

**HALIFAX
NEUROSURGERY**

**20
17**

ANNUAL REPORT



Dr. R.O. Holness

Neurosurgical Intermediate Care Unit



In recognition of his dedicated neurosurgical service to patients of Atlantic Canada (1977-2009)

his distinguished local and national leadership as
Professor and Head of Neurosurgery (1987-2000)

and his love of teaching countless students and residents

the Neurosurgical Intermediate Care Unit (IMCU) is dedicated in honor of

Renn O. Holness, BSc, MBBS (Hons), FRCSC, DSc (Honorary), OJ

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Message from the Head of Neurosurgery

DAVID B. CLARKE, MDCM, PhD, FRCSC, FACS

Welcome to the 2017 Division of Neurosurgery Annual Report - this past year has been an eventful one and we are happy to share some of the major milestones with you.

For many of us, the start of 2017 was saddened by the loss of our much-loved friend and colleague, Ginette Thibault-Halman – who passed away at 43 years old of cancer in early March. Ginette was an extraordinarily talented researcher and a wonderful colleague who contributed so much in her work with us. Her premature passing reminds us to treasure those around us - at work, at home and in our community.

Our year has also been marked by many triumphs. At the Halifax Infirmary, our fantastic 7.3 unit Health Services Manager, Fran Kelloway, supported by our superb Director, Randi Monroe, have recruited a wonderful group of new staff to our in-patient Neurosurgery unit. Over the past year, we have seen the tangible results of our multi-million dollar QEII Academic Neuroscience Program initiative – our new Neurosurgical Intermediate Care Unit (IMCU) has had a major positive impact on OR efficiencies, significantly reducing the frustrating task of cancelling a patient's scheduled surgery. In addition, the new IMCU has resulted in patients moving more efficiently from the Emergency Department and from the Intensive Care Unit (ICU). Our Academic Neuroscience Program funding has made possible the opening of our newly constructed Epilepsy Monitoring Unit (EMU), doubling our capacity to evaluate and treat people with drug-resistant epilepsy. In addition, the in-patient neuro-ortho spine program has been consolidated on 7.3; our spine program, the first to be accredited in Canada, again received full national accreditation. Congratulations to all on the spine team, led by Dr. Sean Christie - well done!

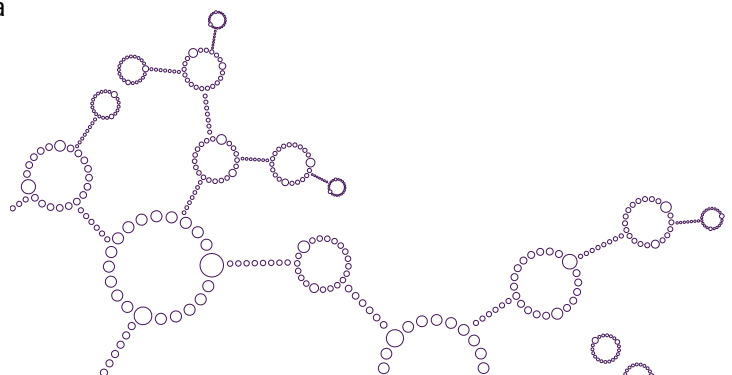
At the IWK Health Centre - thanks to successful fundraising for the Neurosurgery Kids Fund - the first ever neurosurgery Kids Camp, October 27-29, brought together a dozen children with neurosurgical conditions, ranging in age from 8-18, for a weekend of fun at Camp Brigadoon.

After a very successful first Camp, plans are already underway for a second expanded Camp next year. Kudos to Drs. Dan McNeely, Simon Walling and the IWK neurosurgery team for this wonderful initiative.

A highlight of 2017 was the dedication of our Neurosurgical IMCU in honor of Dr. Renn Holness, neurosurgeon and former Head of Neurosurgery. Dr. Holness spent most of his neurosurgical career in Halifax and has given tremendously in his caring for a generation of neurosurgery patients and in his educating countless students and residents. It is fitting to have this new unit named in his honor.

I am quite regularly reminded of the high quality of the care we provide. I happened upon this note that was sent to one of my colleagues from a very grateful family in Ontario: "My brother was admitted to your service with an extremely severe brain bleed which almost cost him his life. He is now back home and doing very well. We know we are exceptionally fortunate (lucky, lucky, lucky) that he was tended to for many hours by your knowledgeable and positive-thinking neurosurgical team. It was his care that saved his life! We are eternally grateful. You gave him back to us. We love him so much. This letter is sent to say thank you!!!!!"

And that is what neurosurgery does – day in, day out - in the clinic, in the OR, on the wards, in the laboratories, on our clinical and research teams - working together to improve outcomes of patients who literally put their trust and their lives in our hands, knowing that we will provide the best of care. Enjoy our report!



Neurosurgery Faculty



DAVID B. CLARKE MDCM, PhD, FRCSC, FACS

- Head, Division of Neurosurgery
- Professor, Departments of Surgery, Medical Neuroscience, Medicine (Endocrinology) and Ophthalmology & Visual Sciences

Areas of Interest:

- Transsphenoidal Surgery, Neuro-oncology
- Epilepsy Surgery
- Neurotrauma and Injury Prevention
- Neurosurgery Simulation/Education



SEAN CHRISTIE MD, FRCSC

- Vice-Chair, Division of Neurosurgery
- Director, Neurosurgery Spine Program
- Director of Research, Division of Neurosurgery
- Associate Professor, Department of Surgery

Areas of Interest:

- Minimally Invasive Spinal Surgery
- Complex Spinal Surgery
- Neurotrauma
- Sport-Related Neurological Injuries



DANIEL MCNEELY MD, FRCSC

- Chief, Pediatric Neurosurgery, IWK Health Centre
- Program Director, Neurosurgery Residency Program
- Associate Professor, Department of Surgery

Areas of Interest:

- Pediatric Neurosurgery
- Pediatric Epilepsy Surgery
- Spinal Dysraphism
- Hydrocephalus
- Intraventricular Neuroendoscopy



SEAN BARRY MD, FRCSC

- Treasurer, Division of Neurosurgery
- Assistant Professor, Department of Surgery

Areas of Interest:

- Minimally Invasive Spinal Surgery
- Complex Spinal Surgery
- Spinal Oncology
- Neurotrauma

Neurosurgery Faculty (cont'd)



SIMON WALLING MBChB, FRCSC
• Assistant Professor, Department of Surgery
Areas of Interest:
• Neurotrauma
• Injury Prevention
• Neuro-Oncology
• Pediatric Neurosurgery
• Surgical Education



GWYNEDD PICKETT MD, FRCSC
• Associate Professor, Department of Surgery
Areas of Interest:
• Cerebrovascular Surgery
• Endovascular Treatment of Aneurysms



ADRIENNE WEEKS MD, PhD, FRCSC
• Assistant Professor, Department of Surgery
Areas of Interest:
• Cerebrovascular Diseases
• Endovascular Treatment of Aneurysms
• Neuro-Oncology



JACOB ALANT MBChB, MSc, MMed, FRCSC
• Assistant Professor, Department of Surgery
Areas of Interest:
• Minimally Invasive Spinal Surgery
• Peripheral Nerve Surgery



LUTZ WEISE MD, PhD
• Associate Professor, Department of Surgery
Areas of Interest:
• Functional Neurosurgery
• Movement Disorders
• Complex Pain
• Stereotaxy
• Image Guided Surgery
• Neurophysiology
• Spinal Surgery

Neurosurgery Residency Program

Director: Dr. P. Daniel McNeely

Program Administrator: Valerie Wilson

The major objective of the Neurosurgery Residency Program at Dalhousie is the development of highly skilled neurosurgeons who can practice anywhere they choose. This is achieved by exposure to a broad range of clinical neurosurgery cases over a six-year period. Residents assume graduated levels of responsibility in patient care as training progresses. The majority of procedures are carried out with significant resident involvement. At the senior resident level, independent clinical and operative decision making is promoted. Final year residents achieve confidence in neurosurgical decision-making and independent performance of operative procedures.

We strive to provide an academic environment in which residents are continually challenged to acquire decision-making skills in neurosurgery. Regular teaching rounds and seminars create ample opportunities for in-depth discussion of neurosurgical cases.

The Dalhousie Neurosurgery Residency Program is based in Halifax, Nova Scotia with rotations at the QEII Health Sciences Centre and the IWK Health Centre. There are also opportunities for rotations in Saint John, Moncton, and St. John's. This provides residents with exposure to a wide variety of neurosurgical problems and training experiences.

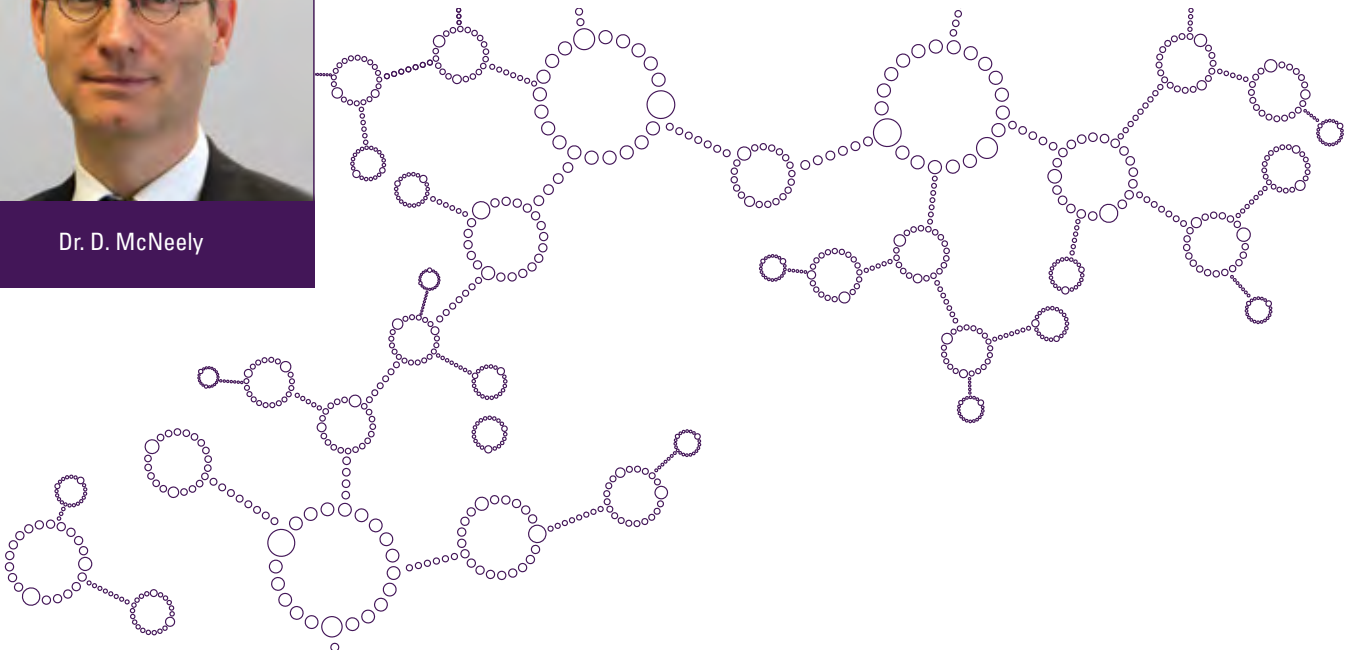
The Division of Neurosurgery encourages the role of research in residency training. The Clinician Investigator Program (CIP) is available at Dalhousie University. The goal of the CIP is to provide residents with structured research training, so they may become clinician investigators upon completion of their residency. This program, which is a minimum duration of two years, results in certification by the Royal College of Physicians and Surgeons of Canada. We endeavour to facilitate resident involvement in research projects that suit their interests.

The Division of Neurosurgery is one of nine Divisions in the Department of Surgery that includes Cardiac, General, Orthopedic, Otolaryngology, Pediatric, Plastic, Thoracic and Vascular Surgery. All Divisions are involved in residency training at various levels.

We are proud to offer a highly collegial training environment that prepares our graduates for success in their future careers.



Dr. D. McNeely



Neurosurgery Residents



GREG JENKINS MD

Postgraduate Year 6
MD Memorial University
Newfoundland, Canada

Dr. Jenkins obtained his medical degree at Memorial University in 2011. He also earned an honors degree in biochemistry at Memorial University in 2007. Dr. Jenkins completed his residency training on June 30, 2017 and was recruited to join the neurosurgery group in St. John's, NL.



AYOUB DAKSON MD

Postgraduate Year 5/6
MD University of Manchester
Manchester, England

Dr. Ayoub Dakson obtained his MBChB from the University of Manchester, England in 2011 with a Masters in Medical Research (Merits). Prior to this, he completed a BSc (honors) in Medical Sciences at St. Andrews University in Scotland. Dr. Dakson is expected to complete his training in 2018.



AARON ROBICHAUD MD

Postgraduate Year 4/5
MD Dalhousie University
Nova Scotia, Canada

Dr. Robichaud obtained his medical degree from Dalhousie University in 2012. Prior to studying medicine, Dr. Robichaud obtained a Bachelor of Science degree in biology at Mount Allison University. He is pursuing a Master's degree in Neuro-oncology in Dr. Weeks' laboratory. Dr. Robichaud is expected to complete his residency training with Dalhousie University in 2019.



DAVID BRANDMAN MD

Postgraduate Year 4
MD University of Calgary
Alberta, Canada

Dr. David Brandman obtained his medical degree at the University of Calgary in 2010. Prior to studying medicine, he pursued a degree in biophysics at the University of British Columbia. Dr. Brandman has successfully completed his PhD at Brown University, studying brain-machine interface. He is expected to complete his training in 2020.



JOHN ADAMS MD

Postgraduate Year 4/5
MD Memorial University
Newfoundland, Canada

Dr. Adams obtained his medical degree at Memorial University in 2013. Prior to studying medicine, Dr. Adams obtained a Bachelor of Science Degree in Neuroscience. Dr. Adams is expected to complete his training in 2019.



OMAR ALSHARIF MD

Postgraduate Year 2/3
MD King Saud University
Riyadh, Saudi Arabia

Dr. Alsharif obtained his medical degree at King Abdulaziz University in 2011. He joined the department of Neurosurgery at King Abdulaziz University as a teaching assistant in September 2012. In 2013 he began working as a research fellow at the University of Toronto on a scholarship. He is expected to complete his residency training in 2021.



ALWALAA ALTHAGAFI MD

Postgraduate Year 1/2
MD King Abdulaziz University
Jeddah, Saudi Arabia

Dr. Althagafi obtained his medical degree at King Abdulaziz University in 2013. Prior to studying medicine, Dr. Althagafi pursued a bachelor of medical laboratory science in New Zealand. He is expected to complete his residency training in 2022.



ERIKA LECK MD

Postgraduate Year 1/2
MD Dalhousie University
Nova Scotia, Canada

Dr. Leck obtained her Medical Degree at Dalhousie University in 2017. Prior to studying medicine, Dr. Leck obtained a Bachelor of Science degree (Honours) in Life Sciences at Queen's University. Dr. Leck is expected to complete her residency training with Dalhousie University in 2023.



MOSAAB ALSUWAIHEL MD

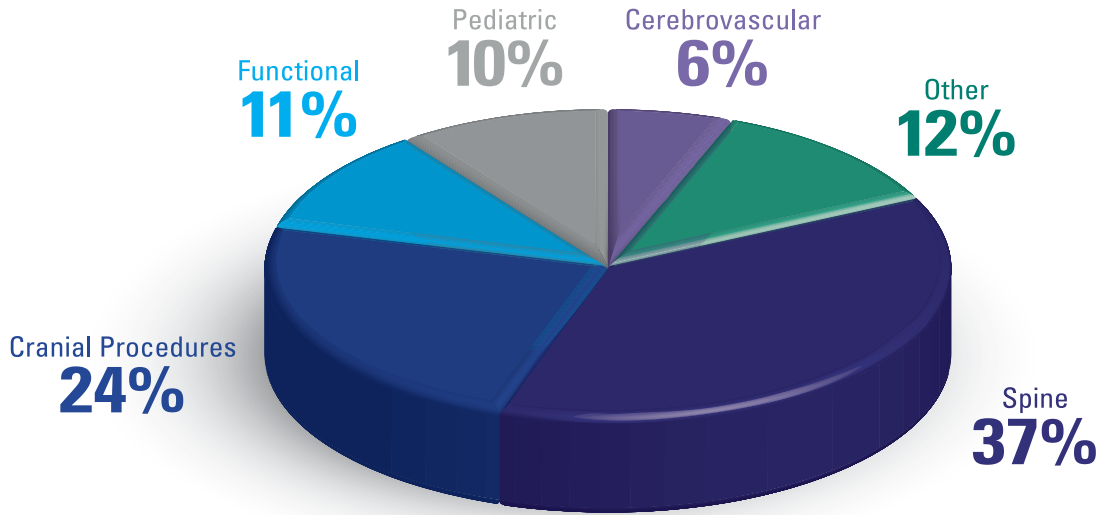
Postgraduate Year 1/2
National University of Ireland
Dublin, Ireland

Dr. Mosaab Alsuwaihel obtained his Bachelor of Medicine, Bachelor of Surgery and Bachelor of the Art of Obstetrics degrees in 2015 from the National University of Ireland. Dr. Alsuwaihel is expected to complete his residency training in 2023.

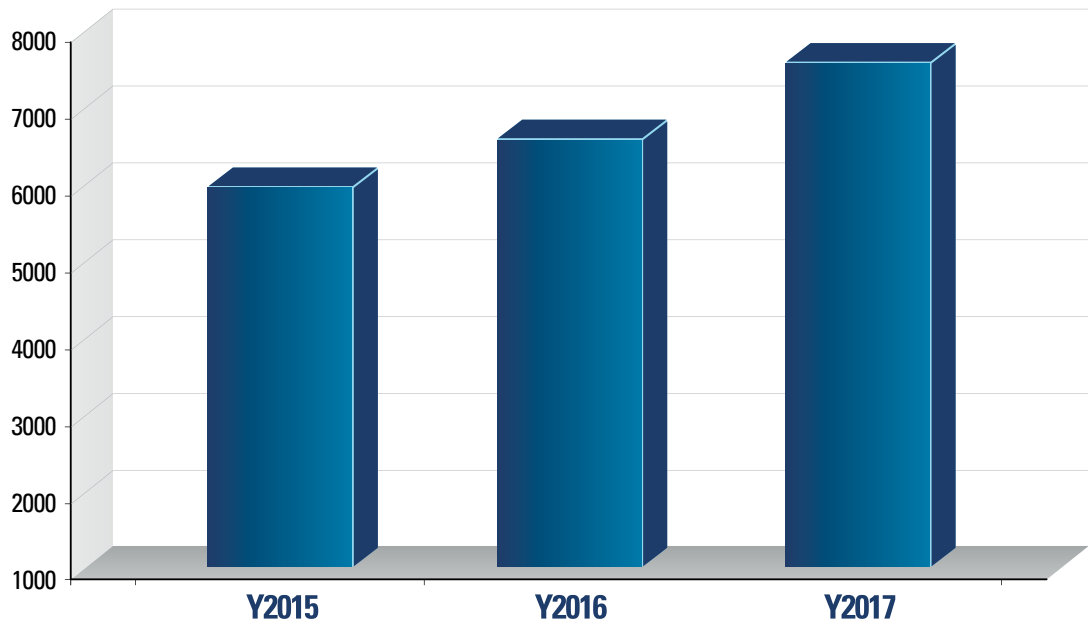
Clinical Activities



Neurosurgical Procedures

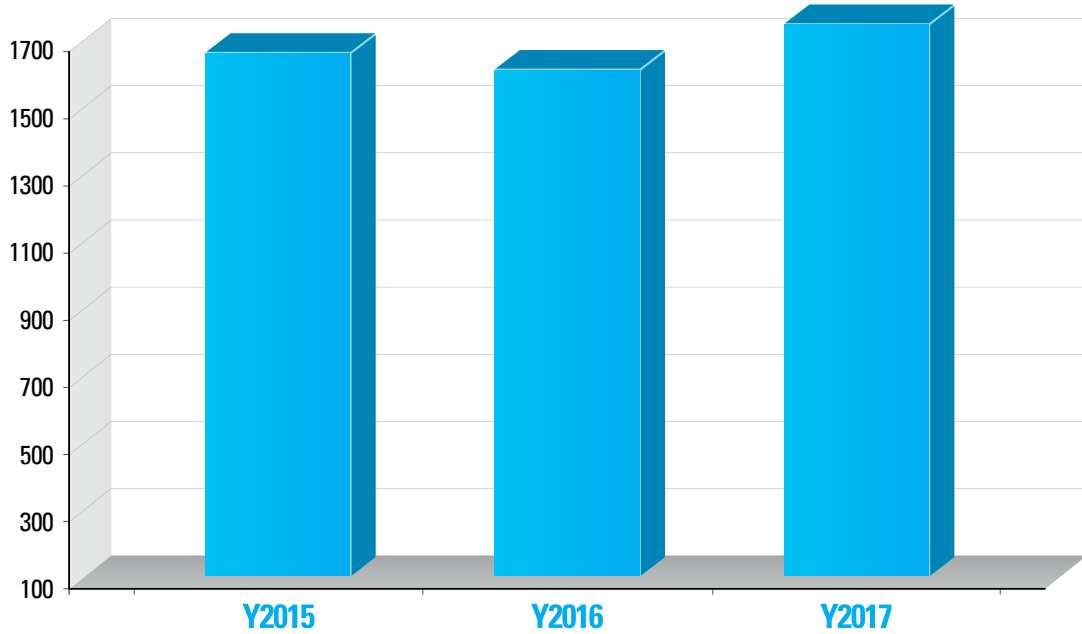


Ambulatory Care Visits

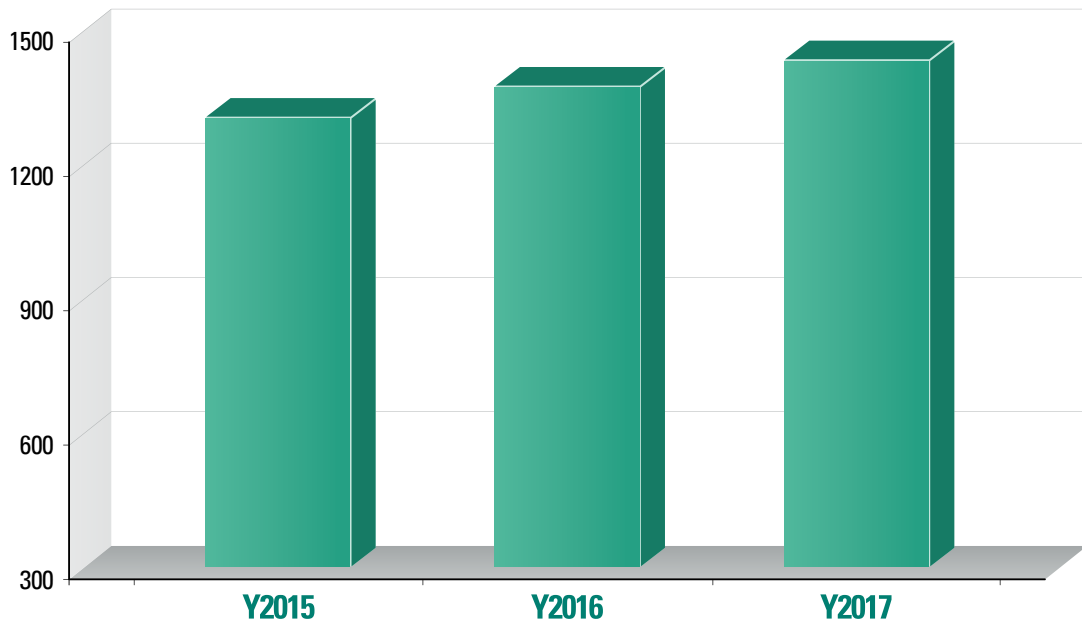




Admissions



Neurosurgical Procedures



Academic Neuroscience Program

The Neuroscience Alliance with our Neurology and Orthopedic Spine partners was completed in 2017. The Academic Neuroscience Program has been established to provide timely access to advanced patient care, leading edge research and training of health professionals. A new six bed Neurosurgical Intermediate Medical Care Unit (IMCU) was completed. The Epilepsy Monitoring Unit (EMU) was expanded from two beds to four beds and moved to the Neurology inpatient unit. The last phase of this project included Neuro-Ortho Spine (NOS) patients moving to the New Spine Unit located in the Neurosurgery Inpatient Unit with an increased capacity from twelve SPI beds to seventeen SPI beds. Both the Neurology and the Neurosurgery units now have completed their renovations and have a patient capacity of 33 (thirty-three) and 37 (thirty-seven) inpatient beds, respectively.

A professional practice review had been completed in 2016 and the recommendations for staffing and models of care for the new Neuroscience Alliance teams were put in place in 2017. Part of this work involved introducing a new model of care in our expanded IMCU. This new model included utilizing care team assistants (CTAs) as part of our staffing mix in the IMCU.

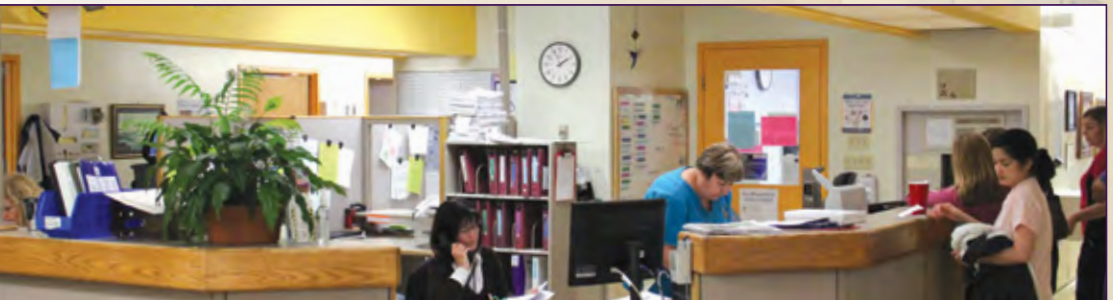
This model was evaluated in the fall of 2017 and changed to an all RN model based on the assessment of the patient care falling more under the scope of the RNs and the high patient turnover rate.

The Allied Health team on 7.3 also saw some changes in 2017 as a result of Model of Care work. Physiotherapy started offering therapy on Saturdays as a prioritized service to see new consults and those that would benefit from an additional day of therapy. Feedback has been positive about this added service. New roles for 7.3 were created for Physiotherapy, Occupational Therapy and Recreations Therapy. A permanent rehabilitation assistant was hired to provide assistance with occupational therapy and physiotherapy and a recreation associate was hired. Recreation therapy adapted a shared staffing model between 7.3 and 7.4. In general there has been more sharing of Allied Health resources between these two units with the formation of the Neuroscience Team.

We would like to thank all our staff for their patience during this project.

We would also like to thank the QEII Foundation and the NSHA leadership for their support in this endeavor.

Neurosurgery Inpatient Unit 7.3



FRAN KELLOWAY
Health Service Manager

Health Services Manager: Fran Kelloway

In 2017, the Neurosurgery Inpatient Unit continued to experience some changeover in nursing staff related to relocations, personal leaves and maternity leaves. In total, fourteen new staff RNs were hired. In addition to this turnover in staff, we have welcomed two of our staff nurses into the charge roles, Dayna ElHassan (to replace Shelley Nikolaev who went on leave in April 2017) and Laura Croft (to replace Samantha Warren who went on maternity leave in June 2016).

The Neurosurgery Quality Management Committee, consisting of members from various disciplines, continues to meet on a monthly basis to identify successes as well as issues related to quality and efficiency of care, patient safety and accreditation standards. The purpose of this committee is to promote education and excellence in patient care and safety. In 2017, our Quality Team and staff within the Neurosurgery team worked on providing evidence that we are working within the standards set by Accreditation Canada and had very positive feedback for both our Acute Spine and Neurosurgery Services.

Clinical / Research Staff



LORELEI AUDAS
RN, BScN, CCRP
Program Coordinator:
Neurotrauma/Simulation



ANNIE CUDMORE
Research Student Aide:
Neurotrauma and Injury
Prevention



NICKY AYLES
RN
Program RN:
Neuromodulation



SUSAN DOBBIN
RN
Neurosurgery Clinic



MISSY BRINSON
RN
Brain Tumour Liaison Nurse



LYNNE FENERTY
RN, BN, DO(MP)
Program Manager:
Neurotrauma/Injury Prevention



CORALEA CAREY
Research Assistant:
Neurotrauma/Injury Prevention



ALENA GALILEE
Research Associate:
Neurotrauma/Simulation

Clinical / Research Staff (cont'd)



JENNIFER GALLANT

**Health Services Manager:
Neurosurgery Clinic**



JUDITH JARRETT

**RN, CCRP
Program Coordinator:
Cerebrovascular**



ANDREA L.O. HEBB

**MSc., PhD, RN
Clinical/Research Coordinator:
Brain Tumour
Maritime Lateral Skull Base
Neuropituitary**



LISA JULIEN

**RB, BScN, CCRP
Program Team Lead:
Neurosurgery Spine**



RON HILL

Technology Coordinator



NELOFAR KURESHI

**MD, MHI
Research Associate:
Neurotrauma/Simulation/
Neurosurgery Spine**



MURRAY HONG

**PhD
Imaging Specialist**



ANITA MCPHEE

**RN
Research Coordinator:
Neurosurgery Spine**



ANGELA MEAGHER

RN, NP

Neurosurgery Spine



SUSAN RAHEY

BSc, RET, RT(EMG)

**Program Coordinator:
Epilepsy**



CAROLE-ANN MILLER

RN, NP

Cerebrovascular



KARINA RANKKA

**Health Services Manager:
Neurosurgery Clinic**



LESLIE PERRIN

RN

Neurosurgery Clinic



**GINETTE THIBAUT-
HALMAN**

RN, CNN(c), MSc

**Program Coordinator:
Neuro-Trauma/Injury Prevention/
Neurosurgery Spine**



SARANYAN PILLAI

PhD

**Research Associate:
Neurosurgery Spine**



TIFFANY WEBBER

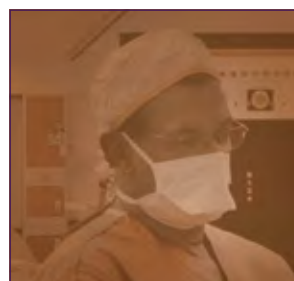
**Spine Referral Triage
Residency Program
Coordinator**



CHRISTINE POTVIN

RN

**Program Coordinator:
Neuromodulation**



RACHEL WOODMAN

Neurosurgery Clinic Aide

Administrative Staff



DEBBIE AMIRAULT

Assistant to
Dr. Sean Barry



PAM DOUCETTE

Assistant to
Dr. Lutz Weise



**KATHARINE
ANDERSON**

Assistant to
Dr. Gwynedd Pickett



**EMMA GILLESPIE-
FRASER**

Assistant to
Dr. Adrienne Weeks



CATHY CARON

Assistant to
Dr. Daniel McNeely



DIANE JARDINE

Assistant to
Dr. David Clarke



MELISSA COOK

Assistant to
Dr. Sean Christie



MAUREEN KAY

Assistant to
Dr. Jacob Alant



SHIRLEY MACLEOD

Assistant to
Dr. Sean Christie



LORRAINE SMITH

Administrator
Division of Neurosurgery



KELLY MARTIN

Executive Assistant
to Dr. David Clarke



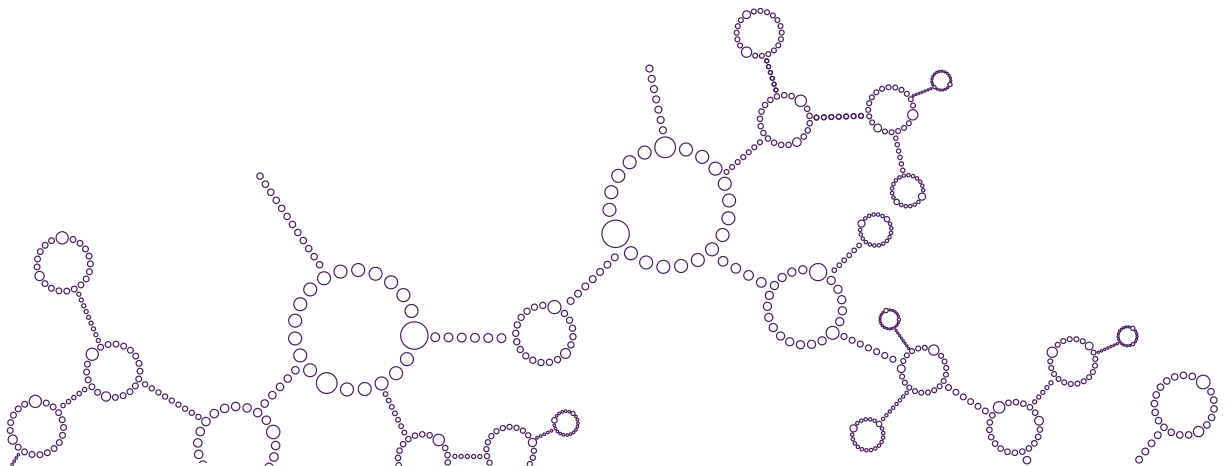
TIFFANY WEBBER

Residency Training
Program Coordinator
Spine Referral Triage



CHRISSY SHAY

Assistant to
Dr. Simon Walling



Neurosurgery OR Nurses

JENNY BARNES SMITH

SAM CAMERON

JENNIFER DERENGOSKI

AMANDA GEORGE

JEN HOYT

ANNE JURCINA

DONNA MACQUEEN

DENYNE PARK

JESSICA TAYLOR

AMANDA WOODS



Neurosurgery Spine Program



BACK (LEFT TO RIGHT): D. Amirault, Dr. S. Christie, M. Cook, A. McPhee
FRONT (LEFT TO RIGHT): Dr. S. Barry, M. Kay, L. Jarvie, G. Thibault-Halman, A. Meagher, S. Pillai, Dr. J. Alant

Director: Dr. Sean Christie

Program Team Lead: Lisa Julien

Research Coordinators: Anita McPhee and Ashleigh Benton

Research Associates: Nelofar Kureshi and Saranyan Pillai

Research Assistants: Sue Moore and Tanya Myers

The Neurosurgery Spine Program provides comprehensive care to patients with spinal disorders and spinal cord injuries.

Accomplishments

In February 2017, Dr. Sean Christie became the newly elected President of the Canadian Spine Society. Dr. Christie is looking forward to assuming the role of President and continuing to expand upon the great work of his predecessors over the next two years.

- This year the Spine Program welcomes our second Dalhousie Spine Fellow, Fred Xavier MD, PhD. Dr. Xavier will be part of our Combined Spine Program between Neurosurgery and Orthopedics and will participate in a breadth of procedures including adult and Pediatric spine as well as neuromodulation procedures. Welcome Dr. Xavier!

- We would also like to welcome our new spine research coordinator, Ashleigh Benton, to the team. Ashleigh has over four years' experience in research at NSHA and the IWK/BIOTIC. She has taken Neuroscience and Research Method courses at Dalhousie and Memorial Universities. She is currently completing her Master of Arts (Anthrozoology) at Exeter University, UK.
- The Atlantic Canada Spine meeting was held for the ninth consecutive year as a regional CME spine-focused event. The topic of focus was "General Topics in Spine Surgery". Dr. John Street (University of British Columbia) was this year's invited guest speaker. We thank Medtronic Canada for their continued support.
- OpNote is capturing spine operative data in a synoptic template for both Orthopedic Spine and Neurosurgery Spine Programs. Synoptic operative reports will standardize the clinical information captured by various surgeons and improve the quality of data captured compared to dictated reports.

Neurosurgery Spine Program (cont'd)

- In Oct 2017, we implemented the SAVES form (Spine Adverse Events Severity system) for all spine surgeries conducted at NSHA. We hope to incorporate this reporting into OpNote in the near future.
- With great sadness we said goodbye on March 5, 2017 to our dear colleague and friend, Ginette Thibault-Halman, after a courageous battle with breast cancer. She is deeply missed.

Research

Spine program research projects include investigator-initiated and pharmaceutical driven studies, as well as multi-centre national and international studies.

- Improving Patient Access to Spine Care Through Implementation of an Evidence-Based Spine Triage Clinic: This TRIC Level 1 project aims to plan the development of a comprehensive spine triage clinic with the goals of reducing wait times, improving patient outcomes, increasing patient and provider satisfaction levels, and decreasing healthcare costs.
- Trends and Regional Variations in Surgical Interventions for Spinal Degenerative Disorders in Canada: This project will evaluate the changing epidemiology of spinal degenerative diseases and rates of elective spinal surgeries in Canada from 2004-2015 in order to establish the trajectory of these entities and their economic impact on the Canadian healthcare system.
- Frailty Index in Spinal Cord Injury Patients: The assessment of frailty may be an important determinant in the appropriate management of older SCI patients. A series of standard laboratory values and clinical data have been previously used to determine a frailty index, which has been linked to clinical outcomes in the elderly. This project will investigate whether the frailty index is associated with in-hospital mortality in SCI patients.
- Attitudes of Canadian Spine Surgeons Towards Medical Assistance in Dying (MAID): A national survey was conducted to determine the level of support among Canadian spine surgeons for MAID. This project is in the manuscript writing phase.
- Modic changes in Chronic Lower Back Pain Patients: A retrospective chart and radiological review has been completed to determine whether patients with modic changes have poorer surgical outcomes than those without these imaging features. This project has been submitted for publication.
- A Study of Titanium Ion Concentrations in the Whole Blood of Patients Following Metal-on-Metal Cervical Arthroplasty: This project is designed to investigate the level of titanium metal ions in a patient's whole blood. Patients who are invited to participate have previously undergone, or are scheduled to undergo cervical arthroplasty surgery using the Medtronic Prestige LP prosthesis or are scheduled to undergo a single level anterior cervical disectomy and fusion with the Atlantis Vision Elite plate. Patients will be monitored for ten years post-op; all serum samples are sent to a central facility for analysis. If patient titanium levels are reported to be > 100ppb there may be health concerns. To date 23 patients have been enrolled.
- Utility of the Spinal Instability Neoplastic Score (SINS) System in Surgical Practice: A retrospective chart review of patients with spinal metastatic cancer, to assess the Spinal Instability Neoplastic Score System (SINS) and its clinical utility in predicting surgical treatment decision is underway.

Several studies are conducted in partnership with the Rick Hansen Institute (RHI):

- The Canadian Multicenter Cerebrospinal Fluid Pressure Monitoring and Biomarker (CAMPER) study: a national multi-centre clinical trial examining spinal cord perfusion pressure (SCPP) in patients with acute SCI, as well as the effect of different vasopressor agents on SCPP. Cerebrospinal fluid samples collected as part of this study will be used to validate a series of biochemical markers correlating with injury severity and predicting neurologic outcome. We are pleased to be participants in the Biomarkers for Crossing the Translational Divide in Acute Spinal Cord Injury project, led by Dr. Brian Kwon's team in Vancouver, which was awarded \$3 million through the Brain Canada MIRI competition. To date we have enrolled 13 patients into this project.
- This year marks our 10th year of enrollment in the Rick Hansen Spinal Cord Injury Registry (RHSCIR), a national registry of patients with traumatic spinal cord injury (SCI). To date 221 patients have been included and we conducted our first 10th year follow up visits in July 2017.
- Using data collected nationally by RHSCIR and previously published inclusion/exclusion criteria for spinal cord injury (SCI) trials, we have examined the feasibility of recruiting subjects for acute spinal SCI clinical trials in Canada. The manuscript has been published.

- The Canadian Spine Society (CSS) Registry is a national health data registry that tracks outcome measures of the surgical and non-surgical treatment of specific spinal conditions. We are currently in our 4th year of enrollment for this registry. The spine patient populations that are offered participation at our site are surgically managed for the following procedures/indications:
 - o Cervical Arthroplasty
 - o Cervical Myelopathy/Myeloradiculopathy and
 - o Lumbar Spondylolisthesis.

Currently 174 patients have been included, 47 in 2017. Within this registry, patients may also be eligible for three sub-studies:

1. Management and Outcome of Cervical Spondylotic Myelopathy: A Standardized Clinical Assessment and Management Plan.
2. Surgical Treatment of Degenerative Spondylolisthesis: A Standardized clinical assessment and management plan (SCAMPS) Canadian Spine Society (CSS) multicenter prospective cohort study.
3. Decompression Alone vs. Decompression and Instrumented Fusion for the Management of Lumbar Spinal Stenosis Associated with Stable Degenerative Spondylolisthesis: A Pragmatic Randomized Clinical Pilot Trial.

- Vertex: A Phase 2b/3, Double-blind, Randomized, Placebo-Controlled, Multicenter Study to Assess the Efficacy and safety of VX-210 in subjects with Acute Traumatic Cervical Spinal Cord Injury: This study is being done to learn more about the safety and effects of VX-210 in patients with acute traumatic cervical spinal cord injury. VX-210 is a protein derivative of C3 transferase that inhibits Rho in a dose-dependent manner. It is combined with a fibrin sealant and directly applied onto the dura mater of the spinal cord at or near the site of injury during decompression/stabilization surgery within 72hrs after initial injury. Approximately 150 patients in North America will be enrolled. To date we have enrolled 2 patients.
- A Data-Driven e-Health Platform for Informed and Evidence-based Decision Making to Triage Spinal Surgeries: In collaboration with Dr. Raza Abidi (Faculty of Computer Science, Dalhousie University), we have been awarded funding from CIHR Personalized Health Catalyst Grant to conduct this project.

Publications

Ahn H, Lewis R, Santos A, Cheng CL, Noonan VK, Dvorak MF, Singh A, Linassi AG, **Christie S**, Goytan M, Atkins D. "Forecasting Financial Resources for Future Traumatic Spinal Cord Injury Care Using Simulation Modeling." *J Neurotrauma*. 2017 Oct 15;34(20):2917-2923.

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Barry S, Ekong C, Wheelock BW, Moulton R, Gorman P, Reddy K, Fleetwood I. "Medical Assistance in Dying (MAID) and the Neurosurgeon: Position Statement of the Canadian Neurosurgical Society (CNSS)." *Can J Neurol Sci*. 2017 Aug, 14:1-3.

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Maghsoud-Lou E, **Christie S**, Abidi SR, Abidi SSR. "Protocol-Driven Decision Support within e-Referral Systems to Streamline Patient Consultation, Triage and Referrals from Primary Care to Specialist Clinics." *J Med Syst*. 2017 Sep; 41(9):139.

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Pencle FK, **Kureshi N**, Benstead T, **Christie SD**. "Critical illness myopathy in a cervical spine-injured patient." *Spinal Cord Series and Cases*, 2, 16017. <http://doi.org/10.1038/scsandc.2016.17>.

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Neurosurgery Spine Program (cont'd)

Squair JW, Bélanger LM, Tsang A, Ritchie L, Mac-Thiong JM, Parent S, **Christie S**, Bailey C, Dhall S, Street J, Ailon T, Paquette S, Dea N, Fisher CG, Dvorak MF, West CR, Kwon BK. "Spinal cord perfusion pressure predicts neurologic recovery in acute spinal cord injury." *Neurology*. 2017 Oct 17; 89(16):1660-1667.

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Thibault-Halman G, Rivers CS, Bailey CS, Tsai EC, Drew B, Noonan VK, Fehlings MG, Dvorak MF, Kuerban D, Kwon BK, **Christie SD**. "Predicting Recruitment Feasibility for Acute Spinal Cord Injury Clinical Trials in Canada Using National Registry Data." *J Neurotrauma*. 2017 Feb; 34(3):599-606.

Book Chapters

Fehlings MG, **Barry S**, *Cervical Spondylotic Myelopathy, Spine Surgery: Current Concepts and Evidence: Hardcover – Oct 22, 2017.*

Case Report

Sean D. Christie, Nelofar Kureshi, Ian Beauprie & Renn O. Holness: Occipital osteomyelitis and epidural abscess after occipital nerve block: A case report. *Canadian Journal of Pain* Accepted author version posted online: 02 Aug 2017 <https://doi.org/10.1080/24740527.2017.1360725>.

Abstracts

Alwalaa Althagafi. Cauda equina syndrome secondary to leptomeningeal metastasis of breast carcinoma. A case report and literature review, 9th Annual Atlantic Canada Spine Meeting, October 20-22, 2017

Ayoub Dakson, M. Butler, **E. Leck** and **S. Christie**. Stratification of patients with metastatic spinal epidural disease on the basis of expected survival in Nova Scotia, 9th Annual Atlantic Canada Spine Meeting, October 20-22, 2017

Fred Xavier, N. Cornish, R. Jason-Rousseau, D. Chatterjee, W. Hayes, H. Yoshihara, and S. Saha. Variations in Density and Shear Strength within the Human Thoracic Vertebral Endplate and Trabecular Bone, 9th Annual Atlantic Canada Spine Meeting, October 20-22, 2017

Ginette Thibault-Halman, Nelofar Kureshi, Hamilton Hall, **Sean Barry, Jacob Alant**, Andrew Glennie, William Oxner, **Sean Christie**. Determining spine surgeon supply and demand in Canada. *Can J Surg*, Vol. 60 (3 Suppl 4), June 2017

Mark MacLean, **Ginette Thibault-Halman, Nelofar Kureshi**, Jai Jai Shankar, **Sean Barry, Jacob Alant**, Andrew Glennie, William Oxner, **Sean Christie**. Investigating the association between modic changes and chronic lower back pain in patients receiving surgical therapy for lumbar disc herniation: a retrospective chart review. *Can J Surg*, Vol. 60 (3 Suppl 4), June 2017

Mustafa Nadi, Nelofar Kureshi, Ginette Thibault-Halman, Sean Barry, Jacob Alant, Andrew Glennie, William Oxner, Kenneth Rockwood, **Sean Christie**. Frailty index in spinal cord injury patients: an indicator that may change surgical management strategy. *Can J Surg*, Vol. 60 (3 Suppl 4), June 2017

Nelofar Kureshi, Sean Christie, Sean Barry. Attitudes of Canadian spine surgeons toward medical assistance in dying: a national survey. *Can J Surg*, Vol. 60 (3 Suppl 4), June 2017

Shawn Brophy, Jaclyn Ferris, Jill Hayden, **Sean Barry, Sean Christie**. Decompression surgery improves tibialis anterior muscle strength in cases of painful and painless foot drop caused by neurodegenerative lumbar disease: a systematic review. *Can J Surg*, Vol. 60 (3 Suppl 4), June 2017

Presentations

Alant, J. 9th Annual Atlantic Canada Spine Meeting, October 20-22, 2017

Barry, S. Medical Aid in Dying: Survey of Canadian Spine Society Members: Canadian Spine Society Meeting, February 26, 2017, Montreal, QC.

Barry, S. Moderator: Symposium – Medico-Legal Challenges in Modern Spinal Practice; Medical Aid In Dying. Canadian Spine Society Meeting, February 24, 2017

Christie, S. 9th Annual Atlantic Canada Spine Meeting, October 20-22, 2017

Christie, S. Determining spine surgeon supply and demand in Canada, Canadian Spine Society Meeting, February 26, 2017, Montreal, QC.

MacLean, M. Investigating the association between modic changes and chronic lower back pain in patients receiving surgical therapy for lumbar disc herniation: a retrospective chart review, Canadian Spine Society Meeting, February 26, 2017, Montreal, QC.

Nadi, M. Frailty index in spinal cord injury patients: an indicator that may change surgical management, Canadian Spine Society Meeting, February 26, 2017, Montreal, QC.

Invited Lectures

Barry, S. "Evidence Based Spine Surgery Course" October 21, 2017 Montreal, Quebec

Christie, S. "Spinal Trauma", NS Trauma Program, February 15, 2017, Halifax Nova Scotia

Christie, S. "Concepts of Navigated Posterior Cervical Reconstructive Surgery with VERTEX SELECT, STEALTH MIDAS and O-ARM." Surgical Synergy Course, January 13, 2017, Toronto, Ontario

Christie, S. "5th Annual Neurosurgery Review Course-Spinal Biomechanics, Decision Making and Surgical Options In Degenerative Spine Disease". February 9, 2017, Ottawa, Ontario

Christie, S. "5th Annual Neurosurgery Review Course-Cervical Spondylosis: Diagnosis and Management" February 9, 2017, Ottawa, Ontario

Christie, S. "Canadian Contemporary Spinal Techniques-Concepts of Navigated Posterior Cervical Reconstructive Surgery: Procedural Workflow, Surgical Synergies and the Economic Argument" May 26, 2017, Toronto, Ontario

Funding/Grants

Rick Hansen Institute. Canadian Multicentre Cerebrospinal Fluid Pressure Monitoring and Biomarker Study. \$311,980. 2012-2017

Rick Hansen Institute. Rick Hansen Spinal Cord Injury Registry. \$442,000. 2008-2017

Medtronic of Canada, Ltd. Unrestricted research grant. 2017 \$40,000

Vertex Pharmaceutical Inc.: 2017 \$40,480

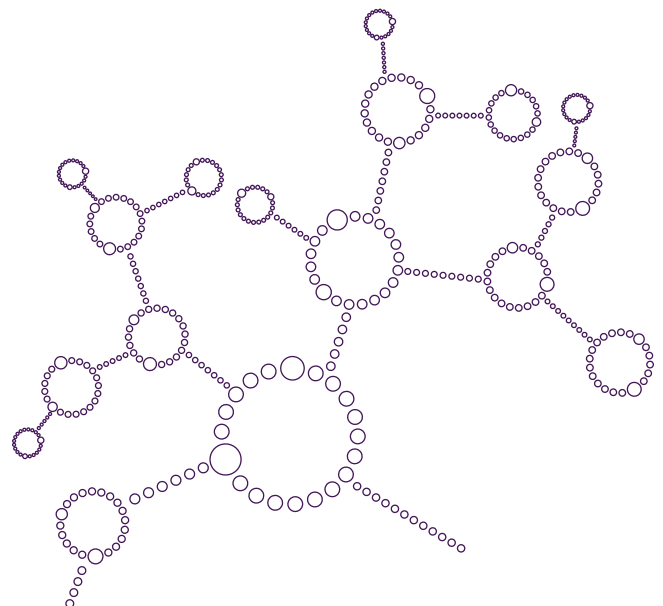
CIHR Personalized Health Catalyst Grant: \$199,408 (2017-2019)

Team Members:

- Dr. Sean Christie, Neurosurgeon
- Dr. Jacob Alant, Neurosurgeon
- Dr. Sean Barry, Neurosurgeon
- Dr. Dan McNeely, Neurosurgeon
- Dr. Gwynedd Pickett, Neurosurgeon
- Dr. Simon Walling, Neurosurgeon
- Nelofar Kureshi, Research Associate
- Dr. Saranyan Pillai, Research Associate
- Lisa Julien, Research Coordinator
- Anita McPhee, Research Coordinator
- Ashleigh Benton, Research Coordinator
- Sue Moore, Research Assistant
- Tanya Myers, Research Assistant
- Tiffany Webber, Spine Referral Triage
- Debbie Amirault, Administrative Support
- Melissa Cook, Administrative Support
- Maureen Kay, Administrative Support

Team Collaborators:

- Dr. William Oxner, Orthopedic surgery
- Dr. Andrew Glennie, Orthopedic surgery
- Dr. Cynthia Dunning Zwicker, Research Manager, Orthopedic Spine Service
- Dr. Christine Short, NS Rehabilitation Centre
- Dr. Sonja McVeigh, NS Rehabilitation Centre
- Dr. Mary Lynch, Pain Management Unit
- Dr. Ian Beuprie, Pain Management Unit
- Dr. Matthias Schmidt, Anesthesia
- Dr. Susan Morris, Neurophysiology



Neuromodulation Program

Director: Dr. Lutz Weise

Program Coordinator: Christine Potvin

Program RN: Nichola Ayles

Our neuromodulation program provides neuromodulation care to the people of Atlantic Canada (population ~2.3M). The program focuses on improvements to quality of life primarily for people suffering from movement disorders, complex pain syndromes, and spasticity. The patient population includes patients with implantable neurostimulators for deep brain (DBS), cortical, spinal cord (SCS), and peripheral stimulation. We currently follow 215 people with stimulators for movement disorders, and 233 with stimulators for pain.

In addition to regular deep brain stimulation rounds in which patients are reviewed by the team and treatment options discussed, we run a complex pain clinic in which patients are seen and evaluated by both a neurosurgeon and a complex pain anesthesiologist, and a treatment plan decided upon.

With their consent, patient information including quality of life surveys and intraoperative microelectrode recording data are kept on a database for analysis.

Various research activities are in progress, including electrophysiological and tractography studies in patients undergoing Deep Brain Stimulation. An ethics application was obtained on "Correlation of tractography and motor evoked potentials in deep brain stimulation" and we have started recruiting the first patients. Further projects include the evaluation of the impact of disease lateralization on imaging characteristics such as tractography.

Oral Presentations were given at local, national and international meetings:

- Aspects of Lateralization in Parkinson, impact on DBS? Weise L. Interdisciplinary DBS Rounds February 17, 2017 Halifax, Canada

- Spinal Cord Stimulation for the Treatment of Neuropathic Pain. Weise L. May 25, 2017 Canadian Pain Society 2017. 38th annual scientific meeting. May 23 – 25, 2017, Halifax, Canada.
- An Overview of Neuromodulation techniques for the Treatment of Chronic Pain. May 24, 2017 Canadian Pain Society 2017. 38th annual scientific meeting. May 23 – 25, 2017, Halifax, Canada.
- Spinal Cord Stimulation in the Treatment of Neuropathic Pain 9th Annual Atlantic Canada Spine Meeting, October 21, 2017
- Influence of Disease Lateralization in Movement Disorders on Fiber Tracking and Deep Brain Stimulation. Weise L, Hill R, Quick J, Hebb A, Schmidt M. June 28, 2017. World Society for Stereotactic and Functional Neurosurgery Berlin, Germany June 26-29, 2017

In January 2017 the program welcomed Nichola Ayles, who is the program RN.

Team Members:

- Dr. Lutz Weise, Neurosurgeon
- Dr. Sean Christie, Neurosurgeon
- Dr. Ian Beauprie, Anesthesiologist/Pain Specialist
- Christine Potvin, Program Coordinator
- Nichola Ayles, Program RN
- Ron Hill, Neurosurgery Technology Coordinator
- Murray Hong, Neurosurgery OR/Technical Specialist
- Susan Morris, Neurophysiologist
- Dr. John Fisk, Neuropsychologist
- Dr. Mark Rubens, Psychiatry
- Dr. David King, Neurologist (movement disorders)
- Dr. Kerry Schoffer, Neurologist (movement disorders)
- Dr. Roger McKelvey, Neurologist (movement disorders)
- Dr. Heather Rigby, Neurologist (movement disorders)
- Pam Doucette, Administrative Assistant

Off Site Collaborators:

- Dr. Renju Kuriakose, (Neurologist NB)
- Dr. Kyna Squarey, (Neurologist NFLD)



LEFT TO RIGHT: N. Ayles, C. Potvin, R. Hill, Dr. L. Weise, P. Doucette

Surgical Epilepsy Program

Co-Chairs: Drs. David Clarke and Mark Sadler

Program Coordinator: Susan Rahey

Epilepsy patients referred from Nova Scotia, Prince Edward Island, New Brunswick and Newfoundland have access to a collaborative service supported by the Divisions of Neurology and Neurosurgery, including:

- specialty outpatient clinics with support from Neuropsychology and Social Work
- a four-bed inpatient Epilepsy Monitoring Unit (Phase I and Phase II studies)
- access to a variety of structural and functional imaging techniques (3T MRI, fMRI, PET and MEG)
- surgical services including invasive recordings (SEEG depth electrodes and subdural strips/grids), cortical resection, lesionectomy, corpus callosotomy, hemispherotomy and vagus nerve stimulator implantation

Program Goals

- To provide access to the latest medications and surgical techniques in the setting of a comprehensive epilepsy program to people in Nova Scotia, Prince Edward Island, New Brunswick and Newfoundland
- To continue to seek out innovative ways to continue to improve all aspects of service

Accomplishments

2017 was an exciting year for the Epilepsy Program. A new Epileptologist, Dr. Kristin Ikeda, joined the team and our ability to provide excellent service was enhanced by the official opening of a state-of-the-art expanded Epilepsy Monitoring Unit. In addition, Dr. Dan McNeely began doing adult epilepsy cases to help with the increased surgical demand.

- There were 48 admissions to the Epilepsy Monitoring Unit (EMU), despite a two month closure for construction and a staged opening of the additional beds. Included in that total were six admissions for invasive recording with depth electrodes or a combination of depth and subdural strips/grids. Epilepsy surgical procedures were performed on 17 patients and more than 1400 patients were assessed in the various outpatient epilepsy clinics.
- Joshua Logan, staff EEG technologist and recent graduate of the British Columbia Institute of Technology, successfully completed the C.B.R.E.T., Inc. Part II examinations. Following in the footsteps of several of our QEII EEG technologists, he was the recipient of the Dan Campbell Award, presented to the student with the highest marks that year in all sections of the Canadian examination.
- Dr. Mazen Basheikh completed his Fellowship and successfully challenged the CSCN EEG Examinations. He has since returned to Saudi Arabia.
- Dr. Stephanie Woodroffe assumed leadership of the First Seizure Clinic along with Karen Legg, NP.
- Dr. Kristin Ikeda joined the team, having recently completed a two year fellowship in EEG and Epilepsy at the University of Western Ontario and the London Health Sciences Centre. She and Dr. Sadler share responsibility for the EMU and the Epilepsy Surgical Pre-Assessment service. Dr. Ikeda attended the North American SEEG Course in Quebec.
- Susan Rahey was awarded the Canadian League Against Epilepsy Clinical Practice/Advocacy Award.
- The newly constructed 4-bed state-of-the-art Epilepsy Monitoring Unit opened on May 30, with a gala reception and presentations, hosted by the QEII Foundation. The event was well attended by staff and patients (both current and former). There was a staged opening of the additional beds, with all four beds opened for admission in September 2017.
- Ms. Margaret Hamilton, RN of the London Health Sciences Centre Epilepsy Monitoring Unit, came to Halifax to provide our EMU Nursing Staff with a much appreciated in-service in the art of caring for this patient population, with emphasis on clinical assessment during seizure.
- Weekly epilepsy case conferences continue to be widely attended by team members along with colleagues from the IWK Health Centre, Maritime Medical Genetics and the MEG laboratory. Discussions of outpatient and EMU cases are augmented by a monthly journal club.
- Educational opportunities were made available to community groups, nursing, technical and medical students and staff and to colleagues attending various local, national and international meetings. The results of research projects were presented at national and international professional meetings. We continue to benefit from the enthusiasm and commitment brought to the program by Residents assigned to the Epilepsy Program.
- Celebration of Purple Day for Epilepsy Awareness on March 27th (the first Monday after the 26th) continues to be a high point of our year, with many staff and patients volunteering or attending our booth for purple cupcakes and education. Our own Cassidy Megan, Founder of Purple Day, once again joined us for the occasion.

Surgical Epilepsy Program (cont'd)

Challenges

Intermittent antiepileptic drug shortages in Canada have been stressful for many patients and for the medical epilepsy team.

Future Directions

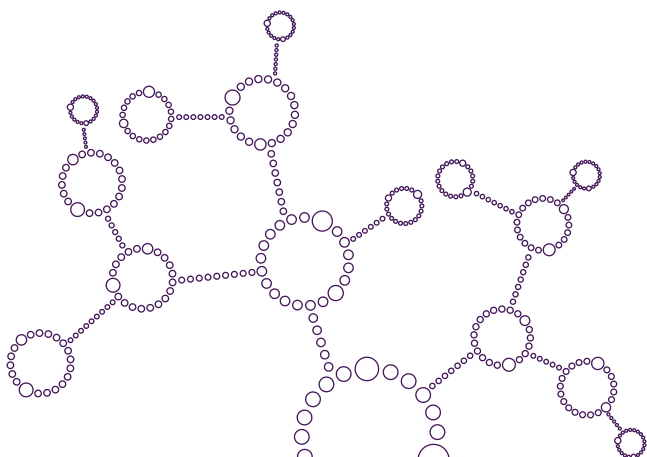
Program Members continue their commitment to the betterment of epilepsy care in our region and beyond. Technical advances within the epilepsy surgery program continue.

Team Members:

- Dr. Mark Sadler, Neurologist
- Dr. David Clarke, Neurosurgeon
- Dr. Dan McNeely, Neurosurgeon
- Dr. Kristin Ikeda, Neurologist
- Dr. Stephanie Woodroffe, Neurologist
- Susan Rahey, Neurology, Program Coordinator
- Dr. Antonina Omisade, Neuropsychologist
- Ron Hill, Neurosurgery Technology Coordinator
- Dawnette Benedict-Thomas, Psychometrist
- Karen Legg, Neurology, Nurse Practitioner
- EEG Technologists
- Heather Smith, Social Worker

Team Collaborators:

- Divisions of Neurology, NSHA, Central Zone and IWKHC
- Neuroradiologists
- Neuropathologists
- Neuroscience and Perioperative Staff
- Biomedical Translational Imaging Centre Staff
- Maritime Medical Genetics Service
- Health Services Managers
- Biomedical Engineering
- Sterile Processing



BACK (LEFT TO RIGHT): T. Bardouille, Dr. B. Pohlmann-Eden, Dr. D. Clarke, Dr. D. McNeely, D. Gayala
FRONT (LEFT TO RIGHT): A. Taylor, K. Legg, Dr. S. Al Hindi, Dr. A. Omisade, S. Rahey, Dr. N. Parks, Dr. M. Sadler

Neurosurgery Simulation Program

Director: Dr. David Clarke

Program Manager: Lynne Fenerty

Technology Coordinator: Ron Hill

OR/Technical Specialist: Murray Hong

Research Associate: Nelofar Kureshi

Rapid technological advances have enabled simulation training to provide reality based learning experiences for clinician trainees for our “next generation” of health care professionals. These customizable simulation platforms provide new and augmented educational programs that focus on required skills traditionally practiced in clinical settings.

As medical residency programs move towards competency based training, simulation can provide an effective system for measuring and recording competencies in clinical knowledge and the development of surgical technical skills.

Current technology coupled with the needs of advancing health care systems, dictates a strong need for simulation based learning opportunities for all health care professionals. Simulation supports a cost-effective, accessible and timely system to support well trained practitioners in the delivery of safe health care, with the ultimate goal of improved patient outcomes.

Goals

- Enhance education and skills for health care professionals through simulation – based training.

Mission

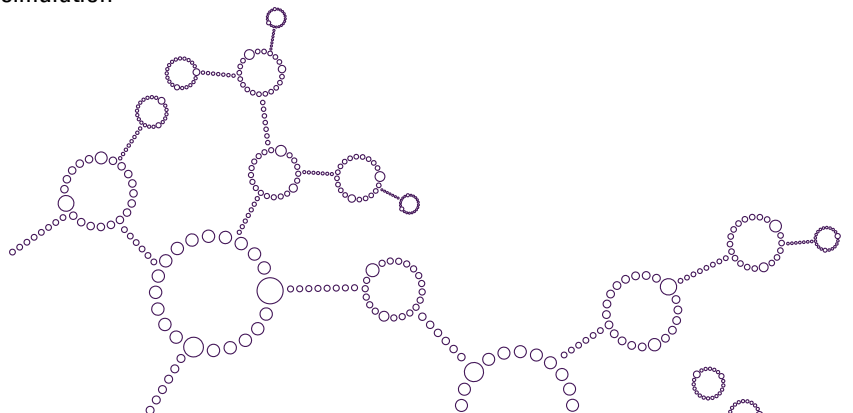
- To develop and expand simulation – based educational environments for healthcare trainees and inter-professional teams.
- To create a comprehensive surgical simulation program for health care professionals.
- To engage research and knowledge translation of simulation-based education.

Accomplishments

- PeriopSim™, an application for surgical instrument training, developed by Conquer Mobile in collaboration with Dr. David Clarke, Dr. Ryan D’Arcy (Simon Fraser University), Dr. James Bond (Surrey Memorial Hospital), and Denise Lalanne (BIOTEC) is in use in more than 100 North American hospitals and is available on the Apple App Store.
- The Association of Peri-Operative Registered Nurses (AORN), the largest group of OR nurses in the US, continues to pilot PeriopSim™ in their training program.

Research

- Virtual Reality (VR) Training for Neurosurgery Residents: PeriopSim™ VR versus PeriopSim™ Ipad APP was tested at the 2017 Canadian Neurosurgery Rookie Camp. The PeriopSim™ VR provides fully immersive medical simulation surgical instrument training. The comparative study will analyze and compare the two different simulation platforms.
- Simulation Training for Perioperative Nurses: The 100 Nurses study, supported by a grant from the Brain Repair Centre to evaluate the PeriopSim™ platform, has been completed and is in the manuscript phase. Results show that the PeriopSim™ is effective for neurosurgical instrument identification training and short term knowledge retention.
- Simulation Training for Perioperative Orthopedic Nurses using Digital Instrument Recognition (the PONDIR study) – effectiveness and health economic implications. This study, led by Drs. R. Hurley and D. Clarke and supported by the Neurosurgery Simulation Program, will be undertaken at the Dartmouth General Hospital to determine the effectiveness of tablet-based simulation training for common orthopedic procedures.



Neurosurgery Simulation Program (cont'd)

Presentations

1. **Clarke DB, Hong M, Kureshi N, Fenerty L, Thibault-Halman G, D'Arcy RC.** Simulation-Based Training for Surgical Instrument Recognition. 52nd Annual Congress of the Canadian Neurological Sciences Federation, Victoria BC, June 20, 2017; Canadian Journal of Neurological Sciences, P. 102, Volume 44, Issue S2, pp. S39-S40, June 2017.

2. **Clarke DB, Hong M, Kureshi N, Fenerty L, Thibault-Halman G, D'Arcy R.** Simulation-Based Training for Burr Hole Surgery and Surgical Instrument Recognition. Trauma Association of Canada (TAC) 2017 Conference, Vancouver, BC, February 23-24, 2017; Canadian Journal of Surgery, 60(3), p. S19, June 2017.

Invited Lectures/Presentations 2017

Nova Scotia Health Authority Board of Directors and Leadership Team, Halifax, NS, "Innovation in Training the Surgical Team – the Future is Now", December 5, 2017.

Canadian Neurosurgical Innovation Meeting, "Roboscope", Toronto, ON, September 16, 2017.

NSHA's MDR Managers Meeting, "Simulation-Based Training for Burr Hole Surgery and Surgical Instrument Recognition", Truro, NS, September 14, 2017.

Canadian Neurosurgical Leadership Meeting, "Neurosurgery Resident Training: Atlantic Canada", Victoria, BC, June 19, 2017.

OR Nursing Grand Rounds, "Medical Simulation Training – PeriopSim™", October 25, 2017.

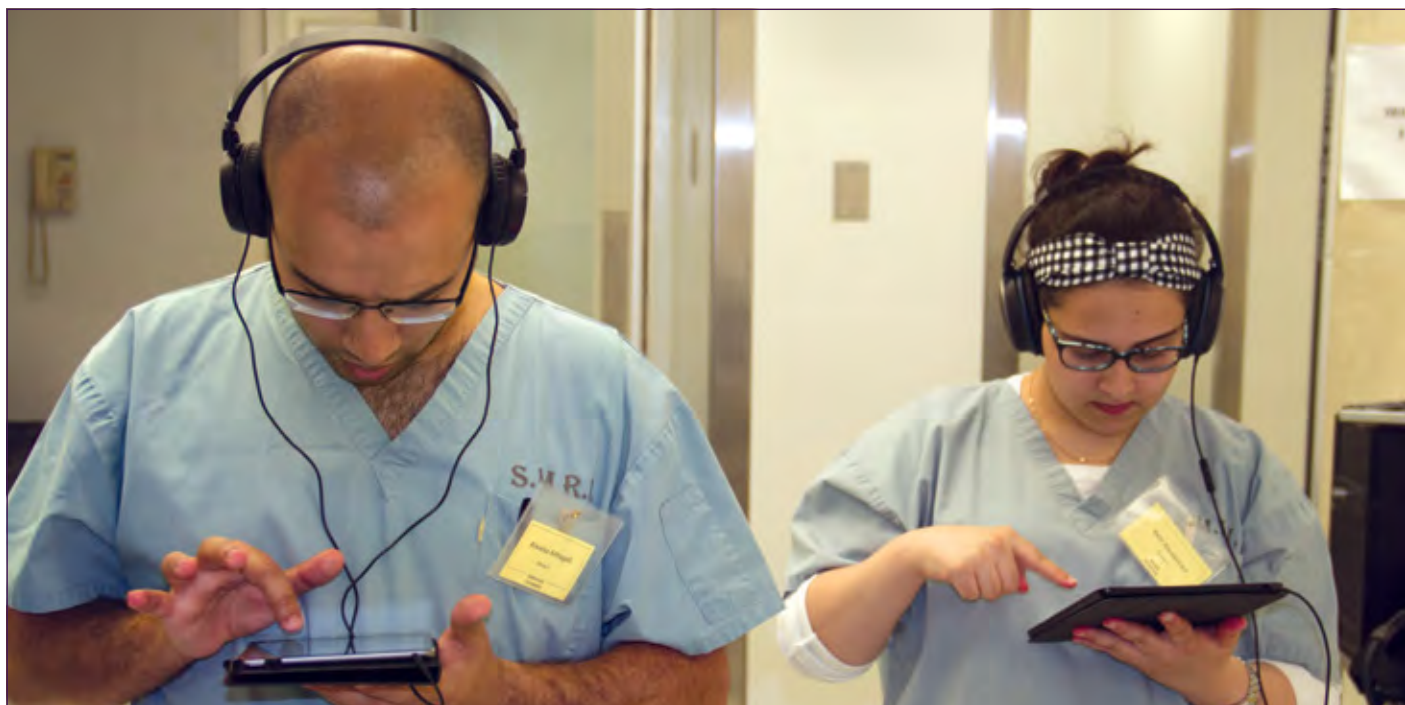
Annual Canadian Neurosurgery Rookie Camp, Halifax, NS, July 2017.

Team Members:

- Dr. David Clarke, Neurosurgeon
- Ron Hill, Neurosurgery Technology Coordinator
- Murray Hong, Neurosurgery OR/Technical Specialist
- Lynne Fenerty, Program Manager
- Ginette Thibault-Halman, Program Coordinator
- Nelofar Kureshi, Research Associate

Team Collaborators:

- Dr. Ryan D'Arcy, Department of Computing Science, Simon Fraser University
- Denise Lalanne, BIOTEC
- Conquer Mobile
- Dr. R. T. Hurley, Orthopedic Surgeon, Dartmouth General Hospital



Cerebrovascular Program

Director: Dr. Gwynedd Pickett

Coordinator: Judith Jarrett

The Cerebrovascular Program is a multidisciplinary program involving neurosurgeons, neuroradiologists, stroke neurologists, nurses and trainees in each of these disciplines. Halifax is the referral centre for the treatment of cerebrovascular disorders in Atlantic Canada with extensive experience in surgical and endovascular management of aneurysms and arteriovenous malformations (AVM), and the only centre with a stereotactic radiosurgery program for the treatment of patients with AVMs. The cerebrovascular team meets weekly to review clinical cases from all of the Atlantic Provinces, and discuss recommendations for a multidisciplinary evidence-based approach to patient care.

Mission

Our team is dedicated to providing world class, innovative care for patients with cerebrovascular disorders.

Program Goals

- To treat patients with cerebrovascular disorders using the latest technology.
- To advance the knowledge and techniques for the treatment of cerebrovascular disorders through education and research.
- To translate research to evidence based practice.

Research

We have had an active year in research, participating in several multi-center studies and local investigator driven studies as listed below. We maintain a number of databases that provide valuable information for local research endeavors.

Ongoing Multi-Centre Studies

- **CURES** - The Canadian Unruptured Endovascular Coiling versus Surgical Clipping Trial, a randomized comparison of angiographic and clinical outcomes following treatment for Unruptured intracranial aneurysms. Currently enrolling, (Funding: \$6,000.00).
- **STAT** – Stenting in the Treatment of Large, Wide-necked or Recurring Intracranial Aneurysm Trial. Currently enrolling.

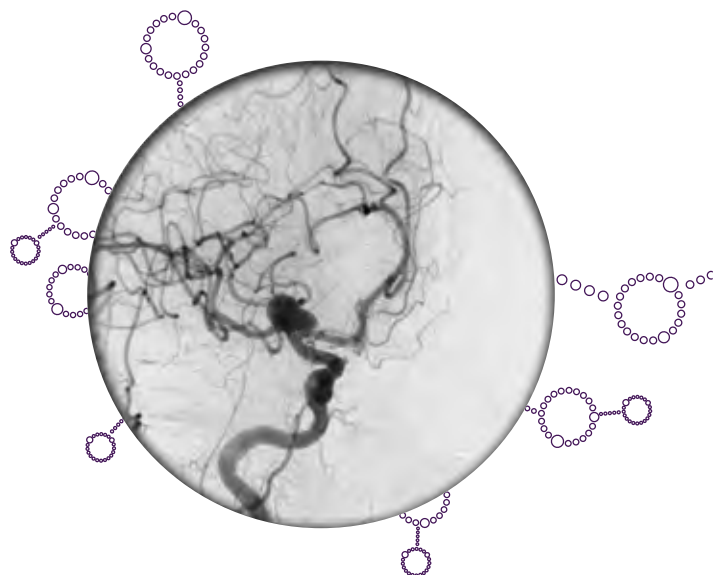
- **ECST-2** – The 2nd European Carotid Surgery Trial: A multicenter randomized controlled open prospective clinical trial with blinded outcome assessment. Currently enrolling, 7 subjects enrolled (Funding: \$282,673.00).
- **HEAT** – Multi-center randomized controlled trial of new generation Hydrogel coils versus bare platinum coils in the endovascular treatment of intracranial aneurysms. In follow-up, 22 subjects enrolled, (Funding: \$82,800.00).
- **NAVIGATE ESUS** – Secondary Prevention of Stroke in Patients with ESUS. In follow-up, 9 subjects enrolled, (Funding: \$282,673.00).
- **ESCAPE NA1** – A Multi-center, Randomized, Double-blinded, Placebo-controlled, Parallel Group, Single-dose Design to Determine the Efficacy and Safety of Intravenous NA-1 in Subjects with Acute Ischemic Stroke Undergoing Endovascular Thrombectomy. Currently enrolling, 3 subjects enrolled (Funding: \$144,000.00).

Ongoing Local Studies

Evaluation of the Unruptured Intracranial Aneurysm Treatment Score: how does it compare with treatment decisions made by a multidisciplinary team?

CT Perfusion Imaging to Predict Vasospasm in Subarachnoid Hemorrhage (Funding: \$25,000.00).

Intracranial Aneurysm Measurement with Magnetic Resonance Angiography: what is the smallest change that signifies growth?



Cerebrovascular Program (cont'd)

Accomplishments

- Dr. Pickett was promoted to Associate Professor in the Dalhousie University Department of Surgery. In addition, she was President of the 48th Atlantic Clinical Neurosciences Society Conference and Annual General Meeting, Halifax, Nova Scotia, May 4 - 6, 2017.
- The Brain Aneurysm Support Group has been meeting regularly since October 2006. This invaluable resource serves as an opportunity for brain aneurysm patients and families to share information, give and receive emotional support, educate each other, identify needs and access further resources.
- We continue to treat patients from across the Maritime Provinces for a variety of complex cerebrovascular conditions. 2017 saw expansion of our stereotactic radiosurgery program, with an increasing number of patients referred and treated.

Future Directions

Program members continue to work together to improve the care of patients with cerebrovascular disorders in Nova Scotia and the Atlantic Provinces. Upcoming research projects will investigate potential applications of 3D printing to enhance patient care planning.

Presentations

Canadian Association of Neurological Nurses, Nova Scotia Chapter Annual Education Day, May 5 2017. **Abstract:** Godbout H, Jarrett J, Pickett GE. Validation of the unruptured intracranial aneurysm treatment score against "real-world" MDT decisions. Canadian Neurological Sciences Federation 52nd Congress, Victoria BC, June 20-23, 2017.

Team Members & Collaborators:

- Dr. Gwynedd Pickett, Director, Neurosurgeon
- Judith Jarrett, Research Coordinator
- Carole-Ann Miller, Specialty Nurse Practitioner
- Dr. Adrienne Weeks, Neurosurgeon
- Dr. Gordon Gubitz, Neurologist
- Dr. Stephen Phillips, Neurologist
- Dr. Laine Green, Neurologist
- Dr. William Maloney, Neuroradiologist
- Dr. Robert Vandorpe, Neuroradiologist
- Dr. Matthias Schmidt, Neuroradiologist
- Dr. Jai Shankar, Neuroradiologist
- Dr. Jens Heidenreich, Neuroradiologist
- Dr. Aiman Quateen, Neurointerventional Fellow
- Dr. Mandeep Ghuman, Neurointerventional Fellow



BACK (LEFT TO RIGHT): A. Al-Habsi, Dr. G. Gubitz, Dr. R. Vandorpe, Dr. W. Maloney, Dr. S. Phillips, Dr. J. Shankar
FRONT (LEFT TO RIGHT): C-A Miller, Dr. G. Pickett, Dr. A. Weeks, J. Jarrett

Brain Tumour Program

Program Co-Chairs: Drs. Adrienne Weeks and Mary McNeill
Brain Tumour Nurse Coordinator: Missy Brinson
Research Coordinator: Andrea L.O. Hebb

The Brain Tumour Program is a multidisciplinary program involving neurosurgeons, medical oncologists, radiation oncologists, neuropathologists, neuroradiologists, nurses, and trainees of each of these disciplines. Weekly meetings of the Neuro-oncology Cancer Site Team provide evidence based recommendations for patient management. This team organizes visiting speakers and rounds, and is responsible for the development of provincial guidelines for the management of patients with brain tumours. This past fall the first annual Brain Cancer Bash fundraiser for research was held at the Lord Nelson Hotel in Halifax. The night included magicians, food and music by local band Big Fish. The event was a huge success thanks to the support of Lori Duggan and Garry Beatie as well as the Division of Neurosurgery. Please look forward to next year's event to be held in the fall and with continued support we hope to continue to raise even more funds to go towards our brain tumour research here in Halifax.

The Brain Tumour Support Groups are located in Halifax and New Glasgow.

The Halifax Group holds meetings every 2nd Tuesday of each month at:

The Lodge That Gives
 5826 South Street
 Halifax, NS

The New Glasgow Group holds meetings every 3rd Monday of the month at:

The East River Manor
 695 East River Road
 New Glasgow, NS

Brain Tumour Support Groups help survivors, family and caregivers through their journey with a brain tumour in a number of ways:

- Providing connections with others who have faced life with a brain tumour thereby offering reassurance, reducing feelings of isolation and reinforcing a positive, hopeful attitude.
- Sharing practical information to:
 - o help make informed decisions about brain tumour treatment options
 - o learn about relevant community resources
 - o enhance coping skills in order to reduce anxiety, feelings of loss of control and fear of the unknown, changes in family roles, and financial strain as a result of a brain tumour diagnosis

See more at: <http://www.braintumour.ca/280/halifax-nova-scotia#sthash.TwDcHPLw.dpuf>

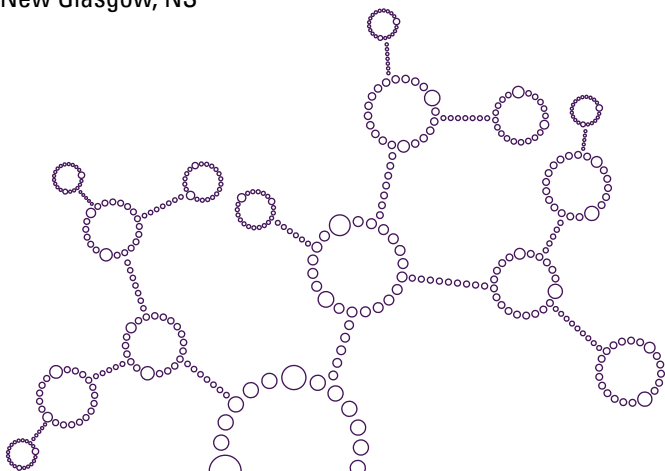
Our prospective epidemiology Brain Tumour Database continues with over 4300 patients currently entered.

Research

Dr. Adrienne Weeks and Dr. Sid Croul, in coordination with the Division of Neurosurgery and Pathology, started Nova Scotia Brain Tumour Bank to aid in future research.

Dr. Simon Walling, Dr. Conrad Fernandez (IWK), Dr. Adrienne Weeks, Dr. Dan McNeely and Andrea L.O. Hebb, MSC, PhD, RN (Local Associate Investigators) are part of a collaborative research team lead by Dr. Nada Jabado at McGill University/McGill University Health Center (Principal Investigator Genome Canada). "Biomarkers for Pediatric and Adult High Grade Astrocytoma through Genomics and Epigenomics" is a Canada wide study for adult patients under the age of 50 and children, and their families surveying their thoughts surrounding receiving genetic research results.

A sub-study of this grant involves collecting tumour samples in patients with high grade astrocytoma, with the formation of human tumour cell lines in the basic science laboratory of Dr. Adrienne Weeks (PI) and Dr. Simon Walling (PI) and co-investigators Dr. David B. Clarke, Dr. Dan McNeely and Andrea L.O. Hebb, in collaboration with Dr. Sidney Croul, Pathology & Laboratory Medicine.



Brain Tumour Program (cont'd)

In collaboration with the Division of Pediatric Neurosurgery, British Columbia's Children Hospital and Division of Neurosurgery, Department of Surgery, University of British Columbia and members of the Vancouver Pediatric Neurosurgery Study Group Dr. Simon Walling and Dr. Dan McNeely (Local Associate Investigators) are participating in a nationwide study "Mutism After Posterior Fossa Tumour Resection in Children: A Multicentered International Retrospective Study" to identify factors related to the overall management or surgical technique that correlate with a lower or higher incidence of Cerebellar mutism syndrome (CMS).

Basic Science Brain Tumour Research: see Brain Tumour Laboratory, Dr. Adrienne Weeks.

Accomplishments

Dr. Aaron Robichaud won best basic science award presented at DOS Research Day and Neurosciences day.

Dr. Adrienne Weeks successfully obtained a DMRF grant to aid in the purchase of a high throughput image analyzer to aid in brain tumour research.

Dr. Adrienne Weeks was highlighted in the faces fighting cancer book.

BRAIN TUMOUR BANK

Formation of Nervous System Tumour Tissue Bank at Dalhousie University/Nova Scotia Health Authority

Abstracts/Conferences

Dr. Adrienne Weeks and Dr. Aaron Robichaud presented their research on GBM and stress granules on RUA granules in Germany and at the Society of Neuro Oncology in San Francisco.

Dr. Adrienne Weeks gave a talk at Dalhousie TEDx event on GBM.

Team Members:

- Dr. Adrienne Weeks, Neurosurgeon, Co-Chair CNS CST
- Dr. Mary McNeill, Medical Oncologist, Co-Chair CNS CST
- Dr. Simon Walling, Neurosurgeon
- Dr. Dan McNeely, Neurosurgeon
- Dr. David Clarke, Neurosurgeon
- Dr. Gwynedd Pickett, Neurosurgeon
- Dr. Sean Christie, Neurosurgeon
- Dr. Sean Barry, Neurosurgeon
- Missy Brinson, Neurosurgery Brain Tumour Nurse Coordinator
- Andrea L.O. Hebb, Neurosurgery Research Coordinator
- Dr. Sid Croul, Neuropathologist
- Dr. Alex Easton, Neuropathologist
- Dr. Beecham, Radiation Oncologist
- Dr. Liam Mulroy, Radiation Oncologist
- Dr. Lara Best, Radiation Oncologist
- Dr. Jai Shankar, Neuroradiologist
- Dr. Robert Vandorpe, Neuroradiologist
- Heather MacKenzie, Coordinator, Cancer Care Nova Scotia
- Erin Little, Research Coordinator



BACK (LEFT TO RIGHT): H. MacKenzie, Dr. J. Shankar, Dr. R. Vandorpe, Dr. A. Weeks, Dr. S. Croul, Dr. S. Walling, Dr. D. Clarke
FRONT (LEFT TO RIGHT): Dr. Badahdah, Dr. M. MacNeill, M. Brinson, A. Hebb, Dr. D. McNeely

Neurotrauma and Injury Prevention Programs

Director: Dr. David Clarke

Program Manager: Lynne Fenerty

Program Coordinator: Ginette Thibault-Halman

Research Coordinator: Lorelei Audas

Research Associate: Nelofar Kureshi

Direct and indirect costs associated with TBI are estimated at three billion dollars annually in Canada. Over the past decade there has been a 19% increase in major traumatic injury in Nova Scotia (NS). In 2016, there was a greater proportion of TBIs associated with increasing age, with 59% occurring at >65 years of age (n=239), 37% at 46-65 years of age (n= 271), 26% at 30-45 years of age (n=143), 25% 16-29 at years of age (n=181) and 16% at <16 years of age (n=45).

The Neurotrauma and Injury Prevention programs are dedicated to conducting research for preventative strategies and improved clinical management for TBI patients and their families. Both programs collaborate to deliver targeted, evidence-based injury prevention and clinical programming for TBI care.

Mission

- Provide leadership in injury prevention and neurotrauma research, advocacy, education and knowledge translation.

Goals

- Participate in national traumatic brain injury research.
- Support evidence-based care solutions to improve access to neurosurgical care, reduce lengths of stay and optimize patient outcomes.
- Implement and support advocacy efforts for neurotrauma injury prevention.

Accomplishments

- In partnership with the Division of Physical Medicine and Rehabilitation, Department of Family Medicine, and the Department of Emergency Medicine, we have received approval to establish a multi-disciplinary mTBI/concussion clinic at the Nova Scotia Rehab Centre.
- The Concussion Nova Scotia resource website has been successfully launched: www.concussionns.com
- TBI Preceptorship program: Dalhousie Medical Students, Jake Blacklaws, Mike Smyth and Michelle Trenholm attended the preceptor program with Dr. David Clarke.

- Canadian Traumatic Brain Injury Research Consortium (CTRC), a partnership of Canadian basic and clinician scientists focused on TBI research. Dr. Clarke is an active member, attending national meetings.

Research

- TBI database: all TBI admissions to Neurosurgery are reviewed at TBI teaching and quality rounds, chaired by Dr. Clarke. Currently, over 2,335 cases have been reviewed for inclusion in the TBI database.
- The investigation of the incidence and economic burden of alcohol-related traumatic brain injury in Nova Scotia, a joint partnership with the Department of Health and Wellness and the Nova Scotia Trauma Program, has been completed and is in manuscript preparation.
- “A National Biobank and Database for Patients with Traumatic Brain Injury”, the CanTBI study, is currently enrolling participants with mild, moderate and severe TBIs.
- “Microvascular injury and the blood brain barrier dysfunction as novel biomarkers and targets for treatment in traumatic brain injury”. This study has received research ethics approval and will begin enrolment in 2018.

Publications

Huybers S, Fenerty L, Kureshi N, Thibault-Halman G, LeBlanc JC, Clarke DB, Walling S. Long-Term Effects of Education and Legislation Enforcement on All-Age Bicycle Helmet Use: A Longitudinal Study. *Journal of Community Health*, 42:83-89, 2017.

Presentations

Thibault-Halman G, Fenerty L, Taylor P, Kureshi N, Walling S, Clarke DB. Early Telephone Follow-Up for Traumatic Brain Injury Patients Using the Rivermead Post-Concussion Symptoms Questionnaire. 52nd Annual Congress of the Canadian Neurological Sciences Federation, Victoria BC, June 22, 2017; *Canadian Journal of Neurological Sciences*, P.016, Volume 44, Issue S2, pp. S17-S18, June 2017.

Thibault-Halman G, Fenerty L, Taylor P, Kureshi N, Walling S, Clarke DB. Early Telephone Follow-Up for Traumatic Brain Injury Patients Using the Rivermead Post-Concussion Symptoms Questionnaire. Trauma Association of Canada (TAC) 2017 Conference, Vancouver, BC, February 23-24, 2017; *Canadian Journal of Surgery*, 60(3), pp. S18-19, June 2017.

Neurotrauma and Injury Prevention Programs (cont'd)

Education

- Inter-Professional Clinical Trauma Rounds, Departments of Surgery, Anesthesia, Radiology and Emergency Medicine, "Epidural Hematoma: Case Review", **Dr. David Clarke**. Halifax, NS, January 17, 2017.
- Dalhousie University Neurosurgery Resident Curriculum, "Minor head injury, concussion, post-concussion syndrome, diffuse axonal injury, dementia pugilistica / thalamus: major relay nuclei and reticular nucleus", **Dr. David Clarke**. July 12.
- Third Year Clerks, Dalhousie Medical School, "Managing Patients with Acute CNS Injury", **Dr. David Clarke**. January 24, May 9, July 11, October 3.

Funding and Grants

\$3 Million: A National biobank and database for patients with traumatic brain injury. Brain Canada Platform Support Grant. Matching contributions have been provided towards this Platform Support Grant by the Division of Neurosurgery, the Department of Surgery, and Nova Scotia Health Authority. Primary Investigator: Jamie Hutchison (University of Toronto); Co-Investigators: Andrew Baker, Karen Barlow, **David Clarke**, Michael Esser, Robin Green, Anne-Marie Guerguerian, Jacques Lacroix, Alain Pitto, Keith Walley, Jamie Hutchison.

\$237,050: Microvascular injury and the blood brain barrier dysfunction as novel biomarkers and targets for treatment in traumatic brain injury. Primary Investigators: Dr. Alon Friedman and **Dr. David Clarke**. Co-Investigators: **Dr. Simon Walling**, Dr. Robert Green, Dr. Christopher Bowen, Dr. Matthias Schmidt.

\$20,000: An Investigation of the Health and Economic Outcomes of Alcohol-Related Traumatic Brain Injury in Nova Scotia. Department of Health Promotion and Protection. **David Clarke**, **Simon Walling**, Robert Green, **Lynne Fenerty**, **Nelofar Kureshi**, Mete Erdogan, **Ginette Thibault-Halman**.

Team Members:

- Dr. David Clarke, Neurosurgeon
- Dr. Simon Walling, Neurosurgeon
- Lynne Fenerty, Program Manager
- Ginette Thibault-Halman, Program Coordinator
- Lorelei Audas, Research Coordinator
- Nelofar Kureshi, Research Associate
- Annie Cudmore, Data Entry
- Coralea Carey, Data Entry
- Maggie Moores, Research Student

Team Collaborators:

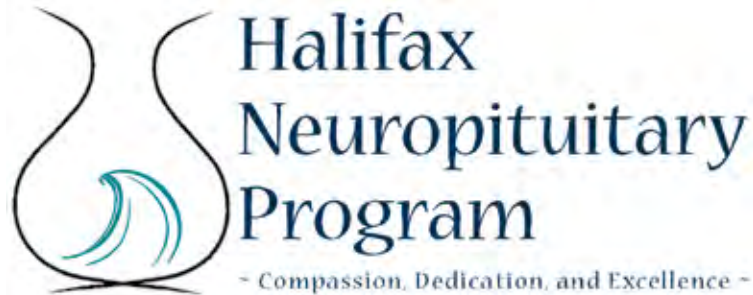
- Department of Physical Medicine and Rehabilitation
- Department of Health Promotion and Protection
- Atlantic Collaborative for Injury Prevention
- Department of Emergency Medicine
- Parachute (ThinkFirst) Canada
- Department of Critical Care
- Emergency Health Services
- Trauma Nova Scotia



BACK ROW: Dr. S. Walling, Dr. D. Clarke

FRONT ROW: M. Moores, N. Kureshi, G. Thibault-Halman, L. Fenerty

Halifax Neuropituitary Program



Program Co-Chairs: Drs. David B. Clarke and S. Ali Imran
Research Coordinator: Andrea L.O. Hebb

Mission

Our team is dedicated to providing world class, innovative care for patients with pituitary/parasellar tumours.

Objectives

- To provide a comprehensive, multi-disciplinary, patient-focused team.
- To be leaders in delivering accessible and innovative health care for patients with pituitary disorders.
- To create an environment that fosters education and research.

This program, unique to the Atlantic Provinces and much of Canada, provides comprehensive care to over 1700 patients with pituitary and sellar region tumours in a multidisciplinary clinic. Patients in the surgery clinic are seen by both Neurosurgery and Endocrinology. Collaboration with the Stereotactic Radiosurgery Group, Otolaryngology and Ophthalmology ensures coordinated assessment, treatment and follow-up. Monthly multidisciplinary teleconference rounds are held with external sites from Nova Scotia, New Brunswick and PEI.

Patients were referred from all Atlantic Provinces. New patients seen in 2017 included 52 referrals to our surgery clinic and 199 to our medical clinic. There were 415 patient visits to the medical clinic and 363 patient visits to the surgical clinic.

Forty-one transsphenoidal surgeries were performed endoscopically in 2017 by Drs. Clarke (Neurosurgery) and Massoud (Otolaryngology).

Research/Program Development

In collaboration with the IGNITE team of researchers (<http://igniteproject.ca/team/view/11>), we are continuing to collect sellar/parasellar tumour tissue intra-operatively under the protocol "Functional and Genetic Analysis and Banking of Neuro-Oncological Disease Tissues". We hope to develop a better understanding of the genetic and functional pathways that confer an increased risk of developing and perpetuating neuro-oncological diseases (NODs), including neuropituitary tumours.

In addition, we have treated our 12th patient as part of our Health Canada approved clinical trial on the stereotactic intracavitary instillation of ⁹⁰Yttrium for treatment of cystic sellar/parasellar lesions (PI: Dr. David Clarke). This clinical trial is being performed in collaboration with Dr. Steven Burrell and Dr. George Mawko in the Department of Diagnostic Imaging, QEII Health Sciences Centre, for treatment of HNP patients with cystic lesions.

Halifax Neuropituitary Program (cont'd)

Nova Scotia Health Authority Research Fund “Non-functioning pituitary adenomas biomarkers” (PI: Andrea Hebb, PhD) was approved for funding in 2014 and we are starting the process of molecular analysis.

Publications

Imran SA, Shankar J, **Hebb ALO**, Croul SE, **Clarke DB**. Radiological Growth Patterns of Prolactinomas and Nonfunctioning Adenoma. Canadian Journal of Neurological Sciences, 3:1-6, 2017.

Burrell S, **Hebb ALO**, Imran SA, Mishra A, Mawko G, **Clarke DB**. Visualization of ⁹⁰Yttrium Colloid Within A Cystic Craniopharyngioma Using PET/CT/MRI Fusion. The Canadian Journal of Neurological Sciences, 44:192-193, 2017.

Presentations

Neurosurgery Fireside Chat, “Transsphenoidal Surgery: Know where the carotid is...and avoid it!” Canadian Neurological Sciences Federation annual meeting, Victoria, BC, June, 2017 (Dr. D. Clarke).

Team Members:

- Dr. David Clarke, Neurosurgeon
- Dr. Ali Imran, Endocrinologist
- Dr. Emad Massoud, Otolaryngologist
- Raven Glasgow, Program Clinic Coordinator
- Andrea Hebb, Neurosurgery Research Coordinator
- Lisa Tramble, Endocrinology Clinic Nurse
- Murray Hong, Neurosurgery OR Technologist
- Dr. Aditya Mishra, Ophthalmologist
- Dr. Janice Ho, Endocrinologist
- Dr. Deborah Zwicker, Endocrinologist, Sydney, NS
- Dr. Vicki Munro, Endocrinologist, Saint John, NB
- Dr. Angela McGibbon, Endocrinologist, Fredericton, NB
- Dr. Sid Croul, Neuropathologist
- Dr. Liam Mulroy, Radiation Oncology
- Dr. Dorianne Rheaume, Radiation Oncology
- Dr. Steven Burrell, Diagnostic Radiologist
- Dr. George Mawko, Diagnostic Radiologist

Team Collaborators:

- Neuroradiology
- Nova Scotia Eye Centre



BACK ROW: Dr. D. Clarke, A. Hebb, Dr. A Imran, R. Glasgow, Dr. D. Zwicker

FRONT ROW: Dr. E. Massoud, D. Jardine, L. Tramble

Maritime Lateral Skull Base Program

Program Co-Directors: Drs. David Morris and Simon Walling

Program Coordinator: Andrea L.O. Hebb

Clinic Coordinators: Bonita Meade and Keri Sampson



The Maritime Lateral Skull Base Clinic provides coordinated care through Otolaryngology, Neurosurgery and the Stereotactic Radiotherapy Group to patients with unilateral or bilateral vestibular schwannomas, acoustic neuromas and a range of other lateral skull base tumours.

The program provides coordinated care to over 700 patients with a range of lateral skull base tumours including vestibular schwannomas, other cerebellopontine angle (CPA) tumours, lesions of the petrous apex and jugular foramen. Patients are carefully assessed and appropriate plans formulated. When treatment is required, the experts on our team provide a full range of treatment options including surgery, stereotactic radiation therapy (SRT), balance and hearing rehabilitation. This program is unique in Canada in allowing members from all disciplines to formulate management decisions in the same clinic.

NF2 Clinics continue to be held once every 2nd month. This clinic is dedicated to patients with Neurofibromatosis Type 2 and includes collaboration with Medical Genetics, Radiology, Nova Scotia Hearing and Speech as well as Ophthalmology.

Our program referrals have increased since 2016, with 57 new Maritime Lateral SBC referrals, to include 15 patients from New Brunswick, 2 from PEI, 1 from NL and 39 from NS. Five hundred and seventy four clinic visits occurred in 2017. Dr. Simon Walling and Dr. David P. Morris performed 17 surgeries to remove CPA tumours in 2017. In addition, 17 patients underwent stereotactic radiation therapy (SRT) to control tumour growth.



Maritime Lateral Skull Base Program (cont'd)

Program Goals

- To offer a single centre, multidisciplinary approach
- To be an internationally recognized centre for lateral skull base lesions
- To be at the forefront of clinical research in lateral skull base lesions
- To maintain a detailed database allowing critical appraisal of current treatment strategies
- To be sensitive to new developments in our specialty allowing us to be critical of our practice and outcomes
- To change our practice in light of evidence based research

Research

We have developed several research fronts in this program. Some are listed below:

- What is useful hearing? Speech in noise comprehension with asymmetric hearing in acoustic neuroma subjects, when does the tumour ear stop contributing to binaural hearing?

- Database of tumour growth and outcomes. One of the largest series in the world with the “wait and scan” policy
- Patient expectations and attitudes to acoustic neuroma – questionnaire for all patients in our database
- Subjective hearing handicaps measured with standardized instruments
- Tinnitus and quality of life questionnaires added to each clinic visit
- Simon Walling, Dan McNeely, Andrea L.O. Hebb Mutism After Posterior Fossa Tumour Resection in Children: A Multicentre International Retrospective Study- collaboration with Vancouver Pediatric Neurosurgery Study Group (VPNSG)

Publication

The Maritime Lateral Skull Base Clinic: Multidisciplinary Collaboration, Peer Mentoring and Innovation in Patient Care. A Publication of the Acoustic Neuroma Association of Canada. Summer Edition 2017. www.anac.ca

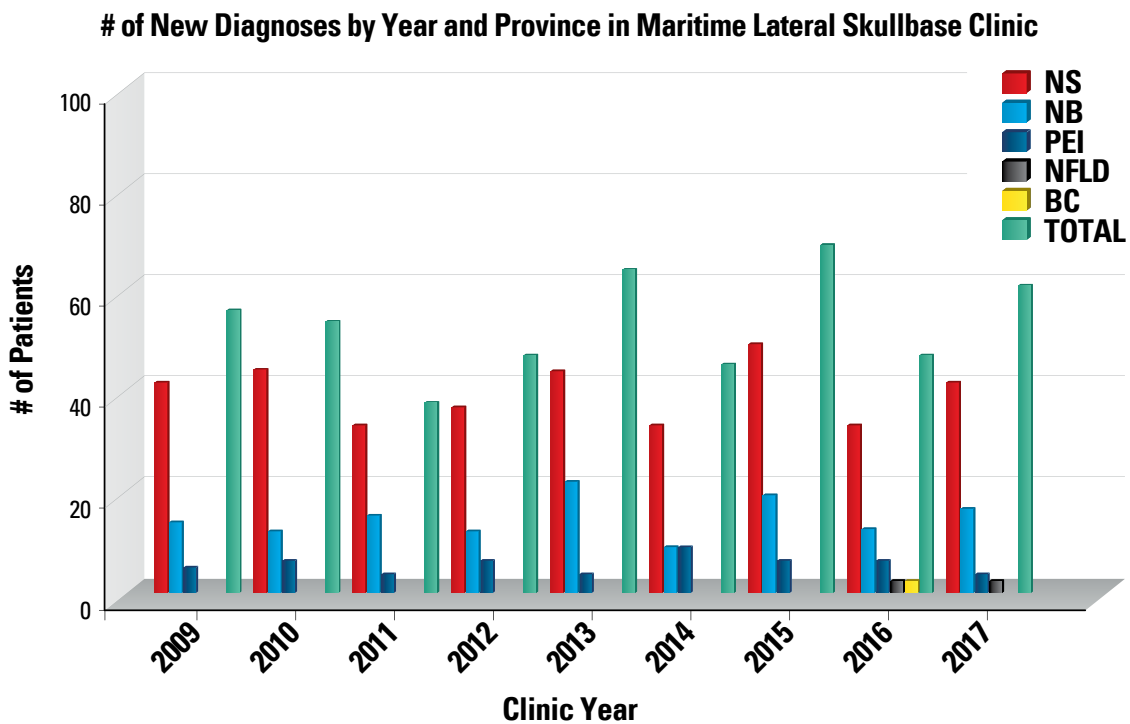


Figure 1: Referrals are received across Canada with the majority from the Maritime provinces. The number of new patients seen by year per province are outlined.

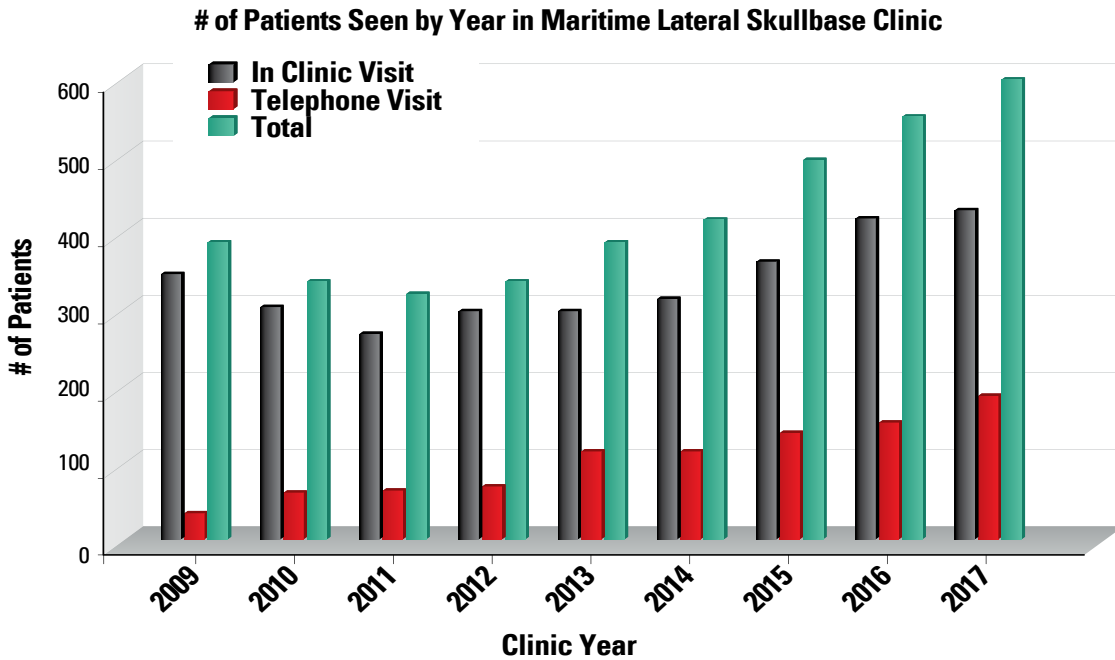


Figure 2: Patients are initially seen in clinic and depending on the stability of their tumour and symptoms patients may be followed periodically by telephone visits or chart checks. Patients are registered in the hospital system, MRI scans are reviewed by the team, the patient is called and a letter dictated to the family doctor. The number of in clinic and telephone visits by year are outlined in the graph. Over 500 patients were reviewed in 2017 and in clinic and telephone visits have been steadily increasing since 2012.

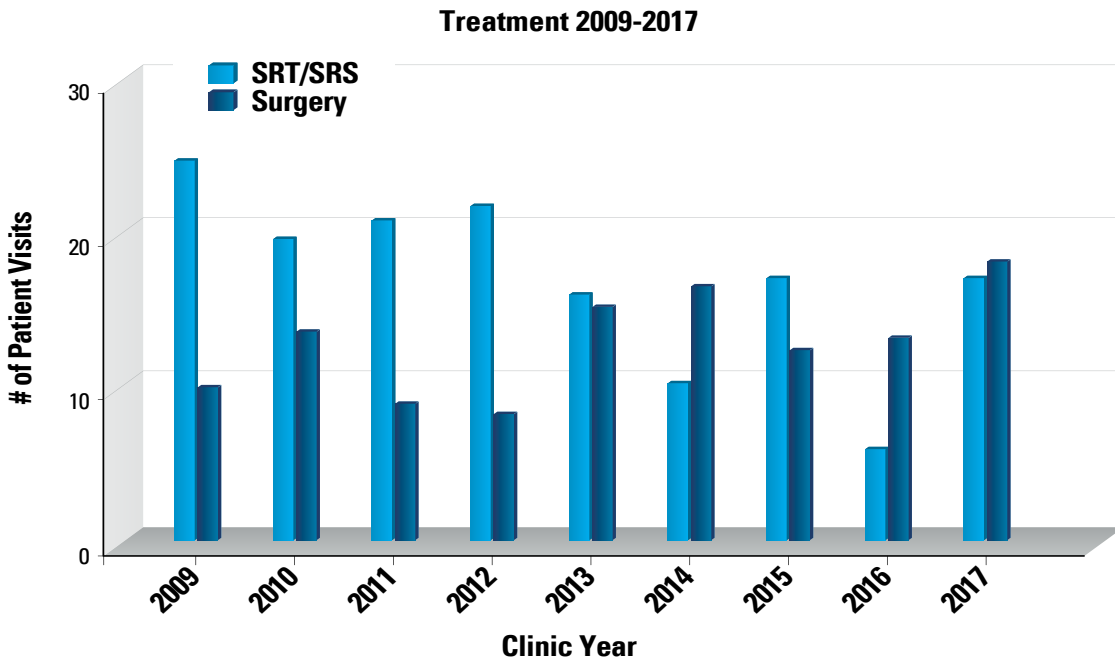


Figure 3: The number of patients treated with SRT/SRS or surgery are outlined per year since 2009.

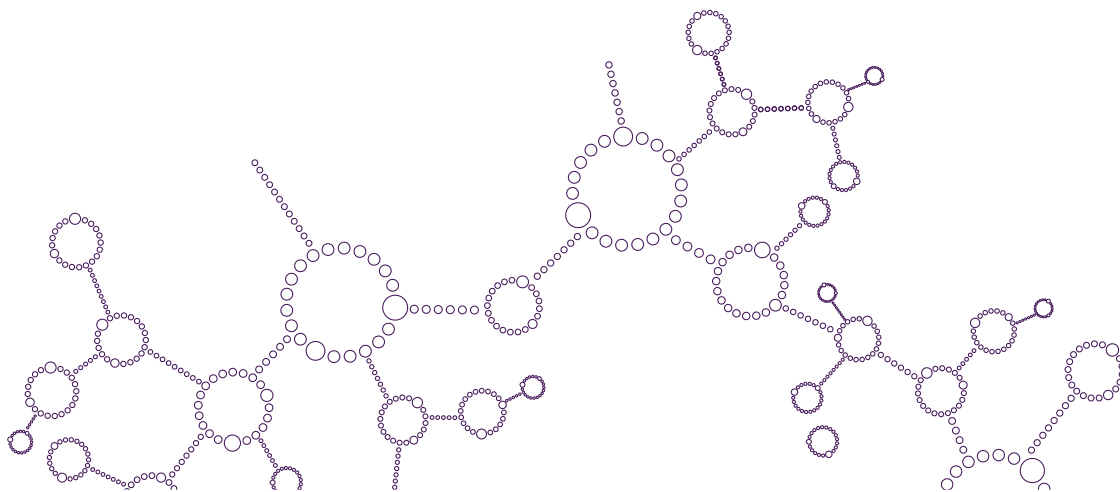
Maritime Lateral Skull Base Program (cont'd)

Team Members:

- Dr. Simon Walling, Neurosurgeon
- Dr. Manohar Bance, Otolaryngologist
- Dr. David P. Morris, Otolaryngologist
- Andrea Hebb, Research Coordinator
- Bonita Meade, Clinic Coordinator
- Keri Sampson, Clinic Coordinator

The Stereotactic Radiosurgery Team:

- Dr. Liam Mulroy, Radiation Oncology
- Dr. Dorianne Rheaume, Radiation Oncology
- Mark Gulliver, Audiologist
- Dr. Marie Earl, Dalhousie University School of Physiotherapy
- Maritime Medical Genetics, IWK Health Centre



BACK ROW: Dr. M. Brace, Dr. D. Morris, Dr. B. Wickens
FRONT ROW: A. Hebb, Dr. M. Bance, J. Seagers, Dr. S. Walling

Pediatric Neurosurgery

The goal of the Division of Neurosurgery at the IWK Health Centre is to offer the highest quality clinical service to pediatric patients of the region, in collaboration with our colleagues at referring sites. We also strive to offer high quality teaching, and to contribute to the advancement of knowledge through our participation in research.

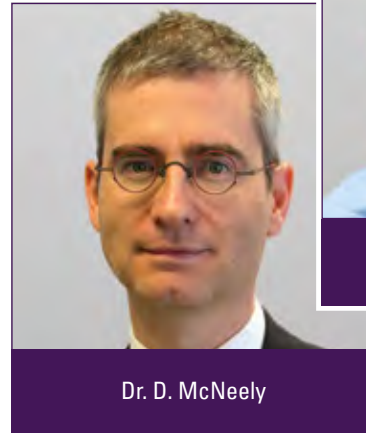
We were very pleased to welcome Dr. Jordan Sheriko to the IWK Health Centre in July 2017. Dr. Sheriko's expertise in pediatric physical medicine and rehabilitation will be invaluable to our patients.

Eastern Canada Pediatric Video-Conference rounds with Montreal Children's Hospital and l'Hôpital Sainte-Justine occur every other month. Although there have been technical challenges, the stimulating discussion that results from these exchanges has motivated us to continue on with this endeavor.

The Neurosurgery Kids Fund continues to provide support to our patients and their families during their stay at the IWK Health Centre. We are grateful to the many benefactors who have donated their money, time, and energy towards sustaining this endeavor. This year, the Neurosurgery Kids Fund paid for the first ever Neurosurgery Kids Camp that was held from October 27-29, 2017 at Brigadoon Village in Aylesford, NS. The camp welcomed 12 kids who have a neurosurgical condition. Brigadoon Staff ensured that the camp ran smoothly. Thank you to our nursing volunteers Marie MacNeil & Colleen O'Toole who spent the weekend with these kids.

Team Members and Collaborators:

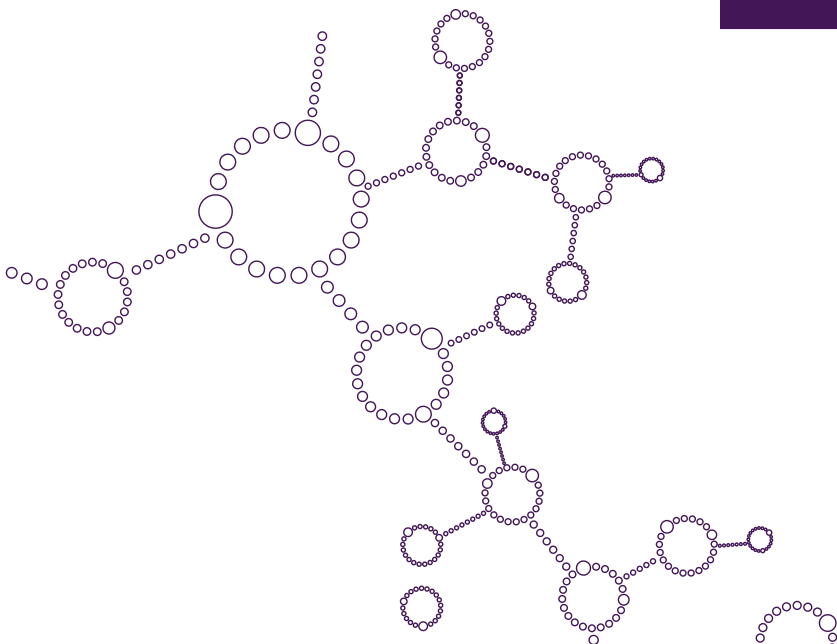
- Dr. P. Daniel McNeely, Chief, Pediatric Neurosurgery
- Dr. Simon A. Walling, Neurosurgery
- Marie MacNeil, Neurosurgery Clinic Nurse
- Kelly Boileau, Brain Tumour Clinic Nurse
- Katherine Wagner, Spina Bifida Clinic Nurse
- Janet Woods, Neurosurgery OR Nursing Team Lead
- Susan Morris, Neurophysiologist
- Cathy Caron, Administrative Assistant
- Chrissy Shay, Administrative Assistant



Dr. D. McNeely



Dr. S. Walling



IWK Health Centre

Neurosurgery Technology Program

Ron Hill: Technology Coordinator

MER – Microelectrode Recording

This year we upgraded our MER system with the Alpha Omega Neuro Omega; 5 recording electrode bengun drive, 16 channels of EMG and MEP, multiple analog and digital inputs and outputs with online data streaming to MatLab. This system will enable a more streamlined and efficient surgical flow as well as enable expanded research capabilities. Online statistics including evoked potentials, firing rates and raster graphs assist in more accurate and fast analysis of MER recordings and surgical decision making.

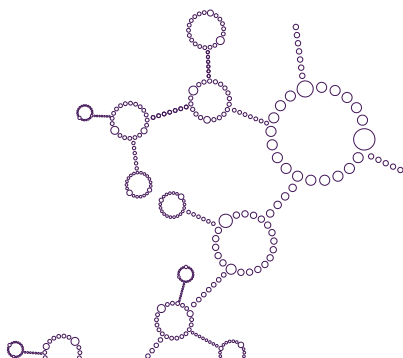
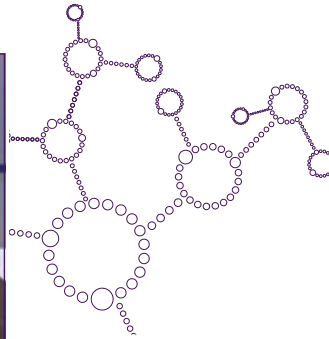
Virtual Reality Training

In our continued collaboration, in surgical simulation and training, with Conquer Mobile, we have started on a VR module for interactive training between residents and nurses. This module continues to use the HTC VIVE 3D VR headset that we have used for our Burr Hole procedure.

Imaging and Image Guided Surgery

We continue to investigate fMRI and have included MEG functional maps, merged with MR and PET on the OR Image Guided work stations. These maps allow better localization for intra-operative mapping and resection for both tumour and epilepsy surgeries.

To supplement our image guidance with MR, CT and PET, DTI scans are loaded into the StealthViz software application (Medtronic Navigation, Louisville, CO) for fiber tracking to better understand the connecting pathways. These tracks are overlaid on various merged image sequences that can then be used for intra-operative navigation. Our work this year has focused on mapping tracks to lesions, functional areas, optic tract and pyramidal tracks for DBS surgery planning.



Intraoperative Neurophysiological Monitoring (IONM)

Intraoperative neurophysiological mapping and monitoring (IONM) uses electrophysiological methods to provide ongoing feedback about brain, brainstem and spinal cord function during specific types of neurosurgery. As a mapping technique, IONM provides real-time functional guidance to help surgeons identify and navigate vital regions of the central nervous system. As a monitoring tool, IONM acts as an early warning signal, enabling timely intraoperative intervention and avoidance of post-operative deficits such as paralysis. Neurosurgeries that most benefit from IONM include brain, brainstem and spinal cord tumour resections and complex spinal deformity corrections.

The IONM program in the Division of Neurosurgery is run by Dr. Susan Morris, an experienced neurophysiologist, in collaboration with Dr. Murray Hong who also brings years of experience in intraoperative neurophysiology.

In addition to clinical work, Dr. Morris is involved in research with a focus on understanding how different neurophysiological signals change in response to spinal cord compression. The goal is to improve existing intraoperative neuromonitoring methods and develop new techniques to optimize patient safety during spine surgery.

Publications

- **Morris SH**, Howard JJ, El-Hawary R. Comparison of Motor Evoked Potentials versus Somatosensory Evoked Potentials as Early Indicators of Neural Compromise in Rat Model of Spinal Cord Compression. *Spine (Phila Pa 1976)*. 2017 Mar 15; 42(6):E326-E331.

Team Members:

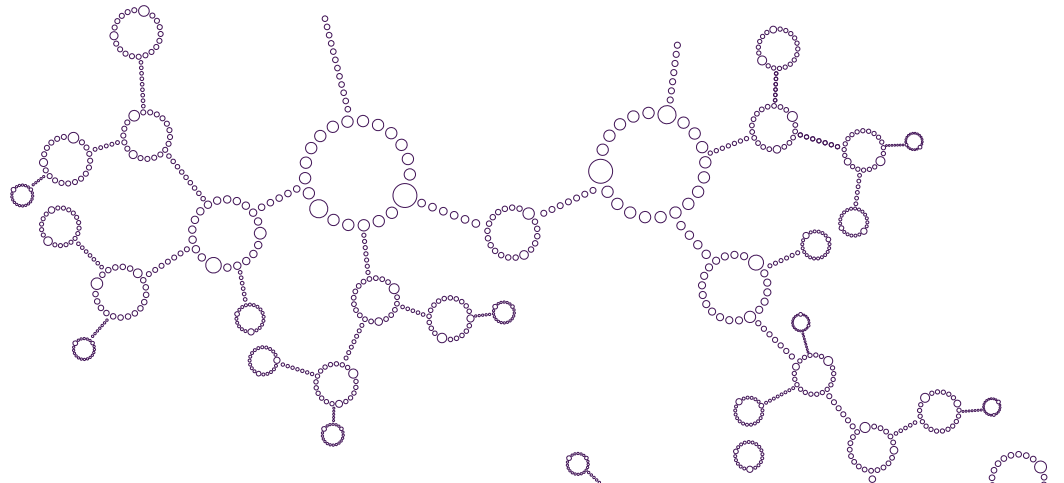
- Susan Morris, PhD
- Murray Hong, PhD



SUSAN MORRIS

PhD

**Neurophysiologist,
Intraoperative
Neurophysiological
Monitoring**



Neurosurgery Basic Science Labs

Life Sciences Research Institute (LSRI)

Brain Repair Centre (BRC)

Spinal Cord Injury Laboratory

Dr. Sean Christie

The Spinal Cord Injury Laboratory has a number of basic research initiatives aimed at elaborating our understanding of CNS injury, from both cellular and genetic perspectives. This year again marks a continuation of exciting partnership projects with local private industry and the development of modernized protocols for whole tissue imaging of spine and brain tissue. Dr. Saranyan Pillai, Ph.D. continues to manage the lab on a day-to-day basis as Research Associate and oversees the progress of our multiple research goals. Our current team includes Ms. MacKenzie Cook, undergraduate student from the Biomedical Sciences program, Ms. Tanya Myers, an experienced animal surgeon and scientific technician and Dr. Mustafa Nadi, who completed a clinical spine fellowship and transitioned to a Master's degree in Medical Neurosciences. Our current research projects are as follows:

- **Methodologies for identifying and analyzing spinal cells sensitive to secondary spinal cord injury progression.** Following an initial mechanical trauma to the spinal cord, there is a progressive cascade of cell death that involves changes in the biochemical state of cells in proximity to the injury site. This "secondary spinal cord injury" mechanism is a central theme of our interest. To date, we have been characterizing a novel class of lipid peroxidation sensor for use in screening injured animal spinal tissue for early secondary injury events. The ability to isolate and enrich cells that exhibit sensitivity to secondary spinal cord injury allows us to screen for changes in gene regulation that may be central to the progression of this disease.

- **Changes in microRNA expression in the context of spinal injury.** MicroRNAs are small (~22 nucleotide) genetic regulators that exert widespread changes on the post-transcriptional activity of the genome. The ability of a single species of microRNA to regulate a large number of target genes makes them an exciting therapeutic prospect. Using Next Generation Deep Sequencing services, we hope to identify key microRNA species that are critical for the initiation and propagation of secondary spinal cord injury across several species. We are also expanding our collaborations with other AMAP faculty, where our surgical spinal injury model may prove to be very useful.
- **Adaptation of methodologies for whole tissue analysis in the context of neural injury.** To circumvent the artefactual and labour-intensive nature of conventional histological approaches, we are working on adapting a recently developed method of tissue clearing, termed CUBIC, for use in spinal cord and brain analysis. By this method, which renders the normally opaque CNS tissue clear (by removing lipids while fixing the protein matrix) we are able to visualize neuronal injury and repair at the single cell level, using whole-tissue laser scanning confocal microscopy.
- **A novel model of spinal cord injury and characterization of blood flow autoregulation in pigs.** Our collaboration with Dr. Michael Schmidt (Anesthesia) and Dr. Susan Morris continues to be productive. This project uses neurophysiological monitoring, total intravenous anesthesia and neurosurgical techniques in order to perform a precisely graded compression injury. Tissue procured from spinalized pigs is then analyzed (lipid peroxidation and microRNA screening) and serves as a proxy to the genetic and anatomical landscape seen in humans. We secured external funding and recently procured a new non invasive neurophysiology monitor, essential for this study. We also extended the grant awarded for this study to accommodate the characteristically greater logistical demands of large animal studies on research time and personnel.
- **RNA stress granule formation in the spinal cord.** In collaboration with Dr. Adrienne Weeks, we are examining the formation of RNA stress granules in the spinal cord. These granules, formed by an evolutionarily conserved response, renders the cell populations resistant to treatment methods in malignant conditions, but the implications in SCI require further understanding.



Brain Tumour Laboratory

Dr. Adrienne Weeks

The Brain Tumour Laboratory, in collaboration with the Atlantic Canada Molecular Oncology Centre, is working to deliver precision and personalized therapeutic options for malignant brain cancer survivors in Atlantic Canada.

A prospective tissue banking program for Neurooncology is in development with Dr. Croul and Dr. Weeks.

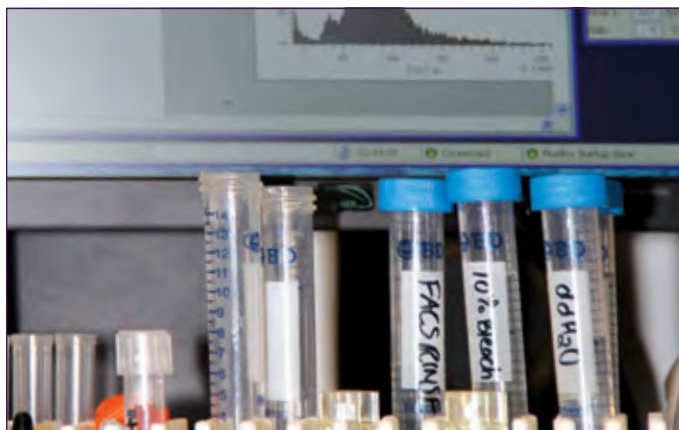
Dr. Aaron Robichaud won a Killam Research Scholarship and a Beatrice Hunter Research Scholarship for his MSc Thesis work on Targeting Stress Granules in Astrocytoma Cells in the laboratory of Dr. Adrienne Weeks.

Current projects include:

Dr. Adrienne Weeks received both a Meghans Walk (\$25 000) and Department of Surgery Grant (\$50 000) to continue to fund her research studies on targeting stress granules in brain cancer.

Dr. Adrienne Weeks is a Co-PI in a multimillion dollar Atlantic Canada Opportunities Agency grant with Dr. Jeremy Brown and Dr. Jim Fawcett studying a novel ultrasound based therapy for brain cancer.

Dr. Adrienne Weeks and Dr. Aaron Robichaud presented their work on Stress Granules and Astrocytoma Cells at two international conferences. The Society of Neurooncology meeting in Phoenix, Arizona and American Association of Cancer Research in San Francisco, California.

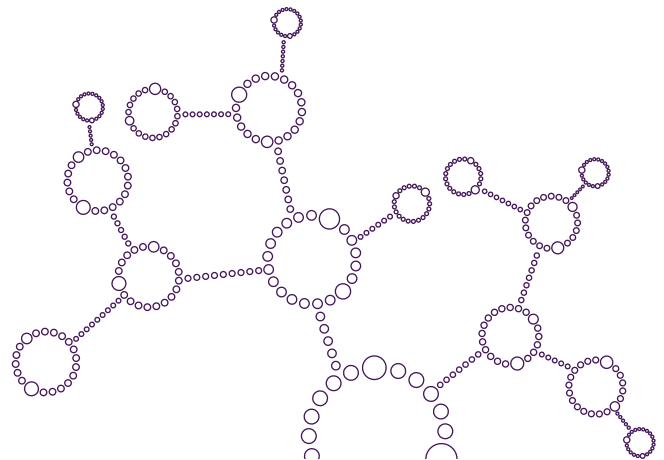


Neuron Survival & Regeneration Laboratory

Dr. David Clarke

The Neuron Survival and Regeneration Laboratory focuses on understanding the neuronal response to trauma, and developing strategies aimed at enhancing the survival and regeneration of injured neurons. We are currently examining the role of specific cell surface molecules on survival of injured neurons and using genetic knockout models to examine functions of specific molecules.

This year, PhD student, Margaret Po-Shan Luke, received the "Best Research Presentation" Award at the Dalhousie Clinical Neuroscience Research Day in Halifax for our work on the "Effect of NCAM on Aged-Related Deterioration in Vision". Congratulations, Margaret!



Neurosurgery Research Funding

(PI = Principal Investigator)

Dr. Sean Christie (Co-Investigator)

2008-2017
Rick Hansen Institute
Rick Hansen Spinal Cord Injury Registry
\$442,000

Dr. Sean Christie (Co-Investigator)

2012-2017
Rick Hansen Institute
Canadian Multicentre Cerebrospinal Fluid Pressure
Monitoring and Biomarker Study
\$311,980

Dr. Sean Christie (Co-Investigator)

2017-2019
CIHR
Predictive Modeling to Predict Personalized Spinal Surgery
Outcomes: A Data-Driven e-Health Platform for Informed
and Shared Decision Making to Triage Spinal Surgeries
\$199,408

Dr. Sean Christie (Co-Investigator)

2015-2017
Brain Canada MIRI Competition
Biomarkers for Crossing the Translational Divide
in Acute Spinal Cord Injury
\$3,000,000

Dr. Sean Christie (PI)

2017-2018
Medtronic of Canada Ltd.
Prospective Registry of Clinical Outcomes following
Elective Spine Surgery
\$40,000

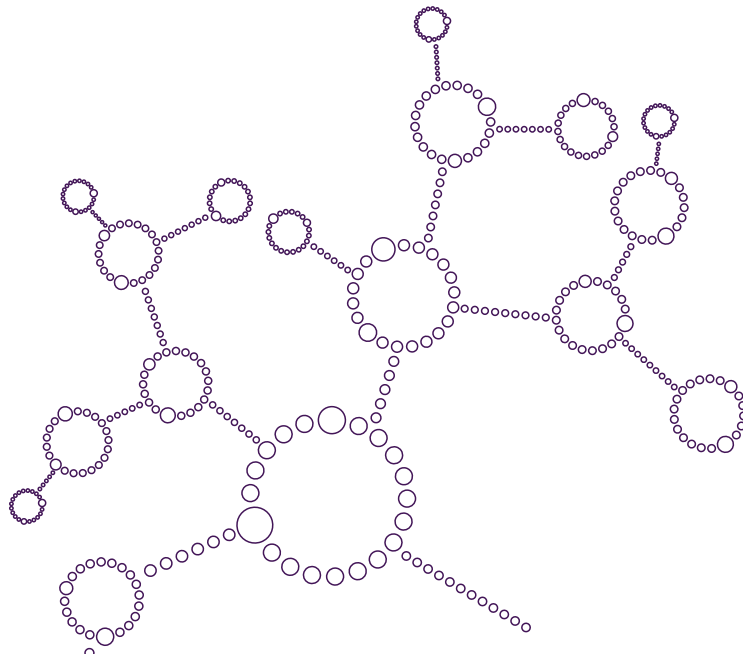
**Dr. David Clarke (Co-Investigator and several others)
Collaborator: Simon Walling**

PI: Alon Friedman

2016-2021
Canadian Institutes of Health Research
Microvascular Injury and Blood-Brain Barrier
Dysfunction as Novel Biomarkers and Targets for
Treatment in Traumatic Brain Injury
\$950,000

**Dr. David Clarke (Co-Investigator and several others)
PIs: Jamie Hutchison, Alexis Turgeon (co-leads)**

2015-2019
Canadian Institutes of Health Research
Canadian Traumatic Brain Injury Research
Consortium (CTRC) Grant
\$1,824,513



Dr. David Clarke (Co-Investigator and several others)**PI: Jamie Hutchison**

2015-2018

Brain Canada Platform Support Grant (Matching contributions provided by the Division of Neurosurgery, the Department of Surgery and Capital Health)
A National Biobank and Database for Patients with Traumatic Brain Injury

\$3,000,000

Dr. David Clarke (PI)**Co-Investigators: Steven Beyea, Lauren Petley, Tim Bardouille, Denise Lalanne**

2015-2018

ACOA's Business Development Program, Government of Canada, QEII Foundation and Conquer Mobile Biomedical Translational Imaging Centre (BIOTIC) R&D projects, Supporting the development and commercialization of neuro-based technologies

\$370,000

Dr. David Clarke (Co-Investigator)**Co-Investigator: Richard Hurley**

2017

Nova Scotia Health Authority, 2nd Periop Dragons' Den, Digital Simulation-Based Training Initiative for Perioperative Nurses in Orthopedics

\$45,000

Dr. David Clarke (Co-Investigator)**Co-Investigators: Murray Hong & Ron Hill**

2016-2017

Medtronic Navigation, Inc.
Pre-Clinical Validation of the Little Cranial Robot

\$54,970

Dr. Gwynedd Pickett (PI)**Co-Investigator: Jai Shankar**

2014-2017

Capital Health Research Fund
CT Perfusion in Subarachnoid Hemorrhage

\$15,000

Dr. Simon Walling (Co-Investigator)**Co-Investigators: N. Jabad, C. Fernandez**

2017

Genome Canada
Biomarkers for Pediatric and Adult High Grade Astrocytoma through Genomics and Epigenomics.

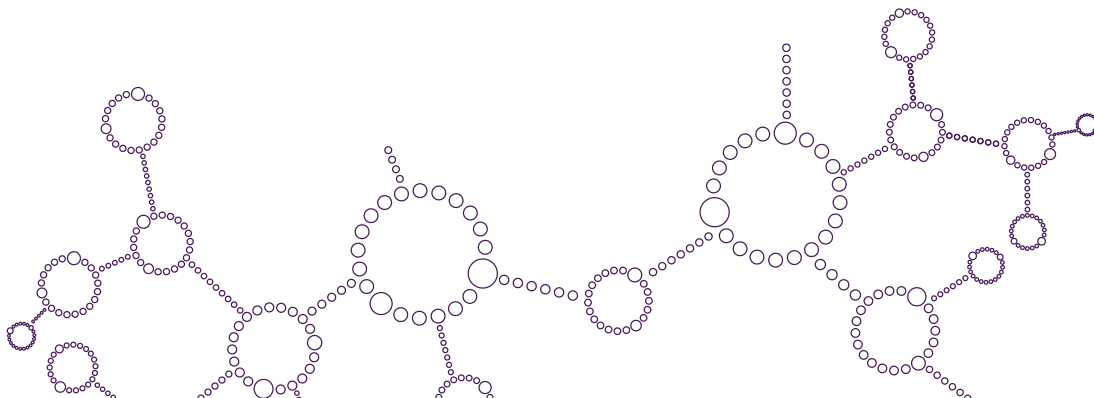
\$10,000

Dr. Simon Walling (PI)**Co-Investigators: David Clarke, Lynne Fenerty, Ginette Thibault-Halman, Nelofar Kureshi, Mete Erdogan, Rob Green**

2017

Department of Health Promotion and Protection
An Investigation of the Health and Economic Outcomes of Alcohol-Related Traumatic Brain Injury in Nova Scotia

\$20,000



Publications

Ahn H, Lewis R, Santos A, Cheng CL, Noonan VK, Dvorak MF, Singh A, Linassi AG, **Christie SD**, Goytan M, Atkins D. Forecasting Financial Resources for Future Traumatic Spinal Cord Injury Care Using Simulation Modeling. *Journal of Neurotrauma*, Oct 15;34 (20):2917-2923, 2017.

Alant, J, Al-Sharif, O. Currarino Syndrome. *Spinal Columns*, 17.3 36-38, 2017.

Barry S, Ekong C, Wheelock BW, Moulton R, Gorman P, Reddy K, Fleetwood I. Medical Assistance in Dying (MAID) and the Neurosurgeon: Position Statement of the Canadian Neurosurgical Society (CNSS). *Canadian Journal of Neurological Sciences*, Aug 14:1-3, 2017.

Burrell S, **Hebb ALO**, Imran SA, Mishra A, Mawko G, **Clarke DB**. Visualization of 90Yttrium Colloid Within A Cystic Craniopharyngioma Using PET/CT/MRI Fusion. *The Canadian Journal of Neurological Sciences*, 44:192-193, 2017.

Christie SD, **Kureshi N**, Beauprie I, **Holness RO**. Occipital osteomyelitis and epidural abscess after occipital nerve block: A case report. *Canadian Journal of Pain* Accepted author version posted online: 02 Aug 2017.

Dakson A, **Brandman D**, **Thibault-Halman G**, **Christie SD**. Optimization of the mean arterial pressure and timing of surgical decompression in traumatic spinal cord injury: a retrospective study. *Spinal Cord*, 55(11):1033-1038, 2017.

Dakson A, Tso MK, Ahmed SU, Bigder M, Elliott C, Guha D, Lavergne P, Makarenko S, Iorio-Morin C, Kameda-Smith M, Taccone MS, Wang BH, Winkler-Schwartz A, Sankar T, **Christie SD**. Canadian Neurosurgery Research Collaborative Launch of the Canadian Neurosurgery Research Collaborative. *Canadian Journal of Neurological Sciences*, Mar; 44(2):204-206, 2017.

Dützmann S, Cole T, Seifert V, Setzer M, **Weise LM**. Die Wirbelsäule Mini Open direct lateral corpectomy – a single center experience Minimal Invasive Teil-Korporektomie von direkt lateral – Erfahrungen an einer Serie von 45 Patienten, 01(04): 303 – 309, 2017.

Dvorak MF, Cheng CL, Fallah N, Santos A, Atkins D, Humphreys S, Rivers CS, White BAB, Ho C, Ahn H, Kwon BK, **Christie SD**, Noonan VK. Spinal Cord Injury Clinical Registries: Improving Care across the SCI Care Continuum by Identifying Knowledge Gaps. *Journal of Neurotrauma*, Oct 15; 34(20):2924-2933, 2017.

Gessler F, Baumgarten P, Bernstock JD, Harter P, Lescher S, Senft C, Seifert V, Marquardt G, **Weise LM**. Assessment of molecular markers demonstrates concordance between samples acquired via stereotactic biopsy and open craniotomy in both anaplastic astrocytomas and glioblastomas. *Journal Neurooncology*, Jun;133(2):399-407, Epub May 15, 2017.

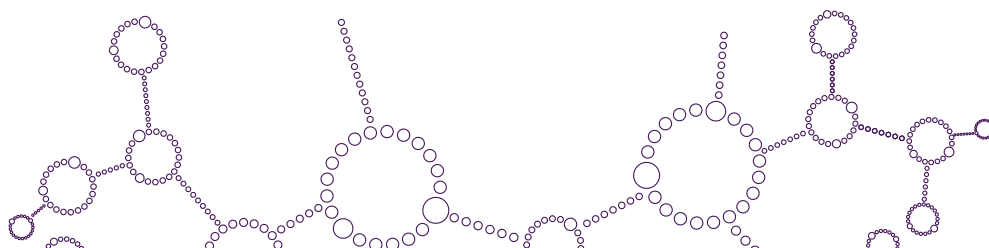
Glennie RA, Bailey CS, Tsai EC, Noonan VK, Rivers CS, Fourny DR, Ahn H, Kwon BK, Paquet J, Drew B, Fehlings MG, Attabib N, **Christie SD**, Finkelstein J, Hurlbert RJ, Parent S, Dvorak MF. An analysis of ideal and actual time to surgery after traumatic spinal cord injury in Canada. *Spinal Cord*. 55(6): 618-623, 2017.

Huybers S, **Fenerty L**, **Kureshi N**, **Thibault-Halman G**, LeBlanc JC, **Clarke DB**, **Walling S**. Long-Term Effects of Education and Legislation Enforcement on All-Age Bicycle Helmet Use: A Longitudinal Study. *Journal of Community Health*, 42:83-89, 2017.

Imran SA, Shankar J, **Hebb ALO**, Croul SE, **Clarke DB**. Radiological Growth Patterns of Prolactinomas and Nonfunctioning Adenoma. *Canadian Journal of Neurological Sciences*, 3:1-6, 2017.

Kuta V, **McNeely PD**, **Walling S**, Bezuhly M. Sagittal craniosynostosis: a utility outcomes study. *Journal of Neurosurgery Pediatrics* 20:113-118, 2017.

Maghsoud-Lou E, **Christie SD**, Abidi SR, Abidi SSR. Protocol-Driven Decision Support within e-Referral Systems to Streamline Patient Consultation, Triage and Referrals from Primary Care to Specialist Clinics. *Journal Med Syst. Sep*; 41(9):139, 2017.



Noonan VK, Chan E, Santos A, Soril L, Lewis R, Singh A, Cheng CL, O'Connell C, Truchon C, Paquet J, **Christie SD**, Ethans K, Tsai E, Ford MH, Drew B, Linassi G, Bailey C, Fehlings MG. Traumatic Spinal Cord Injury Care in Canada: A Survey of Canadian Centres. *Journal of Neurotrauma*, Apr 1, 2017.

Panwalkar P, Clark J, Ramaswamy V, Hawes D, Yang F, Dunham C, Yip S, Hukin J, Sun Y, Schipper MJ, Chavez L, Margol A, Pekmezci M, Chung C, Banda A, Bayliss JM, Curry SJ, Santi M, Rodriguez FJ, Snuderl M, Karajannis MA, Saratsis AM, Horbinski CM, Carret AS, Wilson B, Johnston D, Lafay-Cousin L, Zelcer S, Eisenstat D, Silva M, Scheinmann K, Jabado N, **McNeely PD**, Kool M, Pfister SM, Taylor MD, Hawkins C, Korshunov A, Judkins AR, Venneti S. Immunohistochemical analysis of H3K27me3 demonstrates global reduction in group A childhood posterior fossa ependymoma and is a powerful predictor of outcome. *Acta Neuropathologica* 134(5):705-714, 2017.

Pencle FK, Kureshi N, Benstead T, **Christie SD**. Critical illness myopathy in a cervical spine-injured patient. *Spinal Cord Series and Cases*, 2, 16017, 2017.

Quick-Weller J, Tichy J, Dinc N, Tritt S, Won SY, Behmanesh B, Bruder M, Seifert V, **Weise LM**, Marquardt G. Benefit and Complications of Frame-Based Stereotactic Biopsy in Old and Very Old Patients. *World Neurosurgery*, Jun; 102:442-448, 2017.

Quick-Weller J, Tritt S, Behmanesh B, Mittelbronn M, Spyranitis A, Dinc N, **Weise LM**, Seifert V, Marquardt G, Freiman TM. Biopsies of pediatric brainstem lesions display low morbidity but strong impact on further treatment decisions. *Clinical Neuroscience*. Oct; 44:254-259, 2017.

Setzer M, Duetzmann S, **Weise LM**, Marquardt G, Seifert V. Current neurosurgical management of spine tumours. *Current progress in neurosurgery*. Herausgeber; Basant K Misra, Edward R Laws, Andrew H Kaye. TreeLife Media (A Div of Kothari Medical), Mumbai, 2017.

Setzer M, Ulrich CT, Duetzmann S, Seifert V, **Weise LM**, Marquardt GM. Predictor of neurological recovery after surgery of metastatic epidural spinal cord Compression. *Neurol Disord Therap*, Volume 1(3): 1-5, 2017.

Sharieff W, Mulroy L, **Weeks A**, Mansoor S, Pahil R, Islam MU. Scalp Seeding Post Craniotomy and Radiosurgery for Solitary Brain Metastasis: A Case Report and Systematic Review. *Cureus*, Mar 7; 9(3):e1083, 2017.

Squair JW, Bélanger LM, Tsang A, Ritchie L, Mac-Thiong JM, Parent S, **Christie SD**, Bailey C, Dhall S, Street J, Ailon T, Paquette S, Dea N, Fisher CG, Dvorak MF, West CR, Kwon BK. Spinal cord perfusion pressure predicts neurologic recovery in acute spinal cord injury. *Neurology*. Oct 17; 89(16):1660-1667, 2017.

Streijger F, Skinnider MA, Rogalski JC, Balshaw R, Shannon CP, Prudova A, Belanger L, Ritchie L, Tsang A, **Christie SD**, Parent S, Mac-Thiong JM, Bailey C, Urquhart J, Ailon T, Paquette S, Boyd M, Street J, Fisher CG, Dvorak MF, Borchers CH, Foster LJ, Kwon BKA. Targeted Proteomics Analysis of Cerebrospinal Fluid after Acute Human Spinal Cord Injury. *Journal of Neurotrauma*, Jun 15; 34(12):2054-2068, 2017.

Thibault-Halman G, Rivers CS, Bailey CS, Tsai EC, Drew B, Noonan VK, Fehlings MG, Dvorak MF, Kuerban D, Kwon BK, **Christie SD**. Predicting Recruitment Feasibility for Acute Spinal Cord Injury Clinical Trials in Canada Using National Registry Data. *Journal of Neurotrauma*, Feb; 34(3):599-606, 2017.

Tso MK, **Dakson A**, Ahmed SU, Bigder M, Elliott C, Guha D, Iorio-Morin C, Kameda-Smith M, Lavergne P, Makarenko S, Taccone MS, Wang B, Winkler-Schwartz A, Sankar T, **Christie SD**. Operative Landscape at Canadian Neurosurgery Residency Programs. *Canadian Journal of Neurological Sciences*. Jul; 44(4):415-419, 2017.

Whatley BP, Jubenville C, **Clarke DB**, Sadler MR. Focal Seizures with Left Hemibody Piloerection Related to Left Hemisphere Cavernous Angiomas. *Epileptic Disorders*, 19(2):232, 2017.

Books and Chapters

Fehlings MG, **Barry S**, *Cervical Spondylotic Myelopathy, Spine Surgery: Current Concepts and Evidence: Hardcover*, Oct 22, 2017.

Presentations

Babadaglim, Cooke D, **Walling S, McNeely PD**. "Endoscopic Retrieval of Flanged Ventricular Catheters.", International Society of Pediatric Neurosurgery (ISPN) 2017 Conference, Denver CO. October 11, 2017.

Brophy S, Ferris J, Hayden J, **Barry S, Christie S**. "Decompression surgery improves tibialis anterior muscle strength in cases of painful and painless foot drop caused by neurodegenerative lumbar disease.", Canadian Spine Society Meeting 2017, Canadian Journal of Surgery, 60(3):S81, June 2017.

Clarke B, Schmidt M, **Pickett GE**. "Presence of infiltrative glioblastoma cells in an isolated area of diffusion restriction.", Canadian Neurological Sciences Federation 52nd Congress, Victoria BC, June 20-23, 2017.

Clarke DB, Hebb ALO, Hill R, Imran SA, Mishra A, Mawko G, Burrell S. "Efficacy of Stereotactic Intracavitary Instillation of ⁹⁰Yttrium Colloid for Treatment of Cystic Sellar/Parasellar Tumours.", 52nd Annual Congress of the Canadian Neurological Sciences Federation, Victoria BC, June 22, 2017; Canadian Journal of Neurological Sciences, P.017, Volume 44, Issue S2, p. S18, June 2017.

Clarke DB, Hong M, Kureshi N, Fenerty L, Thibault-Halman G, D'Arcy RC. "Simulation-Based Training for Surgical Instrument Recognition.", 52nd Annual Congress of the Canadian Neurological Sciences Federation, Victoria BC, June 20, 2017; Canadian Journal of Neurological Sciences, P. 102, Volume 44, Issue S2, pp. S39-S40, June 2017.

Clarke DB, Hong M, Kureshi N, Fenerty L, Thibault-Halman G, D'Arcy R. "Simulation-Based Training for Burr Hole Surgery and Surgical Instrument Recognition.", Trauma Association of Canada (TAC) 2017 Conference, Vancouver, BC, February 23-24, 2017; Canadian Journal of Surgery, 60(3), p. S19, June 2017.

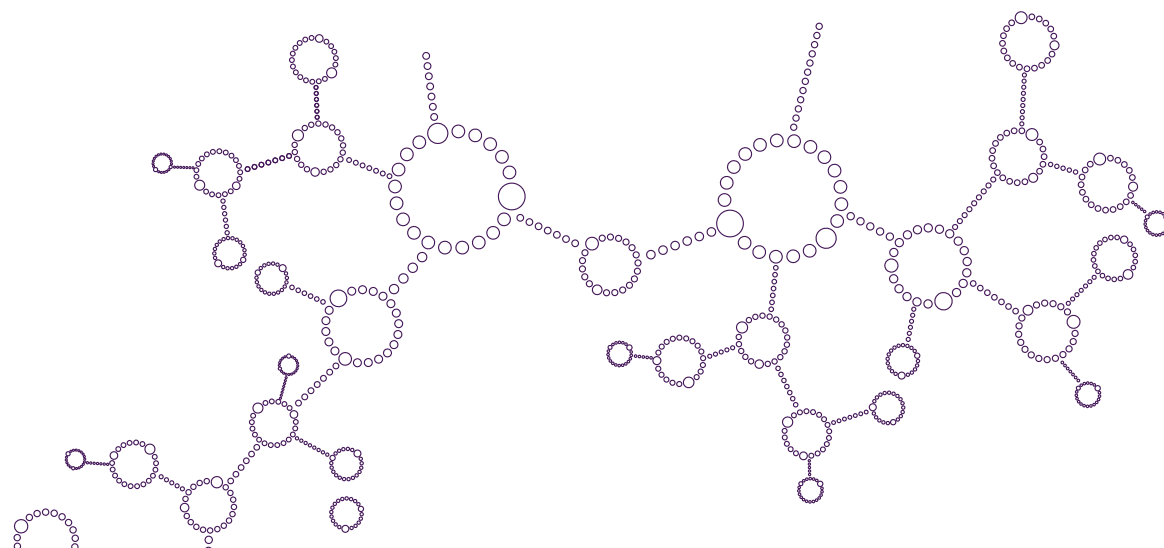
Dakson A, M. Butler, Leck E, Christie S. "Stratification of patients with metastatic spinal epidural disease on the basis of expected survival in Nova Scotia.", 9th Annual Atlantic Canada Spine Meeting, October 20-22, 2017.

Godbout H, Jarrett J, Pickett GE. "Validation of the unruptured intracranial aneurysm treatment score against "real-world" MDT decisions.", Canadian Neurological Sciences Federation 52nd Congress, Victoria BC, June 20-23, 2017.

Han J, **Hebb ALO, Imran SA, Clarke DB**. "Delayed New-Onset Hormone Dysfunction Following Complete and Incomplete Resection of Nonfunctioning Pituitary Adenomas.", 52nd Annual Congress of the Canadian Neurological Sciences Federation, Victoria BC, June 21, 2017; Canadian Journal of Neurological Sciences, C.02, Volume 44, Issue S2, p. S12, June 2017.

Kureshi N, Christie S, Barry S. "Attitudes of Canadian spine surgeons toward medical assistance in dying: a national survey.", Canadian Journal of Surgery, 60 (3 Suppl 4), June 2017.

MacLean M, Easton A, **Pickett GE**. "Focal cortical dysplasia type IIIb associated with oligodendroglioma in a seizure free patient: a case report.", Canadian Neurological Sciences Federation 52nd Congress, Victoria BC, June 20-23, 2017.



MacLean M, **Thibault-Halman G, Kureshi N**, Shankar J, **Barry S, Alant J**, Glennie A, Oxner W, **Christie S**. "Investigating the association between modic changes and chronic lower back pain in patients receiving surgical therapy for lumbar disc herniation.", Canadian Spine Society Meeting 2017, Canadian Journal of Surgery, 60(3):S82–S83, June 2017.

Munro V, Tugwell B, Doucette S, **Clarke DB**, Lacroix A, Imran SA. "Recovery from Chronic Secondary Adrenal Insufficiency in Patients with Pituitary Disorders.", 51st Annual Congress of the Canadian Neurological Sciences Federation, Quebec City, QC, June 23, 2016; Canadian Journal of Neurological Sciences, Vol 43, Supplement S2, June 2016, ppS41-S41.

Mustafa N, Kureshi N, Thibault-Halman G, Barry S, Alant J, Glennie A, Oxner W, Rockwood K, **Christie S**. "Frailty index in spinal cord injury patients.", Canadian Spine Society Meeting 2017, Canadian Journal of Surgery, 60(3):S88, June 2017.

Renne B, Radic J, Argrawal D, Albrecht B, Beanfield C, Cohrs G, Davis T, Gupta A, **Hebb AO**, Knerilich F, Lindsay S, **McNeely PD**, Pillai S, Indersingh H, Sborov K, Vitali A, **Walling S**, Cochrane D, Singhal A, Steinbok P. "Cerebellar Mutism after Posterior Fossa Tumour Resection in Children: A multi-center international retrospective study to determine possible modifiable factors", International Society of Pediatric Neurosurgery (ISPN) 2017 Conference Denver Co, October 11, 2017.

Robichaud A, Atwood K, Inhwa K, **Weeks A**. "Raloxifene sensitizes GBM to hypoxic included death; Second International Symposium RNA granules, Heidelberg, Germany, September 9-14, 2017.

Thibault-Halman G, Fenerty L, Taylor P, **Kureshi N, Walling S, Clarke DB**. "Early Telephone Follow-Up for Traumatic Brain Injury Patients Using the Rivermead Post-Concussion Symptoms Questionnaire.", 52nd Annual Congress of the Canadian Neurological Sciences Federation, Victoria BC, June 22, 2017; Canadian Journal of Neurological Sciences, P.016, Volume 44, Issue S2, pp. S17-S18, June 2017.

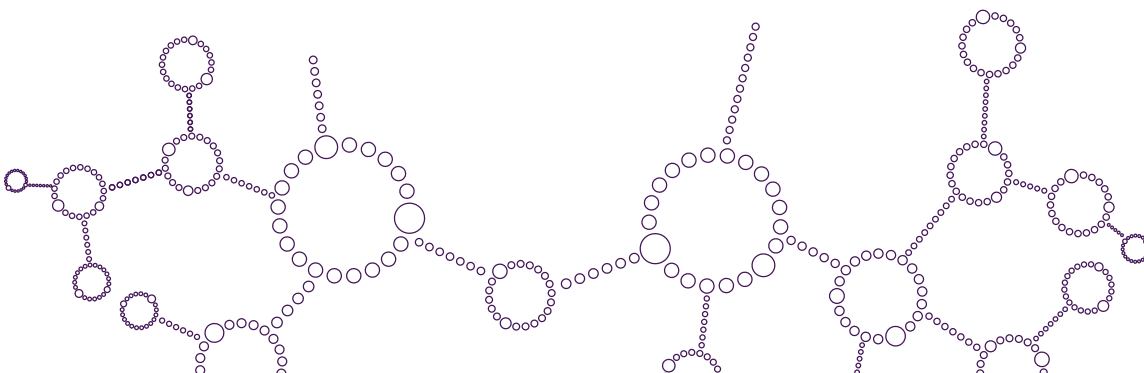
Thibault-Halman G, Fenerty L, Taylor P, **Kureshi N, Walling S, Clarke DB**. "Early Telephone Follow-Up for Traumatic Brain Injury Patients Using the Rivermead Post-Concussion Symptoms Questionnaire.", Trauma Association of Canada (TAC) 2017 Conference, Vancouver, BC, February 23-24, 2017; Canadian Journal of Surgery, 60(3), pp. S18-19, June 2017.

Thibault-Halman G, Kureshi N, Hamilton H, **Barry S, Alant J**, Glennie A, Oxner W, **Christie S**. "Determining spine surgeon supply and demand in Canada.", Canadian Spine Society Meeting 2017, Canadian Journal of Surgery, 60(3):S84, June 2017.

Walling S, Bezuhly M. "Autologous Fat Grafting in Craniofacial Surgery.", CPNSG, Banff, AB, February 15, 2017.

Weise L, Hill R, Quick J, Hebb A, Schmidt M. "Influence of Disease Lateralization in Movement Disorders on Fiber Tracking and Deep Brain Stimulation.", World Society for Stereotactic and Functional Neurosurgery Berlin, Germany, June 26-29, 2017.

Weise L. "Aspects of Lateralization in Parkinson, impact on DBS?", Interdisciplinary DBS Rounds, Halifax, NS, February 17, 2017.



Invited Lectures

Alant, J. “Challenging Lumbar Foraminal Stenosis”, 9th Annual Atlantic Canada Spine Meeting, Wallace, NS, October 20-22, 2017

Barry, S. “Cervical Facet Injuries: Evidence from across the Spectrum of Severity”, Evidence Based Spine Surgery Course, Montreal, QC, October 21, 2017.

Barry, S. “MAID: Brave New Slope?”, Moderator: Symposium – Medico-Legal Challenges in Modern Spinal Practice, Canadian Spine Society Meeting, Montreal, QC, February 24, 2017.

Barry, S. “MAID and the Spine Surgeon: A Survey of Canadian Spine Surgeons”, Canadian Spine Society Meeting, Montreal, QC, February 26, 2017.

Christie, S. “Novel Approaches to Management of Spinal Metastases”, 9th Annual Atlantic Canada Spine Meeting, Wallace, NS, October 20-22, 2017

Christie, S. “Determining spine surgeon supply and demand in Canada”, Canadian Spine Society Meeting, Montreal, QC, February 26, 2017.

Christie, S. “Spinal Trauma”, NS Trauma Program, Halifax, NS, February 15, 2017.

Christie, S. “Concepts of Navigated Posterior Cervical Reconstructive Surgery with VERTEX SELECT, STEALTH MIDAS and O-ARM.”, Toronto, ON, Surgical Synergy Course, January 13, 2017.

Christie, S. “Spinal Biomechanics, Decision Making and Surgical Options in Degenerative Spine Disease”, 5th Annual Neurosurgery Review Course, Ottawa, ON, February 9, 2017.

Christie, S. “Cervical Spondylosis: Diagnosis and Management”, 5th Annual Neurosurgery Review Course, Ottawa, Ontario, February 9, 2017.

Christie, S. “Concepts of Navigated Posterior Cervical Reconstructive Surgery: Procedural Workflow, Surgical Synergies and the Economic Argument”, Canadian Contemporary Spinal Techniques, Toronto, Ontario, May 26, 2017.

Clarke, DB. “Innovation in Training the Surgical Team – the Future is Now”, Nova Scotia Health Authority Board of Directors and Leadership Team, Halifax, NS, December 5, 2017.

Clarke, DB. “Roboscope”, Canadian Neurosurgical Innovation Meeting, Toronto, ON, September 16, 2017.

Clarke, DB. “Simulation-Based Training for Burr Hole Surgery and Surgical Instrument Recognition”, MDR Managers Meeting, Truro, NS, September 14, 2017.

Clarke, DB. “Transsphenoidal Surgery: Know where the carotid is... and avoid it!”, Neurosurgery Fireside Chat, Victoria, BC, June 20, 2017.

Clarke, DB. “Neurosurgery Resident Training: Atlantic Canada”, Canadian Neurosurgical Leadership Meeting, Victoria, BC, June 19, 2017.

Clarke, DB. “Surgery for Epilepsy”, 5th Annual Ottawa Neurosurgery Review Course, Ottawa, ON, February 10, 2017.

Clarke, DB. “Epidural Hematoma: Case Review”, Inter-Professional Clinical Trauma Rounds, Departments of Surgery, Anesthesia, Radiology and Emergency Medicine, Halifax, NS, January 17, 2017.

Clarke, DB. “Treatment of Epilepsy: A Surgical Perspective”, Michael Richard Visiting Professorship, University of Ottawa, Neuroscience Rounds, Ottawa, ON, January 13, 2017.

Clarke, DB. “The Temporal Lobe: A Review for Residents”, Michael Richard Visiting Professorship, University of Ottawa, Residents and Faculty Rounds, Ottawa, ON, January 12, 2017

McNeely, PD. “Normal Pressure Hydrocephalus”, Cape Breton Neurology Update, Membertou Trade & Convention Centre, Sydney, NS, October 13, 2017.

McNeely, PD. “Neural Tube Defects: from birth to the NICU”, Neonatal Emergency Team Orientation Course, IWK Health Centre, Halifax, NS, February 23, 2017.

McNeely, PD. “Trauma & Congenital Brain Malformations”, Pediatric Resident Academic Half-Day, IWK Health Centre, Halifax, NS, January 24, 2017.

Pickett, G. “Unruptured Intracranial Aneurysms”, Atlantic Clinical Neurological Sciences Meeting, Halifax NS, May 6, 2017

Weeks, A. “GBM”, Talkin TEDx Presentation, Dalhousie University, Halifax, NS, March 12, 2017.

Weeks, A. “Surgical Management of Carotid Disease and Stroke Prevention”, Neurology Conference, Cape Breton, NS, October 12 2017.

Weeks, A. “Raloxifene sensitizes GBM to hypoxic included death; Second International Symposium RNA granules”, Society of Neuro Oncology, San Francisco, CA, November 16-20 2017.

Weise, L. “Spinal Cord Stimulation in the Treatment of Neuropathic Pain”, 9th Annual Atlantic Canada Spine Meeting, Wallace, NS, October 21, 2017.

Weise, L. “Spinal Cord Stimulation in the Treatment of Neuropathic Pain”, Canadian Pain Society, 38th Annual Scientific Meeting, Halifax, NS, May 23 – 25, 2017.

Weise, L. “An Overview of Neuromodulation techniques for the Treatment of Chronic Pain”, Canadian Pain Society, 38th Annual Scientific Meeting, Halifax, NS, May 23 – 25, 2017.

Neurosurgery Rookie Camp

Training the next generation of Canada's Neurosurgeons

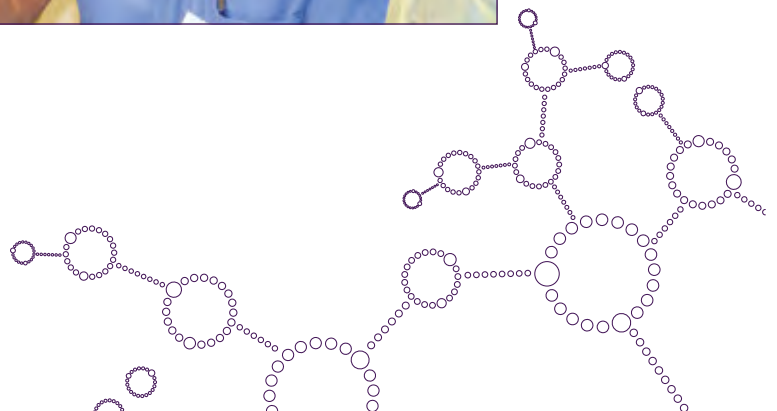
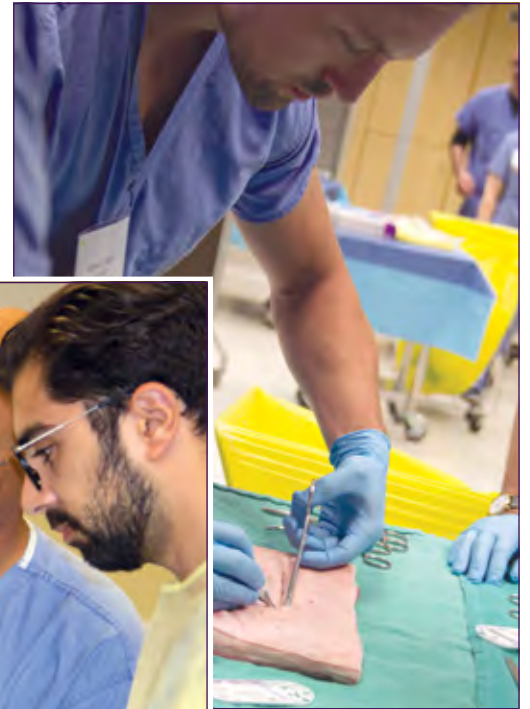
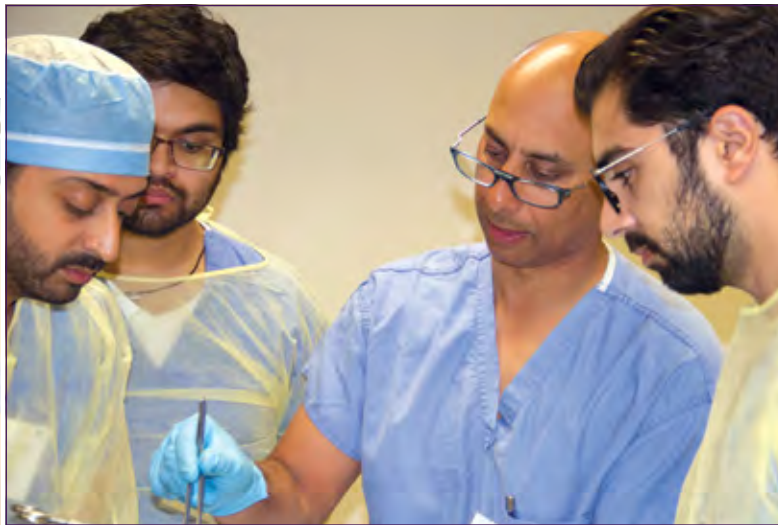
Director: Cian O'Kelly

Site Director for 2017: Sean P. Barry

July 2017 saw another successful iteration of the Canadian Neurosurgery Rookie Camp at Dalhousie University. We had 17 residents from programs across Canada. Nine faculty, our surgical skills staff and numerous industry representatives worked tirelessly to make this a valued experience for our neurosurgical Rookies. Feedback was unanimously strong – this course continues to take an important place in the early development of our neurosurgical trainees.

We look forward to hosting the Rookie Camp again in the summer of 2018. The Canadian Neurosurgery Rookie Camp is endorsed by the Royal College of Physicians and Surgeons of Canada's Specialty Committee in Neurosurgery and the Canadian Neurosurgical Society. A special thank you to this year's sponsors: Medtronic, J&J Codman, Synaptive Medical, Integralife, The Canadian Neurosurgical Society.

Visit www.neurosurgeryrookie.ca



Clinical Neuroscience Guest Speakers



DR. NATALIE PARKS

**Assistant Professor of Neurology
Mayo Clinic College of Medicine, Maine**

Topic: NEDA new goal in multiple sclerosis? Exploring no evidence of disease activity and more



DR. JAY RIVA-CAMBRIN

**Associate Professor of Neurosurgery
University of Calgary, Alberta
Director, Neurosurgery Residency Training Program
Founder & Director, ACORN Kids**

Topic: The Resurrection of endoscopy for the treatment of infant hydrocephalus: ETV+CPC



DR. ANIL MATTHEW

**Associate Professor Orthopedic Surgery
Paul Brand Centre for Hand Surgery, Christian Medical College & Hospital, South India**

Topic: Hand function in tetraplegia: can we make it better?



DR. BERTRAND C. DEVAUX

**Paris Descartes University & Sainte-Anne Hospital Center, Paris
Head, Department of Neurosurgery Sainte-Anne Hospital Center**

Topic: Surgery for Epilepsy at Sainte-Anne Hospital Center: yesterday and today



DR. PETER G. BRINDLEY

**Professor of Critical Care Medicine, Anesthesiology and Medical Ethics
Faculty, Canadian Neurosurgery Rookie Camp
University of Alberta Hospital, Alberta**

Topic: Communication: the most dangerous procedure in the hospital? (a practical guide to improve communication with patients and families, during handover, and during acute crises)



DR. DHANY CHAREST

**Chief Neurosurgery, The Moncton Hospital
Dalhousie University, Moncton NB**

Topic: GBM: why stop now?



DR. JAI JAI SHIVA SHANKAR

**Associate Professor of Radiology (Neuroradiology)
Dalhousie University, Nova Scotia**

Topic: CT perfusion in brain ischemia



DR. EDWIN F ROSS – VISITING PROFESSORSHIP LECTURE IWK DR. NALIN GUPTA

**Associate Professor Neurological Surgery
University of California San Francisco, California**

Topic: Evaluation and surgical management of neurological disorders in children



DR. RENN HOLNESS

**Professor of Neurosurgery
University of West Indies Medical School, Jamaica**

Topic: Clinical Neurosciences in Jamaica: a personal journey



DR. JANICE CHISHOLM

**Associate Professor, Departments of Critical Care and Anesthesia, Pain Management & Perioperative Medicine, Dalhousie University, Nova Scotia
Deputy Head of the Department of Critical Care & Anesthesia Site Chief at the Victoria General Hospital, Nova Scotia Health Authority (NSHA), Nova Scotia**

Topic: Inpatient Rapid Response Escalation Protocol: Improving patient safety in our hospitals

Awards and Recognitions

Dr. R.O. Holness Neurosurgical Intermediate Care Unit

In Recognition of his dedicated neurosurgical service to patients of Atlantic Canada (1977-2009), his distinguished local and national leadership as Professor and head of Neurosurgery (1987-2000) and his love of teaching countless students and residents, the Neurosurgical Intermediate Care Unit (IMCU) was dedicated in honor of Renn O. Holness, BSc, MBBS (Hons), FRCSC, DSc (Honorary), OJ.

2017 Clinical Neuroscience Resident Research Day

Congratulations to Dr. Aaron Robichaud for winning Best Basic Scientist Presentation for his work, "Identification of Approved Drugs Altering Stress Granule Dynamics and Implications in Glioblastoma Therapy", at Department of Surgery's Resident Research Day on April 21, 2017! Dr. Robichaud is working on his research under the supervision of Dr. Adrienne Weeks.

Congratulations to Dr. David Brandman who successfully defended his Doctoral Thesis "Rapid Calibration of Intracortical Brain Computer Interfaces in People with Paralysis" at Brown University, Providence, Rhode Island (Dr. Leigh Hochberg, advisor).

Congratulations to Margaret Po-Shan Luke who earned her Doctor of Philosophy, Anatomy & Neurobiology (Medical Neuroscience), for her thesis "Influence of the Neural Cell Adhesion Molecule on Age-Related Changes in Vision". Margaret completed her research under the supervision and in the lab of Dr. David Clarke.

Congratulations to Erika Leck who, upon earning her Doctor of Medicine from Dalhousie University, also received the Dr. Clara Olding Prize for highest standing in the clinical years, the Dr. John F. Black Prize for the highest standing in surgery, and the Dr. Michael Brothers Memorial Prize in Neuroscience for aptitude in neuroscience. Erika started her neurosurgery training within the Division of Neurosurgery as a Post Graduate Year 1 (PGY1) Resident on July 1, 2017.

Canadian Neurological Sciences Federation's Annual Meeting

Congratulations to Dr. Gwynedd Pickett and Dr. David Clarke for their scientific contributions to the Canadian Neurological Sciences Federation's annual meeting in Victoria, British Columbia.

Neurosurgery Spine Team National Accreditation

Congratulations to our Spinal Cord Injury Acute Services Team, the first to be accredited in Canada, for again receiving full national accreditation in 2017.

Canadian Spine Society

Congratulations Dr. Sean Christie who was elected president of the Canadian Spine Society at the 17th Annual Scientific Conference in Montreal in February. Dr. Christie will serve in this position for the next two years. The CSS is a national organization of surgeons and spine practitioners who share a common interest in excellence in spine care, education and research to provide benefits to both patients and professionals across Canada.

2017 Canadian League Against Epilepsy (CLAE) Clinical Practice/Advocacy Award

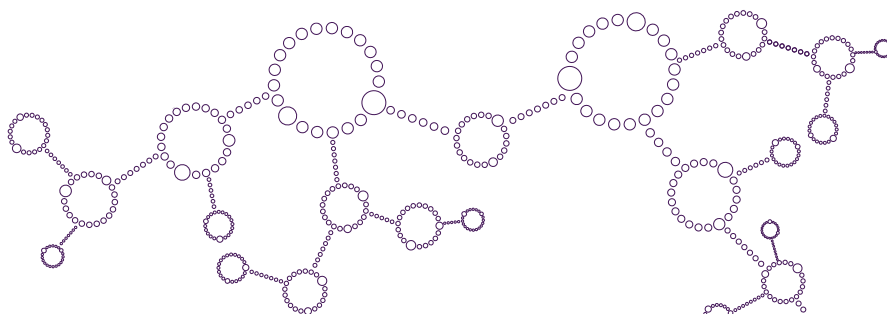
Congratulations to Susan Rahey, Program Coordinator of the Epilepsy Program, who was selected as the winner of the 2017 Canadian League Against Epilepsy (CLAE) Clinical Practice/Advocacy Award! Susan is being honored for excellence in clinical practice and engagement in representing and supporting patients with epilepsy.

Academic Promotions

Congratulations to Dr. Pickett and Dr. McNeely for their promotion to Assistant Professor, Dalhousie University.

Visiting Professorship

Congratulations to Dr. David Clarke, the Michael Richard Visiting Professor, University of Ottawa.



Cross-Appointed Faculty

Department of Anesthesia

Dr. Ian Beuprie, MD, FRCPC
 Dr. Adam Law, MD, FRCPC
 Dr. Kirk MacQuarrie, MD, FRCPC
 Dr. Thomas Coonan, MD, FRCPC
 Dr. Orlando Hung, MD, FRCPC
 Dr. Michael Schmidt, MD, FRCPC
 Dr. Carlo Mariotti, MD, FRCPC
 Dr. Karim Mukhida, MD, FRCPC

Department of Diagnostic Radiology (Neuroradiology)

Dr. William Maloney, MD, FRCPC
 Dr. Robert Vandorpe, MD, FRCPC
 Dr. Matthias Schmidt, MD, FRCPC
 Dr. Jai Shankar, MD, DM, MSc

Department of Medicine (Endocrinology & Metabolism)

Dr. Ali Imran, MBBS, MRCP, FRCPC

Department of Medicine (Physical Medicine & Rehabilitation)

Dr. Christine Short, MD, FRCPC
 Dr. Sonya McVeigh, MD, FRCPC

Department of Pathology

Dr. Alex Easton, MD FRCPC

Department of Radiation Oncology

Dr. Liam Mulroy, MD, FRCPC
 Dr. Dorianne Rheaume, MD, FRCPC

Department of Surgery (Orthopaedics)

Dr. Bill Oxner, MD, FRCSC
 Dr. Ron El-Hawary, MD, FRCSC

Department of Surgery (Otolaryngology)

Dr. Emad Massoud, MD, FRCSC
 Dr. David Morris, MD, FRCS (ORL-HNS)
 Dr. Manohar Bance, MB, MSc., FRCSC
 Dr. Robert Hart, MD FRCS (C)
 Dr. Jonathon Trites, MD, FRCSC

Affiliated Faculty

Department of Neurosurgery, The Moncton Hospital South East Regional Health Authority, Moncton, NB

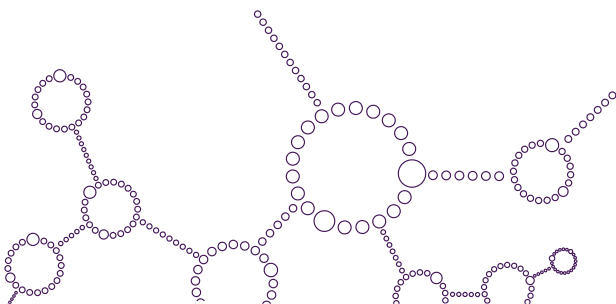
Dr. Robert Adams
 Dr. Dhany Charest
 Dr. Charbel Fawaz
 Dr. Brendan Kenny
 Dr. Gilbert Quartey

Department of Neurosurgery, Saint John Regional Hospital South East Regional Health Authority, Saint John, NB

Dr. George Kolyvas
 Dr. Ayman Al-Shayji
 Dr. Najmeeden Attabib
 Dr. Andre le Roux
 Dr. Brian Wheelock

Department of Neurosurgery, Health Sciences Center Eastern Health, St. John's, NL

Dr. Falah Maroun
 Dr. Gerry Murray
 Dr. Andre Engelbrecht
 Dr. Greg Jenkins
 Dr. Roger Avery



HALIFAX NEUROSURGERY

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ANNUAL REPORT

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