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2023 NEUROSURGERY RESIDENCY AT BRIGHAM AND WOMEN'S HOSPITAL, BOSTON CHILDREN HOSPITAL, AND HARVARD MEDICAL SCHOOL

 **Brigham and Women's Hospital**
Founding Member, Mass General Brigham

 **Boston Children's Hospital**

 **HARVARD MEDICAL SCHOOL**

NEUROSURGERY RESIDENCY

ALUMNI 2004-2023

FACULTY RESEARCH & PUBLICATIONS 2019-2023

INTRODUCTION



Thank you for your interest in the Neurosurgery Residency Program of Brigham and Women's Hospital, Boston Children's Hospital and Harvard Medical School. In our program, trainees are exposed to a wealth of neurosurgical pathology. Residents learn the fundamentals of surgical skills, the care of critically ill patients, and the principles of neurologic evaluation, differential diagnosis and interpretation of neuro-imaging. These goals are facilitated by clinical rotations on ancillary services and in the various neurosurgery hospital services. A rich and graduated neurosurgical experience and close mentorship by the thirty-nine clinical faculty allow the development and maturation of outstanding operating skills. Technical and clinical experiences are complemented by emphasis on clinical judgment, evidence-based outcome assessment, and thoughtful analysis of morbidity. These and core neuroscience educational objectives are covered at scheduled weekly conferences, in bedside teaching and in the operating room. Brigham and Women's Neurosurgery Residency Program is committed to providing two years of basic or clinical research time to enhance your development

as future academic neurosurgeons. We encourage participation at national meetings and have numerous visiting professors come to Boston to interface with our trainees.

WE ARE COMMITTED TO ADDING VALUE TO EVERY FACET OF YOUR TRAINING.

On behalf of each faculty member of the Department of Neurosurgery and our team of residents, we can affirm that we have no mission more sacred than that of training the next generation of neurosurgeons. Specific educational curriculum objectives shall guide your development at every stage. You shall be taught and individually mentored, and critiqued, but also asked to evaluate us and help the Program integrate numerous educational and clinical innovations. Most of all, you will grow into a surgically skilled and academically-oriented neurosurgeon, positioned to be a future leader in the world of neurosurgery.

While a student clerkship experience in our Department is not required for application, it is highly recommended, as it will allow us to get better acquainted. Rotations can be arranged at any time during the junior or senior medical student years. Visit www.brighamandwomens.org/nsresidency to learn more about our program. Please do not hesitate to contact us directly at any stage of the application and matching process if we can answer any of your questions about the BWH/BCH/HMS Residency Program.

Sincerely,

G. REES COSGROVE, MD, FRCSC, FAANS
RESIDENCY PROGRAM DIRECTOR,
BRIGHAM AND WOMEN'S HOSPITAL,
BOSTON CHILDREN'S HOSPITAL,
HARVARD MEDICAL SCHOOL

Brigham and Women's Hospital Founding Member, Mass General Brigham

Brigham and Women's Hospital, a founding member of Partners HealthCare System, Inc., is a major teaching hospital of Harvard Medical School. Internationally recognized as a leading academic health care institution, Brigham and Women's is committed to excellence in patient care, medical research, and the training and education of health care professionals.

Boston Children's Hospital

Boston Children's Hospital has the largest training program for pediatricians and pediatric subspecialists in the country. Every year, 400 of the country's best and brightest medical and surgical trainees come to Boston Children's from around the world; more than half come from the top medical schools.

HARVARD MEDICAL SCHOOL

Established in 1782, Harvard Medical School began with a handful of students and a faculty of three. The first classes were held in Harvard Hall in Cambridge, long before the school's iconic quadrangle was built in Boston. With each passing decade, the school's faculty and trainees amassed knowledge and influence, shaping medicine in the United States and beyond. Some community members -and their accomplishments- have assumed the status of legend. Today, the School continues to enhance its curriculum to meet the needs of 21st century medicine by integrating clinical and basic science across the curriculum, developing new models for clinical education and engaging students in an in-depth scholarly experience.

In memory of R. Michael Scott, MD



February 19, 1941 – August 4, 2023



This book is dedicated to Dr. R Michael Scott who passed away this past August. Dr. Scott was a brilliant neurosurgeon and researcher who greatly contributed to the study of vascular malformations of the brain in pediatric patients and neurosurgical treatment of stroke in children.

Dr. Scott was a known leader, teacher, and mentor across Boston Children's, Harvard Medical School, and Brigham and Women's. We thank him for his years of dedication to his patients, our team, and to the neurosurgery field as a whole.

OUR ALUMNI, 1913-2003

1913	Charles E. Dowman, Jr.	1923-1925	R. Glen Spurling	1927-1929	Ignaz Oljenick	1931-1932	Bronson Ray	1956-1959	Ernest Matthews	1979-1984	Robert M. Beatty
1913	Frederic Bremer	1923-1924	Tracy J. Putnam	1927-1928	Dmitri Bagdesar	1931-1932	Richard U. Light	1958-1960	Robert Shick	1980-1984	Stephen Ofori-Kwakye
1913	John J. Morton	1924	Geoffrey Jefferson	1927-1928	John F. Fulton	1932	Francis Murphey	1959-1962	John T. Garner	1981-1986	Gregory W. Hornig
1913-1914	Wilder Penfield	1924-1925	William P. Van Wagenen	1928-1929	W. Gayle Crutchfield	1932	C. C. Bishop	1960-1964	Francis X. Rockett	1982-1987	John R. Adler, Jr.
1918-1919		1925	Arthur van Dessel	1928-1929	Frederic Schreiber	1932	D. Vasiliu	1961	August W. Geise	1983-1985	Luis M. Zavala-Roman
1913-1914	Charles Bagley Jr.	1925	Boris M. Fried	1928-1929	Harold M. Teel	1932	Arsit A. Stender	1962-1963	Eric Wisiol	1984-1989	Richard Ellenbogen
1913-1914	Carl W. Rand	1925-1926	Jean Morelle	1928-1929	Richard C. Buckley	1932	Ferdinand Verbeek	1962-1963	David L. Kelly, Jr.	1985-1988	Robert Peterson
1914-1916	Gilbert Horrax	1925-1926	Leo M. Davidoff	1928-1929	Alan C. Gairdner	1932	F. N. Glenn	1962-1966	Larry K. Page	1986-1991	Clifford M. Gall
1919-1928		1925-1926	Francis C. Grant	1928-1929	Edwan M. Deery	1932	L. C. Kendall	1963	Ronald Birkenfeld	1987-1992	Matthew R. Moore
1928-1932		1925-1928	Franc D. Ingraham	1928-1934	Louise Eisenhardt	1932	Vittorio Putti	1963-1965	Michael J. Jerva	1988-1995	Sumeer Sathi
1914-1915	Edward B. Towne	1926	Walter Lehmann Gottingen	1929	A. Herbert Olivecrona	1932	Arthur L. D. Pattison	1963-1967	Edward L. Katz	1989-1995	Philip A. Starr
1914-1915	L.H. Weed	1926	Edgar J. Fincher, Jr.	1929	Attracta Halpenny	1932-1933	Lycergus Davey	1964-1968	Alan D. Rosenthal	1990-1992	Patrick A. Juneau III
1915-1918	Clifford B. Walker	1926	William J. German	1929	F. A. R. Stammers	1933	Edvard Busch	1964-1965	Donliin M. Long	1990-1996	Simcha J. Weller
1915-1917	Conrad Jacobson	1926-1928	Hugh W. B. Cairns	1929-1930	Gaston de Coppet	1939-1942	Eben Alexander, Jr.	1966-1970	Howard M. Eisenberg	1991-1995	P. Langham Gleason
1916-1917	Samuel C. Harvey	1926-1927	Georges Schaltenbrand	1930	Daniel Petit-Dutaillis	1946-1947	Donald Matson	1967-1968	John M. Tew	1991-1996	Faith Barnett
1917-1919	Henry R. Viets	1927	Claude S. Beck	1930	Daniel C. Bell	1939-1943	1946-1947	1967-1971	Edwin G. Fischer	1991-1997	Thomas Moriarty
1917-1920	J.J. Keegan	1927	Lawrence B. Kubie	1930-1931	William R. Henderson	1941-1944	Frank Nulsen	1968-1971	Robin Davidson	1992-1997	Marc. S. Schwartz
1919-1920	Howard Fleming	1927	Arthur J. McLean	1930-1931	Thomas I. Hoen	1942	Griffith R. Harsh, III	1968-1969	A. Loren Amacher	1992-1998	John K. Park
1919	Percival Bailey	1927-1928	Trygve Gunderson	1930-1931	Francois Ody	1942-1944	1948-1949	1969-1973	J. Gordon McComb	1992-1998	Craig van Horne
1922-1925		1927-1928	Cameron L. Haight	1930-1931	Thomas Hoen	1949-1950	Albert Farley	1970-1974	John W. Walsh	1993-1999	Subu N. Magge
1926-1928		1927-1928	Joseph Barr	1931	Johannes Rives Tartu	1949-1953	Anthony Susen	1970-1975	James E. McLennan	1993-2000	Kai U. Frerichs
1920-1921	Charles E. Locke	1927-1928	Richard H. Meagher	1931-1932	Bronson Ray	1949-1952	Edgar Bering	1972-1978	Thomas Arkins	1995-2001	Adel Malek
1920	Charles P. Symonds	1928-1929	John G. Scarff	1931-1932	Carl F. List	1950-1953	Robert Mc Laurin	1972-1976	J. Parker Mickle	1996-2003	Peng Chen
1920	F. E. B. Foley	1927-1928	Cobb Pilcher	1931-1932	Abraham Kaplan	1953-1957	John Shillito, Jr.	1975-1977	Dennis L. Johnson	1996-2000	Claudia Martin
1921-1922	Daniel W. Wheeler	1927-1928	E. Jefferson Browder	1931-1932	Benno Schlesinger	1953-1959	E. Bruce Hendrick	1975-1979	Joseph Ordia	1999-2000	Steven P. Leon
1921-1922	Paul Martin	1927-1928	Cyril B. Courville	1931-1932	Robert A. Groff	1953-1959	E. Bruce Hendrick	1976-1980	David C. Y. Kung	2001-2002	Alexandra Golby
1923	J. Paterson Ross	1927-1928	Frederick E. Kredel	1931-1932	William (C. G.) de Gutierrez-Mahoney	1954-1956	Fred Fowler	1997-1980	Clarence S. Greene		
1923	Ferdinand C. Lee					1954-1961	Walt Cotter				
1923-1924	Norman M. Dott										
1929											

CLASS OF 2004



KADIR ERKMEN, MD

MEDICAL SCHOOL
University of Maryland School of Medicine

FELLOWSHIP
Skull Base Surgery, University of Arkansas
Neuroendovascular Surgery, University of Texas

SUBSEQUENT EMPLOYMENT
Faculty, Dartmouth Hitchcock Medical Center

CURRENT EMPLOYMENT
Director of Cerebrovascular Neurosurgery
& Neurosurgery Residency Program, Temple University



STEPHANIE GREENE, MD

MEDICAL SCHOOL
Albany Medical College

FELLOWSHIP
Pediatric Neurosurgery,
University of Washington Children's Hospital

SUBSEQUENT EMPLOYMENT
Director of Pediatric
Neurosurgery, Hasbro Children's Hospital

CURRENT EMPLOYMENT
Faculty, University of Pittsburgh

CLASS OF 2006



IAN JOHNSON, MD

MEDICAL SCHOOL
University of Kentucky School of Medicine

FELLOWSHIP
Orthopedic Spine Surgery, New England Baptist Hospital
Minimally Invasive Spine Surgery, Good Samaritan Hospital

SUBSEQUENT EMPLOYMENT
Faculty, Neurological Surgery, The Medical University of South Carolina, North Broward Health Coral Springs Medical

CURRENT EMPLOYMENT
Chief of Neurosurgery,
University Neuroscience Institute, UCSF-Fresno



DEEPA SONI, MD

MEDICAL SCHOOL
Howard University

FELLOWSHIP
Cerebrovascular, Macquarrie University

SUBSEQUENT EMPLOYMENT
Faculty, Berkshire Medical Center

CLASS OF 2005



CHIMA OHAEBULAM, MD

MEDICAL SCHOOL
University of Nigeria Medical School

FELLOWSHIP
Spinal Neurosurgery, Brigham and Women's Hospital

SUBSEQUENT EMPLOYMENT
Faculty, New England Baptist Hospital

CLASS OF 2007



BRYAN FIGUEROA, MD

MEDICAL SCHOOL
University of Michigan

FELLOWSHIP
Cerebrovascular Surgery,
Indianapolis Neurosurgical Group

SUBSEQUENT EMPLOYMENT
Staff, Spectrum Health



JONATHAN SLOTKIN, MD

MEDICAL SCHOOL
University of Maryland School of Medicine

FELLOWSHIP
Spine Surgery, New England Baptist Hospital

SUBSEQUENT EMPLOYMENT
The Washington Brain & Spine Institute

CURRENT EMPLOYMENT
Chief of Spine Surgery and Spinal Cord Injury Research, Geisinger Medical Center

CLASS OF 2008



SATHISH SUBBIAH, MD, MS

MEDICAL SCHOOL
Harvard Medical School

GRADUATE
Yale University

FELLOWSHIP
Endoscopic/Minimally Invasive Spine
Surgery, Northwestern Memorial Hospital

SUBSEQUENT EMPLOYMENT
Faculty, Mount Sinai School of Medicine
Practice, Orthopedic Associates of Long Island

CLASS OF 2010



LANCE GOVERNALE, MD

MEDICAL SCHOOL
Harvard Medical School

FELLOWSHIP
Shillito Pediatric Fellow, Boston Children's Hospital

SUBSEQUENT EMPLOYMENT
Faculty, Nationwide Children's Hospital, Ohio
State

CURRENT EMPLOYMENT
Chief of Pediatric Neurosurgery, University of
Florida



ALBERT KIM, MD, PHD

MEDICAL SCHOOL
New York University

GRADUATE/PHD
New York University

FELLOWSHIP
Skull Base/Vascular, Jackson Memorial
Hospital

SUBSEQUENT EMPLOYMENT
Faculty, Washington University

CLASS OF 2009



IAN DUNN, MD

MEDICAL SCHOOL
Harvard Medical School

FELLOWSHIP
Skull Base Surgery, University of Arkansas

SUBSEQUENT EMPLOYMENT
Faculty, Brigham and Women's Hospital

CURRENT EMPLOYMENT
Wilkins Professor and Chair of the
Department of Neurosurgery, University of
Oklahoma



ALEX PAPANASTASSIOU, MD

MEDICAL SCHOOL
University of California, San Francisco

FELLOWSHIP
Epilepsy, Yale University

SUBSEQUENT EMPLOYMENT
Faculty, University of Texas

CLASS OF 2011



KEVIN CAHILL, MD, PHD

MEDICAL SCHOOL
University of Florida

GRADUATE/PHD
Harvard School of Public Health/University of
Florida

FELLOWSHIP
Spine, University of Miami

SUBSEQUENT/CURRENT EMPLOYMENT
Private Practice, Carolina Neurosurgery & Spine



SUZANNE THARIN, MD, PHD

MEDICAL SCHOOL
Columbia University

GRADUATE/PHD
University of Toronto, SUNY Stony Brook

FELLOWSHIP
Spine, Cleveland Clinic

SUBSEQUENT/CURRENT EMPLOYMENT
Faculty, Stanford University Medical Center

CLASS OF 2012



SARAH JERNIGAN, MD

MEDICAL SCHOOL
University of Louisville

GRADUATE/PHD
Tulane University

FELLOWSHIP
Shillito Pediatric Fellow, Boston Children's Hospital

SUBSEQUENT/CURRENT EMPLOYMENT
Private Practice, Carolina Neurosurgery & Spine



YI LU, MD, PHD

MEDICAL SCHOOL
Columbia University

GRADUATE/PHD
Albert Einstein College of Medicine

FELLOWSHIP
Deformity & Minimally Invasive Spine Surgery, University of Miami

SUBSEQUENT/CURRENT EMPLOYMENT
Faculty, Brigham and Women's Hospital/Faulkner Hospital

CLASS OF 2014



STEPHEN NALBACH, MD

MEDICAL SCHOOL
Temple University

SUBSEQUENT/CURRENT EMPLOYMENT
Private Practice, Tyler Neurosurgical Associates, TX



ALEXANDER ROPPER, MD

MEDICAL SCHOOL
Tufts University

FELLOWSHIP
Spine Fellowship, Barrow Neurological Institute

CURRENT EMPLOYMENT
Director of Spine Surgery, Assistant Professor, Baylor College of Medicine, Texas

CLASS OF 2013



NING LIN, MD

MEDICAL SCHOOL
Harvard Medical School

FELLOWSHIP
Endovascular Neurosurgery, SUNY Buffalo, NY

SUBSEQUENT EMPLOYMENT
Faculty, Well Cornell Medicine Brain and Spine Center, NY



URVASHI UPADHYAY, MD

MEDICAL SCHOOL
Johns Hopkins School of Medicine

FELLOWSHIP
Skull Base Surgery, Brigham and Women's Hospital

CURRENT EMPLOYMENT
Faculty, Boston Medical Center



JUDITH WONG, MD, MPH

MEDICAL SCHOOL
University of California, San Francisco

GRADUATE/MPH
Harvard School of Public Health

FELLOWSHIP
Pediatric Fellowship, University of California Los Angeles

CURRENT EMPLOYMENT
Private Practice, Kaiser Permanente, California

CLASS OF 2015



BRADLEY GROSS, MD

MEDICAL SCHOOL
Northwestern University

FELLOWSHIP
Neuroendovascular
Fellowship, Barrow
Neurological Institute

CURRENT EMPLOYMENT
Assistant Professor, University of
Pittsburgh



PELEG HOROWITZ, MD, PHD

MEDICAL SCHOOL
Northwestern University

FELLOWSHIP
Skull Base Neuro-Oncology
Fellowship, MD Anderson Cancer
Center

CURRENT EMPLOYMENT
Assistant Professor, University of
Chicago

CLASS OF 2017



WENYA LINDA BI, MD, PHD

MEDICAL SCHOOL
Yale School of Medicine

FELLOWSHIP
Skull Base Fellowship, Brigham and Women's
Hospital

CURRENT EMPLOYMENT
Faculty, Brigham and Women's Hospital



MATTHEW VESTAL, MD, MHS

MEDICAL SCHOOL
Yale School of Medicine

POST-GRADUATE
Harvard Business School, MBA

FELLOWSHIP
Shillito Pediatric Fellow, Boston Children's
Hospital

CURRENT EMPLOYMENT
Assistant Professor, Duke University Medical
Center

CLASS OF 2016



MUHAMMAD ABD-EL-BARR, MD, PHD

MEDICAL SCHOOL
Baylor College of Medicine

FELLOWSHIP
Spine Fellowship, Brigham and Women's Hospital

CURRENT EMPLOYMENT
Faculty, Duke University Medical Center



MICHAEL RABER, MD

MEDICAL SCHOOL
Wake Forest University School of Medicine

FELLOWSHIP
Spine Fellowship, The Johns Hopkins
University

CURRENT EMPLOYMENT
Kootanai Clinic, Neurosurgery and
Spine, Coeur d'Alene, Idaho

CLASS OF 2018



HORMUZDIYAR DASENBROCK, MD

MEDICAL SCHOOL
Johns Hopkins University School of Medicine

FELLOWSHIP
Endovascular Fellowship, Rush University
Neuroendovascular Fellowship (enfolded), Brigham
and Women's Hospital

CURRENT EMPLOYMENT
Faculty, Boston Medical Center



VIREN VASUDEVA, MD

MEDICAL SCHOOL
Medical College of Georgia School of
Medicine

FELLOWSHIP
Spine Fellowship (enfolded), Brigham and
Women's Hospital, MA

CURRENT EMPLOYMENT
St. Mary's Healthcare System, Georgia
Neurological Surgery and Comprehensive
Spine, Athens, GA

CLASS OF 2019



VAMSIDHAR CHAVAKULA, MD

MEDICAL SCHOOL

Harvard Medical School

FELLOWSHIP

BWH Functional Attending, Fellowship
Epilepsy Fellowship, Claudio Munari Epilepsy
Center, Ospedale Niguarda, Milan, Italy

CURRENT EMPLOYMENT

Faculty, Neurosurgical Medical Clinic, San Diego,
California



ZIEV MOSES, MD

MEDICAL SCHOOL

Geisel School of Medicine at Dartmouth

FELLOWSHIP

Spine Fellowship, Rush University

CURRENT EMPLOYMENT

Faculty, Beth Israel Deaconess Medical Center,
Boston

CLASS OF 2020



DUSTIN DONNELLY, MD

MEDICAL SCHOOL

The Ohio State University College of
Medicine

FELLOWSHIP

Spine Fellowship, Duke University

CURRENT EMPLOYMENT

Faculty, Case Western Reserve University



DAVID PENN, MD

MEDICAL SCHOOL

Sidney Kimmel Medical
College, Thomas Jefferson
University

FELLOWSHIP

Skull Base/ Cerebrovascular
Fellowship, Case Western Reserve
University

CURRENT EMPLOYMENT

Attending, Vassar Brothers Medical Center and
Danbury Hospital, Nuvance Health, Poughkeepsie
NY



POKMENG (ALFRED) SEE, MD

MEDICAL SCHOOL

Johns Hopkins University

FELLOWSHIP

Cerebrovascular Fellowship, University of Illinois at
Chicago

Shillito Fellowship, Boston Children's Hospital

CURRENT EMPLOYMENT

Faculty, Boston Children's Hospital



CHRISTIAN STRONG, MD

MEDICAL SCHOOL

Harvard Medical School

FELLOWSHIP

Spine Fellowship, New England Baptist
Hospital

CURRENT EMPLOYMENT

Private Practice, Wellstar Atlanta Medical
Center

CLASS OF 2021



KEVIN TED HUANG, MD

MEDICAL SCHOOL

Duke University School of Medicine

FELLOWSHIP

Complex Spine Fellowship, Cleveland Clinic

SUBSEQUENT EMPLOYMENT

Faculty, Brigham and Women's Hospital



IAN JAMES TAFEL, MD

MEDICAL SCHOOL

Geisinger Commonwealth School of Medicine

FELLOWSHIP

Spine Fellowship, University of Miami

SUBSEQUENT EMPLOYMENT

Faculty, University of Florida Health



PABLO ANDRES VALDES QUEVEDO, MD, PHD

MEDICAL SCHOOL

Geisel School of Medicine at Dartmouth

FELLOWSHIP

Neurosurgical Oncology and Functional Brain Mapping Fellowship, Montpellier, France

SUBSEQUENT EMPLOYMENT

Assistant Professor, University of Texas Medical Branch

CLASS OF 2022



YASSER JEELANI, MD

MEDICAL SCHOOL

University of Jammu, India

FELLOWSHIP

Skull Base and Open CV Fellowship, Arkansas Neuroscience Institute



ROSALIND LAI, MD

MEDICAL SCHOOL

Harvard Medical School

FELLOWSHIP

Cerebrovascular/Endovascular Fellowship, University at Buffalo Neurosurgery (UBNS)

SUBSEQUENT EMPLOYMENT

Faculty, University at Buffalo, Neurosurgery (UBNS)



KYLE WU, MD

MEDICAL SCHOOL

UMass Chan Medical School

FELLOWSHIP

Skull Base & Minimally Invasive Cranial Surgery Fellowship, The Ohio State University Wexner Medical Center & James Cancer Institute, Ohio

CURRENT EMPLOYMENT

Faculty, The Ohio State University, Wexner Medical Center

CLASS OF 2023



JOSEPH DRIVER, MD

MEDICAL SCHOOL
Loyola University Chicago

FELLOWSHIP
Complex Spine Fellowship, Cleveland
Clinic



WALID IBN ESSAYED, MD

MEDICAL SCHOOL
Medical Faculty of Tunis, Tunisia

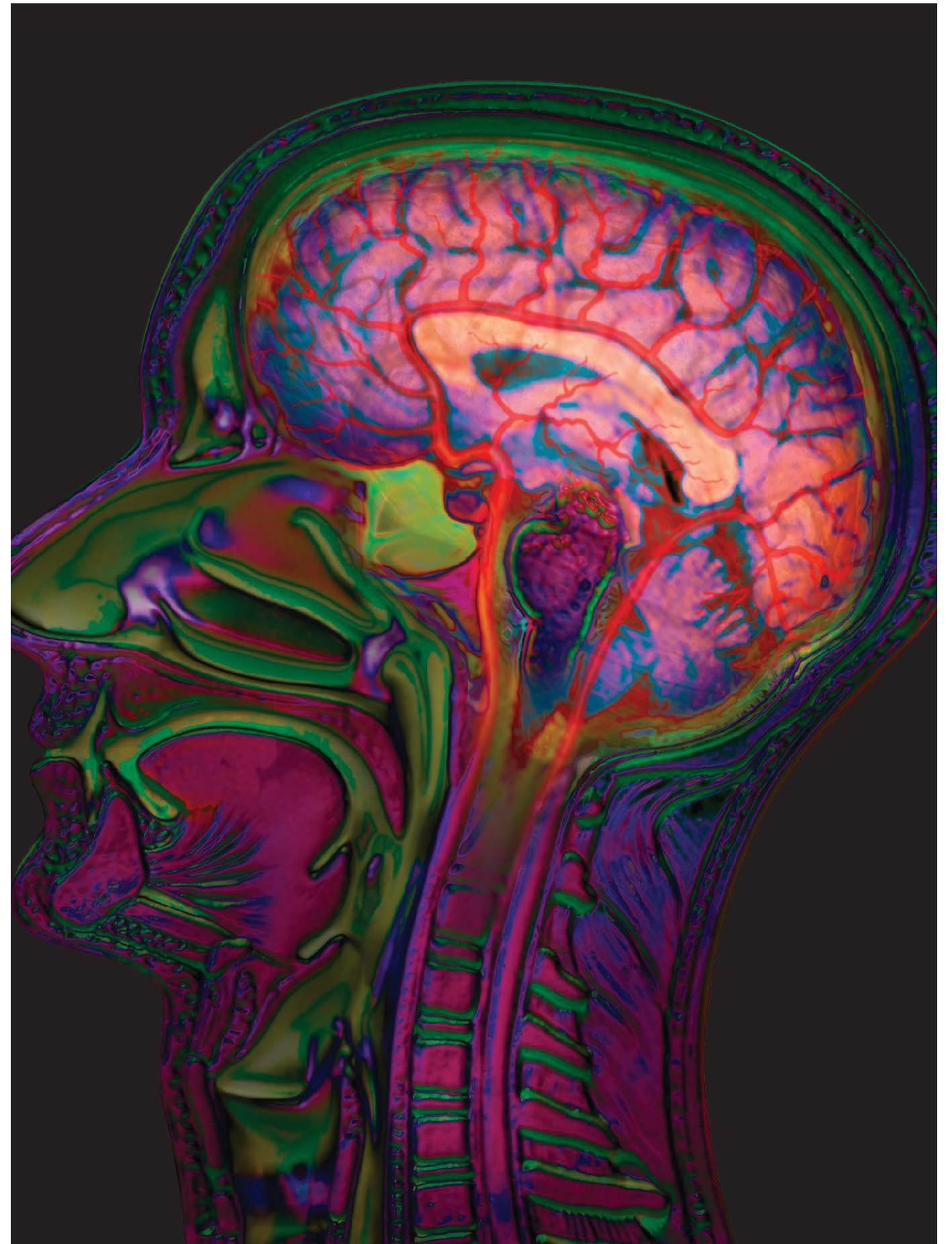
SUBSEQUENT EMPLOYMENT
UTHealth Neurosciences and
McGovern Medical School Houston

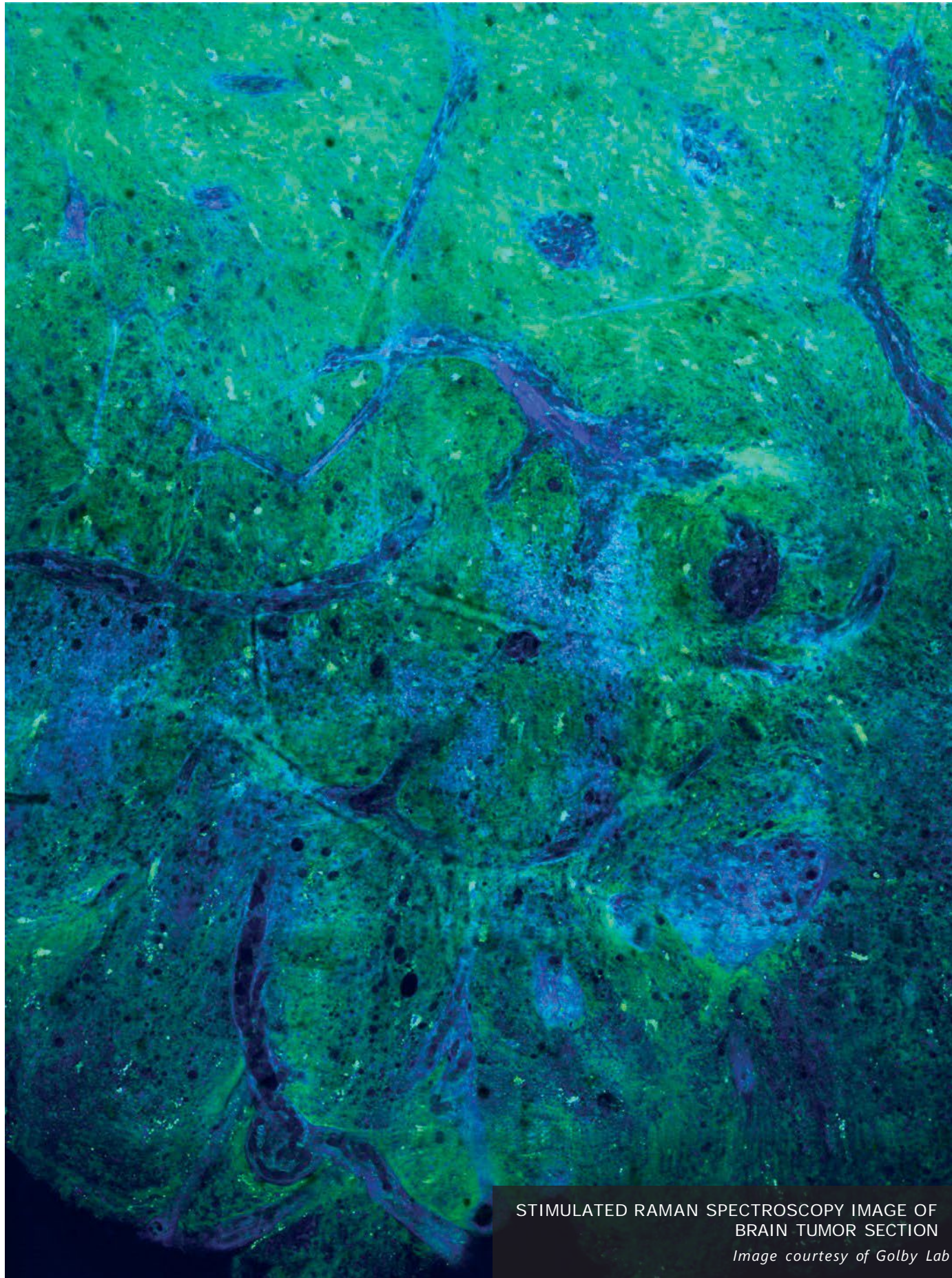


DAVID SEGAR, MD

MEDICAL SCHOOL
Warren Alpert Medical School of Brown University

FELLOWSHIP
Functional and Epilepsy Fellowship, University of California, San
Francisco





STIMULATED RAMAN SPECTROSCOPY IMAGE OF
BRAIN TUMOR SECTION
Image courtesy of Golby Lab

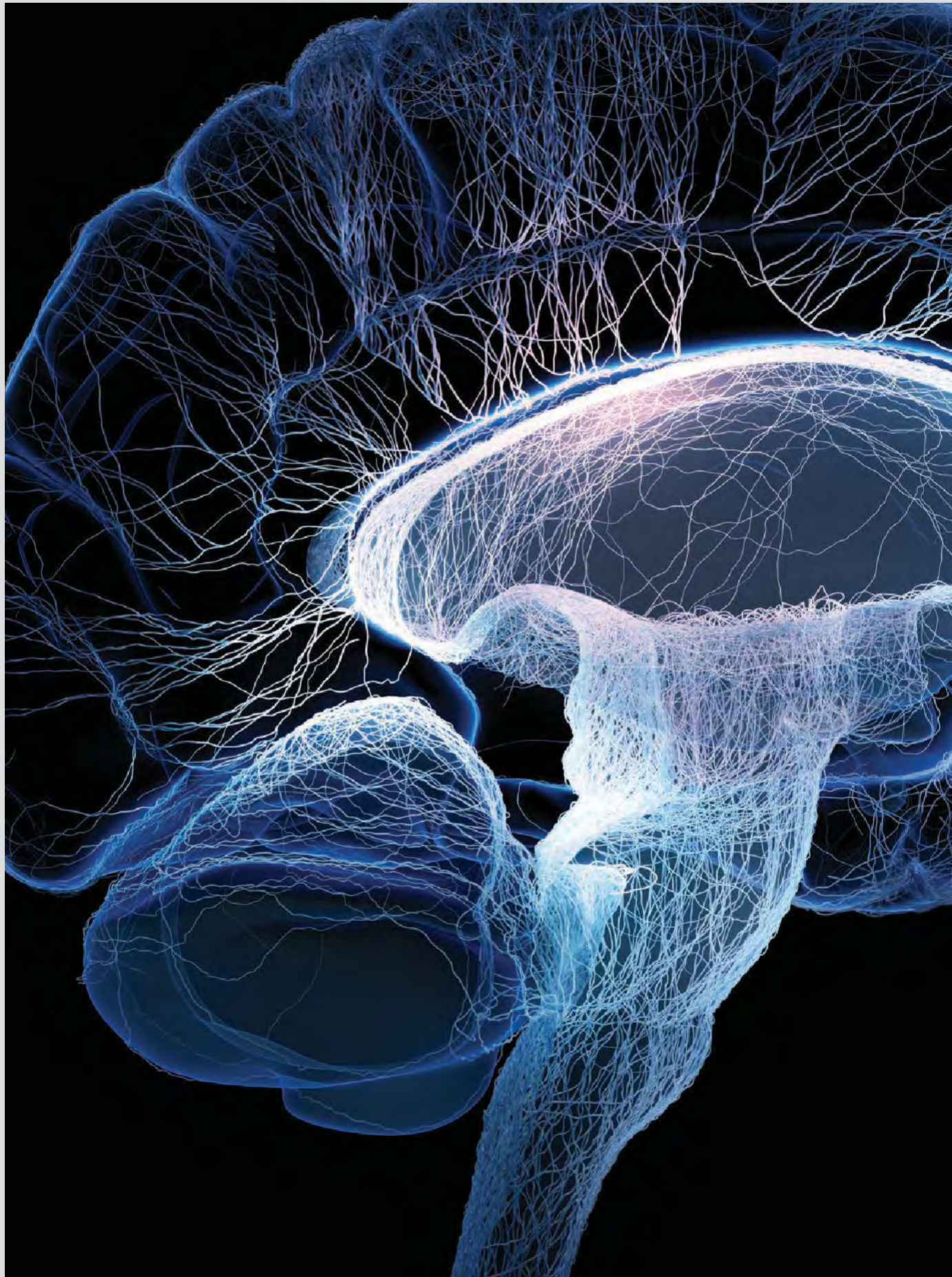
CURRENT RESIDENTS AND FELLOWS

RESIDENTS

Stanley Bazarek, MD, PhD	Chief Resident
Neil Klinger, MD	Chief Resident
Martina Mustroph, MD, PhD	Chief Resident
Benjamin Johnston, MD, PhD	PGY-6
Ari Kappel, MD	PGY-6
Genaro Villa, MD, PhD	PGY-6
Joshua Bernstock, MD, PhD	PGY-5
Melissa Chua, MD	PGY-5
Saksham Gupta, MD	PGY-5
Marcelle Altshuler, MD	PGY-4
Joshua Chalif, MD, PhD	PGY-4
Jason Chen, MD, PhD	PGY-4
Casey Jarvis, MD	PGY-3
Sean Lyne, MD	PGY-3
James Tanner McMahon, MD	PGY-3
Adam Glaser, MD	PGY-2
David Liu, MD	PGY-2
Gabrielle Luiselli, MD	PGY-2
Eric Chalif, MD	PGY-1
Ron Gadot, MD	PGY-1
Chibueze Nwagwu, MD	PGY-1

FELLOWS

David Bass, MD, PhD	CV-EV Fellow
Abdullah Feroze, MD	CV-EV Fellow
Charles Couturier, MD, PhD	Image Guided Surgery Fellow
Erickson Torio, MD	Image Guided Surgery Fellow
Christopher Hong MD	Pituitary Fellow
Serdar Kaya, MD	Skull Base Fellow



WEEKLY CONFERENCE SCHEDULE

MONDAY

7:00am - 7:30am	Cushing Service Didactics	BWH
7:30am - 8:15am	Neuro-Oncology/Tumor Board Conference	BWH/Dana-Farber

TUESDAY

7:00am - 7:30am	Dandy Service Didactics	BWH
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WEDNESDAY

6:30am - 7:00am	Morbidity/Mortality Conference	BWH (every Wed except 1st)
7:00am - 8:00am	Combined QI Conference	BWH (1st Wed of each month)
7:00am - 8:00am	Neurosurgery Grand Rounds	BWH (every Wed except 1st)
7:00am - 9:00am	Skull Base Cadaver Lab	BWH (Quarterly)
8:00am - 9:00am	Neuroradiology Conference	BWH
4:00pm - 5:00pm	Movement Disorder Conference	BWH (1st & 3rd Wed of each month)

THURSDAY

7:00am - 8:00am	Cerebrovascular/Endovascular Conference	BWH
7:00am - 8:00am	Skull Base Conference	BWH (every other Thurs)
9:30am - 10:30am	Pituitary Multidisciplinary Conference	BWH (monthly)
10:00am - 12:00pm	Resident Clinics (PGY 2 & 6s)	BCH
12:00pm - 1:00pm	Resident Core Curriculum Conference	BWH
1:00pm - 2:00pm	Epilepsy Conference	BWH
6:15pm - 7:15pm	Educational Conference	BWH

FRIDAY

7:30am - 8:30am	Neuropathology/Brain cutting	BWH
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GRAND ROUNDS SCHEDULE 2022-2023

JUNE 29, 2022

Neurosurgery for Gilles de la Tourette Syndrome (GTS)

Ludvic Zrinzo, MD PhD FRCS UOM

JULY 13, 2022

Evolution of My Preferred Skull Base Approaches over 28 Years

Carl B. Heilman, M.D.

JULY 20, 2022

Speech neuroprosthesis

Edward F Chang, MD

JULY 27, 2022

Global Surgery 2.0: Reconciling National and International Health Priorities

Kavitha Ranganathan, MD

AUGUST 10, 2022

Neurosurgery's Moonshot

Dr. Gail Rosseau

AUGUST 17, 2022

The Impact of Physician Financial Stewardship on Patient Care

Richard Meredith Westmark, M.D., FAANS

AUGUST 24, 2022

Cervical Spondylitic Myelopathy

Michael W. Groff, MD

SEPTEMBER 14, 2022

Closing the loop on impulsivity: what we can learn from BITES

Casey Halpern, MD

SEPTEMBER 21, 2022

Role of the VA in Neurosurgical Education

Jacob Rachlin, MD and Michael Mooney, MD

SEPTEMBER 28, 2022

Management of penetrating injury traumatic CSF leaks

Peleg M. Horowitz, M.D., Ph.D.

OCTOBER 5, 2022

Microsurgical Approaches to the Thalamus

Professor Ugur Ture

OCTOBER 19, 2022

GBM: Perspectives from off the beaten path

L. Gerard Toussaint III, MD

OCTOBER 26, 2022

The Future of the Neurosurgery Residency Match

Lola B. Chambless, MD, FAANS

NOVEMBER 9, 2022

The Role of Medical Illustration in the Evolution of Transsphenoidal Surgery

James Naples, MD and William B. Westwood, MS

NOVEMBER 16, 2022

A Path Forward: Understanding implicit bias, microaggressions in medicine and cultivating an advocacy mindset

Tina Gelsomino, MSW, LCSW, RCC and Galen Henderson, MD, FNCS

NOVEMBER 30, 2022

Fostering technology and collaboration to improve clinical care in LMICs

Alexandra J. Golby, MD

JANUARY 11, 2023

Healer or Technician: Reflection of a Die Hard Dinosaur

Dr. Ossama Al-Mefty

JANUARY 18, 2023

Reconsidering management of small and medium-sized sporadic vestibular schwannoma

Matthew L. Carlson, M.D.

JANUARY 25, 2023

Modern Landscape of Adult Spinal Deformity Surgery

Hasan Zaidi, MD

FEBRUARY 15, 2023

Improving Access to Stroke Care: How future devices, robotics, and AI will change the landscape of care

Raymond D. Turner, IV, M.D., FAANS

FEBRUARY 22, 2023

Microsurgical Anatomy of the Limbic System

Dr. Paulo Abdo do Seixo Kadri

MARCH 8, 2023

Therapeutic Modulation of Complement Cascade for Stroke and COVID

E. Sander Connolly, Jr., M.D., F.A.A.N.S., F.A.C.S

MARCH 22, 2023

Peripheral Nerve Surgery: The Lost Art?

Dr. E. Antonio Chiocca

APRIL 12, 2022

Neurosurgery and Health Care Policy: Working for You in Washington

Katie O'Meara Orrico, Esq.

(Senior Vice President, Health Policy and Advocacy – American Association of Neurological Surgeons/Congress of Neurological Surgeons)

APRIL 26, 2023

Bypass Training- Developing Hand Skills

Dr. Ahmad Hafez

MAY 10, 2023

Building a Scientific Framework to Advance the Care of Pediatric Neurosurgical Disease

David D. Limbrick, Jr., MD, PhD

MAY 17, 2023

Striking the Balance: Career, Life and Leadership

Ann R. Stroink, MD, CPE, FACS, FAANS

MAY 24, 2023

Innovations In The Diagnosis And Surgical Treatment Of Pediatric Epilepsy

P. David Adelson, MD, FACS, FAAP, FAANS

JUNE 21, 2023

New Frontiers in Spine Surgery: Research Update

Praveen V. Mummaneni, MD, MBA

JULY 12, 2023

Post-operative pharmacology in the neurosurgical patient

Michael J. Schontz, PharmD, BCPS, BCCCP

JULY 19, 2023

MRgFUS in Movement Disorder Surgery

Dr. G. Rees Cosgrove

JULY 26, 2023

Updates on Artificial Intelligence in Neurosurgery: Promises and Pitfalls

Kevin Huang, MD

AUGUST 16, 2023

Harvey Cushing at the Brigham

Dr. Edward Laws

AUGUST 23, 2023

Medical Innovation at Mass General Brigham

Dr. William Gormley

SEPTEMBER 13, 2023

Aerospace Medicine in Neurosurgery

Marvin William Jackson, M.D., M.S., FABPM

Acting Regional Flight Surgeon, Aerospace Medicine, New England

SEPTEMBER 27, 2023

Optimizing Mental Performance in Teams: The Role of Mental Skills to Enhance Self-Awareness and Communication

Ari S. Miller, MA, CMPC (ASM Performance Consulting, LLC)

RESEARCH STUDIES

THE DEPARTMENT OF NEUROSURGERY AT BRIGHAM AND WOMEN'S HOSPITAL IS A PIONEER IN NEUROSCIENCE AND IS DEDICATED TO THE RESEARCH OF NEUROLOGICAL DISORDERS INCLUDING TUMOR BIOLOGY, ANEURYSMS, STROKE, EPILEPSY, AND SPINAL DISORDERS.

Below are our current research studies and clinical trials. Please note that not all of the studies are human subject trials.

BRAIN TUMOR RESEARCH

A Phase I Study of the Treatment of Recurrent Malignant Glioma with rQNestin34.5v.2, a Genetically Engineered HSV-1 Virus, and immunomodulation with Cyclophosphamide

PI: E. Antonio Chiocca, MD, PhD

Phase I Study of Neoadjuvant GMCI plus Immune Checkpoint Inhibitor Combined with Standard of Care for Newly Diagnosed High-Grade Gliomas

PI: Wenya Linda Bi, MD, PhD

A Randomized, Double-blinded, Placebo-controlled Phase 2, Study of (ERC1671/GM-CSF/Cyclophosphamide)+Bevacizumab vs. (Placebo Injection/Placebo Pill) +Bevacizumab in the Treatment of Recurrent/Progressive, Bevacizumab naïve Glioblastoma and Gliosarcoma Patients (WHO grade IV malignant gliomas, GBM)

PI: E. Antonio Chiocca, MD, PhD

Protocol AT1001-102 Substudy: Evaluation of Ad-RTS-hIL-12 + Velelimex in Combination with Nivolumab in Subjects with Recurrent or Progressive Glioblastoma

PI: E. Antonio Chiocca, MD, PhD

A Multicenter Phase 2 Study of Oncolytic Polio/Rhinovirus Recombinant (PVSRIPO) in Recurrent WHO Grade IV Malignant Glioma Patients

PI: E. Antonio Chiocca, MD, PhD

A Phase 2, Open-label, Single-arm Study Evaluating the Efficacy, Safety, and Tolerability of Oncolytic Polio/Rhinovirus Recombinant (PVSRIPO) and the Immune Checkpoint Inhibitor Pembrolizumab in the Treatment of Patients with Recurrent Glioblastoma

PI: Patrick Wen, MD

Protocol AT1001-102 Expansion Substudy: Evaluation of Ad-RTS-hIL-12 + Velelimex in Subjects with Recurrent or Progressive Glioblastoma

PI: E. Antonio Chiocca, MD, PhD

Assessment of Safety and Feasibility of ExAblate Blood-Brain Barrier Disruption for the Treatment of High Grade Glioma in Patients Undergoing Standard Chemotherapy

PI: Alexandra Golby, MD

Assessment of Safety and Feasibility of Exablate Type 2 for Blood-Brain Barrier Disruption (BBBD) with Microbubble Resonators for the Treatment of Recurrent Glioblastoma (rGBM) in Subjects Undergoing Carboplatin Monotherapy

PI: Alexandra Golby, MD

Feasibility of the LUM Imaging System for Intraoperative Detection of Residual Cancer in the Tumor Bed in Subjects with Cancer Metastases to the Brain

PI: E. Antonio Chiocca, MD, PhD

A Pilot Study of an Implantable Microdevice for In Situ Evaluation of Drug Response in Patients with Primary Brain Tumors

PI: Pier Paolo Peruzzi, MD, PhD

Treatment response assessment maps (TRAMs) in the delineation of radiation necrosis from tumor progression after stereotactic radiation in patients with brain metastases: A prospective study

PI: Wenya Linda Bi, MD, PhD

SPINE RESEARCH

SIJ Stabilization in Long Fusion to the Pelvis: Randomized Controlled Trial

PI: Yi Lu, MD, PhD

A prospective, Randomized, controlled, single-blind, dose-finding, multi-Center, parallel group study of the safety and efficacy of KUR-113 Bone Graft (TGplPTH1-34 in fibrin) versus local autograft for the treatment of patients undergoing single-level transforaminal lumbar interbody fusion (the STRUCTURE study)

PI: John Chi, MD, MPH

Study to Assess the Efficacy and Safety of VX-210 Subjects with Acute Traumatic Cervical Spinal Cord Injury

PI: Yi Lu, MD, PhD

The INSPIRE Study: Probably Benefit of the Neuro-Spinal Scaffold for Treatment of AIS. A Thoracic Acute Spinal Cord Injury

PI: Yi Lu, MD, PhD

A Clinical Study to Assess the Safety and Effectiveness of the Premia Spine TOPS System

PI: John Chi, MD, MPH

A Prospective, Concurrently Controlled, Multi-Center Study to Evaluate the Safety and Effectiveness of the Spinal Kinetics M6-C™ Artificial Cervical Disc Compared to Anterior Cervical Discectomy and Fusion (ACDF) for the Treatment of Contiguous Two-Level Symptomatic Cervical Radiculopathy

PI: John Chi, MD, MPH

The coflexCOMMUNITY Study: An Observational Study of coflex Interlaminar Technology

PI: Yi Lu, MD, PhD

FUNCTIONAL DISORDER CLINICAL TRIALS

A Randomized, Placebo Surgery Controlled, Double-blinded, Multi-center, Phase 2 Clinical Trial, Evaluating the Efficacy and Safety of VY-AADC02 in Advanced Parkinson's Disease with Motor Fluctuations

PI: G. Rees Cosgrove, MD

ExAblate Transcranial MRgFUS of the Globus Pallidum for Treatment of Parkinson's Disease

PI: G. Rees Cosgrove, MD

Global Registry: ExAblate 4000 Transcranial MR Guided Focused Ultrasound (TcMRgFUS) of Neurological Disorders

PI: G. Rees Cosgrove, MD

A Pivotal Clinical Trial of the Management of the Medically-Refractory Dyskinesia Symptoms or Motor Fluctuations of Advanced Idiopathic Parkinson's Disease with Unilateral Lesioning of the Globus Pallidum Using the ExAblate Neuro System

PI: G. Rees Cosgrove, MD

CEREBROVASCULAR CLINICAL TRIALS

ENRICH (Early Minimally-invasive Removal of ICH)

PI: M. Ali Aziz-Sultan, MD

SURF: A Prospective, Multicenter Study Assessing the Embolization of Intracranial Aneurysms using WAVE™ Extra Soft coils, a part of the Penumbra SMART COIL® System

PI: Nirav J. Patel, MD

Embolization of the Middle Meningeal Artery with ONYXTM Liquid Embolic System In the Treatment of Subacute and Chronic Subdural Hematoma (EMBOLISE)

PI: M. Ali Aziz-Sultan, MD

SOFia Aspiration System as first line Technique (SOFAST)

PI: M. Ali Aziz-Sultan, MD

HUMANITARIAN USE DEVICE STUDIES

MicroVention Low-profile Visualized Intraluminal Support (LVIS) Device

PI: M. Ali Aziz-Sultan, MD

Codman Neurovascular Enterprise Vascular Reconstruction Device and Delivery System

PI: Kai Frerichs, MD

Wingspan Stent System with Gateway PTA Balloon Catheter for the Treatment of Symptomatic Atherosclerotic Disease for Humanitarian Use

PI: Kai Frerichs, MD

Use of the Neuroform Atlas Stent, a Humanitarian Use Device, for the Treatment of wide-necked Cerebral Aneurysms

PI: Kai Frerichs, MD

PulseRider Aneurysm Neck Reconstruction Device

PI: M. Ali Aziz-Sultan, MD

ADDITIONAL CLINICAL RESEARCH STUDIES

Behavioral and MRI Studies in Healthy Subjects

PI: Alexandra Golby, MD

(continue)

RESEARCH STUDIES (CONTINUED)

Optical Coherence Tomography: Evaluation of the Retinal Thickness and Correlation with Clinical Outcomes after Transsphenoidal Surgery

PI: Edward Laws, MD

Endocrine and Surgical Complications in Pure Endoscopic Endonasal Transsphenoidal Surgery

PI: Edward Laws, MD

Outcomes for Neurosurgical Patients

PI: Elizabeth Claus, MD, PhD

Retrospective Review of Imaging Characteristics of Patients with Dural Arteriovenous Fistulas

PI: M. Ali Aziz-Sultan, MD

Biomarkers in Stroke and Intracerebral Hemorrhage

PI: Rose Du, MD, PhD

The GLIOGENE (Glioma Genetics) Study

PI: Elizabeth Claus, MD, PhD

Risk Factors and Outcomes for Glioma (GLIOGENE International Case/Control Study)

PI: Elizabeth Claus, MD, PhD

Three-Dimensional Angiography for Intraoperative Neuronavigation During Intracranial Tumor Resection: A Technical Note and Case Series

PI: M. Ali Aziz-Sultan, MD

Genetics of Intracranial Vessels

PI: Rose Du, MD, PhD

Gene Expression in Cerebral Aneurysms

PI: Rose Du, MD, PhD

Identification of Delirium Biomarkers Using Multimodal Sensor Data from the E4 Wristband Wearable Device

PI: William Gormley, MD, MPH, MBA

Radiographic Analysis of Image-Guidance Technology to Improve Accuracy and Reduce Iatrogenic Hemorrhage Associated with Ventriculostomy

PI: William Gormley, MD, MPH, MBA

Image and Function Guided Surgery of Brain Lesions

PI: Alexandra Golby, MD

Brain Basis of Memory Studied by fMRI and Intracranial EEG

PI: Alexandra Golby, MD

Digital Phenotyping of the Neurosurgical Patient: Towards More Effective Post-Operative Care – A Pilot Study

PI: Timothy R. Smith, MD, PhD, MPH

Outcomes in Patients Undergoing Spine Surgery

PI: Michael Groff, MD

Biomarkers of Traumatic Brain Injury

PI: William Gormley, MD, MPH, MBA

Intraoperative Stereotactic Molecular Imaging of Brain Tumor Margins

PI: Alexandra Golby, MD

Incidence of C2 Dysesthesia After C1 Lateral Mass Screws: Comparison Between Techniques of C2 Nerve Sectioning and C2 Nerve Preservation

PI: Michael Groff, MD

Retrospective Review of Patients Undergoing Arthroplasty vs ACDF

PI: John Chi, MD, MPH

GWAS Database for Aneurysms

PI: Rose Du, MD, PhD

Nanoscale Imaging of Neuromuscular Diseases

PI: E. Antonio Chiocca, MD, PhD

Retrospective Review of Transitional Care from Hospital to Discharge

PI: William Gormley, MD, MPH, MBA

Management of CNS Disorders Using Functional and Stereotactic Neurosurgical Interventions: Identifying Differentiating Features and Predictors of Improved Outcomes, in order to Improve Quality of Care

PI: G. Rees Cosgrove, MD

Retrospective Analysis of the Operative Management of Chronic Subdural Hematomas Following a Modified Technique for Introduction of a Subdural Catheter

PI: John Chi, MD, MPH

Diagnosis and Management of Rare CNS Lesions: Identifying Differentiating Features and Predictors of Improved Outcomes, in order to Improve Quality of Care

PI: Timothy R. Smith, MD, PhD, MPH

Genetic Epidemiology of Cerebral Aneurysms

PI: Rose Du, MD, PhD

Clinical Implications of Pipeline Embolization of Paraclinoidal Aneurysms

PI: M. Ali Aziz-Sultan, MD

The Impact of Medical School Research Funding on Career Choices

PI: Timothy R. Smith, MD, PhD, MPH

Long-term Outcomes for Neurosurgical Patients with Intracranial Neoplasms

PI: Elizabeth Claus, MD, PhD

Database of Skull Based Surgery Outcomes

PI: Linda Bi, MD, PhD

Degenerative Spine Disease – Characteristics, Treatments and Complications

PI: John Chi, MD, MPH

Neurovascular Disease Study

PI: Rose Du, MD, PhD

Spine Surgery Discharge Disposition

PI: William Gormley, MD, MPH, MBA

Evaluation and Treatment of Neurosurgical Disorders

PI: Alexandra Golby, MD

Craniectomy Associated Complications

PI: William Gormley, MD, MPH, MBA

Dural AVF Study

PI: Rose Du, MD, PhD

Analyzing Semantic Differences in the Documented Clinical Histories of Patients Undergoing Different Methods of Spinal Surgical Intervention

PI: Michael Groff, MD

Medical Complications in Patients with Intracranial Hemorrhage Managed in the NICU

PI: William Gormley, MD, MPH, MBA

Non-Invasive Collection of Physiologic Data Using a Novel Diffuse Optical Tomography Device for Measurement of Cerebral Oximetry in Intracranial Stroke: A Prospective, Non-Randomized, Single Center, Single Arm, Observational Physiologic Data Collection Trial

PI: William Gormley, MD, MPH, MBA

Indocyanine Green Angiography Guidance in Cranial Neurosurgery

PI: Linda Bi, MD, PhD

Patient-Reported Outcome Measure for Meningiomas

PI: Timothy R. Smith, MD, PhD, MPH

Use of Diffusion Tensor Imaging in Interventional MRI Implantation of Deep Brain Stimulation Electrodes

PI: G. Rees Cosgrove, MD

Efficacy of 68Ga-DOTATATE PET/CT in the Diagnosis of Ectopic ACTH Secreting Tumors After Failed Surgery for Cushing's Disease

PI: Edward Laws, MD

Biomarkers in Urine

PI: William Gormley, MD, MPH, MBA

Meningioma Segmentation Public Database

PI: Linda Bi, MD, PhD

5-ALA Intraoperative Fluorescence Imaging of Brain Tumors

PI: Alexandra Golby, MD

Machine learning of CT imaging for stroke patients

PI: Omar Arnaout, MD

Retrospective analysis of the outcomes of patients managed with Coflex Interlaminar Stabilization device

PI: Yi Lu, MD, PhD

Immune escape mechanisms in brain tumors

PI: Sean E. Lawler, PhD

Radiographic Changes in Spinal Biomechanics after Thoracolumbar Fusion

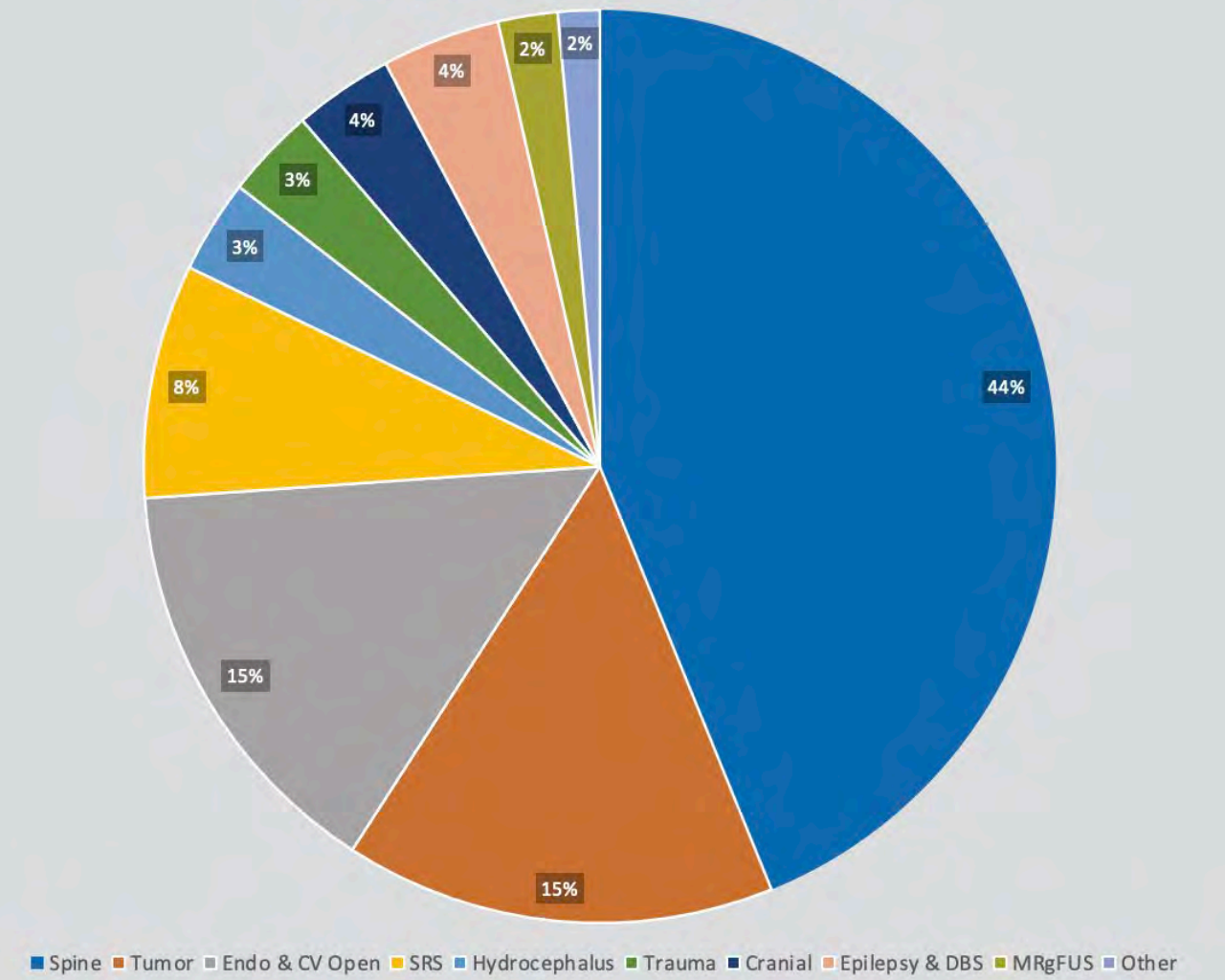
PI: Yi Lu, MD, PhD

NEUROSURGERY AT A GLANCE

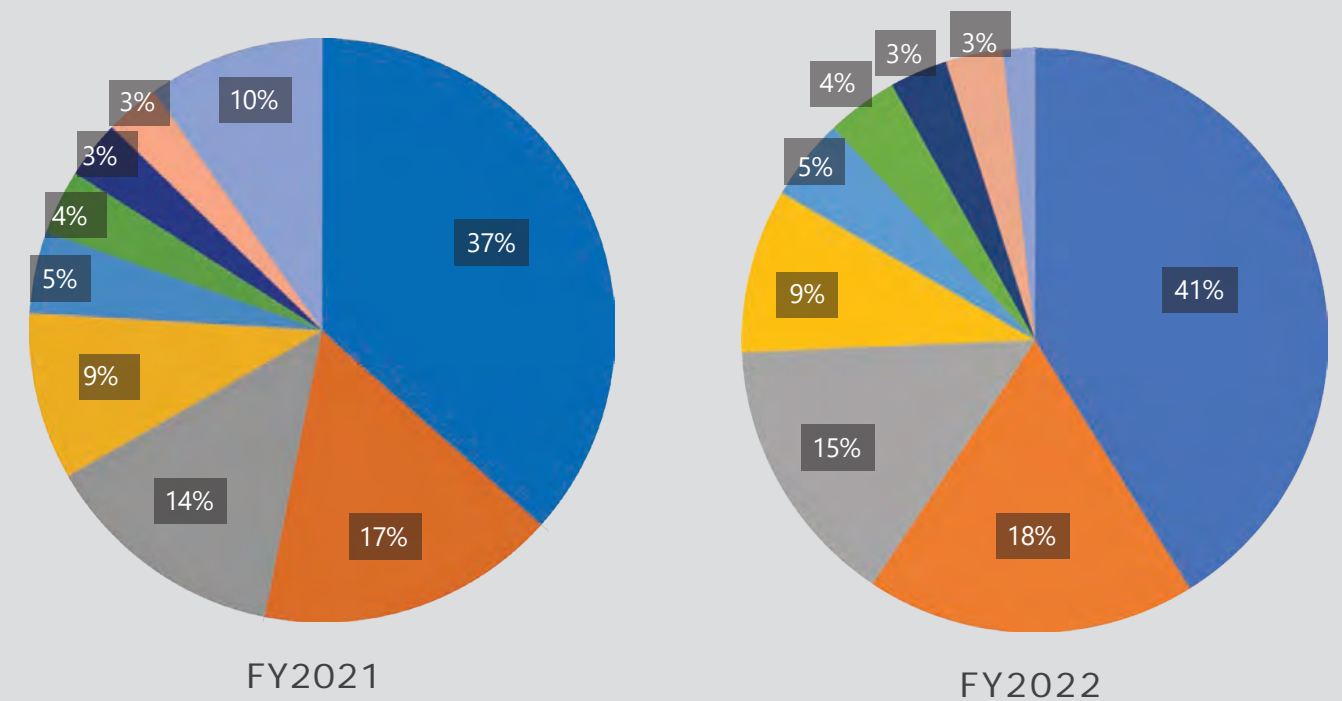
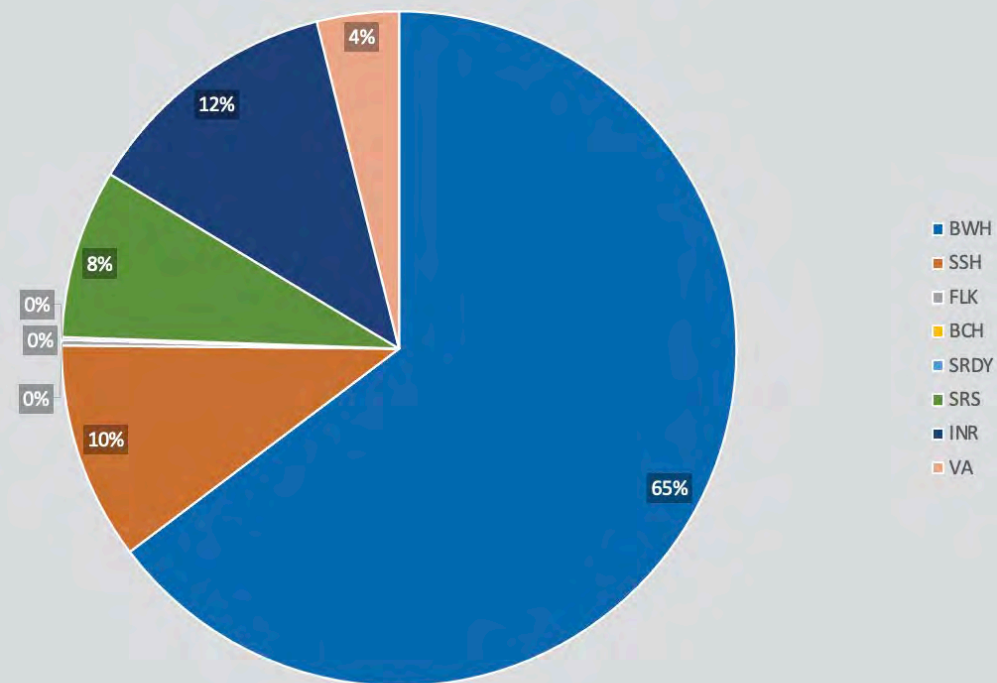
ANNUAL NEUROSURGICAL CASE VOLUME



FY23 CASE VOLUME BY SERVICE



FY23 CASE VOLUME BY LOCATION





HALE BUILDING FOR TRANSFORMATIVE MEDICINE AT BRIGHAM AND WOMEN'S HOSPITAL

OVERVIEW

Our new state-of-the-art Hale Building for Transformative Medicine (BTM), brings together the world's finest clinicians and scientists to accelerate breakthroughs and transform patient care in the neurosciences, orthopedics, rheumatology, immunology, and musculoskeletal health. Over one hundred years ago, the Peter Bent Brigham Hospital was erected behind Harvard Medical School so that its curious minds in science and medicine would never be too far from the laboratory bench. The BTM takes that idea and adapts it for 21st century medicine: bringing our clinicians and scientists together in one building to tackle the toughest dilemmas in healthcare.

This carefully constructed building located on the Brigham and Women's Hospital main campus is made of glass and steel, reaching 13 stories above ground and three below. The goal of the BTM is to promote collaboration and accelerate advancements in care for patients suffering from neurologic, orthopedic, and rheumatologic conditions such as Alzheimer's disease, Parkinson's disease, spinal disorders, brain tumors, multiple sclerosis and cerebrovascular disorders.

The BTM is home of the Neurosciences Center, which offers a multidisciplinary clinic where patients can receive a comprehensive evaluation and consensus opinion from several disciplines in one location. Traditionally, patients would have to visit separate clinics, which made

coordination of care difficult. With one Neurosciences Center, patients have a new experience with their treatment being led by highly skilled, collaborative teams. Patients are able to meet with top clinicians and specialists regarding the management and treatment of their condition.

In addition to these multidisciplinary centers, the facility also includes the following services and features:

- The Ann Romney Center for Neurologic Diseases
- Ambulatory Infusion Service
- Center for Alzheimer Research and Treatment (CART)
- Center for Brain Therapeutics
- Conference Center
- A cafe with a full-service menu for patients, visitors, and staff
- All Neurosurgical Laboratories (see page 36)
- Imaging services, including MRI, CT and X-Ray
- Innovation Hub
- Parking facility, including valet assistance
- Neuro-Procedural Suite for Diagnostics and Treatment, which includes EMG, EEG and TMS
- Neurosciences Center which includes, ophthalmology rooms, neuropsychiatry testing rooms, 28 exam rooms, 16 consult rooms and 2 procedure rooms.

BUILDING ON EXCELLENCE CUTTING-EDGE TECHNOLOGIES AVAILABLE

NEUROSURGERY CLINICIANS AND RESEARCHERS HAVE ACCESS TO ADVANCED TOOLS AND OPPORTUNITIES TO COLLABORATE AND PUSH THE BOUNDARIES OF DISCOVERY IN WAYS THAT HAVE NEVER BEEN POSSIBLE BEFORE NOW.

MRI GUIDED FOCUSED-ULTRASOUND (MRGFUS)

Focused ultrasound treatments can be performed on an outpatient basis, require no incisions, and can result in minimal discomfort and few complications, allowing for rapid recovery. This technology is currently FDA approved for the treatment of essential tremor, and is currently being evaluated on its capability to treat parkinsonian tremor, blood brain barrier, and other neuro conditions via clinical trials here at Brigham and Women's Hospital.

7 TESLA (7.0T MRI)

This device aids our clinicians and researchers to visualize critical structures and pathologies that, until now, were not visible through MRI. Seeing these structures and pathologies will help clinicians differentiate between diseases and conditions in which symptoms may be similar and, in turn, choose the best treatment option for patients.

ROSA™ ROBOTIC SURGICAL ASSISTANT

ROSA™ acts as an assistant in the operating room and provides a service to help navigate and map the brain, similar to a GPS. It can be used in any type of cranial or spinal procedure that requires surgical planning with preoperative data and precise position and handling of instruments.

ADVANCED MULTIMODALITY IMAGE GUIDED OPERATING (AMIGO) SUITE

A state-of-the-art medical and surgical research environment that houses a complete array of advanced imaging equipment and interventional surgical systems.

O-ARM®

The O-arm® and StealthStation® systems eliminate the need to wear lead protective apparel during the navigated steps of the procedure. The O-arm offers multiple image protocols allowing you the flexibility to minimize dose to your patient based on your individual clinical objectives.

HYBRID OR (OPERATING ROOM)

This system allows our staff to perform high-end diagnostic imaging and multiple surgical or non-surgical interventions for an individual patient without ever leaving the operating room.

INTERVENTIONAL NEURORADIOLOGY SUITE

Endovascular procedures are performed in the angiographic suite rather than the operating room. Fluoroscopy (x-rays), ultrasound (US), computed tomography (CT), and magnetic resonance imaging (MRI) are used to guide their way through the body without making a skin incision.



7 TESLA



INTERVENTIONAL NEURORADIOLOGY SUITE



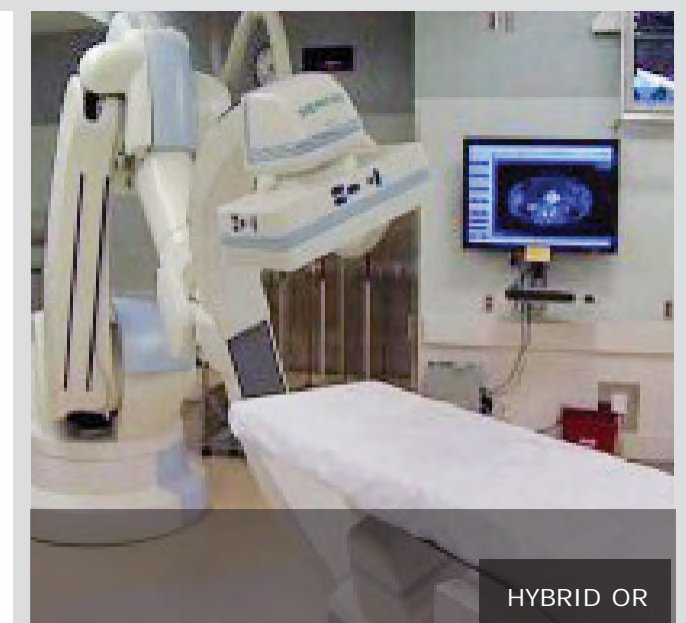
AMIGO SUITE



ROSA



O-ARM



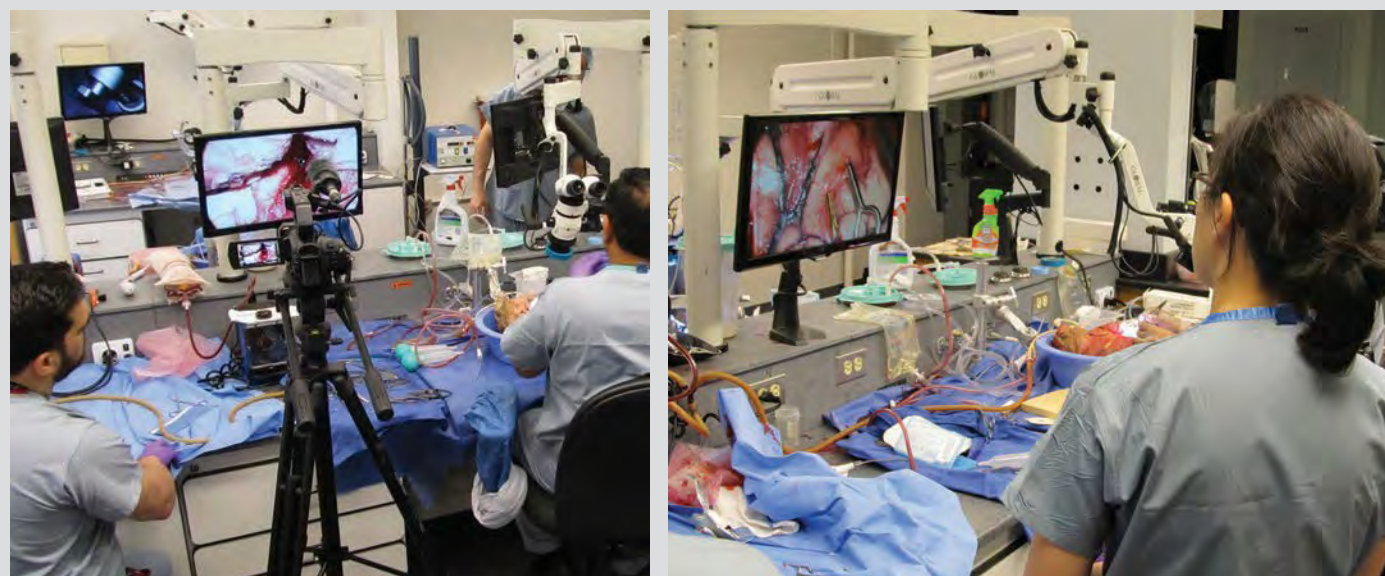
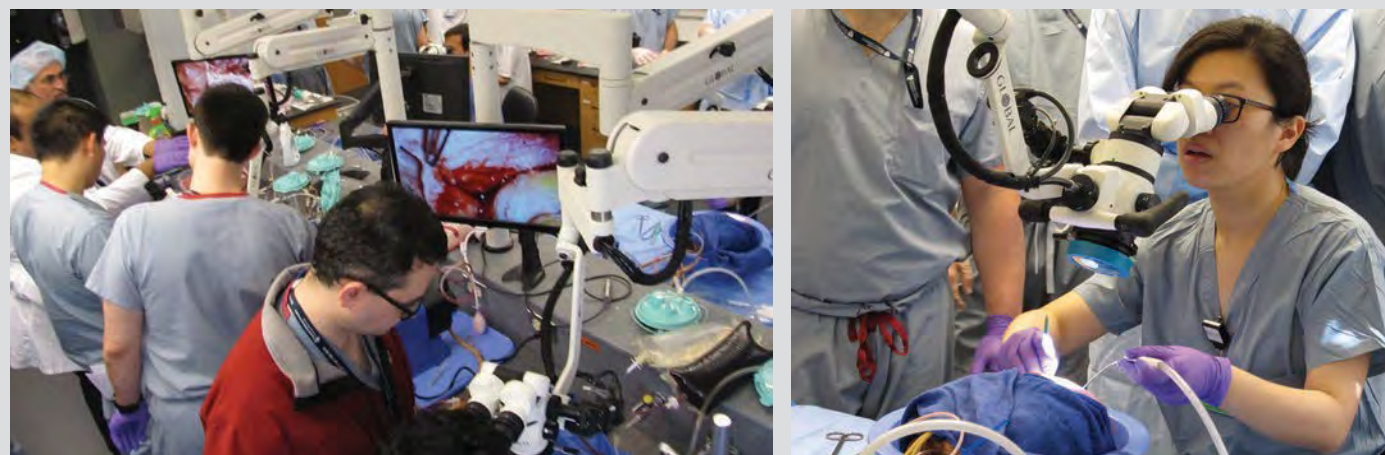
HYBRID OR

EDUCATION

THE DEPARTMENT OF NEUROSURGERY AIMS TO UNDERTAKE RELEVANT RESEARCH AND PROVIDE ACCESS TO RESOURCES AND PROFESSIONAL DEVELOPMENT OPPORTUNITIES FOR ALL ESTABLISHED PHYSICIANS AND SURGEONS, AS WELL AS THE EDUCATION AND TRAINING OF RESIDENTS AND FELLOWS — THE NEXT GENERATION OF MEDICAL PROFESSIONALS.

ANATOMICAL TRAINING LABORATORY

The Anatomical Training Laboratory (ATL) is a joint venture between neurosurgical departments at Boston Children's Hospital and Brigham and Women's Hospital to provide the Harvard medical community and other not for profit academic research institutions with training space, equipment and expert faculty resources to create the highest quality training environment for users to learn the latest neurosurgical techniques.



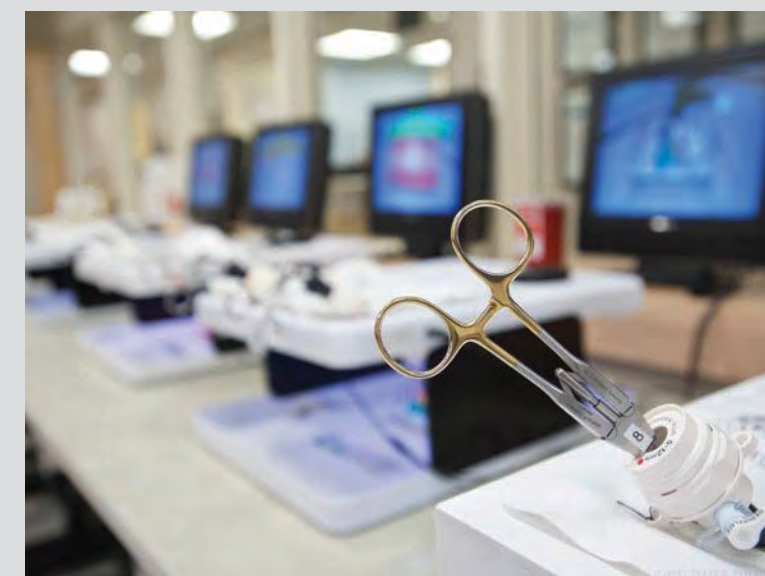
NEIL & ELISE WALLACE
BWH STRATUS
CENTER FOR MEDICAL SIMULATION

STRATUS CENTER

The STRATUS Center for Medical Simulation is dedicated to advancing healthcare education, enhancing patient safety, and improving clinical outcomes. We leverage simulation's array of applications to support clinicians, researchers, industry, and other simulation centers. To learn more, visit stratus.brighamandwomens.org.

OUR INTERDISCIPLINARY CENTER FOCUSES ON
EDUCATION
ASSESSMENT
RESEARCH
PROCESS IMPROVEMENT

To learn more, visit stratus.brighamandwomens.org



FACULTY RESEARCH & PUBLICATIONS 2019-23

OVERVIEW

Neurosurgery was founded by Dr. Harvey Cushing in 1913 at The Department of Neurosurgery at Brigham and Women's Hospital. Shortly after in 1929, Dr. Harvey Cushing's trainee, Dr. Franc D. Ingraham, created the pediatric neurosurgical service at Boston Children's Hospital. Today, these two institutions, along with Harvard Medical School, host a highly esteemed and fully integrated Neurosurgical Residency Program.

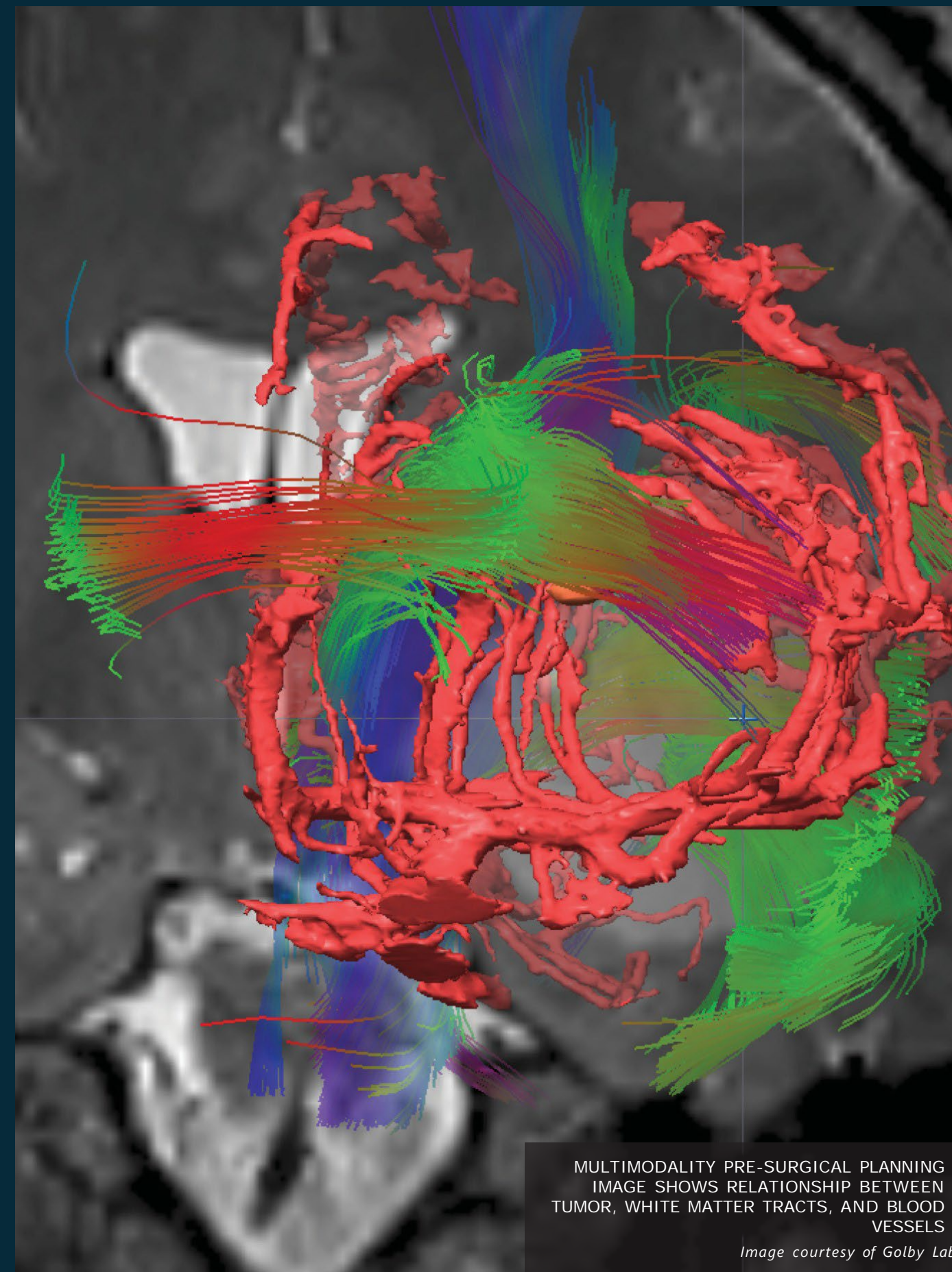
Today, the Departments of Neurosurgery at Boston Children's Hospital and Brigham and Women's Hospital are made up of 34 clinical faculty and over 100 department members devoted to the advancement of neurosurgical care, research, and education. Last year alone, the Department of Neurosurgery at Brigham and Women's Hospital offered 4,109 surgical treatments to patients from local, national, and international communities.

Our clinical faculty also conducts extensive scientific and clinical research to explore a range of complex neurological diseases, such as brain tumors, spinal disorders, stroke, and epilepsy. The aim of our research is to investigate the underlying risks, treatment strategies, and outcomes associated with these diseases and translate new findings to design and optimize neurosurgical treatments for each of our patients.

The Neurosurgery Residency Program of Brigham and Women's Hospital, Boston Children's Hospital and Harvard Medical School has a tradition of encouraging residents to participate in clinical and basic research studies with faculty, with exposure to emerging concepts and innovations.

OUR CLINICAL FACULTY SET AN IMPRESSIVE EXAMPLE FOR PRESENTING RESEARCH STUDIES, PUBLISHING PEER-REVIEWED ARTICLES, TEXTBOOKS, ABSTRACTS AND PRESENTATIONS.

The following booklet contains a listing of the Brigham and Women's Hospital affiliated neurosurgical research laboratories, as well as the research publications authored by the 34 neurosurgical clinical faculty at BWH and BCH over the past six years. As you will see, the range and depth of neurosurgical topics covered is impressive, and a testament to both the knowledge of our faculty and the dedication we have to the advancement of neurosurgical treatment and care.



MULTIMODALITY PRE-SURGICAL PLANNING IMAGE SHOWS RELATIONSHIP BETWEEN TUMOR, WHITE MATTER TRACTS, AND BLOOD VESSELS

Image courtesy of Golby Lab

BRIGHAM AND WOMEN'S HOSPITAL NEUROSURGICAL RESEARCH LABORATORIES

1

BEI LABORATORY

PRINCIPAL INVESTIGATOR: Fengfeng Bei, PhD

FOCUS: Established at the end of 2016, the Bei laboratory seeks to understand why damaged brain circuits cannot regenerate their connection and repair themselves. The lab studies this broad question in a range of model systems, using standard molecular and histological tools, electrophysiological assessment, behavioral analysis, as well as novel gene therapy approaches and transplantation strategies. Current projects include attempts to repair the optic nerve axons to restore vision, to regenerate the brain-spinal cord projecting axons for treating.

2

CENTER FOR STEM CELL THERAPEUTICS AND IMAGING (CSTI)

PRINCIPAL INVESTIGATOR: Khalid Shah, PhD

FOCUS: The overall goal of CSTI is to develop and test targeted cell-based therapies for cancer. The Center's theme is unique as it focuses on developing engineered cell-based therapies for cancer and integrates state of the art imaging techniques to assess the fate and therapeutic efficacy of such therapies in mouse tumor models that mimic clinical settings. Previously, the CSTI developed different mouse resection models of glioblastoma (GBM) utilizing image guided resection and followed recurrence non-invasively with optical and magnetic resonance (MR) imaging. As metastatic brain tumors are the most commonly observed intracranial tumors, the CSTI recently developed in vivo imageable mouse models of breast and melanoma to brain metastasis. These mouse models provide a unique and valuable platform to test novel therapeutic approaches for primary and metastatic tumor types. To develop novel biological therapies for cancer, the center engineered protein and oncolytic viral based cell surface receptor therapies that target cell death and proliferation pathways in tumor cells and tumor associated endothelial cells. Additionally, the CSTI pioneered two unique approaches that address the therapeutic delivery issues for the tumors

in the brain. Specifically, the center engineered stem cells that migrate to sites of primary tumors and micro-invasive tumor deposits and result in significant survival benefit in mice when placed in the biocompatible gels in the tumor resection cavity or injected via intracarotid artery in metastatic tumor bearing brains. Recently, the center has focused on targeting resistant tumors and developed stem cell deliverable bi-modal therapeutic molecules and immune-modulatory proteins and shown their efficacy in mouse models of brain tumors.

3

CEREBROVASCULAR LABORATORY

PRINCIPAL INVESTIGATOR: Rose Du, MD, PhD

FOCUS: The Cerebrovascular Laboratory studies the genetics of cerebrovascular diseases including intracranial aneurysms and stroke.

4

COMPUTATIONAL NEUROSCIENCE OUTCOMES CENTER (CNOC)

PRINCIPAL INVESTIGATORS: William B. Gormley, MD, MPH, MBA; Timothy R. Smith, MD, PhD, MPH; Omar Arnaout, MD; Hasan A. Zaidi, MD

FOCUS: CNOC was developed by William Gormley, MD, MPH, MBA and Timothy R. Smith, MD, MPH, PhD in 2015. The center has grown out of the collaboration between leading healthcare organizations involved in the management and study of Neurosurgical disease. The center incorporates the clinical expertise of one of the leading Neurosurgical Centers in the world at Brigham and Women's Hospital in Boston Massachusetts, the resources and groundbreaking health care philosophy of Harvard Medical School. Along with the experience of two of the leading schools of Public Health in the United States; the Harvard T.H. Chan School of Public Health and the Yale School of Public Health. The academic and innovation skills of these institutions are brought together at the CNOC to expand knowledge and create and deliver improved patient centered outcomes in neurosurgery. The core values of the center include

research-based care, artificial intelligence (AI) analytics, patient-centered care, value-based care, clinical innovation, and global education.

5

HARVEY CUSHING NEURO-ONCOLOGY LABORATORIES (HCNL)

PRINCIPAL INVESTIGATOR: E. Antonio Chiocca, MD, PhD

FOCUS: Named after the father of modern Neurosurgery, Harvey Cushing, the goal of the laboratory is to perform research to improve the outcomes of patients suffering from brain tumors. Under the direction of E. Antonio Chiocca (Director) and Sean Lawler (Managing Director), the HCNL studies mouse tumor models, in vitro systems, and state of the art cell and molecular biology to meet this challenge. Major areas of interest include oncolytic viruses, extracellular vesicles, tumor immunology, anti-invasive drugs, the role of CMV in cancer, the blood brain barrier and non-coding RNAs. The HCNL is comprised of seven distinct research lab groups: Chiocca, Bronisz, Cho, Godlewski, Lawler, Nakashima, and Peruzzi. In this highly collaborative environment, the HCNL is able to conduct cutting edge research that is being pushed forward into clinical trials, which will improve the basic understanding and ability to treat these challenging and devastating tumors.

HCNL – CHIOCCA LABORATORY

PRINCIPAL INVESTIGATOR:

E. Antonio Chiocca, MD, PhD

FOCUS: The Chiocca lab focuses on developing therapies for brain tumors based on oncolytic viruses. The lab was involved in the first trials for locally delivered viral therapies for glioblastoma and has developed a number of novel, improved next generation viruses for tumor therapy and are engaged in numerous clinical trials in this area. The current focus is to determine how oncolytic viruses engage the immune system to promote sustained anti-tumor immunity, by acting as in situ vaccines.

HCNL – BRONISZ LABORATORY

PRINCIPAL INVESTIGATOR: Agnieszka Bronisz, PhD

FOCUS: The Bronisz lab utilizes cancer research approaches coupled with biochemistry, molecular biology, cell biology, functional assays, and computation to derive principles of cellular and extracellular ncRNAs-mediated regulation of tumor cells' function in the context of the microenvironmental niches. The lab is focused on identifying and determining the function and mechanism of clinically-relevant ncRNAs in an unbiased manner, utilizing patient-derived cells in the model of heterogeneous intracranial xenografts. The lab uses molecular approaches to test various experimental assays to define the formation of ncRNA/protein complexes and their function. Together with the computational group, pathology expertise, clinical support and collaboration with RNA biology group group's goal is to test the hypothesis that extracellular vesicles and ncRNA-dependent signaling modify cellular response to the microenvironment and mediates the interaction between heterogeneous brain tumor cells and their anatomic niches.

HCNL – CHO LABORATORY

PRINCIPAL INVESTIGATOR: Choi-Fong Cho, PhD

FOCUS: The Cho lab focuses on: developing peptide(s) that can specifically bind high-grade gliomas, generating novel peptide-based anti-glioma therapeutics that can specifically target brain tumor cells and cross the blood-brain-barrier, developing the blood-brain-barrier organoid model, and bio-printing the blood-brain-barrier model on a chip.

HCNL – GODLEWSKI LABORATORY

PRINCIPAL INVESTIGATOR: Jakub Godlewski, PhD

FOCUS: The focus of the Godlewski lab is the development of novel non-coding RNA (ncRNA) – based therapeutic approaches for the treatment of the most common and most deadly brain tumor in adults – glioblastoma.

HCNL – LAWLER LABORATORY

PRINCIPAL INVESTIGATOR: Sean Lawler, PhD

FOCUS: The Lawler Lab focuses on developing new approaches for the treatment of brain tumors. The lab extensively uses pre-clinical murine models, patient specimens, glioblastoma cell lines, a range of custom assays, and online databases to identify and characterize novel experimental approaches for the treatment of glioblastoma, a very challenging and aggressive brain tumor with a very poor prognosis. The lab's primary skills are in the areas of molecular and cellular biology, with some biochemistry, microscopy, and immunological approaches.

HCNL – NAKASHIMA LABORATORY

PRINCIPAL INVESTIGATOR: Hiroshi Nakashima, PhD

FOCUS: The Nakashima lab focuses on the development of novel successful oncolytic virus (OVs) therapeutic approach for glioblastoma patients. The lab has committed to preclinical in vivo evaluation of promising OV in brain tumor models and reveal complex interplay of virus and immunosuppressive glioma microenvironments. Past work includes the study of virus and host relationships at the cellular level to improve the OV approach in glioma and generated preclinical and clinical strains of OVs. The team has been expanding this relationship at the host level, adaptive immunity, for the comprehensive therapeutic approach.

HCNL – PERUZZI LABORATORY

PRINCIPAL INVESTIGATOR: Pier Paolo Peruzzi, MD, PhD

FOCUS: The Peruzzi Lab investigates the role of non-coding RNAs in the biology and therapy of brain cancers. More specifically, the major goal is to define novel biological features of microRNAs in order to develop a new generation gene therapy application, based on multifactorial genetic interference of cancer cells and disruption of their epigenetic regulation.

6

NEUROAPOPTOSIS DRUG DISCOVERY LABORATORY

PRINCIPAL INVESTIGATOR: Xin Wang, PhD

FOCUS: The Neuroapoptosis Drug Discovery Laboratory is primarily interested in translational neuroscience that uses novel approaches to identify candidate therapeutics and potential targets for therapeutic intervention in neurological disorders. This includes cerebral ischemia, neonatal brain injury, Amyotrophic Lateral Sclerosis,

Huntington's disease, and Parkinson's disease as well as alcohol-induced neurotoxicity and organ injuries. To date, most of the lab's research has involved the identification of neuroprotective compounds like melatonin, dipyrone, nortriptyline, N-acetyl-tryptophan, N-acetyl-serotonin, minocycline, methazolamide and herbs like buckwheat alcoholic extract and others which slow down the progression of neurological disorders and neurotoxicity. The laboratory also focuses on the fundamental mechanisms of neurological disorders and neurotoxicity. The lab's research also focuses on stem cell therapy.

7

NEURO-EPIDEMIOLOGY LABORATORY

PRINCIPAL INVESTIGATOR: Elizabeth Claus, MD, PhD

FOCUS: The Neuro-epidemiology Laboratory focuses on cancer and genetic epidemiology with an emphasis on the development of risk models for breast and brain tumors. Elizabeth Claud, MD, PhD is the overall PI of the Meningioma Consortium, the Meningioma Genome-Wide Association Study, and the Yale Acoustic Neuroma Study as well as a co-investigator of the GLOGENE (Genes for Glioma) and International Glioma Case/Control (GICC) projects in partnership with national patient brain tumor organizations including the American Brain Tumor Association (ABTA), the National Brain Tumor Society (NBTS) and the ANA. Dr. Claus works to develop cost- and time-efficient web- and smartphone- based recruitment strategies to be used in the study of brain tumors. She has developed such work in collaboration with the ANA and has funding from the ABTA/NBTS to develop a web-based registry for patients with low grade glioma to advance research efforts for this group of patients.

8

SKULL BASE LABORATORY

PRINCIPAL INVESTIGATOR: Wenya Linda Bi, MD, PhD

FOCUS: The Skull Base Laboratory focuses on the translational biology of skull base tumors, including meningiomas, pituitary tumors, and vestibular schwannomas. The group applies genomic, immune, computational, and advanced microscopy imaging methodologies to define the biological landscape of skull base tumors, the mechanisms underlying their tumorigenesis, tumor evolution during recurrence, and treatment resistance for aggressive subtypes.

9

SPINAL CORD INJURY RESEARCH LABORATORY

PRINCIPAL INVESTIGATOR: Yi Lu, MD, PhD

FOCUS: The Spinal Cord Injury Research Laboratory focuses on research that has the potential to advance the clinical functional recovery in patients suffering from spinal cord injury and other traumatic neurological injuries. The main areas of interest include the mechanisms of axon regeneration with neurotrophic factors and integrins and the mechanisms of dormant pathway activation after incomplete injury leading to enhanced functional recovery.

10

SURGICAL BRAIN MAPPING LABORATORY (SBML)

PRINCIPAL INVESTIGATOR: Alexandra Golby, MD

FOCUS: The Surgical Brain Mapping Laboratory leads the Department's research in surgical brain mapping, intraoperative imaging, and image guided neurosurgery through the use of intra-operative imaging to guide neurosurgical interventions, development and validation of tissue markets to guide surgery for brain tumors, develop diffusion imaging as a tool for pre-surgical mapping of white matter, translation of fMRI from neuroscience applications towards a tool for pre-surgical brain mapping in patients, and clinical trial of MR guided focused ultrasound for targeted blood brain barrier opening in patients with brain tumors. Building on a long history of preclinical and clinical use of MRgFUS at BWH, the lab is working with the industry leader to use non-invasive FUS as an adjunct to the clinical standard of care with the Stupp protocol.

SBML – TIE RESEARCH GROUP

PRINCIPAL INVESTIGATOR: Yanmei Tie, PhD

FOCUS: The Tie research group develops neuroimaging techniques, such as functional magnetic resonance imaging (fMRI) and diffusion MRI, to improve presurgical mapping of brain functions for neurosurgery planning and guidance. Additionally, the group combines brain functional and structural connectivity approaches to understand neural mechanism of disease pathophysiology, and to develop neuroimaging biomarkers for treatment-induced cognitive impairment in cancer patients. The goals are to inform therapeutic development and improve patients' overall well-being.

11

SURGICAL MOLECULAR IMAGING LABORATORY

PRINCIPAL INVESTIGATOR: Nathalie Agar, PhD

FOCUS: The Surgical Molecular Imaging Laboratory develops and implements mass spectrometry and optical imaging approaches for surgical pathology and oncology. The lab also develops, validates, and applies imaging approaches for drug development research and molecular classification of disease, and works toward translating methodologies for the practice of individualized medicine. More specifically, part of the research takes place in the AMIGO suite, standard operating rooms, and a state-of-the-art laboratory equipped for tissue culture and optical and mass spectrometry imaging. Since receiving the NIH Director's New Innovator Award in 2010 for the work on "Real-Time Stereotactic Mass Spectrometry Tissue Analysis for Intraoperative Neurosurgical Guidance", the lab has implemented mass spectrometry protocols in the operating room for brain and breast cancer surgery. The work on the real-time analysis of an onco-metabolite (2-HG) to support surgical decision making now constitutes the basis for the very first IRB-approved study to use mass spectrometry derived diagnostic information to support surgical decision making. The effort to improve the management of brain tumors also includes extensive imaging of targeted therapies that transit through the blood-brain barrier in pre-clinical animal models and clinical trial patients with correlation to non-invasive radiologic imaging and detailed pharmacodynamics. Using MALDI FTICR mass spectrometry imaging we can specifically image most drugs and spatially resolve their distribution as it relates to the vasculature by simultaneously imaging heme as a natural biomarker of the vasculature. Using the same approach on stereotactic MRI-registered surgical samples from clinical trials for primary brain tumors and brain metastases, we further assess drug distribution in the 3D anatomy of the tumor and brain to account for the effect of brain anatomy and tumor heterogeneity on the permeability of blood-brain and blood-tumor barriers.



OSSAMA AL-MEFTY, MD
DIRECTOR, SKULL BASE PROGRAM,
BRIGHAM AND WOMEN'S HOSPITAL

ACADEMIC TITLE

Lecturer, Harvard Medical School

MEDICAL SCHOOL

Damascus University School of Medicine, 1972

RESIDENCY

Medical College of Ohio at
Toledo, General Surgery, 1974

West Virginia
University,
Neurosurgery, 1978

CERTIFICATIONS

Neurosurgery, 1980

CLINICAL INTERESTS

Acoustic neuroma, aneurysms, arteriovenous malformations, brain tumors, bypass, cavernomas, cavernous malformations, cerebral revascularization, craniopharyngioma, gliomas, glomus tumor, jugular foramen tumors, meningiomas, percutaneous radiofrequency, pineal region tumor, pituitary tumors, radiosurgery, skull base neurosurgery, skull base tumors, spinal cord tumors, trigeminal neuralgia

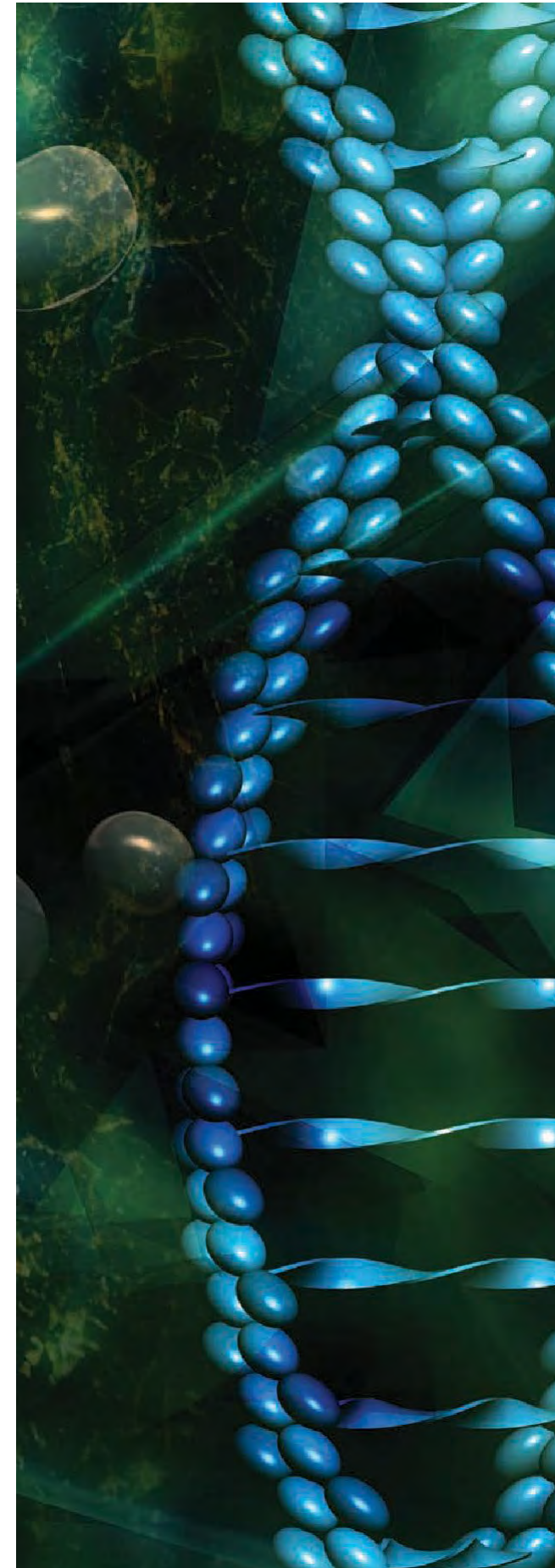
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NEUROSURGERY, BRIGHAM AND
WOMEN'S HOSPITAL

ACADEMIC TITLE
 Associate Professor, Harvard Medical School

MEDICAL SCHOOL
 George Washington School of Medicine, 1999

INTERNSHIP
 Georgetown University
 Hospital, General Surgery, 2000

RESIDENCY
 University of Miami Department of
 Neurosurgery Spine, Neurological Surgery,
 2006

FELLOWSHIP
 University of Miami Hospital &
 Clinics, Endovascular Intervention,
 2004

Barrow Neurological Institute,
 Endovascular Intervention,
 2005

Barrow Neurological
 Institute, Cerebrovascular
 Surgery, 2007

CERTIFICATIONS
 Neurological Surgery, 2012

CLINICAL INTERESTS
 Aneurysms, arteriovenous malformations,
 brain tumors, bypass, carotid artery disease,
 cavernomas, cerebral ischemia,
 cerebrovascular
 disease, embolization, neurological, endovascular
 neurosurgery, image-guided surgery, microvascular
 decompression, Moyamoya disease, radiosurgery,
 skull base neurosurgery, spine tumors, stroke
 therapy, trigeminal neuralgia

PUBLICATIONS

1. Subat YW, Dasenbrock HH, Gross BA, Patel NJ, Frerichs KU, Du R, Aziz-Sultan MA. Periprocedural intracranial hemorrhage after embolization of cerebral arteriovenous malformations: a meta-analysis. *J Neurosurg*. 2019 Sep 13:1-11. doi: 10.3171/2019.5.JNS183204. Epub ahead of print. PMID: 31518979.
- 2: Lai PMR, Gormley WB, Patel N, Frerichs KU, Aziz-Sultan MA, Du R. Age- Dependent Radiographic Vasospasm and Delayed Cerebral Ischemia in Women After Aneurysmal Subarachnoid Hemorrhage. *World Neurosurg*. 2019 Oct;130:e230-e235. doi: 10.1016/j.wneu.2019.06.040. Epub 2019 Jun 13. PMID: 31203057.
3. Rosenblum JS, Neto M, Essayed WI, Bi WL, Patel NJ, Aziz-Sultan MA, Heiss JD, Al-Mefty O. Tentorial Venous Anatomy: Cadaveric and Radiographic Study with Discussion of Origin and Surgical Significance. *World Neurosurg*. 2019 Nov;131:e38-e45. doi: 10.1016/j.wneu.2019.06.232. Epub 2019 Jul 9. PMID: 31295599; PMCID: PMC6819248.
- 4: Silva MA, Patel J, Kavouridis V, Gallerani T, Beers A, Chang K, Hoebel KV, Brown J, See AP, Gormley WB, Aziz-Sultan MA, Kalpathy-Cramer J, Arnaout O, Patel NJ. Machine Learning Models can Detect Aneurysm Rupture and Identify Clinical Features Associated with Rupture. *World Neurosurg*. 2019 Nov;131:e46-e51. doi: 10.1016/j.wneu.2019.06.231. Epub 2019 Jul 9. PMID: 31295616.
- 5: Dasenbrock HH, Smith TR, Gormley WB, Castlen JP, Patel NJ, Frerichs KU, Aziz-Sultan MA, Du R. Predictive Score of Adverse Events After Carotid Endarterectomy: The NSQIP Registry Carotid Endarterectomy Scale. *J Am Heart Assoc*. 2019 Nov 5;8(21):e013412. doi: 10.1161/JAHA.119.013412. Epub 2019 Oct 30. PMID: 31662028; PMCID: PMC6898838.
6. Cerecedo-Lopez CD, Cantu-Aldana A, Patel NJ, Aziz-Sultan MA, Frerichs KU, Du R. Insulin in the Management of Acute Ischemic Stroke: A Systematic Review and Meta-Analysis. *World Neurosurg*. 2020 Apr;136:e514-e534. doi: 10.1016/j.wneu.2020.01.056. Epub 2020 Jan 16. PMID: 31954893.
7. Silva MA, See AP, Sur S, Aziz-Sultan MA. Treatment of complex intracranial pathologies with transcirculation endovascular approaches. *Neurocirugia (Astur : Engl Ed)*. 2020 Jul-Aug;31(4):173-183. English, Spanish. doi: 10.1016/j.neucir.2019.10.003. Epub 2020 Jan 24. PMID: 31987753.

8. Silva MA, Lai PMR, Du R, Aziz-Sultan MA, Patel NJ. The Ruptured Arteriovenous Malformation Grading Scale (RAGS): An Extension of the Hunt and Hess Scale to Predict Clinical Outcome for Patients With Ruptured Brain Arteriovenous Malformations. *Neurosurgery*. 2020 Aug 1;87(2):193-199. doi: 10.1093/neuros/nyz404. PMID: 31586199.
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11. Chua MMJ, Gupta S, Essayed W, Donnelly DJ, Ziayee H, Vicenty-Padilla J, Das AS, Lai RPM, Izzy S, Aziz-Sultan MA. Endovascular treatment of a ruptured posterior fossa pure arterial malformation: illustrative case. *J Neurosurg Case Lessons*. 2021 Jan 11;1(2):CASE2073. doi: 10.3171/CASE2073. PMID: 35854927; PMCID: PMC9241320.
12. Lai PMR, Ng I, Gormley WB, Patel NJ, Frerichs KU, Aziz-Sultan MA, Du R. Familial Predisposition and Differences in Radiographic Patterns in Spontaneous Nonaneurysmal Subarachnoid Hemorrhage. *Neurosurgery*. 2021 Jan 13;88(2):413-419. doi: 10.1093/neuros/nyaa396. PMID: 33017030.
13. Griessenauer CJ, Enriquez-Marulanda A, Xiang S, Hong T, Zhang H, Taussky P, Grandhi R, Waqas M, Tutino VM, Siddiqui AH, Levy EI, Ogilvy CS, Thomas AJ, Ulfert C, Möhlenbruch MA, Renieri L, Limbucci N, Parra-Fariñas C, Burkhardt JK, Kan P, Rinaldo L, Lanzino G, Brinjikji W, Spears J, Müller-Thies-Broussalis E, Killer-Oberpfalzer M, Islak C, Kocer N, Sonnberger M, Engelhorn T, Ghuman M, Yang VX, Salehani A, Harrigan MR, Radovanovic I, Pereira VM, Krings T, Matouk CC, Chen K, Aziz-Sultan MA, Ghorbani M, Schirmer CM, Goren O, Dalal SS, Koch MJ, Stapleton CJ, Patel AB, Finkenzeller T, Holtmannspötter M, Buhk JH, Foreman PM, Cress M, Hirschl R, Reith W, Simgen A, Janssen H, Marotta TR, Dmytriw AA. Comparison of PED and FRED flow diverters for posterior circulation aneurysms: a propensity score matched cohort study. *J Neurointerv Surg*. 2021 Feb;13(2):153-158. doi: 10.1136/neurintsurg-2020-016055. Epub 2020 Jul 1. PMID: 32611622.
14. Wu KC, Sunwoo J, Sheriff F, Farzam P, Farzam PY, Orihuela-Espina F, LaRose SL, Monk AD, Aziz-Sultan MA, Patel N, Vaitkevicius H, Franceschini MA. Validation of diffuse correlation spectroscopy measures of critical closing pressure against transcranial Doppler ultrasound in stroke patients. *J Biomed Opt*. 2021 Mar;26(3):036008. doi: 10.1117/1.JBO.26.3.036008. PMID: 33774980; PMCID: PMC7998065.
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16. Mooney MA, Ibn Essayed W, Aziz-Sultan MA, Al-Mefty O. Concomitant Embolization and Microsurgical Resection of a Giant, Hypervascular Skull Base Meningioma: 2-Dimensional Operative Video. *Oper Neurosurg (Hagerstown)*. 2021 Jul 15;21(2):E97-E98. doi: 10.1093/ons/opab128. PMID: 33930164.
17. Lai PMR, Patel NJ, Frerichs KU, Patel AB, Aziz-Sultan MA, Ogilvy CS, Du R. Direct vs Indirect Revascularization in a North American Cohort of Moyamoya Disease. *Neurosurgery*. 2021 Jul 15;89(2):315-322. doi: 10.1093/neuros/nyab156. PMID: 33957674.
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19. Lai PMR, Ng I, Gormley WB, Patel N, Frerichs KU, Aziz-Sultan MA, Du R. Cannabis Use and Increased Nonaneurysmal Subarachnoid Hemorrhage in the Past Decade. *World Neurosurg*. 2021 Oct;154:e580-e589. doi: 10.1016/j.wneu.2021.07.079. Epub 2021 Jul 27. PMID: 34325028.
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21. Dmytriw AA, Diestro JDB, Dibas M, Phan K, Sweid A, Cuellar-Saenz HH, Lay SV, Guenego A, Renieri L, Al Balushi A, Sundararajan SH, Carnevale J, Saliou G, Möhlenbruch M, Vranic JE, Harker P, Rabinov JD, Lylyk I, Foreman PM, Vachhani JA, Župančić V, Hafeez MU, Rutledge C, Waqas M, Tutino VM, Abbas R, Inoue Y, Capirossi C, Ren Y, Schirmer CM, Piano M, Kühn AL, Michelozzi C, Elens S, Regenhardt RW, Ghozy S, Alotaibi NM, Tjoumakaris S, Starke RM, Lubicz B, Panni P, Puri AS, Pero G, Griessenauer CJ, Ulfert C, Asadi H, Brooks M, Maingard J, Jhamb A, Siddiqui A, Ducruet AF, Albuquerque FC, Kan P, Kalousek V, Lylyk P, Savardekar A, Boddu S, Knopman J, Limbucci N, Chen KS, Aziz-Sultan MA, Stapleton CJ, Jabbour P, Cognard C, Patel AB, Adeeb N. International Study of Intracranial Aneurysm Treatment Using Woven EndoBridge: Results of the WorldWideWEB Consortium. *Stroke*. 2022 Feb;53(2):e47-e49. doi: 10.1161/STROKEAHA.121.037609. Epub 2021 Dec 17. Erratum in: *Stroke*. 2022 Mar;53(3):e128. PMID: 34915737; PMCID: PMC8792251.
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24. Lak AM, Cerecedo-Lopez CD, Cha J, Aziz-Sultan MA, Frerichs KU, Gormley WB, Mekary RA, Du R, Patel NJ. Seizure Outcomes After Interventional Treatment in Cerebral Arteriovenous Malformation-Associated Epilepsy: A Systematic Review and Meta-Analysis. *World Neurosurg*. 2022 Apr;160:e9-e22. doi: 10.1016/j.wneu.2021.09.063. PMID: 35364673.
25. Lai PMR, Gomez-Paz S, Patel NJ, Frerichs KU, Thomas AJ, Aziz-Sultan MA, Patel AB, Ogilvy CS, Du R. Asymptomatic Moyamoya Disease in a North American Adult Cohort. *World Neurosurg*. 2022 May;161:e146-e153. doi: 10.1016/j.wneu.2022.01.076. Epub 2022 Jan 29. PMID: 35092810.

26. Srinivasan VM, Dmytriw AA, Regenhardt RW, Vicenty-Padilla J, Alotaibi NM, Levy E, Waqas M, Cherian J, Johnson JN, Jabbour P, Sweid A, Gross B, Starke RM, Puri A, Massari F, Griessenauer CJ, Catapano JS, Rutledge C, Tanweer O, Yashar P, Cortez GM, Aziz-Sultan MA, Patel AB, Ducruet AF, Albuquerque FC, Hanel RA, Lawton MT, Kan P. Retreatment of Residual and Recurrent Aneurysms After Embolization With the Woven EndoBridge Device: Multicenter Case Series. *Neurosurgery*. 2022 May 1;90(5):569-580. doi: 10.1227/neu.0000000000001883. PMID: 35244028; PMCID: PMC9524592.
27. Cerecedo-Lopez CD, Ng I, Nguyen HB, Lai PMR, Gormley WB, Patel N, Frerichs KU, Aziz-Sultan MA, Du R. Incidence and Outcomes of Registry-Based Acute Myocardial Infarction After Aneurysmal Subarachnoid Hemorrhage. *Neurocrit Care*. 2022 Jun;36(3):772-780. doi: 10.1007/s12028-021-01365-3. Epub 2021 Oct 25. PMID: 34697769.
28. abbour P, Dmytriw AA, Sweid A, Piotin M, Bekelis K, Sourour N, Raz E, Linfante I, Dabus G, Kole M, Martínez-Galdámez M, Nimjee SM, Lopes DK, Hassan AE, Kan P, Ghorbani M, Levitt MR, Escalard S, Missios S, Shapiro M, Clarençon F, Elhorany M, Vela-Duarte D, Tahir RA, Youssef PP, Pandey AS, Starke RM, El Naamani K, Abbas R, Hammoud B, Mansour OY, Galvan J, Billingsley JT, Mortazavi A, Walker M, Dibas M, Settecase F, Heran MKS, Kuhn AL, Puri AS, Menon BK, Sivakumar S, Mowla A, D'Amato S, Zha AM, Cooke D, Goyal M, Wu H, Cohen J, Turkel-Parrella D, Xavier A, Waqas M, Tutino VM, Siddiqui A, Gupta G, Nanda A, Khandelwal P, Tiu C, Portela PC, Perez de la Ossa N, Urrea X, de Lera M, Arenillas JF, Ribo M, Requena M, Piano M, Pero G, De Sousa K, Al-Mufti F, Hashim Z, Nayak S, Renieri L, Aziz-Sultan MA, Nguyen TN, Feineigle P, Patel AB, Siegler JE, Badih K, Grossberg JA, Saad H, Gooch MR, Herial NA, Rosenwasser RH, Tjoumakaris S, Tiwari A. Characteristics of a COVID-19 Cohort With Large Vessel Occlusion: A Multicenter International Study. *Neurosurgery*. 2022 Jun 1;90(6):725-733. doi: 10.1227/neu.0000000000001902. Epub 2022 Mar 7. PMID: 35238817; PMCID: PMC9514728.
29. Nawabi NLA, Duey AH, Kilgallon JL, Jessurun C, Doucette J, Mekary RA, Aziz-Sultan MA. Effects of the COVID-19 pandemic on stroke response times: a systematic review and meta-analysis. *J Neurointerv Surg*. 2022 Jul;14(7):642-649. doi: 10.1136/neurintsurg-2021-018230. Epub 2022 Apr 6. PMID: 35387860.
30. Diestro JDB, Dibas M, Adeeb N, Regenhardt RW, Vranic JE, Guenego A, Lay SV, Renieri L, Al Balushi A, Shotar E, Premat K, El Naamani K, Saliou G, Möhlenbruch MA, Lylyk I, Foreman PM, Vachhani JA, Župančić V, Hafeez MU, Rutledge C, Rai H, Tutino VM, Mirshani S, Ghozy S, Harker P, Alotaibi NM, Rabinov JD, Ren Y, Schirmer CM, Goren O, Piano M, Kuhn AL, Michelozzi C, Elens S, Starke RM, Hassan A, Salehani A, Nguyen A, Jones J, Psychogios M, Spears J, Parra-Fariñas C, Bres Bullrich M, Mayich M, Salem MM, Burkhardt JK, Jankowitz BT, Domingo RA, Huynh T, Tawk R, Ulfert C, Lubicz B, Panni P, Puri AS, Pero G, Griessenauer CJ, Asadi H, Siddiqui A, Ducruet AF, Albuquerque FC, Du R, Kan P, Kalousek V, Lylyk P, Boddu SR, Stapleton CJ, Knopman J, Jabbour P, Tjoumakaris S, Clarençon F, Limbucci N, Aziz-Sultan MA, Cuellar-Saenz HH, Cognard C, Patel AB, Dmytriw AA. Intracranial flow disruption for ruptured aneurysms: an international multicenter study. *J Neurointerv Surg*. 2022 Jul 22;neurintsurg-2022-019153. doi: 10.1136/jnis-2022-019153. Epub ahead of print. PMID: 35868856
31. Adeeb N, Dibas M, Diestro JDB, Cuellar-Saenz HH, Sweid A, Kandregula S, Lay SV, Guenego A, Renieri L, Sundararajan SH, Saliou G, Aslan A, Möhlenbruch M, Vranic JE, Regenhardt RW, Savardekar A, Mamilly A, Lylyk I, Foreman PM, Vachhani JA, Župančić V, Hafeez MU, Rutledge C, Waqas M, Parra Farinas C, Tutino VM, Inoue Y, Mirshahi S, Rabinov JD, Ren Y, Schirmer CM, Piano M, Kühn AL, Michelozzi C, Elens S, Starke RM, Hassan A, Salehani A, Sporns P, Brehm A, Jones J, Psychogios M, Spears J, Lubicz B, Panni P, Puri AS, Pero G, Griessenauer CJ, Asadi H, Stapleton CJ, Siddiqui A, Ducruet AF, Albuquerque FC, Kan P, Kalousek V, Lylyk P, Boddu S, Knopman J, Aziz-Sultan MA, Limbucci N, Jabbour P, Cognard C, Patel AB, Dmytriw AA. Multicenter Study for the Treatment of Sidewall versus Bifurcation Intracranial Aneurysms with Use of Woven EndoBridge (WEB). *Radiology*. 2022 Aug;304(2):372-382. doi: 10.1148/radiol.212006. Epub 2022 Apr 19. PMID: 35438564.
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Tumor, Pituitary Tumors, Radiosurgery, Skull Base
Neurosurgery, Skull Base Tumors, Transnasal
Endoscopic Pituitary Surgery Trigeminal Neuralgia

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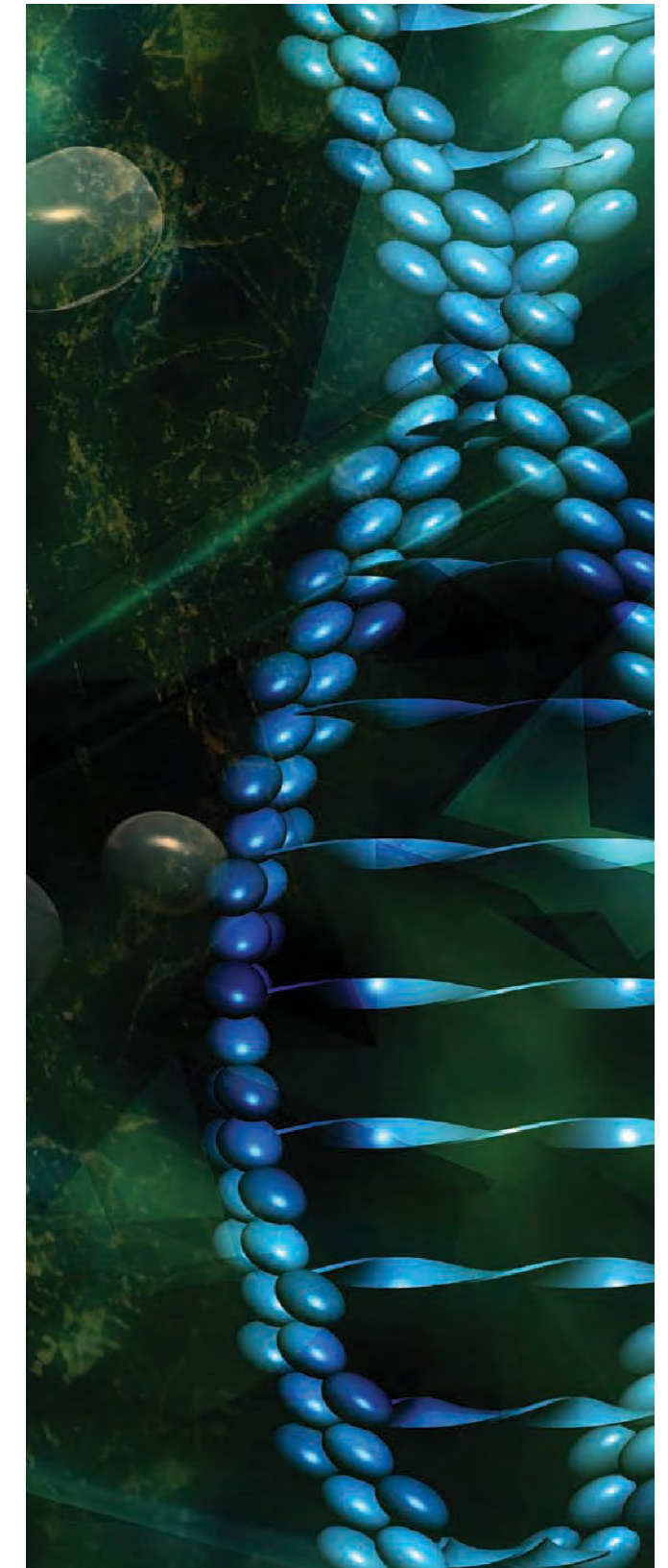
FELLOWSHIP
Johns Hopkins Hospital, Spine, 2008

CERTIFICATIONS
Neurological Surgery, 2012

CLINICAL INTERESTS
Arthroplasty, artificial disc replacement, brachial
plexus injury, brachial plexus tumor, carpal tunnel
syndrome, cervical radiculopathy, cervical
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chordoma, claudication, cubital tunnel syndrome,
degenerative disc disease, disc herniation,
entrapment neuropathy, ependymoma, image-
guided surgery, lumbar radiculopathy, lumbar
stenosis, minimally invasive surgery, myelopathy,
osteosarcoma, pain management, peripheral
nerve disease, scoliosis, slipped disc, spinal cord
tumors, spinal deformity, spinal disorders, spinal
fusion, spine tumors, spondylolisthesis, thoracic
outlet syndrome

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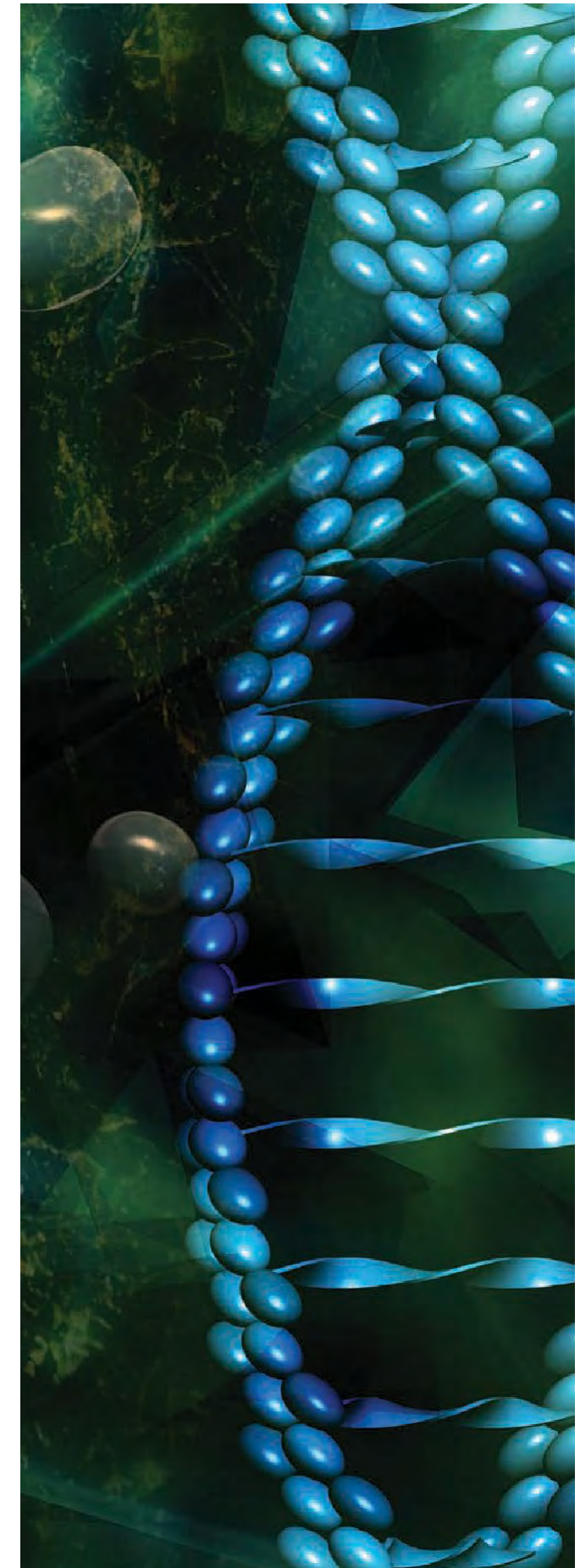
CERTIFICATIONS
Neurological Surgery, 2000

CLINICAL INTERESTS
Brain tumors, Glioblastoma, Neurological
Oncology, Peripheral Nerve Disease, Spinal Cord
Tumors, Spinal Tumors

PUBLICATIONS

1. Lim-Fat MJ, Bi WL, Lo J, Lee EQ, Ahluwalia MS, Batchelor TT, Chang SM, Chiocca EA, Chukwueke U, Cloughesy TF, Colman H, Deangelis LM, Galanis E, Gilbert MR, De Groot JF, Lassman AB, Liao LM, Mason W, McFaline-Figueroa JR, Mehta MP, Mellinger IK, Nabors LB, Nayak L, Reardon DA, Wen PY. Letter: When Less is More: Dexamethasone Dosing for Brain Tumors. *Neurosurgery*. 2019 Sep 1;85(3):E607-E608. PMID: 31215634
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PUBLICATIONS

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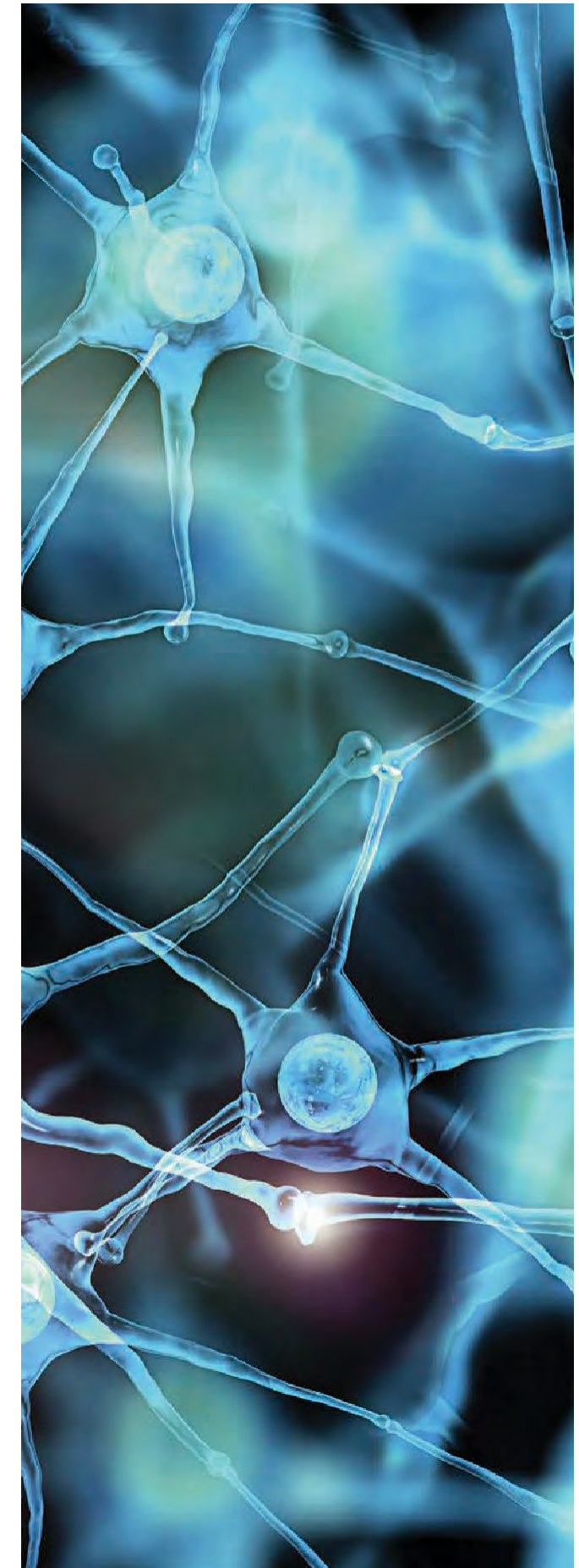
Acoustic Neuroma, Astrocytoma, Brain Tumors, Glioblastoma, Gliomas, Hydrocephalus, Image-Guided Surgery, Meningiomas, Oligodendroglioma

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Queens University School of Medicine, 1980

RESIDENCY
Montreal Neurological Institute,
McGill University, Neurosurgery,
1986

CERTIFICATIONS
Neurological Surgery, 1989

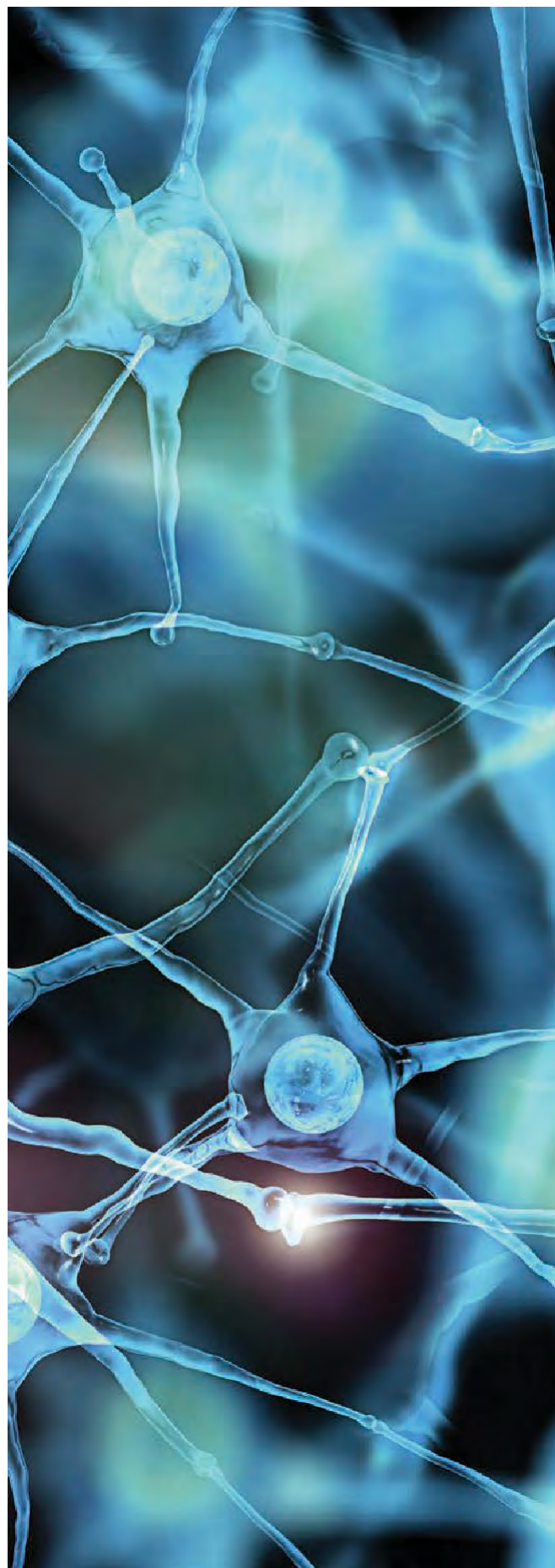
CLINICAL INTERESTS
Awake surgery for speech and motor monitoring,
brain tumors, cavernomas, cervical radiculopathy,
cervical stenosis, Chiari malformation, disc
herniation, epilepsy, essential tremor, gliomas,
hemifacial
spasm, lumbar stenosis, meningiomas,
microvascular decompression, movement disorder
surgery, oligodendroglioma, Parkinson's disease,
psychiatric neurosurgery, radiosurgery, spasticity,
surgical management, trigeminal neuralgia

PUBLICATIONS

1. Harary M, Segar DJ, Hayes MT, Cosgrove GR. Unilateral Thalamic Deep Brain Stimulation Versus Focused Ultrasound Thalamotomy for Essential Tremor. *World Neurosurg*. 2019 Feb 19. pii: S1878-8750(19)30400-0. PMID: 30794976
2. D'Souza M, Chen KS, Rosenberg J, Elias WJ, Eisenberg HM, Gwinn R, Taira T, Chang JW, Lipsman N, Krishna V, Igase K, Yamada K, Kishima H, Cosgrove R, Rumià J, Kaplitt MG, Hirabayashi H, Nandi D, Henderson JM, Butts Pauly K, Dayan M, Halpern CH, Ghanouni P. Impact of skull density ratio on efficacy and safety of magnetic resonance-guided focused ultrasound treatment of essential tremor. *J Neurosurg*. 2019 Apr 26:1-6. Doi:10.3171/2019.2.JNS183517. PMID: 31026836
3. Krishna V, Sammartino F, Cosgrove R, Ghanouni P, Schwartz M, Gwinn R, Eisenberg H, Fishman P, Chang JW, Taira T, Kaplitt M, Rezai A, Rumià J, Gedroyc W, Igase K, Kishima H, Yamada K, Ohnishi H, Halpern C. Predictors and Outcomes After Focused Ultrasound Thalamotomy. *Neurosurgery*. 2019 Nov 6. pii: nyz417. doi: 10.1093/neuros/nyz417. PMID: 31690945.
4. McDannold N, White PJ, Cosgrove R. Elementwise approach for simulating transcranial MRI-guided focused ultrasound thermal ablation. *Phys Rev Res*. 2019 Dec;1(3):033205. doi: 10.1103/physrevresearch.1.033205. Epub 2019 Dec 26. PMID: 34164625; PMCID: PMC8218657
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6. Crotty GF, McKee KE, Klufan R, Cosgrove GR, Schmahmann, JD. Progressive cervical myelopathy due to intramedullary migration of forgotten Torkildsen shunt. *Neurology* 2019 93:1-2 doi:10.1212
7. Proix T, Aghagolzadeh M, Madsen JR, Cosgrove R, Eskandar E, Hochberg LR, Cash SS, Truccolo W. Intracortical neural activity distal to seizure-onset-areas predicts human focal seizures. *PLoS One*. 2019 Jul 22;14(7):e0211847. doi: 10.1371/journal.pone.0211847. PMID: 31329587; PMCID: PMC6645464
8. Park YS, Cosgrove R, Madsen JR, Eskandar EN, Hochberg LR, Cash SS, Truccolo W. Early Detection of Human Epileptic Seizures Based on Intracortical Microelectrode Array Signals. 2019 Jun 6. doi: 10.1109/TBME.2019.2921448. PMID:31180831.
9. Three-year follow-up of prospective trial of focused ultrasound thalamotomy for essential tremor. Halpern CH, Santini V, Lipsman N, Lozano AM, Schwartz ML, Shah BB, Elias WJ, Cosgrove GR, Hayes MT, McDannold N, Aldrich C, Eisenberg HM, Gandhi D, Taira T, Gwinn R, Ro S, Witt J, Jung NY, Chang JW, Rosenberg J, Ghanouni P. *Neurology*. 2019 Dec 10;93(24):e2284-e2293. doi: 10.1212/WNL. Epub 2019 Nov 20. PMID:31748250
10. "MRI-based thermal dosimetry based on single-slice imaging during focused ultrasound thalamotomy" by McDannold, Nathan; White, Phillip; Cosgrove, G. Article reference: PMB-110633.R1
11. Impact of skull density ratio on efficacy and safety of magnetic resonance-guided focused ultrasound treatment of essential tremor. D'Souza M, Chen KS, Rosenberg J, Elias WJ, Eisenberg HM, Gwinn R, Taira T, Chang JW, Lipsman N, Krishna V, Igase K, Yamada K, Kishima H, Cosgrove R, Rumià J, Kaplitt MG, Hirabayashi H, Nandi D, Henderson JM, Butts Pauly K, Dayan M, Halpern CH, Ghanouni P. *J Neurosurg*. 2019 Apr 26:1-6. doi: 10.3171/2019.2.JNS183517.
12. Proix T, Aghagolzadeh M, Madsen JR, Cosgrove R, Eskandar E, Hochberg LR, Cash SS, Truccolo W. Intracortical neural activity distal to seizure-onset-areas predicts human focal seizures. *PLoS One*. 2019 Jul 22;14(7):e0211847. doi: 10.1371/journal.pone.0211847. PMID: 31329587; PMCID: PMC6645464.
13. Predictors of Outcomes After Focused Ultrasound Thalamotomy. Krishna V, Sammartino F, Cosgrove R, Ghanouni P, Schwartz M, Gwinn R, Eisenberg H, Fishman P, Chang JW, Taira T, Kaplitt M, Rezai A, Rumià J, Gedroyc W, Igase K, Kishima H, Yamada K, Ohnishi H, Halpern C. *Neurosurgery*. 2020 Aug 1;87(2):229-237. doi: 10.1093/neuros/nyz417. PMID: 31690945
14. Predicting bone marrow damage in the skull after clinical transcranial MRI-guided focused ultrasound with acoustic and thermal simulations. McDannold N, White PJ, Cosgrove R. *IEEE Tran Med Imaging*. 2020 Apr 21. doi: 10.1109/TMI.2020.2989121. Epub ahead of print PMID:32324544
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16. Park YS, Cosgrove GR, Madsen JR, Eskandar EN, Hochberg LR, Cash SS, Truccolo W. Early Detection of Human Epileptic Seizures Based on Intracortical Microelectrode Array Signals. *IEEE Trans Biomed Eng*. 2020 Mar;67(3):817-831. doi: 10.1109/TBME.2019.2921448. Epub 2019 Jun 6. PMID: 31180831; PMCID: PMC7067044.
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38. Sheth SA, Cosgrove GR, McLaughlin NCR. Introduction. *Neurosurgical neuroscience. Neurosurg Focus.* 2023 Feb;54(2):E1. doi: 10.3171/2022.11.FOCUS22621. PMID: 36724518.
39. Xiao Y, Chou CC, Cosgrove GR, Crone NE, Stone S, Madsen JR, Reucroft I, Shih YC, Weisholtz D, Yu HY, Anderson WS, Kreiman G. Cross-task specificity and within-task invariance of cognitive control processes. *Cell Rep.* 2023 Jan 31;42(1):111919. doi: 10.1016/j.celrep.2022.111919. Epub 2023 Jan 10. PMID: 36640346.
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42. Joutsa J, Lipsman N, Horn A, Cosgrove GR, Fox MD. The return of the lesion for localization and therapy. *Brain.* 2023 Apr 11:awad123. doi: 10.1093/brain/awad123. Epub ahead of print. PMID: 37040563. 2023 Apr 11:awad123. doi: 10.1093/brain/awad123. Epub ahead of print. PMID: 37040563.
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ACADEMIC TITLE
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American University of the Caribbean, 2002

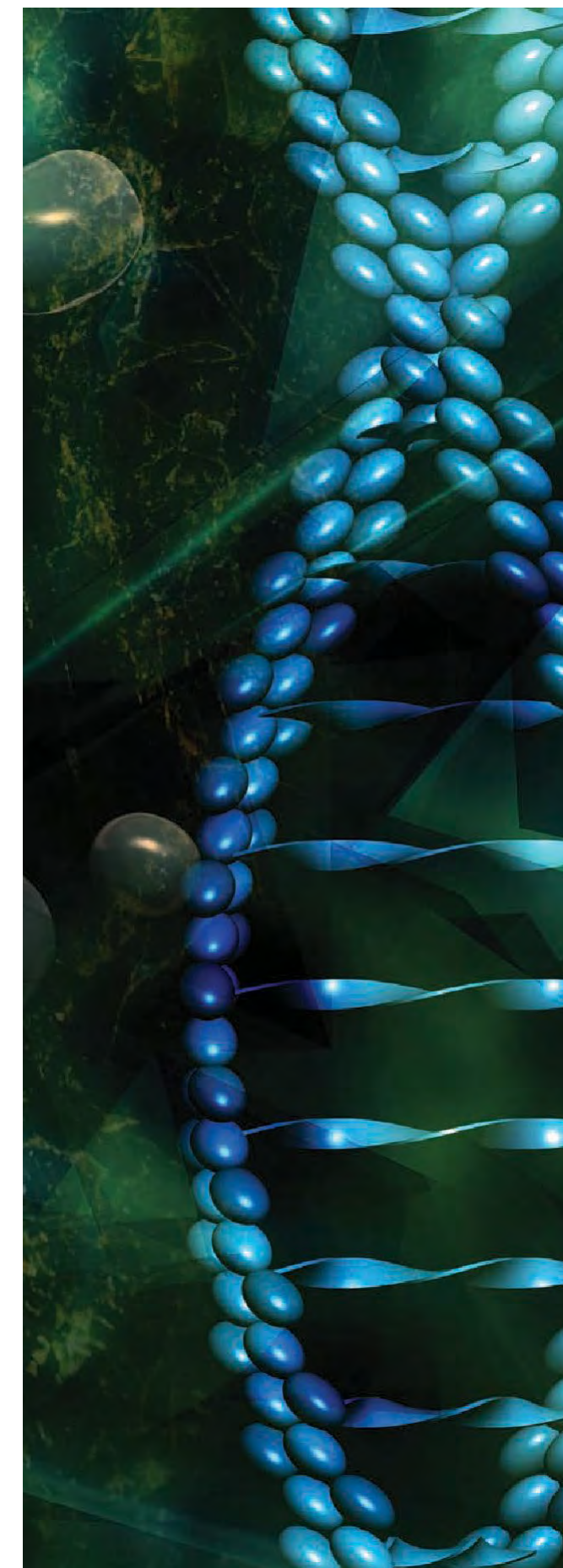
RESIDENCY
Tulane University, Neurological Surgery, 2009

FELLOWSHIPS
University of Washington, Harborview Medical Center Neurological Surgery, 2009

Oregon Health and Sciences University, Orthopaedic Spine Fellowship, 2010

CERTIFICATIONS
Neurological Surgery, 2015

CLINICAL INTERESTS
Artificial disc replacement, cervical radiculopathy, cervical stenosis, degenerative disc disease, lumbar radiculopathy, lumbar stenosis, minimally invasive surgery, spinal deformity, spine tumors, spondylolisthesis





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Harvard Medical School, 2000

INTERNSHIP

University of California at San Francisco, General Surgery, 2001

RESIDENCY

University of California, San Francisco School of Medicine, Neurosurgery, 2006

FELLOWSHIP

Brigham and Women's Hospital, Cerebrovascular and Skull Base Surgery, 2007

CERTIFICATIONS

Neurological Surgery, 2011

CLINICAL INTERESTS

Aneurysms, Arteriovenous Malformations, Brain Tumors, Bypass, Carotid Artery Disease, Cavernomas, Cavernous Malformations, Cerebral Ischemia, Cerebral Revascularization, Cerebrovascular Disease, Hemifacial Spasm, Meningiomas, Microvascular Decompression, Moyamoya Disease, Skull Base Neurosurgery, Skull Base Tumors, Trigeminal Neuralgia

PUBLICATIONS

1. Lai PMR, See AP, Silva MA, Gormley WB, Frerichs KU, Aziz-Sultan MA, and Du R. Non-infectious fever in aneurysmal subarachnoid hemorrhage: association with cerebral vasospasm and clinical outcome, *World Neurosurg*, 122:e1014-e1019, 2019.
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8. Subat YW, Dasenbrock HH, Gross BA, Patel NJ, Frerichs KU, Du R, and Aziz-Sultan MA. Periprocedural intracranial hemorrhage after embolization of cerebral arteriovenous malformations: A meta-analysis, *J Neurosurgery*, 133:1417-1427, 2019.
9. Du R, Carey V, and Weiss ST. deconvSeq: deconvolution of cell mixture distribution in sequencing data, *Bioinformatics*, 35:5095-5102, 2019.
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PUBLICATIONS

1. Pui Man Rosalind Lai, MD¹, William B. Gormley, MD, MPH¹, Nirav Patel, MD¹, MD, Kai U. Frerichs, MD¹, M. Ali Aziz-Sultan, MD¹, and Rose Du, MD PhD¹ Age dependent radiographic vasospasm and delayed cerebral ischemia in women after aneurysmal subarachnoid hemorrhage *World Neurosurg*. 2019 Jun 13. S1878-8750(19)31581-5P PMID: 31203057
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Brigham and Women's
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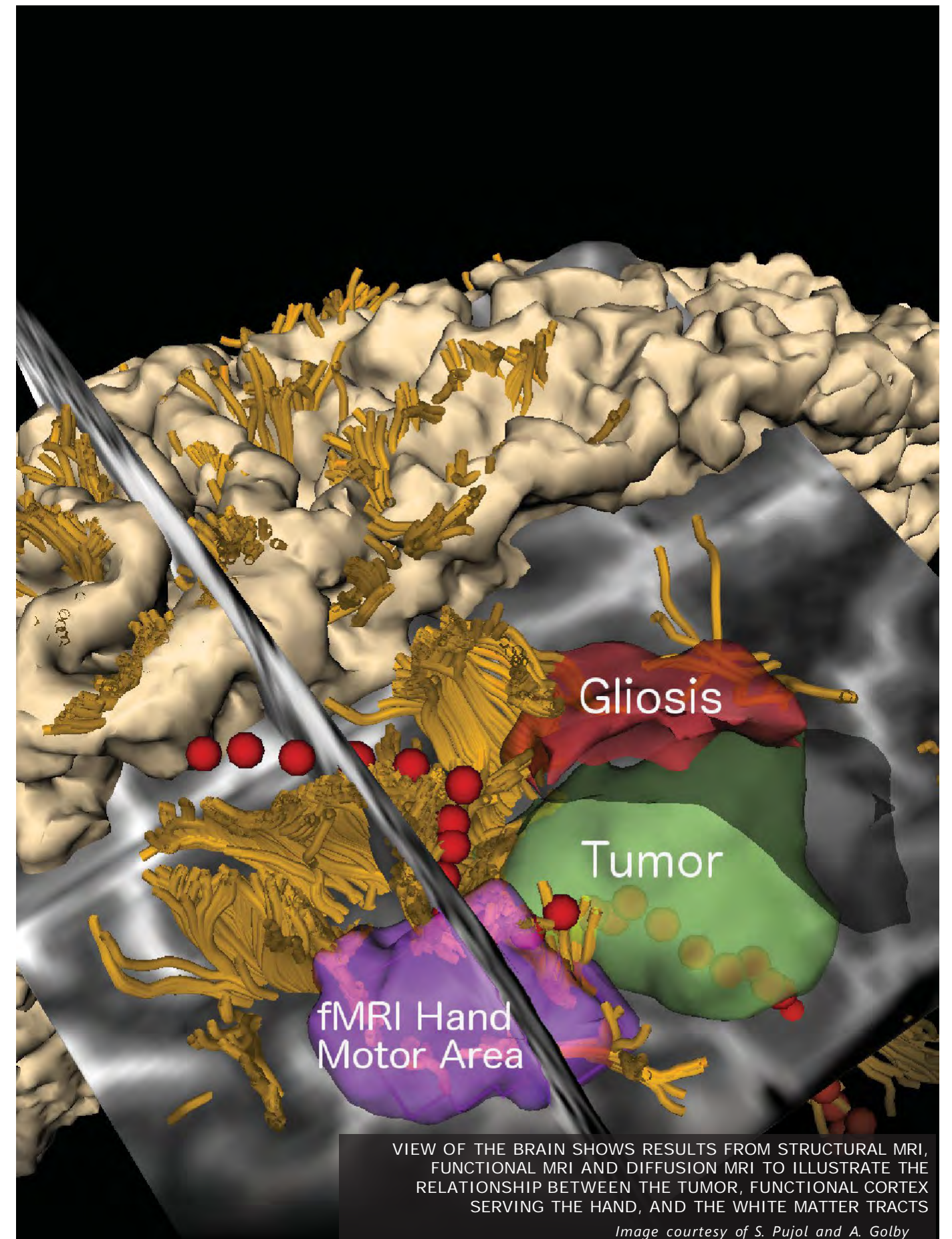
CERTIFICATIONS
Neurosurgery, 2007

CLINICAL INTERESTS
Acoustic neuroma, arachnoid cyst, awake surgery
for speech and motor monitoring, brain
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neurological oncology, oligodendroglioma, pituitary
tumors, radiosurgery, seizure management

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ACADEMIC TITLE
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Autonomous University of Guadalajara, 1985

INTERNSHIP
American British Cowdray
Hospital, Internal Medicine, 1986

St. Matthew's Community Hospital,
Social Services/Internal Medicine,
1987

RESIDENCY
Henry Ford Hospital,
General Surgery & Neurosurgery, 1994

FELLOWSHIP
Allegheny General Hospital, Neurosurgery, 1995
George Washington University, Neurosurgery,
1995 Nordstadt Krankenhaus, Neurosurgery, 1996

University of Pittsburgh Medical
School, Neurosurgery, 1996

University of Texas Medical School at
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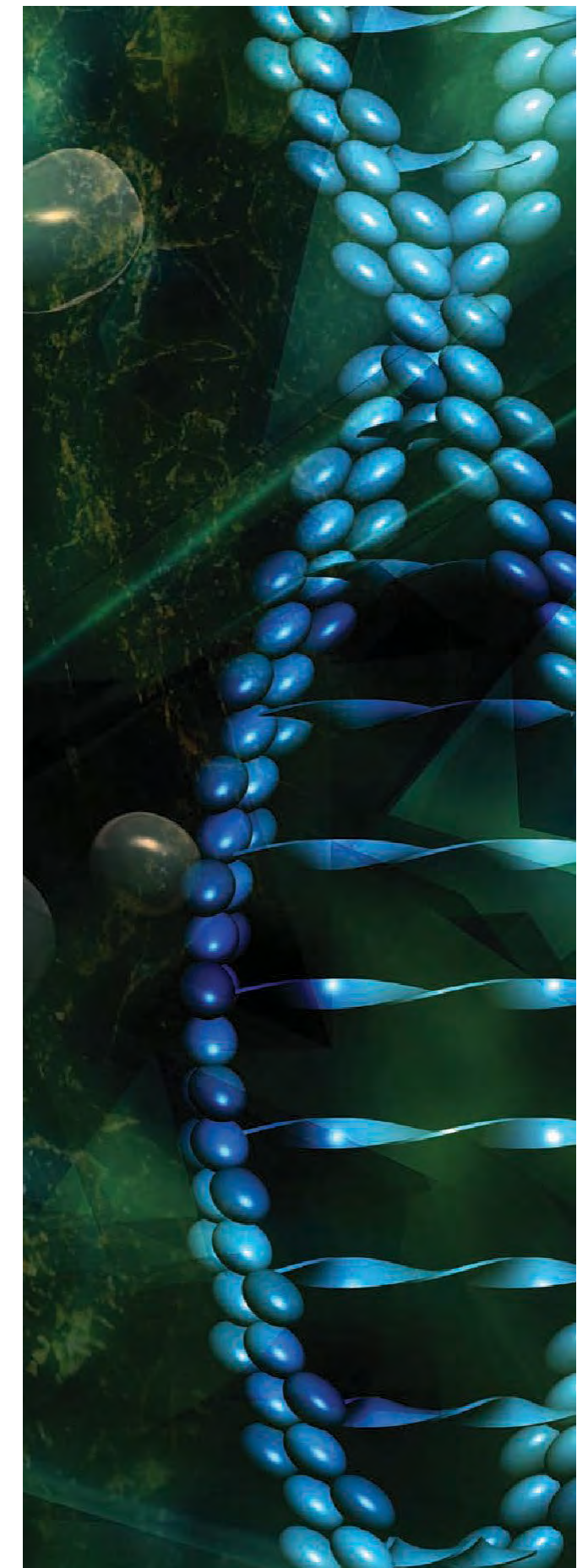
CERTIFICATIONS
Neurological Surgery, 2002
Surgical Critical Care, 2007

CLINICAL INTERESTS
Cerebral blood flow monitoring, cerebral
hemorrhage, cerebral tissue protection, concussion
evaluation and management, critical care,
endoscopic neurosurgery, head injury, intracranial
waveform analysis, spinal cord injury, spinal fracture
reconstruction, traumatic brain injury, variance
reduction in neurosurgical practice

PUBLICATIONS

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Center, Surgery/Neurosurgery,
1999

RESIDENCY

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Center, Surgery/Neurosurgery,
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FELLOWSHIP

Medical College of Wisconsin, 2000

CERTIFICATIONS

Neurological Surgery, 2005

CLINICAL INTERESTS

Arthroplasty, artificial disc replacement, brachial plexus injury, brachial plexus tumor, cervical radiculopathy, cervical stenosis, Chiari malformation, chondrosarcoma, degenerative disc disease, disc herniation, image-guided surgery, Klippel-Feil syndrome, lumbar radiculopathy, lumbar stenosis, minimally invasive surgery, myelopathy, neurological oncology, pain management, quality and safety metrics In care delivery, slipped disc, spinal cord injury, spinal cord tumors, spinal deformity, spinal disorders, spinal fracture reconstruction, spinal fusion, spine tumors, spondylolisthesis, tethered cord

PUBLICATIONS

1. Goedmakers CMW, Lak AM, Duey AH, Senko AW, Arnaout O, Groff MW, Smith TR, Vleggeert-Lankamp CLA, Zaidi HA, Rana A, Boaro A. Deep Learning for Adjacent Segment Disease at Preoperative MRI for Cervical Radiculopathy. *Radiology*. 2021 Dec; 301(3):E446. PMID: 34807775.
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INTERNSHIP

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RESIDENCY

The Johns Hopkins Hospital, 1971

CERTIFICATIONS

Neurological Surgery, 1974

CLINICAL INTERESTS

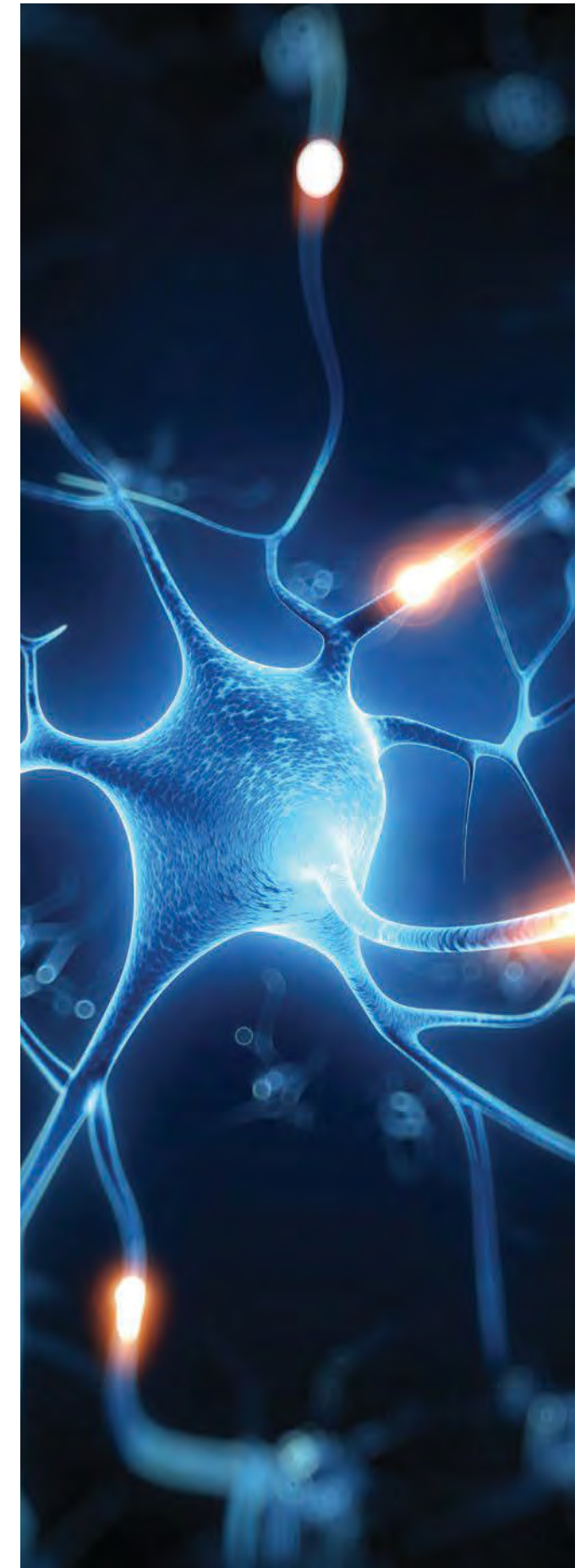
Craniopharyngioma, endoscopic neurosurgery, epilepsy, pituitary tumors, transnasal endoscopic pituitary surgery

PUBLICATIONS

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7. Jamshidi AO, Beerfurlan A, Prevedello DM, Sahyouni R, Elzoghby MA, Safain M, Jane J, Laws ER. "A modern series of subdiaphragmatic craniopharyngiomas" *Journal of Neurosurgery*. 2019, 161:526-531 PMID: 30238283
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9. Mattogno P, Mattavelli D, Marciano F, Schreiber A, Nicolai P, Lawes E, Witterick I, Raxa S, Devaiah A, Lauretti L, Olivi A, Fontanella M, Gentili F, Doglietto F; : "Ergonomics in endoscopic transsphenoidal surgery: A Survey of the North American Skull Base Society". -Skull Base, 2019
10. Bunevicius A, Laws ER, Vance ML, Iuliano S, Sheehan J: "Surgical and radiosurgical treatment strategies in Cushing's Disease". *Journal of Neuro-Oncology*, 2019 doi: 110.1007/s 11060-019-03325-6
11. Catalino M, Laws ER Jr: "Exemplary Mentorship in action: Harvey Cushing's Trainees from 1912-1919". *Journal of Neurosurgery*; in press 2019
12. Ahmed A-K, Smith T R, Cote D, Dawood HY, Bale TA, De Girolami U, Laws ER Jr: "Surgical resection of granular cell tumor of the sellar region: three indications", *Pituitary*, 2019; 22: 633-639.
13. Cappabianca P, Laws ER Jr: "You'll Never Walk Alone". *Journal of Neurosurgical Sciences* Nov 5, 2019
14. 547. Bunevicius A, Laws ER, Audargiene A, Tamasauskas A, Iervasi G, Deltuva V, Smith TR, Bunevicius R. "Common genetic variations of deiodinase genes and prognosis of brain tumor patients". *Endocrine*, 2019 08., doi:10, 1007/ s12020-019-02016-6
15. Cote DJ, Penn D, Iuliano S, Catalino M, "Optimizing pre- intra-and post-operative management of patients with sellar pathology undergoing transsphenoidal surgery". *Neurosurgical Focus*, 2020, June
16. Burke W, Cote D, Penn D, Iuliano S, McMillen K, Laws ER. "Diabetes insipidus after endoscopic transsphenoidal surgery". *Neurosurgery*
17. Guaraldi F, Cilloni N, Laws ER, Mazzatenta D. "The role of prolactin and dopamine agonists in the onset and modulation of the COVID-19 hyper-cytokinemic inflammatory state. Missing pieces of the COVID-19 puzzle?", *Journal of Endocrine Investigation*, 2020, in press
18. Giustina A, Barkhoudarian G, Beckers A, Ben-Shlomo A, Biermasz N, Biller B, Boguszewski C, Bollerslev J, Bonert V, Bronstein M, Buchfelder M, Casanueva F, Chanson P, Clemmons D, Fleseriu M, Freda P, Formenti M, Gadhela M, Geer E, Gurnell M, Heaney A, Ho K, Iachimescu A, Lamberts S, Laws E, Losa M, Maffei P, Mamelak A, Mercado M, Molitch M, Mortini P, Pereira A, Petersenn S, Post K, Puiu-Domingo Salvatori R, Samson S, Shimon I, Strasburger C, Swearingen B, Trainer P, Vance ML, Wass J, Wierman M, Yuen K, Zatelli M, Melmed S. "Multidisciplinary Management of Acromegaly: A Consensus", 2021 in press
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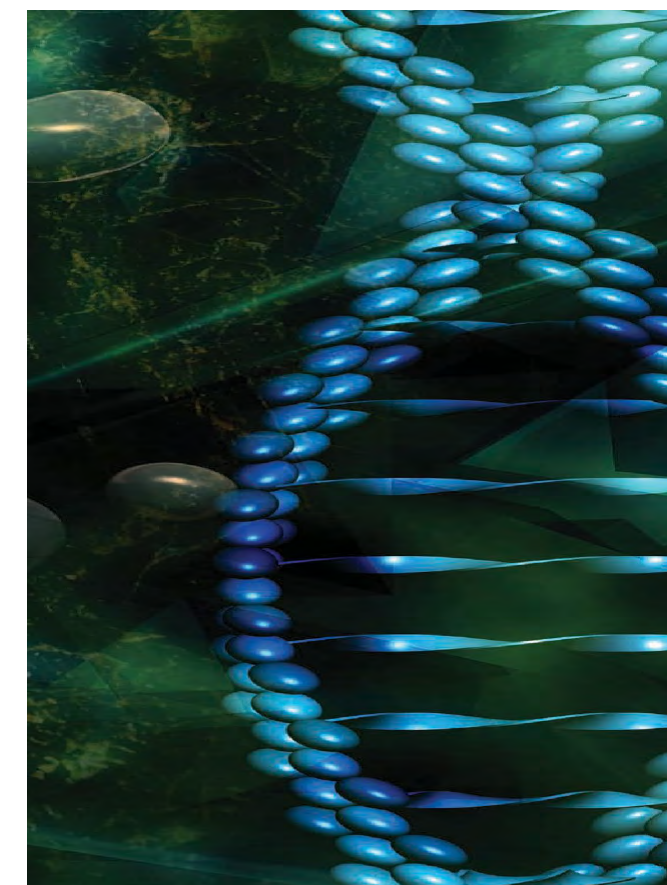
Complex Spine Surgery, Cleveland Clinic

CLINICAL INTERESTS

Artificial Disc Replacement, Cervical Radiculopathy, Cervical Stenosis, Chiari Malformation, Chondrosarcoma, Chordoma, Claudication, Degenerative Disc Disease, Arachnoid Cyst Arthroplasty, Disc Herniation, Ependymoma, Osteosarcoma, Scoliosis, Spinal Cord Injury, Spinal Cord Tumors, Spinal Deformity, Muscle Sparing Spine Surgery, Spinal Fracture Reconstruction, Spinal Fusion, Lumbar Radiculopathy, Spine Treatment, Lumbar Stenosis, Minimally Invasive Surgery, Meningiomas, Spine Tumors, Spondylolisthesis, Tethered Cord, Vestibular Schwannoma

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MEDICAL SCHOOL

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INTERNSHIP

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RESIDENCY

Brigham and Women's Hospital/
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FELLOWSHIP

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CLINICAL INTERESTS

Arthroplasty, artificial disc replacement,
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Chiari malformation, chondrosarcoma, chordoma,
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injury, spinal cord tumors, spinal deformity, spinal
disorders, spinal fracture reconstruction, spinal
fusion, spine tumors, spondylolisthesis, tethered
cord, thoracic outlet syndrome

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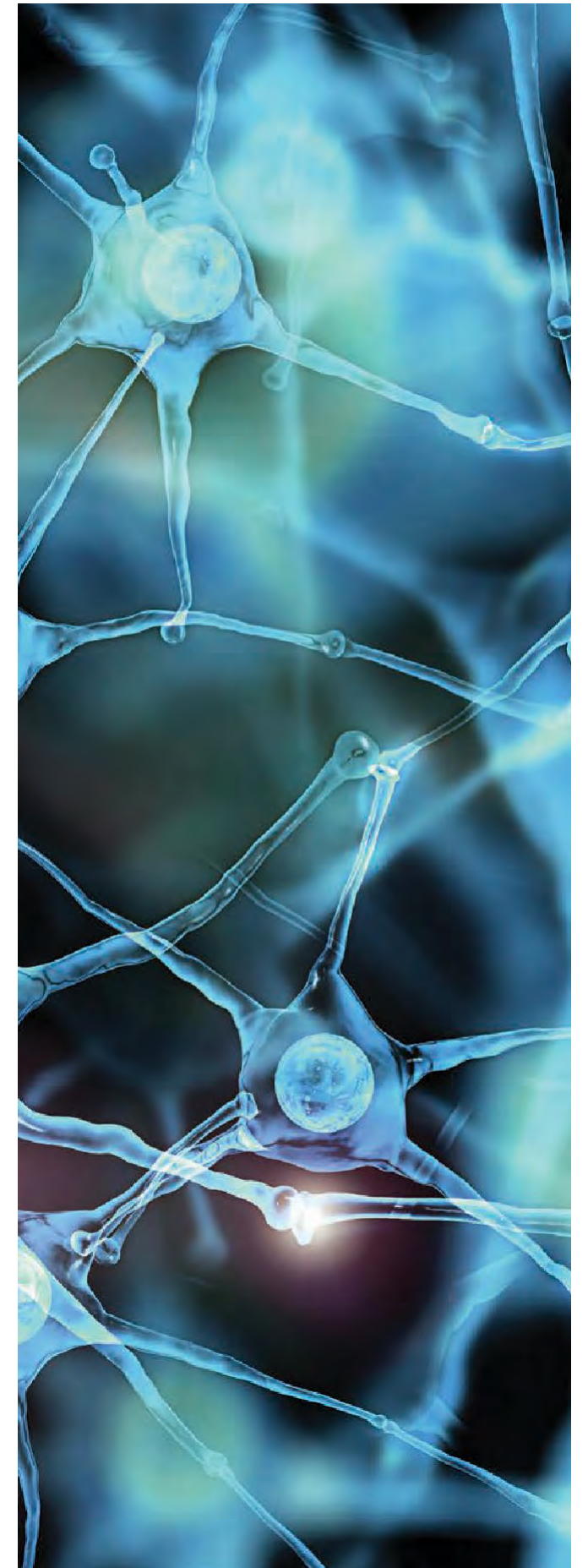
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Neurosurgery, 2016

CLINICAL INTERESTS
Acoustic neuroma, aneurysms, arteriovenous malformations, astrocytoma, brain tumors, bypass, carotid artery disease, cavernous malformations, cerebral revascularization, endovascular neurosurgery, meningiomas, Moyamoya disease, radiosurgery, skull base neurosurgery, trigeminal neuralgia

PUBLICATIONS

- Lai PR, Gormley WB, Patel NJ, Frerichs KU, Aziz-Sultan MA, Du, R. Age-dependent radiographic vasospasm and delayed cerebral ischemia in women after aneurysmal subarachnoid hemorrhage. *World Neurosurgery.* June 2019. PMID: 31203057.
- Subat YW, Dasenbrock HH, Gross BA, Patel NJ, Frerichs KU, Du R, Aziz-Sultan MA. Periprocedural intracranial hemorrhage after embolization of cerebral arteriovenous malformations: a meta-analysis. *Journal of Neurosurgery.* Accepted June 2019.
- Silva MA, Patel J, Kavouridis V, Gallerani T, Beers A, Chang K, Hoebel KV, Brown J, See AP, Gormley WB, Aziz-Sultan MA, Kalpathy-Cramer J, Arnaout O, Patel NJ. Machine learning models can detect aneurysm rupture and identify clinical features associated with rupture. *World Neurosurgery.* July 2019. PMID: 31295616.
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- Silva MA, Lai PR, Du R, Aziz-Sultan MA, Patel NJ. The Ruptured AVM Grading Scale (RAGS): An extension of the Hunt & Hess scale to predict clinical outcome for patients with ruptured brain arteriovenous malformations. *Neurosurgery.* Accepted July 2019.
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- Patel NJ, Hogan KJ, Rizk E, Stewart K, Madrid A, Meethal SV, Alisch R, Borth L, Papale LA, Ondoma S, Gorges LR, Weber K, Lake W, Bauer A, Hariharan N, Kuehn T, Cook T, Keles S, Newton MA, Iskandar BJ. Ancestral Folate Promotes Neuronal Regeneration in Serial Generations of Progeny. *Molecular Neurobiology.* October 2019. <https://doi.org/10.1007/s12035-019-01812-5>.
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10. Cikla U, Rowley P, Jennings Simoes EL, Ozaydin B, Goodman SL, Avic E, Baskaya MK, Patel NJ. Grapefruit Training Model for Distal Anterior Cerebral Artery Side-to-Side Bypass. *World Neurosurgery*. June 2020
11. Michael A Silva, Pui Man Rosalind Lai, Rose Du, Mohammad A Aziz-Sultan, Nirav J Patel. The Ruptured Arteriovenous Malformation Grading Scale (RAGS): An Extension of the Hunt and Hess Scale to Predict Clinical Outcome for Patients With Ruptured Brain Arteriovenous Malformations. August 2020. *PMID: 31586199 DOI: 10.1093/neuros/nyz404*
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15. Lai PRM, Ng I, Gormley WB, Patel Nirav J, Frerichs KU, Aziz-Sultan MA, Du, R. Familial Predisposition and Differences in Radiographic Patterns in Spontaneous Nonaneurysmal Subarachnoid Hemorrhage. *Neurosurgery*. 2021 Jan 13; *PMID 33017030*
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ACADEMIC TITLES

Assistant Professor, Harvard Medical School

MEDICAL SCHOOL

Università La Sapienza di Roma, Medicine, 2004

RESIDENCY

Ohio State University Medical Center, Neurosurgery, 2014

FELLOWSHIP

Nationwide Children's Hospital, Pediatric Neurosurgery, 2015

CLINICAL INTERESTS

Awake Surgery for Speech and Motor Monitoring, Brain Metastases, Brain tumors, Chiari malformation, endoscopic neurosurgery, gliomas, meningiomas, peripheral nerve disease, skull base neurosurgery, spinal cord tumors, spinal disorders

PUBLICATIONS

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ACADEMIC TITLES

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MEDICAL SCHOOL

Tufts University School of Medicine, 2008

INTERNSHIP

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RESIDENCY

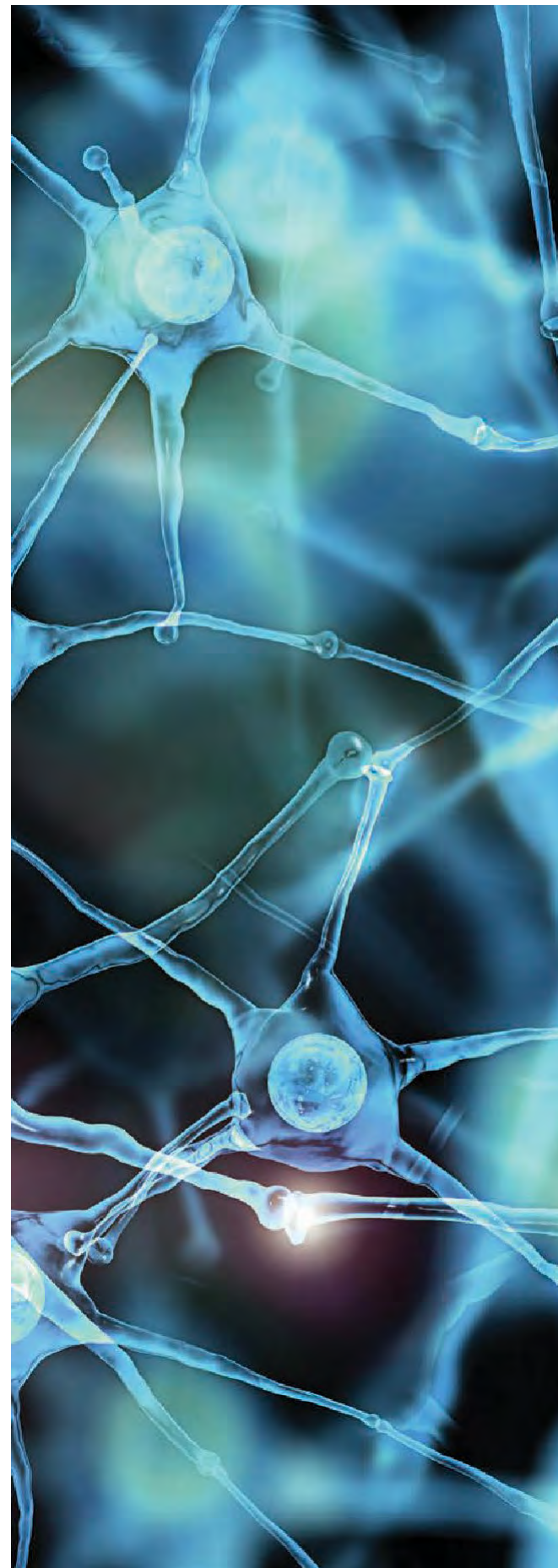
Tufts Medical Center 2014

BOARD CERTIFICATION

ABNS, Neurosurgery 2020

CLINICAL INTERESTS

Artificial Disc Replacement, Cervical Radiculopathy, Chiari Malformation, Degenerative Disc Disease, Endoscopic Neurosurgery, Image-Guided Surgery, Lumbar Radiculopathy, Neurological Oncology, Pituitary Tumors, Radiosurgery, Skull Base Neurosurgery, Spinal Disorders, Spinal Fusion, Spine Treatment, Cervical Stenosis, Lumbar Stenosis, Spinal Deformity, Spondylolisthesis



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ACADEMIC TITLE

Associate Professor, Harvard Medical School

MEDICAL SCHOOL

Emory University School of Medicine, 2011

RESIDENCY

University of California, San Francisco, 2017

BOARD CERTIFICATION

Neurological Surgery, 2020

CLINICAL INTERESTS

Deep Brain Stimulation, Dystonia, Epilepsy, Essential Tremor, Focused Ultrasound, Hemifacial Spasm, Laser Ablation, Microvascular, Decompression, Movement Disorder Surgery, Parkinson's Disease, Psychiatric Neurosurgery, Seizure Management, Trigeminal Neuralgia

PUBLICATIONS

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29: Shlobin NA, Campbell JM, Rosenow JM, Rolston JD. Ethical considerations in the surgical and neuromodulatory treatment of epilepsy. *Epilepsy Behav*. 2022 Feb;127:108524. doi: 10.1016/j.yebeh.2021.108524. Epub 2022 Jan 5. PMID: 34998267; PMCID: PMC10184316.

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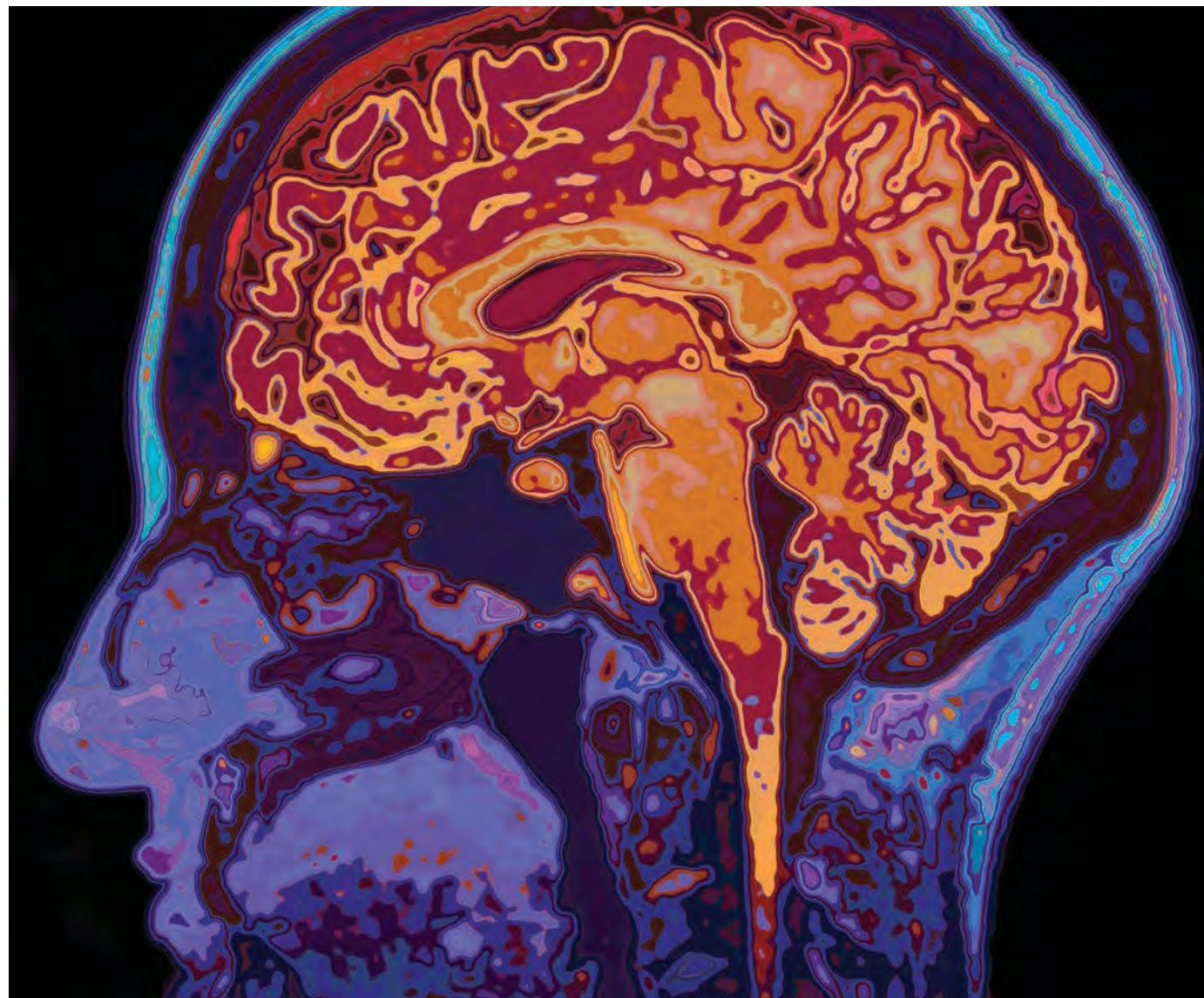
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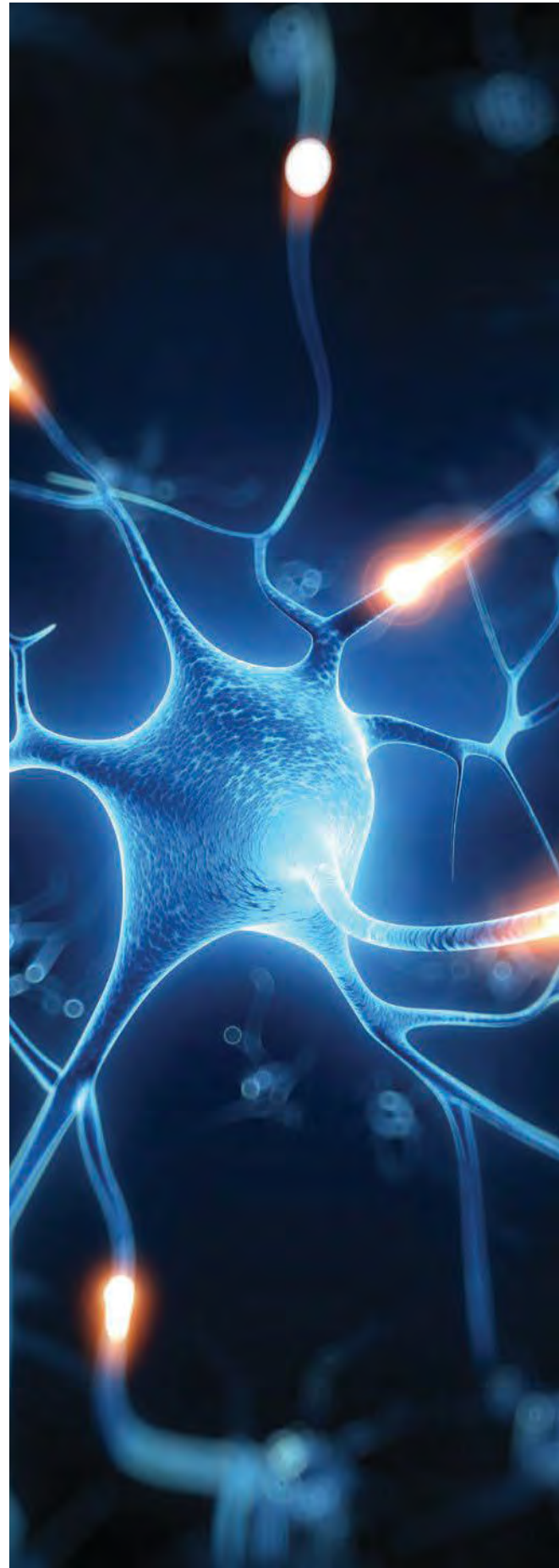
National Institutes of Health, 1989

CERTIFICATIONS

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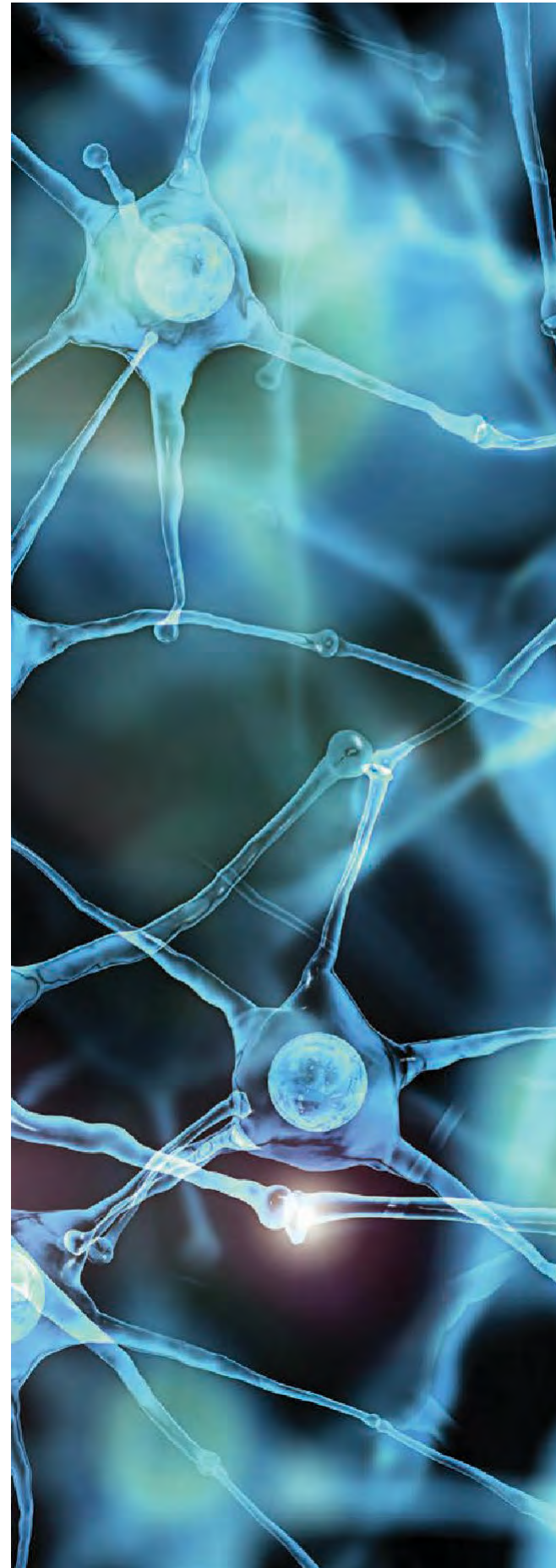
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PUBLICATIONS

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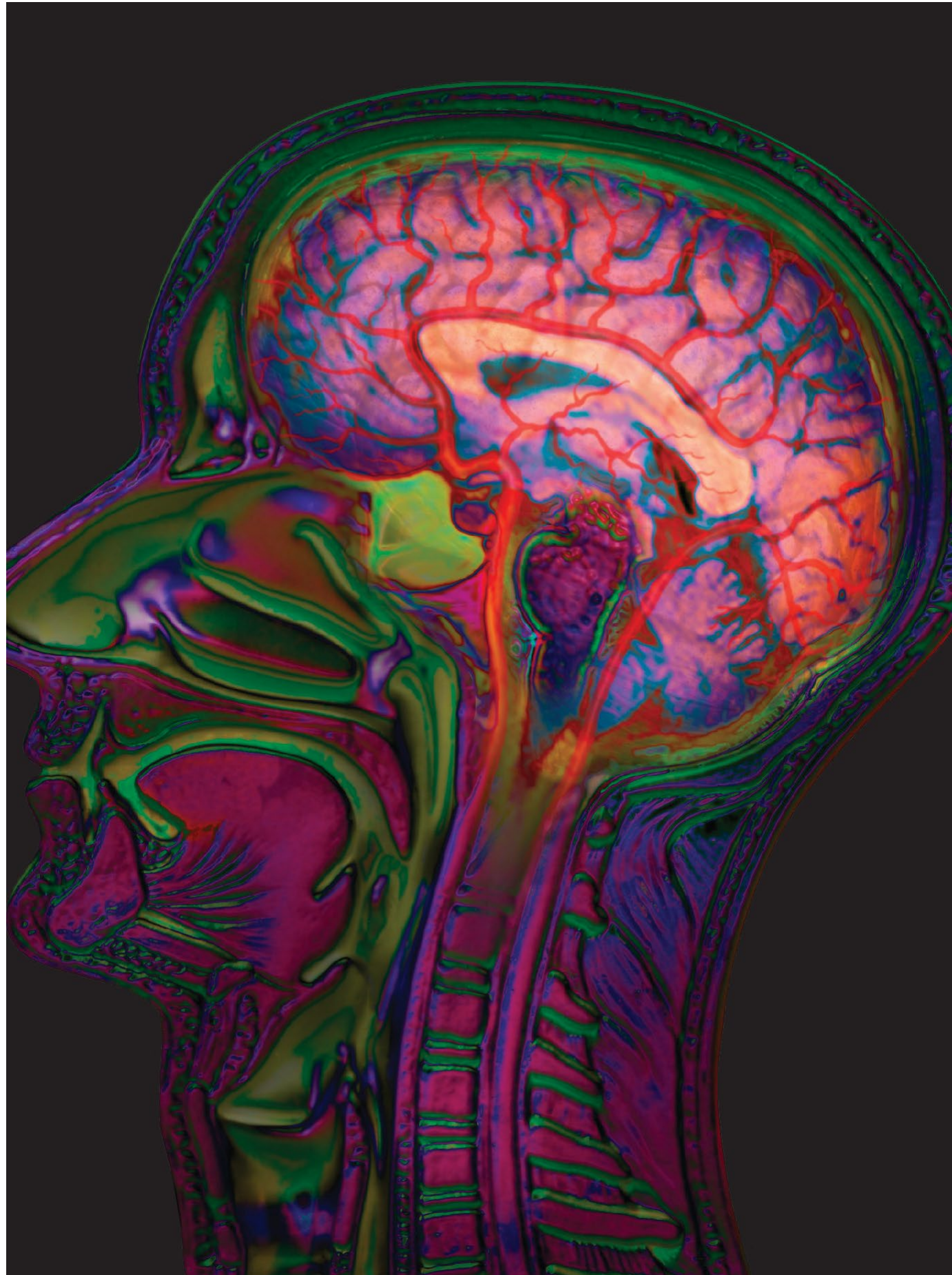
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PUBLICATIONS

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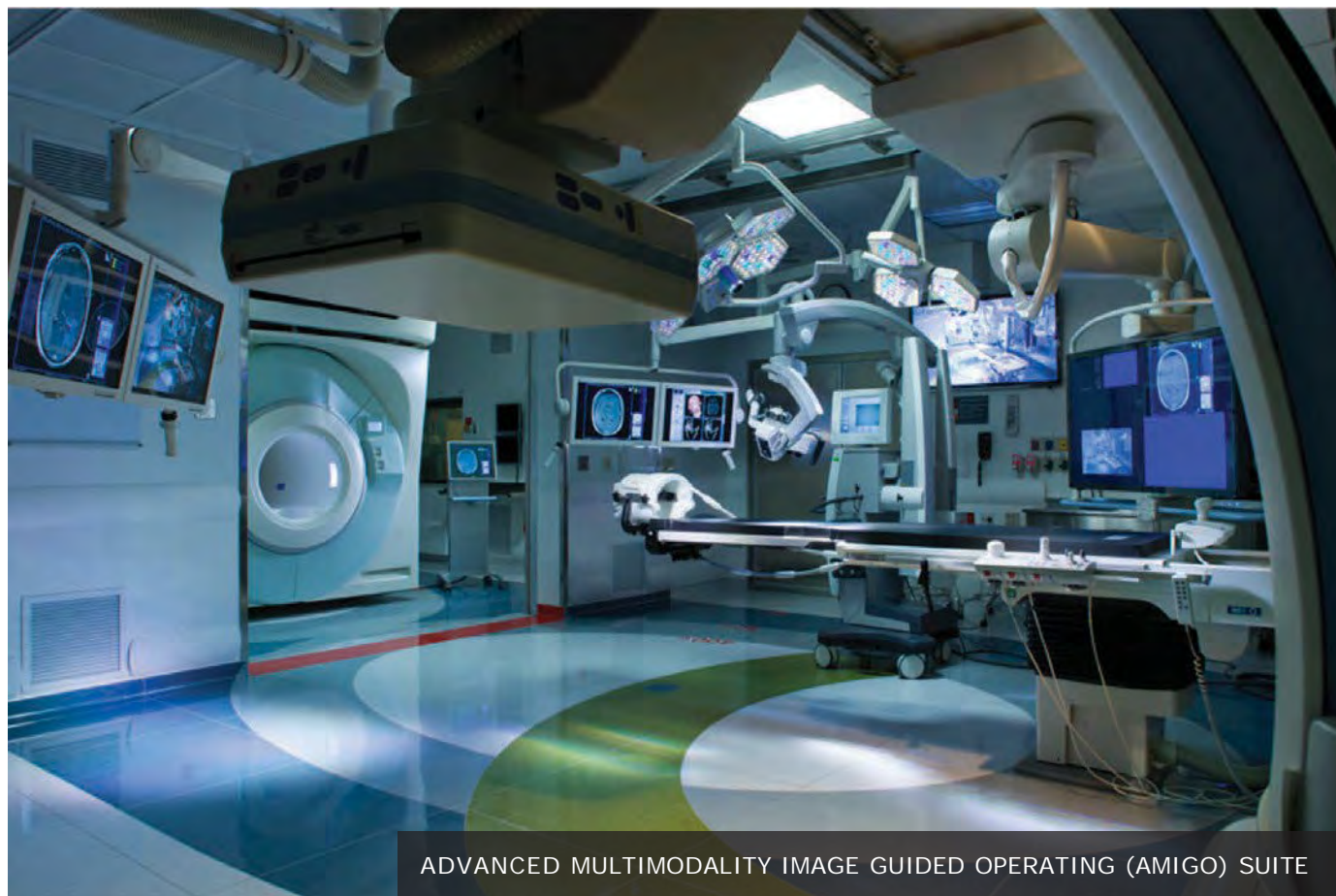
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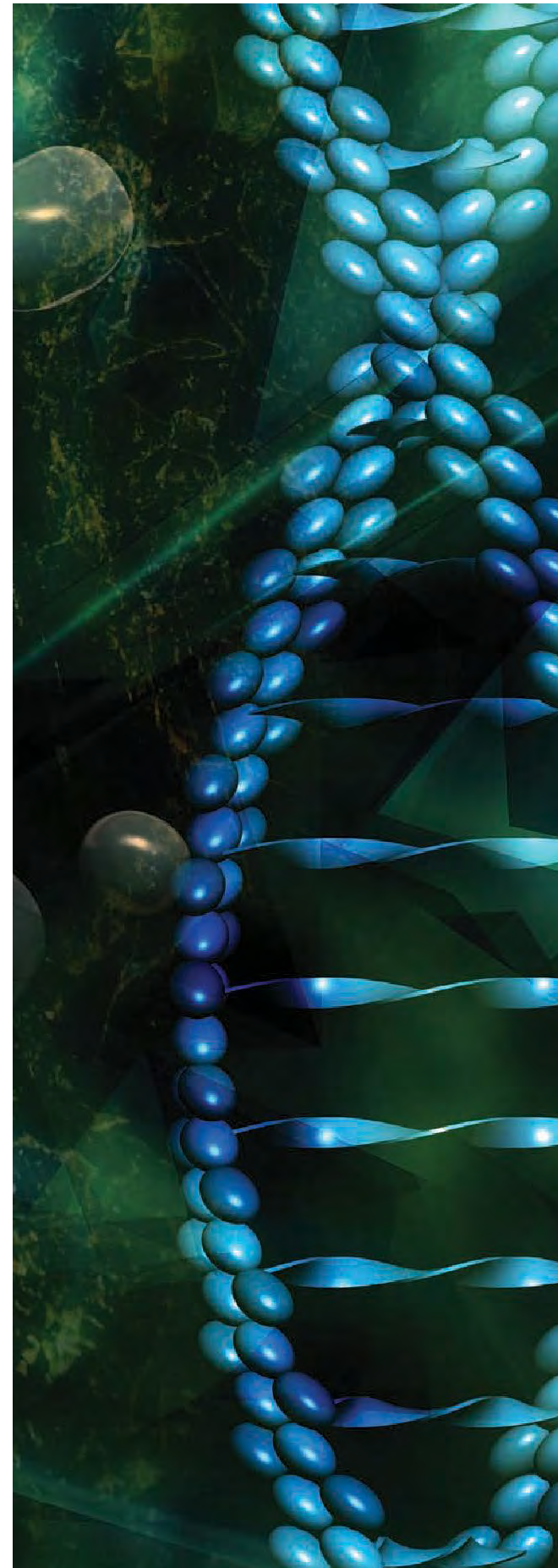
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CLINICAL INTERESTS
Arthroplasty, Artificial Disc Replacement, Cervical
Radiculopathy, Cervical Stenosis, Chordoma,
Degenerative Disc Disease, Disc Herniation,
Endoscopic Neurosurgery, Image-Guided Surgery,
Lumbar Radiculopathy, Lumbar Stenosis, Minimally
Invasive Surgery, Muscle Sparing Spine Surgery,
Myelopathy, Neurological Oncology, Pain
Management, Pituitary Tumors, Scoliosis, Slipped
Disc, Spinal Cord Injury, Spinal Cord Tumors Spinal
Deformity, Spinal Disorders, Spinal Fractures
Reconstruction, Spinal Fusion, Spine Tumors,
Spondylolisthesis, Tethered Cord, Transnasal
Endoscopic Pituitary Surgery

PUBLICATIONS

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2. Gupta SA, Hauser BM, Zaki MM, Xu E, Cote DJ, Lu Y, Chi JH, Groff M, Khawaja AM, Harris MB, Smith TR, Zaidi HA. Morbidity after traumatic spinal injury in pediatric and adolescent sports-related trauma. *Journal of Neurosurgery—Spine*. 2019 Dec 27:1-7. PMID: 31881536.
3. Cerecedo-Lopez CD, Tafel I, Lak AM, Chi J, Lu Y, Groff M, Zaidi HA. Surgical management of ossification of the posterior longitudinal ligament in the cervical spine. *Journal of Clinical Neuroscience*. 2019 Dec 26. PMID 31883815.
4. Lak AM, Rahimi A, Abunimer AM, Tafel I, Devi S, Premkumar A, Ida F, Lu Y, Chi JH, Tanguturi S, Groff MW, Zaidi HA. Quantifying the impact of surgical decompression on quality of life and identification of factors associated with outcomes in patients with symptomatic metastatic spinal cord compression. *Journal of Neurosurgery—Spine*. 2020 Apr 3:1-8. PMID: 32244218.
5. Lak A, Tafel IA, Rahimi A, Zaidi HA. Outcomes of Minimally Invasive versus Open surgery for Intermediate to High Grade Spondylolisthesis Correction: a 10 year retrospective, Multicenter experience. *Spine*. 2020 Oct 15; 45(20):1451-1458. PMID: 32453240.
6. Boaro A, Lu Y, Chi JH, Groff MW, Smith TR, Zaidi HA. A National Surgical Quality Improvement Program (NSQIP) analysis of postoperative major and minor complications in patients with spinal metastatic disease. *World Neurosurgery*. 2020 Aug;140:e203-e211. PMID: 32389869.
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8. Yeung CM, Lightsey HM, Isaac S, Issac Z, Gilligan CJ, Zaidi H, Ludwig SC, Kang JD, Makhni MC. Improving Spine Models of Care. *JBJS Review*. 2021 April; 9(4):e. PMID: 33982981.
9. Gupta SA, Zaki M, Khawaja A, Lu YL, Groff M, Chi JC, Zaidi HA. Adult Sport-related Traumatic Spinal Injuries: Do Different Activities Predispose to Certain Injuries? Congress of Neurological Surgeons Annual Meeting. *Journal of Neurosurgery: Spine*. In-press. 2021 Aug 24:1-7. PMID: 35354117
10. Goedmakers C, Lak A, Duey A, Senko A, Arnaout O, Groff M, Smith T, Vleggeert-Lankamp C, Zaidi H, Rana A, Boaro A. Deep Learning for Adjacent Segment Disease on Preoperative MRI for Cervical Radiculopathy. *Radiology*. 2021 Sep 21. PMID: 34546126.
11. Hauser BM, McNulty J, Zaki MM, Gupta S, Cote DJ, Bernstock JD, Lu Y, Chi JH, Groff MW, Khawaja AM, Smith TR, Zaidi HA. Predictors of thoracic and lumbar spine injuries in patients with TBI: A nationwide analysis. *Injury*. 2021 Oct 2. PMID 34625238.
12. Hauser BM, Hoffman SE, Gupta S, Zaki MM, Xu E, Chua M, Bernstock JD, Khawaja A, Smith TR, Proctor MR, Zaidi HA. Association of venous thromboembolism following pediatric traumatic spinal injuries with injury severity and longer hospital stays. *Journal of Neurosurgery—Spine*. 2021 Sep. PMID: 34534962
13. Hoffman SE, Hauser BM, Zaki MM, Gupta S, Chua M, Bernstock JD, Khawaja AM, Smith TR, Zaidi HA. Spinal level and cord involvement in the prediction of sepsis development after vertebral fracture repair for traumatic spinal injury. *J Neurosurg Spine*. 2022 Feb 04; 1-7. PMID: 35120317; PMID: PMC9349473.
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15. Yearly A, Chaliff J, Chaliff EJ, Zaidi HA. The relationship between surgeon experience, complications, and radiographic outcomes in spine deformity surgery: the experience of a junior surgeon. *World Neurosurgery*. *World Neurosurg*. 2022 Dec;168:e399-e407. PMID: 36307035.
16. Abunimer A, Hammoudeh L, Dee E, Lak A, Chi J, Lu Yi, Groff M, Shin J, Lam Miranda, Zaidi H. Gross Total Resection of Spinal Chondrosarcoma is Associated with Improved Locoregional Relapse-Free Survival and Overall Survival. *Eur Spine J*. 2023 Jan 2. PMID: 36592209.
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22. Sultan I, Lamba N, Liew A, Doung P, Tewarie I, Amamoo JJ, Gannu L, Chawla S, Doucette J, Cerecedo-Lopez CD, Papatheodorou S, Tafel I, Aglio LS, Smith TR, Zaidi H, Mekary RA. The safety and efficacy of steroid treatment for acute spinal cord injury: a systematic review and meta-analysis. *Heliyon*. Feb 2020. PMID: 32095652.

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25. Lak AM, Zaidi HA. Commentary: Minimally Invasive Posterior Cervical Foraminotomy Using 3-Dimensional Total Navigation: 2-Dimensional Operative Video. *Operative Neurosurgery*. 2020 Dec 8. PMID: 33294921.

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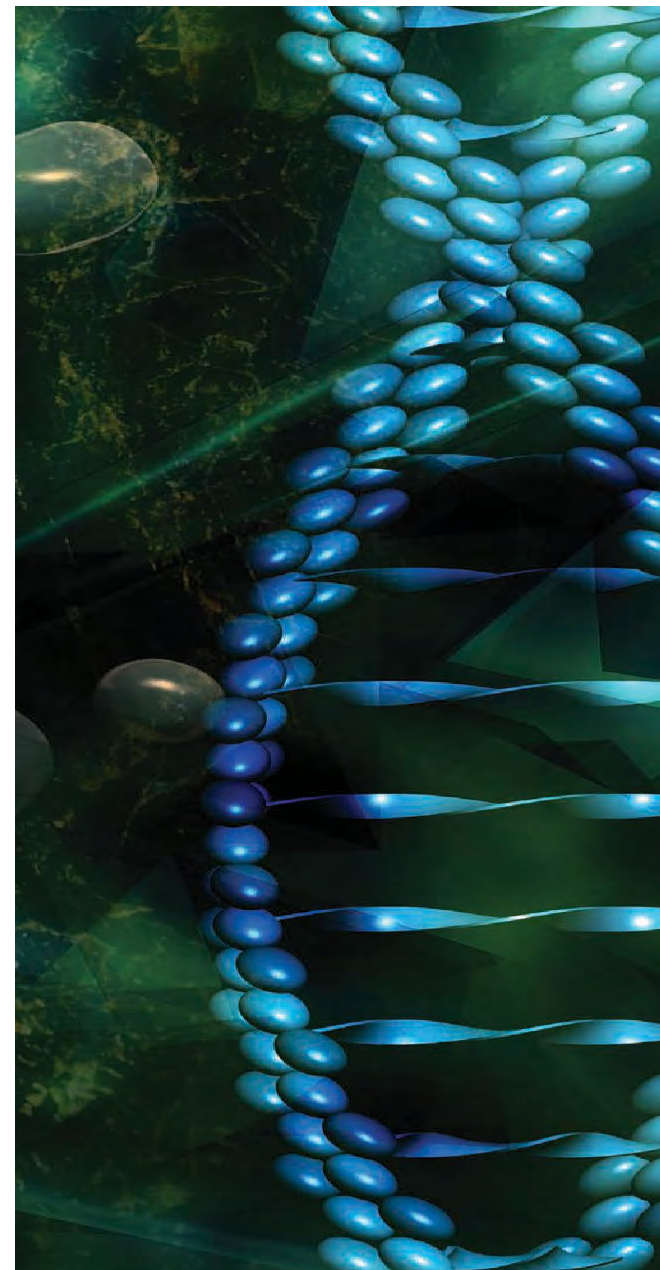
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31. Mammi M, Wat R, Paredes J, Smith TR, Gormley WB, Zaidi H, Mekary RA. In Reply to the Letter to the Editor Regarding "The effectiveness of antiepileptic medications as prophylaxis of early seizure in patients with traumatic brain injury compared with Placebo or no treatment: a systematic review and meta-analysis". *World Neurosurgery* 2019 Nov;131:207. PMID: 31658672.

32. Lak A, Zaidi HA, Smith TR. Commentary: Cottonoid Sliders: A Simple and Cost-effective tool for Retractorless intracranial Surgery. *Operative Neurosurgery*. 2020 Sep 15;19(4):E432-433. PMID: 32396188.



BOSTON CHILDREN'S HOSPITAL NEUROSURGICAL RESEARCH

OVERVIEW

Laboratory research in the Neurosurgery Department focuses on the basic mechanisms of common neurosurgical conditions such as trauma to the brain and spinal cord, the genetic make-up of brain tumors, and the dynamics of brain and cerebrospinal fluid pulsation. The researchers are investigating the utility of measuring certain enzymatic compounds as markers of tumor growth and recurrence, as well as of cerebral ischemia. They are also exploring the role of temporarily-implanted cortical electrodes in the study of memory and learning paradigms.

RESEARCHERS

Larry Benowitz, PhD

FOCUS: Brain rewiring after injury

Katie Fehnel, MD

FOCUS: Brain Tumors

Joseph Madsen, MD

FOCUS: Epilepsy

Mark Proctor, MD

FOCUS: Improvement of longterm outcomes in neurotrauma, Craniosynostosis

AREAS OF CURRENT RESEARCH

- The role of novel growth factors in optic nerve regeneration, stroke, and spinal cord injury;
- Inosine and cell-signaling pathways in the CNS;
- Finite element analysis description of the changes in brain and ventricular system during the cardiac cycle;
- Detailed genetic analysis of malignant and non-malignant brain tumors in children;
- The role of matrix metalloproteinases in the detection of recurrence of pediatric brain tumors;
- Advance precision medicine for brain disorders using genome-edited human stem cells.

Alfred Pokemeng See, MD

FOCUS: Venous malformations

Edward R. Smith, MD

FOCUS: Moyamoya syndrome, Brain tumors

Scellig Stone, MD, PhD

FOCUS: Pediatric Movement Disorders

Xin Tang, PhD

FOCUS: Pathology of brain disorders, molecular mechanism-guided therapeutics

Benjamin C. Warf, MD

FOCUS: Hydrocephalus





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ACADEMIC TITLE
Associate Professor, Harvard Medical School

MEDICAL SCHOOL
Columbia University,
College of Physicians and Surgeons, 2004

INTERNSHIP
UCSD Medical Center, 2005

RESIDENCY
UCSD Medical Center, 2011

FELLOWSHIP
LSU Health Sciences Center-
Shreveport, Skull Base, 2010
Boston Children's Hospital, Harvard Medical
School, Pediatric Neurosurgery, 2012

CLINICAL INTERESTS
Brain Tumors, Hydrocephalus, Tethered Spinal
Cord, Chiari Malformation, Vascular
Malformations

PUBLICATIONS

1. Pricola Fehnel K, Klein J, Warf BC, Smith ER, Orbach DB: Reversible intracranial hypertension following treatment of an extracranial vascular malformation: case report. *J Neurosurg Pediatr* 23:369-373, 2019
2. See AP, Fehnel KP, Orbach DB, Smith ER: Microsurgical Ligation of Residual Fistulous Arteriovenous Shunt From a Radicular Artery to a Thoracic Arteriovenous Malformation: 2-Dimensional Operative Video. *Oper Neurosurg (Hagerstown)*, 2019
3. Edlow BL, Threlkeld ZD, Fehnel KP, Bodien YG: Recovery of Functional Independence After Traumatic Transtentorial Herniation With Duret Hemorrhages. *Front Neurol* 10:1077, 2019
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6. Tsetsou S, Butler W, Borges L [...] Fehnel KP [...]Dynamic mapping of the corticospinal tract in open cordotomy and myelomeningocele surgery. *J Clin Neurosci.* 2020;74:225-231. doi:10.1016/j.jocn.2020.01.054
7. Bernstock, JD; Tafel, I; Segar, DJ; ... Aglan, O; Montaser, A; Gupta, S; Johnston, B; Judge, J; Fehnel, K; Stone, S.S; Warf,B.C. Complex Management of Hydrocephalus Secondary To Choroid Plexus Hyperplasia, *World Neurosurgery*, 2020, ISSN 1878-8750. <https://doi.org/10.1016/j.wneu.2020.05.211>
8. Fehnel KP, McClain CD, Smith ER: Indirect bypass for maternal symptomatic moyamoya in the first trimester of pregnancy: case report. *J Neurosurg Pediatr*:1-6, 2019
9. Koch MJ, Mahal BAV, Hadzipasic M, Fehnel KP, Chapman PH, Loeffler JS, Orbach D.B., Smith ER: Dynamic Changes in Arteriovenous Malformations (AVMs): Spontaneous Growth and Resolution of AVM-Associated Aneurysms in Two Pediatric Patients. *Pediatr Neurosurg* 54:394-398, Oct. 2019
10. Fehnel KP, Penn DL, Duggins-Warf M [...] Smith ER. Dysregulation of the EphrinB2-EphB4 ratio in pediatric cerebral arteriovenous malformations is associated with endothelial cell dysfunction in vitro and functions as a novel noninvasive biomarker in patients. *Exp Mol Med.* 2020;52(4):658-671. doi:10.1038/s12276-020-0414-0
11. Day EL, Smith ER, Fehnel KP. Single-institution case series of pituitary biopsy for suspected germinoma in the pediatric population: diagnostic utility, operative risks, and biopsy approaches. *Sci Rep.* 2020 Sep 17;10(1):15257. doi: 10.1038/s41598-020-71988-7. PMID: 32943645.
12. Fouda MA, Karsten M, Staffa SJ, Scott RM, Marcus KJ, Baird LC. Management strategies for recurrent pediatric craniopharyngioma: new recommendations. *J Neurosurg Pediatr.* 2021 Mar 5:1-8. doi: 10.3171/2020.9.PEDS20606. Epub ahead of print. PMID: 33668031.
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20. Ibn Essayed W, Jarvis CA, Bernstock JD, Slingerland A, Albanese J, Friedman GK, Arnaout O, Baird L. Positioning Transclival Tumor-Treating Fields for the Treatment of Diffuse Intrinsic Pontine Gliomas. *Life.* 2023 Feb 21;13(3):601.
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22. Warf BC, Weber DS, Day EL, Riordan CP, Staffa SJ, Baird LC, Fehnel KP, Stone SSD. Endoscopic third ventriculostomy with choroid plexus cauterization: predictors of long-term success and comparison with shunt placement for primary treatment of infant hydrocephalus. *J Neurosurg Pediatr.* 2023 May 12;32(2)



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 Assistant Professor, Harvard Medical School

MEDICAL SCHOOL
 Stanford University, 2010

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 Massachusetts General Hospital, 2011

RESIDENCY
 Massachusetts General Hospital, 2017

FELLOWSHIP
 Boston Children's Hospital, 2018

CLINICAL INTERESTS
 Brain Tumors, Chiari Malformation, Hydrocephalus, Spinal Cord Injury, Spine problems, Tethered Spinal Cord, Vascular Malformations, Hemangioma

PUBLICATIONS

1. Pricola Fehnel K, Klein J, Warf BC, Smith ER, Orbach DB: Reversible intracranial hypertension following treatment of an extracranial vascular malformation: case report. *J Neurosurg Pediatr* 23:369-373, 2019
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13. Fouda MA, Day EL, Zurakowski D, Scott RM, Smith ER, Marcus KJ, Fehnel KP. Predictors of progression in radiation-induced versus nonradiation-induced pediatric meningiomas: a large single-institution surgical experience. *J Neurosurg Pediatr.* 2021 Jun 11:1-7. doi: 10.3171/2021.1.PEDS20819. Epub ahead of print. PMID: 34116509
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CLINICAL INTERESTS
Movement disorders, maternal fetal care, spina bifida and spinal cord conditions

PUBLICATIONS

1. Northam WT, Chandran A, Quinsey C, Abumoussa A, Flores A, Elton S. Pediatric nonoperative skull fractures: delayed complications and factors associated with clinic and imaging utilization. *J Neurosurg Pediatr.* 2019 Aug 30;1-9.
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15. Kappel AD, Lehman LL, Northam WT, See AP, and Smith ER. Pediatric moyamoya syndrome secondary to tuberculous meningitis: a case report. *Neurology: Clinical Practice.* 2023, Vol.13 (1)
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CLINICAL INTERESTS

Surgical treatment of epilepsy, minimally invasive
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stimulator, invasive phase II monitoring for
epilepsy, hydrocephalus, fetal anomalies, chiari
malformations, brain tumors, congenital anomalies

PUBLICATIONS

Research Investigations

1. Park YS, Cosgrove R, Madsen JR, Eskandar EN, Hochberg LR, Cash SS, et al: Early Detection of Human Epileptic Seizures Based on Intracortical Microelectrode Array Signals. *IEEE Trans Biomed Eng*: 2019
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3. Peters JM, Hyde DE, Chu CJ, Boom M, Scherrer B, Madsen JR, et al: Lesion-Constrained Electrical Source Imaging: A Novel Approach in Epilepsy Surgery for Tuberous Sclerosis Complex. *J Clin Neurophysiol*: 2019
4. Proix T, Aghagolzadeh M, Madsen JR, Cosgrove R, Eskandar E, Hochberg LR, et al: Intracortical neural activity distal to seizure-onset-areas predicts human focal seizures. *PLoS One* 14: 2019
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CLINICAL INTERESTS

Craniosynostosis, chiari malformations,
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trauma, brain and spine trauma, sports related
head and spine injury, general neurosurgery

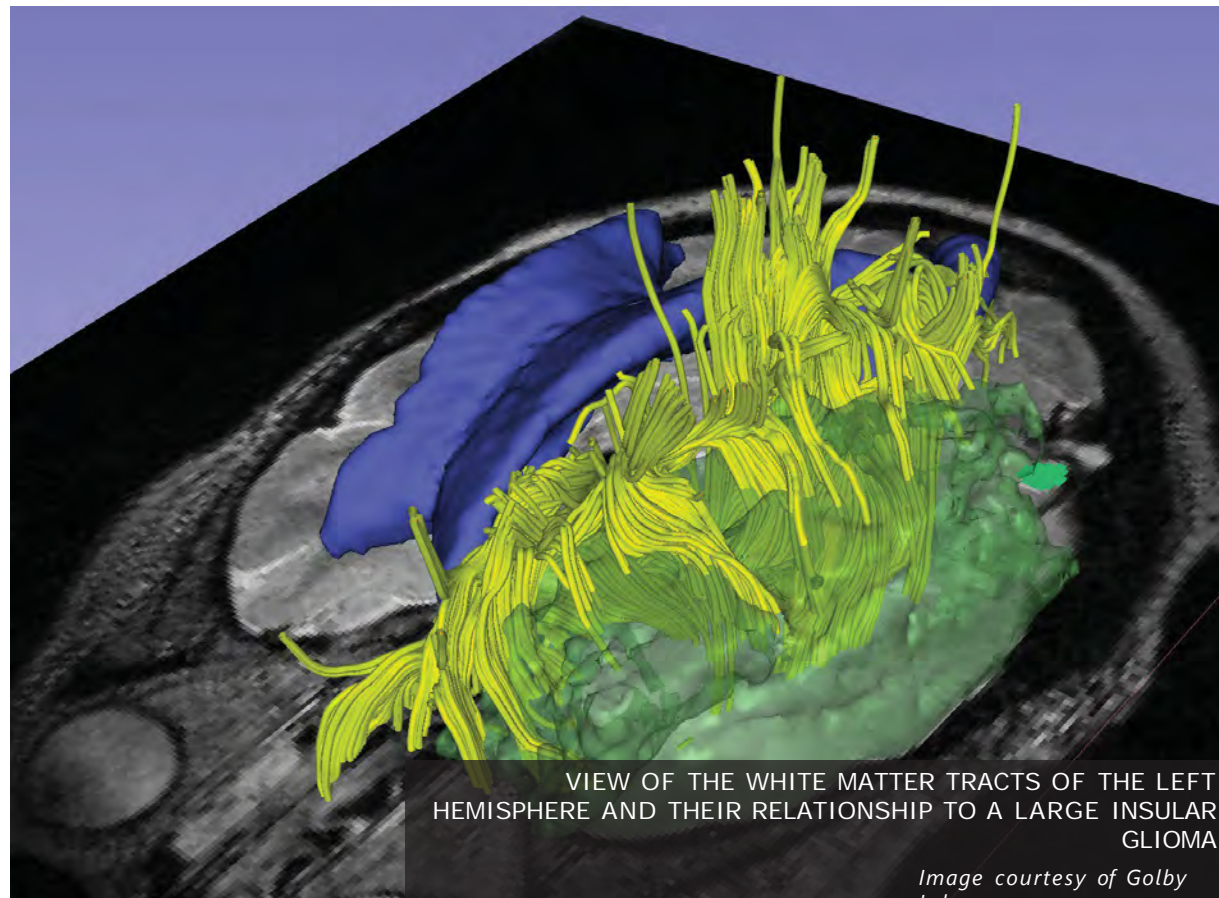
PUBLICATIONS

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2. Hameed MQ, Zurakowski D, Proctor MR, Stone SSD, Warf BC, et al: Noninvasive Thermal Evaluation of Ventriculoperitoneal Shunt Patency and Cerebrospinal Fluid Flow Using a Flow Enhancing Device. *Neurosurg* 85:240-249, 2019
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VIEW OF THE WHITE MATTER TRACTS OF THE LEFT HEMISPHERE AND THEIR RELATIONSHIP TO A LARGE INSULAR GLIOMA

Image courtesy of Golby Lab



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CLINICAL INTERESTS
Arteriovenous fistulas (AVFs), Pediatric stroke, Brain Aneurysms, Brain Arteriovenous Malformation, Cavernous Malformations, Moyamoya in Children, Retinoblastoma, Vein of Galen Malformation (VOGM)

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Hospital, General Surgery, 1997

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Massachusetts General
Hospital, Neurosurgery, 2003

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Massachusetts General
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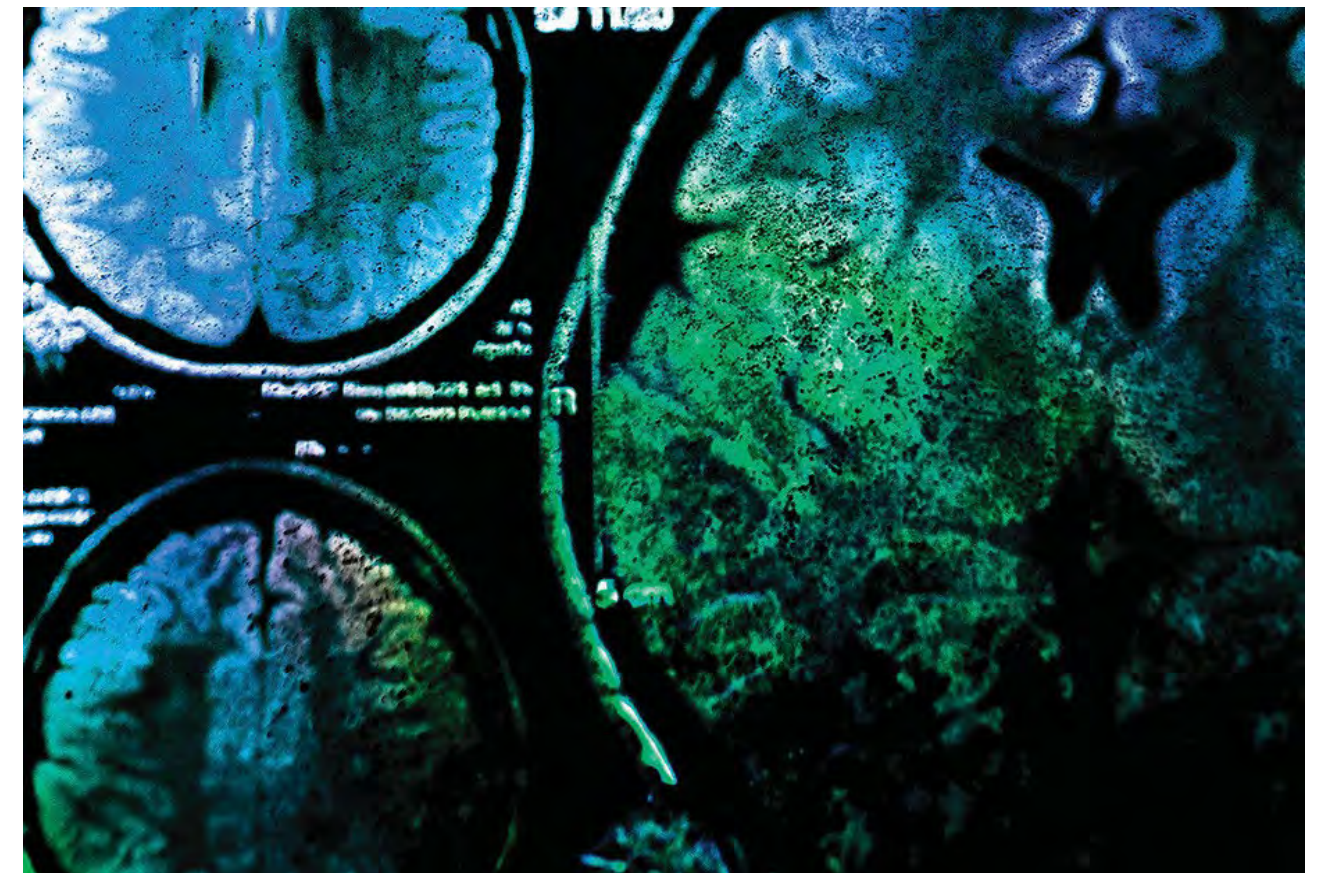
Boston Children's Hospital,
Pediatric Neurosurgery,
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CLINICAL INTERESTS
Aneurysms, arteriovenous malformation (AVM),
brain tumors, cavernous malformations, chiari
malformations, general neurosurgery,
moyamoya,
neuro-trauma, pediatric stroke, pituitary tumors,
skull base lesions, vascular anomalies

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RESIDENCY

Neurosurgery-University of
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FELLOWSHIP

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Pediatric Neurosurgery,
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CLINICAL INTERESTS

Epilepsy surgery, endoscopy, functional
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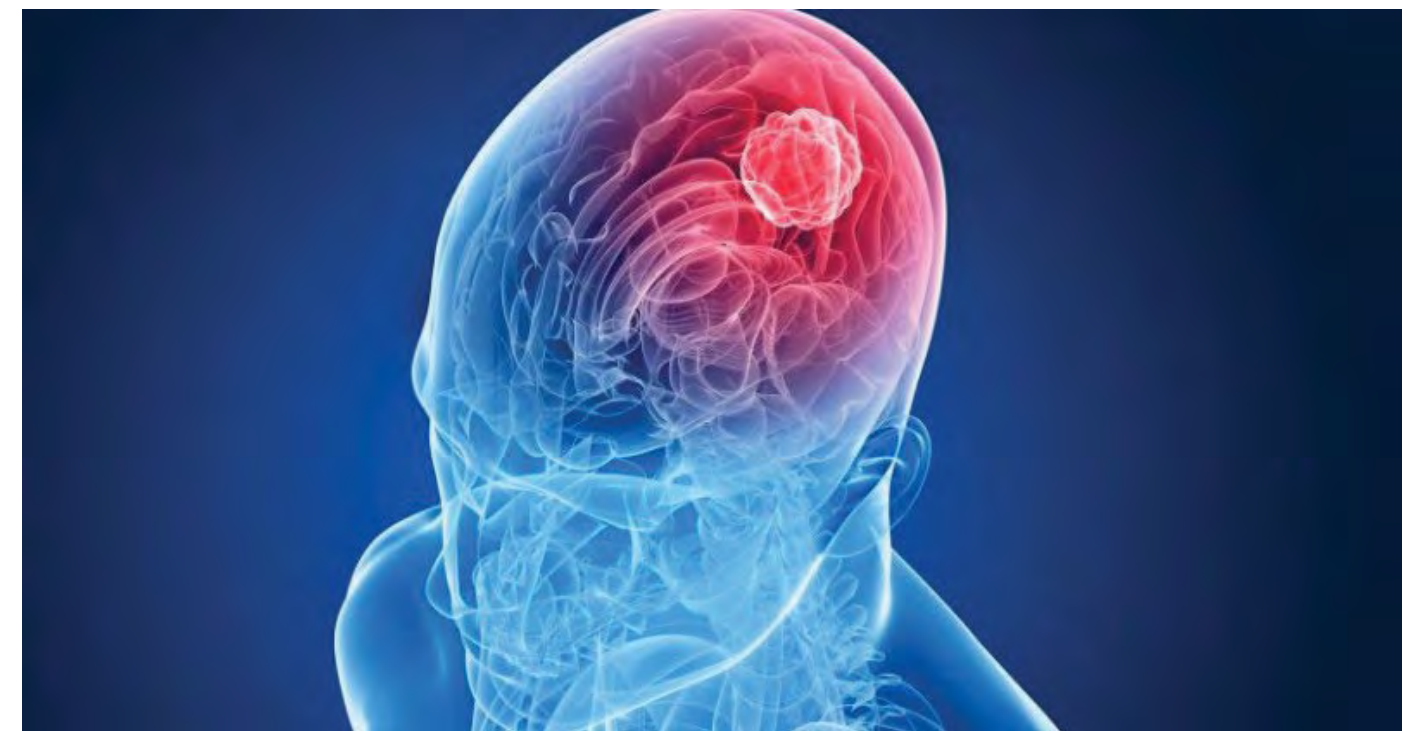
PUBLICATIONS

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