.

"A lot of it is trying to maximize development; maximize their potential as opposed to getting them back to a previous status."

Driving programs for an adult recovering from an injury rely on the 10 or 20 years of driving experience the patient has under their belt.

"Many of these kids have no experience controlling a vehicle at a fast speed. A lot of them have limited ability to ride a bicycle," he says.

The answer was a modern computerized driving simulator, based at the Sheldon Chumir Community Accessible Rehabilitation site. Learning to drive, a milestone for any teen, is now an achievable life skill that will benefit them as they transition to adulthood.

"Several of these youth do not have a lot those prerequisite experiences, thus they need a protected environment to build these experiences and then troubleshoot whatever problems or limitations they have."



"A lot of it is trying to maximize development; maximize their potential as opposed to getting them back to a previous status."

– Dr. Lee Burkholder

Physiatry resident embraces being a 'lifetime student'

IF YOU ASK PGY1 RESIDENT Dr. Lauren Capozzi how she came to the Physical Medical and Rehabilitation program, be prepared to take a seat.

It's a long, empowering story of dedication and perseverance—and explains why the physiatry trainee approaches things from a slightly different perspective.

After completing two undergraduate degrees at the University of Alberta and not getting into medical school, many students might have given up. Instead, the future Killam, Vanier and Alberta Innovates scholar moved to Calgary to be a research assistant with Dr. Nicole Culos-Reed and completed a PhD in kinesiology.

"Yes, I'm a lifetime student," she jokes. "My husband says, 'you need to get a job one day!' "

While completing her PhD under Dr. Culos-Reed, she was accepted into the Leaders in Medicine Program and fulfilled her dream of becoming an MD.

Medical school was a silver lining, says Dr. Capozzi, after losing her father to cancer when she was a teenager. "He had a fantastic team of physicians around him as he was going through his treatments. But there was no one there helping him with the thing that mattered most to him—which was his function."

That desire to help patients—especially cancer patients—through movement and rehabilitation is evident in many of her achievements.

"I really knew I wanted a career that could tie cancer survivorship and rehabilitation together because I had personally watched this person who was so important to me struggle with this at the end of his life," she says.

Dr. Capozzi, who's also an exercise physiologist, helped establish a student-run fitness centre for cancer survivors, the Thrive Centre, and co-founded Thrive Health Services, which delivers training and workshops for health care and fitness professionals who work with cancer survivors.



Dr. Lauren Capozzi

Neurosciences, Dr. Capozzi's PhD defense panel included an external examiner by the name of Dr. Chester Ho, who told her "you have to consider physiatry!"

"I don't think I ever looked back," she says. "I went through med school and I knew I wanted to do physiatry and Calgary had become home and the program was fantastic here."

After 15 years of post-secondary education, the Canadian Resident Matching Service became the next hurdle to overcome. "It was my No. 1 goal to stay here and do physiatry so it was an incredible day on March 1st this past year when I matched to the program."

Dr. Ho has continued to be a mentor, she says, along recent PM&R graduate Dr. David Langelier, and Dr. George Francis, who is building a cancer rehab program in Calgary. "I aspire to be a lifelong learner and I've been lucky to have fantastic mentors throughout the different layers of my training," she says.

Fortunately for the Department of Clinical

"I'm already looking at fellowship opportunities..."

The Amputee Rehabilitation Program

Program Lead: Dr. Kenneth Lam

Overview

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



Dr. Kenneth Lam

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

Outpatient rehabilitation is organized through the Community Accessible Rehabilitation (CAR) Program. With close partnership with the CAR Program we have garnered expertise in managing complex amputees. We have started a new collaboration with our local plastic surgeons in looking at novel approach to neuroma treatment and targeted muscle reinnervation.

Education

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

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

Members

Dr. Kenneth Kui Sai Lam Dr. Gentson Leung

The Burn Rehabilitation Program

Program Lead: Dr. Vincent Gabriel

Overview

The Burn Rehabilitation program continues to increase inpatient volume 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.

The Calgary Brain Injury Program

Program Lead: Dr. Rodney Li Pi Shan

Overview

The Calgary Brain Injury Program (CBIP) 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.

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

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

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

 Sub-acute concussion education sessions delivered approximately every two weeks. This consists of symptom management advice in a group format to individuals affected by concussion within three months of injury. An early concussion education module for patients has been created: https://myhealth.alberta.ca/ learning/modules/Early-Concussion

- A Brain Injury Rehabilitation Clinic provides assessment and treatment by physiatrists. Social workers are also associated with the clinic.
- Liaising with the Community Accessible Rehabilitation (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 support learning by medical students, residents, graduate students, Allied Health students, and nursing students.

Grants and Research

The CBIP research program, led by Dr. Chantel Debert, allows residents, graduate students, and undergraduate students to participate in clinical and basic science research. Researchers lead and collaborate on grants funded by the Cumming School of Medicine, Hotchkiss Brain Institute (HBI), and the Canadian Institute of Health Research. We have a relationship with the Integrative Concussion Research Program. We are actively involved in the non-invasive neurostimulation (N3) initiative and the Brain and Mental Health Research Clinics, both HBI funded research initiatives. Multiple personnel in the Calgary Brain injury Program are also involved with the HBI TBI neuroteam.

Members

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

Alison Barnfather

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

Li Pi Shan, Dr. Chantel Debert, Dr. Christopher Grant, Dr. George Francis, Dr. Ranita Manocha Psychiatrist: Dr. Jeremy Quickfall

Clinic Social Workers: Valerie Bunz, Leianne Bouillet

Neuropsychologists: Dr. Stewart Longman, Dr. Amy Siegenthaler, Dr. Ashley Fischer

Administration Support: Kendra McDonald, Susan Morson, Ashley Derksen, Marj Moon, Shelby O'Connell, Charmaine McLean, Kristie Chow

Pediatric and Young Adult Rehabilitation Medicine Program

Program Lead: Dr. Lee Burkholder

Overview

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

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



Dr. Lee Burkholder

patients transitioning from pediatric care to the adult world.

Clinical Care Updates

The Pediatric Rehabilitation Medicine inpatient consultation service assessed and treated 59 children, many within the context of the ACH interdisciplinary neuro-rehabilitation team, while admitted to hospital. An additional 12 patients were followed during admission to the ACH Dr. Gordon Townsend School (GTS) Rehabilitation and Education Program for management of medical and rehabilitation issues. The program also provided 837 pediatric outpatient consultation and followup appointments through various ACH rehabilitation clinics. A further 297 outpatient appointments were attended by adult patients through the Young Adult Rehabilitation Clinic. The program continued as a primary contributor to the interdisciplinary ACH Spasticity Assessment Program (SAP), which provides comprehensive assessment and management recommendations to children with complex hypertonicity issues. The SAP assessed six children for possible neurosurgical tone management with intrathecal baclofen via

pump implant or selective dorsal rhizotomy. Gait analysis, collaborative with Orthopedic Surgery, Physiotherapy and Orthotics, for recommendation of therapeutic interventions continued through the C.H. Riddell Movement Assessment Centre at the ACH with 37 patients undergoing evaluation.

Education

Program educational pursuits were related to postgraduate medical education as well as research training for undergraduate and graduate students participating in program-led projects. The program had five medical post-graduate trainees, including PM&R and Developmental Pediatric residents, on service for 12 of 13 academic blocks. Dr. Condliffe provided mentorship and academic supervision for one MSc (Kinesiology) graduate student as well as four undergraduate students participating in rehabilitation-focused research projects.

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 Pediatric Neurology Residency Training Committee.

Research

Research endeavours comprised of site leadership for numerous multicentre research studies, including two that are CIHR-funded, as well as planning for a purpose-built, on-site research laboratory to support Dr. Condliffe's research program, which is scheduled to open in spring 2019. Dr. Condliffe is a co-investigator, Calgary site lead for three current studies—one examining fatigue in children with cerebral palsy and the remaining studying early intensive exercise for children suffering perinatal stroke and encephalopathy of prematurity. Dr. Gnanakumar is the Calgary site lead for a clinical study focused on optimizing the management of pain and irritability in children with severe neurological impairments. Dr. Burkholder is a Calgary site co-lead for the Canadian Cerebral Palsy Registry.

Members

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

PM&R Musculoskeletal and Chronic Pain Programs

Program Lead: Dr. Noorshina Virani

Musculoskeletal (MSK) Program

Musculoskeletal Physiatry continues to grow in Calgary. We welcomed Dr. Andrew Malawski, who has interests in general PMR, MSK and electrodiagnostic medicine, as well as ultrasound guided interventions. Dr. Malawski graduated from residency at the Cumming School of Medicine and has joined the expanding community practice at Kinesis Medical Centre.

We also welcome to Calgary Dr. Ranita Manocha, who completed her PMR residency at University of Western Ontario. As part of her residency, in the Clinician Investigator Program, Dr. Manocha completed an MSc in Medical Biophysics at the Hand and Upper Limb Centre at St. Joseph's hospital. She has recently started a Bracing Clinic at the Foothills Medical Centre.



Dr. Noorshina Virani

focusing on complex upper and lower extremity bracing needs.

Additionally, Dr. Maryana Apel has retired this year after 20 years in community practice; continuing to do some part-time, non-insured work to fulfill her retirement.

Four physiatrists from Kinesis Medical Centre continue to provide non-surgical neuromusculoskeletal expertise to the FMC Spine Triage Assessment Clinic. This joint venture with neurosurgery has a wait list of approximately six to 12 months.

Research

Motyka P, Chiu D, Dukelow S, Huang C, Laplante L, Tulsi V, Raugust J. Prevalence of musculoskeletal disorders in patients referred for electrodiagnostic studies: a prospective observational study. Canadian Association of Physical Medicine and Rehabilitation 66nd Annual Scientific Meeting. May 29-June 2, 2018. Poster Presentation.

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, TX. May 17-20, 2017. Arthritis Rheum. 2017;69:S4.

Education

Several learners, locally and from abroad, including medical students, residents and graduate physicians are eager to participate in clinical educational opportunities through the AHS Chronic Pain Centre, Kinesis Medical Centre and through Interventional Physiatry with Dr. Arun Gupta's Regenerative Medical Centre at EFW Radiology.

Kinesis has expanded those opportunities to including residents from Rheumatology and Geriatrics in addition to Family Medicine (18) and PMR (6), as well as 11 medical students.

Raugust J. Pediatric Sports Medicine. Canadian Physical Therapy Association. December 1, 2017. Online Podium Presentation.

Tulsi V. Neck Pain: Approach for the Family Doctor. 42nd Annual Family Practice and Update Course. University of Calgary. November 2017. Podium Presentation.

Chronic Pain Program

There are three streams of patient delivery at the AHS Chronic Pain Centre (AHS CPC) in Calgary, including the neuromusculoskeletal (NMSK), pelvic and headache teams. Currently 787 patients are on the NMSK wait list as of Sept. 26, 2018. An additional 144 patients are on the pelvic and headache team waitlists. NMSK physicians assessed 566 new patients in the reporting period, while pelvic and headache teams assessed 123 and 122 new patients respectively. Average wait time until the first patient-physician visit to the NMSK team is approximately 20 months. The wait times for patients to see a physician on the pelvic team is 7.3 months and on the headache team is 14.6 months. This does not include visits to lectures, groups or other Allied Health providers, which may occur prior to the first physician visit.

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The CPC is a mandatory rotation for Family Medicine and Physiatry residents. Additional learners may include Psychiatry residents, medical students (local and interprovincial), as well as CME observers, (graduate family physicians) and foreign trained graduates.

Members

AHS Chronic Pain Centre (AHS CPC): Dr. Nwamara Dike, Dr. Noorshina Virani Performing Arts Medicine (PAM): Dr. Arun Gupta

Community Practitioners:

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

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 nontraumatic SCI for southern Alberta, eastern British Columbia and western Saskatchewan.

There were 403 physician patient visits, 145 physician patient phone call follow ups, 105 nurse or nurse practitioner followup visits, and 96 nurse or nurse practitioner phone call followup visits (for a total of 753 patient encounters) from July 1, 2017 to June 30, 2018.



Dr. Denise Hill

Highlights

The SCI program admitted 70 persons for acute inpatient rehabilitation on Unit 58 between July 1, 2017 and June 30, 2018. Outpatient rehabilitation clinics for people with spinal cord injuries were conducted year round—by both physiatrists and the SCI rehab nurse practitioner, Raj Parmar.

The diaphragm pacer system continues to operate at the Foothills Medical Centre. Diaphragm pacing is facilitated by a collaborative team, with pulmonology, respiratory therapy, thoracic surgery and physiatry. Patients are able to be off the ventilator for improved quality of life. This also has potential to translate into improved cost benefits for the health care system. The exoskeleton research study that was initiated in 2016 is complete. The main outcome was to measure the safety and feasibility of its use for gait training shortly after an acute spinal cord injury. Qualitative interviews were also conducted to capture patient-reported outcomes. Data analysis is complete and a manuscript is expected to be ready for submission for publication by early 2019.

Results of this research were presented at the Academy for Spinal Cord Injury Professionals (ASCIP) conference in Denver in September 2017. The study continues to be funded by the Alberta Paraplegic Foundation, Calgary Health Trust, Cumming School of Medicine and Hotchkiss Brain Institute.

The provincial SCI registry initiative entered its fourth year in 2018. The main achievements of this project include the development and pilot testing of a patient-reported tool for spasticity called the Spas-Q, the collection of information on nontraumatic SCI patients during the rehabilitation phase, the development, validation and refinement of an algorithm to leverage administrative data, and a redesign of long-term community followup (CFU) for persons with SCI.

The algorithm work and the Spas-Q initiative resulted in two poster presentations at the Academy for Spinal Cord Injury Professionals (ASCIP) conference in New Orleans in September 2018, while the development and implementation of the new CFU was presented at the SCI Canada



▲ Alex McEwan, who suffered a spinal cord injury in high school, gets a standing ovation from his teachers and peers as walks across the stage with the exoskeleton at the Jubilee Auditorium to receive his diploma in June 2018.

Conference in Niagara Falls, Ont., in November 2017 and at the Strategy for Patient Oriented Research (SPOR) Summer Institute in Calgary in May 2018.

The new CFU model sees our community partner organization, Spinal Cord Injury Alberta (SCI AB), completing the ongoing CFU for registry participants. This facilitates real time followup of concerns identified in the CFU and has resulted in positive feedback from patients, along with increased completion rates and retention.

Collaborations were strengthened with individuals and groups from Campus Alberta Neuroscience, Universities of Calgary, Edmonton and Toronto, Alberta Health Services, AHS Analytics, SCI AB, the Ward of the 21st Century, the SPOR support units, and the Brain and Mental Health Research Clinic.



Physiatrist Dr. Rebecca Charbonneau (left) attends a Spinal Cord Injury Alberta meeting with colleagues from Edmonton and patient advocates.

CONTINUED FROM PAGE 63

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. Work is underway to embed the registry into standard clinical care and to expand enrollment opportunities to all persons living with an SCI in Alberta. The registry will serve as a foundational platform to continue to track, evaluate and address patient outcomes and concerns moving forward.

A scoping review was conducted to understand international models of care for SCI. A health care utilization project was also conducted to leverage AHS administrative data to learn about the demographics and health care utilization and associated costs for persons with SCI in Alberta. This will all contribute to the work of the provincial network that is collaborating to develop and implement a model of care for SCI in our province. Jason Knox, Michelle Wallace, Tanya McFaul and Dr. Rebecca Charbonneau were awarded a provincial seed grant from the Alberta Paraplegic Foundation to look at standardized, best practice implementation of neurogenic bladder management 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. The learnings from this quality project can inform other SCI practices, including approach to standardizing best practice for neurogenic bowel and autonomic dysreflexia.

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 Early Supported Discharge (ESD), Community Accessible Rehabilitation (CAR), Association for Rehabilitation of the Brain Injured (ARBI), and other private rehabilitation providers. We accept referrals from across southern Alberta for patients who require stroke rehabilitation expertise.



Dr. Sean Dukelow

Highlights

We were fortunate this year to have Dr. Marcin Partyka, a recent graduate in Physical Medicine and Rehabilitation, come to our program to take on a fellowship in spasticity. Dr. Partyka is working with all of the physicians in the Stroke Rehabilitation Program and helping to enhance the care of those individuals with post-stroke spasticity. At the Fanning Centre, Dr. Leung and colleagues initiated a new pilot project examining return to driving after stroke. The project intends to foster more collaboration between the rehabilitation team members to lead to better outcomes with respect to driving post-stroke.

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 sessions.

Dr. Lam helped to co-ordinate participants in the Allied Health staff education day at Foothills Medical Centre in May 2018 where Dr. Gail Eskes from Dalhousie University spoke about cognitive challenges post-stroke. Clinicians from across the Calgary Zone shared highlights from their work in the Calgary Stroke Program.

Research

Members of the Stroke Rehabilitation Program published 12 papers last year. A number of trials are ongoing, including the CIHR-funded RESTORE trial examining robotic rehabilitation early after stroke, and the TMAT trial, which is investigating the use of transcranial magnetic stimulation and multi-modal aphasia therapy to improve post-stroke aphasia.

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 primary members distinguished by their PhD background.

In the past year we have been joined by a new assistant professor recruited from Stanford University, Dr. Hedwich Kuipers, and by the new director of the Hotchkiss Brain Institute (HBI), who relocated from the University of Ottawa, Dr. David Park.

We now have seven primary members in the division, a substantial growth. 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 codirects the MS NeuroTeam of HBI and he is the director of the Alberta MS Network. Dr. Yong was the president of the International Society of Neuroimmunology (2014-2016) and he continues to run the society's international schools. Dr. Yong's research interests have been guided by MS, spinal cord injury and malignant gliomas, and findings have been translated into clinical trials in these conditions These translational activities include a recent publication of minocycline in MS with neurology collaborator Dr. Luanne Metz (New Engl J Medicine 376:2122, 2017), and a recently funded CIHR grant with neuro-oncologists Drs. Paula de Robles and Gloria Roldan Urgoiti to test niacin (to restimulate compromised immunity) in glioblastoma. Dr. Yong's publications have been cited over 19,000 times (Web of Science, h index: 78). His research activities are supported by CIHR, the MS Society of Canada, and the Alberta Innovates - Health Solutions (AIHS) CRIO Team program. Dr. Yong is the recipient



of the 2017 Allyn Taylor International Prize in Medicine for "transformational discoveries in MS".

Dr. Minh Dang Nguyen received a CIHR Operating Grant (~\$987K for five years -2018-2023) to investigate the roles of the Alzheimer's disease predisposition factor CD2AP in cerebrovascular dysfunction. The project is being led by Dr. Milene Vandal, a CIHR postdoctoral fellow. Dr. Nguyen also successfully graduated one master candidate, Colin Gunn, whose thesis defense was described as "the best I have seen both at the Master and PhD levels (sic)" by his external committee member. Colin Gunn has been nominated for a Governor General's Gold Medal Award and for a Distinguished Thesis Award from the Western Association of Graduate Schools. He is now in medical school at the University of Western Ontario and does research during the summer.

- Dr. Shalina Ousman is an associate professor and a member of the MS and Spinal Cord/Nerve Injury and 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. Hu's Ambulosono research has been reported in Nature Parkinson's Disease and featured at the recent HBI Brain, Mind And Music Symposium where Ms. Renee Fleming and Dr. Hu were keynote speakers.
- 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 nonmedication 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.

Dr. Hedwich Kuipers is an assistant professor of neuroimmunology and joined the HBI MS NeuroTeam in April of 2018, holding a membership at the Snyder Institute for Chronic Diseases as well. Her research is aimed at understanding the interaction between immune cells entering the CNS and its resident cells. Her main focus is on astrocytes, whose role in neuroinflammation is often overlooked. She has shown before that these cells, which are highly abundant in the brain, can release factors that help T lymphocytes infiltrate into CNS tissue. She currently investigates how astrocytes interact with these T cells and how they shape their responses, using molecular and cell biology approaches, as well as animal models of MS. Dr. Kuipers's research has previously been supported by the Human Frontier Science Program, NIH and the National MS Society.

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.

Translational Program

STN is in a unique position to foster cutting edge translational neuroscience research. We are somewhat different from the basic science departments in that our program has a clear mandate to facilitate and integrate research and education 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, neuro-oncology and neurosurgery colleagues, has resulted in a successful Phase III clinical trial in MS, an ongoing Phase III trial in traumatic spinal cord injury, and a soon-to-start Phase I/IIa trial of niacin in glioblastoma. A \$5 million team grant from AIHS, led by one of our members and which includes several clinical colleagues, has enabled us to initiate and continue clinical trials of potential remyelinating therapies in MS.

READY FOR COMBAT

ASSISTANT PROFESSOR DR. HEDWICH KUIPERS

joined the Section of Translational Neurosciences in 2018 ready to attack MS research with a PhD from Leiden University in the Netherlands and postdoc training from Stanford. If that's not enough, she might have to resort to Brazilian jiu-jitsu.

The DCNS scientist came to Calgary after eight years in California studying, among other things, extracellular matrix components and how they may play a role in shaping immune responses in MS. The job posting, recalls Dr. Kuipers, grabbed her attention.

"They really wanted somebody to bridge immunology and neuroscience and that's what I've always done in my research."

Calgary, albeit with a few climate challenges versus the San Francisco Bay Area, has been a good move for Dr. Kuipers and her husband, Andrew Brainard.

"It's large enough that it has a lot of things good food, culture, the new library for example is amazing. But it's not too big that it's hard to get around. You can get anywhere in the city within 15-30 minutes."

Naturally, being a proud Dutch ex-pat, the bicycle is her preferred method of commuting. And she refuses to let Calgary's weather get in the way.

"I've always biked as a Dutch person. The moment you're born you're put on a bike there," she laughs.

"This summer we biked quite a bit—along the river through town. It's a great way to see the city."

Jiu-jitsu is a passion that Dr. Kuipers and her husband brought with them from California.

"It's what keeps me sane outside of work. And it's actually how I met my husband, too."

Her favourite form of martial arts, however, is as much mental as physical, she says.

"It's a very cerebral sport. You have to think during it a lot because it's all about leverage and pressure and momentum and things like that. That's why they sometimes call it 'three-dimensional chess'."

Instead of the traditional offensive and defensive roles in Japanese jiu-jitsu, which she also practiced for over 15 years, Dr. Kuipers says Brazilian jiu-jitsu is more about the process.

"It's not like one person is attacking and one's defending—both of you are trying to get to a better position," she says, noting the sport has parallels with her research.

"I think there are definitely similarities because in both of them you have to analyze the situation and you have to see the different elements of it."

It's methodical, she says, and each match requires a very different approach, depending on the opponent.

"Sometimes you have to make a move to make the other person make a move. I guess that's the same with experiments. You probe things and see what happens."

The other similarity, she notes, are the unpredictable outcomes.

"The one thing that I learned from jiu-jitsu—what I think also applies to science—is that you should never give up, because you never know what's going to happen.

"My first match I actually won in the last two seconds. I was behind in points and then at the last moment I reversed and scored more points on the other person, winning the match."

Visitors to Dr. Kuiper's soon-to-be-completed lab would be advised not to sneak up on the researcher!

> Dr. Hedwich Kuipers spars with husband and fellow jiu-jitsu fan Andy.

Department of Clinical Neurosciences 2017-2018

IN THE LAB

"The one thing that I learned from jiu-jitsu—what I think also applies to science—is that you should never give up, because you never know what's going to happen."

– Dr. Hedwich Kuipers

Undergraduate Medical Education in Clinical Neurosciences

Co-Chairs: Dr. Erika Dempsey and Dr. Philippe Couillard Evaluation Coordinator: Dr. Scott Jarvis Anatomy Coordinator: Heather Jamniczky PhD Course Coordinator: Kelsey O'Donnell

Overview

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

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

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

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

Course V Committee:

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




A Research Day winners Dr. Stefan Lang, centre, and Dr. Aravind Ganesh, right, with Dr. Rajiv Midha.

Resident Research Day

RESIDENT RESEARCH DAY, which was held on Nov. 24 last year, is celebrated within the Department of Clinical Neurosciences and is a highlight of our Grand Rounds calendar.

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

Abstracts from 21 residents were presented and the judges had their work cut out to decide the winners. For 2017, the J. Gregory Cairncross Award for Excellence in Clinical Research was awarded to Dr. Aravind Ganesh for his presentation "Consequences of further post-stroke disability in premorbidly disabled patients."

The Doug W. Zochodne Award for Excellence in Basic Science Research was won by Dr. Stefan Lang for his work "Dual Regression ICA reveals brain network connectivity is related to serum Alpha Synuclein Concentrations in Parkinson's Disease."

Congratulations to all who participated!

Neurology Residency Program

Program Director: Dr. Michael Yeung Program Administrator: Christopher Smith Number of positions per year: 3 Accreditation: Royal College of Physicians and Surgeons of Canada Length of Training: 5 years Mandatory Research Block: 3 months

The University of Calgary Adult Neurology Residency Training Program is dedicated to educating residents in Neurology. The program has trained over 50 neurologists since its inception in 1981 and these specialists practise neurology in community and academic institutions throughout the world. The program currently has 18 residents from across Canada.

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.



Dr. Michael Yeung

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.

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.

Physical Medicine and Rehabilitation (PM&R) Residency Program

Program Director: Dr. Gentson Leung Program Administrator: Selena Smith Number of positions per year: 2 Accreditation: Royal College of Physicians and Surgeons of Canada Length of Training: 5 years

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



Dr. Gentson Leung

physiatrists, and are excited to continue to improve upon the training we provide.

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

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

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

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

Further information about the PM&R Residency Training Program can be viewed at www.dcns.ca/ pmr-residency.



PMR residents celebrate the graduating PGY5s in June 2018.

Neurosurgery Residency Program

Program Director: Dr. Jay Riva-Cambrin Program Administrator: Patti Sullivan Number positions per year: 2 Accreditation: Royal College of Physicians and Surgeons of Canada Length of Training: 6 years Mandatory Research: 1 block in PGY1; entire PGY4 year or more

Education of our postgraduate and undergraduate students remains one of the highest priorities of DCNS and the Section of Neurosurgery. The teaching faculty consists of a large complement of dynamic key opinion leaders representing all subspecialties of neurosurgery, including vascular, interventional, intracranial lesions, skull base,



Dr. J. Riva-Cambrin

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.

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

A number of our residents continue to garner awards and scholarships for their outstanding clinical and academic endeavors in addition to a few celebrating engagements, marriages, and births.

- Dr. Albert Isaacs was awarded a three year Vanier Canada Graduate Scholarship and is involved in a unique inter-university (Wash U in St. Louis and the U of C) PhD program focused on post-hemorrhagic hydrocephalus.
- **Dr. Stefan Lang** was awarded a 2018 Junior Award at the International Congress of Parkinson's Disease and Movement Disorders and presented his paper at their annual meeting in Hong Kong.
- Dr. Candice Poon achieved a 2018 Adult Basis Research Abstract Award and will be presenting at the 23rd Annual Meeting of the Society for Neuro-Oncology in New Orleans.
- Dr. Andrew Ryu was recognized as one of Calgary's top 40 under 40 professionals and following graduation, will be heading to Chicago for a spine fellowship at Rush University in July, 2019.
- **Dr. Michael Yang** was awarded the CIHR Frederick Banting and Charles Best Canada Graduate Scholarship and achieved the best poster award in the Masters category for his project at the 2018 ACHRI and Dept. of Pediatrics Symposium.

Team relationships outside the hospital are of equal importance to the Section of Neurosurgery as they are within the hospital. The program offers a wellrounded 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. Alastair Buchan, a founder of the Calgary Stroke Program, reunited with fellows from around the globe at the World Stroke Congress in Montreal.

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

Research in Clinical Neurosciences

Overview

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

Many of the physicians and surgeons in Clinical Neurosciences are actively engaged in research, however some focus exclusively on patient care. The spirit of research and innovation are integral to our team and are continuously fostered. Members 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



Dr. Chantel Debert talks to the media about concussion biosensor research in June 2018.

current standards of care to determine which is superior.

- Health Services Research: The study of health care access and health care delivery to detect deficiencies and design improvements. Health services research often involves careful analysis of databases.
- **Population Health Research:** The study of disease in populations to find risk factors and design prevention methods.

Our research-focused doctors and scientists are also members of the Cumming School of Medicine, Alberta Health Services (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



Veronica Bruno



Jodie Burton



Kevin Busche



Greg Cairncross



Sameer Chhibber



Lara Cooke



Fiona Costello



Shelagh Coutts



Jeptha Davenport



Andrew Demchuk



Paula de Robles



Hamid Ebadi



Tom Feasby



Paolo Federico



William Fletcher

NEUROLOGY



Sarah Furtado



Chris Hahn



Alexandra Hanson



Michael Hill



Scott Jarvis



Colin Josephson



Ronak Kapadia



Brian Klassen



Gary Klein





Jagdeep Kohli



Lawrence Korngut



Scott Kraft



Elizabeth Leroux



Davide Martino



Bijoy Menon



Luanne Metz



William Murphy



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Steven Peters



Gerald Pfeffer



Neelan Pillay



Tamara Pringsheim



Justyna Sarna



Shaily Singh



Eric Smith



Peter Stys



Suresh Subramaniam



Chris White



Samuel Wiebe



Scott Wilson



Katie Wiltshire

NEUROSURGERY



Michael Yeung



David Cadotte



Steven Casha



Stephan du Plessis



Clare Gallagher

NEUROSURGERY



Mark Hamilton



Bradley Jacobs



John Kelly



Zelma Kiss



Rajiv Midha



Alim Mitha







Yves Starreveld



Garnette Sutherland



John Wong

PHYSICAL MEDICINE & REHABILITATION



Lee Burkholder



Rebecca Charbonneau



Darren Chiu



Elizabeth Condliffe



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Sean Dukelow



George Francis



Vincent Gabriel



Vithya Gnanakumar

PHYSICAL MEDICINE & REHABILITATION



Chris Grant



Arun Gupta



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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



Noorshina Virani

TRANSLATIONAL NEUROSCIENCE



Bin Hu



Hedwich Kuipers



Oury Monchi



Minh Dang Nguyen



Shalina Ousman



David Park



Boguslaw Tomanek



V. Wee Yong



Zonghang Zhao



Werner Becker



Keith Brownell



Manuel Hulliger



John Latter



Francis LeBlanc



Robert G. Lee



Terry Myles